



Serial No. N7025

NAFO SCS Doc. 19/23

SCIENTIFIC COUNCIL MEETING – NOVEMBER 2019**Contents**

I. Plenary sessions.....	3
II. Review of Recommendations in 2018.....	3
III. NAFO/ICES <i>Pandalus</i> Assessment Group	3
IV. Formulation of Advice (see Annexes 1, 2 and 3).....	4
1. Request from the Commission.....	4
a) Sustainable management methods for northern shrimp in Div. 3M (Commission request #15, COM. Doc. 19-029).....	4
2. Requests from Coastal States	6
a) Northern shrimp in Subarea 1 and Div. 0A	6
b) Northern shrimp in Denmark Strait and off East Greenland	9
c) Denmark (on behalf of Greenland) special request for scientific information for 2020 (NAFO SCS Doc. 19/05).....	11
V. Other Matters	12
1. Scheduling of Future Meetings	12
a) Scientific Council Meetings.....	12
b) NAFO/ICES Joint Working Groups	12
2. Topics for Future Special Sessions.....	12
3. Other Business	12
VI. Adoption of Scientific Council and NIPAG Reports	12
VII. Adjournment	13
Appendix I. Revised Agenda – Scientific Council Meeting.....	14
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	15
Annex 2: Denmark (on behalf of Greenland) Requests for Scientific Advice on Management in 2020 of Certain Stocks in Subarea 0 and 1	20
Coastal State Special Request for Scientific Advice for 2020	21
Annex 3. Requests for Advice from Canada for 2020.....	22
Annex 4. Excerpt from The Commission's Request for Scientific Advice on Management in 2021 and Beyond of Certain Stocks in Subareas 2, 3 and 4 and Other Matters	23
Appendix II. List of Research (SCR) and Summary (SCS) Documents	24
Appendix III. List of Participants.....	26



SC-NIPAG Participants 2019



From left to right: Carsten Hvingel, Katherine Sosebee, AnnDorte Burmeister, Susan Thompson, José Miguel Casas Sanchez, Katherine Skanes, Frank Rigét, Tom Blasdale, Guldborg Søvik, Ole Ritzau Eigaard, Trude Thangstad, Kalvi Hubel, Fabian Zimmermann

Report of the Scientific Council Meeting 08 to 13 November 2019

Chair: Katherine Sosebee

Rapporteur: Tom Blasdale

I. PLENARY SESSIONS

The Scientific Council met at the Havforskningsinstituttet (IMR), Tromsø, Norway from 8 to 13 November 2019 to consider the various matters in its Agenda. Representatives attended from Canada, Denmark (in respect of Greenland), European Union, Norway and the USA. The Scientific Council Coordinator and Scientific Information Administrator were in attendance.

The opening session of the Council was called to order at 09:00 on 8 November 2019. The Chair welcomed representatives, advisers and experts to the opening session of Scientific Council. The Chair noted that the primary reason for this meeting was to provide advice on shrimp stocks based on the assessments provided by the joint NAFO/ICES *Pandalus* Assessment Group (NIPAG). It was further noted that advice for the 3M and 3NLO stocks was given in September 2019 (SCS Doc. 19-021) and hence no further assessment would be carried out in the present meeting. ICES members of NIPAG were granted observer status at the Scientific Council meeting, and the Chair wished all NIPAG members a productive and successful meeting.

The Scientific Council Coordinator, Tom Blasdale, was appointed Rapporteur.

Several sessions were held throughout the course of the meeting to deal with specific items on the agenda. The concluding session was convened at 09:00 13 November 2019 when the Council then considered and adopted Sections III.1–4 of the “Report of the NAFO/ICES *Pandalus* Assessment Group” (NAFO SCS Doc. 19/24, ICES CM 2019/~~FRSG~~). The Council, having considered the results of the assessments of the NAFO stocks, provided advice and recommendations and noted the requests of the Fisheries Commission and Coastal States had been addressed.

The meeting was adjourned at 14:00 13 November 2019.

The revised Agenda, List of Research (SCR) and Summary (SCS) Documents, and the List of Representatives, Advisers and Experts, are given in Appendix I, II and III, respectively.

II. REVIEW OF RECOMMENDATIONS IN 2018

These were reviewed in the appropriate sections of the NIPAG report.

