Northwest Atlantic Fisheries Organization

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SCIENTIFIC COUNCIL MEETING - SEPTEMBER 2015

Contents

REPORT OF SCIENTIFIC COUNCIL MEETING

21-25 September 2015

Chair: Don Stansbury Rapporteur: Neil Campbell

I. PLENARY SESSIONS

The Scientific Council met at the Westin Nova Scotian, Halifax, Nova Scotia, Canada, during 21-25 September 2015, to consider the various matters in its agenda. Representatives attended from Canada, European Union (France, Portugal, Spain and the United Kingdom), France (with respect to St. Pierre et Miquelon), Norway, the Russian Federation and the United States of America. The Scientific Council Coordinator was in attendance.

The Executive Committee met prior to the opening session of the Council to discuss the provisional agenda and plan of work.

The opening session of the Council was called to order at 0930 hours on 21 September 2015.

The Chair welcomed participants to the 37th Annual Meeting and thanked the NAFO Secretariat for hosting this event.

The provisional agenda was adopted with minor additions. The Council appointed Neil Campbell, the Scientific Council Coordinator, as rapporteur. The Chair welcomed the Ecology Action Centre and FAO as observers to this meeting.

The Council and its Standing Committees met through 21-25 September 2015 to address various items in its agenda. The Council considered and adopted the reports of the STACFIS and STACREC Standing Committees on 25 September 2015. The final session was called to order at 0900 hours on 25 September 2015. The Scientific Council then considered and adopted its report of this meeting. The meeting was adjourned at 1100 hours on 25 September 2015.

The Reports of the Standing Committees as adopted by the Council are appended as follows: Appendix I - Report of Standing Committee on Research Coordination (STACREC), and Appendix II - Report of Standing Committee on Fisheries Science (STACFIS).

The Agenda, List of Research (SCR) and Summary (SCS) Documents, and the List of Representatives, Advisers and Experts, are given in Appendices III, IV, and VI, respectively.

II. REVIEW OF SCIENTIFIC COUNCIL RECOMMENDATIONS

There were no recommendations arising from the 2013 or 2014 Scientific Council Meetings.

III. RESEARCH COORDINATION

The Council adopted the Report of the Standing Committee on Research Coordination (STACREC) as presented by the Chair, Kathy Sosebee. The full report of STACREC is at Appendix I.

IV. FISHERIES SCIENCE

The Council adopted the Report of the Standing Committee on Fisheries Science (STACFIS) as presented by the Chair, Brian Healey. The full report of STACFIS is at Appendix II.

V. REQUESTS FROM THE FISHERIES COMMISSION

1. Requests deferred from the June Meeting

Capelin in Div. 3NO

Scientific Council responded:

Capelin in Div. 3NO Advice September 2015

Recommendation for 2016-2018
No directed fishery.

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.

Convention objectives	*Status*	*Comment/consideration*
Restore to or maintain at B_{msy}	🔴	B_{msy} unknown, stock at low level
Eliminate overfishing	🟢	No directed fishery
Apply Precautionary Approach	⚪	Reference points not defined
Minimise harmful impacts on living marine resources and ecosystems	🟢	VME closures in effect, no directed fishing
Preserve marine biodiversity	⚪	Cannot be evaluated

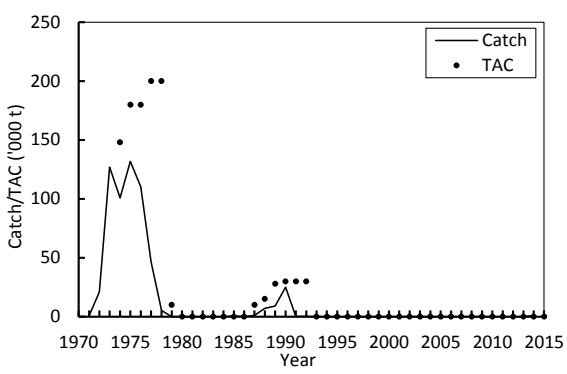
🟢 OK
🟡 Intermediate
🔴 Not accomplished
⚪ Unknown

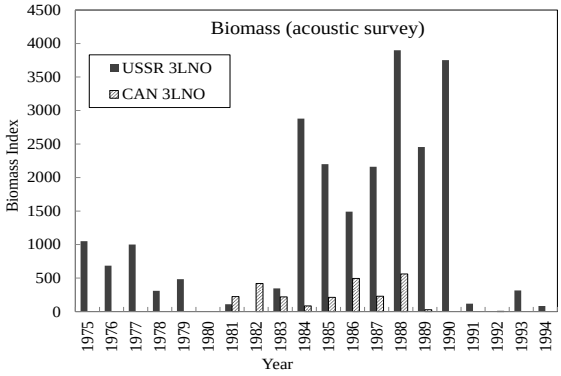
Management unit

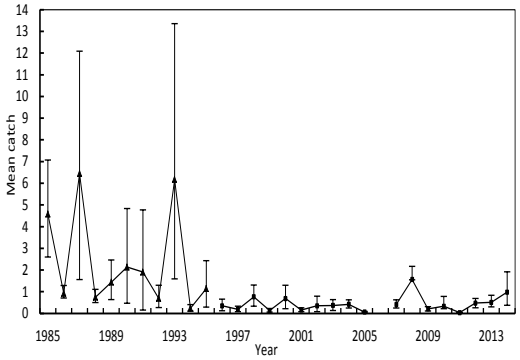
The capelin stock is distributed in Div. 3NO, mainly on the Grand Bank.

Stock status

Acoustic surveys series terminated in 1994 indicated a stock at a low level. Although biomass indices have increased in recent years, bottom trawl surveys are not considered a satisfactory basis for a stock assessment of a pelagic species.







Reference points

Not defined.

Projections

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

Assessment

Assessment was based on evaluation of trends in acoustic survey data (1975 – 1994) and bottom trawl surveys (1995 – 2014). Bottom-trawling is not a satisfactory basis for a stock assessment of a pelagic species. At best the assessment is only indicative of major changes in abundance.

Next full assessment is scheduled for 2018. Unless an acoustic survey is available, Scientific Council will be unable to produce more specific advice.

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

Changes in growth, maturity and recruitment are linked to temperature on the Grand Banks. Recent changes in temperature (STACFEN 2015) may provide more favorable conditions for capelin. Predatory groundfish in Div. 3NO have increased slightly in recent years, and may cause increased natural mortality through predation.

Fishery

Capelin was caught in a directed trawl fishery. There is low bycatch in other trawl fisheries. The fishery is regulated by quota and has been under moratorium since 1995, and there were no reported catches between 1994 and 2013. Recent catch estimates and TACs (t) are as follows:

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
TAC	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf
STATLANT 21	0	0	0	0	0	0	0	0	1	

ndf - no directed fishery

Effects of the fishery on the ecosystem

No fishery.

