**SCIENTIFIC COUNCIL MEETING – 23 - 27 SEPTEMBER 2019**

**Scientific Council Annual Meeting Participants**

**23- 27 September 2019**

**Back row (left to right):** Ricardo Alpoim, Pierre Pepin, Kalvi Hubel, Martha Krohn, Fernando González Costas, Katherine Sosebee, Miguel Caetano (STACFEN Chair), Tom Blasdale (Scientific Council Coordinator), Konstantin Fomin, and Herlé Goraguer

**Front row (left to right):** Karen Dwyer (STACFIS Chair), Carmen Fernandez (Vice-Chair of Scientific Council and STACREC Chair), Lisa Hendrickson, Brian Healey (Scientific Council Chair), Diana González Troncoso, Carsten Hvingel, Mar Sacau-Cuadrado, Antonio Ávila de Melo, Cristina Ribeiro

**Missing from photo:** Tom Nishida, Mark Dickey-Collas, Valentin Litvinov

# REPORT OF SCIENTIFIC COUNCIL MEETING

## 23-27 September 2019

Chair: Brian Healey Rapporteur: Tom Blasdale

## I. PLENARY SESSIONS

The Scientific Council (SC) met at the Hotel Pullman Bordeaux Lac, Bordeaux, France during 23-27 September 2019 to consider the various matters in its agenda. Representatives attended from Canada, the European Union, France (with respect to St. Pierre et Miquelon), Japan, Norway, the Russian Federation, Ukraine and the United States of America. The Scientific Council Coordinator and NAFO intern were in attendance. With a view towards potentially strengthening NAFO-ICES collaboration and exchange, Mark Dickey-Collas (Chair of ICES Advisory Committee) participated in part of the meeting as an observer.

The Executive Committee (except for the STACPUB chair) 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 09:30 on 23 September 2019.

The Chair welcomed participants to the 41st Annual Meeting and thanked France for hosting this event. The provisional agenda was adopted as amended (Appendix III) and the Council appointed Tom Blasdale, the Scientific Council Coordinator, as rapporteur.

The Council and its Standing Committees met through 23-26 September 2019 to address various items in its agenda. The Council considered and adopted the reports of the STACFIS and STACREC Standing Committees on 26 September 2019. The final session was called to order at 09:00 on 26 September 2019 and the Scientific Council agreed that the report of this meeting would be finalized by correspondence. The meeting was adjourned at 18:00 hours on 26 September 2019.

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, Designated Experts, List of Research (SCR) and Summary (SCS) Documents, and the List of Participants are given in Appendices III, IV, V and VI, respectively.

## II. REVIEW OF SCIENTIFIC COUNCIL RECOMMENDATIONS

There were no Scientific Council recommendation requiring immediate attention at this meeting. A detailed review of recommendations was deferred to the June 2020 meeting.

## III. JOINT SESSION OF COMMISSION AND SCIENTIFIC COUNCIL

The Commission and Scientific Council met in joint sessions on 24 September to discuss the 2018 NAFO performance review, the Scientific Council's response to requests for advice from the Commission, the reports of the joint SC/Commission Working Groups and other matters of common interest.

### 1. 2018 Performance Review

The Vice-Chair of the Commission, Temur Tairov (Russian Federation), presented the Report of the Commission Working Group to Address the Recommendations of the 2018 Performance Review Panel (COM Doc 19-03) along with its recommendations (COM WP 19-22). The recommendations consisted of an Action Plan that, for each of the Performance Review Recommendations, designated a proposed action, its priority and lead NAFO body or bodies to address this action; and a process for reporting on the progress in addressing each proposed action at subsequent Annual Meetings. Scientific Council had been previously apprised of the outcomes of this WG and its proposed recommendations by the SC chair during its June 2019 meeting.

The recommendations of this Working Group were adopted by the Commission.

## 2. Presentation of Scientific Advice by the Chair of the Scientific Council

### a) Response of the Scientific Council to the Commission's Request for Scientific Advice

The Chair of the Scientific Council (SC) presented this year's scientific advice. The presentation also included an overview of the work of SC since the 2018 NAFO Annual Meeting, a report on the catch and survey data used in the stock assessments, plus environmental and ecosystem trends (COM- SC WP 19-04 Rev). The scientific advice on fish stocks and other topics was formulated mainly during the SC meeting in June 2019 (SCS Doc 19-20), except for northern shrimp in Division 3M and northern shrimp in Divisions 3LNO, which was formulated in September during an intersessional NAFO/ICES *Pandalus* Assessment Group (NIPAG) meeting (SCS Doc 19-21), and for northern shortfin squid in Subareas 3+4, which was formulated during the current meeting (SCS Doc 19-22). The advice represents the response of SC to the request from the Commission (COM Doc 18-20).

### b) Feedback to the Scientific Council Regarding the Advice and its Work during this Meeting

The Commission noted the SC Reports and the presentation of advice. They engendered follow-up questions and enquiries for further clarification to which SC provided responses during the meeting. These questions pertained to redfish in Division 3O, redfish in Division 3M, non-sponge and non-corals VMEs, human activities other than fishing, cod in Division 3M, and splendid alfonsino in Sub-area 6.

The Commission questions and SC responses are presented in section VI.2. of this report.

### c) Other issues as determined by the Chairs of the Commission and Scientific Council

No issues were discussed under this item.

## 3. Meeting Reports of the Joint Commission–Scientific Council Working Groups

### a) Working Group on Improving Efficiency of NAFO Working Group Process (E-WG), 2019

The NAFO Working Group on Improving Efficiency of NAFO Working Group Process (E-WG) met via WebEx on 05 February 2019 (COM-SC Doc. 19-06). The report was presented by NAFO Executive Secretary, Fred Kingston. The Working Group agreed on the following two-week periods to be considered for NAFO intersessional meetings:

- 24 February – 06 March
- 27 April – 08 May
- 10 August – 21 August

Contracting Parties are not obliged to schedule meetings during these periods, but these dates may help in future planning of intersessional meetings.

The recommendations of E-WG were adopted by the Commission.

### b) Joint Commission–Scientific Council Working Group on Risk-based Management Strategies (WG-RBMS), April and September 2019

The co-Chairs of WG-RBMS, Jacqueline Perry (Canada) and Carmen Fernandez (EU), presented the April meeting report (COM-SC Doc 19-01) and the results of the September 2019 meeting.

Highlights of the meetings include: 1) the decision to suspend the 3M Cod MSE work, 2) a reflection on future MSE processes, emphasizing that they should be realistic and take into account the very large amount of work required, and 3) the need for an update assessment and five-year projections for 3LN Redfish to evaluate the impact of annual removals at 18 100 tonnes against the following performance statistics:

- Very low (< 10%) probability of biomass declining below $B_{lim}$.
- Low (< 30%) probability of fishing mortality >$F_{msy}$
- Less than 50% probability of declining below 80% $B_{msy}$ on or before 2026.

Recommendations to this effect were forwarded to the Commission and the Scientific Council (COM-SC WP 19-08).

The co-Chairs also indicated that the Precautionary Approach (PA) Framework review, which was identified by the Commission as a task priority the previous year, will be the major agenda item in the August 2020 meeting.

All the recommendations of WG-RBMS were adopted by the Commission.

**c) Joint Commission–Scientific Council Working Group on Ecosystems Approach Framework to Fisheries Management (WG-EAFFM), July 2019**

WG-EAFFM co-Chair Elizabethann Mencher (USA) presented the July 2019 report (COM-SC Doc. 19-03) and the recommendations.

Recommendations include, among others, 1) that Contracting Parties continue to avoid scientific surveys in VME closed areas, 2) that Contracting Parties support the participation of relevant experts in relation to the 2020 re-assessment of VME closures and the 2021 re-assessments of the impacts of NAFO bottom fishing, 3) update of the VME species list in Annex I.E of the NCEM, 4) that Scientific Council present the Ecosystem Summary Sheet for 3LNO to the Commission at the 2020 Annual Meeting, with a view of informing decision-making processes, 5) that the Commission develop ecosystem level objectives to inform the Scientific Council's development of the EAF Roadmap, including through a possible intersessional workshop.

Several Contracting Parties expressed support for the proposal for an intersessional workshop on the development of ecosystem level objectives.

All the recommendations of WG-EAFFM were adopted by the Commission.

**d) Joint Commission–Scientific Council Catch Estimation Strategy Advisory Group (CESAG), 2019**

CESAG co-Chair, Kathrine Sosebee presented the report of various meetings of CESAG to the Commission. SC will defer discussion of this until June 2020.

**4. Formulation of Request to the Scientific Council for Scientific Advice on the Management in 2021 and Beyond of Certain Stocks in Subareas 2,3, and 4 and Other Matters**

In accordance with the procedure outlined in FC Doc. 12-26, a steering committee was formed to assist in the drafting of the Commission request. The committee consisted of the SC Coordinator, Steve Hwang (Canada), Martha Krohn (Canada) and Cristina Ribeiro (EU).

## IV. RESEARCH COORDINATION

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

## V. FISHERIES SCIENCE

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

## VI. REQUESTS FROM THE COMMISSION

**1. Requests deferred from the June Meeting**

**a) Northern shortfin squid in Subareas 3+4**

Scientific Council responded:

**Northern shortfin squid in Subareas 3+4** **Advice in September 2019 for 2020 - 2022**

**TAC recommendation for 2020 – 2022**
The primary biomass index (Div. 4VWX) and mean body size value for 2018 were not available for use in the assessment. The 2019 values indicated that the stock may be moving towards a high productivity period. SC advice is a TAC of no more than 34 000 tons/yr.

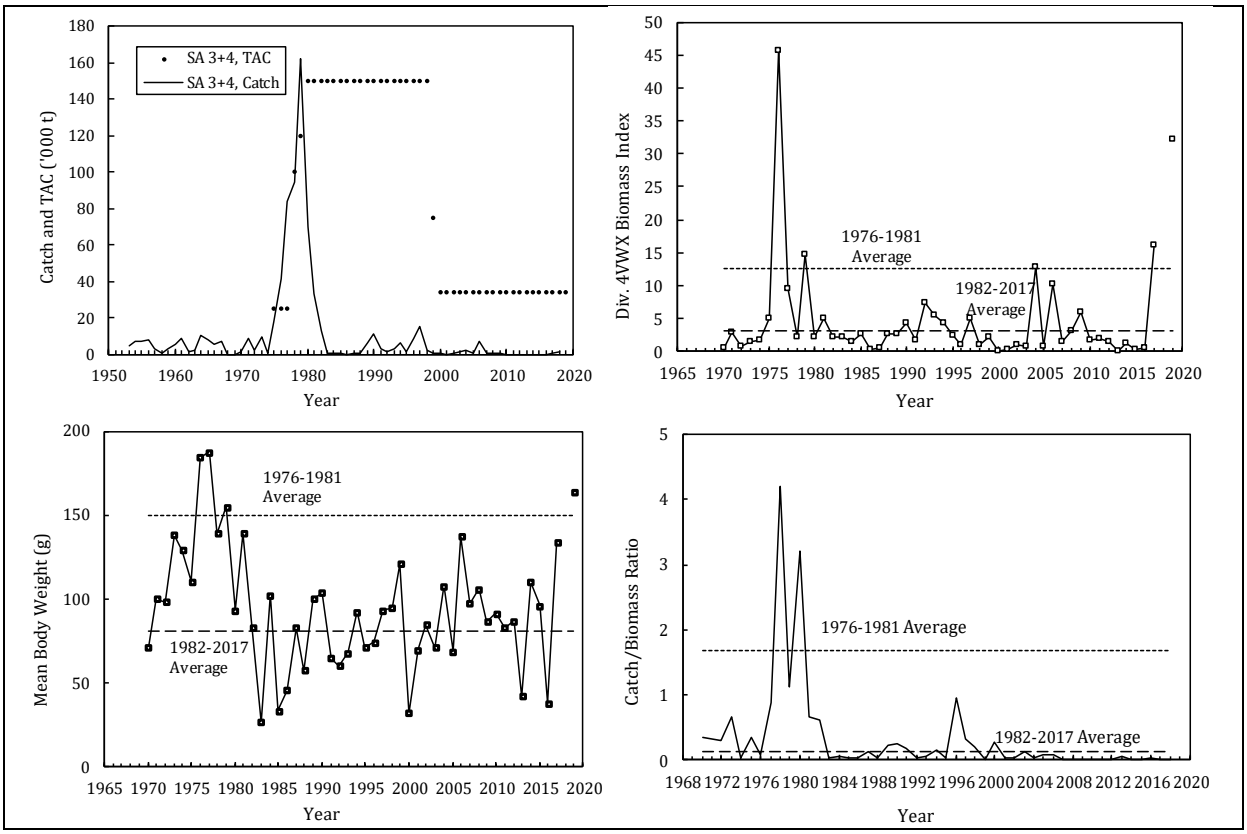
**Management objectives**
No explicit management plan or management objectives have been defined by the Commission. Convention General Principles are applied.

| *Convention General Principles* | *Status* | *Comment/consideration* |
|---|---|---|
| Restore to or maintain at $B_{msy}$ | ○ | $B_{msy}$ inappropriate given life history |
| Eliminate overfishing | ○ | Not quantifiable |
| Apply Precautionary Approach | ● | Reference points based on productivity level |
| Minimize harmful impacts on living marine resources and ecosystems | ● | VME closures in effect, no bycatch in SA 3 jig fishery, no SA 4 directed trawl fishery since 1999 |
| Preserve marine biological biodiversity | ○ | Cannot be evaluated |

● OK
● Intermediate
● Not accomplished
○ Unknown

**Management unit**
The species is assumed to constitute a single stock throughout its range in the Northwest Atlantic Ocean, from Newfoundland to Florida, including Subareas 2-6, but is managed separately as northern (Subareas 3+4, by NAFO and by Canada and France (in respect of St. Pierre and Miquelon) within their respective EEZs) and southern stock components (Subareas 5+6, by USA within its EEZ). However, fishery removals in relation to the biomass levels of each stock component affect one another.

**Stock status**
Trends in fishery and research vessel survey data indicate that a period of high productivity (1976-1981) occurred in Subareas 3+4 between two low productivity periods (1970-1975 and 1982-2017). During 2018, the Div. 4VWX survey was not completed. However, the Div. 4VWX biomass index and mean body size during 2019 indicate that the stock may be moving towards a high productivity period.




**Reference points**

Conventional reference points are inappropriate for squid stocks because of their unique life history. Two reference states, termed "high productivity" or "low productivity" states are defined by trends in the Div. 4VWX biomass indices and mean body weight. Low productivity periods have an estimated potential annual yield of 19 000 t to 34 000 t. The potential yields of a high productivity state have not been determined.

**Projections**

Projections were not possible because, like most squid stocks, recruitment is highly variable and cannot currently be predicted.

