Northwest Atlantic Fisheries Organization

Serial No. N6763 **NAFO SCS Doc. 17-18**

SCIENTIFIC COUNCIL MEETING – SEPTEMBER 2017
27 SEPTEMBER to 03 OCTOBER 2017

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SC-NIPAG Participants 2017

Back Row: Carsten Hvingel, Kalvi Hubel, Frank Rigét, Massimilliano Cardinale, Mats Ulmestrand, Tom Blasdale, Katherine Skanes, AnnDorte Burmeister, Mikel Casas, Nannette Hammeken-Arboe
Front Row: Don Power, Guldborg Søvik (NIPAG co-chair), Karen Dwyer (NIPAG co-chair), Mikaela Bergenius
Missing from photo: Ole Eigaard

Chairs: Guldborg Søvik (NIPAG co-chair) & Karen Dwyer (NIPAG co-chair & NAFO SC chair)

Report of the Scientific Council Meeting
27 September to 03 October 2017

Chair: Karen Dwyer Rapporteur: Tom Blasdale

I. PLENARY SESSIONS

The Scientific Council met at the Swedish University of Agricultural Sciences, Institute of Marine Research, Lysekil, Sweden during 27 September – 03 October 2017, to consider the various matters in its Agenda. Representatives attended from Canada, Denmark (Greenland), European Union (Estonia, Spain and Sweden) and Norway. The Scientific Council Coordinator and Scientific Information Administrator were in attendance.

The Executive Committee met at 0900 to discuss a plan of work. The opening session of the Council was called to order at 0930 hours on 27 September 2017.

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). 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.

This opening session was adjourned at 1000 hours. Several sessions were held throughout the course of the meeting to deal with specific items on the agenda.

The concluding session was convened at 0900 hours on 03 September 2017. The Council then considered and adopted Sections III.1–4 of the "Report of the NAFO/ICES *Pandalus* Assessment Group" (NAFO SCS Doc. 17/17, ICES CM 2017/ACOM:09). 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 adjourned at 1800 hours on 03 September 2017, one day ahead of the scheduled finish.

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 2016

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

III. NAFO/ICES *PANDALUS* ASSESSMENT GROUP

NIPAG has assessed four stocks of relevance to NAFO: northern shrimp in Div. 3M, northern shrimp in Div. 3LNO, northern shrimp in Subareas 0 and 1, and northern shrimp in Denmark Strait and off East Greenland. The Scientific Council summary sheets and conclusions for these stocks are presented in Section IV of this report. The recommendations to Fisheries Commission, with respect to stock advice, appear in the summary sheets. The full NIPAG report is available in NAFO SCS Doc. 17/17 and ICES CM 2017/ACOM:09.

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

1. Request from Fisheries Commission

The response of Scientific Council to the Fisheries Commission Request for Advice (Annex 1a) for northern shrimp in Div. 3LNOand northern Shrimp in Division 3M regarding stock assessment (Item 1) is given below.

a) Northern shrimp in Divisions 3LNO

Advice October 2017 for 2018-2019

Recommendation

No directed fishery in 2018 and 2019 as the stock is below B_{lim} with no indication of short-term recovery.

Management objectives

No explicit management plan or objectives defined by Fisheries Commission. General convention objectives (GC Doc. 08/3) are applied. Advice is based on qualitative evaluation of biomass indices in relation to historic levels, and provided in the context of the precautionary approach framework (FC Doc. 04/18).

Convention objectives	*Status*	*Comment/consideration*
Restore to or maintain at B_{msy}	🔴	Stock below B_{lim}
Eliminate overfishing	🟢	No directed fishery
Apply Precautionary Approach	🟡	B_{lim} is defined. No fishing mortality reference point defined
Minimise harmful impacts on living marine resources and ecosystems	🟢	No directed fishery
Preserve marine biodiversity	⚪	Cannot be evaluated