Special comments

Bottom-trawling is not a satisfactory basis for a stock assessment of a pelagic species and survey results are indicative only. Investigations to evaluate the status of capelin stock should utilize trawl acoustic surveys to allow comparison with historical time series.

Source of Information

SCR Doc. 15/27

Advice on Yellowtail flounder for 2018

Scientific Council responded:

Yellowtail Flounder in Divisions 3LNO Advice September 2015

Recommendation for 2016, 2017 and 2018

Based on recent catch levels, fishing mortality up to 85% F_{msy} corresponding to a catch of 26 300 t in 2016, 23 600 t in 2017 and 22 000 t in 2018 has low risk (5%) of exceeding F_{lim}, and is projected to maintain the stock well above B_{msy}.

Management objectives

No explicit management plan or management objectives are defined by Fisheries Commission. General convention objectives (NAFO/GC Doc. 08/3) are applied. Advice is provided in the context of the Precautionary Approach Framework (NAFO/FC 04/18).

Convention objectives	*Status*	*Comment/consideration*
Restore to or maintain at B_{msy}		$B > B_{msy}$
Eliminate overfishing		$F < F_{msy}$
Apply Precautionary Approach		Stock in safe zone of PA framework
Minimise harmful impacts on living marine resources and ecosystems		Bycatch regulations in place for moratorium stocks, general VME closures in effect
Preserve marine biodiversity		Cannot be evaluated

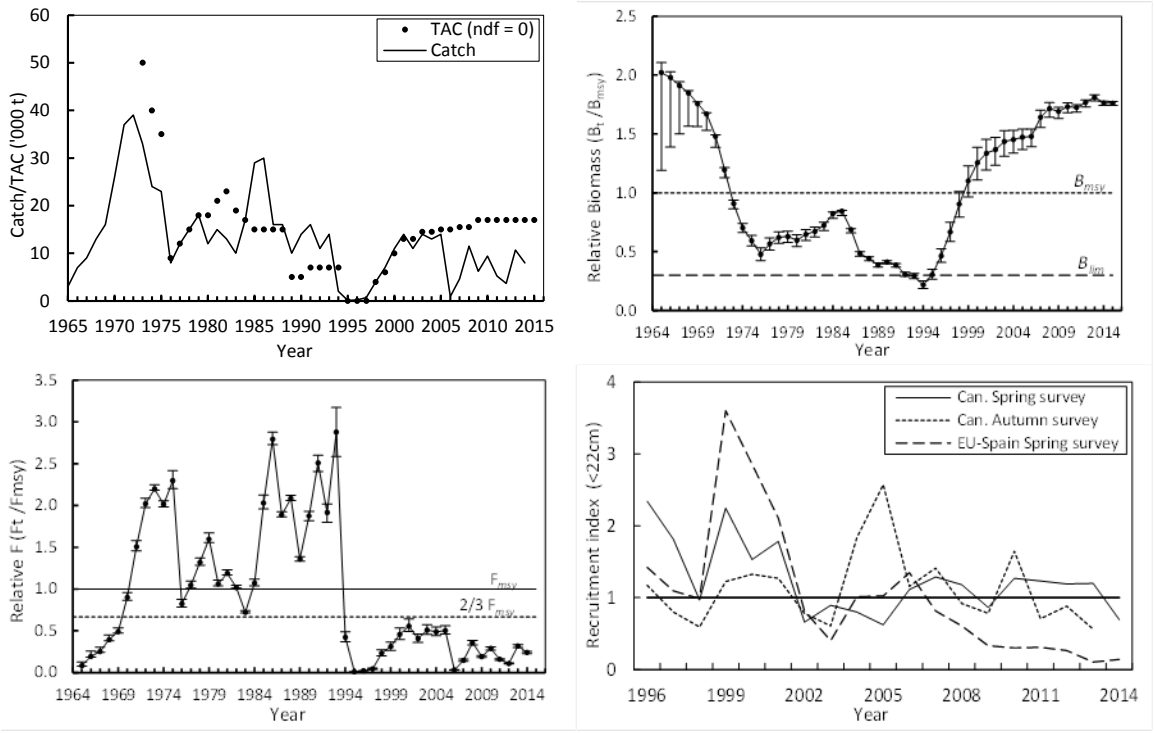
OK
Intermediate
Not accomplished
Unknown

Management unit

The stock occurs in Divs. 3LNO, mainly concentrated on the southern Grand Bank and is recruited from the Southeast Shoal area nursery ground.

Stock status

The stock size has steadily increased since 1994 and is now well above B_{msy}. There is very low risk of the stock being below B_{msy} or F being above F_{msy}. Recent recruitment appears lower than average.



Reference points

B_{lim} 30% B_{msy}

F_{lim} F_{msy} (STACFIS 2004 p 133).

Projections

Projections were conducted assuming two levels of catch in 2015: TAC level (17 000t) and the average of the 2007-2014 catch (7 400 t) followed by constant fishing mortality from 2016-2018 at 2/3 F_{msy}, 75% F_{msy}, and 85% F_{msy}. Although yields are projected to decline in the medium term at both levels of catch in 2015, at the end of the projection period, the risk of biomass being below B_{msy} is less than 1% in all cases. The probability of biomass increasing in the projection period (P(B_{2018}>B_{2014})) is <1%. The stock is well above B_{msy} and the projected levels of F result in catches higher than the estimated surplus production which will result in a decline in biomass toward B_{msy}.

	Projections with Catch in 2015 = Average 2007-2014 catch (7 400t)			
	Projected Yield ('000t) Median (80% CI)		Projected Relative Biomass (B_y/B_{msy}) Median (80% CI)	
⅔ F_{msy}				
2016	21.02	(19.69 - 23.01)	1.77	(1.75 - 1.77)
2017	19.52	(18.42 - 21.21)	1.61	(1.60 - 1.62)
2018	18.58	(17.66 - 20.02)	1.52	(1.50 - 1.54)
75% F_{msy}				
2016	23.43	(21.95, 25.64)	1.77	(1.75 - 1.77)
2017	21.44	(20.25 - 23.27)	1.58	(1.57 - 1.60)
2018	20.21	(19.24 - 21.72)	1.47	(1.45 - 1.49)
85% F_{msy}				
2016	26.26	(24.61 - 28.74)	1.77	(1.75 - 1.77)
2017	23.62	(22.33 - 25.59)	1.55	(1.53 - 1.56)
2018	21.97	(20.97 - 23.57)	1.42	(1.40 - 1.44)
F_{msy}				
2016	30.39	(28.49 - 33.24)	1.77	(1.75 - 1.77)
2017	26.60	(25.20 - 28.78)	1.50	(1.49 - 1.52)
2018	24.27	(23.25 - 25.98)	1.35	(1.32 - 1.37)

				Catch $_{2015}$ = 7400 t								
	Yield			P($F_y > F_{msy}$)				P($B_y < B_{msy}$)				
F Level	2016	2017	2018	2015	2016	2017	2018	2016	2017	2018	2019	P ($B_{2018} > B_{2014}$)
2/3 F_{msy}	21.02	19.52	18.58	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%
75% F_{msy}	23.43	21.44	20.21	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%
85% F_{msy}	26.26	23.62	21.97	5%	5%	5%	5%	<1%	<1%	<1%	<1%	<1%

Projections (cont.)