**Assessment**

Data used for the assessment were from the Division 4VWX July bottom trawl surveys and the catches in Subareas 3+4 (STACFIS Report 2019). The 2019 assessment consisted of a comparison of average survey biomass indices and mean body weights, during high (1976 – 1981) and low (1982 – 2017) productivity periods, with the values of these indices during 1970-2019. The Div. 4VWX survey was not completed in 2018, so the biomass index and mean body weight were not computed. Fishing mortality indices (catch in SA 3+4/Div. 4VWX biomass index) were used to assess exploitation. Uncertainty in the assessment is high because of the species' sub-annual lifespan and the fact that recruitment, occurrence of the species in the survey area, and growth rates are all highly variable and greatly influenced by oceanographic conditions.

The next assessment is scheduled for 2022. Due to the short life-span of this species (less than one year), it is recommended that, if possible, future assessments occur after the summer surveys in order to incorporate data from the current year.

*Human impacts*

Fishery related mortality in SA 3+4 has been very low since 2006 and primarily from the Canadian inshore jig fishery in SA 3. Other sources (e.g. pollution, shipping, oil-industry) are undocumented.

*Biology and Environmental Interactions*
Recruitment for this species is highly variable, and the species is semelparous (spawns once during its lifetime then dies). A sufficient number of spawners must survive the fishery (spawner escapement) each year in order to ensure a high probability of successful recruitment during the subsequent year, to reduce the risk of stock collapse. Although environmental factors play a role in the recruitment process, such factors cannot be controlled or predicted. Ideally, fishing intensity should be such that spawner escapement is set at some target level which is above a minimum spawning stock biomass ($SSB_{min}$) threshold. Without the ability to estimate stock size in real-time during the fishing season, as well as before and after the fishing season, the TAC should be set at a conservative level in order to avoid recruitment overfishing.

Ocean climate effects have a strong influence on the distribution, growth rates, and recruitment of Northern shortfin squid. For example, variation in the latitudinal position of the Shelf Slope Front is related to efficiency of downstream dispersal by the Gulf Stream and increased survival of young stages.

This species is both an important prey and predator in the ecosystem. The natural mortality of this prey species, which is consumed by a wide range of cetacean, pinniped, avian, invertebrate, and finfish predators, is very high. Small Northern shortfin squid prey primarily upon crustaceans and larger squid prey primarily upon finfish, and during the fall, on smaller shortfin squid.

**Fisheries**
Prior to the mid-1980s, international bottom trawl and midwater trawl fleets participated in directed fisheries in Subareas 3, 4 and 5+6. Since 1999, there has been no directed fishery in Subarea 4, but some squid is taken as bycatch in the Canadian small-mesh bottom trawl fishery for silver hake. Directed fisheries currently consist of a Canadian inshore jig fishery in Subarea 3 and a small-mesh bottom trawl fishery in Subareas 5+6. In 2018, at least one vessel conducted a directed trawl fishery in 3O. There is no bycatch in the jig fishery. There are separate management regulations applied by NAFO, USA and Canada. Recent catch estimates and TACs ('000 t) are as follows:

| | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|---|---|---|---|
| TAC SA 3+4 | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 |
| STATLANT21 SA 3+4 | 0.1 | 0.2 | <0.1 | 2.7 | 0.1 | <0.1 | <0.1 | 0.4 | 1.2 | |
| STACFIS SA 3+4 | 0.1[1] | 0.1[1] | <0.1[1] | <0.1[1] | <0.1[1] | <0.1[1] | 0.1 | 0.4 | 1.4 | |

[1] Includes amounts, ranging from 0.001-18 t, reported as Unspecified Squid from Subarea 4.

**Effects of the fishery on the ecosystem**

The effects of the directed fisheries on the ecosystem are unknown, but are generally limited to June through November (depending on fishery Subarea) as a result of the species' migration patterns on and off the continental shelves. There has not been a directed fishery in Subarea 4 since 1999 and the catches from the SA 3 inshore jig fishery, the main source of catches in SA 3+4, have been low since 2007.

**Special comments**
The assessment of this stock component may not reflect stock conditions during the three years for which management advice is given because the species has a sub-annual lifespan and the most recent year of data used in the assessment is normally for two years prior.

There are no TACs set by France (in respect of St. Pierre et Miquelon) or Canada for jig fisheries within their respective EEZs. The latter comprises the majority of the catch since 1999.

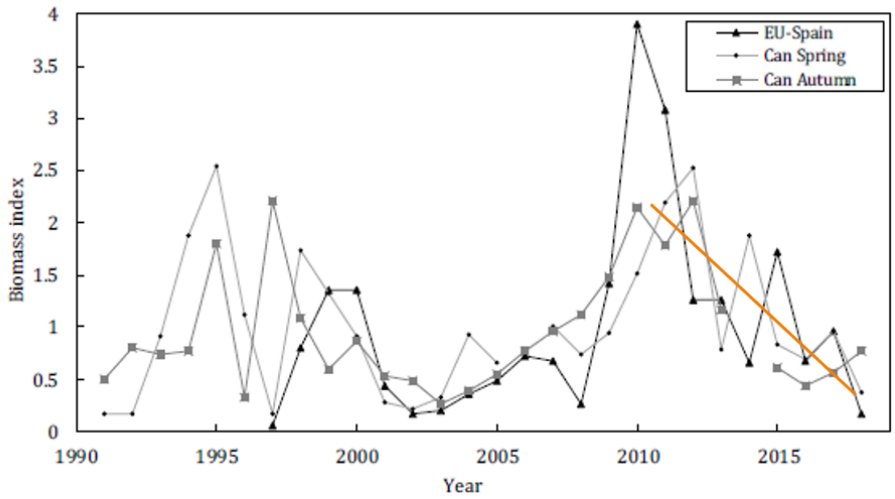
**Sources of information**
SCR Doc. 98/59,75; 99/66; 06/45; 16/34; 19/42

## 2. Requests Received from the Commission during the Annual Meeting

Requests for clarification of scientific advice were received in advance of the meeting from the European Union and Norway. Further requests which arose as questions within the SC/Commission joint session or within the Commission's discussions were submitted in writing to SC during the meeting. All of these requests are addressed below.

### *i) In relation to the Scientific Council's advice regarding Redfish in Div. 3O (From Norway, COM WP 19-24)*

*We take note of the SC statement that the average catch level of 12 000 tonnes appear to have been sustainable, but that the SC at the same time is unable to advise on a TAC for the stock for 2020-2022. We would further refer to the STACFIS section on page 188 in the SC report (SCS 19-20) where the three stock biomass index series for redfish in Div. 3O are put together in a single figure (Figure 15.4). Even though there are large year-to-year variations in the indices, there seems to be an overall declining trend since 2010 illustrated by orange line imposed on the graph below:*




*One might infer that the stock has declined by a factor of about 5 (from a value of around 2 to around 0.4 – reading from the graph). Does the SC consider that this decline should be a reason for concern, e.g. indicate that the recent catch levels maybe are not sustainable?*

**Scientific Council responded:**

SC is unable to determine whether the apparent decline (noting the large uncertainty in the survey results) is due to fishing mortality, natural mortality or emigration. SC reiterates its advice that there is insufficient information on which to base predictions of annual yield potential for this resource. To mitigate against further declines the Commission may consider implementing measures that do not allow catches to increase.

*Recommendation for 2020-22:* There is insufficient information on which to base predictions of annual yield potential for this resource. Stock dynamics and recruitment patterns are also poorly understood. Catches have averaged about 12 000 t since the 1960s and over the long term, catches at this level appear to have been sustainable. Scientific Council is unable to advise on an appropriate TAC for 2020, 2021 and 2022.

### *ii) In relation to the Scientific Council's advice regarding redfish in Div. 3M (From European Union, COM WP 19-25)*

*What would be the probability of having in 2022 a biomass (SSB) level higher than the average level during the period 2002 - 2006 (14,062 t), which was estimated to produce the highest recruitments (age 4) in the time series (1989 - 2018) in the $F_{max}$ scenario, which was one of the models provided.*

**Scientific Council responded:**

There is a high probability (>90%) that, by the start of 2022, SSB should be at or above 40 713 t, a level 2.9x higher than the average 2002-2006 SSB level of 14 063 t associated with the highest recruitments so far recorded. However one should take into account that there is no evidence of a stock recruitment relationship for this stock (over a similar range of SSB there was much poorer recruitment in 1993 and 1994). Concern should be raised regarding the continuous decline of the exploitable stock 2014 onwards combined with a very low level of recruitment at age 4 observed since then.

***iii) In relation to the Scientific Council's advice regarding Non-Sponge and Non-corals VMEs (From European Union, COM WP 19-25)***

*The EU would like to ask the Scientific Council on the decision of including two additional taxa, bryozoans and sea squirts, in the reassessment of the VME closed areas at this time. The bryozoan and sea squirts in question occupy relatively shallow water habitats (~50m) on top of the Grand Bank. The FAO guidelines, that define VMEs, were primarily developed to protect deep sea sensitive species and habitats from the deleterious effects of bottom fishing activities in the high seas. As such, classifying relatively shallow water bryozoan and seasquirt assemblages as VME, or VME indicator species, implies they have the same environmental and biological characteristics as deep-sea VME, which is potentially confusing. Given the important differences known to exist between deep-sea and shallow-sea (shelf-based) ecosystem dynamics, it is important the assessment approaches and terms applied are not conflated between the two systems, including the habitats and species which they support.*

**Scientific Council responded:**

The decision to include non-coral and non-sponge VMEs was made in 2012 (SCS-Doc. 12-19, Pages 36-38) and has been incorporated into the VME identification guides as well as the list of VME indicators adopted by the Fisheries Commission for inclusion in the NCEM (FC-Doc, 12-31). The VME indicators on the list were all screened against the FAO guidelines. Scientific Council has already been asked to review the list. Following acceptance by NAFO, Scientific Council was asked to develop encounter protocols for bryozoans and ascidians. These taxa were included in work plans presented by the SC in 2018. Also, the FAO and ABNJ make no distinction of VMEs based on depth. There is no precedent in any RFMO of excluding indicators because they occur in shallower water. Note that all of the VME indicators have been identified in shallow areas (e.g. this also applies to *Lophelia* reefs which live in Oslo fjord).

Because many of the species are widespread SC has developed methods to identify significant concentrations. Those methods have been applied to the species groups in question and Scientific Council has located some key areas of high densities. The work continues and will be assessed using the same criteria that were used to determine the location of significant areas of coral and sponge VME, and whether they are at risk. It is essential if NAFO is to provide a thorough assessment of the risk to VMEs that are appropriate to meet UNGA resolutions (61/105, 64/72, 66/68).

NAFO may wish to consider indicator lists from other RFMOs and/or NAFO Coastal States, to ensure that NAFO's list of VME indicators is comprehensive.

If there are new objective, scientifically sound data available that bryozoans and ascidians are not VME indicators, SC will review that evidence at a future meeting.

***iv) In relation to the Scientific Council's advice regarding Humans Activities other than fishing (From European Union, COM WP 19-25)***

*In July 2019 the EU was informed about an oil spill incident that happened in the Canadian EEZ, which also affected international waters. This information also included an environmental response carried out by the competent Canadian authorities. However, following this initial information, to our knowledge Canada did not provide further update concerning the extent of the oil spill, the mitigation measures put in place and the impact in the ecosystem.*

*The EU would like to ask the SC about any additional information the SC might have received and whether could provide an assessment about the impact on the ecosystem and notably on the fish stocks.*

**Scientific Council responded:**

The SC has not received official documentation about this environmental accident. The available information about oil spills is supplied by the website of the C-NLOPB informing about the occurrence of accidental oil discharges, but does not contain scientific information on impacts on the water quality, biota or in the ecosystems. The dimension of the spill is not documented and their spread in the marine environment unknown. Furthermore, there is no information on mitigation measures and/or remediation actions taken after the spill.

SC reiterates its response to Commission request #15.

***v) In relation to the Scientific Council's advice regarding 3M cod: (From Denmark (in respect of the Faroe Islands and Greenland), COM WP 19-30)***

***Question #1****. How is recruitment linked to the size of the stock? Is there a clear relationship between the size of the Spawning Stock Biomass and the level of recruitment?*

**Scientific Council responded:**

There is no clear relationship between the size of the spawning stock and recruitment. During the 3M cod MSE process, a number of possible stock recruit relationships were considered, including a segmented regression with a break point at $B_{lim}$, a Ricker curve either fitted to the entire time series or excluding years with very low recruitment values, and geometric means of recruitment within a number of separate SSB bins (with break points at fixed values of SSB, specified quantiles, or corresponding to SSB in specific years)(Figure. VI. 1). For all the fitted relationships, the fits were poor with particularly large positive residuals in the mid-range of SSB:

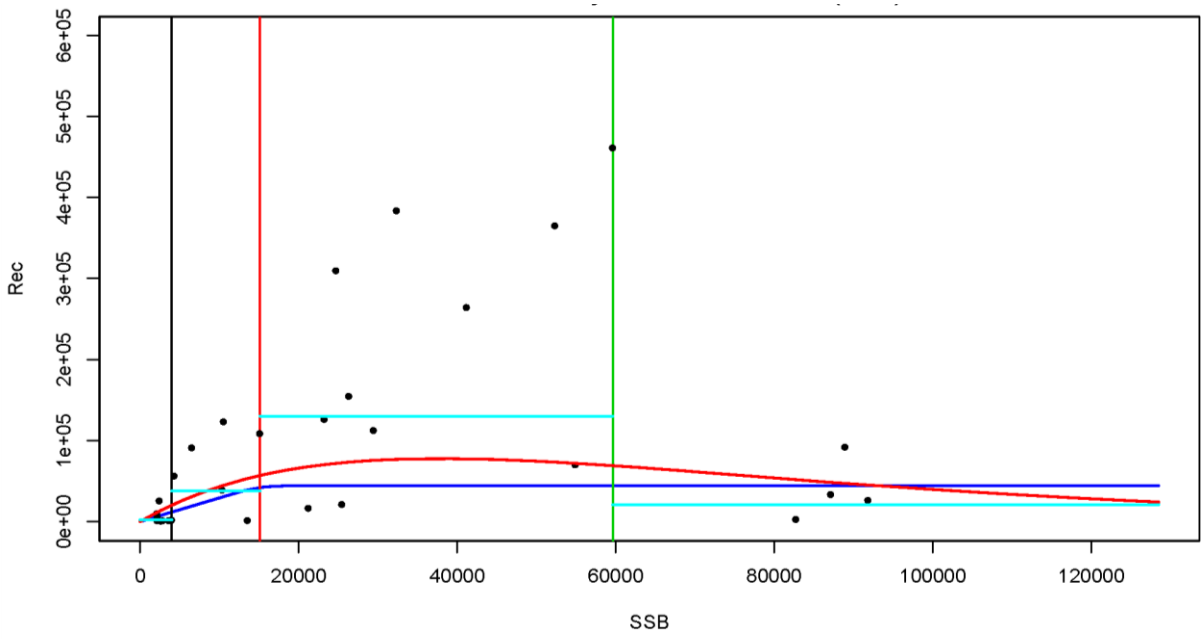



**Figure VI.1.** Historical SSB/recruit pairs (posterior medians) for the base case OM, with the SSB divided into bins with cut-offs at $SSB_{1997}$ (black line), $SSB_{2007}$ (red) and $SSB_{2010}$ (green). A segmented regression with a break point at $SSB_{2007}$ and a Ricker curve fitted to years with SSB > $SSB_{1997}$ are shown by the dark blue and red fitted lines respectively. The sky blue lines represent the geometric mean of historical recruitment within each SSB bin.