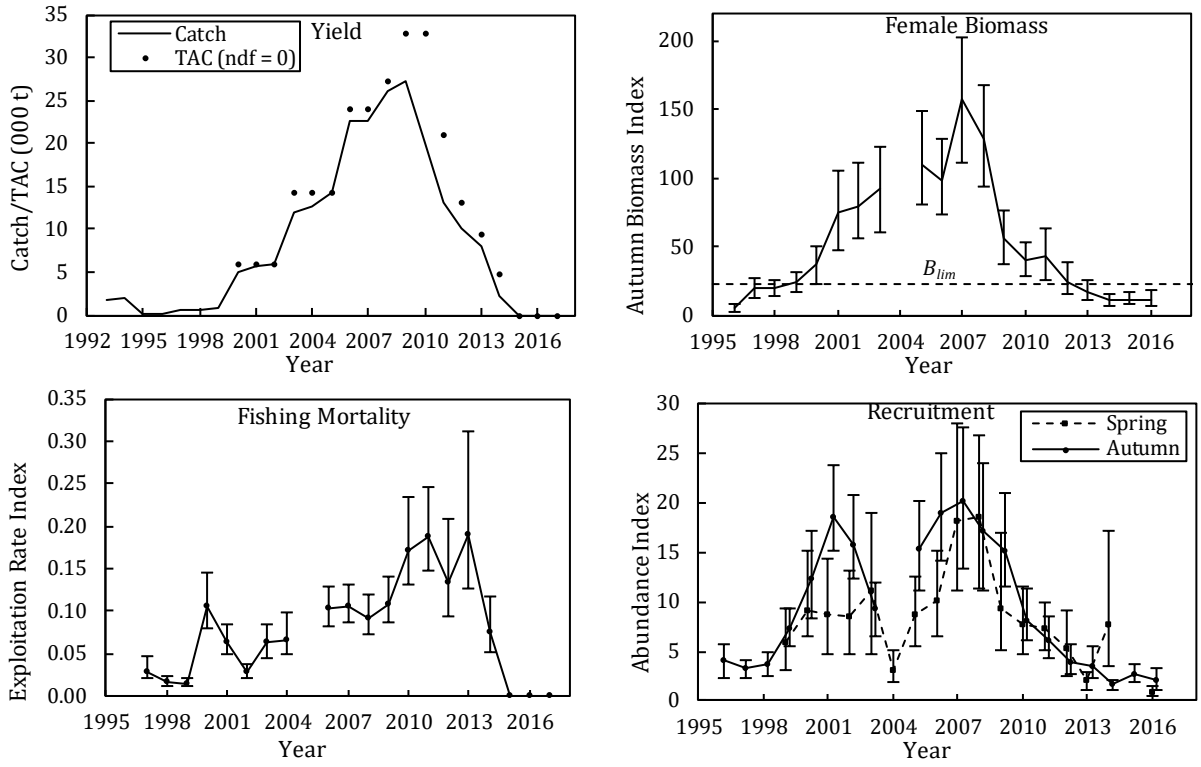
🟢 OK
🟡 Intermediate
🔴 Not accomplished
⚪ Unknown

Management Unit

The stock in Div. 3LNO is assessed and managed as a discrete population (see special comment).

Stock Status

The stock has declined since 2007, and in 2016 the risk of being below B_{lim} is greater than 95%. Given expectations of poor recruitment, the stock is not expected to increase in the near future.



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

Based upon a qualitative evaluation of trends in stock biomass, fishing mortality proxy and recruitment. Input data are research survey indices and fishery catches (NIPAG 2017).

Next full assessment is planned for 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

Temperature in the stock area had been warming up to 2011 but was lower than average in 2014-2016. Direct effects of temperature on shrimp distribution, recruitment, growth and survival are poorly understood.

Predation (by cod, Greenland halibut and redfish), low abundance of high energy prey (such as capelin) and environmental factors (including phytoplankton bloom dynamics) appear to be important drivers of the decline of northern shrimp in Divs. 2J3KL.

Fishery

The fishery, until 2014, was a directed bottom trawl fishery and there is little or no bycatch of shrimp in other trawl fisheries. The fishery in Div. 3LNO is regulated by quota.

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Enacted TAC[1]	27306	32767	32767	20971	13108	9393	4697	ndf	ndf	ndf
STATLANT 21	26097	27236	19745	13013	10099	7919	2282	0	0	
NIPAG[2]	25407	25900	20536	12900	10108	8647	2289	0	0	

[1] Includes autonomous TAC as set by Denmark (in respect of Faroes and Greenland).

[2] NIPAG catch estimates have been updated using various data sources (see p. 13, SCR Doc 14/048).

Effects of the fishery on the ecosystem

The fishery was closed to directed fishing beginning in 2015.

Special Comments

Shrimp in Div. 3LNO are genetically distinct from those in Div. 3M and the Gulf of Maine, but not from those further north. Work is ongoing to investigate the contribution of stocks north of Div. 3L to the production of Div. 3LNO shrimp.

Larval drift/dispersal studies using biophysical models were presented at the meeting and demonstrated that most larvae that settle in Div. 3L originate further **n**orth while **most** larvae that originate in Div. 3L settle outside the Division.

Research into assessment model(s) that might inform on stock dynamics, reference points and projections is ongoing with expected results in 2-3 years.

Sources of information

SCR Doc. 17/070; http://www.dfo-mpo.gc.ca/Library/352955.pdf

b) Northern shrimp in Division 3M

Advice October 2017 for 2018-19

Recommendation

No directed fishery for 2018 and 2019 as the stock is below B_{lim}.

Management objectives

No explicit management plan or management objectives defined by Fisheries Commission. General convention objectives (GC Doc. 08-03) are applied. Advice is based on qualitative evaluation of biomass indices in relation to historic levels, and provided in the context of the precautionary approach framework (FC Doc. 04/18).

