Northwest Atlantic Fisheries Organization

Serial No. N6505 **NAFO SCS Doc. 15/14**

SCIENTIFIC COUNCIL SEPTEMBER MEETING – 2015
9-16 SEPTEMBER 2015

Contents

SC-NIPAG Participants 2015

Back Row: Brian Healey (NIPAG co-chair), Don Stansbury (SC chair), Don Power, Silver Sirp, Geoff Evans, Ole Eigaard, Peter Shelton (NIPAG co-chair), Neil Campbell, Carsten Hvingel.

Middle Row: Mikaela Bergenius, AnnDorte Burmeister, Nannette Hammeken-Arboe.

Front Row: Guldborg Søvik, Anne Richards, Katherine Skanes, Ingibjorg Jonsdottir, Mats Ulmestrand, Mikel Casas, Michael Kingsley.

Chairs: Peter Shelton (NIPAG co-chair), Don Stansbury (NAFO SC chair) Brian Healey (NIPAG co-chair), Neil Campbell (NAFO SC Coordinator).

Report of the Scientific Council Meeting 9-16 September 2015

Chair: Don Stansbury Rapporteur: Neil Campbell

I. PLENARY SESSIONS

The Scientific Council met at the Northwest Atlantic Fisheries Centre, St John's, Newfoundland during 9-16 September 2015, to consider the various matters in its Agenda. Representatives attended from Canada, Denmark (Greenland), European Union (Denmark, Estonia, Spain and Sweden), Iceland, Norway and the United States of America. The Scientific Council Coordinator was 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 9 September 2015.

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, Neil Campbell, 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 16 September 2015. The Council then considered and adopted Sections III.1–4 of the "Report of the NAFO/ICES *Pandalus* Assessment Group" (NAFO SCS Doc. 15/13, ICES CM 2015/ACOM:14). 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 Council then considered and adopted its own report of the 10-17 September 2014 meeting.

The meeting adjourned at 1800 hours on 16 September 2015.

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 2014

These were reviewed in the appropriate STACFIS sections below.

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. 15/13 and ICES CM 2015/ACOM:14.

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 shrimp in Div. 3M and Div. 3LNO regarding stock assessment (Item 1) is given below.

Northern Shrimp in Division 3M

Advice September 2015 for 2016-17

Recommendation

No directed fishery for 2016 and 2017.

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	🟢	No directed fishery
Preserve marine biodiversity	⚪	Cannot be evaluated

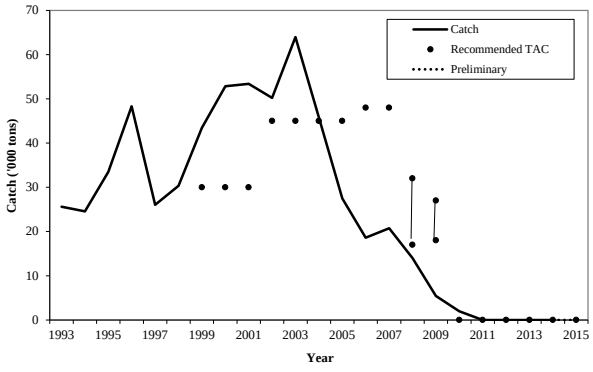
🟢 OK
🟡 Intermediate
🔴 Not accomplished
⚪ Unknown

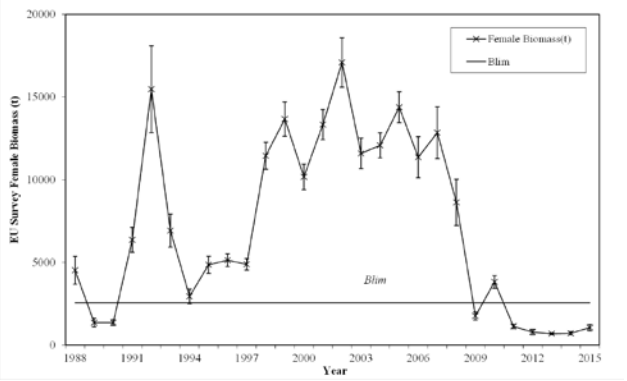
Management unit

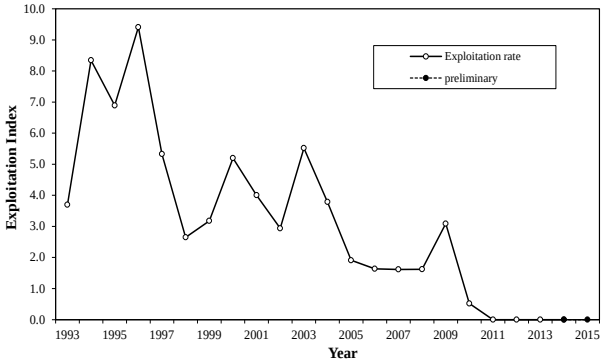
The Northern Shrimp stock on Flemish Cap is considered to be a separate population.