*Source*: NAFO, 2019. NAFO Scientific Council Flemish Cap (NAFO Div. 3M) Cod Stock Management Strategy Evaluation (MSE). NAFO SCS Doc. 19/04, Serial No N6911.

***Question #2.*** *The advice last year indicated that ¾$F_{lim}$ would provide a yield of 12 359 t for 2020. The advice this year suggests a yield of 8 531 in 2020 if ¾$F_{lim}$ is applied. What has changed since 2018 to result in such a different figure?*

**Scientific Council responded:**

The rapid change of the biological parameters of the 3M cod makes very difficult to predict the future state of the stock. During recent years the mean weight at age, both in stock and in catch, have been declining, as we can see in Figure VI.2:

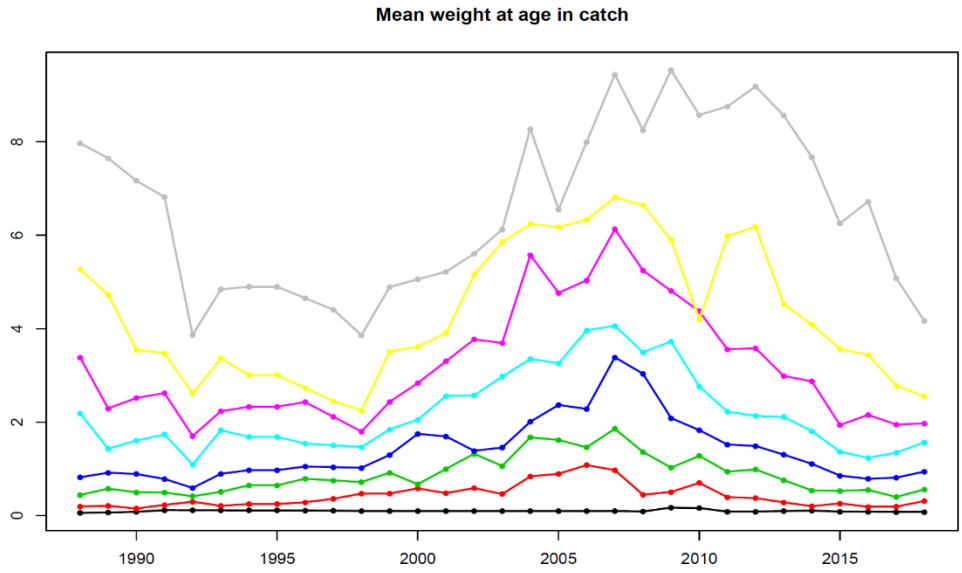



**Figure VI.2.** Mean weights at age in catch used in the 2019 assessment of 3M cod.

During the 2018 SC meeting, to get the projected catch for the beginning of 2020, the 2017 mean weight-at-age was taken, whereas during the 2019 SC meeting the 2018 mean weight-at-age was used. So, for example, for the 8+ age, that in the last year was the most abundant in the stock, for the 2018 projection a weight of 5.1 kg was used, while for the 2019 projection that weight was 4.2 kg. This means that even with the same numbers-at-age, the biomass from one year to the next has highly decreased, as does the possible yield, even with the same level of *F*.

Other factors affect the projected yield from one year for the next, including estimated selectivity.

Furthermore, in the 2018 assessment updated ageing data were not available and therefore 2017 results were applied. In the 2019 assessment these data were available and resulted in changes to the age composition of the projected yield in 2020.

***Question #3.*** *Two technical measures apply to cod in the RA: 130 mm minimum mesh size and 41 cm minimum length. To what extent has the Scientific Council considered other measures that could help conserve the SSB of 3M cod, such as area and time-based measures and the use of sorting grids in trawls.*

**Scientific Council responded:**

In 2015 the Commission requested the SC to analyze and provide advice on management measures that could improve selectivity in the Div. 3M cod and Div. 3M redfish fisheries in the Flemish Cap in order to reduce possible by catches and discards.

The implementation of sorting-grids in the Div. 3M cod fishery gear will reduce catch of small and immature individuals of cod. These devices would to a large extent prevent catches of individuals less than the minimum landing size (41 cm) and have the advantage also of reducing redfish by-catches and thereby reduce discards. It is estimated that by introducing sorting grids, the actual $F_{msy}$ value and the equilibrium yield (catches) would increase but it should have a small impact in the equilibrium SSB. To quantify these improvements more precisely, selectivity experiments with the modified gears needs to be performed in the Flemish Cap area.

The SC also noted that other measures to avoid excessive catch of juveniles could be considered, e.g. the closure of the areas at less than 400 meters depth where these fish are more abundant. The effect in the exploitation pattern of this technical measure should be similar to the implementation of the 135 mm cod-end with sorting grids. However, this measure could increase the by-catch of redfish as this species is more abundant in depths more than 400 meters. Another problem of implementing these closures would be the effort concentration in small areas.

*Source*: NAFO, 2015. Report of the Scientific Council Meeting. NAFO SCS Doc. 15/12, Serial No N6469.

***vi) In relation to the Scientific Council's advice regarding alfonsinos: (From European Union, COM WP 19-31)***

***Question #1.*** *Scientific advice recommends closing this fishery, based on a sharp decline on catches and CPUE in recent years. Although we understand the sensitivity of these indicators, we would like to understand the process based on which scientific advice is produced in a context of limited data, such in this case, and also, if in previous experiences other fisheries were also closed using CPUE as the only indicator.*

**Scientific Council responded:**

No analytical or survey based assessment were possible. The only data available at present are the catch and effort time series. Despite the difficulties of interpreting the CPUE as an indicator of stock status and knowing that this species is easily overexploited and can only sustain low rates of exploitation, the sharp decline in CPUE to the lowest observed (92 % lower than in 2017) and catches in the last year indicate an apparent overfishing situation and that the stock may be depleted.

The alfonsino 6G stock is the only stock managed by NAFO that has only catch and effort data and no fisheries independent data. SC is aware of at least one alfonsino fishery elsewhere that has been closed using CPUE information (FAO, 2016, Wiff *et al*, 2012 ).

***Question #2.*** *According to SC report, the EU also supports some sort of scientific data collection to be carried out concerning the stock of Alfonsinos, through trawl acoustic surveys, or any other relevant scientific mechanism that SC may consider appropriate, in order to make a future assessment of the stock. In this regard, the EU requests from the SC what type of scientific information would be required in order to carry out such assessment of this stock.*

**Scientific Council responded:**

There are fishery independent methods that could be explored for alfonsino, e.g. acoustic or longline surveys. Protocols for survey methods should be reviewed by SC.

FAO, 2016. *Global Review of Alfonsino (Beryx Spp.), Their Fisheries, Biology and Management*. Food and Agriculture Organization of The United Nations. Rome, 2016.

Wiff, Rodrigo & Quiroz, Juan Carlos & Flores, Andrés & Gálvez, Patricio. (2012). An overview of the alfonsino (Beryx splendens) fishery in Chile. FAO circular de pesca.

## VII. MEETING REPORTS

### a) Joint Commission – Scientific Council Working Group on the Ecosystem Approach Framework to Fisheries Management (WG-EAFFM)

This joint working group met at the NAFO Secretariat during 16–18 July 2019 and was co-Chaired by Elizabethann Mencher (USA) and Andrew Kenny (EU). The Scientific Council was advised of progress of this group by the co-Chairs in their presentation of the report to the joint session of Commission and Scientific Council (see section III of this report).

### b) Joint Commission–Scientific Council Working Group on Risk-based Management Strategies (WG-RBMS)

This joint working group met at the European Commission's Directorate-General for Maritime Affairs and Fisheries (DG-MARE) in Brussels, Belgium, during 10-12 April 2019 with an additional meeting held on 21 September 2019 in Bordeaux, France. Both meetings were co-Chaired by Jaqueline Perry (Canada) and Carmen Fernandez (EU). The Scientific Council was advised of progress of this group by the co-Chairs in their presentation of the report to the joint session of Commission and Scientific Council (see section III of this report).

### c) Joint Commission-Scientific Council Catch Estimation Strategy Advisory Group (CESAG).

CESAG met via WebEx on 30 April and 23 July 2019, co-Chaired by Katherine Sosebee (Scientific Council, USA) and Temur Tairov (Commission, Russian Federation). The report was presented to the Commission by Katherine Sosebee. Scientific Council deferred consideration of this report until its June 2020 meeting.

## VIII. REVIEW OF FUTURE MEETING ARRANGEMENTS

### 1. Scientific Council, (in conjunction with NIPAG), 08 – 13 Nov 2019

Scientific Council noted that the Scientific Council shrimp advice meeting will be held in Tromsø, Norway, 08 – 13 November, 2019, immediately following the ICES/PICES/NAFO shellfish symposium.

### 2. WG-ESA, 19- 28 Nov, 2019

The Working Group on Ecosystem Science and Assessment will meet at the NAFO Secretariat, Dartmouth, Nova Scotia, 19-28 November, 2019.

### 3. Scientific Council, 29 May – 11 June 2020

Scientific Council agreed that its June meeting will be held on 29 May - 11 June 2020, at Saint Mary's University, Halifax, Nova Scotia.

### 4. Scientific Council (in conjunction with NIPAG), 2020

Dates and location to be determined.

### 5. Scientific Council, 21 – 25 Sep. 2020

Scientific Council noted that the Annual meeting will be held 21 – 25 September in Halifax, Nova Scotia, unless an invitation to host the meeting is extended by a Contracting Party.

### 6. Scientific Council, June 2021

Scientific Council agreed that its June meeting will be held 28 May - 10 June 2021 (dates to be confirmed) at Saint Mary's University, Halifax, Nova Scotia.

**7. NAFO/ICES Joint Groups**

**a) NIPAG, 08 – 13 Nov 2019**

Scientific Council noted that the Scientific Council shrimp advice meeting will be held in Tromsø, Norway, 08 – 13 November, 2019.

**b) NIPAG, 2020**

Dates and location to be determined. A WebEx will be scheduled by the NIPAG co-chairs and SC chair in advance of the 2020 Annual Meeting to produce advice for northern shrimp in Div. 3M.

**c) ICES – NAFO Working Group on Deep-water Ecosystems, 2020**

Dates and location to be determined.

**d) WG-HARP, 2020**

The report of the 2019 WGHARP meeting is not yet available and the date and location of the next meeting are unknown.

**8. Commission- Scientific Council Joint Working Groups**

**a) WG-RBMS, 2020**

The joint SC-Commission Working Group on Risk Based Management Systems (WG-RBMS) will be held in August 2020.

**b) WG-EAFFM, 2020**

The dates and location of the next meeting of the joint SC-Commission Working Group on the Ecosystem approach to Fisheries Management (WG-EAFFM) have not yet been decided.

**c) CESAG, 2020**

The dates and location the next meeting of the Catch Estimation Strategy Advisory Group (CESAG) have not yet been decided.

## IX. FUTURE SPECIAL SESSIONS

**1. Mini-symposium on Integration of Oceanographic and Environmental Information on Stock Assessments**

The STACFEN chair and an SC member from the USA proposed that a mini-symposium could be held in 2021 to help better integrate oceanography and other environmental information in the issues regularly discussed by SC, particularly assessment and advice on fish stocks.

The event could last for about 3 days and have a workshop format, where there could be 7-10 presentations and breakout groups to further discuss particular aspects. The workshop could be built around case studies, so as to help develop collaborations between oceanographers, ecosystem scientists and scientists working in assessment and advice for fish stocks. The idea is that the NAFO community, including SC participants, engage in the development of case studies. The intention would be also to look outside NAFO, in particular (but not exclusively) to the ICES community. Several meeting participants indicated that they would be interested to develop case studies for the workshop.

The suggested time for this workshop is 2021, either just before the June SC meeting or just after the September SC meeting. Not knowing at this time where the NAFO AM in September 2021 will be held creates logistical difficulties. The USA offered to look into possibilities for organising the workshop, but logistical difficulties were noted and it was thought unlikely that SC could progress much on logistical aspects until their June 2020 meeting. If the workshop was held in 2021, financial support from NAFO could be part of the budget submission in September 2020.

Between now and June 2020, participants agreed to try and progress with the scientific aspects, particularly to consider case studies to be developed for the workshop and to start approaching colleagues to jointly develop collaborations, so that progress on the scientific elements can be evaluated by SC in June 2020. Additionally, the SC chair will coordinate with those interested to prepare a rough budget in advance of the June 2020 SC meeting.

## X. OTHER MATTERS

### 1. Meeting reports

### a) ICES/NAFO Working Group on Deep-water Ecology (WG-DEC)

WG-DEC met in Esporles, Mallorca, Spain during 3–7 June 2019 and was attended by Lindsay Beazley (CAN) representing NAFO. Since the report of WG-DEC was only published during the present meeting, discussion of this WG was deferred to June SC meeting, 2020.

### b) ICES/NAFO/NAMMCO Working Group on Harp and Hooded Seals (WG-HARP)

WG-HARP met in Tromsø, Norway during 2–6 September 2019 and was attended by Garry Stenson (CAN) representing NAFO. Since the report of WG-HARP was not yet published at the time of the present meeting, and there are potential issues regarding continued NAFO participation in this WG, discussion of this WG was deferred to June 2020 SC meeting.

### 2. Scientific Council Work Plan

Scientific Council reviewed the draft work plan that was developed during the June 2019 SC meeting and presented to the Commission as part of the 2019 advice.

Although no decision was reached at this point, the structure of, and progress towards, an initial SC workplan will be further discussed in 2020.

### 3. Notification to Scientific Council of Oil and Gas Industry Information

The chair opened a discussion on whether and how SC should be notified of any such information that NAFO may receive and what action should be taken in such circumstances. SC members reiterated the view previously expressed that the Council lacks the appropriate expertise in these areas.

### 4. Discussion of the MRAG Catch Estimation Study

The discussion was deferred until June 2020.

### 5. Requested Letters of Support for Research Projects

Following a number of requests in recent years for NAFO to provide letters of support for research funding proposals, the SC chair initiated discussion on the basis and process through which SC should decide on whether or not to provide a letter of support in future cases. A variety of views were expressed, including that it might be better for SC not to provide any such letter. However, it was agreed that the SC Executive Committee should decide course of action in each particular instance, including whether to accept, reject or consult SC on the matter. It was also noted that there was a need to be cautious and not simply almost automatically accept to write such letters.