	Projections with Catch in 2015 = TAC (17 000t)			
	Projected Yield ('000t) Median (80% CI)		Projected Relative Biomass (B_y/B_{msy}) Median (80% CI)	
	⅔ F_{msy}			
2016	19.94	(18.70 - 21.80)	1.66	(1.65 - 1.67)
2017	18.85	(17.85 - 20.41)	1.55	(1.53 - 1.56)
2018	18.15	(17.31 - 19.50)	1.48	(1.45 - 1.50)
	75% F_{msy}			
2016	22.22	(20.85 - 24.29)	1.66	(1.65 - 1.67)
2017	20.70	(19.62 - 22.40)	1.52	(1.51 - 1.53)
2018	19.72	(18.85 - 21.15)	1.43	(1.41 - 1.46)
	85% F_{msy}			
2016	24.91	(23.37 - 27.22)	1.66	(1.65 - 1.67)
2017	22.79	(21.62 - 24.64)	1.49	(1.47 - 1.50)
2018	21.44	(20.53 - 22.95)	1.38	(1.36 - 1.41)
	F_{msy}			
2016	28.82	(27.05 - 31.49)	1.66	(1.65 - 1.67)
2017	25.66	(24.38 - 27.69)	1.44	(1.43 - 1.46)
2018	23.66	(22.73 - 25.24)	1.31	(1.28 - 1.33)

				Catch $_{2015}$ = 17 000 t (TAC)								
	Yield			P($F_y > F_{msy}$)				P($B_y < B_{msy}$)				
F Level	2016	2017	2018	2015	2016	2017	2018	2016	2017	2018	2019	P ($B_{2018} > B_{2014}$)
2/3 F_{msy}	19.94	18.85	18.15	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%
75% F_{msy}	22.22	20.70	19.72	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%
85% F_{msy}	24.91	22.79	21.44	5%	5%	5%	5%	<1%	<1%	<1%	<1%	<1%

Assessment

A surplus production model was used (STACFIS 2015). The results were consistent with the previous assessment and are considered to be reliable. Input data comes from research surveys and the fishery (STACFIS 2015) and is considered good quality. Next assessment: 2017.

Human impact

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

Biology and Environmental interactions

As stock size increased from the low level in the mid-90s, the stock expanded northward and continues to occupy this wider distribution. This expansion of the stock coincided with warmer temperatures; temperatures continue to warm, and will likely not limit the stock distribution in the near future.

Despite the increase in stock size observed since the mid-90s, the average length at which 50% of fish are mature has been lower for both males and females in the recent period. There also seems to have been a slight downward trend in weight at length since 1996. The cause of these changes is unknown.

Fishery

Yellowtail flounder is caught in a directed trawl fishery and as by-catch in other trawl fisheries. The fishery is regulated by quota and minimum size restrictions. Catches in recent years have been low due to industry-related factors. American plaice and cod are taken as by-catch in the yellowtail fishery. There is a 15% by-catch restriction on American plaice and a 4% limit on cod.

Recent catch estimates and TACs ('000 t) are as follows:

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
TAC[1]	15.0	15.5	15.5	17	17	17	17	17	17	17
STATLANT 21	0.6	4.4	11.3	5.8	9.3	5.2	3.2	10.5	8.0	
STACFIS	0.9	4.6	11.4	6.2	9.4	5.2	3.1	10.7	8.0	

SC recommended any TAC up to 85% F_{msy} in 2009-2015.

Effects of the fishery on the ecosystem

Fishing intensity on yellowtail flounder has impacts on Divs. 3NO cod and Divs. 3LNO American plaice through by-catch. General impacts of fishing gears on the ecosystem should also be considered.

Special comments

Catch of yellowtail flounder has been below TAC in recent years. If catches increase, fishing mortality on Divs. 3NO cod and Divs. 3LNO American plaice will also increase.

Sources of information

SCR Docs. 11/34, 15/08, 026, 029; SCS Docs. 15-05, 6, 7, 8, 9; NAFO/GC Doc. 08-3; NAFO/FC Doc. 04-18

2. Requests received from the Fisheries Commission during the annual meeting

The following requests were received during the current meeting. Scientific Council noted that these responses are only for the clarification of the advice and do not in any way alter or change the advice published in the previous reports of the Scientific Council.

a) Cod in Division 3M

Fisheries Commission requested:

1. *Regarding the Div. 3M cod advisory sheet, in the projection table for 3M cod the estimated risk of F being larger than F_{lim} in scenario no. 2 (3/4 F_{lim}) is estimated at less than 1%. It seems, however, that by looking at the overlaps of the 90% confidence limits of the catches associated with scenario #1 and scenario #2 that this risk ought to be higher (in the order of 5 to 20%). Is this correct?*

Scientific Council responded:

The council agreed the risk of $F>F_{lim}$ tabulated is underestimated in this case (scenario #2), but the magnitude is unknown. The Council noted this had no bearing on the projected values of yield, biomass and SSB. The Council could not come to a consensus on a better way of expressing risk and uncertainty at this time. Scientific Council will work intersessionally to resolve this issue by June 2016.

2. *Noting that the NAFO PA framework specifies an exploitation boundary with a low risk (~20%) of exceeding F_{lim} and that FC requests the SC to provide advice in accordance with the PA, why is SC promoting advice that implies a risk of 50% of exceeding Flim?*

Scientific Council responded:

The TAC recommendation is that the catch be less than that generated by the corresponding F_{lim}. Yields less than those corresponding to fishing at F_{lim} would result in lower risks of exceeding F_{lim}, however the tolerance of such risk is a decision for managers. Unfortunately none of the scenarios considered provided a risk in the order of 20%. Moreover in all scenarios there is a high probability of biomass growth during the projection period.