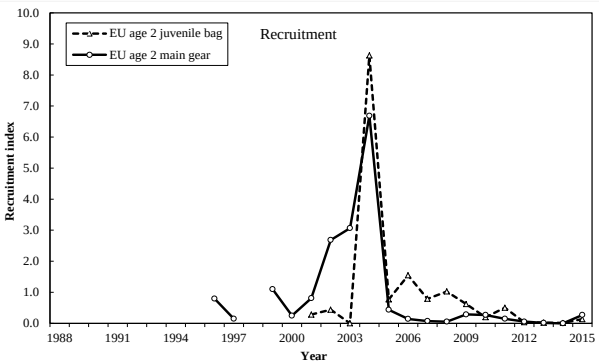
Stock status

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} (2564) (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 2017.

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 correlates 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 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 2015.

Recent catches and agreed effort were as follows:

	2008	2009	2010	2011	2012	2013	2014	2015
NIPAG	13 000	5 000	2 000	0	0	0	0	0[1]
STATLANT 21	13431	5374	1976	0	0	0	0	
Effort (Agreed Days)	10555	10555	5227	0	0	0	0	

[1] To September 2015

Effects of the fishery on the ecosystem

No fishery.

Special comments

None

Source of Information

SCR Doc. 15/047

Northern Shrimp in Divisions 3LNO

Advice September 2015 for 2016

Recommendation for 2016

No directed fishery as the stock is below B_{lim}.

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

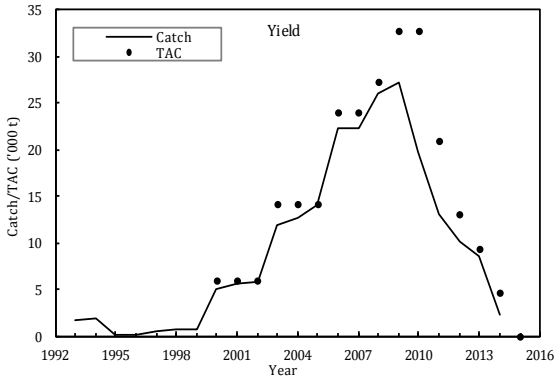
🟢 OK
🟡 Intermediate
🔴 Not accomplished
⚪ Unknown

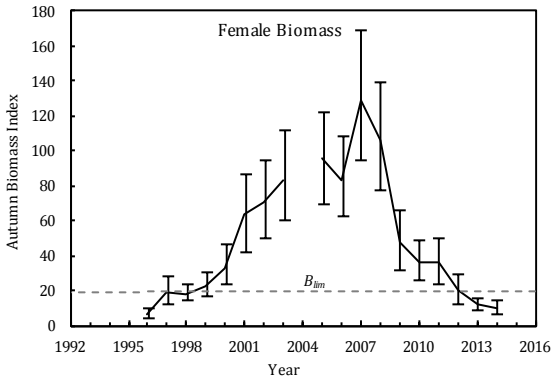
Management Unit

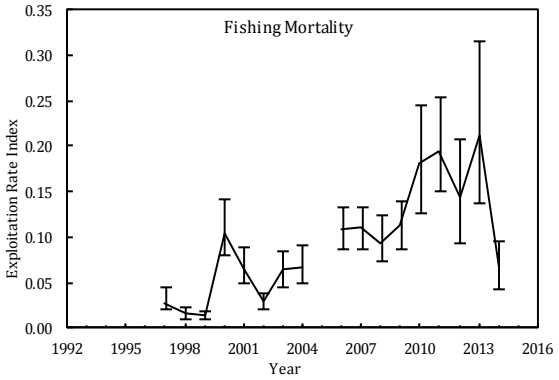
The stock in Div. 3LNO is assessed and managed as a discrete population (see special comment).

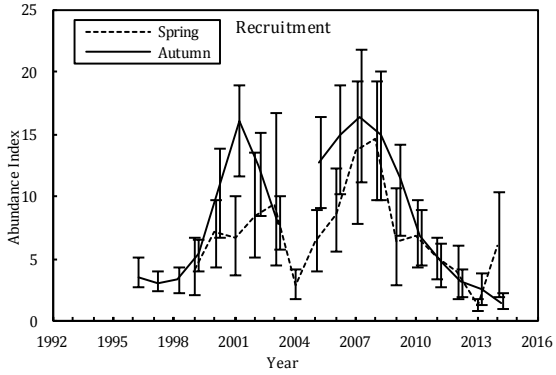
Stock Status

The stock has declined since 2007, and in 2014 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} (19 330) (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 data (NIPAG 2015).

Next full assessment is planned for 2016.

Human impact

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

Biological and Environmental Interactions

Both stock development and the rate at which changes might take place can be affected by changes in predation, in particular by cod, which has been estimated to consume large amounts of shrimp. The size of the cod stocks in Div. 2J3KL and Div. 3NO have increased, but remain at low levels . Some other groundfish (e.g. redfish) which consume shrimps are known to have increased, but the impact on the shrimp stock has not been quantified.

Temperature in the stock area has been warming over the past decade. Effects of temperatures on shrimp distribution, recruitment, growth and survival are poorly understood.

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.

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Enacted TAC[1]	24029	24029	27306	32767	32767	20971	13108	9393	4697	ndf
STATLANT 21	22377	22315	26097	27236	19745	13013	10204	8524	2289	
NIPAG[2]	25689	23570	25407	25900	20536	12900	10108	8647	2289	

[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

No specific information available. General impacts of fishing gear on the ecosystem should be considered.