Convention objectives	*Status*	*Comment/consideration*
Restore to or maintain at B_{msy}	🔴	Stock below B_{lim}
Eliminate overfishing	🟢	No directed fishery
Apply Precautionary Approach	🟡	B_{lim} defined. No fishing mortality reference point defined
Minimise harmful impacts on living marine resources and ecosystems	🟢	VME closures in effect, no directed fishery, sorting grids mandatory
Preserve marine biodiversity	⚪	Cannot be evaluated

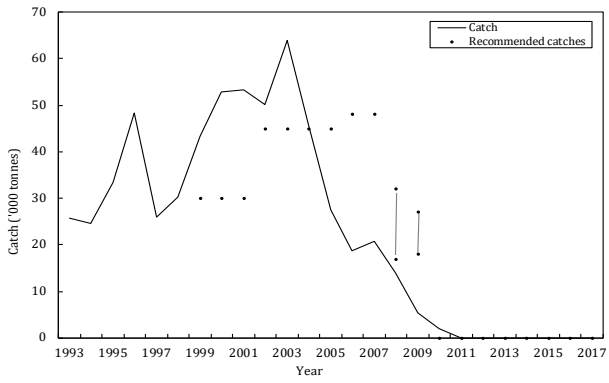
🟢 OK
🟡 Intermediate
🔴 Not accomplished
⚪ Unknown

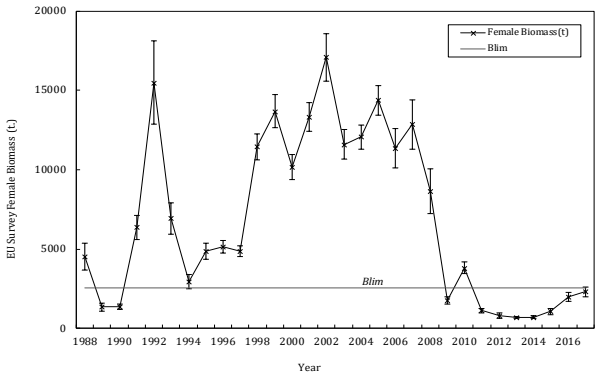
Management unit

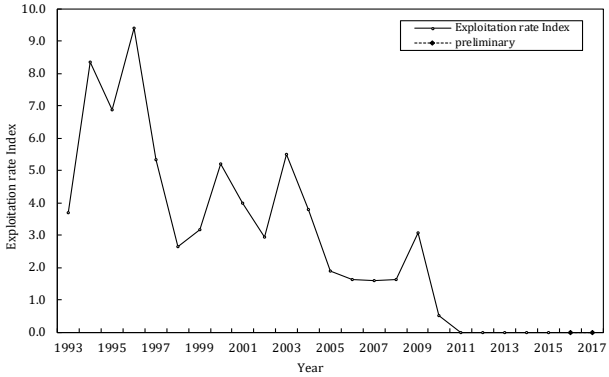
The northern shrimp stock on Flemish Cap is considered to be a separate population.

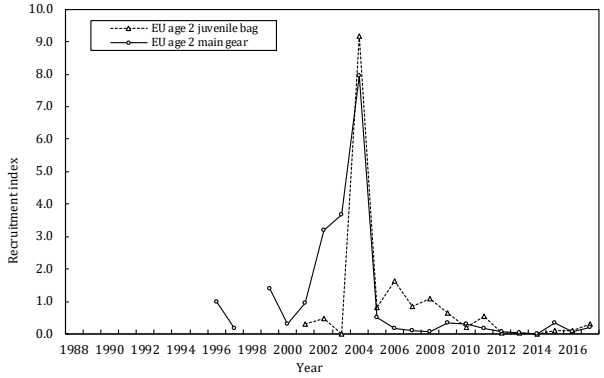
Stock status

Following several years of low recruitment, the spawning stock has declined, and has remained below B_{lim} since 2011. Due to continued poor recruitment there are concerns that the stock will remain at low levels.









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

No analytical assessment is available. Evaluation of stock status is based upon fishery and research survey data.

This stock is now assessed biennialy. The next full assessment is currently scheduled for 2018.

Human impact

Low fishery related mortality due to moratorium and low bycatch in other fisheries. Other sources (e.g. pollution, shipping, oil-industry) are considered minor.

Biological and Environmental Interactions

The drastic decline of shrimp biomass since 2007 coincided with the increase of the cod stock in Div. 3M. It is uncertain whether this represents a causal relationship and/or the result of an environmental factor.

Results of modelling suggest that, in unexploited conditions, cod and redfish would be expected to be a highly dominant component of the system, and high shrimp stock sizes like the ones observed in the 1998 – 2007 period would not be a stable feature in the Flemish Cap.

Fishery

This fishery is effort-regulated. The effort allocations were reduced by 50% in 2010 and a moratorium was imposed in 2011. Catches are expected to be close to zero in 2017.

Recent catches and agreed effort were as follows:

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
NIPAG	13000	5000	2 000	0	0	0	0	0	0	0[1]
STATLANT 21	13431	5374	1976	0	0	0	0	0	0	
Effort (Agreed Days)	10555	10555	5227	0	0	0	0	0	0	

[1] To September 2017

Effects of the fishery on the ecosystem

The fishery was closed to directed fishing beginning in 2011.