III. NAFO/ICES PANDALUS ASSESSMENT GROUP

In 2019, NIPAG fully assessed two stocks of relevance to NAFO: northern shrimp in Subareas 0 and 1, and northern shrimp in Denmark Strait and off East Greenland. The Scientific Council summary sheets, conclusions and advice for these stocks are presented in Section IV of this report.

Additionally, NIPAG reviewed assessments for two stocks for which advice was given in September 2019 (SCS Doc. 19/21): Northern shrimp in NAFO Division 3M and Northern shrimp in NAFO Divisions 3LNO. The full NIPAG report is available in NAFO SCS Doc. 19/24 and ICES CM 2019/FRSG1:84.

IV. FORMULATION OF ADVICE (SEE ANNEXES 1, 2 AND 3)

1. Request from the Commission

a) Sustainable management methods for northern shrimp in Div. 3M (Commission request #15, Com. Doc. 19-029)

The Commission to ask the Scientific Council to advise on the possible sustainable management methods for northern shrimp in Div. 3M, including quota, fishing effort, periods, reporting or other technical measures. This advice should be provided before the intersessional work by the end of this year.

Scientific Council responded:

SC recommends that the management of 3M shrimp be converted from the existing “effort regulation” to “catch regulation” in line with all other stocks in the NRA.

If management aims to include reduction of catches of small shrimp, closure of the shallow area could be beneficial to achieve this. However, SC does not have sufficient information to propose appropriate depth or seasons for closure.

Harvest control

Catch/effort regulation

The 3M shrimp fishery was managed by effort control prior to the moratorium and will be reopened in 2020, initially on the same basis. SC does not consider that the management procedure initiated some 25 years ago constitutes effective means of managing the stock. This is in particular for four reasons:

1. Fishery efficiency improves over time because of new bigger vessels, better gear, more advanced instruments, etc. It is not uncommon to estimate an average efficiency increase of up to 5% per year in trawl fisheries, which would imply that the annual effort limit of 12 175 fishing days introduced in 1996 would now (in 2019) equal an effective effort of 37 396 days, i.e. more than three times the original effort limit.
2. Over the period of this fishery the overall effort allowed has always been high and has not posed much constraint on fishing activity and, as such, it has not been an effective tool for the management of this fishery.
3. It is difficult to standardize “effort units” (e.g. fishing days) in terms of pressure on the stock due to creep in fishing efficiency (see item 1 above) and the diversity of the individual vessels participating in the fishery (a fishing day with one vessel might equal 1.5 days with another and vice versa).
4. SC delivers advice in terms of catch, not effort, and the conversion from catch to effort is not straightforward for the reasons listed under item 3.

As a consequence of these uncertainties, Scientific Council is unable to advise on the number of fishing days in 2020 that would result in a total catch equivalent to the recommended TAC of 5448 tonnes.

SC therefore recommends that the management of 3M shrimp be converted from the existing “effort regulation” to a “catch regulation” in line with all other stocks in the NRA.

Fishing pattern

Season, area closures

Since 2002, the Fisheries Commission implemented a closure of the shallow area (depths less than 140 fathoms approximately) for the period of June to December. The objective of this temporal closure was to protect the juvenile fraction of the stock from some fleets that extended their activity to shallower waters.

Information from the Flemish Cap and from fisheries in other areas (Gulf of Maine, Greenland, Norway) indicates that juvenile shrimps are distributed in shallower water. Analysis of Icelandic observer data from the

Flemish Cap by Skuladottir and Nicolajsen (2002) showed a strong relationship between size and depth in male shrimps, with the smaller individuals being found in shallower water. The relationship was less strong for females and this was believed to be due to mature females migrating back to shallower areas to release eggs during the month of March.

If management aims to include reduction of catches of small shrimp, closure of the shallow area could be beneficial to achieve this. However, SC does not have sufficient information to propose appropriate depth or seasons for closure.

Technical measures

Size limits, sorting grids, mesh size

Others measures (technical) to protect the small shrimp, such as modifications of the present gears (40 mm mesh size) and sorting grids (22 mm), should be investigated.

2. Requests from Coastal States

a) Northern shrimp in Subarea 1 and Div. 0A

Advice November 2019 for 2020

Recommendation

In line with Greenland’s stated management objective of maintaining a mortality risk of no more than 35% (subject to a risk of biomass being below B_{lim} of less than 1%), Scientific Council advises that catches in 2020 should not exceed 110 000 t.

