

Northwest Atlantic Fisheries Organization



Report of the Scientific Council (in conjunction with NIPAG) Meeting

1 to 4 November 2021
By WebEx

NAFO
Halifax, Nova Scotia, Canada
2021

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**REPORT OF THE SCIENTIFIC COUNCIL (IN CONJUNCTION with NIPAG) MEETING
1- 4 November 2021, via WebEx**

Chair : Mark Simpson

Rapporteur : Tom Blasdale

I. PLENARY SESSIONS

Scientific Council, in conjunction with the NAFO/ICES *Pandalus* Assessment Group, met by WebEx on 1- 4 November 2021, to consider the various matters in its agenda. Representatives attended from Canada, Denmark (in respect of the Faroe Islands and Greenland), the European Union, Norway and the Russian Federation. A full list of participants is included in Appendix II.

The Chair, Mark Simpson, opened the meeting 08:00 Halifax time (12:00 UTC) by welcoming participants. The provisional agenda was adopted as circulated. The Scientific Council Coordinator was appointed as rapporteur.

II. REVIEW OF SCIENTIFIC COUNCIL RECOMMENDATIONS IN 2019 AND 2020

Recommendations from 2019 and 2020 are considered in the relevant sections of this report.

III. NAFO/ICES PANDALUS ASSESSMENT GROUP

In November 2021, 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 2021 (SCS Doc. 21/17): Northern shrimp in NAFO Division 3M and Northern shrimp in NAFO Divisions 3LNO. The full NIPAG report is available in NAFO SCS Doc. 21/19.

IV. MANAGEMENT ADVICE

1. Request for Advice on TACs and Other Management Measures

Requests from the NAFO Commission for advice on Northern Shrimp in Division 3M and Northern Shrimp in Divisions 3LNO were addressed during the September meeting (SCS Doc 21/17).

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

Advice November 2021 for 2022


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 2022 should not exceed 115 000 t.

With regard to the Canadian harvest strategy, Scientific Council notes that catches of 115 000 t in 2022 would result in less than 35% risk of exceeding Z_{msy} in 2022, and a 35% risk of exceeding Z_{msy} in 2023 and 2024, assuming catches at the same level as in 2022.

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 the stock in the Healthy Zone (>80% of B_{msy}); when the biomass is above 80% of B_{msy} , the risk of being above Z_{msy} should be less than 35%, based on the 3-year projections. Advice was also drafted to be consistent with the NAFO precautionary approach (FC Doc. 04-12).

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

 OK

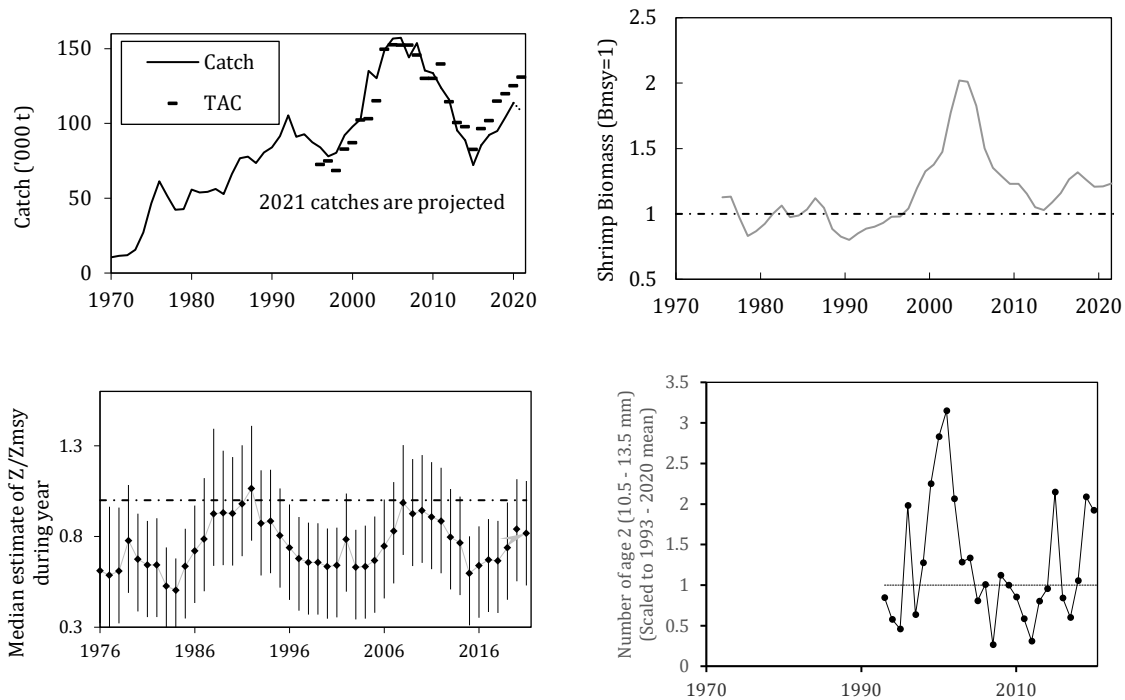
Management unit

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 2020, more that 99% of the landings were from Greenland.

