



Serial No. N7142

NAFO SCS Doc. 20/20

SCIENTIFIC COUNCIL MEETING – OCTOBER 2020

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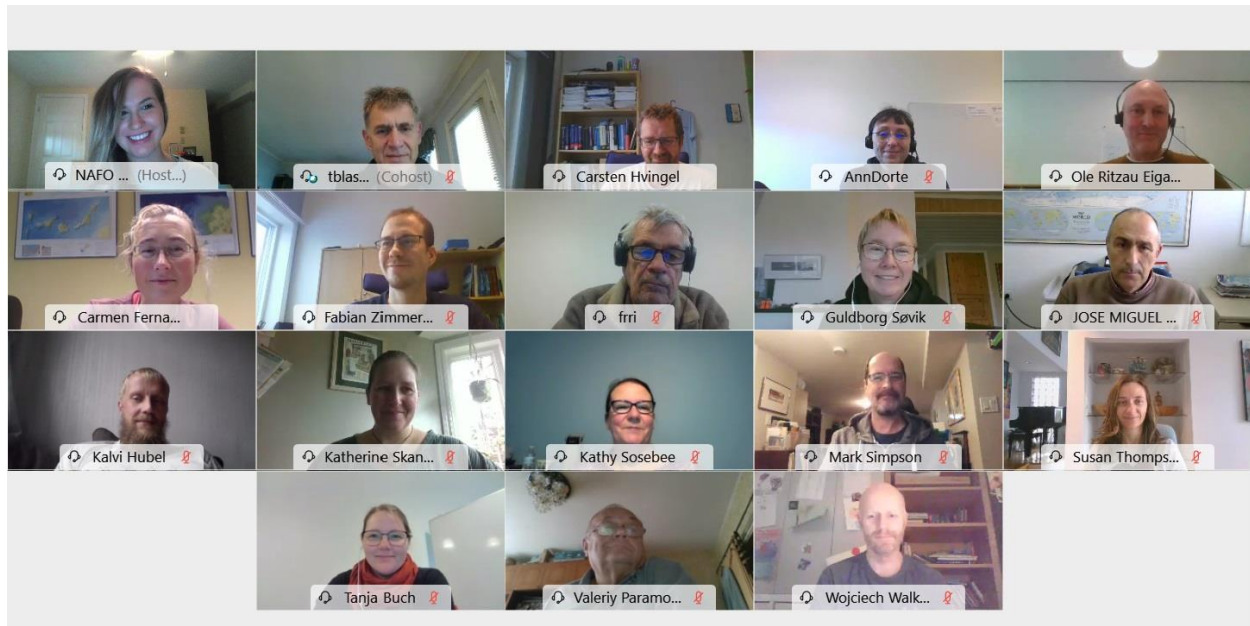
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SC-NIPAG Participants 2020



SC-NIPAG participants from left to right:

First row Dayna Bell MacCallum, Tom Blasdale, Carsten Hvingel, AnnDorte Burmeister, Ole Ritzau Eigaard.

Second row: CarmenFernández, Fabian Zimmermann, Frank Rigét, Guldborg Søvik, José Miguel Casas Sanchez

Third row: Kalvi Hubel, Katherine Skanes, Katherine Sosebee, Mark Simpson, Susan Thompson

Fourth row: Tanja Buch, Valeriy Paramonov, Wojciech Walkusz

Missing from photo: Brittany Beauchamp, Aleksei Stesko, Rui Catarino

Report of the Scientific Council Meeting 26 – 30 October 2020

Chair: Carmen Fernández

Rapporteur: Tom Blasdale

I. PLENARY SESSIONS

The Scientific Council met by correspondence from 26 to 30 October 2020 to consider the various matters in its Agenda. Representatives attended from Canada, Denmark (in respect of Greenland), European Union, Norway, Russian Federation, Ukraine and the United States of America. The NAFO Scientific Council Coordinator and Scientific Information Administrator were also in attendance.

The opening session of the Council was called to order at 08:00 (Halifax time, UTC - 3 hours) on 26 October. 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 stock was given in September 2020 (SCS Doc. 20/22) 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 08:00 30 October 2020 when the Council then considered and adopted Sections III.1–4 of the “Report of the NAFO/ICES *Pandalus* Assessment Group” (NAFO SCS Doc. 20/21). The Council, having considered the results of the assessments of the NAFO stocks, provided advice and recommendations.

The meeting was adjourned at 13:00 on 30 October 2020.