### 6. Current and Potential Future Cooperation between NAFO and ICES

Dr. Mark Dickey-Collas, Chair of ICES Advisory Committee, attended the meeting as an observer between 23 and 25 September at the invitation of the NAFO Executive Secretary and SC chair. The main aim of his visit was to initiate a discussion on the potential for increased collaboration between NAFO and ICES. He provided a presentation that included an introduction to ICES, the range of scientific advice ICES delivers and to whom, and the processes ICES follows to produce the advice. The presentation then focused on ecosystem-based fisheries management (EBFM), and finally concluded by noting ICES progress in the development of ecosystem overviews for different areas of the Northeast Atlantic.

A discussion took place in SC immediately after Mark's presentation. The potential for increasing collaboration in many different areas was acknowledged by everyone, but it was also noted that it would be necessary to identify more carefully where such collaborations could be developed productively and mechanisms whereby this could happen. Differences in the capacity of NAFO SC (~50 members) and the ICES community (~5000 participants) were highlighted during the discussion. The incoming NAFO SC chair noted that, from her perspective, ecosystem-related advice, in particular further advancing the EBFM approach, is a key challenge that NAFO and many other similar organisations face at present and that, therefore, this seemed like an obvious first place to search for enhanced collaboration. This was strongly supported by Mark. In addition, SC members were interested in exploring potential collaborations as well as considering leveraging some of the advances (e.g. advisory frameworks, PA development) supported by extensive research and discussion within ICES.

Following this discussion, some areas initially suggested by Mark for useful collaboration were:

- Ecosystem overview for west Greenland- a range of potential mechanisms.
- Moving from single stock advice to advising on sustainable fishing opportunities in a dynamic ecosystem- building complementary frameworks in ICES & NAFO (including mixed fisheries and PA frameworks).
- Methods for advice on data limited stocks – sharing of methods and challenges, including use of stock categories for data/knowledge availability.
- Sharing approaches and insights for open data, code and decision making (FAIR principles) https://www.go-fair.org/fair-principles/
- Timing of NIPAG, ensuring that the group does not fragment
- Strengthening links between ICES WGNARS and NAFO WG-ESA
- Lessons learnt by ICES from benchmark and review processes

Further discussion and development of these and/or other ideas will continue intersessionally and the incoming NAFO SC chair will aim to facilitate this process. It was also agreed to revisit this item in the June 2020 SC meeting. The SC chair thanked Mark for his participation and for engaging discussion on future directions for NAFO/ICES interactions.

## 7. Planning for the 2020 Update Assessment of Greenland Halibut

Japan reported that they will be able to provide an expert on the SCAA model for the June 2020 meeting.

In connection with the 2020 update assessment, the meeting was reminded of the STACREC recommendation regarding the use of the 2018 Canadian survey indices in age-structured models (June 2019 SC report):

"In relation to Greenland halibut in SA2+3KLMNO, STACREC recommends that the 2018 Canadian fall 2J3K and spring 3LNO indices be included in the calculation of the HCR but that the impact on age structure be examined before these indices are included in any age structured model."

## 8. Election of SC co-Chair for RBMS

Fernando González-Costas was appointed as the new SC co-Chair of WG-RBMS.

## 9. Discussion of the Revision of the PA Framework

Scientific Council discussed progress so far on the review. The revision of the NAFO PA Framework has been ongoing since 2014, when the joint Fisheries Commission-Scientific Council Working Group on Risk-based Management Strategies (WG-RBMS) was established. At its first meeting, WG-RBMS recommended that *FC request the SC to convene a technical working group to explore the revision of the precautionary.* WG-PAF began working in 2016 to develop a multi-authored document reviewing the NAFO PAF in the context of approaches adopted in other jurisdictions, and an incomplete draft of this document was presented to SC and the Commission during September 2016 (NAFO SC Working Paper 16/15). Since 2016, the Commission has requested SC to continue its work on the review and since 2018 this has been classified as a priority; however, due to excessive work load resulting from other requests (particularly the Greenland halibut and 3M cod MSEs) no further progress has been made either in SC or WG-RBMS.

In its advice to the Commission this year, SC stated; …"*Scientific Council will be unable to complete this complex review in the short to medium term*. *To complete this work, participation of the Commission will be required, for example, to specify risk tolerances, potential inclusion of buffers, etc."*

Since the suspension of work on the 3M cod MSE, WG-RBMS has decided that the PA framework review will be given top priority for its August 2020 meeting. It was noted that many of the original members of WG-PAF are now either retired or have moved to other work areas and the possibility of re-constituting the group with renewed membership was discussed. It was agreed that priority should be given to completing the WG-PAF review paper in 2020: SC members will work intersessionally to advance the drafting which will be discussed in the June 2020 meeting.

**10. Discussion of STACFEN 10-year Presentation**

It was noted that it has been accepted practice in the past for the STACFEN chair to give a presentation to the Commission, roughly every 5 years, summarizing recent trends in oceanographic conditions. However, it was noted that this presentation was last given in 2012 and was apparently an irregular occurrence prior to that. It was agreed that the current STACFEN chair will discuss with the Secretariat the possibility of him providing this presentation to the Commission in September 2020 and the format it could have. This will be discussed again in the June 2020 SC meeting.

**11. Update on the 3M Cod MSE Process**

The September meeting of WG-RBMS recommended that:

*WG-RBMS concludes that work in WG-RBMS on the 3M cod MSE should be suspended for the time being. This conclusion was reached based on the strong variability observed in the stock dynamics and biological parameters in the past, that create substantial difficulties for developing realistic future simulations and successful development of an HCR. This situation, coupled with the low recruitment observed in recent years that will likely result in a strong decline of the stock biomass even without a fishery, implies that developing an HCR is not considered feasible at this stage. Reopening this issue in WG-RBMS should occur when SC determines that conditions are such that there is a reasonable probability of success.*

As a result, no further work is required on this item at present.

Scientific Council emphasized that this conclusion in no way reflects poorly on the technical team who did an enormous amount of excellent work that will be valuable in future MSE processes (see Section 14.b).

**12. Discussion of the Review of the 3LN Redfish Management Plan**

The current 3LN Redfish Conservation Plan and Harvest Control Rule provides direction on the TAC up to and including 2020 after which a "full review/evaluation" of the management strategy is required. The September 2019 meeting of WG-RBMS considered this and recommended to the Commission that SC be asked in 2020 to do an update assessment and five-year projections (2021 to 2025) to evaluate the impact of annual removals at 18 100 tonnes against the following performance statistics (from NCEM annex I.H):

(a) Very low (< 10%) probability of biomass declining below $B_{lim}$.
(b) Low (< 30%) probability of fishing mortality >$F_{msy}$
(c) Less than 50% probability of declining below 80% $B_{msy}$ on or before 2026

If this level of catch does not result in fulfilling these performance statistics, SC should advise the level of catch that would.

In line with the WG-RBMS recommendation, the Commission has included this as part of their requests to SC for scientific advice in 2020.

**13. International Protocol for Genetic Sampling**

The European Union informed SC of work to develop an international protocol for genetic sampling for correct identification of fish species which could be applied by fisheries inspectors during onboard sampling. The study is underway and the EU would like to send this for review to the Scientific, Technical and Economic Committee for Fisheries (STECF), which meets in October. It was discussed that this could be presented to the SC June 2020 meeting. The EU is also consulting with ICES. They could distribute protocols to CPs, so that they

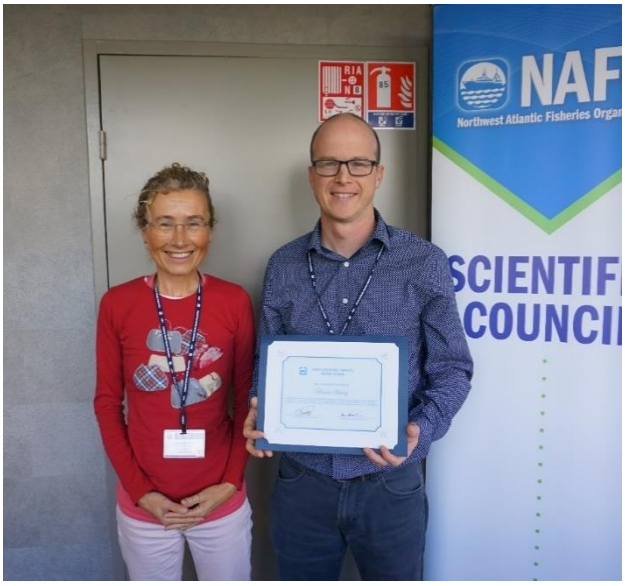
could ask their genetics experts to comment on them, considering that there was limited expertise on this subject in the current SC meeting. Heads of Delegation should be able to distribute to others, so that everybody can be made aware in this way and they know they are requested to consult with their genetics experts.

## 14. Presentation of NAFO Scientific Merit Awards

SC Merit awards recognize outstanding service and/or scientific contributions to the work of the Council.

### a) Presentation of NAFO Scientific Merit Award to Brian Healey

Scientific Council would like to recognize Brian Healey through the Scientific merit award for his six years of service as chair of SC, chair of STACFIS and chair of STACREC, as well as standing in on occasion as chair of both WG-RBMS and WG-EAFFM. Brian has also played a leadership role in a number of initiatives including the Greenland Halibut MSE.




Scientific Council has operated as a well-oiled machine under Brian's direction: even under excessive SC workload Brian has unfailingly modelled highly respectful exchange (always noting SC members valuable contributions and skills), both clear and level-headedness, integrity and good humour. In mid- career, Brian has a very deep expertise in fisheries Science, allowing him to hear and understand the subtlety of all points and quickly make suggestions to address them. These qualities have made for Scientific advisory body that provides robust Science advice in a collaborative and welcoming environment.

Scientific Council members look forward to working with Brian for many years to come.

**b) Presentation of NAFO Scientific Merit Awards to the 3M Cod MSE Technical Team**

In 2018 and 2019, an incredible volume of work was completed to support both the benchmark assessment and technical basis for the MSE explorations of Div. 3M cod. Whilst noting that this work benefited from the contributions of many individuals, SC wishes to recognize the innovation, dedication and perseverance of:

- Fernando Gonzalez-Costas (IEO Vigo, Spain);
- Carmen Fernandez (IEO Gijon, Spain);
- Diana Gonzalez-Troncoso (IEO Vigo, Spain); and
- Agurtzane Urtizberea (AZTI Pasaia Gipuzkoa, Spain: not present at this meeting),

without whom the progress and developments of the benchmark and MSE project would not have been possible. The recent decision to suspend the MSE work was indicative of the deteriorating status of the cod stock and was in no way impacted by the availability of output from the technical team. This group was able to deliver results to WG-RBMS and SC under very challenging timelines. Each of these individuals dedicated extensive time to this project, exploring several technical complications in a comprehensive manner. SC members congratulated their colleagues for their contributions and for receiving this award.

## XI. ADJOURNMENT

There being no other business, the meeting was adjourned at 1800 hours on 26 September 2019. The Chair thanked the Scientific Council Coordinator for his support. The Chair thanked France for their hospitality in hosting the Annual Meeting. As the end of this meeting concluded the term of the current SC Chair, he offered perspectives on a few points relating to the current and future functioning of SC.

He suggested that SC needs to continue to improve the integration of the workings of SC and WG-ESA. A considerable volume of work is being completed in WG-ESA in support of various Commission requests and other initiatives. Given various pending deliverables, and the intention of NAFO to move towards an Ecosystem Approach, this situation will certainly continue in the short to medium term. Continued thinking on how to best improve the efficiency of the current process and timelines for producing SC advice from work initiated in WG-ESA was encouraged. Secondly, the Chair offered the opinion that SC should proceed cautiously when considering which requests can be addressed given the available capacity. In recent years, the number as well as the scope of requests for advice from the Commission has generally increased. When combined with the workload to address the technical needs of the joint SC-Commission WGs, it may be at times advisable to defer one or more requests for future years. Finally, it was suggested that SC consider extending the periods of office for the Chair and Vice-Chair of SC from two year to three year terms. While this would add significantly to the commitments required to any prospective chairs, it would reduce the frequency of needing to find suitable candidates at a time when SC capacity is overburdened.

Finally, the chair thanked the members of Scientific Council for their continuous hard work, offered his congratulations and support to the incoming SC executive Committee, and wished everyone a safe journey home.

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

Chair: Carmen Fernández

### 1. Opening, Appointment of Rapporteur

The Committee met in Bordeaux, France, during 23-26 September 2019, to consider the various matters in its agenda. Representatives attended from Canada, Denmark (in respect of Faroes and Greenland), European Union (Estonia, European Commission, Portugal, Spain), France (in respect to St. Pierre et Miquelon), Japan, Norway, the Russian Federation, Ukraine and the United States of America. The Scientific Council Coordinator was in attendance. The STACREC Chair (Carmen Fernández) opened the meeting and welcomed everyone. She also acted as Rapporteur.

### 2. Fishery Statistics

### a) Progress report on Secretariat activities

There were no new items to report at this meeting.

### b) Review of STATLANT 21

The following table updates the situation with the submission of STATLANT. There are still a few outstanding submissions and the Secretariat will follow up with the data providers.