Special Comments

Genetic analysis has been completed. Shrimp in Div. 3LNO are genetically distinct from those in Div. 3M and the Gulf of Maine, but not from those further north. Additional work is ongoing to investigate the contribution of stocks north of Div. 3L to the production of Div. 3LNO shrimp.

Sources of information

SCR Doc. 14/048, 15/048, /055; http://www.dfo-mpo.gc.ca/Library/352955.pdf

2. Requests from Coastal States

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

Scientific Council responded:

Northern Shrimp in Subarea 1 and Div. 0A

Advice September 2015 for 2016

Recommendation

Previous work has shown that a maintained mortality risk of 35% is low enough to keep stock levels safely at or above B_{msy}. A catch of 90 000 t in 2016 would entail an estimated mortality risk below 35%. Scientific Council therefore advises that catches in 2016 should not exceed 90 000 t.

Management Objectives

Scientific Council is aware of the Greenland management plan for shrimp and of general management objectives specified in the Greenland Fisheries Act; however the contents of these have not been conveyed to the Council. Canada requested Scientific Council to provide advice on this stock within the context of the NAFO Precautionary Approach Framework (SCS Doc. 13/04).

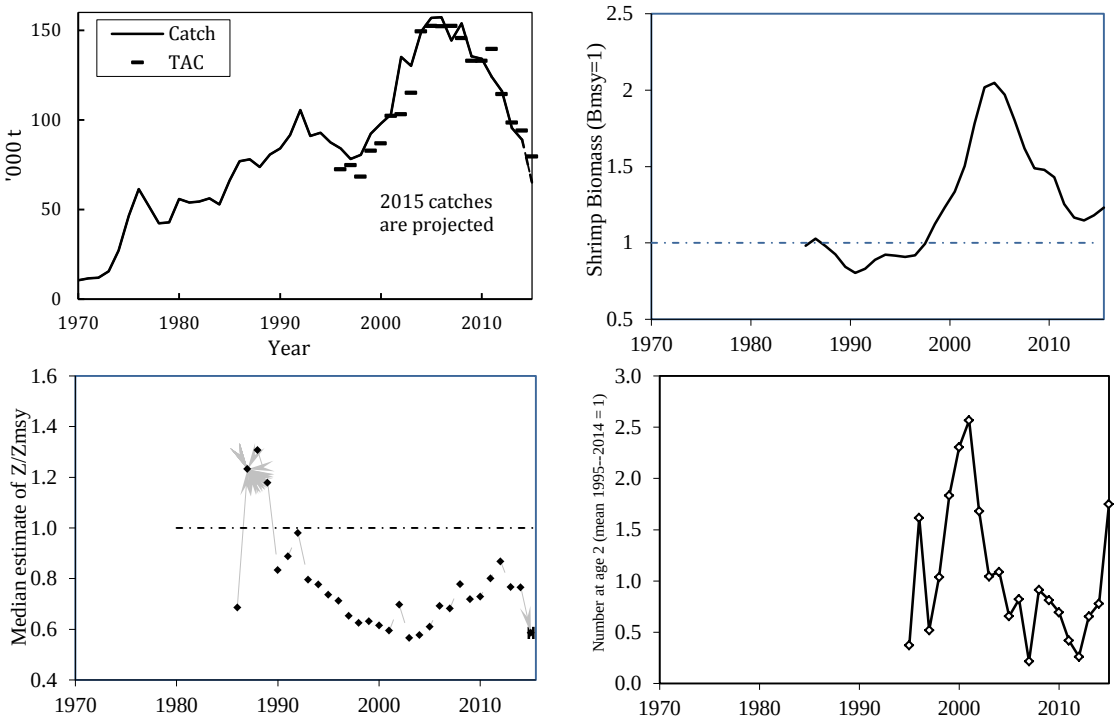
Advice is based on risk analysis coming from a quantitative model, and on qualitative evaluation of biomass and stock-composition indices.

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



A protracted decline in stock size since 2004 appears to have paused, and large numbers of small shrimps in the 2015 survey show good prospects for recruitment. At end 2015 the stock is expected to be 23% above B_{msy} and the risk of being below B_{lim} (30% of B_{msy}) is very low (<1%).

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 2016 – 2018 under seven catch options and subject to predation by a cod stock with an effective biomass of 55 Kt (the value for 2015 being 56Kt.).

55 000 t cod	Catch option ('000 tons)							
Risk of:	60	70	75	80	85	90	95	100
falling below B_{msy} end 2016 (%)	25	25.0	25	26	27	27	27	27
falling below B_{msy} end 2017 (%)	25	26.0	27	27	28	28	29	30
falling below B_{msy} end 2018 (%)	26	28	29	30	31	31	32	33
falling below B_{lim} end 2016 (%)	<5	<5	<5	<5	<5	<5	<5	<5
falling below B_{lim} end 2017 (%)	<5	<5	<5	<5	<5	<5	<5	<5
falling below B_{lim} end 2018 (%)	<5	<5	<5	<5	<5	<5	<5	<5
exceeding Z_{msy} in 2016 (%)	22	25	27	28	31	32	35	37
exceeding Z_{msy} in 2017 (%)	23	26	28	29	32	33	37	39
exceeding Z_{msy} in 2018 (%)	24	27	29	31.0	33	35	38	40.0

Assessment

The analytical assessment was run with the same basic model as in 2011–2014; minor changes in the coding (estimation of parameters of a functional relationship for cod predation; calculation of future mortalities) are described in SCR Doc. 15/49; and with updated data series.