Management Objectives

A management plan and management objectives have been defined by the Government of Greenland in 2018. The objective is to maintain a mortality risk of no more than 35% (subject to a risk of biomass being below B_{lim} of less than 1%). Canada has a harvest strategy with the objective to maintain a mortality risk less than 35%, based on three year projections. Advice was also drafted to be consistent with the NAFO precautionary approach (FC Doc. 04-12).

Objective	Status	Comment/consideration
Apply Precautionary Approach	●	Stock status is both estimated and forecast relative to precautionary reference points

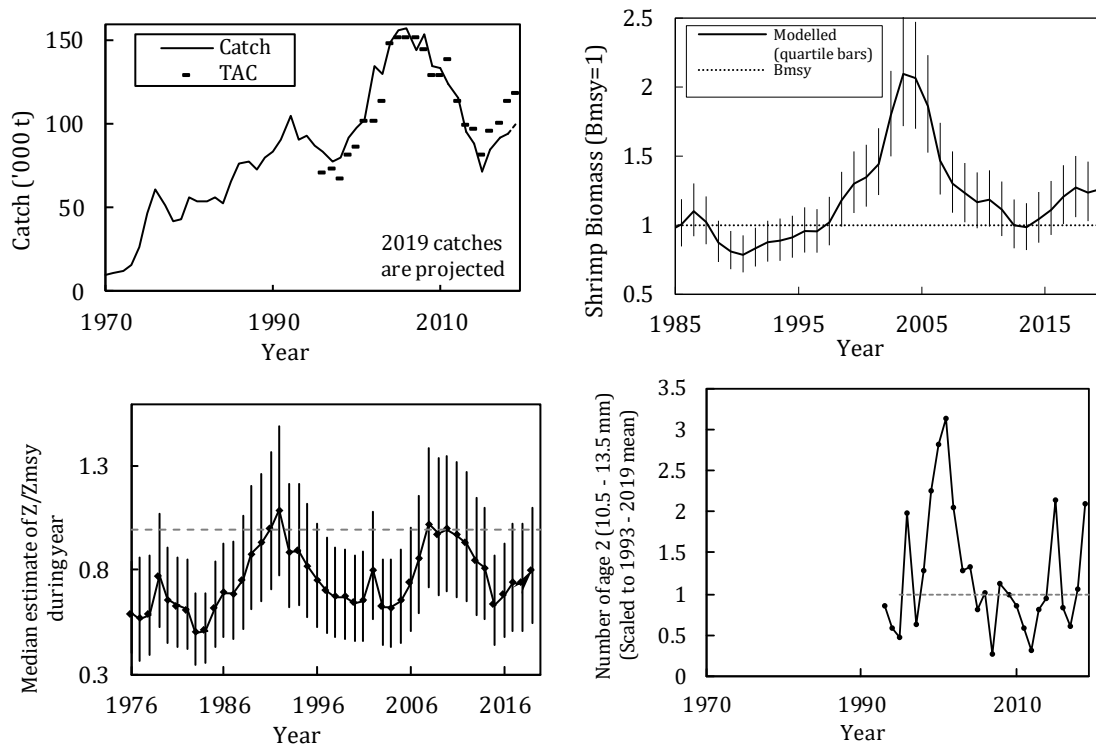
● OK

Management unit

The stock, considered distinct from all others, is distributed throughout Subarea 1, extends into Div. 0A east of 60°30'W, and is assessed as a single stock. In 2018, 97% of the landings were from Greenland.

Stock status

Biomass at the end of 2019 is above B_{msy} and the probability of being below B_{lim} is very low (<1%). The probability of mortality in 2019 being above Z_{msy} is 32%. Recruitment (number of age-2 shrimp) in 2019 is above average.



Reference points

B_{lim} has been established as 30% B_{msy} , and Z_{msy} (fishery and cod predation) has been set as the mortality reference point (FC Doc. 04-18). B_{msy} and Z_{msy} are estimated directly from the assessment model.

Projections

Predicted probabilities of transgressing precautionary reference points in 2020 – 2022 under eight catch options and subject to predation by a cod stock with an effective biomass of 21 Kt.

