PART A: SCIENTIFIC COUNCIL MEETING, 4-18 JUNE 2009

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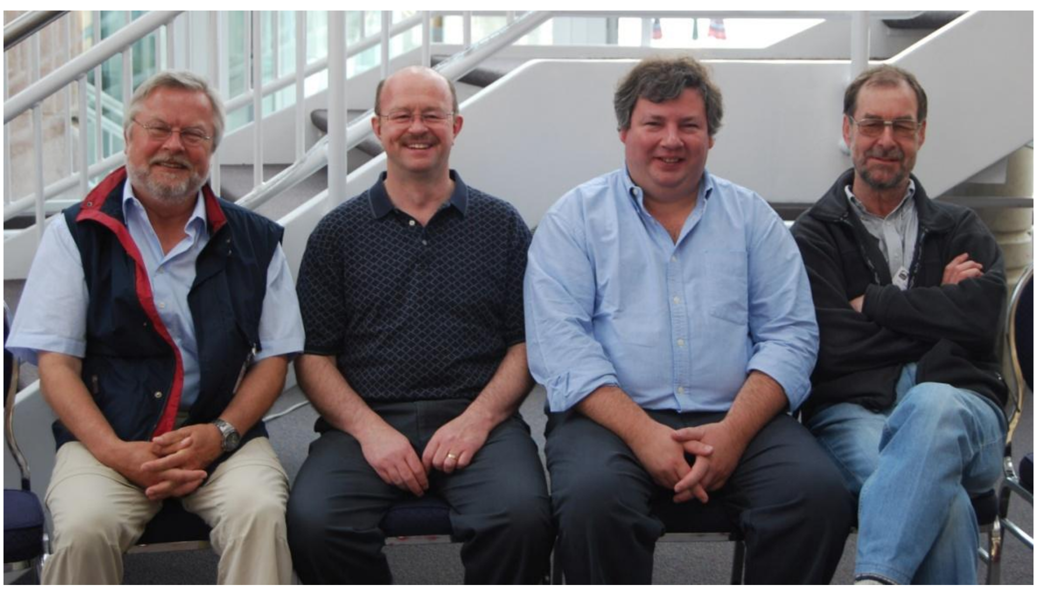
Back Row (left-right): George Campanis, Brian Healey, Anthony Thompson, Ross Hendry, Ricardo Alpoim, Jean-Claude Mahé, Phil Large, Dawn Maddock Parson, Mark Simpson, Antonio Vázquez, Ole Jorgenson, Maris Pliksh, Estelle Couture, Romas Statkus, Michael Kingsley, Vladimir Babayan, Tom Nishida, Barb Marshall, Bill Brodie, Eugene Colbourne

Front Row: Erica Head, Fernando Gonzalez, Diana Gonzalez-Troncoso, Margaret Treble, Manfred Stein, Joanne Morgan, Antonio Avila de Melo, Don Power, Brian Petrie



Scientific Council Chairs: Manfred Stein, Don Power, Ricardo Alpoim, Michael Kingsley

REPORT OF SCIENTIFIC COUNCIL MEETING

4-18 JUNE 2009

Chair: Don Power Rapporteur: Anthony Thompson

I. PLENARY SESSIONS

The Scientific Council met at the Alderney Landing, 2 Ochterloney Street, Dartmouth, Nova Scotia, Canada, during 4-18 June 2009, to consider the various matters in its Agenda. Representatives attended from Canada, Denmark (in respect of Faroe Islands and Greenland), European Union (Estonia, France, Germany, Latvia, Lithuania, Portugal, Spain and United Kingdom), Japan, Russian Federation, and United States of America. The Interim Executive Secretary, Stan Goodick, and the Scientific Council Coordinator, Anthony Thompson, were 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 1310 hours on 4 June 2009. The provisional agenda was **adopted** with modification and the Scientific Council Coordinator, Anthony Thompson was appointed the rapporteur.

The Council was informed that authorization had been received by the Executive Secretary for proxy votes from France (in respect of St. Pierre et Miquelon), Iceland, and Norway.

Observer applications were received from Sierra Club Atlantic Chapter (Gretchen Fitzgerald (Director), Fred Winsor (Chair)) and WWF (Susan Fudge, Bettina Saier and Dave Kulka) to attend this meeting. These were approved according to Scientific Council Rules of Procedure 1.3 following the procedures agreed by Scientific Council in September 2007 (*NAFO Sci. Coun. Rep*., 2007, p. 199) and June 2008 (*NAFO Sci. Coun. Rep*., 2008, p. 69) and Sep 2008 (*NAFO Sci. Coun. Rep*., p. 237). WWF also applied for, and were granted, observer status for the September Scientific Council meeting in Bergen, Norway.

The Council noted the vacancy for Chair of STACFEN, has remained unresolved since September 2008. The Council approved Manfred Stein as the Interim Chair for this meeting and thanked him for his leadership.

The opening session was adjourned at 1445 hours on 4 June 2009. Several sessions were held throughout the course of the meeting to deal with specific items on the agenda. The Council considered and **adopted** the STACPUB and STACFEN reports on 12 June 2009 and the STACREC report on 16 June 2009.

The concluding session was called to order at 0830 hours on 18 June 2009.

The Council considered and **adopted** the report of STACFIS and the Scientific Council Report of this meeting of 4-18 June 2009. The Chair noted that due to time constraints certain agenda items were deferred to the September 2009 meeting as noted in this report. The Chair received approval to leave the report in draft form for about two weeks to allow for minor editing and proof-reading on the usual strict understanding there would be no substantive changes to any previously adopted sections of this report.

The Scientific Council noted the difficulty to reach full consensus on the basis for provision of advice on Greenland halibut in SA 2 + Div. 3KLMNO due to one dissenting view from Japan. Under Article X.1 of the Convention on Future Multilateral Cooperation in the Northwest Atlantic Fisheries, a minority report was submitted by Japan and is recorded in this report under item XII.8.d.

The meeting was adjourned at 1430 hours on 18 June 2009.

The Reports of the Standing Committees as adopted by the Council are appended as follows: Appendix I – Report of the Standing Committee on Fisheries Environment (STACFEN), Appendix II – Report of Standing Committee on Publications (STACPUB), Appendix III – Report of Standing Committee on Research Coordination (STACREC), and Appendix IV – Report of Standing Committee on Fisheries Science (STACFIS).

The Agenda, List of Research (SCR) and Summary (SCS) Documents, List of Representatives, Advisers and Experts are given in Part D.

The Council's considerations on the Standing Committee Reports, and other matters addressed by the Council follow in Sections II-XV.

II. REVIEW OF SCIENTIFIC COUNCIL RECOMMENDATIONS IN 2006-2008

From the Scientific Council Meeting 1–15 June 2006

XII. Other Matters 5. NAFO Reform

Scientific Council **recommended** that *boundaries of Divisions 3M and 3L be re-defined so that 3M includes that small rectangle currently in 3L.*

STATUS: This was discussed by General Council in September 2008 and a decision was deferred until the Annual Meeting in 2009.