Stock status

Biomass at the end of 2021 is above B_{msy} and the probability of being below B_{lim} is very low (<1%). The probability of mortality in 2021 being above Z_{msy} is 33%. Recruitment (number of age-2 shrimp) in 2020 was 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 2022 – 2024 under eight catch options and subject to predation by a cod stock with an effective biomass of 6 Kt.

6 000 t cod Risk of:	Catch option ('000 tons)							
	95	100	105	110	115	120	125	130
falling below B_{msy} end 2022 (%)	26	26	26	26	28	27	27	27
falling below B_{msy} end 2023 (%)	26	27	27	27	29	30	30	30
falling below B_{msy} end 2024 (%)	26	28	28	29	30	32	32	34
falling below B_{lim} end 2022 (%)	0	0	0	0	0	0	0	0
falling below B_{lim} end 2023 (%)	0	0	0	0	0	0	0	0
falling below B_{lim} end 2024 (%)	0	0	0	0	0	0	0	0
exceeding Z_{msy} in 2022 (%)	20	23	26	30	33	37	40	43
exceeding Z_{msy} in 2023 (%)	21	24	27	31	35	38	41	44
exceeding Z_{msy} in 2024 (%)	21	25	28	31	35	38	42	45
falling below B_{msy} 80% end 2022 (%)	9	10	10	10	10	11	10	11
falling below B_{msy} 80% end 2023 (%)	10	11	11	11	13	13	13	14
falling below B_{msy} 80% end 2024 (%)	11	12	12	13	14	16	16	16

Assessment

Advice is based on risk analysis coming from a quantitative model. The analytical assessment was run in 2021 with revised treatment of the input data (SCR Doc. 20/053, 20/057, 21/040, 21/042) and with updated data series.

The next assessment is scheduled for 2022.

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:

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Enacted TAC ¹	114 425	100 596 ¹	97 649 ¹	82 561 ¹	96 426 ¹	101 706 ¹	114 876 ¹	119 875 ¹	125 229 ¹	130 937 ¹
STATLANT 21	114 970	91 802	88 834	71 779	84 303	91 725	91 869	102 706	110 229	
NIPAG	115 977	95 381	88 765	72 256	85 527	92 584	94 878	104 314	113 868	108 000 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

No survey has been conducted in the assessment area in 2021, due to delay of the new Greenlandic research ship.

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.

SC recommend that the catch table should be given in increments of no less than 5 t due to uncertainty in calculating risk levels.

Source of Information

SCS Doc 13/04, FC Docs 04-18, SCR Docs. 20/053, 20/057, 21/040, 21/041, 21/042

b) Northern shrimp in Denmark Strait and off East Greenland

Advice November 2021 for 2022

Recommendation

There is uncertainty about the current stock status, however there is no indication of any change from last year's assessment in 2020. Therefore Scientific Council reiterates its advice that the catch in 2022 should not exceed 3000 t.

Management objectives

No explicit management plan or management objectives have been defined by the Government of Greenland. Advice was drafted to be consistent with the NAFO precautionary approach (FC Doc 04-12).

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

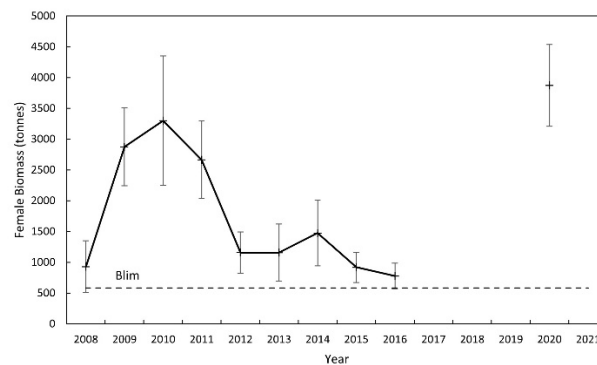
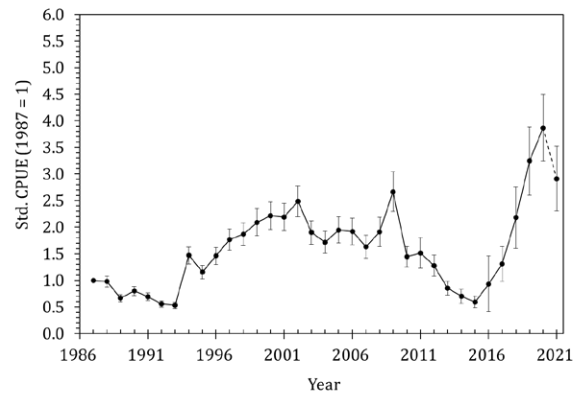
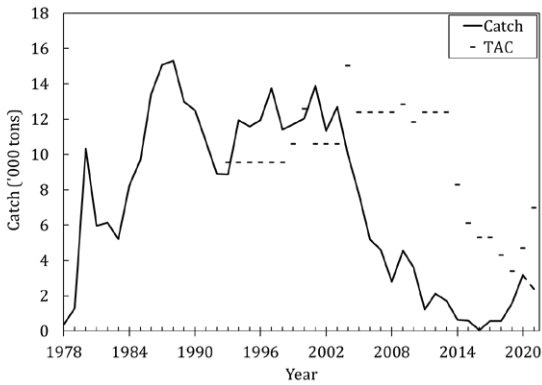
● Intermediate