21 000 t cod Risk of:	Catch option ('000 tonnes)							
	85	90	95	100	105	110	115	120
falling below B_{msy} end 2020 (%)	23	23	23	24	24	24	24	25
falling below B_{msy} end 2021 (%)	24	24	25	25	26	27	27	27
falling below B_{msy} end 2022 (%)	24	25	26	27	29	29	30	31
falling below B_{lim} end 2020 (%)	0	0	0	0	0	0	0	0
falling below B_{lim} end 2021 (%)	0	0	0	0	0	0	0	0
falling below B_{lim} end 2022 (%)	0	0	0	0	0	0	0	0
exceeding Z_{msy} in 2020 (%)	17	20	24	27	30	34	37	40
exceeding Z_{msy} in 2021 (%)	18	21	25	28	32	35	38	41
exceeding Z_{msy} in 2022 (%)	19	22	26	29	33	36	39	43

Assessment

Advice is based on risk analysis coming from a quantitative model. The analytical assessment was run in 2019 with revised treatment of the input data (SCR Doc.19-46, 19-48) and with updated data series.

The next assessment is scheduled for 2020.

Human impact

Mortality related to the fishery has been documented. Other human sources (e.g. pollution, shipping, oil-industry) are considered minor.

Biological and Environmental Interactions

Cod is an important predator on shrimp. This assessment incorporates this interaction. Other predation is likely but not explicitly considered. Shrimps might be important predators on, for example, fish eggs and larvae.

Fishery

Shrimps are caught in a directed trawl fishery. Bycatch of fish in the shrimp fishery is around 1% by weight. The fishery is regulated by TAC.

Recent catches and TACs (t) have been as follows:

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Enacted TAC ¹	130 153	139 583	114 425	100 596 ¹	97 649 ¹	82 561 ¹	96 426 ¹	101 706 ¹	114 876 ¹	119 875 ¹
STATLANT 21	129 179	123 195	114 970	91 802	88 834	71 779	84 303	91 725	91 869	
NIPAG	133 991	123 989	115 977	95 381	88 765	72 256	85 527	92 584	94 878	102 000 ²

¹ Sum of TACs autonomously set by Canada and Greenland.

² Projected to year end

Effects of the fishery on the ecosystem

Measures to reduce effects of the fishery on the ecosystem include area closures, moving rules and gear modifications to reduce damage to benthic communities and reduce bycatch.

Special comment

From 1993 to 2010 the Greenlandic survey in the Canadian area (SFA1) was conducted annually. In that period, average biomass in that area was 2% of the total biomass estimated in Subarea 1 and Div. 0A. Since 2011, due

to ice cover, there has only been sporadic information from the Greenlandic survey in the Canadian area (SFA1). The area was surveyed only in 2013 and 2017. In 2013, the biomass in that area (SFA1) was less than 1% of the total estimated biomass in Subarea 1 and Div. 0A, whereas it was about 2% in 2017.

Source of Information SCS Doc 13/04, FC Docs 04-18, SCR Docs 19-43, 44, 45, 46, 48, 49.

b) Northern shrimp in Denmark Strait and off East Greenland

Advice November 2019 for 2020

Recommendation

In 2016 the stock remained at a low level, comparable to previous years. CPUE has increased in recent years and in the first half of 2019 was at a record high level. However, fishing in recent years has been carried out in a localized area and the effort has been relatively low, so CPUE may not reflect stock status. Given the limited amount of current information, SC is not able to provide advice on the sustainable exploitation of this stock. Therefore, SC has no information to change the advice from the last five years that, as an interim measure, catches should not exceed 2 000 t. SC advises that a survey should be carried out in future years.

Management objectives

No explicit management plan or management objectives have been defined by the Government of Greenland.

Objective	Status	Comment/consideration
Apply Precautionary Approach	●	B_{lim} is defined. No fishing mortality reference point defined