From the Scientific Council Meeting 7–21 June 2007

XII. Other Matters 5. Other Business a) VMS data

Scientific Council **recommended** that *position be reported at shorter intervals than the current 2 hours, and the NAF fields for speed (code SP) and course (code CO) be added to the POS reports transmitted to the Secretariat.*

STATUS: This was discussed by STACTIC in July and September 2008 and by Fisheries Commission in September 2008. A decision by Fisheries Commission was deferred until the Annual Meeting in September 2009 (FC Report, Sep 2008, VI.16).

Scientific Council Meeting 5-19 June 2008

VII. Management Advice and Responses to Special Requests 1. Fisheries Commission (Appendix V, Annex 1) e) Special Requests for Management Advice vi) Protection of vulnerable marine ecosystems

c) Methods for monitoring the health of VMEs VME Data Collection Protocol

Scientific Council **recommended** that *the collection protocol be reviewed and re-drafted, possibly at the Fisheries Commission ad hoc Working Group of Managers and Scientists on VME to take in to account the above issues.*

STATUS: Fisheries Commission referred the discussion and drafting of the data collection protocol to the September 2008 meeting of the Fisheries Commission Working Group of Fishery Managers and Scientists (FC Doc. 08/8). Their text was adopted by Fisheries Commission and incorporated in to Annex XXV of the NCEM (FC Doc. 09/1) under "Contracting Party Exploratory Fishing Trip Report Submitted to the NAFO Scientific Council".

XI. Review of Scientific Council Working Procedures/Protocol 2. Rules of Procedure a) Observer Application Process

Scientific Council **recommended** that *the following changes be made to the Scientific Council Rules of Procedure Rule 1 Representation:*

1.3 The Scientific Council may invite any non-Member Government and any ~~international,~~ public or private~~,~~ organization to be represented at meetings of the Scientific Council or its subsidiary bodies by an observer or observers.

In addition, Scientific Council would like to formalize the position of invited experts by the addition of a new rule and **recommended** that *the following rule be added under Representation Rule 1:*

1.4 The Scientific Council Chair may invite one or more "guest experts" to meetings of Scientific Council and its subsidiary bodies. The guest expert(s) would not represent a Party or Organization and would have no status at the meeting other than to provide specific advice and guidance to Scientific Council on particular issues.

STATUS: This has been included in the newest edition of the NAFO Rules of Procedure & Financial Regulations 2009 (February 2009). At the 2008 Annual Meeting, Russia questioned the use of the expressions "public or private" organization in rule 1.3 and "advice and guidance" in rule 1.4 (*NAFO Sci. Coun. Rep.*, 2008, p. 237). Rule 1.3 will be discussed at this meeting under agenda item XI.4.a. It was felt by Scientific Council that "expertise" may more correctly describe the functions of the guest expert and that this would be discussed at a future meeting when a general revision of the Rules of Procedure is undertaken.

XII. Other Matters 3. Classification Criteria for NAFO Stocks

Scientific Council **recommended** that *the FIRMS Stock classification is*:

- *Next considered and updated by STACFIS in June 2009,*
- *not included in the summary sheets, the Scientific Council report, or any other published documentation, and;*
- *managed by the Secretariat and presented to FIRMS for use for search engine purposes only.*

STATUS: STACFIS reviewed the FIRMS classification for all stocks, except the shrimp stocks which will be reviewed at the Scientific Council meeting in October 2009. Based on the fact that there is now a more thorough review of the classification of stocks and because of the usefulness of having a simple way to quickly show the status of all stocks Scientific Council decided that the updated classification should be included in the STACFIS report.

III. FISHERIES ENVIRONMENT

The Council **adopted** the Report of the Standing Committee on Fisheries Environment (STACFEN), as presented by the Interim Chair, Manfred Stein. The full report of STACFEN is in Appendix I.

The recommendation made by STACFEN for the work of the Scientific Council as **endorsed** by the Council, is as follows:

STACFEN noted that in recent years good year classes have been observed in a number of populations in the northwest Atlantic. STACFEN therefore **recommended** that *the appearance of good year classes be explored in relation to environmental conditions*.

IV. PUBLICATIONS

The Council **adopted** the Report of the Standing Committee on Publication (STACPUB) as presented by the Chair, Manfred Stein. The full report of STACPUB is in Appendix II.

The recommendation made by STACPUB for the work of the Scientific Council as **endorsed** by the Council, is as follows:

STACPUB **recommended** that *a coral guide be published in the NAFO Scientific Council Studies series in a waterproof format as well as an electronic format that would be available on the website*.

V. RESEARCH COORDINATION

The Council **adopted** the Report of the Standing Committee on Research Coordination (STACREC) as presented by the Chair, Ricardo Alpoim. The full report of STACREC is in Appendix III.

The recommendation made by STACREC for the work of the Scientific Council as **endorsed** by the Council, is as follows:

STACREC **recommended** that *Contracting Parties make greater efforts to ensure that sampling of commercial fisheries is representative for all stocks, whether taken in directed fisheries or as bycatch.*

VI. FISHERIES SCIENCE

The Council **adopted** the Report of the Standing Committee on Fisheries Science (STACFIS) as presented by the Chair, Michael Kingsley. The full report of STACFIS is in Appendix IV.

The Council **endorsed** recommendations specific to stock considerations and they are highlighted under the relevant stock considerations in the STACFIS Report in Appendix IV.

A **recommendation** made by STACFIS for the work of the Scientific Council as **endorsed** by the Council, is as follows: *all Contracting Parties take measures to improve the accuracy of their catch estimates and present them in advance of future June Meetings.*

VII. MANAGEMENT ADVICE AND RESPONSES TO SPECIAL REQUESTS

1. Fisheries Commission

The Fisheries Commission requests are given in Annex 1 of Appendix V.

The Scientific Council noted the Fisheries Commission requests for advice on northern shrimp (northern shrimp in Div. 3M and Div. 3LNO (Item 1)) was undertaken during the Scientific Council meeting on 22-28 October 2008. The Scientific Council provided updated scientific advice on northern shrimp stocks for 2009 and advice for 2010. Updated advice for 2010 will be provided at the Annual meeting in 2009 through an interim monitoring report.

a) Request for Advice on TACs and Other Management Measures for the year 2010

Greenland halibut in SA 2 and Div. 3KLMNO

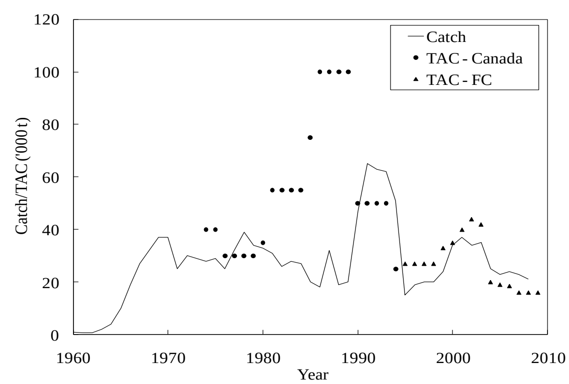
Background: The Greenland halibut stock in SA 2 and Div. 3KLMNO is considered to be part of a biological stock complex, which includes SA 0 and SA 1.