The next assessment is scheduled for 2016.

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:

	2008	2009	2010	2011	2012	2013	2014	2015
Enacted TAC[1]	145 717	132 987	132 987	142 597	118 596	102 767	94 140	79 561
STATLANT 21	148 550	133 990	129 179	123 195	115 080	91 802	88 834	-
NIPAG	153 889	135 458	133 990	123 985	115 975	95 380	88 765	65 000[2]

[1] sum of TACs autonomously set by Canada and Greenland;
[2] provisional—projected to year end.

Effects of the fishery on the ecosystem

Measures to reduce effects of the fishery on the ecosystem include area closures and moving rules to protect sponges and cold-water corals and to reduce bycatch, and gear modifications to reduce damage to benthic communities, and, again, to reduce bycatch.

Special comments

The number of large pre-recruits (14 – 16.5mm, expected to recruit to next year's fishable biomass) is close to its ten-year maximum, so prospects for short-term recruitment are good; this is true both in Disko bay and offshore as well. The number at age 2 in 2015 is well above its 20-year upper quartile.

In the recent past, TAC reductions have been implemented in steps of limited size. Increases should follow a similar method.

Source of Information SCS Doc 13/04, FC Docs 04/18 , SCR Docs 15/42, 43, 44, 48, 49.

Northern Shrimp in Denmark Strait and off East Greenland

Advice September 2015 for 2016

Recommendation

In 2015 the stock remains at a low level, comparable to previous years, and catches should not exceed 2 000 t.

Management objectives

Scientific Council is aware of general management objectives specified in the Greenland Fisheries Act; however the contents of these have not been conveyed to the Council.

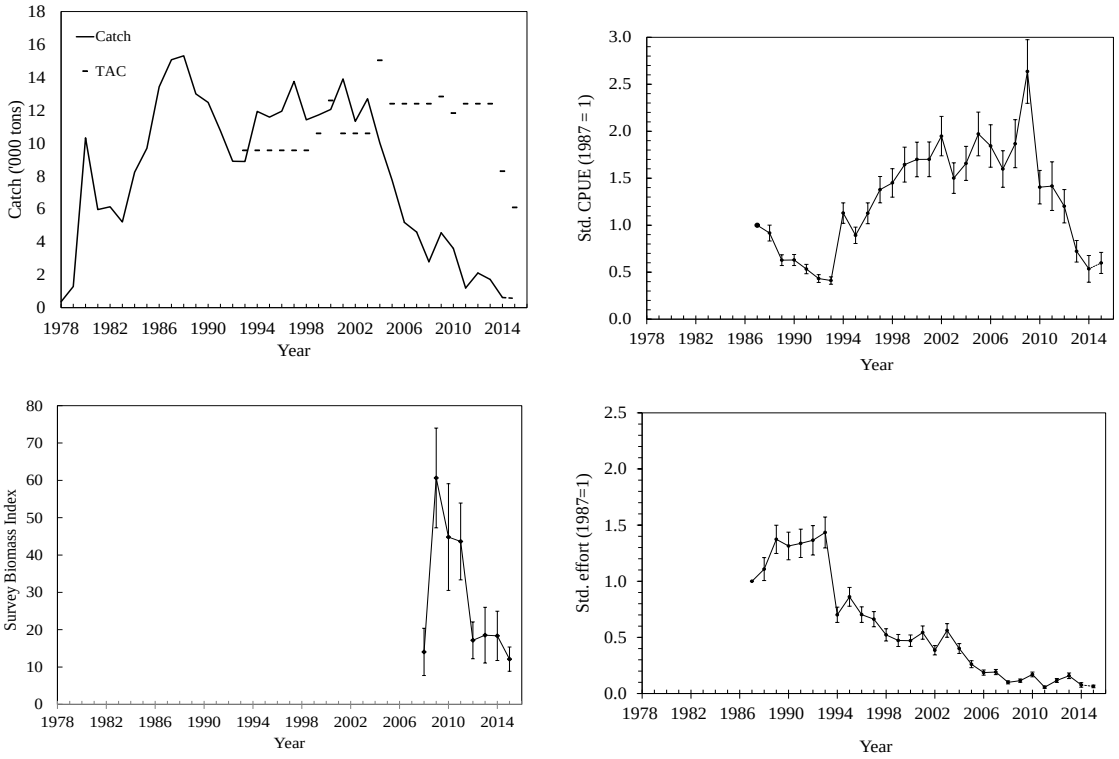
Advice is based on qualitative evaluation of biomass indices in relation to historic levels.

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 in 2015 despite several years of very low exploitation rates.



Reference points

No reference points have been established for this stock

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 interpretation of commercial fishery and research survey data.

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 in recent years.