Special comments

None

Source of Information

SCR Doc. 17/063, 17/064, SCS Doc. 17/17

2. Requests from Coastal States

a) Northern shrimp in Subarea 1 and Division 0A

Scientific Council responded:

Northern shrimp in Subarea 1 and Div. 0A

Advice October 2017 for 2018

Recommendation

Scientific Council advises that catches in 2018 should not exceed 105 000 t.

The TAC advice for this stock has until recently been set according to an accepted risk level of 35% of exceeding Z_{msy}. However, there is concern that the model in the most recent years does not fully reflect the uncertainty associated with stock status. SC therefore considers that a lower risk tolerance of around 20% is warranted equaling a TAC of approximately 105 000 t in 2018. SC notes that catches at this level is likely to maintain the stock at the current level.

Management Objectives

No explicit management plan or management objectives have been defined by the Government of Greenland and Canada. Canada requested Scientific Council to provide advice on this stock within the context of the NAFO Precautionary Approach Framework (SCS Doc. 13/04).

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

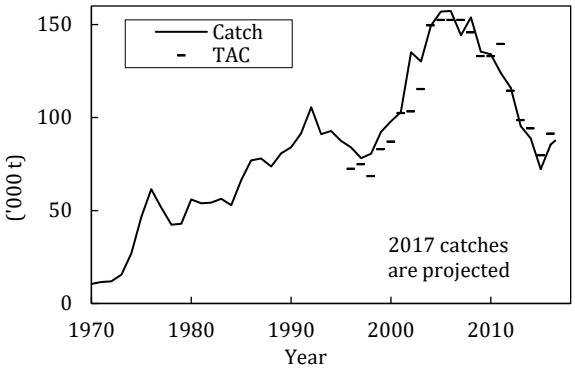
OK

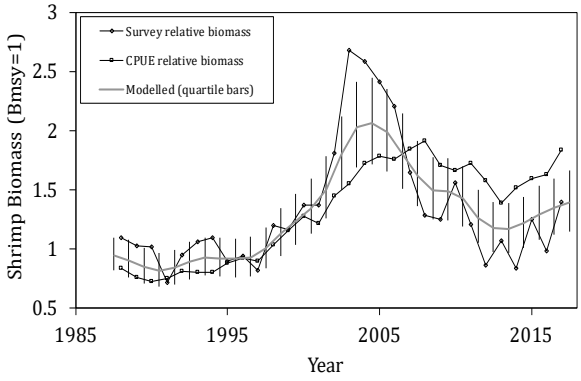
Management unit

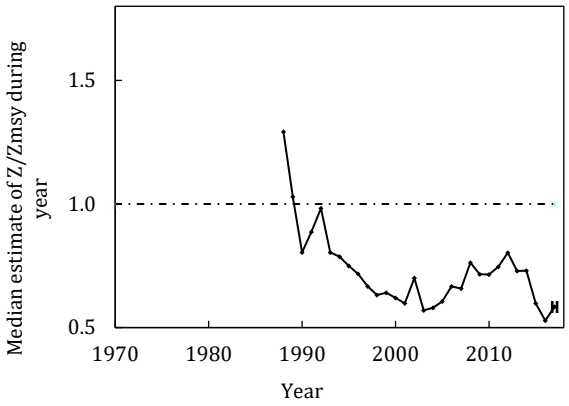
The stock, considered distinct from all others, is distributed throughout Subarea 1, extends into Div. 0A east of 60°30'W, and is assessed as a single stock.

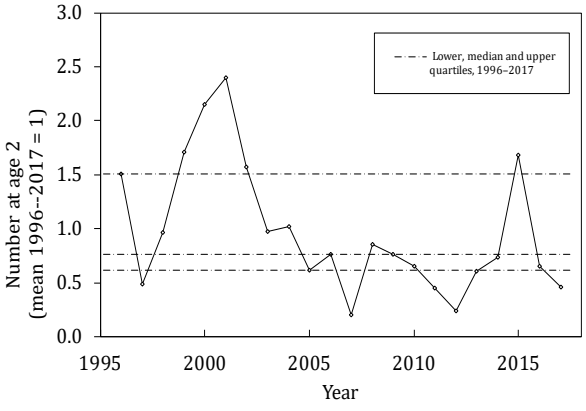
Stock status

The stock is estimated to be 39% above Bmsy and the risk of being below Blim in 2017 is very low (<1%). The number at age 2 in 2017, expected to contribute significantly to the fishable biomass within four years, is low.









Reference points

B_{lim} is 30% of B_{msy} and the limit reference point for mortality is Z_{msy} (FC Doc. 04/18).

Projections

Predicted probabilities of transgressing precautionary reference points in 2018 – 2020 under eight catch options and subject to predation by a cod stock with an effective biomass of 25 Kt.