Fishery and Catches: TACs prior to 1995 were set autonomously by Canada; subsequent TACs have been established by Fisheries Commission. Catches increased sharply in 1990 due to a developing fishery in the NAFO Regulatory Area in Div. 3LMNO and continued at high levels during 1991-1994. The catch was only 15 000 to 20 000 t per year in 1995 to 1998 as a result of lower TACs under management measures introduced by the Fisheries Commission. The catch increased since 1998 and by 2001 was estimated to be 38 000 t, the highest since 1994. The estimated catch for 2002 was 34 000 t. The 2003 catch could not be precisely estimated, but was believed to be within the range of 32 000 t to 38 500 t. A fifteen year rebuilding plan has been implemented by Fisheries Commission for this stock. The catches in 2004-2008 have exceeded the rebuilding plan TACs by 30% on average, despite reductions in fishing effort. The 2008 catch was estimated to be 21 000 t.

	Catch ('000 t)		TAC ('000 t)	
Year	STACFIS	21A	Recc.	Agreed
2006	24	17[1]	nr	18.5
2007	23	15[1]	nr	16
2008	21	15[1]	nr	16
2009			$< F_{0.1}$	16

[1] Provisonal

nr No recommendation – Evaluation of Rebuilding Plan



Data: Standardized estimates of CPUE were available from fisheries conducted by Canada, EU-Spain and EU-Portugal. Abundance and biomass indices were available from research vessel surveys by Canada in SA 2 + Div. 3KLMNO (1978-2008), EU in Div. 3M (1988-2008) and EU-Spain in

Div. 3NO (1995-2008). Commercial catch-at-age data were available from 1975-2008. The Canadian autumn survey of 2008 is not comparable with previous years due to survey coverage deficiencies.

Assessment: Scientific Council reviewed the impact of the incomplete survey coverage of the Canadian utumn survey (SCR Doc. 09/12, 09/39). It was determined that the coverage deficiencies within Div. 2J+3K were such that the mean numbers per tow index from Div. 2J+3K could not be considered comparable to that of previous years. This survey index has been used to calibrate the XSA in recent years, along with the Canadian spring Div. 3LNO and EU Flemish Cap (0-730 m) data. The algorithm within XSA which estimates survivors generates and applies a weighting to estimates of terminal year survivors at each survey-age. In recent assessments of this stock (*e.g*. SCR 08/48), the Canadian Div. 2J+3K index has received the majority of the weight used to estimate the survivors. It is therefore critical to the XSA assessment that the indices from this survey are consistent from year to year. Scientific Council concluded that it would not be appropriate to update that analytical assessment as the Canadian Div. 2J+3K data for 2008 were not comparable to those from previous years.

Biomass: In the recent period, biomass indices from the Canadian survey in Div. 2J+3K and the EU Flemish Cap data from 0-1400 m (available for 2004-2008 only) have increased considerably. At the same time, the EU Flemish Cap index to 730 m (available 1988-2008) and Spanish Div. 3NO biomass indices have generally been stable in recent years.

State of the Stock: Given that Scientific Council did not consider it appropriate to update the analytical assessment, overall stock status has been based upon estimates from the previous assessment. At that time, Scientific Council noted that the exploitable biomass has been declining in recent years and the 2004-2008 estimates are amongst the lowest in the series. Recent recruitment has been far below average, and fishing mortality, although decreasing, remains high.

Reference Points: Limit reference points could not be determined for this stock.

In the 2008 assessment of this stock, F_{max} was estimated to be 0.34 and $F_{0.1}$ was 0.18.

Projections and Evaluation of the Management Strategy:

Scientific Council accepted the view of STACFIS that revising the projections conducted during the 2008 assessment would give a better basis for advice. Scientific Council emphasizes that the amount of uncertainty associated with these projections is increased compared to last year.

Updated projections from the 2008 analytical assessment were considered. The assumed catches for 2010-2012 correspond to those produced under a fishing mortality of $F_{0.1}$, or to fixed 16 000 t catches. The $F_{0.1}$ projection applies a status quo catch in the first projection year (2009).

Projections conducted assuming a fixed catch of 16 000 t do not result in improvements in the 5+ biomass, since the majority of the year-classes which recruit to the exploitable biomass during the projection period are estimated to be well below average. If a fishing mortality corresponding to $F_{0.1}$ is achieved, the exploitable biomass is projected to grow in the medium term.

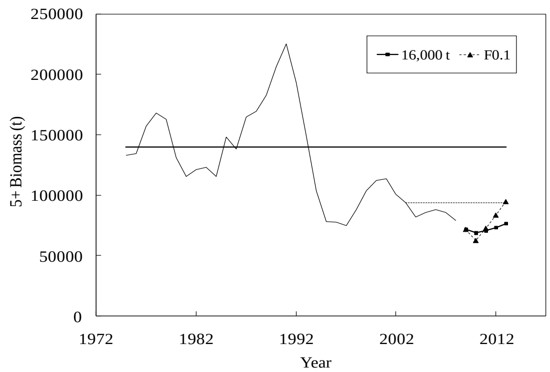
16,000 t

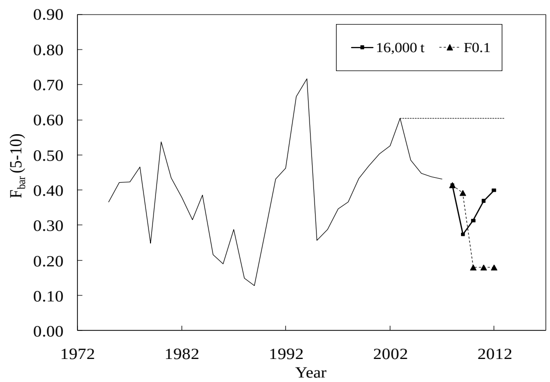
Year	5+ Biomass (t)	Yield	Fbar (5-10)
2008	79050	21178	0.414
2009	71579	16000	0.274
2010	68635	16000	0.313
2011	70580	16000	0.369
2012	73194	16000	0.399
2013	76506		

F0.1 (Status quo catch in 2009)

Year	5+ Biomass (t)	Yield	Fbar (5-10)
2008	79050	21178	0.414
2009	71579	21178	0.392
2010	62332	8807	0.180
2011	72496	9214	0.180
2012	83457	9988	0.180
2013	94691		

In the figure following, the solid horizontal line represents the rebuilding plan target biomass of 140 000 t. The dashed horizontal line in each plot denote the level of the 5+ biomass / fishing mortality in 2003, when the Fisheries Commission rebuilding plan was implemented.





Recommendation: To provide a consistent increase of the 5+ exploitable biomass, Scientific Council recommended that fishing mortality in 2010 should be reduced to a level not higher than $F_{0.1}$.

Special Comments: A minority view on the advisability of basing advice on updated projections from the 2008 assessment was filed by Japan.

The Council reiterates its concern that the catches taken from this stock consist mainly of young, immature fish of ages several years less than that at which sexual maturity is achieved. In recent years, the proportion of older individuals in the catch has decreased.

Scientific Council noted that the prospects of rebuilding this stock have been compromised by catches that have exceeded the Rebuilding Plan TACs.

Scientific Council expressed concern that most of the year-classes which will recruit to the exploitable biomass in coming years (as estimated from the 2008 assessment) have been estimated to be well below average.

Scientific Council reviewed the issue of using CPUE indices in the assessment and confirmed its view that CPUE indices for this stock should not be interpreted to reflect stock size.

During previous assessments, Scientific Council has noted that fishing effort should be distributed in a similar fashion to biomass distribution in order to ensure sustainability of all spawning components.