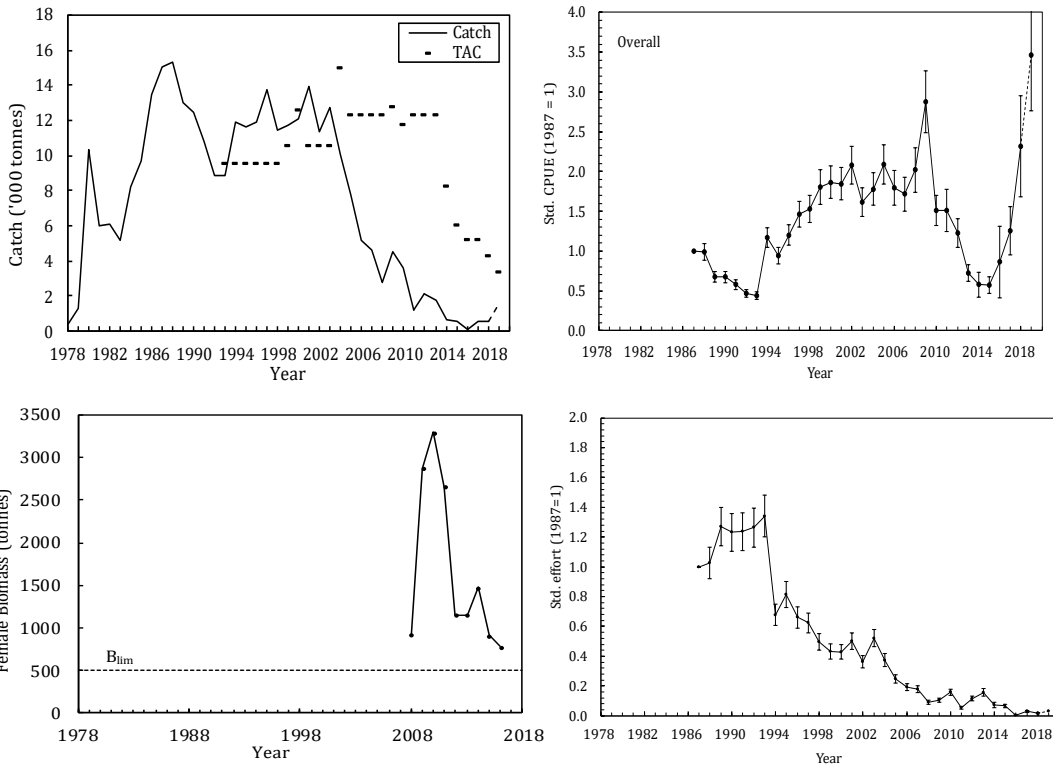
● Intermediate

Management unit

The shrimp stock is distributed off East Greenland in ICES Div. XIVb and Va and is assessed as a single population.

Stock status

The stock size remained at a very low level (relatively close to B_{lim}) in 2016 despite several years of very low exploitation rates. There is no new fishery independent information to indicate a change in stock status.



Reference points

Scientific Council considers that a female survey biomass index of 15% of its maximum observed level provides a proxy for B_{lim} (SCS Doc. 04-12).

Projections

Quantitative assessment of risk at various catch options is not possible for this stock at this time.

Assessment

Advice is based on qualitative evaluation of biomass indices in relation to historic levels.

Evaluation of stock status is based upon interpretation of commercial fishery and research survey data. The trends in the survey and the standardized CPUE have been similar since the start of the survey; however, they diverged in 2016, the last year for which there are survey data available. Recent increasing CPUE values may indicate an improvement of the shrimp density in the northern area; however, this may not reflect overall stock status as the fishery occurs in a localized area and includes only a small number of hauls. No survey was carried out in the period 2017 to 2019.

Human impact

Mainly fishery related mortality has been documented. Other sources (e.g. pollution, shipping, oil-industry) are considered minor.

Biological and Environmental Interactions

Cod is an important predator on shrimp. The cod stock has generally been decreasing in East Greenland waters since 2012.

Fishery

Shrimp is caught in a directed trawl fishery. The fishery is regulated by TAC and bycatch reduction measures include move-on rules and Nordmøre grates.

Recent catches (tonnes) were as follows:

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Enacted TAC	11 835	12 400	12 400	12 400	8 300	6 100	5 300	5 300	4 300	3 384
SC Recommended TAC	12 400	12 400	12 400	12 400	2 000	2 000	2 000	2 000	2 000	2 000
NIPAG	3 602	1 199	2 109	1 717	622	576	49	561	547	1579 ¹

¹ To July 2019

Effects of the fishery on the ecosystem

Measures to reduce effects of the fishery on the ecosystem include move-on rules to protect sponges and corals.