Management unit

The shrimp stock is distributed off East Greenland in ICES Div. 14b and 5a and is assessed as a single population.

Stock status

There was no survey in 2021 nor in 2017 to 2019. The stock in 2020 was at a high level. The survey biomass in 2020 is the highest observed since the beginning of the survey, in 2008. The commercial CPUE in 2021 has decreased compared to 2020 but remains at a high level. There is no recruitment index available for this stock, few juvenile shrimps are caught in the survey area.



Reference points

Scientific Council considers that 15% of the maximum survey female biomass provides a proxy for *Blim* (SCS Doc. 17/17). The record high survey biomass found in 2020 results in *Blim* = 580 t.

Projections

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

Assessment

There was no survey in 2021. The most recent survey was in 2020 after three years with no survey data. The survey biomass was the highest since the survey started in 2008. The standardized commercial CPUE has increased since 2015 and was at a historical high level in 2020, it has since dropped slightly in 2021. In 2021 the fisheries started late due to a delay in licences, this may have impacted the fishing pattern. The survey biomass in 2020 is concentrated in a fairly small geographical area and the recent fishing effort is concentrated in the same general area. Recent fishing effort has been relatively low, so this CPUE may not reflect stock status for the entire stock distribution area.

A comprehensive sensitivity analyses of the surplus production model (SPiCT) was performed as recommended by NIPAG 2021 (SCR Doc 21/044). However, the SPiCT model was not applicable as a preliminary assessment tool this year but encourage future development of this modeling approach.

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 2014.

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 and TAC (t) were as follows:

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Enacted TAC	12 400	12 400	8 300	6 100	5 300	5 300	4 300	3 384	4 750	7 000
SC Recommended TAC	12 400	12 400	2 000	2 000	2 000	2 000	2 000	2 000	3 000	3 000
NIPAG	2 109	1 717	622	576	49	561	547	1 580	3 172	2 370 ¹

¹ To June 30th 2021

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 Docs. 20/066, 21/043, 21/044

V. OTHER MATTERS

1. Scheduling of Future Meetings

a) Scientific Council meetings

i) WG-ESA, 16- 25 November 2021

The Working Group on Ecosystem Science and Assessment (WG-ESA) will meet at the NAFO Secretariat, Nova Scotia, Canada, from 16 to 25 November 2021.

ii) Scientific Council, June 2022

Scientific Council June 2022 meeting will be held in Halifax, Nova Scotia, Canada, from 3 to 16 June 2022.

iii) Scientific Council, (in conjunction with NIPAG), September 2022

The Scientific Council shrimp advice meeting will be held in Copenhagen from 12 to 17 September 2022.

iv) Scientific Council, September 2022

The Annual meeting will be held from 19 to 23 September 2022, in Lisbon, Portugal.

b) NAFO/ICES Joint Groups

i) ICES – NAFO Working Group on Deep-water Ecosystem, 2022

Dates and location to be determined.

ii) ICES/NAFO/NAMMCO WG-HARP

The date and location of the next ICES/NAFO/NAMMCO Working Group on Harp and Hooded Seals (WGHARP) meeting are unknown.

iii) NIPAG, November 2022

The Scientific Council shrimp advice meeting will be held in Copenhagen from 12 to 17 September 2022.

2. Topics for Future Special Sessions

No special session was proposed.

3. Other Business

No other business was discussed.

VI. ADOPTION OF SCIENTIFIC COUNCIL AND NIPAG REPORTS

The Council at its session on 4 November 2021 considered and adopted Sections III.1-4 of the “Report of the NAFO/ICES *Pandalus* Assessment Group” (NAFO SCS Doc. 21/19). The Scientific Council then considered and adopted its own report of the October 2020 meeting subject to editorial changes after the meeting.