Sources of Information: SCR Doc. 08/48, 09/08, 12, 19, 22, 33, 37, 38, 39; SCS Doc. 09/5, 9, 12, 13, 14, 20; FC Doc. 03/13

Redfish in Div. 3LN

This stock was put on a three-year assessment schedule beginning in 2007 and following a thorough assessment that year Scientific Council provided advice on Redfish in Div. 3LN for 2008-2010. In September 2007 the Fisheries Commission requested another thorough assessment be conducted in 2008. Based on the 2008 assessment Scientific Council revised its advice for 2009 only, noting that advice for 2010 would be subject to a review of the interim monitoring assessment to be conducted in 2009.

The Scientific Council reviewed the status of Div. 3LN redfish (interim monitor) at this June 2009 meeting, and found no significant change in the status of this stock and accordingly provided the following recommendation:

Scientific Council reiterates there is sufficient evidence from biomass indices and low recent values of the catch/biomass ratio (as a proxy for fishing mortality) to allow a small amount of directed fishing on the Div. 3LN redfish stock. Given that this species is relatively long-lived and slow growing, Scientific Council **recommended** that *a precautionary adaptive management approach be adopted to determine how resilient the stock is to a slight increase in exploitation, and that this be monitored closely.* Acknowledging the increase in bycatch from 5% to 10% in 2008 did not result in elevated exploitation levels, Scientific Council **recommended** that *total catch of Div. 3LN redfish in 2010 not exceed 3 500 t. This catch should include any directed catches and all bycatches of Div. 3LN redfish taken in other fisheries.*

The next assessment of this stock will be in 2010.

b) Request for Advice on TACs and Other Management Measures for the Years 2010 and 2011

The Fisheries Commission at its meeting of September 2008 reviewed the assessment schedule of the Scientific Council and with the concurrence of the Coastal State agreed to request advice for certain stocks on either a two-year or three-year rotational basis. In recent years, thorough assessments of certain stocks have been undertaken outside of the assessment cycle either at the request of Fisheries Commission or by the Scientific Council given recent stock developments.

The Fisheries Commission requested in 2008 that American plaice in Div. 3LNO and yellowtail flounder in Div. 3LNO be assessed in the same year. This required a thorough assessment of yellowtail flounder at this meeting. In 2008, the Scientific Council also noted that it would undertake a thorough assessment in 2009 for cod in Div. 3M.

This section presents those stocks for which the Scientific Council provided advice for the years 2010 and 2011, with the next assessment due in 2011. For the reasons explained below, Scientific Council provided advice for cod in Div. 3M for 2010 only with the next assessment being due in 2010.

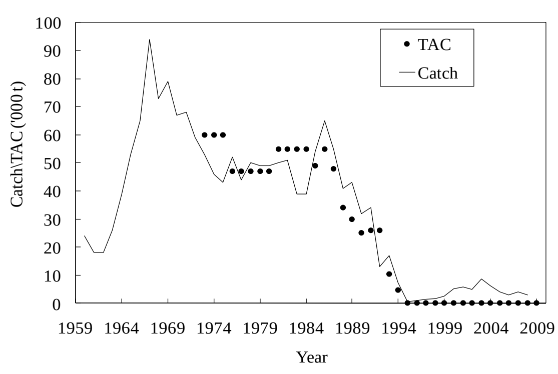
American plaice in Div. 3LNO

Background: Historically, American plaice in Div. 3LNO has comprised the largest flatfish fishery in the Northwest Atlantic.

Fishery and Catches: In most years the majority of the catch has been taken by offshore otter trawlers. There was no directed fishing in 1994 and there has been a moratorium since 1995. Catches increased from 1995 until 2003 after which they began to decline.

	Catch ('000 t)		TAC ('000 t)	
Year	STACFIS	21A	Recc.	Agreed
2006	2.8	0.9[1]	ndf	ndf
2007	3.6	1.0[1]	ndf	ndf
2008	2.5	1.9[1]	ndf	ndf
2009			ndf	ndf

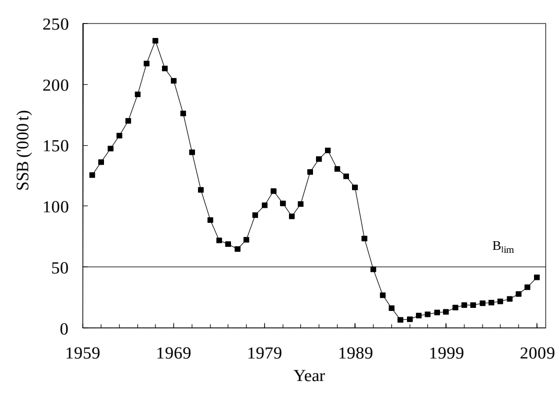
[1] Provisonal
ndf No directed fishing



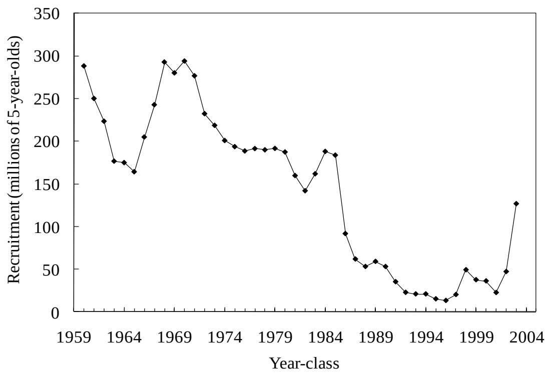
Data: Biomass and abundance data were available from several surveys. Age data from Canadian bycatch as well as length data from bycatch from Russia, EU-Spain and EU-Portugal were available.

Assessment: An analytical assessment using the ADAPTive framework tuned to the Canadian spring, Canadian autumn and the Spanish Div. 3NO surveys were used. Natural mortality was assumed to be 0.2 except from 1989 to 1996 where it was set at 0.53.

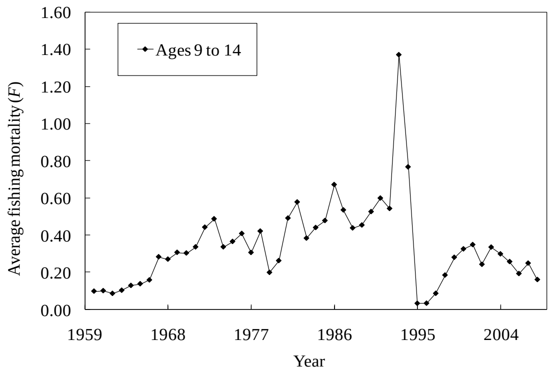
Biomass: Biomass and SSB are very low compared to historic levels. SSB declined to the lowest estimated level in 1994 and 1995. It has been steadily increasing since then and is currently at 41 000 t.



Recruitment: Estimated recruitment at age 5 indicates that the 2003 year class is the largest since the 1985 year class.



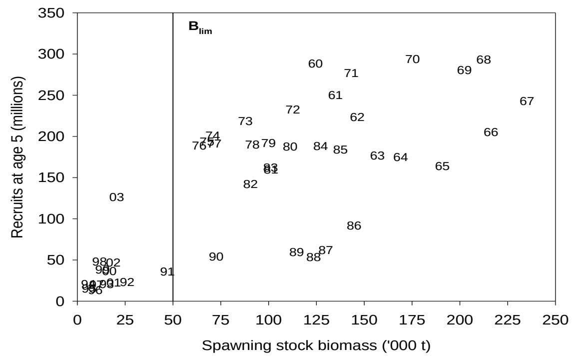
Fishing mortality: Since 1995, the average fishing mortality on ages 9 to 14 increased but since 2003 has declined.