3. *Fishing at Fl_{im} in 2016-2017 would imply a 55% reduction of fishing mortality from 2014 and the exploitation would be kept 18% below the estimated natural mortality. At this level, it is expected with a high probability (95%) that SSB will continue to increase from 2014 to 2018. Also, fishing at a higher rate (e.g. between F_{lim} and ¾ $F_{2012-2014}$) will still imply a high probability of biomass increase and a risk below 1% that biomass would fall below B_{lim} by 2018.*

   Is there a scientific reason to justify the need for a TAC reduction in 2016 followed by an increase in 2017? What are the biological risks for the stock of reducing the TAC variation from year to year and stabilizing the TAC at the mean of the advised TACs for 2016 and 2017?

Scientific Council responded:

Advice was given in terms of F_{lim} projections and these were the resulting yields. Scientific Council sees no significant changes in the projected SSB when averaging over the projected yields. By increasing the TAC in 2016 from 12 425 to 13 931 and reducing the 2017 TAC from 15 436 to 13 931 the fishing mortality will increase above F_{lim} (F_{2016} = 0.15) in 2016 and be below F_{lim} in 2017 (F_{2017} = 0.12).

4. *The SC has stated a decrease in the mean size of the catches of Div. 3M cod and has concluded that the implementation of sorting-grids in Div. 3M cod fishery would reduce catches of small and immature individuals of cod. Having these conclusions in mind, is the Scientific Council in a position at this meeting to formulate a proposal for selectivity experiments with sorting grids in the Flemish Cap area for 2016, i.e. outlining the temporal and spatial coverage of the area, number of vessels required, gear needed for the experiments, etc.*

Scientific Council responded:

Scientific Council is not in a position at this meeting to develop a research plan for investigating selectivity in Div. 3M Cod. SC would encourage any Contracting Party to conduct such selectivity experiments and would welcome the opportunity to review results.

b) Redfish in Div. 3M

Fisheries Commission requested:

1. *What would be the average 2016-2017 TAC for 3M redfish, keeping for beaked redfish the fishing mortality at 2013-2014 $F_{status\ quo}$ and assuming that natural mortality on 2015-2017 will be at the same estimated average level of the past couple of years (2013-2014)?*

Scientific Council responded:

The average projected 2016-2017 catch for Div. 3M beaked redfish, is presented in the STACFIS Report. The average 2013-14 proportion of beaked redfish in the Div. 3M redfish catch is estimated to be 64%. Scientific Council reiterates its concern, *"Given the uncertainty about the actual level of current natural mortality (see STACFIS, 2015) and its impact on short term model projections, Scientific Council decided not to use model predictions as a basis for the recommendation."*

The SC also reiterates its advice that *"Recent decline in proportion of S. mentella and S. fasciatus allows a marginal increase in TAC in 2016-17 to 7000t, without changing the exploitation rate on these species and having the stock remain at a relatively high level".*

c) Splendid alfonsino (*Beryx splendens*)

Fisheries Commission requested:

1. *There are three known banks on which the fishery for Alfonsino has been conducted (Kükenthal Peak, C-3 and Milne-Edwards). The SC is requested to clarify if there has been any research into the Alfonsino stock carried out on the C-3 and Milne-Edwards banks and to provide any intermediate results of such research.*

Scientific Council is not aware of research on C-3 and Milne Edwards peaks, beyond that presented in SCR Doc. 15/06, and reviewed in the June meeting.

2. *According to the advice on the Alfonsino stock presented, three mean catch values (2, 5 and 10- year intervals) have been calculated. The SC is requested to elaborate if any one of these values is more appropriate to be used as a basis for establishing the TAC and has any advantages over the others.*

Scientific Council considered that the 10-year average is too long to reflect current productivity. There was no strong justification for choosing one of the remaining averaging periods (2009-2014 or 2012-2014) over the other – stock status is unknown, as is the sustainability of any of these options.

3. *The SC is requested to provide the catch statistics by the Contracting Parties that conducted fishery for Alfonsino in the areas and time periods in question.*

The following table was extracted from the STATLANT 21 database and provided by the Secretariat.

Year	Country	Division	Species Name	ASFIS Code	Catch (t)
2014	Spain	6G	Alfonsinos (ns)	ALF	118
2013	Spain	6G	Alfonsinos (ns)	ALF	112
2012	Spain	6G	Alfonsinos (ns)	ALF	298
2010	Spain	6G	Alfonsinos (ns)	ALF	53
2006	Spain	6G	Alfonsinos (ns)	ALF	69
2005	Spain	6G	Alfonsinos (ns)	ALF	577

VI. MEETING REPORTS

1. Joint Fisheries Commission – Scientific Council – WG Ecosystem Approach Framework to Fisheries Management

This joint working group met during 15 – 17 July 2015, and was chaired by Andrew Kenny (EU-United Kingdom) (FC-SC Doc 15/03). The Scientific Council was advised of progress in this group by the Chair in their presentation of the report to the joint session of Fisheries Commission and Scientific Council.

2. Joint Fisheries Commission–Scientific Council – WG on Risk-based Management Strategies

This joint working group met during 22– 24 April 2015, and was co-chaired by Carsten Hvingel (Norway) and Kevin Anderson (Canada) (FC-SC Doc 15/02). The Scientific Council was advised of progress in this group by Dr. Hvingel in his presentation of the report to the joint session of Fisheries Commission and Scientific Council. Responses to the group are detailed under Other Business.

3. Joint Fisheries Commission–Scientific Council – WG on Catch Reporting

This joint working group met during 20 – 21 April 2015, and was co-chaired by SC Chair Don Stansbury (Canada) (FC-SC Doc. 15/01). The Scientific Council was advised of progress in this group by the Chair in his presentation of the report to the joint session of Fisheries Commission and Scientific Council.

4. Fisheries Commission – WG on Bycatch, Discards and Selectivity

This Fisheries Commission Working Group met at the NAFO Secretariat 13 – 14 July 2015, and was chaired by FC Chair Sylvie Lapointe (Canada). The Scientific Council was advised of progress in this group by the Chair in her presentation of the report to the joint session of Scientific Council and Fisheries Commission.

VII. SPECIAL SESSIONS

The most recent NAFO symposium, *The Role of Marine Mammals in the Ecosystem in the 21st Century,* was held in 2008. As we have discussed at previous Scientific Council meetings, it is the symposia that have led to increased numbers of publications in the JNAFS. The following suggestions of topics were received at the June 2015 meeting, and forwarded to the September meeting for further consideration.

1. Regime shifts in stock productivity: environmental or anthropogenic?
2. Workshop on stock assessment methods
3. Variable population parameters – K_i, r_i, M_i
4. Otolith data as a tool to track life history changes and population parameters

In general, Scientific Council felt that the workload upcoming in 2016 and 2017 discouraged the possibility of holding a special session at this time.

At the NIPAG meeting in St Johns, the possibility of a joint NAFO-ICES conference on aging techniques for prawns was discussed. This was well received in general, but it was felt that further work was required before we would be in a position to have a symposium discussing results; therefore this was placed on hold for now.