**Table 1.** Dates of receipt of STATLANT 21A and 21B reports for 2016-2018 up to 26 September 2019

| Country/component | STATLANT 21A (deadline, 1 May) | | | STATLANT 21B (deadline, 31 August) | | |
|---|---|---|---|---|---|---|
| | 2016 | 2017 | 2018 | 2016 | 2017 | 2018 |
| CAN-CA | 30 May 17 | 31 May 18 | | 30 May 17 | 31 May 18 | |
| CAN-SF | 28 Apr 17 | 05 May 18 | 29 Apr 19 | 7 Sep 17 | 11 Sep 18 | 30 Aug 19 |
| CAN-G | 26 May 17 | 30 Apr 18 | | 16 Aug 17 | 24 Aug 18 | 23 Aug 19 |
| CAN-NL | 26 Apr 17 | 17 May 18 | 17 May 19 | 29 Aug 17 | | |
| CAN-Q | | | | | | |
| CUB | | | | | | |
| E/BUL | | | | | | |
| E/EST | 22 May 17 | 04 May 18 | 30 Apr 19 | 30 Aug | 13 Sep 18 | |
| E/DNK | 23 May 17 | 23 Apr 18 | 1 May 19 | 31 Aug | 03 Sep 18 | |
| E/FRA | | | | | | |
| E/DEU | 25 Apr 17 | 25 Apr 18 | 30 Apr 19 | 31 Aug | 30 Aug 18 | 19 Sep 19 |
| E/LVA | 20 Apr 17 | | 24 Apr 19 | | | |
| E/LTU | 9 May 17 | 24 Apr 18 | 24 Apr 19 | 31 May 17 | 24 Apr 18 | |
| EU/POL | | | | | | |
| E/PRT | 19 Apr 17 | 20 Apr 18 | 30 Apr 19 | 29 Aug 17 | 03 Sep 18 | 19 Sep 19 |
| E/ESP | 31 May 17 | 30 May 18 | | 7 Aug 17 | 02 Aug 18 | |
| E/GBR | 25 Apr 17 | 31 May 18 | | | 24 Jul 18 | |
| FRO | 2 May 17 | 18 May 18 | 22 May 19 | 09 Jun | | 18 May 19 |
| GRL | 1 May 17 | 30 Apr 18 | 29 Apr 19 | 22 Aug 17 | | 22 Aug 19 |

| | | | | | | |
|---|---|---|---|---|---|---|
| ISL | | | | | | |
| JPN | 19 Apr 17 | 01 May 18 | 23 Apr 19 | 30 Aug 17 | 31 Aug | 30 Aug 19 |
| KOR | | | | | | |
| NOR | 4 May 17 | 23 Apr 18 | 25 Apr 19 | 25 Aug 18 | 16 Aug 18 | 26 Aug 19 |
| RUS | 11 May 17 | 04 May 18 | 14 May 19 | 21 Jul 17 | | |
| USA | | 10 Jul 18 | 10 Jun 19 | | | |
| FRA-SP | 25 May 17 | 18 May 18 | 14 Mar 19 | | 5 Jul 18 | |
| UKR | | | | | | |

## 3. Research Activities

### a) Biological sampling

#### *i) Report on activities in 2018/2019*

The list of Biological Sampling Data for 2018 was compiled by the Secretariat as SCS document 19/18. STACREC reviewed the document, which had entries from EU-Spain, EU-Spain and Portugal and EU-Estonia. The document is in the process of being finalized.

#### *ii) Report by National Representatives on commercial sampling conducted.*

The reports of 2018 activities were presented in June. The current guideline for the suggested format of the National Research Reports is shown in Section 4.b of this report.

#### *iii) Report on data availability for stock assessments (by Designated Experts)*

Designated Experts were reminded to provide the stock assessment data to the NAFO Secretariat, storing the files on the SC June meeting SharePoint under the folder "DATA". If possible, any "non-standard" software or code used in the stock assessments should also be stored in the same place.

### b) Biological surveys

#### *i) Review of survey activities in 2018*

The reports were presented in June.

#### *ii) Surveys planned for 2019 and early 2020*

SCS documents 19/16 and 19/19 were updated for this meeting and will be finalized during the NIPAG meeting in November. Discussion on annual submissions took place in this meeting (see Section 4.b of this report).

### c) Tagging activities

As agreed during the June meeting, an SCS document 19/17 was now finalized. Also as agreed in the June meeting, STACREC recommended that the collection of these data by the NAFO Secretariat and the preparation of this SCS document be discontinued (see Section 4.b of this report).

### d) Other research activities

No new items were presented at this meeting

## 4. Review of SCR and SCS Documents

No new documents were presented at this meeting

## 5. Other Business

Outstanding matters from previous recommendations:

Participants were reminded that some other STACREC recommendations will require action from SC members in 2020, e.g. in connection with presentation of survey results, the validity of survey indices under incomplete survey coverage, or the separation of redfish species in surveys. Participants were requested to read the recommendations section of the STACREC report from June 2019 and to keep them in mind for their work in 2020.

### a) Communication of scientific studies to fishing fleets in the NAFO area

In 2015, STACREC **recommended** that *the NAFO Secretariat develop a framework for communicating tagging study information to vessels from Contracting Parties and Coastal States fishing in the Convention Area (e.g., via a link to this information on the NAFO website homepage).*

This was discussed in several previous meetings, where potential options were considered for communicating information on relevant scientific studies (not necessarily only tagging studies) to fishing vessels in the NAFO area. The intention is to have a pro-active way of sending notifications to the fishing fleets about any relevant scientific studies of which the SC is aware. After various discussions, it was concluded that the best way forward was for STACREC to provide the available scientific information (brought to the SC) in the June meeting every year, inserting any updates in the September meeting (and, if required, again at the end of the year). Upon receipt of this information, the Secretariat will provide the summary list of scientific studies to each flag State Fisheries Monitoring Centre (FMC), for distribution to vessel owners, masters, etc.

### b) Impact of sampling rates and survey coverage on the precision of survey estimates.

In 2015, STACREC **recommended** that *an analysis of sampling rates be conducted to evaluate the impact on the precision of survey estimates.* As a separate aspect, in September 2017 STACREC discussed *possibilities for combining multiple surveys in different areas and at different times of the year to produce aggregate indices*.

When these issues were discussed in recent SC meetings, it was considered that the two topics (*how to deal with reduced survey coverage / reduced sampling rates, and possibilities for combining multiple surveys to produce aggregate indices of stock abundance*), would together constitute the basis of a future practical ("hands-on") workshop, with participation of both external scientists and scientists regularly attending the SC meetings. The timing and organisation of this workshop depends on other commitments the SC needs to attend in the near future (e.g. NAFO PA framework review and VME fisheries work). It was decided that, as a first step:

- A speaker on this topic will be invited to the June 2020 SC meeting. The incoming STACREC chair will take the lead in arranging this invitation.
- In June, STACREC **recommended** that *a consistent approach to determining if an incomplete survey can be considered as an index for a particular stock be developed. As a first step, an analysis of past decisions to include or exclude incomplete surveys was conducted and preliminary guidelines were produced.* STACREC considered it desirable that this work could be presented at the ICES WKUSER workshop (Workshop on Unavoidable Survey Effort Reduction), scheduled for January 2020. A Canadian scientist is planning to attend the workshop and will inform STACREC in 2020 of any relevant feedback and findings from that workshop.

### c) Annual submissions of information to NAFO: National Research Reports, Inventories of biological surveys, List of biological sampling data, List of tag releases, RV surveys on a stock by stock basis

In June 2019, STACREC reviewed the information submitted in response to the annual request by NAFO (by letter sent typically around January) and discussed the relevance of these submissions, both in terms of their content and their format. Details of this discussion can be found in Section 7.b of the June 2019 STACREC report. Several outstanding matters follow from June.

National Research Reports:

STACREC noted in June that these reports are useful and should continue to be produced. However, their quality was perceived to be somewhat variable. As a step towards improving them, it was suggested to have informal exchanges between those SC members most heavily involved in producing or using the reports, in which the main uses and "deficiencies" of the different national reports could be identified. These exchanges could take place in the June 2020 STACREC meeting and would require the National Research Reports to be available at the beginning of the June meeting. The Secretariat was requested to investigate for September 2019 if a format already exists in NAFO for these documents, to ensure that, if such a format exists, it is considered in future discussions about these reports.

The Secretariat reported in September that the NAFO guideline for the suggested format of these reports has not changed much since the ICNAF days and is as included in the annual correspondence (each January) with the NAFO request for SC information. It is copied here for reference (note that format is to be discussed in June 2020, so that the suggested format may change at that time):

"*By NAFO Subarea:*

*I. SUBAREA*

*A. Status of the Fisheries*
*This should be broken down by species and should first indicate the changes that have taken place in the catches. Any available information regarding quantities of fish, by species if possible, being used for industrial purposes should also be presented. An explanation should follow for these changes based on scientists' best judgement. Reference to biological conditions (e.g. length and age composition), fishing conditions (e.g. effort and availability) and environmental conditions, should be made where necessary and appropriate. Any forecasts for the coming year should be included here. Graphic presentations supporting the text are acceptable.*

*B. Special Research Studies*

*1. Environmental Studies*
*a) Hydrographic studies*
*a) Plankton studies (including eggs and larvae)*
*c) Benthic studies*
*d) Observations on ice conditions in Subareas 0 to 4*
*e) Other environmental studies*

*2. Biological studies by species*
*Material should be presented in the order of the life cycle, reporting studies on eggs and larval stages first.*
*3. Gear and selectivity studies, including studies on fishing operations*
*4. Miscellaneous studies*"

RV surveys on a stock by stock basis:

This information is annually provided by the Designated Experts (DEs) as tables by stock and these tables are all included in an SCS document in text file format. In June it was concluded that there is some utility in the information provided in the current tables and in them being publicly available (as is currently the case), but that finding a more convenient way to provide and present this information would be helpful. Instead of submitting plain text files with the information, it would be better to have this information in a relational spreadsheet or database.

The Secretariat conducted an initial exploration of options and reported in September that an RV survey database could be created that would look similar to an Excel spreadsheet and would be searchable for the end user. The database search terms for the end user, such as year, stock, country, research survey, would be determined by SC. The database could be password protected on the data entry end, but visible for the end user

via the NAFO website (similar to the STATLANT tool). The input data from DEs could be submitted to the Secretariat in an Excel file following an agreed template.

STACREC discussed these findings and concluded that an Excel file is the preferred option for the actual submissions from DEs. The appropriate fields in the Excel template, which should be similar to the ones presently used in the submitted tables, will be agreed in STACREC at the start of the June 2020 meeting. The DEs will then fill out the Excel sheets with the agreed fields during the June 2020 meeting.

Inventories of biological surveys:

STACREC **recommended** in June that *the collection of this information and the corresponding SCS document be discontinued after 2019, subject to confirmation in September 2019.*

STACREC reviewed this recommendation in September. It noted that the corresponding SCS document actually contains both commercial sampling and survey information and that, therefore, the decision to discontinue the SCS was not as straightforward as considered in June.

Instead of discontinuing the collection of this information and the SCS document immediately, STACREC decided to request the Secretariat to review the information contained in the different SCS documents it annually compiles on data submissions and to prepare a proposal for the June 2020 meeting regarding what information the NAFO Secretariat needs to hold. STACREC will then make final recommendations.

List of tag releases:

STACREC **recommended** in June that *this information no longer be collected in 2020 and that the SCS be discontinued after 2019, subject to confirmation in September 2019.*

STACREC reviewed this recommendation in September and agreed to recommend its implementation.

**4. Adjournment**

This report was presented and accepted on September 26, and the STACREC meeting closed at 17:00 h.

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

Chair: Karen Dwyer Rapporteur: Tom Blasdale

### I. OPENING

The Committee met at the Pullman Hotel, Bordeaux Lac, France, during 23-27 September 2019, to consider the various matters in its agenda. Representatives attended from Canada, European Union (Estonia, European Commission, Portugal, and Spain), France (with respect to St. Pierre et Miquelon), Denmark (with respect to the Faroe Islands), Japan, Ukraine, Norway, the Russian Federation and the United States of America. The Scientific Council Coordinator was in attendance.

### II. ASSESSMENTS DEFERRED FROM THE JUNE 2019 MEETING.

### 1. Northern Shortfin Squid (*Illex illecebrosus*) in Subareas 3+4

(SCR Doc. 98/59, 75, 06/45, 16/21REV, 16/34REV, 19/042)

#### a) Introduction

Northern shortfin squid (*Illex illecebrosus*) is assumed to constitute a single stock throughout its range from Newfoundland to Florida, in NAFO Subareas 2-6, but is managed as northern (Subareas 3+4) and southern (Subareas 5+6) stock components by NAFO and the USA, respectively (SCR Doc. 98/59). Thus, fishery removals in relation to the biomass levels of each stock component affect one another. As a result, fishery and research survey data for the southern stock component in Subareas 5+6 are also presented. The two stock components have separate annual catch quotas which are computed using different methods.

*I. illecebrosus* is a semelparous species (spawns once during its lifespan then dies shortly thereafter) which has a lifespan of less than one year (SCR Doc. 98/59). Age data indicate that spawning occurs throughout the year. The only documented spawning area is located near the edge of the USA shelf and upper slope in the Mid-Atlantic Bight, where spawners have been caught during spring through summer, and likely provide the primary source of recruitment to northern fishing grounds on the Scotian Shelf and off Newfoundland because only a few mature females have been caught in these northern fishery regions (SCR Doc. 16/34). *I. illecebrosus* is a nerito-oceanic squid species which undergoes annual migrations on and off the continental shelf between Cape Hatteras, North Carolina and the Grand Bank off Newfoundland during spring/early summer and late fall, respectively. The migrations progress from south to north in the spring and north to south in the fall. Environmental factors have a major influence on the distribution, growth rates and recruitment of this highly migratory species, and when favorable, may lead to short high productivity periods.

#### *i) Description of Fisheries and Catches*

The onset and duration of the fisheries in each Subarea generally reflect the timing of squid migrations through each fishing area. Fisheries in the south start and end earlier than those in the north; in Subareas 5+6 and Subarea 4 (June-October) and in Subarea 3 (July-November, SCR Doc. 16/34). Fisheries for Northern shortfin squid consist of Canadian commercial and recreational inshore jig fisheries in Subarea 3, and prior to 1999, an international bottom trawl fishery for silver hake, shortfin squid and argentine operated in Subarea 4. Since 1999, there has been no directed squid fishery in Subarea 4 and catches from this Subarea have mainly been from bycatch in Canadian small-mesh bottom trawl fisheries (e.g., silver hake). Total catches from Subareas 3-6 were primarily from Subareas 3+4 during 1976-1981 and have been primarily from the USA offshore bottom trawl fishery in Subareas 5+6 since then. Prior to the mid-1980s, international bottom trawl and midwater trawl fleets participated in directed squid fisheries in Subareas 3, 4 and 5+6. During 2018, at least one trawler targeted northern shortfin squid in the NRA (in Div. 3O).

In Subareas 3+4, a TAC of 150 000 tons was in place during 1980-1998. The TAC was 75 000 tons in 1999 and has been 34 000 tons since then. Occasionally, very low catches occur in Subarea 2 and these catches have been included with Subarea 3 for convenience. Subareas 3+4 catches were highest during 1976-1981, with a peak of 162 100 tons in 1979, but then declined sharply to only 400 tons in 1983. The Subareas 3+4 fishery has not

recovered from the 1983 collapse. Catches totaled less than 1 000 t during 1983-1988 and, during 1989-1998, ranged between 1 100 t in 1995 and 15 600 t in 1997; the latter being the highest catch since 1981 (SCR Doc. 16/34). Since 1999, catches from Subareas 3+4 have been much lower, and with no directed fishery in Subarea 4, were primarily harvested by the Canadian commercial inshore jig fisheries during 2000-2011. During 1999-2006, catches in Subareas 3+4 ranged between 57 tons in 2001 and 7 000 tons in 2006. Thereafter, Subareas 3+4 catches ranged from 700 tons in 2009 to 14 tons in 2015; the lowest level since 1953. Thereafter, catches increased from 150 t in 2016 to 1 500 t in 2018.

Catches from Subarea 3 are underestimated because the Canadian recreational jig fishery catches are not recorded in their domestic catch database. Since 2000, most of the catches in Subareas 3+4 have been harvested by the Canadian inshore jig fisheries (commercial and recreational), yet neither fishery is subject to annual quotas or any other type of fishery management.