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:

	2008	2009	2010	2011	2012	2013	2014	2015
Enacted TAC	12400	12835	11835	12400	12400	12400	8300	6100
SC Recommended TAC	12400	12400	12400	12400	12400	12400	2000	2000
NIPAG	2794	4555	3602	1199	2109	1717	622	572[1]

[1] To June 2015

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 cold-water corals.

Source of Information

SCR Doc. 15/045, 15/050

V. OTHER MATTERS

1. Scheduling of Future Meetings

The schedule of future meetings

a) Scientific Council Meetings

i) Scientific Council, 21 – 25 Sep 2015

Scientific Council noted the Scientific Council meeting will be held at the Westin Hotel in Halifax, Nova Scotia, 21-25 September 2015.

ii) Scientific Council, June 2016

Scientific Council agreed that its June meeting will be held on 3 – 16 June 2016, at St Mary's University, Halifax.

iii) Scientific Council (in conjunction with NIPAG), Sep 2016

This meeting will be held at the ICES Headquarters, Copenhagen, around 7 – 14 September 2016.

iv) Scientific Council, Sep 2016

Scientific Council noted that the Annual meeting will be held in Cuba, during 19 – 23 September, 2016.

v) Scientific Council, June 2017

The Scientific Council June meeting is scheduled for 2 - 15 June 2017.

NAFO/ICES Joint Working Groups

i) NIPAG, 7 – 14 Sep 2016

This meeting will be held at the ICES Headquarters, Copenhagen, 7 – 14 September 2016.

ii) WG-DEC, 15 – 19 February 2016

The next meeting of the ICES – NAFO Working Group on Deepwater Ecosystems is scheduled to take place at ICES Headquarters, during 15 – 19 February 2016.

iii) WG-HARP, August 2016

WG-HARP will continue its work by correspondence. The next meeting of the ICES – NAFO Working Group on Harp and Hooded Seals is scheduled to take place in during August 2017.

NAFO Working Groups

i) WG-ESA, 17- 26 Nov, 2015

The Working Group on Ecosystem Science and Assessment will meet at the NAFO Secretariat, Dartmouth, Nova Scotia, Canada, 17 - 26 November, 2015.

2. Topics for Future Special Sessions

No special sessions were proposed. Scientific Council noted the thoughts of the group that a special session on growth and aging of prawns may be beneficial at a future time, however some work needs to be carried out beforehand.

3. Other Business

a) A tribute to Dave Orr

Dave Orr (September 11th, 1958 – July 5th, 2015) was a valued member of NIPAG and Scientific Council meetings over many years, acting as the designated expert for the Northern shrimp stock in Div. 3LNO, as well as working on domestic Canadian shrimp assessments. Dave passed away peacefully on Sunday July 5th, 2015 in the presence of his wife and daughters. The SC chair spoke of Dave's many qualities – the dedication he had to his work and colleagues, his friendliness, his openness and the positivity he displayed. Dave's friends at the NIPAG group held a moments silence at the opening of the meeting, and raised a glass to his memory at the reception.

Election of new chairs

Noting that the current chairs of NIPAG, Peter Shelton and Brian Healey (Canada) have reached the end of their current terms, the SC Chair thanked them for their service and wished them well in their next endeavours. The meeting was informed that Joel Vigneau (EU-France) had been elected as the next STACFIS chair at the June SC meeting, and he would be filling the role of NIPAG co-chair. Guldborg Soevik was elected as the other co-chair. The chair wished them all success in their new positions.

VI. ADOPTION OF SCIENTIFIC COUNCIL AND NIPAG REPORTS

The Council at its session on 16 September 2015 considered and adopted Sections III.1-4 of the "Report of the NAFO/ICES *Pandalus* Assessment Group" (SCS Doc. 15/13, ICES CM 2015/ACOM:14). The Council then considered and adopted its own report of the 9-16 September 2015 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, Neil Campbell, 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 Department of Fisheries and Oceans 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. AGENDA – SCIENTIFIC COUNCIL MEETING

Northwest Atlantic Fisheries Centre, St Johns, Canada, 9-16 September 2015

I. Opening (Chair: Don Stansbury)
   1. Appointment of Rapporteur
   2. Adoption of Agenda
   3. Attendance of Observers
   4. Plan of Work

II. Review of Recommendations in 2014

III. NAFO/ICES *Pandalus* Assessment Group (Co-chairs Brian Healey and Peter Shelton)

IV. Formulation of Advice (see Annexes 1–3 of Appendix I)
   1. Request from Fisheries Commission (Items 1 of Annex 1)
      a) Northern shrimp (Div. 3M)
      b) Northern shrimp (Div. 3LNO)
   2. Requests from Coastal States (Items 5 and 6 of Annex 2, 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
      a) A tribute to Dave Orr
      b) Election of chairs

VI. Adoption of Scientific Council and NIPAG Reports

VII. Adjournment

ANNEX 1. FISHERIES COMMISSION'S REQUEST FOR SCIENTIFIC ADVICE ON MANAGEMENT IN 2016 AND BEYOND OF CERTAIN STOCKS IN SUBAREAS 2, 3 AND 4 AND OTHER MATTERS

1. 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 Divs. 3LNO	American plaice in Divs. 3LNO Cod in Div. 3M Redfish in Divs. 3LN Redfish in Div. 3M Northern Shrimp in Div. 3M Thorny skate in Divs. 3LNO White hake in Divs. 3NO Witch flounder in Divs. 3NO	American plaice in Div. 3M Capelin in Divs. 3NO Cod in Divs. 3NO Northern shortfin squid in SA 3+4 Redfish in Div. 3O Witch flounder in Divs. 2J+3KL Yellowtail flounder in Divs. 3LNO

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

In 2015, advice should be provided for 2016 for Northern Shrimp in NAFO Divs. 3LNO

In 2015, advice should be provided for 2016 and 2017 for Cod in Div. 3M and Redfish in Div. 3M, White hake in Divs. 3NO.