Scientific Council noted the intent to hold a benchmark meeting on assessment of Div. 3M cod in 2017 and agreed the chair would bring this issue up in the presentation of the SC budget to ensure resources are available to support participation.

VIII. REVIEW OF FUTURE MEETING ARRANGEMENTS

1. Scientific Council, 3 – 16 June 2016

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

2. Scientific Council (in conjunction with NIPAG), 7 – 14 Sep 2016

The next Scientific Council shrimp meeting is scheduled to meet at ICES Headquarters, Copenhagen, Denmark. The agreed dates are 7 – 14 September, 2016.

3. Scientific Council, 19 – 23 September 2016

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

4. Scientific Council, 2 – 15 June 2017

Scientific Council agreed that its June meeting will be held on 2 – 15 June 2017, at St Mary's University, Halifax.

Scientific Council noted the overlap in timing between the NAFO Annual Meeting and the ICES Annual Science Conference. This discourages participation of SC members in the Annual Meeting. It was agreed that the SC Chair will discuss this with the incoming GC and FC chairs.

5. NAFO/ICES Joint Groups

a) WG-DEC, February 2016

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

b) NIPAG, 7 – 14 September 2016

This meeting will be held 7 – 14 September 2016, Copenhagen, Denmark.

6. NAFO SC Working Groups

a) WG-ESA, 17 - 26 November, 2015

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

IX. OTHER MATTERS

1. Presentation on redfish recruitment

Dr. Alexandra Valentin (DFO, Mont-Joli) was invited by the Scientific Council to make a presentation on redfish recruitment, based on a recent peer-reviewed publication (Valentin, A.E., Power, D., Sévigny, J.-M. 2015. Understanding recruitment patterns of historically strong juvenile year-classes in redfish (*Sebastes* spp): the importance of species identity, population structure, and juvenile migration. Canadian Journal of Fisheries and Aquatic Sciences 72: 774–784).

In this study, genetic analyses (i.e. 13 microsatellite markers) were undertaken on archived otoliths from juveniles representing historically strong year-classes of northwest Atlantic redfish (Sebastes spp.) and on tissue samples from adults of known species and population of origin. The results indicated that the species composition of a year-class is key information for understanding recruitment dynamics, with *S. fasciatus* and *S. mentella* species having distinct population-associated patterns of spatial dispersion. In the Gulf of St. Lawrence-Laurentian Channel area (i.e. Canadian fisheries management zones 'UNIT1' and 'UNIT2'), the last strong year-class which supported the fishery for more than 30 years belonged to *S. mentella*. This year-class carried the same genetic signature as the *S. mentella* adult population in the UNIT1-UNIT2 area, which suggested a local origin of this year-class. It is suggested that the Gulf of St. Lawrence (UNIT1) is the main nursery area for the UNIT1-UNIT2 *S. mentella* population and that juveniles disperse across the whole area as they age. In contrast, four year-classes that appeared abundant at young ages in UNIT1 and UNIT2 research surveys, but contributed only marginally to the adult population and the fishery in those regions, belonged to

S. fasciatus. These four year-classes carried the genetic signature of the adult population distributed along the southern margin of Div. 3Ps in UNIT2 and the slope of the Newfoundland Grand Banks (which includes Div. 3LN and Div. 3O). Ocean currents and spatio-temporal trends in abundance-at-length suggested that the latter adult population uses the Gulf of St. Lawrence as a nursery area, with larvae/early juveniles drifting toward the Gulf of St. Lawrence and older juveniles migrating back (i.e. homing behaviour) to the slope of the Grand Banks (at least to Div. 3O) after about five to six years. In summary, this study illustrated the importance of acknowledging population-associated patterns of spatial dispersion at key life-history stages for understanding redfish recruitment dynamics. By extension, this study suggested that juvenile migration behaviour is a post-settlement process that plays an important role in redfish recruitment dynamics and carries both demographic and evolutionary implications.

The discussion among the participants focused on the extent to which the strong year-classes of *S. fasciatus*, which use the Gulf of St. Lawrence as a nursery area, contribute to the recruitment of *S. fasciatus* in the Div. 3LN + Div. 3O area. Survey data (1991-2013) from Div. 3LN suggest the occurrence of recent good recruitments since 2008, after a period of low productivity that prevailed for more than 15 years. It has also been shown that Div. 3O and Div. 3N have always been composed of a large proportion of small redfish in the 20cm-25cm range without a consistent tracking of juvenile sizes, suggesting younger fish must come from elsewhere. Moreover, these areas are dominated by *S. fasciatus*. This new research linking *S. fasciatus* recruitment in Div. 3LN + Div. 3O to the disappearance of historically strong year-classes in the Gulf of St. Lawrence provides a credible mechanism to explain this situation which has puzzled scientists for many years. While the Council noted the importance of this research in regard to the management of redfish, there are still some challenging aspects of redfish biology that require answers before contemplating revisions to current management units. These include, for example, mixing/migration rates, spawning locations and whether there are areas of local retention of larvae/juveniles, and species composition. General discussions also arose on other research that revealed the importance of sea pens (pennatulacean corals) as habitat for redfish larvae along the slope of the Laurentian Channel (Div. 3Ps) and the west slope of the Grand Bank (Div. 3O). The extent to which sea pen habitat influences survival of early life stages of redfish is also important research for future management considerations.

Scientific Council expressed its appreciated for this presentation, thanked Dr Valentin for her work and stated its strong support for its continuation.

2. Revision of Annex 1 to Requests from Fisheries Commission

Scientific Council discussed a number of options to assist Fisheries Commission in revising the annex to the FC requests for advice, including providing projections at some percentage risk of exceeding F_{lim}, whether SC should prioritize any particular *F* option, including the risk associated with constant catch over the projection period, and whether all projections should be presented, or should those falling below a specified risk of exceeding F_{lim} be presented.

Feedback on these discussions was provided to Fisheries Commission to assist their deliberations.

3. Discussion on merging STACFEN and WG-ESA

At the June 2015 SC meeting it was agreed the SC, WG-ESA and STACFEN chairs would work intersessionally on the possibilities of merging STACFEN and WGESA. The chair of WG-ESA made a presentation summarizing the issue.

The two groups have complimentary roles, with STACFEN developing policies and procedures for the collection, compilation and dissemination of environmental information from oceanographic investigations; providing reviews of environmental conditions and advice to Scientific Council; and encouraging cooperation among Contracting Parties in scientific research, while WG-ESA addresses terms of reference which include *inter alia,* identification and mapping of sensitive species and habitats in the NAFO area, identifying appropriate ecosystem-based management areas, practical application of ecosystem knowledge to fisheries management, and the long-term monitoring of VME status and functioning. Since its inception in 2008 the work of WGESA has grown in scope and volume, and has become a stable contribution to SC work.