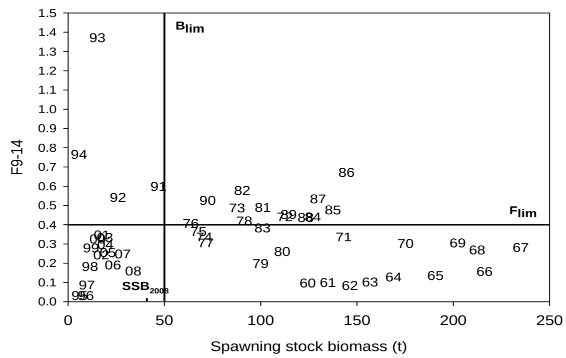


State of the Stock: The stock remains low compared to historic levels although SSB is approaching B_{lim}.

Recommendation: There should be no directed fishing on American plaice in Div. 3LNO in 2010 and 2011. Bycatches of American plaice should be kept to the lowest possible level and restricted to unavoidable bycatch in fisheries directing for other species.

Reference Points: Good recruitment has rarely been observed in this stock when SSB has been below the currently estimated B_{lim} of 50 000 t. In the current assessment Scientific Council adopted an F_{lim} of 0.4 consistent with stock history and dynamics for this stock. The stock is currently below B_{lim} and current fishing mortality is below F_{lim}.





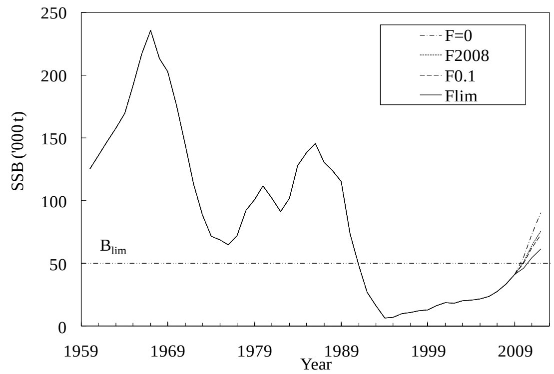
Short term considerations: Deterministic projections were conducted to predict stock biomass over the next 3 years. Projections were limited to 3 years as extended projections are increasingly driven by recruitment assumptions. Spawner biomass, biomass and catch were projected assuming F=0, $F=F_{2008}$ (0.16), $F=F_{0.1}$ (0.2) and F_{lim} (0.4) (shown below).

	SSB ('000 t)			
Year	F=0	F_{2008} = 0.16	$F_{0.1}$ = 0.2	F_{lim} = 0.4
2010	55	52	51	47
2011	73	65	63	55
2012	91	76	73	61

	Biomass ('000 t)			
Year	F=0	F_{2008} = 0.16	$F_{0.1}$ = 0.2	F_{lim} = 0.4
2010	100	96	93	91
2011	119	110	108	99
2012	139	123	120	108

	Catch (t)			
Year	F=0	F_{2008} = 0.16	$F_{0.1}$ = 0.2	F_{lim} = 0.4
2010	0	5640	6756	11058
2011	0	6657	7795	11611
2012	0	7857	9050	12746

The stock is estimated to increase and will likely surpass B_{lim} by 2010 under all fishing mortality scenarios considered (except for F_{lim}).



Special Comment: Scientific Council notes that levels of bycatch allowed for this stock in the yellowtail flounder fishery have been increased for 2009 and 2010 and this is likely to result in an increase in fishing mortality.

The next full assessment of this stock will be conducted in 2011.

Sources of Information: SCS Doc. 09/ 2, 5, 9, 12, 14; SCR Doc. 09/8, 23, 35, 36

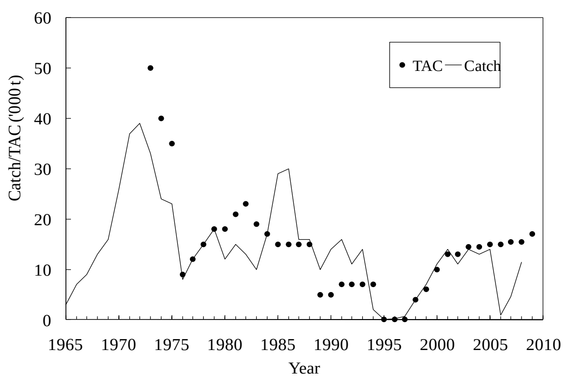
Yellowtail flounder in Div. 3LNO

Background: The stock is mainly concentrated on the southern Grand Bank and is recruited from the Southeast Shoal area nursery ground, where the juvenile and adult components overlap in their distribution.

Fishery and Catches: There was a moratorium on directed fishing from 1994 to 1997, although small catches were taken as bycatch in other fisheries. The fishery was re-opened in 1998 and catches increased from 4 400 t in 1998 to 13 900 t in 2005. TACs were exceeded each year from 1985 to 1993, and 1998-2001, but not since 2002. In 2006 and 2007 catches were much lower than the TACs of 15 500 t. In 2008, catches increased to 11 400 t, but remained lower than the TAC of 15 500 t.

	Catch ('000 t)		TAC ('000 t)	
Year	STACFIS	21A	Recommended	Agreed
2006	0.9	0.6	15.0	15.0
2007	4.4	4.6[1]	15.5	15.5
2008	11.3	11.4[1]	15.5	15.5
2009			<85% F_{msy}	17.0

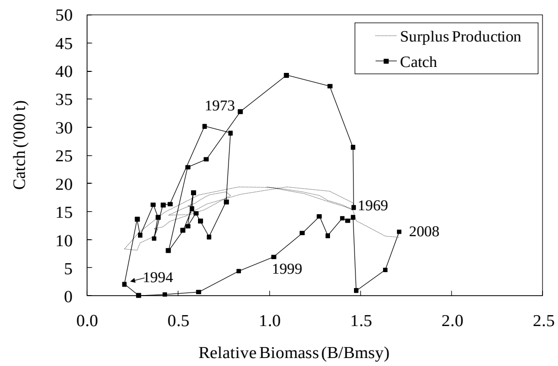
[1] Provisional.



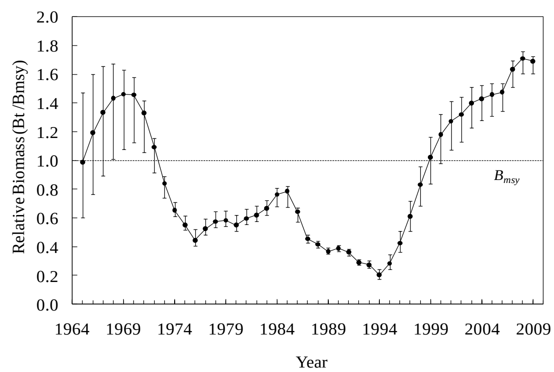
Data: Abundance and biomass indices were available from: annual Canadian spring (1971-1982; 1984-2008) and autumn (1990-2008) bottom trawl surveys; annual USSR/Russian spring surveys (1972-91); and Spanish surveys in the NAFO Regulatory Area of Div. 3NO (1995-2008).