VII. ADJOURNMENT

The meeting was adjourned at 1300 hours on 4 November 2021. The Chair thanked all participants, especially the designated experts and stock coordinators, for their hard work. The Chair thanked the NAFO and ICES Secretariats for all of their logistical support. The report was adopted at the close of the meeting, subject to editorial changes.

APPENDIX I. AGENDA – NAFO SCIENTIFIC COUNCIL IN CONJUNCTION WITH NIPAG

By WebEx
1 to 4 November 2021

Daily hours (Halifax time, Canada): 08:00 to 13:00 h

- I. Opening (Chair: Mark Simpson)
 1. Appointment of Rapporteur
 2. Adoption of Agenda
 3. Attendance of Observers
 4. Plan of Work
- II. Review of Recommendations in 2019
- III. NAFO/ICES Pandalus Assessment Group (Co-chairs Mark Simpson and Ole Ritzau Eigaard)
- IV. Formulation of Advice (see Annexes 1–3)
 1. 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)
- 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 I. THE COMMISSION'S REQUEST FOR SCIENTIFIC ADVICE ON MANAGEMENT IN 2022 AND BEYOND OF CERTAIN STOCKS IN SUBAREAS 2, 3 AND 4 AND OTHER MATTERS

(COM Doc. 20-16)

Following a request from the Scientific Council, the Commission agreed that items 1, 2, 8 and 11 should be the priority for the June 2021 Scientific Council meeting subject to resources and COVID-related restrictions.

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 without a single TAC recommendation. The Commission will decide upon the acceptable risk level in the context of the entirety of the SC advice for each stock guided and as foreseen by the Precautionary Approach.

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 White hake in Div. 3NO	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 Cod in Div. 3NO

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

In 2021, advice should be provided for 2022 for Cod in Div. 3M and Northern shrimp in Div. 3M. With respect to Northern shrimp in Div. 3M, SC is requested to provide its advice to the Commission prior to the 2021 Annual Meeting based on the survey data up to and including 2021.

In 2021, advice should be provided for 2022 and 2023 for: Redfish in Div. 3M, Northern shrimp in Div. 3LNO, and White hake in Div. 3NO

In 2021, advice should be provided for 2022, 2023 and 2024 for: American plaice in Div. 3LNO, Capelin in Div. 3NO, Cod in Div. 3NO, Yellowtail flounder in Div. 3LNO

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 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. 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.
3. The Commission requests that the 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.
4. The Commission requests the Scientific Council to implement the steps of the Action plan relevant to the Scientific Council 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).
 - Tasks outlined in Tasks 3.1 and 3.2 of the NAFO Action Plan in the Management and Minimization of Bycatch and Discards (COM Doc. 17-26).

5. The Commission requests that Scientific Council continue to refine work on the Ecosystem Road Map:
 - Continue to test the reliability of the ecosystem production potential model and other related models
 - Report on these results to WG-EAFFM and WG-RBMS to further develop how it may apply to management decisions
 - Develop options of how ecosystem advice could inform management decisions, an issue which is directly linked to the results of the foreseen EAFM roadmap workshop.
 - Continue its work to develop models that support implementation of Tier 2 of the EAFM Roadmap."
6. The Commission requests that the Scientific Council, in preparation of the re-assessment of NAFO bottom fisheries in 2021 and discussion on VME fishery closures:
 - Assess the overlap of NAFO fisheries with VME to evaluate fishery specific impacts in addition to the cumulative impacts for NRA fisheries;
 - 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 including the three FAO functional SAI criteria which could not be evaluated in the current assessment.
 - Provide input and analysis of potential management options, with the goal of supporting meaningful and effective discussions between scientists and managers at the 2021 WG-EAFFM meeting;
 - Continue to work on the VME indicator species as listed in Annex IE, Section VI to prepare for the next assessment.
7. The Commission requests that the Scientific Council review the proposed revisions to Annex I.E, Part VI as reflected in COM-SC EAFFM-WP 18-01, for consistency with the taxa list annexed to the VME guide and recommend updates as necessary.
8. The Commission requests the Scientific Council to continue progression on the review of the NAFO PA Framework in accordance to the PAF review work plan approved in 2020 (NAFO COM-SC Doc. 20-04)
9. The Commission requests that the Scientific Council Work with WG- BDS to identify areas and times where bycatch and discards of Greenland sharks have a higher rate of occurrence in time for consideration by the Commission in 2021 to inform the development of measures to reduce bycatch in the NRA.
10. The Commission requests the Scientific Council to continue to develop a 3-5 year work plan, which reflects requests arising from the 2020 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.
11. The Commission requests that the Scientific Council, carry out a scoping exercise to provide guidance to the WG-RBMS on the process of conducting of a full review/evaluation of the management strategy of Div. 3LN redfish.