There are obvious overlaps between the STACFEN directives and the WGESA work (e.g. effects of environment on fish stocks and fisheries) and it was agreed the work of both groups would benefit from closer interactions and collaborations.

A proposal for a route forward was tabled by the chairs, which would involve the creation of a new Standing Committee (NStCo). This group will have directives that will integrate the mandates of both groups. At least initially, it will have two co-chairs that will be renewed every two years. Ideally, renewal of co-chairs should not be done in the same year. The NStCo will have its main meeting in November/December of each year. Detailed environmental summaries would be presented and ecosystem-related FC requests would also be addressed at this meeting at this meeting. A summary of the work done will be presented by the chairs of the NStCo at the SC June meeting including both a synoptic environmental summary as well as relevant progress on ecosystem studies.

The advantages of this approach would be that; it will provide a platform for oceanographers to interact with ecologists to explore interactions beyond environmental summaries, it would enhance the oceanographic expertise in the discussion of ecosystem issues, it will improve the use of time during the SC June meeting by integrating the presentations of current STACFEN and WGESA, and it will update and align the structure of SC with the requirements of the new convention (i.e. ecosystem approach)

Potential drawbacks include the possibility that the synoptic environmental summary may not contain all the information of current summaries; it will potentially reduce the interactions/collaborations between current STACFEN members and members of other Standing Committees, some current STACFEN members may not be able to attend the meeting in November or December, and the duration of this meeting, which typically starts on a Tuesday and ends the following Friday, may need to be extended to two full weeks.

Scientific Council thanked the chairs for their work and had extensive discussions on the issues raised. Feedback was generally positive, but there were some concerns regarding timing of meetings with respect to data availability, the change in requirements for participation between and availability of key personnel in November. Chairs will now present this proposal to WGESA, in November 2015, and STACFEN, in June 2016, before any decisions are made.

4. Scientific Council subgroups

During the June meeting, Scientific Council identified a number of areas which it wanted to work on intersessionally, via dedicated subgroups. These were; the revision of the PA framework, analysis and communication of risk, catches for the Greenland halibut MSE, and on the overlap of fishery surveys and VME closures. To facilitate this work, leads for each group were identified, and tasked with reaching out to SC members to arrange meetings via WebEx, in conjunction with the Secretariat. It was agreed that the SC chair and the chairs of RBMS would identify participants and timelines for the PA revision group, depending on the scheduling of the 2016 RBMS meeting. The identified leads of the remaining groups were Joel Vigneau (risk analysis), Joanne Morgan (GHL catches) and Kathy Sosebee (Survey-VME overlap).

Furthermore, SC was asked to identify a number of participants for the FC-SC Technical Working Group on Catch Reporting. It was felt that participation by the STACREC chair, and DE's for Div. 3M cod, Div. 3LNO American plaice and Greenland halibut would be most beneficial at present.

5. Presentation on the FAO Deep-sea ABNJ Project

Scientific Council received a presentation on the status of the FAO ABNJ – Deep Seas project from the project coordinator, Chris O'Brien (FAO), in which NAFO is a partner. The project aims to achieve efficiency and sustainability in the use of deep-sea living resources and biodiversity conservation in the ABNJ, through systematic application of ecosystem approach. The plan is to divide work into four components:

1. Improved application of policy and legal frameworks
2. Reducing adverse impacts on VMEs and components of EBSAs
3. Improved planning and adaptive management for ABNJ deep-sea fisheries
4. Development and testing of a methodology for area-based planning

To date, work has involved coordination of the Global VME database, organizing a review of processes and practices surrounding VME's in RFMO's, development of data collection systems and preparation of a number of species guides and technical papers. Planned for the future are a number of fishery workshops,

participation in a research project on deep-sea sponges in the Atlantic and development of tools for biodiversity monitoring by the fishing industry.

6. Discussion on benchmark stock assessment meetings

Scientific Council and the outgoing Chair of Fisheries Commission discussed the workload imposed by the proposed Div. 3M cod and redfish benchmarking process. Issues raised included as the prioritization of stocks to undergo this process, disruption to the Div. 3M cod management strategy evaluation, the revision of the PA framework, and the workload generated for the scientists and designated experts. Scientific Council could contribute to the process by making research recommendations in June of relevance to this prioritization. The Council thanked the FC Chair for addressing the meeting on this issue. The Scientific Council Chair will write to the chair of Fisheries Commission to highlight the issues on a formal basis.

7. Awards to outgoing chair.

On behalf of Scientific Council, the Vice-Chair, Kathy Sosebee (USA), thanked the Chair, Don Stansbury (Canada) for his leadership as chair of STACFIS (2001 – 2003), STACREC and SC Vice-Chair (2011 – 2013) and Chair of Scientific Council (2013 – 2015) and presented him with a certificate. Scientific Council wished him all the best for the future.

X. ADOPTION OF REPORTS

1. Committee Reports of STACREC and STACFIS

The Council reviewed and adopted the Reports of the Standing Committees (STACREC and STACFIS).

2. Report of Scientific Council

The Council at its concluding session on 25 September 2015 considered and adopted its own report, with the usual caveat that there will be minor corrections.

XI. ADJOURNMENT

There being no other business, the meeting was adjourned at 1200 hours on 25 September 2015. The Chair thanked the Scientific Council Coordinator for his support during his time with the NAFO Secretariat and wished him the best of luck in his future career. The Chair thanked the NAFO Secretariat for their hospitality in hosting the annual meeting and their usual high standard of logistic support. Finally, the chair thanked the members of Scientific Council for their hard work and wished everyone a safe journey home.

APPENDIX I. REPORT OF STANDING COMMITTEE ON RESEARCH COORDINATION (STACREC)

Chair: Kathy Sosebee Rapporteur: Neil Campbell

1. Opening

The Committee met at the Westin Hotel, Halifax, Canada, during 24 September 2015, to consider the various matters in its Agenda. Representatives attended from Canada, European Union (France, Portugal, Spain and UK), France (with respect to St. Pierre et Miquelon), Norway, Russian Federation and USA. The Scientific Council Coordinator was in attendance. The Chair opened the meeting and welcomed everyone. Neil Campbell was appointed the Rapporteur.

2. Fisheries Statistics

a) Progress Reports on Secretariat Activities

There were no activities to report on.

b) Review of STATLANT 21

i) Submission of data

The following table updates the situation with the submission of STATLANT. There are still a few outstanding submissions but in general the submission rate is acceptable.

TABLE 1. Dates of receipt of STATLANT 21A and 21B reports for 2012-2014 up to 21 September 2015.