In 2015, advice should be provided for 2016, 2017 and 2018 for Cod in Div. 3NO, Yellowtail Flounder in 3LNO and Capelin in Divs. 3NO.

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 by-catches in other fisheries, provide updated advice as appropriate.

2. The Fisheries Commission adopted in 2010 an MSE approach for Greenland halibut stock in Subarea 2 + Divs. 3KLMNO (FC Doc. 10/12). This approach considers a survey based harvest control rule (HCR) to set a TAC for this stock on an annual basis. The Fisheries Commission requests the Scientific Council to:

   a. Monitor and update the survey slope and to compute the TAC according to HCR adopted by the Fisheries Commission according to Annex 1 of FC Doc. 10/12.

   b. Advise on whether or not an exceptional circumstance is occurring.

3. The Fisheries Commission requests the Scientific Council to analyze and provide advice on management measures that could improve selectivity in the Div. 3M cod and Div. 3M redfish fisheries in the Flemish Cap in order to reduce possible by catches and discards. The objective is to reduce the mixed fisheries between cod and redfish, the by-catch of non-targeted stocks and to analyze if the selectivity pattern could be improved to reduce the catch of undersized fish.

4. The Fisheries Commission requests the Scientific Council to continue to develop work on Significant Adverse Impacts in support of the reassessment of NAFO bottom fishing activities required in 2016, specifically an assessment of the risk associated with bottom fishing activities on known and predicted VME species and elements in the NRA.

5. Recognizing the work done in NAFO to prevent significant adverse impacts to vulnerable marine ecosystems, and the need for effective stock assessments;

   Further recognizing that modifications to survey designs occur on regular basis in fisheries surveys in many cases,

   FC requests that SC investigate the impacts of removing the closed areas from the survey design for relevant stock surveys.

6. For the cod stock in Divs. 2J+3KL, the Scientific Council is requested to comment on the trends in biomass and state of the stock in the most recent Science Advisory Report from the Canadian Science Advisory Secretariat.

7. The Fisheries Commission requests the Scientific Council to conduct a full assessment of witch flounder in Divs. 3NO.

8. Please provide a stock assessment for Alfonsino, and recommendation.

9. Could the SC liaise with the national institutes of the different CPs to see if – as recommended by STACFIS – acoustic surveys for capelin can be carried out?

10. There are some spatial and depth coverage deficiencies in the Greenland Halibut survey. It is suspected that there is a component of the Greenland Halibut stock of age-class 14+ that lives in depths under 1 500 meters and is therefore inaccessible to scientific trawling. Please:

    a. comment on this hypothesis;
    b. indicate if information on this part of the stock would be useful for the stock assessment and the understanding of the stock dynamics;
    c. indicate if there are techniques available to assess the biomass below 1 500 meters, and;
    d. if useful and possible, implement such techniques in view of the next stock assessment.

11. The NAFO 2011 Performance Review Panel encouraged NAFO to consider whether activities other than fishing in the NAFO Convention Area may impact the stocks and fisheries for which NAFO is responsible as well as biodiversity in the NAFO Regulatory Area. Such activities might include oil

exploration, shipping and recreational activities. Some work has been carried out as part of the ecosystem approach.

As the first step in the assessment of such impacts and for the implementation of the priorities of the Ecosystem Roadmap, could the Scientific Council provide a literature survey that would indicate what the risks are to the fish stocks and ecosystems in the NAFO Regulatory Area by looking at comparable situations.

12. The Fisheries Commission requests the Scientific Council to evaluate the impact of mid-water trawls on VME indicator species in those instances when the gear makes contact with or is lost on the bottom.

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 Fmsy, 3/4 Fmsy, 85% Fmsy, 75% F2014, F2014, 125% F2014,
- For stocks under a moratorium to direct fishing: F2014, 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 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>Flim)			P(B<Blim)			P(F>Fmsy)			P(B<BmsyP				P(B2017 > B2014)
F in 2015 and following years*	Yield 2015 (50%)	Yield 2016 (50%)	Yield 2017 (50%)	2015	2016	2017	2015	2016	2017	2015	2016	2017	2015	2016	2017		
2/3 Fmsy	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%		%
3/4 Fmsy	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%		%
85% Fmsy	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%		%
0.75 X F2014	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%		%
F2014	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%		%
1.25 X F2014	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%		%
F=0	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%		%

2) For stock assessed with an age-structured model, information should be provided on stock size, spawning stock sizes, recruitment prospects, historical fishing mortality. Graphs and/or tables should be provided for all of the following for the longest time-period possible:

- historical yield and fishing mortality;
- spawning stock biomass and recruitment levels;
- Stock trajectory against reference points

And any information the Scientific Council deems appropriate

Stochastic short-term projections (3 years) should be performed with the following constant fishing mortality levels as appropriate:

- For stocks opened to direct fishing: F0.1, Fmax, 2/3 Fmax, 3/4 Fmax, 85% Fmax, 75% F2014, F2014, 125% F2014,
- For stocks under a moratorium to direct fishing: F2014, 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.>Flim)			P(B<Blim)				P(F>F0.1)			P(F>Fmax)				P(B2017 > B2014)
F in 2015 and following years*	Yield 2015	Yield 2016	Yield 2017	2015	2016	2017	2015	2016	2017		2015	2016	2017	2015	2016	2017		
F0.1	t	t	t	%	%	%	%	%	%		%	%	%	%	%	%		%
Fmax	t	t	t	%	%	%	%	%	%		%	%	%	%	%	%		%
66% Fmax	t	t	t	%	%	%	%	%	%		%	%	%	%	%	%		%
75% Fmax	t	t	t	%	%	%	%	%	%		%	%	%	%	%	%		%
85% Fmax	t	t	t	%	%	%	%	%	%		%	%	%	%	%	%		%
0.75 X F2014	t	t	t	%	%	%	%	%	%		%	%	%	%	%	%		%
F2014	t	t	t	%	%	%	%	%	%		%	%	%	%	%	%		%
1.25 X F2014	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 2016 OF CERTAIN STOCKS IN SUBAREAS 0 AND 1

1) For Roundnose grenadier in Subarea 0 + 1 advice was in 2014 given for 2015-2017. Denmark (on behalf of Greenland) requests the Scientific Council to continue to monitor the status of Roundnose grenadier in Subareas 0 and 1 annually, and should significant changes in the stock status be observed (e.g. from surveys) the Scientific Council is requested to provide updated advice as appropriate.

Advice for golden redfish *(Sebastes marinus),* demersal deep-sea redfish *(Sebastes mentella)* American plaice *(Hippoglossoides platessoides),* Atlantic wolffish *(Anarhichas lupus)* and spotted wolffish *(A. minor)* in Subarea 1 was in 2014 given for 2015-2017. Denmark (on behalf of Greenland) requests the Scientific Council to continue to monitor the status of these species annually, and should significant changes in stock status be observed the Scientific Council is requested to provide updated advice as appropriate.

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 2016 separately for Greenland halibut in 1) the offshore areas of NAFO Div. 0A and Div. 1A plus Divs. 1B and 2) NAFO Div. 0B plus Divs. 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.

Advice for Greenland halibut in Div. 1A (inshore) was in 2014 given for 2015-2016. Denmark (on behalf of Greenland) requests the Scientific Council to continue to monitor the status of Greenland halibut in Div. 1A (inshore) annually, and should significant changes in stock status be observed, the Scientific Council is requested to provide updated advice as appropriate.

Subject to the concurrence of Canada as regards Subarea 0 and 1, Denmark (on behalf of Greenland) further requests the Scientific Council before December 2015 to provide advice on the scientific basis for management of Northern shrimp *(Pandalus borealis)* in Subarea 0 and 1 in 2015 and for as many years ahead as data allows for.

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 2016 and for as many years ahead as data allows for.

ANNEX 3. REQUESTS FOR ADVICE FROM CANADA

a. The Scientific Council is requested, subject to the concurrence of Denmark (on behalf of Greenland) as regards Subarea 1, 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 2016, separately, for Greenland halibut in Divs. 0A+1A (offshore) and 1B, and Divs. 0B+1C-F. The Scientific Council is also asked to provide advice on any other management measures it deems appropriate to ensure the sustainability of these resources.

It is noted that at this time only general biological advice 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 and include likely risk considerations and implications as much as possible, including risks of maintaining current TAC levels and any risks and available details of observations that would support an increase or decrease in the TACs.

Recognizing that this is a data poor fishery, and that no model exists at this time to provide risk-based advice to inform management options, the Scientific Council is also asked to identify what would be required in order to provide risk based advice in the future.

The following graphs should be presented, for one or several surveys, for the longest time-period possible:

- historical catches;
- abundance and biomass indices;
- an age or size range chosen to represent the spawning population;
- an age or size range chosen to represent the exploited population;
- recruitment proxy or index for an age or size-range chosen to represent the recruiting population;
- fishing mortality proxy, such as the ratio of reported commercial catches to a measure of the exploited population;
- stock trajectory against reference points

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

b. 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 reviewed and management options evaluated in terms of their implications for fishable stock size, spawning stock size, recruitment prospect, catch rate and catch over the next 5 years. The implications of catch options ranging from 30,000 t to the catch corresponding to Z MSY, in 5,000 t increments, should be forecast for 2016 through 2020 if possible, and evaluated in relation to precautionary reference points of both mortality and fishable stock biomass. Results should include a partitioning of the future estimable removals between catches and estimable predation for the various catch options requested. The present stock size and fishable stock size should be described in relation to those observed historically and those to be expected in the next 5 years under the various catch options requested, and any other options Scientific Council feels worthy of consideration.