Source of Information

SCR Doc. 19-059

c) Denmark (on behalf of Greenland) special request for scientific information for 2020 (NAFO SCS Doc. 19/05)

Denmark (on behalf of Greenland) hereby requests for scientific information on the fishery of Northern shrimp in NAFO Subareas Div. OA in order to improve management of the shrimp stock.

- *Northern Shrimp in Subarea Div. OA*

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

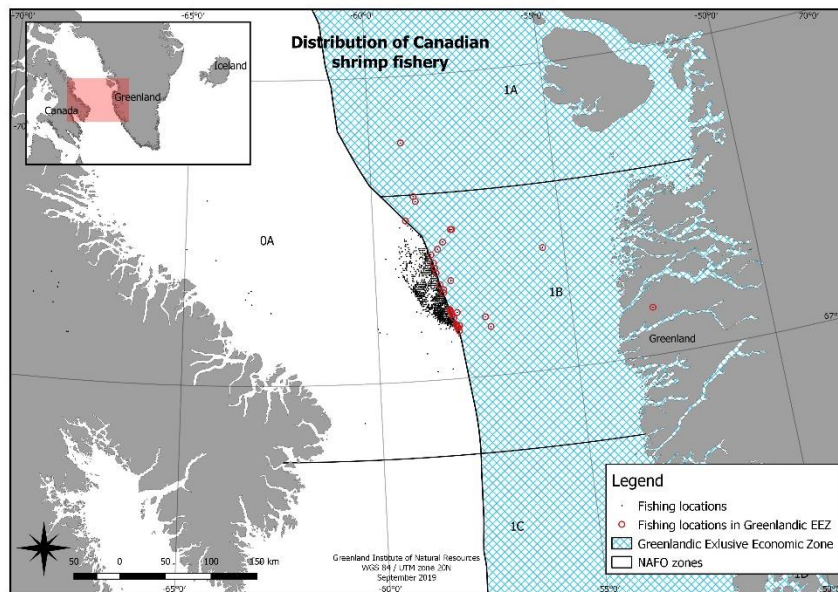
With respect to:

- *Geographical distribution of its fishery*
- *Total catch index*
- *Effort index*
- *Standardized CPUE index*

Scientific Council responded:

SC received from Canada some data in summary form. This is shown in the map and table below. SC notes that additional data, as described below, would be useful for the purposes of stock assessment.

SC received the following information from Canada:



Year	Kept tons (<i>P.Borealis</i>)	Total Hours	CPUE (kg/h)
2010	5 561	6 626.5	839.2
2011	1274	3 192.5	399.1
2012	5	88.5	52.9
2013	2	16.6	124.8
2015	2	58.0	38.7
2016	1 163	2 762.9	421.1
2017	3 001	6 635.6	452.2
2018	1 689	4 471.1	377.7

SC makes the following comments regarding additional data from Canada's fishery that would be useful for the purposes of stock assessment:

With respect to:

Geographical distribution of its fishery in Division 0A

It would be preferable to have maps showing the geographical distribution within the area annually from 2010-2019.

Total catch index

Continue to provide total catches in tonnes by year

Effort index

An index of total effort by year (taking into account the use of single, double or triple trawl)

Standardized CPUE index

A standardized CPUE index, taking account of the use of single, double or triple trawl. The standardized CPUE index from Canada, would then be combined with the CPUE index from Greenland and used in the stock assessment model.

Greenland is willing to make this standardized index, but it would require access to logbook information where each haul taken in SFA1 is available. If this is not possible owing to client protection, Greenland will be happy to provide the SAS program used to prepare the standardized CPUE index.

SC suggests that it would be useful if the stock assessment scientist responsible for SFA1 from DFO science (Central and Arctic) could attend future NIPAG stock assessment meetings. Furthermore, it would be very helpful if Canada could provide information on its fishery in SFA1 in a NAFO SCR Doc. (as in SCR 97-100).

V. OTHER MATTERS

1. Scheduling of Future Meetings

a) Scientific Council Meetings

i) Scientific Council (in conjunction with NIPAG), October/November 2020

The 2020 SC shrimp meeting will be held in Copenhagen, Denmark 27 October to 02 November 2020. For the shrimp stock in Division 3M, the next assessment will take place prior to the NAFO Annual Meeting in September 2020 and advice for 2021 will be provided prior to that meeting (as requested by the Commission).

b) NAFO/ICES Joint Working Groups

i) NIPAG, October/November 2020

This meeting will be held in Copenhagen, Denmark 27 October to 02 November 2020.