Country/Component	STATLANT 21A (deadline, 1 May)			STALANT 21B (deadline 31 August)		
	2012	2013	2014	2012	2013	2014
CAN-CA	21 May 13	30 Apr 14	24 Apr 15	21 May 13	30 Apr 14	19 May 2015
CAN-SF	21 Apr 13	30 May 14	1 Jun 14	6 Sep 13	3 Jun 14	3 Jun 15
CAN-G	9 May 13	24 Dec 14	14 May 15	1 Sep 13	14 May 15	18 Aug 15
CAN-N	30 Apr 13	30 Apr 14	25 May 15	9 Sep 13	29 Aug 14	
CAN-Q						
CUB	7 May 13					
E/BUL	21 May 13 (dnf)			21 May 13 (dnf)		
E/EST	2 May 13	22 May 14	28 Apr 15	1 Sep 13	29 Aug 14	14 Aug 15
E/DNK	17 May 13	21 Aug 14	21 May 15	9 Sep 13	21 Aug 14	31 Jul 15
E/FRA-M	4 Jun 13	22 May 14				
E/DEU	28 May 13	28 Apr 14	29 Apr 15	1 Sep 13	29 Aug 14	3 Jun 15
E/LVA	22 Apr 13		21 Apr 15 (dnf)	6 Sep 13		21 Apr 15 (dnf)
E/LTU	27 May 13		21 May 15	23 Oct 13		28 Jul 15
E/POL			1 Jun 15			21 Sep 15
E/PRT	23 Apr 13	22 May 14	8 May 15	4 Oct 13	29 Aug 14	3 Sep 15
E/ESP	28 May 13	22 May 14	21 May 15	30 Aug 13	25 Aug 14	7 Sep 15
E/GBR	8 May 13	23 May 14		1 Sep 13	20 Aug 14	
FRO	2 Jun 13	12 Jun 14	7 Jul 15	2 June 13	12 Jun 14	7 Jul 15
GRL	30 Apr 13	5 May 14	15 May 15	9 Sep 13	29 Aug 14	1 Sep 15
ISL	23 May 13 (dnf)	23 May 14	15 May 15 (dnf)	23 May 13 (dnf)	8 Sep 14	15 May 15 (dnf)
JPN	26 Apr 13 (dnf)			26 Apr 13 (dnf)		
KOR						
NOR	30 Apr 13	22 May 14	7 May 15	6 Sep 13	26 Aug 14	7 Aug 15
RUS	21 May 13	12 May 14	21 Apr 15	24 Oct 13	28 Aug 14	6 Jul 15
USA	21 May 13	29 May 14	22 May 15			
FRA-SP	21 May 13	30 Jul 14	20 Apr 15	9 Sep 13	30 Jul 14	6 Jul 15
UKR						

3. Research Activities

a) Surveys Planned for 2015 and early 2016

Designated Experts were requested to check and update the information contained in SCS Doc. 15/16.

4. Other Matters

a) Review of SCR and SCS Documents

There were no documents presented.

b) Other Business

i) Investigating potential changes in Canadian survey precision

In regard to the review of survey activities conducted at the June 2015 meeting, STACREC noted the decline in the planned coverage and success rate of the Canadian surveys since 1995, particularly in the autumn, and expressed concern about the impact on the ability to detect signal from noise in regards to evaluating trends in biomass and abundance of various species. There are various reasons for this reduction over time (e.g. mechanical issues with vessels, weather, expanded sampling for non-commercial species, budget constraints) but it is generally considered to have led to increased, albeit unquantified, uncertainty with respect to the provision of scientific advice. Accordingly, STACREC **recommends** *that an analysis of sampling rates be conducted to evaluate the impact on the precision of survey estimates.*

5. Adjournment

The report was reviewed and the meeting was adjourned at 1000 on 24 September 2015.

APPENDIX II. REPORT OF STANDING COMMITTEE ON FISHERIES SCIENCE (STACFIS)

Chair: Brian Healey Rapporteur: Neil Campbell

1. Opening

The Committee met at the Westin Hotel, Halifax, Canada, during 24 September 2015, to consider the various matters in its Agenda. Representatives attended from Canada, European Union (France, Portugal, Spain and UK), France (with respect to St. Pierre et Miquelon), Norway, Russian Federation and USA. The Scientific Council Coordinator was in attendance. The Chair opened the meeting and welcomed everyone. Neil Campbell was appointed the Rapporteur.

2. Nomination of Designated Experts

Scientific Council were informed that following the passing of Dave Orr (see SCS Doc. 15/14), Katherine Skanes (Canada) had taken over as the designated expert for Northern Shrimp in Div. 3LNO. There were no other changes proposed.

3. Other Matters

a) Review of SCR and SCS Documents

There were no SCR documents submitted.

b) 2016 invited speaker

At the June 2014 meeting it was decided that funds would be sought to support the attendance of an invited speaker at the 2015 STACFIS meeting. Unfortunately none of the candidates approached were available to attend the meeting. There was still popular support for this initiative, therefore it was concluded that funds would be requested again, and the STACFIS chair and SC coordinator to engage with proposed speakers at the earliest opportunity to ensure their availability.

c) Other Business

i) Communication of risk in advice to managers

It was noted in the requests from FC for clarification of scientific advice that the risks of exceeding F_{lim} for some scenarios presented in the Div. 3M cod assessment were difficult to interpret in light of the overlap in credible intervals of the yields of the various options. This observation lead to an extensive discussion within STACFIS on the methods used to calculate risk, its perception within Scientific Council and the communication such matters to Fisheries Commission.

Three working documents were presented to SC for consideration on the issue of risk estimates associated with projected scenarios. The first detailed the current computation done for the stock, and although there was no computation error, SC acknowledged that the risk proposed did not correspond to the expected one. The remaining two proposed other approaches, which were perceived to be correct by SC, resulting in the two following options:

- The projected parameter and the corresponding reference point both have a known distribution.
- The projected parameter or the corresponding reference point does not have a known distribution.

Falling into one or the other option will depend on the method used, and vary across stock assessments conducted by SC. It was demonstrated that the risk can differ to significant extent from one option to the other. If computing the risk using two distributions is considered more reflective of the reality, the probability of a point value being greater than a distribution will underestimate the risk when the point value is below the median of the distribution and over-estimate when above. The two options are providing the same estimates (50%) only in the case of comparing the parameter to the median of the other. Including all the information (the distribution shapes) when available is a good principle, but given the discrepancy of risk estimates between the two options, the value provided to the managers will have different meaning depending on the option taken. Moreover, the question was raised on the relevance to compute a distribution on an option demanded by the managers (e.g. 3/4 F_{msy} is a point value or a variable when evaluating the risk

of 3/4 F_{msy} being above F_{lim}). These were causes of concern for SC, and it was agreed to propose a plan for elaborating a standard procedure for all stocks to be included in the NAFO Precautionary Approach Framework (PAF). This initiative is also in line with the setting of a technical subgroup in charge of revising the PAF where a ToR is dedicated to the standard risk computation.