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 2019

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

III. NAFO/ICES PANDALUS ASSESSMENT GROUP

In 2020, 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 one stock for which advice was given in September 2020 (SCS Doc. 20/22): Northern shrimp in NAFO Division 3M. The full NIPAG report is available in NAFO SCS Doc. 20/21.

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

1. Request from the Commission

Advice for shrimp in Division 3M was provided by the Scientific Council in September 2020. No further requests were considered in October 2020.

2. Requests from Coastal States

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

Advice November 2020 for 2021


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 2021 should not exceed 115 000 t.

With regard to the Canadian harvest strategy, Scientific Council notes that catches of 115 000 t in each of the years 2021 to 2023 would result in less than 35% risk of exceeding Z_{msy} in 2021 and 2022 and exactly 35% risk of exceeding Z_{msy} in 2023.

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% of exceeding Z_{msy} (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

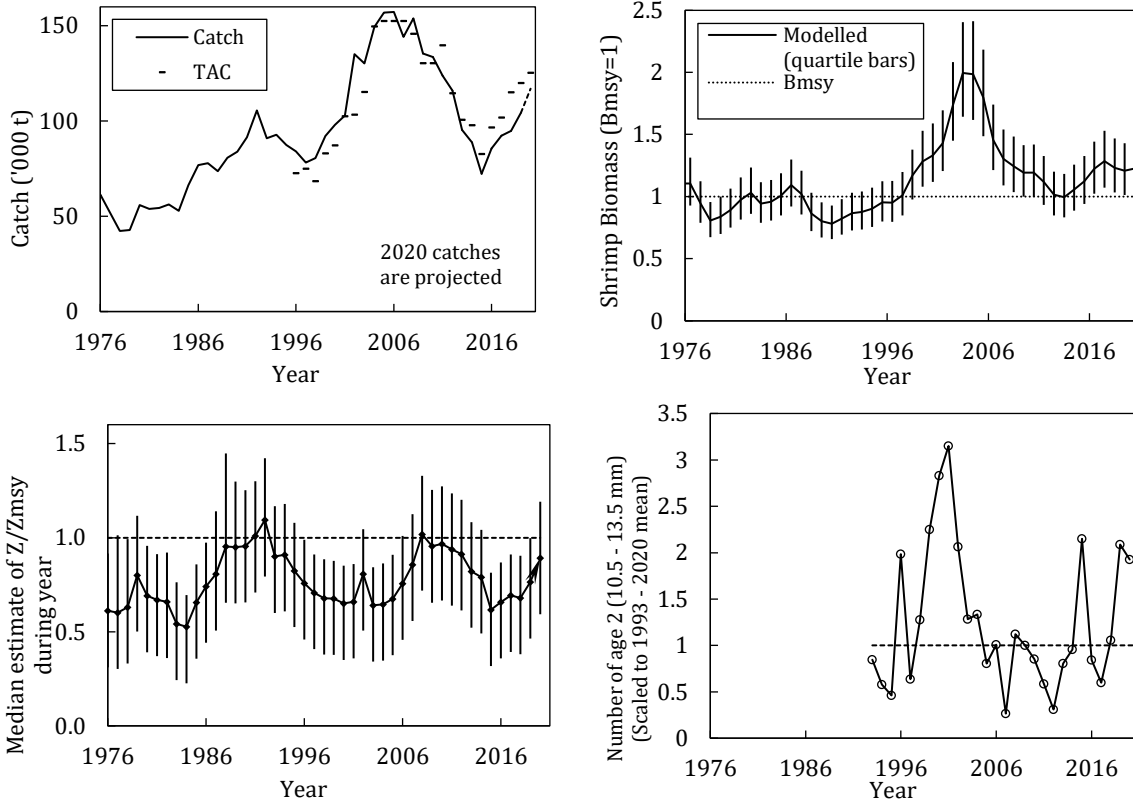
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Management unit

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 2019, 98% of the landings were from Greenland.

Stock status

Biomass at the end of 2020 is above B_{msy} and the probability of being below B_{lim} is very low (<1%). The probability of mortality in 2020 being above Z_{msy} is 40%. Recruitment (number of age-2 shrimp) in 2020 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 2021 – 2023 under eight catch options and subject to predation by a cod stock with an effective biomass of 7 Kt.