Assessment: An analytical assessment using a stock production model was accepted to estimate stock status in 2009.

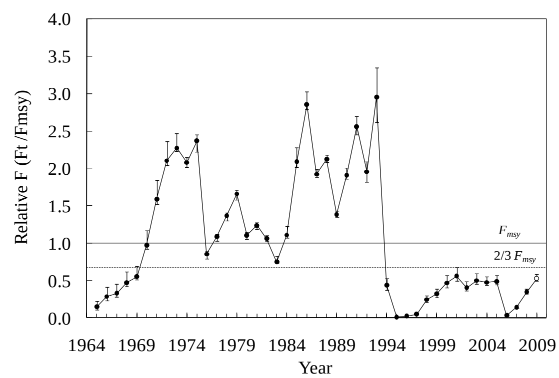
Biomass: Since the moratorium in 1994-1997, the catches have been low enough each year to allow the stock to grow.



Biomass estimates in all surveys have been relatively high since 2000. Relative biomass from the production model has been increasing since 1994, is estimated to be above the level of B_{msy} after 1999, and is 1.6 times B_{msy} in 2009.



Fishing Mortality: *F* has been below F_{msy} since 1994. In 2008, *F* was about 34% of F_{msy}, and is projected to be about 53% of F_{msy} in 2009 with an assumed catch of 17 000 t (TAC).



Recruitment: Based on a comparison of small fish (<22 cm) in research surveys, recent recruitment appears to be slightly below average.

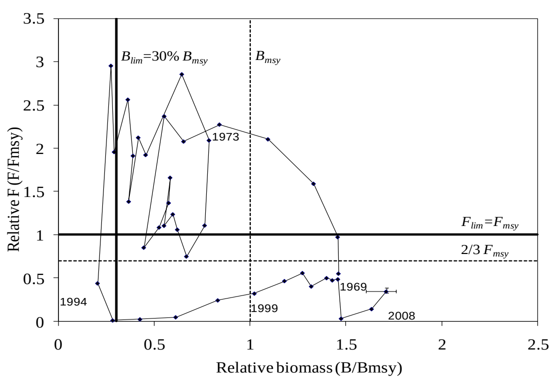
State of Stock: Stock size has steadily increased since 1994 and is currently estimated to be 1.6 times B_{msy}.

Catch Projections in 2010-2011: Catch projections (in '000 t) at various levels of F are shown below.

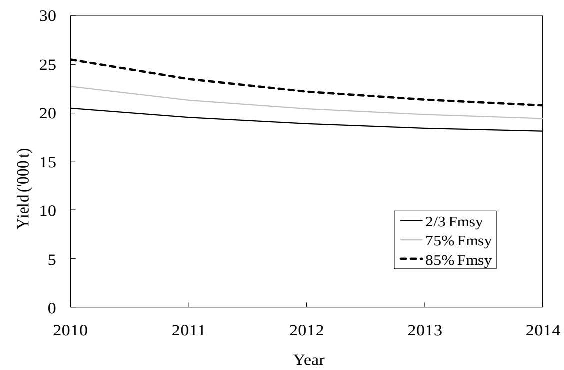
Projected F	Catch 2010	Catch 2011
F_{2009} (catch=17 000t)	16.4	16.0
2/3 F_{msy}	20.5	19.5
75% F_{msy}	22.7	21.3
85% F_{msy}	25.5	23.5
F_{msy}	29.6	26.5

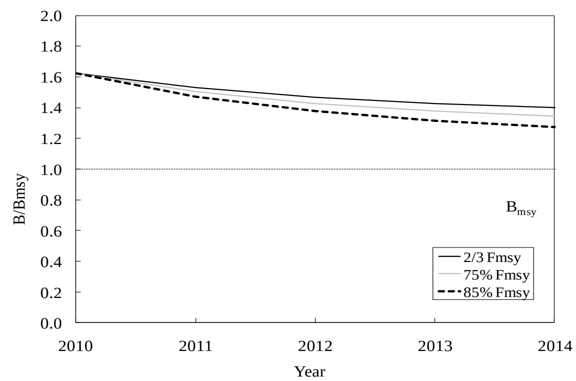
Recommendation: Although biomass is well above B_{msy}, Scientific Council does not consider it prudent to fish above 85% F_{msy} because of the uncertainty in the estimation of F_{msy}. Scientific Council therefore recommended any TAC option up to 85% F_{msy} for 2010 and 2011.

Reference Points: Scientific Council considered that 30% B_{msy} is a suitable limit reference point (B_{lim}) for this stock and that the limit reference point for fishing mortality (F_{lim}) should be no higher than F_{msy}. Currently the biomass is estimated to be above B_{lim} and F below F_{lim}, so the stock is in the safe zone as defined in the NAFO Precautionary Approach Framework.



Medium Term Considerations: F_{msy} was estimated to be 0.25. Projections were made to estimate catch for each year from 2010 to 2014 at a range of fishing mortalities. Although yields are projected to decline in the medium term at the levels of F examined (2/3 F_{msy}, 0.75 F_{msy} and 0.85 F_{msy}), at the end of the projection period, biomass is still projected to be above B_{msy}.





Special Comment: Scientific Council noted that the yellowtail flounder fishery takes cod and American plaice as bycatch. Hence, in establishing the TAC for yellowtail flounder, the impacts on Div. 3NO cod and Div. 3LNO American plaice of any increase in yellowtail flounder TAC should be considered.

The next Scientific Council assessment of this stock will be in 2011.

Sources of Information: SCR Doc. 09/9, 12, 31, 32; SCS Doc. 09/5, 9, 12, 13.

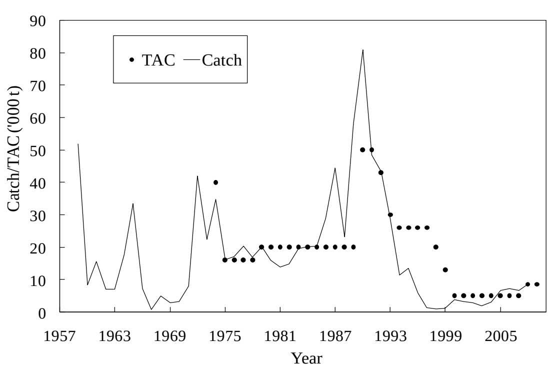
Redfish in Div. 3M

Background: There are three species of redfish, which are commercially fished on Flemish Cap: deep-water redfish *(Sebastes mentella*), golden redfish (*Sebastes marinus*) and Acadian redfish (*Sebastes fasciatus*). The present assessment evaluates the status of the Div. 3M beaked redfish stock, regarded as a management unit composed of two populations from two very similar species (*Sebastes mentella* and *Sebastes fasciatus*). The reason for this approach is that evidence indicates this is the dominant redfish group on Flemish Cap.