A group led by Joël Vigneau (STACFIS chair) - open to all SC participants - will meet by web conference in the second half of January 2016 to propose a standard procedure and/or good practice to compute the risk in the advice sheet. Joël Vigneau will liaise with the PAF technical subgroup and report this subgroup with the progress made. In preparation of the January meeting, the group will:

- invite key experts to provide advice,
- document how risk is computed (when possible) within the NAFO stock assessments,
- seek guidance from relevant literature and other RFMOs on how such risk estimates are computed,
- propose guidance for application in future assessments

4. Adjournment

The meeting was adjourned at 1200 on 24 September 2015.

APPENDIX III. SCIENTIFIC COUNCIL AGENDA, SEPTEMBER 2015

I. Opening

1. Opening
2. Appointment of Rapporteur
3. Adoption of Agenda
4. Plan of Work
    a) Joint FC – SC Session

II. Review of Scientific Council Recommendations

III. Research Coordination

1. Opening
2. Fisheries Statistics
    a) Progress Reports on Secretariat Activities
    b) Review of STATLANT21
3. Research Activities
    a) Surveys Planned for 2015 and early 2016
4. Other Matters
    a) Review of SCR and SCS Documents
    b) Review of Survey SCS Document
    c) Other Business

IV. Fisheries Science

1. Opening
2. Nomination of Designated Experts
3. Other Matters
    a) Review of SCR and SCS Documents
    b) 2016 invited speaker
    c) Other Business

V. Requests from the Fisheries Commission

1. Requests deferred from the June Meeting
    a) Capelin in Div. 3NO
    b) Advice on Yellowtail flounder for 2018
2. *Ad hoc* Requests from Current Meeting

VI. Meeting Reports

1. NAFO Joint Fisheries Commission-Scientific Council Working Group on the Ecosystem Framework for Fisheries Management (WG-EAFFM)

VII. Review of Future Meeting Arrangements

VIII. Future Special Sessions

1. Discussion of proposed topics

IX. Other Matters

1. Report of the NAFO *Ad Hoc* Working Group on Bycatches, Discards and Selectivity (WG-BDS)
2. Presentation on redfish recruitment

X. Adoption of Reports

1. Committee Reports of STACFIS and STACREC
2. Report of Scientific Council

XI. Adjournment

ANNEX 1. FISHERIES COMMISSION'S REQUEST FOR SCIENTIFIC ADVICE ON MANAGEMENT IN 2015 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 Div. 3LNO	American plaice in Div. 3LNO Cod in Div. 3M Redfish in Div. 3LN Redfish in Div. 3M Northern Shrimp in Div. 3M Thorny skate in Div. 3LNO White hake in Div. 3NO Witch flounder in Div. 3NO	American plaice in Div. 3M Capelin in Div. 3NO Cod in Div. 3NO Northern shortfin squid in SA 3+4 Redfish in Div. 3O 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 2015, advice should be provided for 2016 for Northern Shrimp in NAFO Div. 3LNO

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

In 2015, advice should be provided for 2016, 2017 and 2018 for Cod in Div. 3NO, Yellowtail Flounder in 3LNO and Capelin in Div. 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 + Division 3KLMNO (FC Document 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 Document 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 Div. 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 Div. 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 F_{msy}, 3/4 F_{msy}, 85% F_{msy}, 75% F_{2014}, F_{2014}, 125% F_{2014},
- For stocks under a moratorium to direct fishing: F_{2014}, 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($F>F_{lim}$)			P($B<B_{lim}$)			P($F>F_{msy}$)			P($B<B_{msy}P$			P($B_{2017} > B_{2014}$)
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 F_{msy}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%
3/4 F_{msy}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%
85% F_{msy}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%
0.75 X F_{2014}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%
F_{2014}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%
1.25 X F_{2014}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%
F=0	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%

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

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

   And any information the Scientific Council deems appropriate

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

   - For stocks opened to direct fishing: $F_{0.1}$, F_{max}, 2/3 F_{max}, 3/4 F_{max}, 85% F_{max}, 75% F_{2014}, F_{2014}, 125% F_{2014},
   - For stocks under a moratorium to direct fishing: F_{2014}, 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($F>F_{0.1}$)			P($F>F_{max}$)				P($B_{2017} > B_{2014}$)
F in 2015 and following years*	Yield 2015	Yield 2016	Yield 2017	2015	2016	2017	2015	2016	2017	2015	2016	2017	2015	2016	2017		
$F_{0.1}$	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_{2014}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%		%
F_{2014}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%		%
1.25 X F_{2014}	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 2015 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.
2. 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.
3. 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 Division 0A and Division 1A plus Division 1B and 2) NAFO Division 0B 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.
4. Advice for Greenland halibut in Division 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 Division 1A (inshore) annually, and should significant changes in stock status be observed, the Scientific Council is requested to provide updated advice as appropriate.
5. 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.
6. 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

1) 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 Divisions 0A+1A (offshore) and 1B, and Divisions 0B+1C-F.[1] The Scientific Council is also asked to provide advice on any other management measures it deems appropriate to ensure the sustainability of these resources.

   a) 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.
   b) 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:

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

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

2) Canada requests the Scientific Council to consider the following options in assessing and projecting future stock levels for Shrimp in Subareas 0 and 1:

   a) 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 30,000t 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.

   b) 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 B_{lim} and Z_{MSY}.

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

c) Presentation of the results should include the following:
   i) a graph and table of historical yield and fishing mortality for the longest time period possible;
   ii) a graph of biomass relative to B_{MSY}, and recruitment levels for the longest time period possible.
   iii) a graph of the stock trajectory compared to B_{lim} and/or B_{MSY} and Z_{MSY}.;
   iv) 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 B_{MSY} and B_{lim}, and of exceeding Z_{MSY}.;
   v) a graph of the total area fished for the longest time period possible; and
   vi) any other graph or table the Scientific Council feels is relevant.

3) 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 7 July 2014)

APPENDIX IV. LIST SUMMARY (SCS) DOCUMENTS

Summary Documents

SCS Doc. No	Serial No.	Author	Title
SCS Doc. 15-15	N6507	NAFO	Report of the Scientific Council, 21-25 September 2015
SCS Doc. 15-16	N6510	NAFO Secretariat	Available Data from the Commercial Fisheries Related to Stock Assessment (2014) and Inventory of Biological Surveys Conducted in the NAFO Area in 2015 and Biological Surveys Planned for 2015 and Early-2016

APPENDIX V. LIST OF REPRESENTATIVES, ADVISERS, EXPERTS AND OBSERVERS, 2015

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