Since this species is considered to constitute a single stock throughout Subareas 2 to 6 (SCR Doc. 98/59), catch trends in Subareas 3+4 must be considered in relation to those in Subareas 5+6.

During 1972-1982, the period of highest catches by the international squid fishing fleets in Subareas 5+6, catches ranged from 15 600 tons in 1981 to 24 900 tons in 1977. After 1982, the international fleets were phased out and an offshore, domestic bottom trawl fishery for Northern shortfin squid was developed. Catches in Subareas 5+6 averaged 11 500 tons during 1983-2016. Thereafter, catches increased from 22 500 tons in 2017 to 24 100 tons in 2018 (Figure. 1.1). The preliminary catch for 2019 totaled 27 000 tons and was the highest catch since 1963.

Recent nominal catches and TACs ('000 tons) are as follows:

| | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|---|---|---|---|
| TAC SA 3+4 | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 |
| STACFIS SA 3+4 | 0.1 | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 | 0.1 | 0.4 | 1.4 | |
| STACFIS SA 5+6 | 15.8 | 18.8 | 11.7 | 3.8 | 8.8 | 2.4 | 6.7 | 22.5 | 24.1 | |
| STACFIS Total SA 3-6 | 15.9 | 18.9 | 11.7 | 3.8 | 8.8 | 2.4 | 6.8 | 22.9 | 25.5 | |

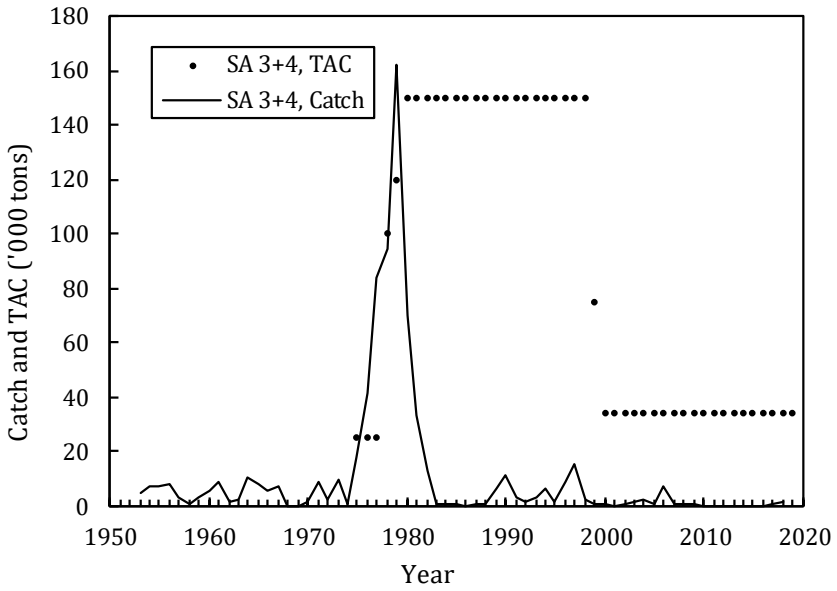



**Figure. 1.1**. Northern shortfin squid in Subareas 3+4: nominal catches and TACs in relation to catches from Subareas 5+6 and the total stock.

## b) Input Data

### *i) Commercial fishery data*

Nominal catches were available for Subareas 3+4, during 1953-2018, and for Subareas 5+6 during 1963-2018, with preliminary catches for 2019. Catches from Subareas 5+6, prior to 1976, may not be accurate because distant-water fleets did not report all squid catch by species, and therefore, shortfin squid catches were prorated. The accuracy of the Subareas 3+4 catches prior to the mid-1970s is unknown. Subarea 4 catches include catches obtained by the Canadian Observer Program Database, during 1987-1998, a period of 100% fishery coverage plus catches from the Canadian MARFIS Database (SCR Doc. 16/34). Catches in Subarea 3 are underestimated because the Canadian inshore recreational jig fishery catches are not recorded (SCR Doc. 19/042). STACFIS catches during 2018 are estimated using the method developed by the joint Com-SC Catch Estimations Strategy Advisory Group (CESAG, Annex 1 of COM-SC Doc. 17-08).

### *ii) Research survey data*

Biomass indices were available from various research bottom trawl surveys, with different depth and area coverage. There is no single synoptic survey that covers the entire distribution of the stock. However, trends in biomass indices were positively correlated for the Div. 4VWX July survey and the Subareas 5+6 and 4T fall surveys (SCR Doc. 98/59). Therefore, biomass indices for these other surveys, including the Div. 3M July survey, were included in the assessment. Relative biomass indices were derived for the northern stock component using data from multi-species bottom trawl surveys conducted in Subarea 3 and Subarea 4. Relative abundance and biomass indices were also derived for the southern stock component using data from multi-species bottom trawl surveys conducted by the Northeast Fisheries Science Center (USA). All of the surveys incorporated stratified-random sampling designs with stratification based on depth. Sampling during all surveys was conducted around-the-clock with the exception of the Div. 3M surveys and the 1971-1984 Div. 4T surveys which were conducted solely during the daytime, the latter which was standardized for diel effects on catches (SCR Doc. 19/042).

The Div. 4VWX survey indices are the best indicator of biomass for the northern stock component because the survey covers a large area of Northern shortfin squid habitat and occurs during July, a time when the species has migrated onto the continental shelf and is most available to the survey, and because the survey is a measure of pre-fishery biomass (SCR Doc. 19/042). As a result, these indices were used to assess whether the Subareas 3+4 stock component was at a low or high productivity level during the previous year.

The Canadian spring and fall surveys in Div. 3LNO occur when the species is migrating on and off the Grand Bank, respectively (SCR Doc. 06/45). As a result, they are not considered a reliable indicator of stock status and so the Div. 3LNO biomass indices were not included in the assessment.

The EU-Spain 3NO survey biomass index increased in 2018 and 2019 to the second highest and highest levels respectively in the time series.

**Summer surveys:** Biomass indices were derived for Canadian research bottom trawl surveys conducted during July on the Scotian Shelf and Bay of Fundy (Div. 4VWX, 1970-2019) for the EU-Spain/Portugal research bottom trawl surveys conducted primarily during July (Div. 3M, 1988-2019; Figure. 1.2). The 2019 biomass index for Div. 3M is preliminary. Both surveys occur before or near the start of the shortfin squid fisheries in all Subareas, so the indices are assumed to represent pre-fishery measures of relative biomass.

Biomass indices for the Div. 4VWX surveys were derived using data from strata 440-495. Different vessels were used to conduct the Div. 4VWX surveys during the periods of 1970 to 2019. A survey gear change occurred in 1982, but there are no gear or vessel conversion coefficients available with which to standardize the shortfin squid biomass indices prior to 2004. However, a comparative fishing experiment, conducted during July of 2005, found no significant vessel effect between the CCGS *Teleost* and CCGS *Needler*. Due to survey vessel mechanical problems, large areas of Northern shortfin squid habitat were not sampled in Div. 4VWX during 2018, so biomass indices for this year was not computed (SCR Doc. 19/042).

Biomass indices (swept-area biomass) for the July Div. 3M surveys were derived using data from strata 1-19 (SCR Doc. 16/21; SCR Doc. 19/042). The biomass time series was standardized for the vessel change that occurred in 2003. Analyses that utilized data from comparative fishing experiments indicated that the vessel

currently used to conduct the Div. 3M surveys is 28% more efficient at catching Northern shortfin squid, in terms of biomass, than the previous survey vessel that conducted most of the surveys during 1988 and 1991-2002 (biomass conversion factor = 1.279, SCR Doc. 16/21).

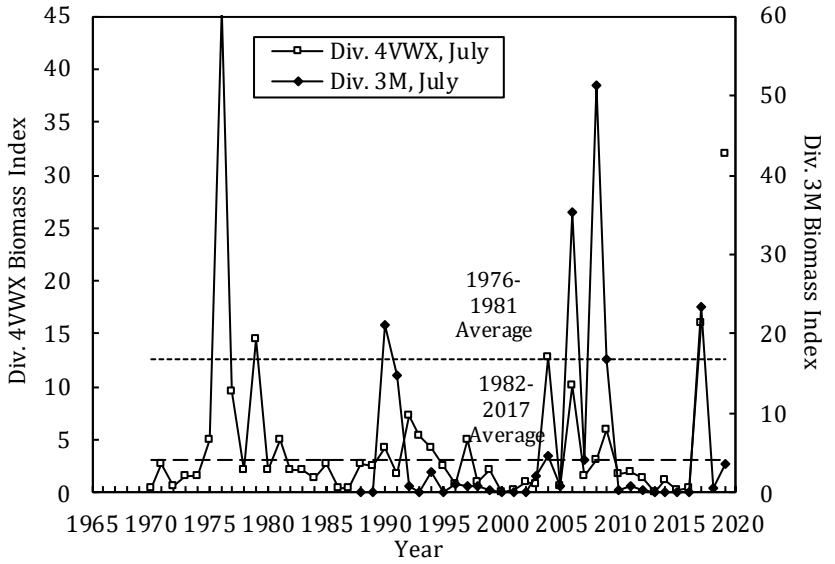



**Figure 1.2. Northern shortfin squid in Subareas 3+4: summer biomass indices for Div. 4VWX and Div. 3M.**

**Fall surveys:** Biomass indices were derived for Canadian research bottom trawl surveys conducted during September in the southern Gulf of St. Lawrence (Div. 4T, 1971-2018) and USA research bottom trawl surveys conducted during September-October on the USA continental shelf between Cape Hatteras, North Carolina and the Gulf of Maine (Subareas 5+6, 1967-2018; Figure 1.3). Due to survey vessel mechanical problems, large areas of Northern shortfin squid habitat were not sampled in Subareas 5+6 during 2017.

Biomass indices for the Subareas 5+6 and Div. 4T surveys were standardized for all vessel and gear changes. The Div. 4T survey indices were also standardized for diel changes in catchability. Both surveys occur at or near the end of the shortfin squid fisheries and are assumed to represent post-fishery measures of relative biomass.

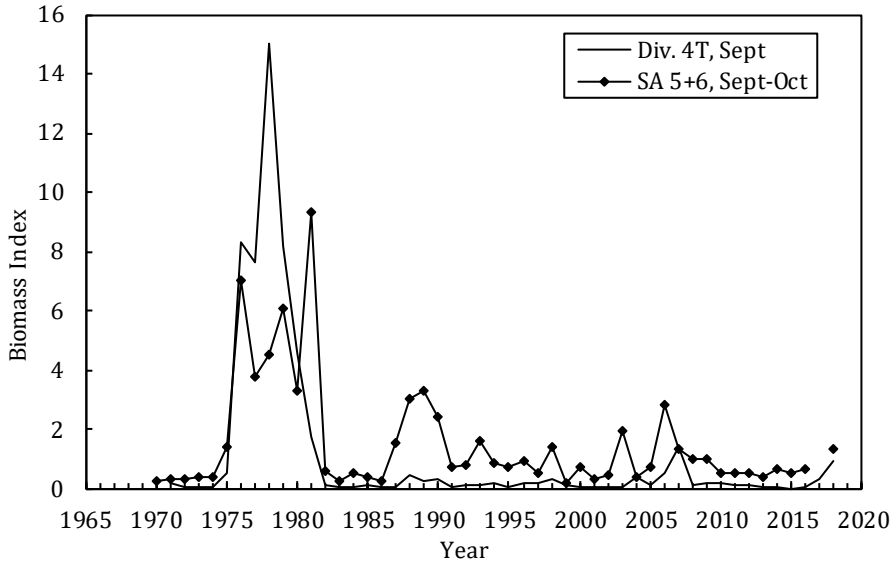



**Figure 1.3.** Northern shortfin squid in Subareas 3+4 in relation to Subareas 5+6: fall survey biomass indices in Div. 4T and Subareas 5+6.

**Summary of research surveys data trends.** The Div. 4VWX biomass indices showed a high degree of inter-annual variability. However, a period of high productivity occurred during 1976-1981, averaging 13.2, and low productivity periods occurred during 1970-1975 and 1982-2017, averaging 2.0 and 3.0, respectively. Biomass indices generally declined after 2004 and were below the 1982-2017 low productivity period average (3.0) during most years for 2007-2016. The biomass index for 2018 was unknown for the reason described above, but the 2019 index (32.1) was the second highest on record.

Trends in the Div. 3M biomass indices were similar to the trends in the Div. 4VWX biomass indices only during periods of high biomass in Div. 3M (SCR Doc. 19/042). This suggests that the Flemish Cap represents marginal *Illex* habitat in July during most years, but that the survey indices are useful biomass indicators for Subareas 3+4 when squid biomass is high on the Flemish Cap.

Similar to the Div. 4VWX survey biomass indices, biomass indices for both the Div. 4T and Subareas 5+6 fall surveys were much higher during 1976-1981 than thereafter. Trends in the biomass indices for both surveys were correlated, despite the fact that the 4T survey area covers only a portion of shortfin squid habitat in Subarea 4. There were no *Illex* catches in the Div. 4T survey during 2015 and biomass indices during 2013 and 2014 were very low, similar to the 2013 and 2015 biomass indices for Div. 4VWX.

Overall, biomass indices for the Div. 4VWX surveys, as well as the Div. 4T and Div. 3M surveys were at or near the lowest values for each time series during 2013-2015. During 2017 and 2018, biomass indices for Div. 4T increased and reached the second highest level in the time series in 2018. Although the Div. 4VWX biomass index was unknown for 2018, the 2019 biomass index was the second highest level in the time series.

***iii) Biological studies***

Trends in mean body size reflect the combined effects of emigration/immigration, recruitment, growth and mortality of the overlapping microcohorts which occur as a result of continuous recruitment throughout the year for this semelparous species. For *I. illecebrosus*, these factors are primarily influenced by environmental conditions (SCR Doc. 16/34). Mean body weights of Northern shortfin squid caught in the July Div. 4VWX surveys were highest during 1976-1981, averaging 150 g, and much lower, averaging 81 g, during 1982-2017 (Figure 1.4). Likewise, mean body weights were much larger in the Subareas 5+6 fall surveys during 1976-1981, averaging 295 g, and much lower, averaging 101 g, during 1982-2017. However, the mean body weight values for the two time series cannot be compared because of the differences in survey selectivity. During 1982-2018, the mean body weight of squid caught in the Subareas 5+6 surveys gradually decreased. The mean body weight trend differed for squid caught in the div. 4VWX surveys. Since 1982, the mean body weight of squid caught in the Div. 4VWX surveys fluctuated widely around the 1982-2017 low productivity period average, and during 1982-1996, was generally below the average (although increasing) and during 1997-2017 was generally above the average. Mean body size was unknown for 2018, but the 2019 mean body size (164 g) was the highest since 1977 and was above the high productivity period average.