12. The Commission requests the Scientific Council review submitted protocols for a survey methodology to inform the assessment of Splendid Alfonsino. The Scientific Council to report on the outcome of this work at next Commission annual meeting.
13. The Commission requests that results from stock assessments and the scientific advice of Cod 2J3KL (Canada), Witch 2J3KL (Canada) and Pelagic *Sebastes mentella* (ICES Divisions V, XII and XIV; NAFO 1) to be presented to the Scientific Council (SC), and request the SC to prepare a summary of these assessments to be included in its annual report.
14. The Commission requests the Scientific Council, jointly with the Secretariat, to conduct ongoing analysis of the Flemish Cap cod fishery data by 2022 in order to:
 - (1) monitor the consequences of the management decisions (including the analysis of the redistribution of the fishing effort along the year and its potential effects on ecosystems, the variation of the cod catch composition in lengths/ages, and the bycatch levels of other fish species, benthos in general, and VME taxa in particular), and
 - (2) carry out any additional monitoring that would be required, including Div. 3M cod caught as bycatch in other fisheries during the closed period.
15. The Commission requests the Scientific Council, in its future work, to consider whether other measures, such as depth restrictions, spatial and mesh changes, could reduce the catch of juvenile and immature cod across all fisheries in 3M.
16. The Commission requests the Scientific Council to continue to monitor and provide updates resulting from relevant research related to the potential impact of activities other than fishing in the Convention Area. Further, that the Secretariat and the Scientific Council work with other international organizations, such as the FAO and ICES, to bring in additional expertise to inform the Scientific Council's work.
17. The Commission requests the Scientific Council to provide information to the Commission at its next annual meeting on sea turtles, sea birds, and marine mammals that are present in NAFO Regulatory Area based on available data.
18. The Commission requests that the Scientific Council proceed with developing the ecosystem summary sheets for 3M and 3LNO move toward undertaking a joint Workshop with ICES (International Council for the Exploration of the Sea) as part of a peer review of North Atlantic ecosystems.

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

The Commission requests 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} , 90% F_{msy} , 95% F_{msy} , F_{msy} 0.75 X $F_{status\ quo}$, $F_{status\ quo}$, 1.25 X $F_{status\ quo}$, $F=0$; TAC $F_{status\ quo}$, 85% TAC $F_{status\ quo}$, 90% TAC $F_{status\ quo}$, 95% TAC $F_{status\ quo}$
- For stocks under a moratorium to direct fishing: $F_{status\ quo}$, $F = 0$.

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 2022 and following years*	Yield 2022 (50%)	Yield 2023 (50%)	Yield 2024 (50%)	Limit reference points						P(F>F _{msy})			P(B<B _{msy})			P(B ₂₀₂₄ > B ₂₀₂₀)
				P(F>F _{lim})			P(B<B _{lim})									
				2022	2023	2024	2022	2023	2024	2022	2023	2024	2022	2023	2024	
2/3 F _{msy}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%
3/4 F _{msy}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%
85% F _{msy}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%
90% F _{msy}																
95% F _{msy}																
F _{msy}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%
0.75 X F _{status quo}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%
F _{status quo}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%
1.25 X F _{status quo}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%
F=0	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%
TAC Status quo																
85% TAC Status quo																
90% TAC Status quo																
95% TAC Status quo																



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

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 2022 and following years*	Yield 2022	Yield 2023	Yield 2024	Limit reference points						P(F>F _{0.1})			P(F>F _{max})			P(B ₂₀₂₄ > B ₂₀₂₀)
				P(F>F _{lim})			P(B<B _{lim})			2022	2023	2024	2022	2023	2024	
				2022	2023	2024	2022	2023	2024							
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 II. DENMARK (ON BEHALF OF GREENLAND) REQUESTS FOR SCIENTIFIC ADVICE ON MANAGEMENT IN 2022 AND BEYOND OF CERTAIN STOCKS IN SUBAREA 0 AND 1

Denmark (on behalf of Greenland) requests scientific advice on management in 2020 of Certain Stocks in NAFO Subarea 0 and 1. Denmark (on behalf of Greenland) requests the Scientific Council for advice on the following species:

- 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 2020 given for 2021-2023. 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.
- 2. Greenland Halibut, Offshore**
Advice on Greenland Halibut, Offshore in Subareas 0 and 1 was in 2020 given for 2021 and 2022. 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. The Scientific Council is also asked to advise on any other management measures it deems appropriate to ensure the sustainability of these resources.
- 3. Greenland Halibut, Inshore, West Greenland**
Advice on Greenland Halibut in Division 1A inshore, Division 1BC inshore, Division 1D inshore and Division 1EF inshore was in 2020 given for 2021-2022. 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. The Scientific Council is also asked to advise on any other management measures it deems appropriate to ensure the sustainability of these resources.
- 4. Northern Shrimp, West Greenland**
Subject to the concurrence of Canada as regards to Subareas 0 and 1, Denmark (on behalf of Greenland) requests the Scientific Council before December 2021 to provide advice on the scientific basis for management of Northern Shrimp (*Pandalus borealis*) in Subareas 0 and 1 in 2022 in line with Greenland's stated management objective of maintaining a mortality risk of no more than 35% in the first year prediction and to provide a catch option table ranging with 5,000 t increments. Future catch options should be provided for as many years as data allows for. Furthermore, Scientific Council is requested to provide a catch level corresponding to a mortality risk of exact 35% in the first year of prediction.
- 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 2022 and for as many years ahead as data allows for.

ANNEX III. REQUESTS FROM CANADA FOR ADVICE ON MANAGEMENT IN 2022 AND BEYOND

1. Greenland halibut (Subarea 0 + 1 (offshore))¹

Advice on Greenland Halibut in Subareas 0 and 1 was provided in 2020 for 2021 and 2022. Canada requests that the Scientific Council monitor the status of this stock in 2021, and, should a significant change be observed in stock status (e.g. from surveys or in bycatches in other fisheries), provide updated advice as appropriate.

2. Shrimp (Subarea 1 and Division 0A)

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

The status of the stock should be determined and risk-based advice provided for catch options corresponding to Z_{msy} , in 5,000-10,000t increments (subject to the discretion of Scientific Council), with forecasts for 2022 to 2024. These options should be evaluated in relation to Canada's Harvest Strategy (attached) and NAFO's Precautionary Approach Framework, and presented in the form of risk analyses related to B_{msy} , 80% B_{msy} , B_{lim} (30% B_{msy}) 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 2022 to 2024. 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} (30% B_{msy}), and of being above Z_{msy} based on the 3-year projections, consistent with the Harvest Decision Rules in Canada's Harvest Strategy; and
- Total area fished for the longest time period possible.

Please provide the advice relative to Canada's Harvest Strategy as part of the formal advice (i.e., grey box in the advice summary sheet).

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

ANNEX IV. ICES TERMS OF REFERENCE FOR NIPAG

A. Generic ToRs for Regional and Species Working Groups

This resolution was approved 2 September 2021

Generic ToRs for Regional and Species Working Groups

2020/2/FRSG01 The following ToRs apply to: AFWG, HAWG, NWWG, NIPAG, WGWIDE, WGBAST, WGBFAS, WGNSSK, WGCSE, WGDEEP, WGBIE, WGEEL, WGEF, WGHANSA and WGNAS.

The working group should focus on:

- a) Consider and comment on Ecosystem and Fisheries overviews where available;
- b) For the aim of providing input for the Fisheries Overviews, consider and comment on the following for the fisheries relevant to the working group:
 - i. descriptions of ecosystem impacts on fisheries
 - ii. descriptions of developments and recent changes to the fisheries
 - iii. mixed fisheries considerations, and
 - iv. emerging issues of relevance for management of the fisheries;
- c) Conduct an assessment on the stock(s) to be addressed in 2021 using the method (assessment, forecast or trends indicators) as described in the stock annex and produce a **brief** report of the work carried out regarding the stock, providing summaries of the following where relevant:
 - i. Input data and examination of data quality; in the event of missing or inconsistent survey or catch information refer to the ACOM document for dealing with COVID-19 pandemic disruption and the linked template that formulates how deviations from the stock annex are to be reported.
 - ii. Where misreporting of catches is significant, provide qualitative and where possible quantitative information and describe the methods used to obtain the information;
 - iii. For relevant stocks (i.e., all stocks with catches in the NEAFC Regulatory Area), estimate the percentage of the total catch that has been taken in the NEAFC Regulatory Area in 2020.
 - iv. Estimate MSY reference points or proxies for the category 3 and 4 stocks
 - v. Evaluate spawning stock biomass, total stock biomass, fishing mortality, catches (projected landings and discards) using the method described in the stock annex;
 - 1) for category 1 and 2 stocks, in addition to the other relevant model diagnostics, the recommendations and decision tree formulated by WKFORBIAS (see Annex 2 of https://www.ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/Fisheries%20Resources%20Steering%20Group/2020/WKFORBIAS_2019.pdf) should be considered as guidance to determine whether an assessment remains sufficiently robust for providing advice.
 - 2) b. If the assessment is deemed no longer suitable as basis for advice, consider whether it is possible and feasible to resolve the issue through an interbenchmark. If this is not possible, consider providing advice using an appropriate Category 2 to 5 approach.;
- vi) The state of the stocks against relevant reference points;

Consistent with ACOM's 2020 decision, the basis for Fpa should be Fp.05.