2. Topics for Future Special Sessions

No special session were proposed

3. Other Business

No other business was discussed.

VI. ADOPTION OF SCIENTIFIC COUNCIL AND NIPAG REPORTS

The Council, at its session on 13 November 2019, considered and adopted Sections III.1-4 of the "Report of the NAFO/ICES *Pandalus* Assessment Group" (NAFO SCS Doc. 19/24 and ICES CM 2019/FRSG1:84. The Council then considered and adopted its own report of the October 2019 meeting subject to editorial changes after the meeting.

VII. ADJOURNMENT

NIPAG meeting was adjourned at 14:00 on November 2019. The Chairs thanked all participants, especially the designated experts, for their hard work. The Chair thanked the NAFO and ICES Secretariats for all of their logistical support and Norway for hosting the meeting. The report was adopted at the close of the meeting, subject to a two week period for editorial changes.

APPENDIX I. REVISED AGENDA – SCIENTIFIC COUNCIL MEETING

Havforskningsinstituttet (IMR), Tromsø, Norway
08 – 13 November 2019

- I. Opening (Chair: Katherine Sosebee)
 1. Appointment of Rapporteur
 2. Adoption of Agenda
 3. Attendance of Observers
 4. Plan of Work
- II. Review of Recommendations in 2018
- III. NAFO/ICES Pandalus Assessment Group (Co-chairs Katherine Sosebee and Ole Ritzau Eigaard)
- IV. Formulation of Advice (see Annexes 1–4)
 1. Request for Advice on TACs and Other Management Measures
 - a. Possible sustainable management methods for northern shrimp in Div. 3M (Annex 4)
 2. Requests from Coastal States (Items 5 and 6 of Annex 3, item 2 of Annex 3)
 - a. Northern shrimp (Subareas 0 and 1)
 - b. Northern shrimp (in Denmark Strait and off East Greenland)
 - c. Fishing patterns in Subarea Div. OA (Denmark special request)
- V. Other Matters
 1. Scheduling of Future Meetings
 2. Topics for Future Special Sessions
 3. Other Business
- VI. Adoption of Scientific Council and NIPAG Reports
- VII. 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
(NAFO SCS Doc. 19/01)

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 Northern shrimp in Div. 3M	Redfish in Div. 3M Northern shrimp in Div. 3LNO Thorny skate in Div. 3LNO Witch flounder in Div. 3NO Redfish in Div. 3LN	American Plaice in Div. 3LNO American Plaice in Div. 3M Capelin in Div. 3NO Northern shortfin squid in SA 3+4 Redfish in Div. 3O Yellowtail flounder in Div. 3LNO Greenland halibut in Div. 2+3KLMNO Splendid alfonso 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	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.

F in 2018 and following years*	Yield 2019	Yield 2020	Yield 2021	Limit reference points									P(B2021 > B2017)												
				P(F > F _{lim})			P(B < B _{lim})			P(F > F _{0.1})				P(F > F _{max})											
				2019	2020	2021	2019	2020	2021	2019	2020	2021		2019	2020	2021									
F _{0.1}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%			
F _{max}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%		
66% F _{max}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	
75% F _{max}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	
85% F _{max}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
0.75 X F 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**
(NAFO SCS Doc. 19-02)

- 1. Golden Redfish, Demersal deep-sea Redfish, Atlantic Wolffish and Spotted Wolffish:** Advice on Golden Redfish (*Sebastes 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. Denmark (on behalf of Greenland) requests the Scientific Council to continue to monitor the status of the stock and should any significant changes in the stock status be observed, the Scientific Council is requested to provide updated advice as appropriate.
- 2. Greenland Halibut, offshore:** For Greenland Halibut in subareas 0 + 1 advice was in 2018 given for 2019 and 2020. Subject to the concurrence of Canada as regards Subareas 0 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 0 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 (*Pandalus borealis*) in Subarea 0 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.

**Coastal State Special Request for Scientific Advice for 2020
(NAFO SCS Doc. 19-05)**

Denmark (on behalf of Greenland) hereby requests for scientific information on the fishery of Northern shrimp in NAFO Subareas Div. OA in order to improve management of the shrimp stock.