Fishery and Catches: The redfish fishery in Div. 3M increased from 20 000 t in 1985 to 81 000 t in 1990, falling continuously since then until 1998-1999, when a minimum catch around 1 100 t was recorded mostly as bycatch of the Greenland halibut fishery. An increase of the fishing effort directed to Div. 3M redfish is observed during the first years of the present decade, pursued by EU-Portugal and Russia fleets. A new golden redfish fishery occurred on the Flemish Cap Bank from September 2005 onwards on shallower depths above 300 m, basically pursued by Portuguese bottom trawl and Russia pelagic trawl. This new reality implied a revision of catch estimates, in order to split recent commercial catch from the major fleets on Div. 3M into golden and beaked redfish catches. In 2001-2003 the redfish bycatch in numbers from the Flemish Cap shrimp fishery was 78% of the total catch numbers, declining to 44% in 2004 and 15% in 2005.

	Catch ('000 t)			TAC ('000 t)	
Year	STACFIS		21A	Recommended	Agreed
2006	7.2[1]	6.3[2]	6.3	3-5	5
2007	6.7[1]	5.5[2]	5.6[3]	3-5	5
2008	8.5[1]	3.2[2]	6.8[3]	5	8.5
2009				5	8.5

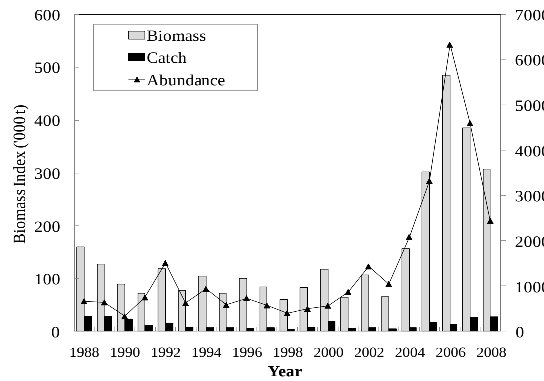
[1] Estimated total redfish catch
[2] Estimated beaked redfish catch
[3] Provisional



Data: Catch-at-age data were available from 1989-2008, including bycatch information from the shrimp fishery.

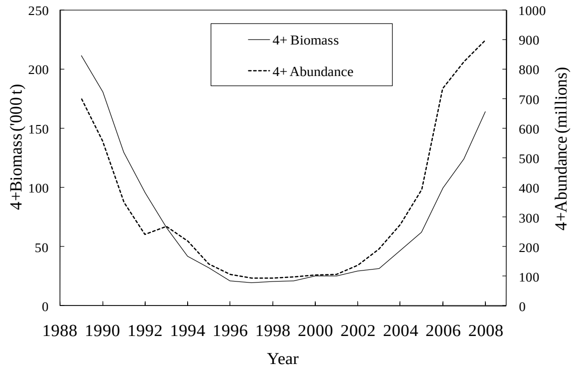
There are three bottom trawl survey series providing biomass indices as well as length and age data for the Flemish Cap redfish stocks; Russia (1983-1993, 1995-1996 and 2001-2002), EU (1988-2008) and Canada (1979-1985 and 1996). The Russian survey was complemented with an acoustic estimate of the redfish pelagic component for the 1988-1992 period.

Assessment: Survey bottom biomass and female spawning biomass were calculated from 1988-2008 EU surveys.

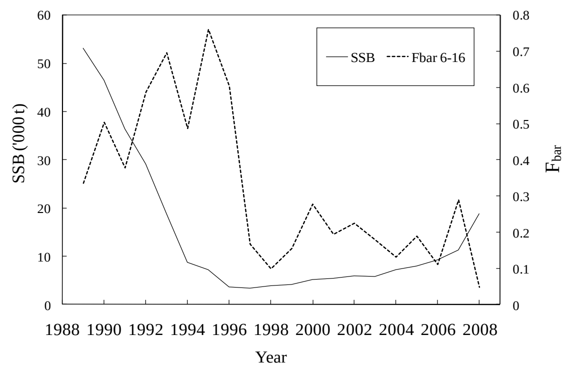


A virtual population (XSA) was carried out for 1989-2008. The assessment was consistent with the results of the 2005 and 2007 XSAs. Although the assessment was accepted it exhibit poor diagnostics and was not considered reliable for projections.

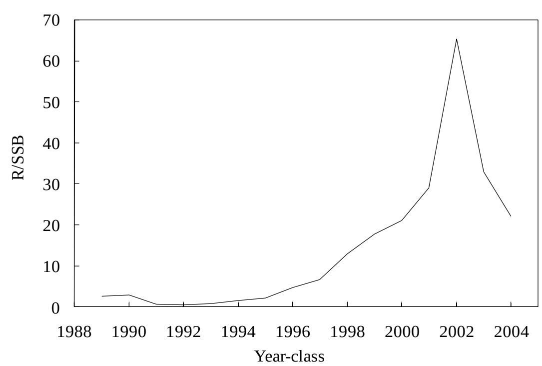
Biomass: The fishable biomass experienced a steep decline from the 1989 until 1996. Biomass is growing since 1998 but at a slow rate until 2003, basically still supported by the biomass of those 1989 and 1990 cohorts and the biomass growth of incoming weak year classes (1991-1997), that despite their small size survived at much higher rates than their predecessors. Over the most recent years biomass is increasing faster, reaching a level only surpassed in 1989 and 1990. Female SSB is growing continuously from 1998 onwards and has reached the level of the early 1990s.



Fishing Mortality: Fishing mortality was at a high level until 1996 and dropped to a low level since 1997.



Recruitment: Since 2002 recruitment at age 4 has been above the 1985-2004 average. Meanwhile recruits per thousand tons of SSB have increase substantially.



State of the Stock: Scientific Council concluded that the stock biomass and spawning biomass are increasing. Nonetheless the spawning stock is currently still at a low level compared to the earlier period in the time series. At the low fishing mortalities of the most recent years and with growth of the relatively strong recent year-classes, spawning biomass should continue to increase.

Recommendation: Low fishing mortalities should be maintained so as to promote female spawning stock recovery. Scientific Council recommended that catch for all redfish in Div. 3M in 2010 and 2011 should not exceed 8 500 t which is in the range of catches in recent years.

Reference Points: No updated information on biological reference points was available.

Special Comments: The next assessment will be in 2011.

Sources of Information: SCR Doc. 09/29; SCS Doc. 09/5, 9, 10, 14.

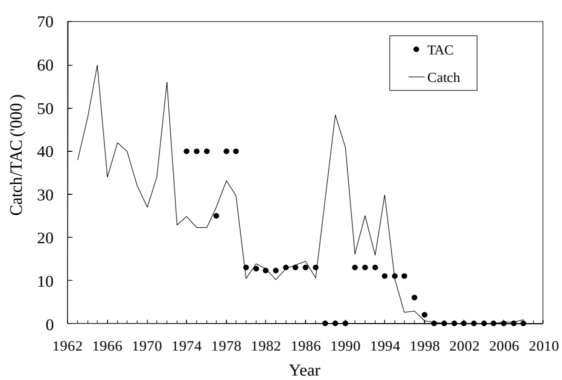
Cod in Div. 3M

Background: The cod stock in Flemish Cap is considered to be a discrete population.

Fishery and Catches: Catches exceeded the TAC from 1988 to 1994, but were below the TAC from 1995 to 1998. Catches taken by vessels from non-Contracting Parties have been important in some years. Large numbers of small fish were caught by the trawl fishery in the past, particularly during 1992-1994. Bycatch was estimated to be low in the shrimp fishery since 1993. Catches since 1996 were very small compared with previous years. The directed fishery was closed in 1999. Yearly bycatch between 2000 and 2005 were below 60 t, rising to 339 and 345 t in 2006 and 2007, respectively. In 2008 the bycatch increased to 889 t.