25 000 t cod	Catch option ('000 tons)							
Risk of:	100	105	110	115	120	125	130	135
falling below Bmsy end 2018 (%)	13.3	14.7	14.6	15.0	15.0	15.4	16.3	16.5
falling below Bmsy end 2019 (%)	14.6	16.0	16.8	17.3	17.8	18.7	19.5	19.2
falling below Bmsy end 2020 (%)	16.0	17.6	18.5	19.2	20.3	21.6	22.4	22.6
falling below Blim end 2018 (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
falling below Blim end 2019 (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
falling below Blim end 2020 (%)	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1
exceeding Zmsy in 2018 (%)	18.0	20.5	22.7	25.0	27.6	30.5	32.9	34.9
exceeding Zmsy in 2019 (%)	19.0	21.2	23.8	26.8	29.3	31.8	34.5	37.0
exceeding Zmsy in 2020 (%)	19.8	22.9	25.0	27.4	30.3	33.9	36.5	38.5

Assessment

Advice is based on risk analysis coming from a quantitative model, and on qualitative evaluation of biomass and stock-composition indices. The analytical assessment was run with the same configuration of the model as in 2016 (SCR Doc.17/52) and with updated data series.

The next assessment is scheduled for 2018.

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 shrimps. 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:

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Enacted TAC[1]	130 153	130 153	139 583	114 425	100 596[3]	97 649[3]	82 561[3]	96 426[3]	101 706
STATLANT 21	133 990	129 179	123 195	114 970	91 802	88 834	71 779	80 802	-
NIPAG	135 458[3]	133 991[3]	123 989[3]	115 977[3]	95 381[3]	88 765[3]	72 256[3]	85 527[3]	*90 000*[2]

[1] Sum of TACs autonomously set by Canada and Greenland.

[2] Expected to year end.

[3] This table has been updated to include the area North of 73°30.

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 comments

SC is concerned that the 2017 parameter estimate of MSY was quite different than that estimated in 2016 suggesting some degree of instability of the model. This was further demonstrated by changes in perception of stock trajectory in recent years based on a 5-year retrospective analysis. The assessment model may now not fully reflect the uncertainty associated with stock status.

Source of Information SCS Doc 13/04, FC Docs 04/18, SCR Docs 17/51, 52, 55, 56.

b) Northern shrimp in Denmark Strait and off East Greenland

Advice October 2017 for 2018

Recommendation

In 2016 the stock remained at a low level, comparable to previous years, and there is no new information to indicate a change in stock status. SC therefore reiterates its advice that catches should not exceed 2 000 t.

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

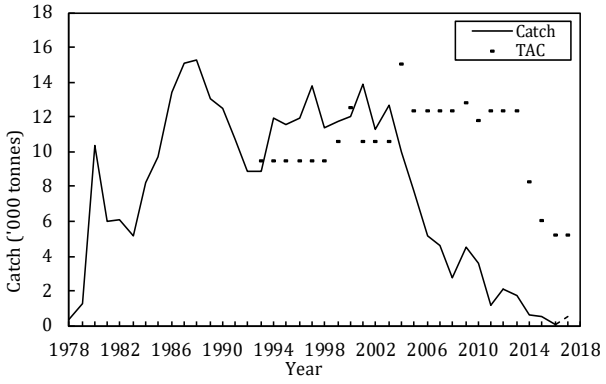
Intermediate

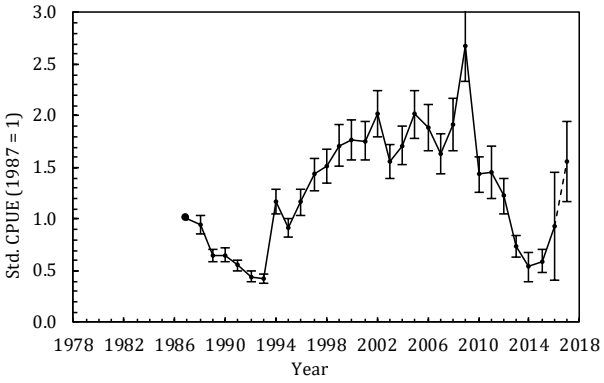
Management unit

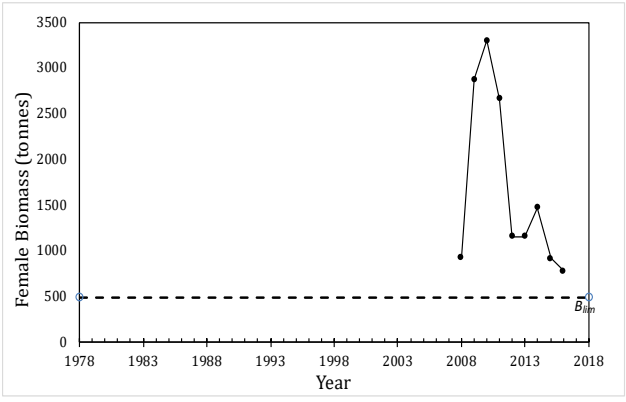
The shrimp stock is distributed off East Greenland in ICES Div. XIVb and Va and is assessed as a single population.

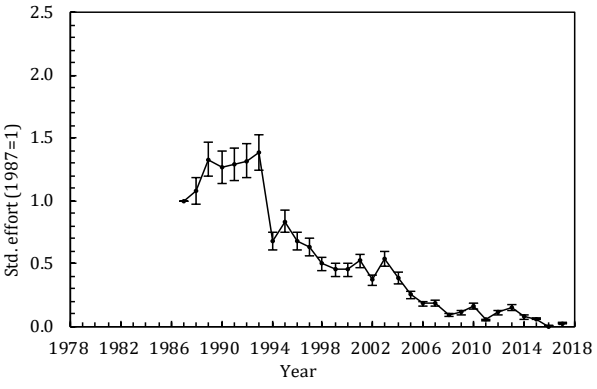
Stock status

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 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). This corresponds to an index value of 495 t.