7 000 t cod	Catch option ('000 tons)								
	Risk of:	95	100	105	110	115	120	125	130
falling below B_{msy} end 2021 (%)	24	24	25	27	26	27	27	27	28
falling below B_{msy} end 2022 (%)	25	25	27	28	29	29	29	30	31
falling below B_{msy} end 2023 (%)	25	26	28	30	31	32	32	33	33
falling below B_{lim} end 2021 (%)	0	0	0	0	0	0	0	0	0
falling below B_{lim} end 2022 (%)	0	0	0	0	0	0	0	0	0
falling below B_{lim} end 2023 (%)	0	0	0	0	0	0	0	0	0
exceeding Z_{msy} in 2021 (%)	19	22	26	30	33	37	40	44	44
exceeding Z_{msy} in 2022 (%)	19	22	27	31	34	39	42	45	45
exceeding Z_{msy} in 2023 (%)	20	23	28	32	35	39	43	46	46
falling below B_{msy} 80% end 2021 (%)	8	8	9	9	9	9	10	9	9
falling below B_{msy} 80% end 2022 (%)	9	10	11	11	11	12	13	13	13
falling below B_{msy} 80% end 2023 (%)	10	10	12	12	13	14	16	17	17

Assessment

Advice is based on risk analysis coming from a quantitative model. The analytical assessment was run in 2020 with revised treatment of the input data (SCR Doc. 20-56, 20-58) and with updated data series.

The next assessment is scheduled for 2021.

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:

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Enacted TAC¹	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	125 229 ¹
STATLANT 21	123 195	114 970	91 802	88 834	71 779	84 303	91 725	91 869	102 706	
NIPAG	123 989	115 977	95 381	88 765	72 256	85 527	92 584	94 878	104 314	117 000 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 20-53, 54, 55, 56, 57, 58.

b) Northern shrimp in Denmark Strait and off East Greenland


Advice November 2020 for 2021

Recommendation

The available information indicates the stock has increased in recent years. Scientific Council advises that fishing mortality should not increase in 2021. On this basis, the catch in 2021 should not exceed 3000 t, corresponding to the projected catch in 2020.

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> is defined. No fishing mortality reference is defined.

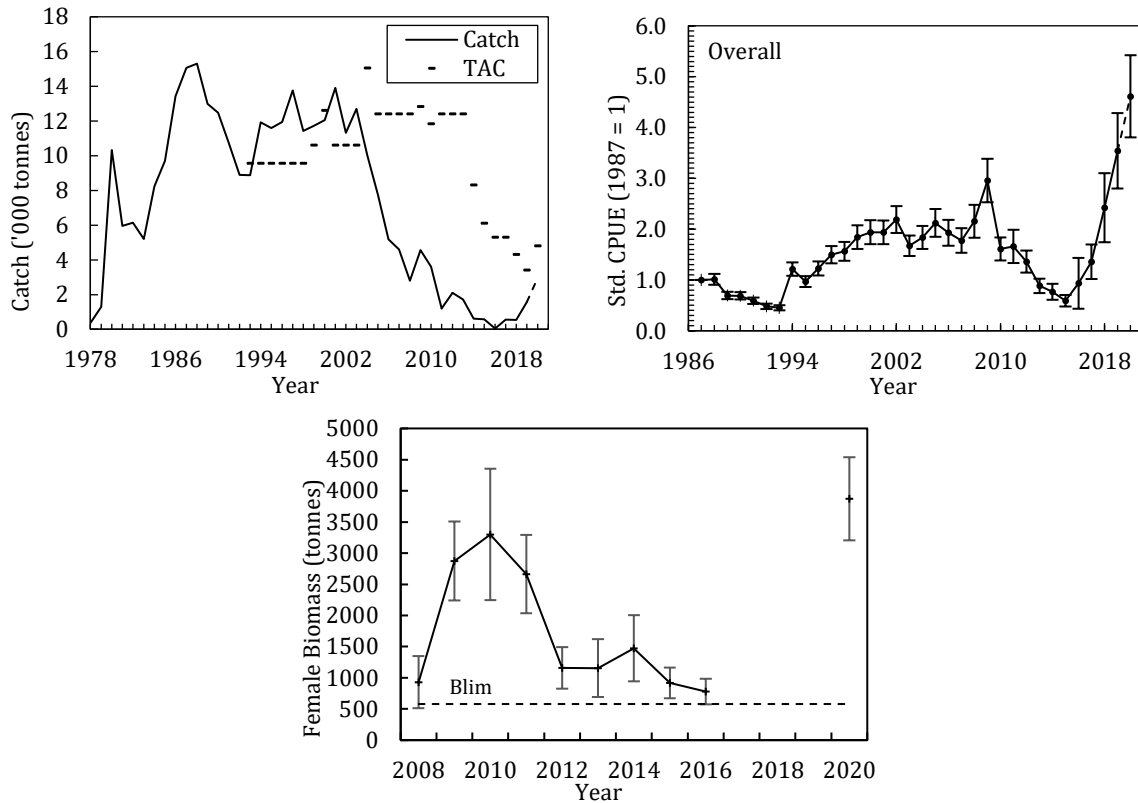
 Intermediate

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

The stock in 2020 is 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 2020 is also the highest since the beginning of the time series, in 1986. 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 B_{lim} . The record high survey biomass found in 2020 results in $B_{lim} = 580$ t.