 - 1) Where Fp.05 for the current set of reference points is reported in the relevant benchmark report, replace the value and basis of Fpa with the information relevant for Fp.05
 - 2) Where Fp.05 for the current set of reference points is not reported in the relevant benchmark report, compute the Fp.05 that is consistent with the current set of reference points and use as Fpa. A review/audit of the computations will be organized.
 - 3) Where Fp.05 for the current set of reference points is not reported and cannot be computed, retain the existing basis for Fpa.

- vii) Catch scenarios for the year(s) beyond the terminal year of the data for the stocks for which ICES has been requested to provide advice on fishing opportunities;
 - viii) Historical and analytical performance of the assessment and catch options with a succinct description of associated quality issues. For the analytical performance of category 1 and 2 age-structured assessments, report the mean Mohn's rho (assessment retrospective bias analysis) values for time series of recruitment, spawning stock biomass, and fishing mortality rate. The WG report should include a plot of this retrospective analysis. The values should be calculated in accordance with the "Guidance for completing ToR viii) of the Generic ToRs for Regional and Species Working Groups - Retrospective bias in assessment" and reported using the ICES application for this purpose.
- d) Produce a first draft of the advice on the stocks under considerations according to ACOM guidelines.
 - i. In the section 'Basis for the assessment' under input data match the survey names with the relevant "SurveyCode" listed ICES survey naming convention (*restricted access*) and add the "SurveyCode" to the advice sheet.
 - e) Review progress on benchmark issues and processes of relevance to the Expert Group.
 - i. update the benchmark issues lists for the individual stocks;
 - ii. review progress on benchmark issues and identify potential benchmarks to be initiated in 2022 for conclusion in 2023;
 - iii. determine the prioritization score for benchmarks proposed for 2022–2023;
 - iv. as necessary, document generic issues to be addressed by the Benchmark Oversight Group (BOG)
 - f) Prepare the data calls for the next year's update assessment and for planned data evaluation workshops;
 - g) Identify research needs of relevance to the work of the Expert Group.
 - h) Review and update information regarding operational issues and research priorities on the Fisheries Resources Steering Group SharePoint site.
 - i) If not completed in 2020, complete the audit spread sheet 'Monitor and alert for changes in ecosystem/fisheries productivity' for the new assessments and data used for the stocks. Also note in the benchmark report how productivity, species interactions, habitat and distributional changes, including those related to climate-change, could be considered in the advice.

B. NIPAG – Joint NAFO/ICES *Pandalus* Assessment Working Group 2020

NIPAG – Joint NAFO/ICES *Pandalus* Assessment Working Group

This resolution was approved 3 November 2020

2020/2/FRSG04 The Joint NAFO/ICES *Pandalus* Assessment Working Group (NIPAG), chaired by Ole Ritzau Eigaard, Denmark (ICES) and Brian Healey, Canada (NAFO), will meet by correspondence, 25–26 February 2021, to:

- a) Address generic ToRs for Regional and Species Working Groups for Northern shrimp in divisions 3.a and 4.a East stock.

NIPAG will report by 5 March 2021 for the attention of ACOM.

APPENDIX II. RELEVANT RECOMMENDATIONS FROM 2019 AND 2020

1. Northern Shrimp in Division 3M

- NIPAG **recommended** in 2016 that *further exploration of the relationship between shrimp, cod and the environment be continued in WGESA and NIPAG encourages the shrimp experts to be involved in this work.* This recommendation is **reiterated**.
- NIPAG **recommends** that *in future years NIPAG should investigate the options to implement an analytical assessment for this stock. Models to explore could include SPiCT, Stock Synthesis (as applied for Northern shrimp in Skagerrak and Norwegian Deep), or other length-based models.*
- NIPAG **recommends** that *this stock be considered for a benchmark workshop in conjunction with the benchmark of the Skagerrak and Barents Sea stocks anticipated for 2020/21. The NIPAG 2020 meeting will be utilized for a workshop to clarify the data situation and potential assessment models.*

2. Northern Shrimp in Divisions 3NLO

- NIPAG **recommended** in 2015 that *ecosystem information related to the role of shrimp as prey in the Grand Bank (i.e. 3LNO) Ecosystem be presented to NIPAG.* This recommendation is **reiterated**.
- NIPAG **recommended** in 2018 that *further work on the development of a recruitment index for Div. 3LNO be completed.* This recommendation is **reiterated**.
- NIPAG **recommends in 2018** that *further work on the development of a recruitment index for Div. 3LNO be completed.* This recommendation is **reiterated**.