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. Since 2015, this has been an opportunistic fishery with vessels stopping off on route between other fishing grounds. This may indicate that the CPUE may no longer be a reliable indicator of the stock status. No survey was carried out in 2017.

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 been increasing in East Greenland waters until recently, but decreased in 2016.

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 were as follows:

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Enacted TAC	12835	11835	12400	12400	12400	8300	6100	5300	5300
SC Recommended TAC	12400	12400	12400	12400	12400	2000	2000	2000	2000
NIPAG	4555	3602	1199	2109	1717	622	576	49	557[1]

[1] To July 2017

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. 16/045, 17/057

V. OTHER MATTERS

1. Scheduling of Future Meetings

The schedule of future meetings

a) Scientific Council Meetings

i) Scientific Council (in conjunction with NIPAG), Oct 2018

This meeting will be held in Vigo, Spain during 17 to 23 October 2018.

b) NAFO/ICES Joint Working Groups

i) NIPAG, 17 - 23 October 2018

This meeting will be held in Vigo, Spain during 17 to 23 October 2018.

2. Topics for Future Special Sessions

No special sessions were proposed.

3. Other Business

VI. ADOPTION OF SCIENTIFIC COUNCIL AND NIPAG REPORTS

The Council at its session on 3 October 2017 considered and adopted Sections III.1-4 of the "Report of the NAFO/ICES *Pandalus* Assessment Group" (SCS Doc. 17/17, ICES CM 2017/ACOM:09). The Council then considered and adopted its own report of the 27 September – 03 October 2017 meeting.

VII. ADJOURNMENT

The Chair thanked the participants for their hard work and contribution to the success of this meeting, and welcomed the peer review and constructive comments received in formulating the scientific advice. The Chair thanked the Scientific Council Coordinator, Tom Blasdale, and Dayna Bell, Scientific Information Administrator for their support during the meeting. The Chair then offered thanks to the ICES and NAFO Secretariats for their support in general, and to Swedish University of Agricultural Sciences Institute of Marine Research for hosting the meeting and for supporting a social gathering. The report was adopted at the close of the meeting, subject to a two-week period for editorial changes. All participants were then wished a safe journey home and the meeting was adjourned at 1800 hours.

APPENDIX I. PROVISIONAL AGENDA – SCIENTIFIC COUNCIL MEETING

Swedish University of Agricultural Sciences, Institute of Marine Research, Lysekil, Sweden, 27 September –04 October, 2017

I. Opening (Chairs: Karen Dwyer)

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

II. Review of Recommendations in 2016

III. NAFO/ICES *Pandalus* Assessment Group (Co-chairs Karen Dwyer and Guldborg Søvik)

IV. Formulation of Advice (see Annexes 1–3 of Appendix I)

1. Request for Advice on TACs and Other Management Measures (Item 1, Annex I)
   a) Northern shrimp in Div. 3LNO
   b) Northern shrimp in Div. 3M

2. Requests from Coastal States (Items 5 and 6 of Annex II, item 2 of Annex III)
   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. FISHERIES COMMISSION'S REQUEST FOR SCIENTIFIC ADVICE ON MANAGEMENT IN 2018 AND BEYOND OF CERTAIN STOCKS IN SUBAREAS 2, 3 AND 4 AND OTHER MATTERS

1. The Fisheries Commission requests that the Scientific Council provide advice for the management of the fish stocks below according to the assessment frequency presented below. The advice should be provided as a range of management options and a risk analysis for each option (rather than a single TAC recommendation).

Yearly basis	Two- year basis	Three-year basis
Northern shrimp in Div. 3LNO	American plaice in Div. 3LNO	American plaice in Div. 3M
Cod in Div. 3M	Redfish in Div. 3M	Capelin in Div. 3NO
	Northern shrimp in Div. 3M	Cod in Div. 3NO
	Thorny skate in Div. 3LNO	Northern shortfin squid in SA 3+4
	White hake in Div. 3NO	Redfish in Div. 3O
	Witch flounder in Div. 3NO	Witch flounder in Div. 2J+3KL
		Yellowtail flounder in Div. 3LNO

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

In 2017, advice should be provided for 2018 for Northern shrimp in NAFO Div. 3LNO and Cod in Div. 3M*.

In 2017, advice should be provided for 2018 and 2019 for Redfish in 3M, Witch flounder in 3NO, shrimp in 3M, and white hake in 3NO.

In 2017, advice should be provided for 2018, 2019 and 2020 for Cod in 3NO, American plaice in Div. 3M

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.