- **Northern Shrimp in Subarea Div. OA**

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 its fishery
- Total catch index
- Effort index
- Standardized CPUE index

ANNEX 3. REQUESTS FOR ADVICE FROM CANADA FOR 2020
(NAFO SCS Doc. 19-03)

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_{MSY} , 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.

ANNEX 4. EXCERPT FROM THE COMMISSION'S REQUEST FOR SCIENTIFIC ADVICE ON MANAGEMENT IN 2021 AND BEYOND OF CERTAIN STOCKS IN SUBAREAS 2, 3 AND 4 AND OTHER MATTERS

15. The Commission to ask the Scientific Council to advise on the possible sustainable management methods for northern shrimp in Div. 3M, including quota, fishing effort, periods, reporting or other technical measures. This advice should be provided before the intersessional work by the end of this year.

APPENDIX II. LIST OF RESEARCH (SCR) AND SUMMARY (SCS) DOCUMENTS**RESEARCH DOCUMENTS (SCR)**

SCR No.	Serial No.	Author(s)	Title
SCR Doc. 19-043	N7007	Burmeister and Riget	The West Greenland trawl survey for <i>Pandalus borealis</i> , 2019, with reference to earlier results.
SCR Doc. 19-044	N7008	Burmeister and Riget	The Fishery for Northern Shrimp (<i>Pandalus borealis</i>) off West Greenland, 1970–2019
SCR Doc. 19-045	N7009	Burmeister	Catch Table Update for the West Greenland Shrimp Fishery
SCR Doc. 19-046	N7010	Burmeister and Riget	A provisional Assessment of the shrimp stock off West Greenland in 2019
SCR Doc. 19-047	N7011	Frank Rigét	The Fishery for Northern Shrimp (<i>Pandalus borealis</i>) in Denmark Strait / off East Greenland 1978 – 2019.
SCR Doc. 19-048	N7012	Riget and Burmeister	Estimation of the cod biomass by SAM and its implication for the assessment of Northern Shrimp (<i>Pandalus borealis</i>) in West Greenland.
SCR Doc. 19-049	N7013	Burmeister and Riget	Relationship between the survey abundance of Age – 2 shrimp, Pre-recruits and fishable biomass two to four years later
SCR Doc. 19-050	N7014	Burmeister	Reply to the Canadian request for advice of shrimps in Subarea 0 and 1.
SCR Doc. 19-051	N7015	J. M. Casas	Assessment of the International Fishery for Shrimp (<i>Pandalus borealis</i>) in Division 3M (Flemish Cap), 1993-2019
SCR Doc. 19-052	N7016	Casas, J.M., E. Román and M. Álvarez	Northern Shrimp (<i>Pandalus borealis</i> , <i>Krøyer</i>) from EU-Spain Bottom Trawl Survey 2019 in NAFO Div. 3LNO
SCR Doc. 19-053	N7017	J. M. Casas	Northern Shrimp (<i>Pandalus borealis</i>) on Flemish Cap Surveys 2019
SCR Doc. 19-054	N7018	Carsten Hvingel	Shrimp (<i>Pandalus borealis</i>) in the Barents Sea – Stock assessment 2019
SCR Doc. 19-055	N7019	Carsten. Hvingel and Trude. H. Thangstad	Research survey results pertaining to northern shrimp (<i>Pandalus borealis</i>) in the Barents Sea and Svalbard area 2004-2019
SCR Doc. 19-056	N7020	Carsten. Hvingel and Trude. H. Thangstad	The Norwegian fishery for northern shrimp (<i>Pandalus borealis</i>) in the Barents Sea and round Svalbard 1970-2019

SUMMARY DOCUMENTS (SCS)

SCS No.	Serial No.	Author(s)	Title
SCS Doc. 19/21	N6970	NAFO/ICES	Report of the Scientific Council- Shrimp Meeting in conjunction with NIPAG, September, 2019
SCS Doc. 19/23	N7025	NAFO	Report of the Scientific Council (in conjunction with NIPAG), 8-13 November 2019
SCS Doc. 19/24 ICES CM 2019/ FRSG1:84	N7026	NAFO/ICES	Report of the NAFO/ICES <i>Pandalus</i> Assessment Group (NIPAG), 8-13 November 2019

APPENDIX III. LIST OF PARTICIPANTS**CANADA**

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