3. Northern shrimp (*Pandalus borealis*) off West Greenland (NAFO Subarea 0 And Subarea 1)

- NIPAG recommended in 2018 that random sampling of the catches be conducted to provide catch composition data to the assessment. This recommendation is reiterated.
- NIPAG recommends that diagnostics of the model should be further explored.

4. Northern shrimp (*Pandalus borealis*) In the Denmark Strait and off East Greenland (ICES Divisions XIVb and Va)

- NIPAG **recommends** in 2020 that: *further model exploration should be carried out, including adding risk levels for different catch projection scenarios.*

5. Northern shrimp (*Pandalus borealis*) in the Skagerrak and Norwegian Deep (ICES Divisions IIIa and IVa East)

- NIPAG **recommended** in 2010-2014 that: *differences in recruitment and stock abundance between Skagerrak and the Norwegian Deep should be explored.* This recommendation is **reiterated**. This issue will be addressed at the 2022 benchmark.
- NIPAG **recommended** in 2016 that: *a full benchmark for this stock, including a data compilation workshop, be conducted in the near future and no later than 2020.* This recommendation is **reiterated**. Benchmark is planned for 2021/2022.

6. Northern shrimp (*Pandalus borealis*) in the Barents Sea (ICES Subareas I and II)

- The assessment procedure used has been in place since 2006 and in 2016 NIPAG **recommended** that *it be considered for a benchmark workshop in near future, no later than 2019.* This recommendation is **reiterated**

- The fishery has expanded since 2014 and catches by countries other than Norway have increased to account for about 65% of the total. In 2016, NIPAG therefore **recommended** that *available data (logbook data and catch samples) from the participating nations be made available to NIPAG*. This recommendation is **reiterated**.
- In 2017, NIPAG **recommended** that a recruitment index should be developed for this stock. This recommendation is **reiterated**.
- In 2017, NIPAG **recommended** that the information regarding catch effort and bycatch from the Estonian commercial fishery should be further analysed e.g. CPUE data explored as a potential index of biomass. This recommendation is **reiterated**.

**APPENDIX III. DESIGNATED EXPERTS FOR PRELIMINARY ASSESSMENT OF
CERTAIN NAFO STOCKS**

The following is the list of Designated Experts for 2020 assessments:

**From the Science Branch, Northwest Atlantic Fisheries Centre, Department of Fisheries and Oceans,
P. O. Box 5667, St. John's, NL, Canada A1C 5X1, Canada**

Northern shrimp in Divisions 3LNO	Katherine Skanes	Tel: +1 709-772-8437	Katherine.skane@dfo- mpo.gc.ca
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From the Instituto Español de Oceanografía, Aptdo 1552, E-36200 Vigo (Pontevedra), Spain

Shrimp in Division 3M	Jose Miguel Casas Sanchez	Tel: +34 986 49 2111	mikel.casas@ieo.es
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From the Greenland Institute of Natural Resources, P. O. Box 570, DK-3900 Nuuk, Greenland

Northern shrimp in Subarea 0+1	AnnDorte Burmeister	Tel: +299 36 1200	anndorte@natur.gl
Northern shrimp in Denmark Strait	Frank Riget		frri@natur.gl

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

SCR Document			
Doc No.	Serial No	Author	Title
SCR 21/040	N7238	Burmeister and Rigét	The Fishery for Northern Shrimp (<i>Pandalus borealis</i>) off West Greenland, 1970–2020
SCR 21/041	N7239	Burmeister	Catch Table Update for the West Greenland Shrimp Fishery
SCR 21/042	N7240	Burmeister and Rigét	A provisional Assessment of the shrimp stock off West Greenland in 2020
SCR 21/043	N7241	Buch, Burmeister and Rigét	The Fishery for Northern Shrimp (<i>Pandalus borealis</i>) in Denmark Strait / off East Greenland 1978 – 2020
SCR 21/044	N7242	Rigét, Burmeister and Buch	Applying a stochastic surplus production model (SPiCT) to the East Greenland Stock of Northern Shrimp

SCS Document			
Doc No.	Serial No	Author	Title
SCS 21/17	N7249	NAFO	Report of the Scientific Council Meeting 20–24 September 2021
SCS 21/19	N7250	NAFO	Report of the NAFO/ICES <i>Pandalus</i> Assessment Group Meeting 01-04 November 2021
SCS 21/20	N7251	NAFO	Report of the Scientific Council (in conjunction with NIPAG) Meeting 01-04 November 2021

APPENDIX V. PARTICIPANT LIST

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