The Fisheries Commission also requests the Scientific Council to continue to monitor the status of all these 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 Fisheries Commission requests the Scientific Council to implement the steps of the work plan relevant to the SC for progression of the Greenland halibut Management Strategy Evaluation Review (FC Working Paper 16-11 Rev. 2 adopted at the NAFO 2017 annual meeting).
3. The Fisheries Commission requests that the Scientific Council continue its risk assessment of scientific trawl surveys impact on VME in closed areas, and the effect of excluding surveys from these areas on stock assessments.
4. The Fisheries Commission requests the Scientific Council, based on analysis of the 2016 haul by haul data and patterns of fishing activity, to examine relative levels of by-catch and discards of 3M cod/redfish, and stocks under moratoria in the different circumstances (e.g. fisheries areas, season, fleets, depths, timing).
5. The stock of redfish 3M covers catches of three Sebastes species and the scientific advice is based on data of only two species (*S. mentella* and *S. fasciatus*). Golden redfish, *Sebastes marinus* (a.k.a. *S. norvegicus*), represents part of the catch but has not yet been subject to a full assessment in NAFO. The Scientific Council is requested to conduct a full assessment on 3M golden redfish in June 2017. The Scientific Council is also requested to advice on the implications for the three species in terms of catch reporting and stock management.
6. In relation to the assessment of NAFO bottom fisheries, the Fisheries 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 risk;
- 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.
- The SC further develops and compile identification guides for fishes (e.g. sharks and skates) that could be provided to observers.

7. The Fisheries Commission requests the SC to continue progression on the review of the NAFO PA Framework.

8. The Fisheries Commission requests the Scientific Council, by their 2018 annual meeting engage with relevant experts as needed, review the available information on the life history, population status, and current fishing mortality of Greenland sharks (*Somniosus microcephalus*), on longevity and records of Greenland shark bycatch in NAFO fisheries, and develop advice for management, in line with the precautionary approach, for consideration by the Fisheries Commission.

9. The Fisheries Commission requests the Scientific Council start working on and finalizing by SC 2018 a strategic scientific plan based on a Strength, Weaknesses, Opportunities and Threats (SWOT) analysis defining the strategy and the mid and long-term objectives and tasks in view of NAFO's amended convention objectives. The plan should define for each strategic objective goals, tasks and measurable targets.

** 3M cod Benchmark process has been delayed at the request of the Fisheries Commission in favour of the Greenland halibut MSE work plan*

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

The Fisheries 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_{2016}, F_{2016}, 125% F_{2016},
   - For stocks under a moratorium to direct fishing: F_{2016}, 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($B_{2019} > B_{2016}$)
F in 2016 and following years*	Yield 2017 (50%)	Yield 2018 (50%)	Yield 2019 (50%)	2016	2017	2018	2016	2017	2018		2016	2017	2018	2016	2017	2018	
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_{2015}	t	t	t	%	%	%	%	%	%		%	%	%	%	%	%	%
F_{2015}	t	t	t	%	%	%	%	%	%		%	%	%	%	%	%	%
1.25 X F_{2015}	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 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_{2016}, F_{2016}, 125% F_{2016},
   - For stocks under a moratorium to direct fishing: F_{2015}, F = 0.

   The first year of the projection should assume a catch equal to the agreed TAC for that year.

   Results from stochastic short-term projection should include:

   - The 10%, 50% and 90% percentiles of the yield, total biomass, spawning stock biomass and exploitable biomass for each year of the projections
   - The risks of stock population parameters increasing above or falling below available biomass and fishing mortality reference points. The table indicated below should guide the Scientific Council in presenting the short-term projections.

				Limit reference points													
				$P(F.>F_{lim})$			$P(B<B_{lim})$			$P(F>F0.1)$			$P(F>F_{max})$				$P(B2019 > B2016)$
F in 2017 and following years*	Yield 2018	Yield 2019	Yield 2020	2017	2018	2019	2017	2018	2019	2017	2018	2019	2017	2018	2019		
F0.1	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%		%
F_{max}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%		%
66% F_{max}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%		%
75% F_{max}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%		%
85% F_{max}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%		%
0.75 X F_{2016}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%		%
F_{2015}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%		%
1.25 X F_{2016}	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) REQUEST FOR SCIENTIFIC ADVICE ON MANAGEMENT IN 2017 OF CERTAIN STOCKS IN SUBAREAS 0 AND 1

1. **Golden redfish, demersal deep-sea redfish, Atlantic wolffish and spotted wolfish:** 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 2014 given for 2015-2017. Denmark (on behalf of Greenland) requests the Scientific for advice on these species.

2. **Greenland halibut, offshore: For Greenland halibut in Subareas 0 + 1 advice was in 2016 given for 2017 and 2018.** Subject to the concurrence of Canada as regards Subareas 0 and 1, the Scientific Council is requested 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 for Greenland halibut as appropriate in 1) the offshore areas of NAFO Division 0A and Division 1A plus Division 1B and 2) NAFO Division 0B plus Divisions 1C-1F. 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:** Advice on Greenland halibut in Division 1A inshore was in 2016 given for 2017 and 2018. Denmark (on behalf of Greenland) requests 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 for Greenland halibut 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 2017 to provide advice on the scientific basis for management of northern shrimp (*Pandalus borealis*) in Subarea 0 and 1 in 2018 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 2018 and for as many years ahead as data allows for.