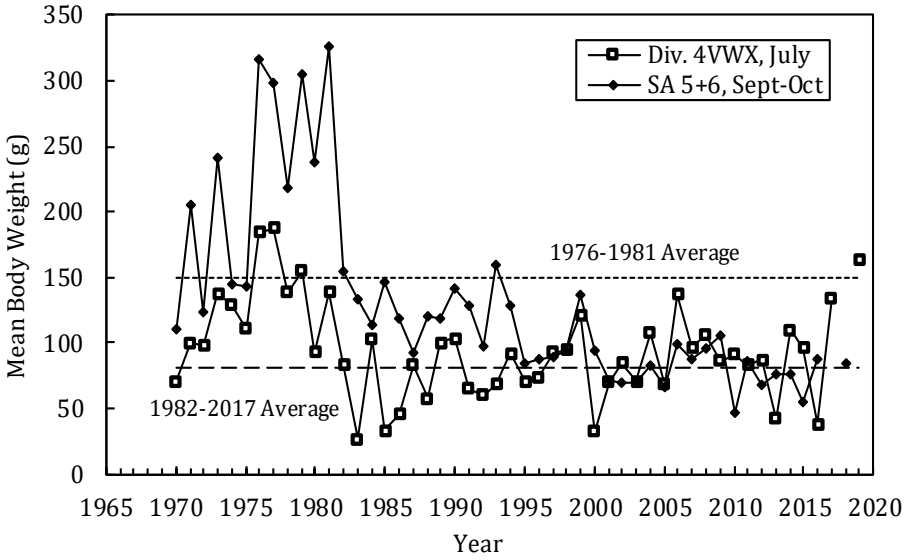



**Figure 1.4.** Northern shortfin squid in Subareas 3+4: mean body weight of squid in the Div. 4VWX surveys during July and in the Subareas 5+6 surveys during September-October.

***iv) Relative fishing mortality indices***

Relative fishing mortality indices for Subareas 3+4 were computed as the Subareas 3+4 nominal catch divided by the Div. 4VWX July survey biomass index (SCR Doc. 98/75). The indices were highest during 1977-1982, reaching a peak of 4.20 in 1978 and averaging 1.69 (Figure 1.4). During 1982-2014, relative fishing mortality indices were much lower, averaging 0.12, with a peak of 0.96 in 1996. Relative fishing mortality indices have consistently been below 0.12 since 2004, and during 2009-2017, were the lowest values in the time series. There was no index for 2018.

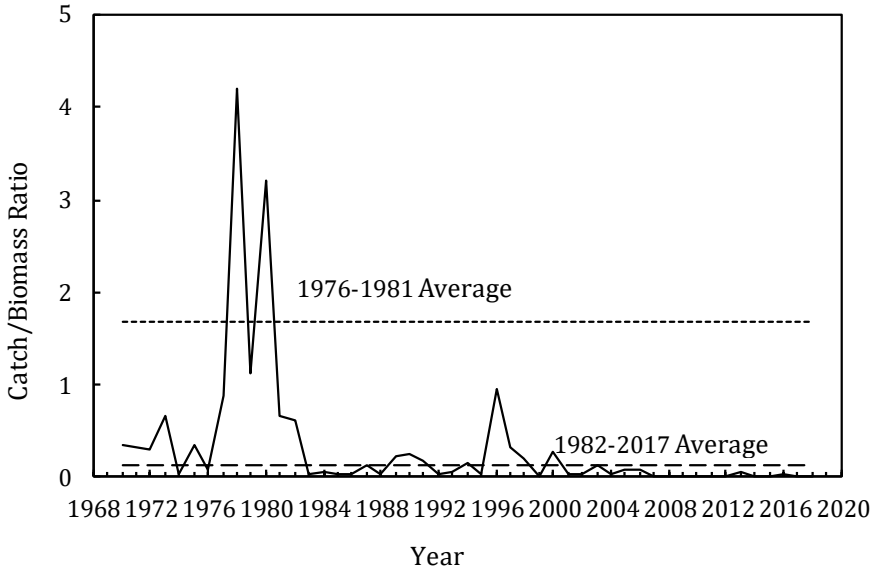



**Figure. 1.5.** Northern shortfin squid in Subareas 3+4: relative fishing mortality indices – SA 3+4 CATCH/Div.4VWX survey biomass.

**c) Assessment Results**

**Biomass and Mean Body Size:** During 2010-2012, relative biomass indices from the Division 4VWX surveys remained at levels ranging from 1.5-1.9 kg per tow, which were well below the average for the 1982-2017 low

productivity period. During 2013 and 2015 the Div. 4VWX biomass indices were the two lowest values in the time series. The biomass index was unknown for 2018, but the 2019 biomass index was the second highest in the time series.

For squid caught during the Div. 4VWX surveys, the high productivity period was associated with a larger mean body size (averaging 150 g) than the 1982-2017 low productivity period (averaging 81 g). During 1982-1996, mean body sizes were generally below the 1982-2017 low productivity period average (although increasing) and during 1997-2017 were generally above the average. Mean body size was unknown for 2018, but the 2019 mean body size (164 g) was the highest since 1977 and was above the high productivity period average.

**Fishing Mortality:** Relative fishing mortality indices for Subareas 3+4 were highest during 1977-1982 and have been much lower since 1982. There were no catches of *Illex* in Subarea 3 during 2013-2015 and there has not been a directed fishery in Subarea 4 since 1999. During 2009-2017, relative fishing mortality indices were at the lowest levels on record. There was no index for 4VWX in 2018.

**Recruitment:** Recruitment occurs throughout the year and is strongly influenced by environmental conditions, resulting in low and high productivity states and the lack of a stock-recruitment relationship (SCR Doc. 98/75).

**State of the Stock:** Trends in fishery and research vessel survey data indicate that a period of high productivity (1976-1981) occurred in Subareas 3+4 between two low productivity periods (1970-1975 and 1982-2017). During 2018, the Div. 4VWX survey was not completed. The Div. 4VWX biomass index and mean body size during 2019 indicate that the stock may be moving towards a high productivity period.

### d) Reference Points

Conventional reference points are inappropriate for squid stocks because of their unique life history. Two reference states, "high productivity" or "low productivity" states, are defined by trends in stock biomass and mean body weight in the July Div. 4VWX bottom trawl surveys. Two proxies for $F_{lim}$, the potential yield which the northern stock component may be able to sustain under the current low productivity regime, are 19 000 tons and 34 000 tons (SCR Doc. 98/75). The potential yield during a high productivity state has not been determined.

The method used to compute potential yield only applies to the low productivity period, does not account for effects of environmental conditions on squid yield, and assumes that the high relative fishing mortality indices which occurred during 1976-1981 (which were followed by a rapid decline in the Div. 4VWX biomass indices) are appropriate for the current time period.

### e) Research Recommendations

STACFIS **recommends** that *gear/vessel conversion factors be computed to standardize the 1970-2003 relative abundance and biomass indices from the July Div. 4VWX surveys.*

STATUS: No progress. STACFIS reiterates this research recommendation.

## III. OTHER MATTERS

### 1. Nomination of Designated Experts

There were no changes to the current Designated Experts for stocks.

### 2. Other matters

### a) Review of SCR and SCS Documents

There was one SCR submitted, NAFO SCR Doc. 19/042, 2019 Assessment of Northern Shortfin Squid (*Illex illecebrocus*) in Subareas 3+4 by Hendrickson and Showell, Ser No. N6973 which was taken as part of the stock assessment for SA 3+4 squid assessment.

### b) FIRMS Classification for NAFO Stocks

STACFIS reiterates that the Stock Classification system is not intended as a means to convey the scientific advice to the Commission, and should not be used as such. Its purpose is to respond to a request by FIRMS to provide such a classification for their purposes. The category choices do not fully describe the status of some stocks. Scientific advice to the Commission is to be found in the Scientific Council report in the summary sheet for each stock.

| Stock Size (incl. structure) | Fishing Mortality | | | |
|---|---|---|---|---|
| | None–Low | Moderate | High | Unknown |
| Virgin–Large | 3LNO Yellowtail Flounder<br>3LN Redfish | | | |
| Intermediate | 3M cod<br>3M Northern shrimp[3]<br>SA3+4 Northern shortfin squid | SA0+1 Northern shrimp[1]<br>DS Northern shrimp[1]<br>0&1A Offshore & 1B–1F Greenland halibut<br>3M Redfish[3] | | Greenland halibut in Disko Bay[2]<br>SA1 American Plaice<br>SA1 Spotted Wolffish<br>SA2+3KLMNO Greenland halibut |
| Small | 3NOPs White hake<br>3NO Witch flounder<br>3LNOPs Thorny skate | | | Greenland halibut in Uummannaq[2]<br>Greenland halibut in Upernavik[2] |
| Depleted | 3M American plaice<br>3LNO American plaice<br>3NO Cod<br>3LNO Northern shrimp | | | SA1 Redfish<br>SA1 Atlantic Wolffish |
| Unknown | SA2+3 Roughhead grenadier<br>3NO Capelin<br>3O Redfish | | | 6G Alfonsino |

[1]Shrimp will be re-assessed at the SC shrimp meeting in November 2019
[2] Assessed as Greenland halibut in Div. 1A inshore
[3] Fishing mortality may not be the main driver of biomass for Div. 3M Shrimp and Redfish

### c) Other business

#### *i) Invited speaker*

STACFIS discussed having an invited speaker attend the June 2020 Scientific Council meeting, in conjunction with STACREC on the topic of combining surveys for the purpose of developing more fulsome indices wherever possible. This person may also be an external reviewer for the meeting.

### 3. Adjournment

The meeting was adjourned on 26 September 2019.

## APPENDIX III. SCIENTIFIC COUNCIL AGENDA, SEPTEMBER 2019

### I. Plenary Session

1. Opening
2. Appointment of Rapporteur
3. Adoption of Agenda
4. Plan of Work

### II. Review of Scientific Council Recommendations

### III. Joint Session of Commission and Scientific Council

1. Implementation of 2018 Performance Review Panel recommendations

2. Presentation of scientific advice by the Chair of the Scientific Council
   a) Response of the Scientific Council to the Commission's request for scientific advice
   b) Feedback to the SC regarding the advice and its work during this meeting
   c) Other issues as determined by the Chair of the Commission and of the Scientific Council

3. Meeting Reports and Recommendations of the Joint Commission–Scientific Council Working Groups
   a) Working Group on Improving Efficiency of NAFO Working Group Process (E-WG), February 2019
   b) Joint Commission–Scientific Council Working Group on Risk-based Management Strategies (WG-RBMS), April and September 2019
   c) Joint Commission–Scientific Council Working Group on Ecosystems Approach Framework to Fisheries Management (WG-EAFFM), July 2019
   d) Joint Commission–Scientific Council Catch Estimation Strategy Advisory Group (CESAG), 2019

4. Formulation of Request to the Scientific Council for Scientific Advice on Management in 2021 and Beyond of Certain Stocks in Subareas 2, 3 and 4 and Other Matters

### IV. Research Coordination

1. Opening
2. Fisheries Statistics
   a) Progress Reports on Secretariat Activities
   b) Review of STATLANT21
3. Research Activities
   a) Surveys Planned for 2019 and 2020
4. Other Matters
   a) Review of SCR and SCS Documents
   b) Review of Survey SCS Document
   c) Other Business
      i. Communication of scientific studies to fishing fleets in the NAFO area
      ii. Analysis of sampling rates to evaluate the impact on the precision of survey estimates.
      iii. Format of submission to the Secretariat

**V. Fisheries Science**

1. Opening
2. Nomination of Designated Experts
3. Other Matters
   a) Review of SCR and SCS Documents
   b) Assessments deferred from the June meeting
      i) Northern shortfin squid in SA 3+4

   c) Review of FIRMS classification of NAFO stocks
   d) Other Business

**VI. Requests from the Commission**

1. Requests/advice deferred from the June Meeting
   a) Scientific Council budget for 2020
   b) Requests arising from Working Groups in 2019
2. *Ad hoc* Requests from Current Meeting

**VII. Review of Future Meeting Arrangements**

**VIII. Future Special Sessions**

1. Discussion of proposed topics

**IX. Other Matters**

1. Meeting reports
   a) ICES/NAFO Working Group on Deep-water Ecology (WG-DEC)
   b) ICES/NAFO/NAMMCO Working Group on Harp and Hooded Seals (WG-HARP)
2. SC work plan
3. Notification to SC of oil and gas industry information
4. Discussion of the MRAG catch estimation study [possibly should be in STACREC?]
5. Requested Letters of Support for Research Projects
6. Current and potential future cooperation between NAFO and ICES
7. planning for the 2020 update assessment of Greenland halibut
8. election of SC co-Chair for RBMS: EU nominate
9. Discussion of the revision of the PA framework
10. Discussion of STACFEN 10 year presentation
11. update on the 3M cod MSE process
12. Discussion of the review of the 3LN Redfish management plan
13. International protocol for Genetic sampling

**X. Adoption of Reports**

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

**XI. Adjournment**

## ANNEX 1. THE COMMISSION'S REQUEST FOR SCIENTIFIC ADVICE ON MANAGEMENT IN 2020 AND BEYOND OF CERTAIN STOCKS IN SUBAREAS 2, 3 AND 4 AND OTHER MATTERS

Following a request from the Scientific Council, the Commission agreed that items 1, 2, 3, 4, and 12 should be the priority for the June 2019 Scientific Council meeting. Items 4 and 12 were identified as top priorities for Scientific Council subject to resources.

1. The Commission requests that the Scientific Council provide advice for the management of the fish stocks below according to the assessment frequency presented below. In keeping with the NAFO Precautionary Approach Framework (FC Doc. 04/18), the advice should be provided as a range of management options and a risk analysis for each option (rather than a single TAC recommendation) and the actual risk level should be decided upon by managers.

| Yearly basis | Two-year basis | Three-year basis |
|---|---|---|
| Cod in Div. 3M<br>Northern shrimp in Div. 3M | Redfish in Div. 3M<br>Northern shrimp in Div. 3LNO<br>Thorny skate in Div. 3LNO<br>Witch flounder in Div. 3NO<br>Redfish in Div. 3LN | American Plaice in Div. 3LNO<br>American Plaice in Div. 3M<br>Capelin in Div. 3NO<br>Northern shortfin squid in SA 3+4<br>Redfish in Div. 3O<br>Yellowtail flounder in Div. 3LNO<br>Greenland halibut in Div. 2+3KLMNO<br>Splendid alfonsino in SA 6 |

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

In 2019, advice should be provided for 2020 for Cod in 3M (subject to the outcomes of the Management Strategy Evaluation process) and Northern shrimp in 3M. With respect to Northern shrimp in 3M, SC is requested to provide its advice to the Commission prior to the 2019 Annual Meeting.

In 2019, advice should be provided for 2020 and 2021 for: Redfish in 3M, White hake in 3NO, and Northern shrimp in 3LNO.