Projections

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

Assessment

A survey was conducted 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. The survey biomass in 2020 is concentrated in a fairly small geographical area and the recent fishing effort concentrates 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.

An analytical assessment model (surplus production model, SPiCT), using both the commercial and the survey CPUE, was investigated this year. Results can be found in the NIPAG report (SCS 20/021). The model results indicated a healthy stock status; however, the model needs to be further explored next year.

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:

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Enacted TAC	12 400	12 400	12 400	8 300	6 100	5 300	5 300	4 300	3 384	4 750
SC Recommended TAC	12 400	12 400	12 400	2 000	2 000	2 000	2 000	2 000	2 000	2 000
NIPAG	1 199	2 109	1 717	622	576	49	561	547	1 580	2 839 ¹

¹ To July 2020

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. 20-059, 20-060, 20-061.

V. OTHER MATTERS

1. Scheduling of Future Meetings

a) Scientific Council Meetings

i) Scientific Council Shrimp Meeting September 2021

The 2021 Scientific Council shrimp meeting will be held in Copenhagen, Denmark 8-14 September 2021. There will be an additional meeting by WebEx in November 2021 to provide advice on shrimp in East Greenland (ICES Div. 14b and 5a).

b) NAFO/ICES Joint Working Groups

i) NIPAG, October/November 2020

The 2021 NIPAG meeting will be held in Copenhagen, Denmark 8-14 September 2021.

2. Topics for Future Special Sessions

No special sessions were proposed.

3. Other Business

No other business was discussed.

VI. ADOPTION OF SCIENTIFIC COUNCIL AND NIPAG REPORTS

The Council at its session on 30 October 2020 considered and adopted Sections III.1-4 of the “Report of the NAFO/ICES *Pandalus* Assessment Group” (NAFO SCS Doc. 20/21). 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 NIPAG meeting was adjourned at 13:00 on 30 October 2020. 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. The report was adopted at the close of the meeting, subject to editorial changes after the meeting.

APPENDIX I. REVISED AGENDA – SCIENTIFIC COUNCIL MEETING

By WebEx

26 October – 02 November 2020 (excluding weekend)

Daily hours (Halifax time, Canada): 7:30 to 13:00 h

- I. Opening (Chair: Carmen Fernández)
 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 Katherine Sosebee 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 1. 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

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 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 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 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 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 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 SC 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 request 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 COM request 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 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 SC, 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 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 request that 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 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: $2/3 F_{msy}$, $3/4 F_{msy}$, $85\% F_{msy}$, $90\% F_{msy}$, $95\% F_{msy}$, $F_{msy} 0.75 \times F_{status\ quo}$, $F_{status\ quo}$, $1.25 \times F_{status\ quo}$, $F=0$; TAC Status quo, $85\% TAC\ Status\ quo$, $90\% TAC\ Status\ quo$, $95\% TAC\ Status\ quo$
- 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(B ₂₀₂₄ > B ₂₀₂₀)						
				P(F > F _{lim})			P(B < B _{lim})				P(F > F _{msy})			P(B < B _{msy})		
				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 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 2: DENMARK (ON BEHALF OF GREENLAND) REQUESTS FOR SCIENTIFIC ADVICE ON
MANAGEMENT IN 2021 OF CERTAIN STOCKS IN SUBAREA 0 AND 1
(NAFO SCS Doc. 20-03)**

Denmark (on behalf of Greenland) requests scientific advice on management in 2021 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 2017 given for 2018-2020. Denmark (on behalf of Greenland) requests the Scientific Council to provide advice on appropriate TAC levels for 2021 to 2023.
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 provide advice on appropriate TAC levels for 2021 to 2022. in 1) the offshore areas of NAFO Division OA and Division 1 A plus Division 1 B and 2) NAFO Division OB plus Divisions 1C-1F. The Scientific Council is also asked to advice on any other management measures it deems appropriate to ensure the sustainability of these resources. The Scientific Council is requested to consider the possibility for providing a separate advice for 1 B-1 F inshore.
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 provide advice on appropriate TAC levels for 2021 to 2022.
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 2020 to provide advice on the scientific basis for management of Northern Shrimp (*Pandalus borealis*) in Subarea 0 and 1 in 2021 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 2021 and for as many years ahead as data allows for