Management options should be provided within the Northwest Atlantic Fisheries Organization Precautionary Approach Framework. Uncertainties in the assessment should be evaluated and presented in the form of risk analyses related to the limit reference points of Blim and ZMSY.

Presentation of the results should include the following:

- a graph and table of historical yield and fishing mortality for the longest time period possible;
- a graph of biomass relative to B MSY, and recruitment levels for the longest time period possible.
- a graph of the stock trajectory compared to Blim and/or B MSY and Z MSY.;
- graphs and tables of total mortality (Z) and fishable biomass for a range of projected catch options (as noted in 2 a) for the years 2016 to 2020 if possible. Projections should include both catch options and a range of cod biomass levels considered appropriate by SC. Results should include risk analyses of falling below BMSY and Blim, and of exceeding Z MSY.;
- a graph of the total area fished for the longest time period possible; and

Any other graph or table the Scientific Council feels is relevant.

c. Canada requests the Scientific Council to explore the impact of proposed harvest strategies that would maintain the North Atlantic harp seal population at a precautionary level of a PA framework, using the Canadian levels as a case study, and that would have a low risk of decreasing below the critical level. (Received July 7 2014)

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

RESEARCH DOCUMENTS (SCR)

SCR Doc. 15-042	N6477	Nanette Hammeken-Arboe	Greenland Fishery
SCR Doc. 15-043	N6478	A.Burmeister and M.C.S. Kingsley	The West Greenland trawl survey for Pandalus borealis, 2015, with reference to earlier results
SCR Doc. 15-044	N6479	A.Burmeister and M.C.S. Kingsley	A Provisional Assessment of the Shrimp Stock off West Greenland in 2015
SCR Doc. 15-045	N6480	H. Siegstad	Results of the Greenland Bottom Trawl Survey for Northern shrimp (*Pandalus borealis*) Off East Greenland (ICES Subarea XIV b), 2008-2015
SCR Doc. 15-046	N6481	H. Siegstad	Occurrence of *Pandalus montagui* in Trawl Survey Samples from NAFO Subareas 0+1 2000-2015
SCR Doc. 15-047	N6482	J. M. Casas	Northern Shrimp (*Pandalus borealis*) on Flemish Cap Surveys 2015
SCR Doc. 15-048	N6483	Casas, J.M., E. Román and J. Teruel	Northern Shrimp (*Pandalus borealis*, Krøyer) from EU-Spain Bottom Trawl Survey 2015 in NAFO Div. 3LNO
SCR Doc. 15-049	N6484	Nanette Hammeken-Arboe	Greenland Catch table
SCR Doc. 15-050	N6485	M. C. S. Kingsley	Greenland Model description
SCR Doc. 15-051	N6486	Nanette Hammeken-Arboe	Greenland Fishery East Coast
SCR Doc. 15-052	N6488	C. Hvingel and T. H. Thangstad	Research survey results pertaining to Northern shrimp (*Pandalus borealis*) in the Barents Sea and Svalbard area 2004-2014
SCR Doc. 15-053	N6489	C. Hvingel and T. H. Thangstad	The Norwegian fishery for northern shrimp (*Pandalus borealis*) in the Barents Sea and round Svalbard 1970-2015
SCR Doc. 15-054	N6490	Carsten Hvingel	Shrimp (*Pandalus borealis*) in the Barents Sea – Stock assessment 2014
SCR Doc. 15-055	N6491	K. Skanes & D. E. Stansbury	Canadian 3LNO Assessment Paper
SCR Doc. 15-056	N6492	Anders Nielsen, Sten Munch- Petersen, Ole Eigaard, Sovik Guldborg and Mats Ulmestrand	A stochastic length-based assessment model for the *Pandalus* stock in Skagerrak and the Norwegian Deep
SCR Doc. 15-057	N6493	G. Søvik and T. H. Thangstad	The Norwegian Fishery for Northern Shrimp (*Pandalus borealis*) in Skagerrak and the Norwegian Deep (ICES Divisions IIIa and IVa east), 1970-2015
SCR Doc. 15-058	N6494	G. Søvik and T. H. Thangstad	Results of the Norwegian Bottom Trawl Survey for Northern Shrimp (*Pandalus borealis*) in Skagerrak and the Norwegian Deep (ICES Divisions IIIa and IVa east) in 2015
SCR Doc. 15-059	N6495	Carsten Hvingel	The 2015 assessment of the North Sea/Skagerrak shrimp stock using a Bayesian surplus production model

SCR Doc. 15-060	N6496	M. Ulmestrand, M. Bergenius, O. Eigaard, G. Søvik and S. Munch-Petersen	The Northern shrimp (*Pandalus borealis*) Stock in Skagerrak and the Norwegian Deep (ICES Divisions IIIa and IVa East)
SCR Doc. 15-061	N6509	Zakharov D.V.	Results of Russian investigations of the Northern shrimp in the Barents Sea in 2004-2015

SUMMARY DOCUMENTS (SCS)

SCS No.	**Ser. No.**	**Author(s)**	**Title**
SCS 15/13	N6497	NAFO	NIPAG Report
SCS 15/14	N6505	NAFO	SC Report

APPENDIX III. LIST OF REPRESENTATIVES, ADVISERS AND EXPERTS

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