In 2019, advice should be provided for 2020, 2021 and 2022 for: Northern shortfin squid in SA 3+4, and Redfish in 3O.

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 (currently 3LN Redfish and Greenland halibut 2+3KLMNO).

The Commission also requests the Scientific Council to continue to monitor the status of all other 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. In 2019, the Commission requests Scientific Council to conduct a full assessment of Witch Flounder in Div. 3NO. The advice should be provided for 2020 and 2021.

3. The Commission requests the Scientific Council to monitor the status of Greenland halibut in Subarea 2+Div 3KLMNO annually to compute the TAC using the agreed HCR and determine whether exceptional circumstances are occurring. If exceptional circumstances are occurring, the exceptional circumstances protocol will provide guidance on what steps should be taken.

4. The Commission requests the Scientific Council to implement the steps as described in the revised calendar (COM/SC Doc 18-02, Annex 4 relevant to the SC for progression of the 3M Cod Management Strategy Evaluation for 2019.

5. The Commission requests that Scientific Council continue its evaluation of the impact of scientific trawl surveys on VME in closed areas, and the effect of excluding surveys from these areas on stock assessments.

6. The Commission requests the Scientific Council to implement the steps of the Action plan relevant to the SC and in particular the tasks identified under section 2.2 of the Action Plan, for progression in the management and minimization of Bycatch and discards (COM Doc 17-26).

7. The Commission requests Scientific Council to conduct a full assessment on 3M golden Redfish in 2019 and, acknowledging that there are three species of redfish that exist in 3M and are difficult to separate in the catch, provide advice on the implications for catch reporting and stock management.

8. The Commission requests the Scientific Council to continue to refine its work under the Ecosystem Approach Road Map, including testing the reliability of the ecosystem production potential model and other related models, and to report on these results to both the WG –EAFFM and WG- RBMS to further develop how it may apply to management decisions.

9. In relation to the assessment of NAFO bottom fisheries, the Commission endorsed the next re-assessment in 2021 and that the Scientific Council should:

    - Assess the overlap of NAFO fisheries with VME to evaluate fishery specific impacts in addition to the cumulative impacts;
    - Consider clearer objective ranking processes and options for objective weighting criteria for the overall assessment of significant adverse impacts and the risk of future adverse impacts;
    - Maintain efforts to assess all of the six FAO criteria (Article 18 of the FAO International Guidelines for the Management of Deep Sea Fisheries in the High Seas) including the three FAO functional SAI criteria which could not be evaluated in the current assessment (recovery potential, ecosystem function alteration, and impact relative to habitat use duration of VME indicator species).
    - Continue to work on non-sponge and coral VMEs (for example bryozoan and sea squirts) to prepare for the next assessment.

10. Review the proposed revisions to Annex I.E, Part VI as reflected in COM/SC WG –EAFFM WP 18-01, for consistency with the taxa list annexed to the VME guide and recommend updates as necessary.

11. The Commission requests Scientific Council to conduct a re-assessment of VME closures by 2020, including area #14.

12. The Commission requests the Scientific Council to continue progression on the review of the NAFO PA Framework.

13. According to the Scientific Advice for years 2019, 2020 and 2021, fishing should not be allowed to expand above current levels on Kükenthal Peak (Div. 6G, part of the Corner Rise seamount chain). To allow this recommendation to be enforceable the Commission requests the Scientific Council to provide the map and coordinates of the Kükenthal Peak.

14. The Commission requests Scientific Council work with WG- BDS to identify areas and times where bycatch and discards of Greenland sharks have a higher rate of occurrence. This work will support WG-BDS in developing appropriate management recommendations, including safe handling practises for live release of Greenland sharks, for consideration by the Commission at its 2021 Annual Meeting.

15. The Commission requests Scientific Council to monitor and provide regular updates on relevant research related to the potential impact of activities other than fishing in the Convention Area, such as oil exploration, shipping and recreational activities, and how they may impact the stocks and fisheries as well as biodiversity in the Regulatory Area.

16. The Commission requests Scientific Council to take the first steps to develop a 3-5 year work plan, which reflects requests arising from the 2018 Annual Meeting, other multi-year stock assessments and other scientific inquiries already planned for the near future. The work plan should identify what resources are necessary to successfully address these issues, gaps in current resources to meet those needs and proposed prioritization by the Scientific Council of upcoming work based on those gaps.

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

The 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% $F_{2018}$, $F_{2018}$, 125% $F_{2018}$,
- For stocks under a moratorium to direct fishing: $F_{2018}$, 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 | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $P(F>F_{lim})$ | | | $P(B<B_{lim})$ | | | $P(F>F_{msy})$ | | | $P(B<B_{msy})$ | | | | $P(B_{2021} > B_{2017})$ |
| F in 2018 and following years* | Yield 2019 (50%) | Yield 2020 (50%) | Yield 2021 (50%) | 2019 | 2020 | 2021 | 2019 | 2020 | 2021 | 2019 | 2020 | 2021 | 2019 | 2020 | 2021 | | |
| 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 $F_{2018}$ | t | t | t | % | % | % | % | % | % | % | % | % | % | % | % | | % |
| $F_{2018}$ | t | t | t | % | % | % | % | % | % | % | % | % | % | % | % | | % |
| 1.25 X $F_{2018}$ | 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% $F_{2018}$, $F_{2018}$, 125% $F_{2018}$,
- For stocks under a moratorium to direct fishing: $F_{2018}$, 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 | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $P(F.>F_{lim})$ | | | $P(B<B_{lim})$ | | | | $P(F>F0.1)$ | | | $P(F>F_{max})$ | | | | $P(B2021 > B2017)$ |
| F in 2018 and following years* | Yield 2019 | Yield 2020 | Yield 2021 | 2019 | 2020 | 2021 | 2019 | 2020 | 2021 | | 2019 | 2020 | 2021 | 2019 | 2020 | 2021 | | |
| F0.1 | 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 $F_{2018}$ | t | t | t | % | % | % | % | % | % | | % | % | % | % | % | % | | % |
| $F_{2018}$ | t | t | t | % | % | % | % | % | % | | % | % | % | % | % | % | | % |
| 1.25 X $F_{2018}$ | 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) REQUESTS FOR SCIENTIFIC ADVICE ON MANAGEMENT IN 2020 OF CERTAIN STOCKS IN SUBAREA 0 AND 1.

1. **Golden Redfish, Demersal deep-sea Redfish, Atlantic Wolffish and Spotted Wolffish:** Advice on Golden Redfish (*Sebastes norvegicus* [marinus]), Demersal Deep-Sea Redfish (*Sebastes mentella*), Atlantic Wolffish (*Anarhichas lupus*) and Spotted Wolffish (*Anarhichas minor*) in Subarea 1 was in June 2017 given for 2018-2020. Consequently, the Scientific Council is requested to continue its monitoring of the above stocks and provide updated advice as appropriate in the event of significant changes in stock levels. Furthermore, the Scientific Council is asked to advice on any other management measures it deems appropriate to ensure the sustainability of these resources.

2. **Greenland Halibut, offshore:** For Greenland Halibut in subareas O + 1 advice was in 2018 given for 2019 and 2020. Subject to the concurrence of Canada as regards Subareas O and 1, the Scientific Council is requested to continue to monitor the status. Should significant changes in the stock status be observed the Scientific Council is requested to provide updated advice as appropriate for Greenland Halibut in 1) the offshore areas of NAFO Division OA and Division 1 A plus Division 1B and 2) NAFO Division OB plus Divisions 1 C-1F. The Scientific Council is also asked to advice on any other management measures it deems appropriate to ensure the sustainability of these resources.

3. **Greenland Halibut, inshore, Northwest Greenland:** Advice on Greenland Halibut in Division 1 A inshore was in 2018 given for 2019-2020. Denmark (on behalf of Greenland) requests the Scientific Council to continue to monitor the status, and should significant changes in the stock status be observed the Scientific Council is requested to provide updated advice as appropriate.

4. **Northern Shrimp, West Greenland:** Subject to the concurrence of Canada as regards Subarea O and 1, Denmark (on behalf of Greenland} requests the Scientific Council before December 2019 to provide advice on the scientific basis for management of Northern Shrimp (Panda/us borealis) in Subarea O and 1 in 2020 and for as many years ahead as data allows for.

5. **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 2020 and for as many years ahead as data allows for.

## 1. Coastal state Request for Scientific Advice for 2020

Denmark (on behalf of Greenland) hereby requests for scientific information on the fishery of northern Shrimp in NAFO Div 0A in order to improve management of the shrimp stock

**Northern shrimp in Div 0A**

Canada is requested to inform on its fishery patterns since 2012 as well as the geographical distribution of its fishery in the same period.

With respect to:

- Geographical distribution of the fishery
- total catch index
- Effort index
- Standardized CPUE index

## ANNEX 3. REQUEST FOR ADVICE FROM CANADA FOR 2020

**Shrimp (Divisions OA and Subarea 1)**

Canada requests the Scientific Council consider the following options in assessing and projecting future stock levels for Shrimp in Subareas O and I:

The status of the stock should be determined and management options evaluated for catch options ranging from 30,000 t to the catch corresponding to $Z_{Msv}$, in 5,000-10,000 t increments (subject to the discretion of Scientific Council), with forecasts for the next 5 years if possible. These options should be evaluated in relation to Canada's Harvest Strategy (attached) and the Northwest Atlantic Fisheries Organization Precautionary Approach Framework, and presented in the form of risk analyses related to the $B_{MSY}$. $B_{lim}$ and $Z_{MSY}$.

Presentation of the results should include graphs and/or tables related to the following:

- Historical and current yield, biomass relative to $B_{MSY}$, total mortality relative to $Z_{MSY}$, and recruitment (or proxy) levels for the longest time period possible;
- Total mortality (Z) and fishable biomass for a range of projected catch options (as noted above) for the years 2019 to 2023 if possible. Projections should include both catch options and a range of effective cod predation biomass levels considered appropriate by the Scientific Council. Results should include risk analyses of falling below: $B_{MSY}$, 80%$B_{MSY}$ and $B_{lim}$, and of being above $Z_{MSY}$ based on the 3-year projections; and
- Total area fished for the longest time period possible.

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

## APPENDIX IV: EXPERTS FOR PRELIMINARY ASSESSMENT OF CERTAIN STOCKS

The Designated Experts for 2019 were:

**From the Science Branch, Northwest Atlantic Fisheries Centre, Department of Fisheries and Oceans, St. John's, Newfoundland & Labrador, Canada**

| | | |
|---|---|---|
| Cod in Div. 3NO | Rick Rideout | rick.rideout@dfo-mpo.gc.ca |
| Redfish Div. 3O | Danny Ings | danny.ings@dfo-mpo.gc.ca |
| American Plaice in Div. 3LNO | Laura Wheeland | laura.wheeland@dfo-mpo.gc.ca |
| Witch flounder in Div. 3NO | Joanne Morgan | joanne.morgan@dfo-mpo.gc.ca |
| Yellowtail flounder in Div. 3LNO | Dawn Maddock Parsons | dawn.parsons@dfo-mpo.gc.ca |
| Greenland halibut in SA 2+3KLMNO | Joanne Morgan | joanne.morgan@dfo-mpo.gc.ca |
| Northern shrimp in Div. 3LNO | Katherine Skanes | katherine.skanes@dfo-mpo.gc.ca |
| Thorny skate in Div. 3LNO | Mark Simpson | mark.r.simpson@dfo-mpo.gc.ca |
| White hake in Div. 3NO | Mark Simpson | mark.r.simpson@dfo-mpo.gc.ca |

**From the Department of Fisheries and Oceans, Winnipeg, Manitoba, Canada**

| | | |
|---|---|---|
| Greenland halibut in SA 0+1 | Margaret Treble | margart.treble@dfo-mpo.gc.ca |

**From the Instituto Español de Oceanografia, Vigo (Pontevedra), Spain**

| | | |
|---|---|---|
| Roughhead grenadier in SA 2+3 | Fernando Gonzalez-Costas | fernando.gonzalez@ieo.es |
| Splendid alfonsino in Subarea 6 | Fernando Gonzalez-Costas | fernando.gonzalez@ieo.es |
| Cod in Div. 3M | Diana Gonzalez-Troncoso | diana.gonzalez@ieo.es |
| Shrimp in Div. 3M | Jose Miguel Casas Sanchez | mikel.casas@ieo.es |

**From the Instituto Nacional de Recursos Biológicos (INRB/IPMA), Lisbon, Portugal**

| | | |
|---|---|---|
| American plaice in Div. 3M | Ricardo Alpoim | ralpoim@ipma.pt |
| Golden redfish in Div. 3M | Ricardo Alpoim | ralpoim@ipma.pt |
| Redfish in Div. 3M | Antonio Ávila de Melo | amelo@ipma.pt |
| Redfish in Div. 3LN | Antonio Ávila de Melo | amelo@ipma.pt |

**From the Greenland Institute of Natural Resources, Nuuk, Greenland**

| | | |
|---|---|---|
| Redfish in SA1 | Rasmus Nygaard | rany@natur.gl |
| Other Finfish in SA1 | Rasmus Nygaard | rany@natur.gl |
| Greenland halibut in Div. 1A | Rasmus Nygaard | rany@natur.gl |
| Northern shrimp in SA 0+1 | AnnDorte Burmeister | anndorte@natur.gl |
| Northern shrimp in Denmark Strait | Frank Rigét | frri@natur.gl |

**From Knipovich Polar Research Institute of Marine Fisheries and Oceanography (PINRO), Russian Federation**

| | | |
|---|---|---|
| Capelin in Div. 3NO | Konstantin Fomin | fomin@pinro.ru |

**From National Marine Fisheries Service, NEFSC, Woods Hole, Massachusetts, United States of America**

| | | |
|---|---|---|
| Northern Shortfin Squid in SA 3 & 4 | Lisa Hendrickson | lisa.hendrickson@noaa.gov |

## APPENDIX V. LIST RESEARCH (SCR) AND SUMMARY (SCS) DOCUMENTS

### Research Documents (SCR)

| SCR Doc No. | Serial No. | Author | Title |
|---|---|---|---|
| SCS Doc. 19/42 | N6819 | L. C. Hendrickson and M. A. Showell | 2019 Assessment of Northern Shortfin Squid (*Illex illecebrosus*) in Subareas 3+4 |

### Summary Documents (SCS)

| SCS Doc No. | Serial No. | Author | Title |
|---|---|---|---|
| SCS Doc. 19/17 | N6963 | NAFO Secretariat | Tagging 2018 |
| SCS Doc. 19/18 | N6964 | NAFO Secretariat | List of Biological Sampling Data 2018 |
| SCS Doc. 19/22 | N7024 | NAFO | Report of the Scientific Council, 23 – 27 September 2019 |

## APPENDIX VI. LIST OF PARTICIPANTS, SEPTEMBER 2019

| | |
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| | |
|---|---|
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