ANNEX 3. REQUESTS FOR ADVICE FROM CANADA FOR 2021
(NAFO SCS Doc. 20-02)

1. Greenland halibut (Subarea 0 + 1A (offshore) and 1B-F)

The Scientific Council is requested to provide an overall assessment of status and trends in the total stock area throughout its range and to specifically advise on TAC levels for 2021 and 2022. The stock status should be evaluated in the context of management requirements for long-term sustainability and the advice provided should be consistent with NAFO's Precautionary Approach Framework.

Canada again encourages the Scientific Council to continue exploring opportunities to develop risk-based advice, including the implications of catch differing from the TAC (e.g. +/- 5-15%) on the stock's long-term trajectory.

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 2021-2025, if possible. 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 2021 to 2025 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} (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).

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

SCR No.	Serial No.	Author(s)	Title
SCR Doc. 20-051	N7102	J.M. Casas Sánchez and M. Álvarez	Division 3M Northern shrimp (<i>Pandalus borealis</i>) – Interim Monitoring Update
SCR Doc. 20-052	N7126	Heino Fock, Karl-Michael Werner and Christoph Stransky	Survey results of the German bottom trawl survey 1982-2019 with special reference to years 2016 - 2019
SCR Doc. 20-053	N7127	Burmeister and Rigét	The West Greenland trawl survey for <i>Pandalus borealis</i> , 2020, with reference to earlier results.
SCR Doc. 20-054	N7128	Burmeister and Rigét	The Fishery for Northern Shrimp (<i>Pandalus borealis</i>) off West Greenland, 1970–2020
SCR Doc. 20-055	N7129	Burmeister	Catch Table Update for the West Greenland Shrimp Fishery
SCR Doc. 20-056	N7130	Burmeister and Rigét	A provisional Assessment of the shrimp stock off West Greenland in 2020
SCR Doc. 20-057	N7131	Burmeister and Rigét	Relationship between abundance of age-2 shrimps, pre-recruits and fishable biomass two to four years later
SCR Doc. 20-058	N7132	Rigét 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. 20-059	N7133	Rigét	The Fishery for Northern Shrimp (<i>Pandalus borealis</i>) in Denmark Strait / off East Greenland 1978 – 2020.
SCR Doc. 20-060	N7134	Buch	Results of the Greenland Bottom Trawl Survey for Northern shrimp (<i>Pandalus borealis</i>) Off East Greenland (ICES Subarea XIV b), 2008-2020
SCR Doc. 20-061	N7135	Rigét, Burmeister and Buch	Applying a stochastic surplus production model (SPiCT) to the East Greenland Stock of Northern Shrimp
SCR Doc. 20-062	N7136	Burmeister	Reply to the Canadian request for advice of shrimps in Subarea 0 and 1.
SCR Doc. 20-063	N7137	Sergey Bakanev	Russian fishery for the northern shrimp (<i>Pandalus borealis</i>) in the Barents Sea in 2000-2020
SCR Doc. 20-064	N7138	J. M. Casas	Northern Shrimp (<i>Pandalus borealis</i>) on Flemish Cap Surveys 2020
SCR Doc. 20-065	N7139	Carsten Hvingel, Fabian Zimmermann and Trude H. Thangstad	Research survey results pertaining to northern shrimp (<i>Pandalus borealis</i>) in the Barents Sea and Svalbard area 2004-2020
SCR Doc. 20-066	N7140	Carsten Hvingel and Fabian Zimmermann	Shrimp (<i>Pandalus borealis</i>) in the Barents Sea – Stock assessment 2020
SCR Doc. 20-067	N7141	Carsten Hvingel, Trude H. Thangstad and Fabian Zimmermann	The Norwegian fishery for northern shrimp (<i>Pandalus borealis</i>) in the Barents Sea and round Svalbard 1970-2020

SUMMARY DOCUMENTS (SCS)

SCS No.	Serial No.	Author(s)	Title
SCS Doc. 20/20	N7142	NAFO	SC Shrimp Report 26-30 October 2020
SCS Doc. 20/21	N7143	NAFO/ICES	NAFO/ICES Pandalus Assessment Group Report, 26-30 October 2020
SCS Doc. 20/22	N7147	NAFO	SC Shrimp (in conjunction with NIPAG) Report, 14 September 2020

APPENDIX III. LIST OF PARTICIPANTS

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