ANNEX 3. REQUESTS FOR ADVICE FROM CANADA

1. **Greenland halibut (Subareas 0 and 1).** Advice on Greenland Halibut in Subareas 0 and 1 was provided in 2016 for 2017 and 2018. Therefore, Canada requests the Scientific Council to continue to monitor the status of this stock annually 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 (Divisions 0A and Subarea 1).** Canada requests the Scientific Council to consider the following options in assessing and projecting future stock levels for shrimp in Subareas 0 and 1:

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 the Northwest Atlantic Fisheries Organization Precautionary Approach Framework and presented in the form of risk analyses related to the limit reference points 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 2018 to 2022 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 exceeding Z_{MSY};
- total area fished for the longest time period possible; and
- any other graph or table the Scientific Council deems relevant.

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

RESEARCH DOCUMENTS (SCR)

SCR No.	Serial No.	Author(s)	Title
SCR Doc. 17-051	N6720	AnnDorte Burmeister and Frank Farsø Riget	The West Greenland trawl survey for Pandalus borealis, 2017, with reference to earlier results.
SCR Doc. 17-052	N6721	AnnDorte Burmeister and Frank Farsø Riget	A Provisional Assessment of the shrimp Stock off West Greenland in 2017
SCR Doc. 17-053	N6722	AnnDorte Burmeister and Frank Farsø Riget	Pandalus montagui in the West Greenland offshore shrimp fishery 2011–2016.
SCR Doc. 17-054	N6723	AnnDorte Burmeister and Helle Torp Christensen	Experimental and development fishery for shrimp (*Pandalus borealis*) in Melville Bay, West Greenland waters North of 73°30'N, 2014 - 2016
SCR Doc. 17-055	N6724	Nanette Hammeken Arboe	Catch Table Update for the West Greenland shrimp Fishery
SCR Doc. 17-056	N6725	Nanette Hammeken Arboe	The Fishery for northern shrimp (*Pandalus borealis*) off West Greenland, 1970–2017
SCR Doc. 17-057	N6726	Nanette Hammeken Arboe	The Fishery for northern shrimp (*Pandalus borealis*) in Denmark Strait / off East Greenland 1978 - 2017.
SCR Doc. 17-058	N6727	Frank Rigét and AnnDorte Burmeister	A note on the relationship between the survey abundance of 2-years old West Greenland shrimp and the biomass two to four years later
SCR Doc. 17-059	N6728	Rasmus Hedeholm and Frank Rigét	Prediction of Atlantic cod (*Gadus morhus*) biomass in West Greenland waters based on a regression approach
SCR Doc. 17-060	N6729	Frank Rigét and AnnDorte Burmeister	Applying a stochastic surplus production model (SPiCT) to the West Greenland stock of northern shrimp
SCR Doc. 17-061	N6730	Frank Rigét and Nanette Hammeken Arboe	Applying a stochastic surplus production model (SPiCT) to the East Greenland stock of northern shrimp
SCR Doc. 17-062	N6731	Frank Rigét and AnnDorte Burmeister	Applying a stochastic surplus production model (SPiCT) to the West Greenland stock of *Pandalus montagui*
SCR Doc. 17-063	N6743	J.M. Casas Sánchez	Assessment of the international fishery for shrimp (*Pandalus borealis*) in Division 3M (Flemish Cap), 1993-2017
SCR Doc. 17-064	N6744	J.M. Casas Sánchez	Northern shrimp (*Pandalus borealis*) on Flemish Cap surveys 2017
SCR Doc. 17-065	N6745	Casas, J.M., E. Román and M. Álvarez	Northern shrimp (*Pandalus borealis*, Krøyer) from EU-Spain bottom trawl survey 2017in NAFO Div. 3LNO
SCR Doc. 17-066	N6749	A. Ávila de Melo	The Mterm projections from the 2017 assessment of beaked redfish (*S. mentella and S. fasciatus*) in NAFO Division 3M
SCR Doc. 17-067	N6750	C. Hvingel	The Norwegian fishery for northern shrimp (*Pandalus borealis*) in the Barents Sea and round Svalbard 1970-2017
SCR Doc. 17-068	N6751	C. Hvingel	Research survey results pertaining to northern shrimp (*Pandalus borealis*) in the Barents Sea and Svalbard area 2004-2016
SCR Doc. 17-069	N6752	C. Hvingel	Shrimp (*Pandalus borealis*) in the Barents Sea – stock assessment 2017

SCR Doc. 17-070	N6753	K. Skanes	3LNO shrimp

SUMMARY DOCUMENTS (SCS)

SCS No.	Serial No.	Author(s)	Title
SCS Doc. 17-17	N6762	NAFO/ICES	NIPAG Report 2017
SCS Doc. 17-18	N6763	NAFO	Report of the Scientific Council- shrimp meeting 2017

APPENDIX III. LIST OF REPRESENTATIVES, ADVISERS AND EXPERTS

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