	Catch ('000 t)		TAC ('000 t)	
Year	STACFIS	21A	Recommended	Agreed
2006	0.3	0.1	ndf	ndf
2007	0.3	0.1[1]	ndf	ndf
2008	0.9	0.4[1]	ndf	ndf
2009			ndf	ndf

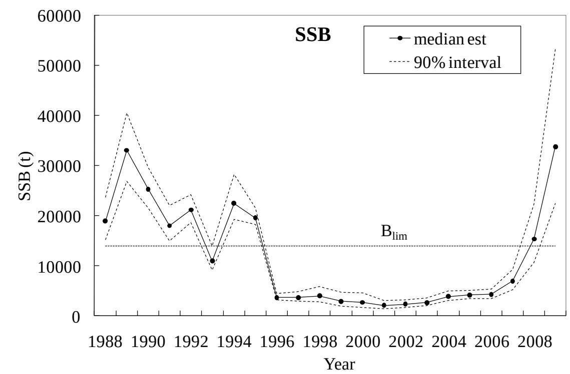
[1] Provisional.
ndf No directed fishing.



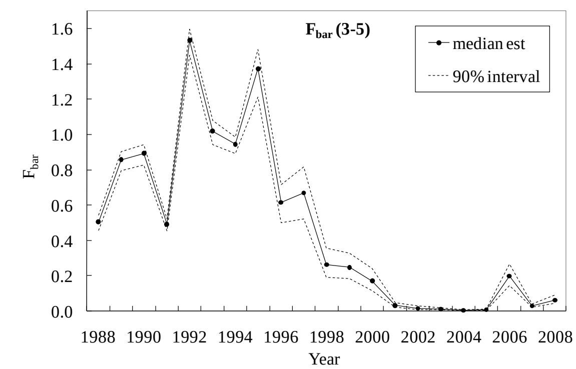
Data: Length and age compositions of the 2002-2005 bycatch were not available. Length distributions were available for 2006-2008, although sampling levels were low. Abundance at age indices were available from the EU bottom trawl survey since 1988, covering the whole distribution area of the stock. Survey age-length keys were applied to the bycatch.

Assessment: An analytical assessment based on an age-structured model was accepted to estimate the state of the stock.

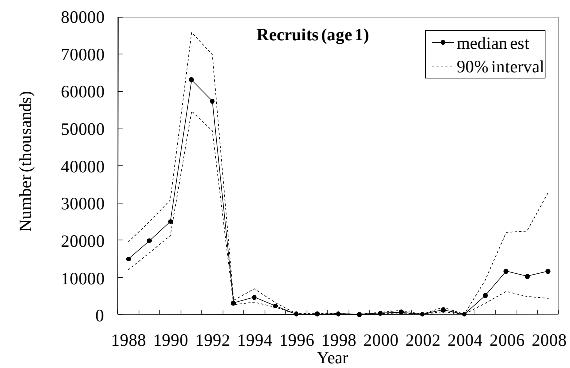
Biomass: Spawning biomass has increased in recent years, with the increases in 2008 and 2009 largely due to the recruitments in 2005-2007. However, the composition of 2007-2009 spawning biomass is unusual, as population numbers are still much lower than before 1995. This is explained by the fact that fish are now heavier at age than they were then and are maturing at younger ages.



Fishing mortality: Very low since 2001.



Recruitment: After recruitment failures during 1996-2004, values are higher in 2005-2008, although still below the levels of the late 1980s and early 1990s.



State of the Stock: Despite the significant spawning biomass increase, stock numbers are still lower than before 1995. As a result of changes noted in weight and maturity, it is unclear whether the meaning of spawning biomass as an indicator of stock status is the same as in the earlier period. Whereas recruitment has been better during 2005-2008, it is below levels in the earlier period.

Reference Points: A spawning biomass of 14 000 t has been identified as B_{lim} for this stock. There is a high probability that spawning biomass is above B_{lim} in 2009.

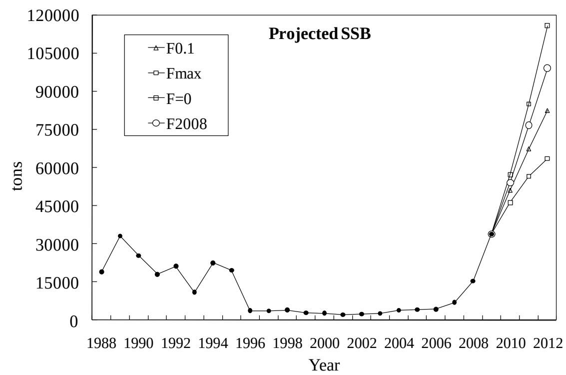
Stock Projections: Stochastic projections were performed for 2010-2012 under four fishing mortality scenarios: (1) $F_{bar} = F_{0.1}$ (median = 0.135); (2) $F_{bar} = F_{max}$ (median = 0.245); (3) $F_{bar} = 0$; (4) $F_{bar} = F_{2008}$ (median = 0.062).

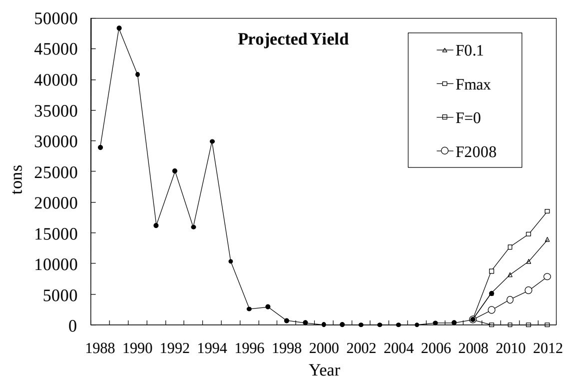
The 2009 catches were generated from each of the fixed F options considered. Under all scenarios, SSB has a high probability of growing to levels greater than all of the 1988-2009 estimates. However, the weights and maturities at age used in the projections were drawn from those in the last three years (much improved from those in the earlier period). If these conditions do not persist, projection results will be overly optimistic.

Projected values for 2010-2012 are heavily reliant on the relatively abundant four most recent cohorts rather than on healthy population abundances across all ages.

	SSB			Yield		
	5%	50%	95%	5%	50%	95%
$F_{bar}=F_{0.1}$ (median=0.135):						
2009	22418	33979	53143	3176	5157	8369
2010	34128	51030	77397	4899	8173	13800
2011	43499	67372	113316	5671	10335	19982
2012	46992	82485	181975	6573	13904	32655
$F_{bar}=F_{max}$ (median=0.245):						
2009	22549	33993	52380	5343	8792	14822
2010	31017	46202	70864	7695	12716	21737
2011	35445	56535	98980	7798	14818	30540
2012	34384	63551	156406	8483	18528	48392

	SSB			Yield		
	5%	50%	95%	5%	50%	95%
$F_{bar}=0$						
2009	22488	34198	52821	0	0	0
2010	38836	57230	87119	0	0	0
2011	56096	85018	139930	0	0	0
2012	68711	115838	234925	0	0	0
$F_{bar}=F_{2008}$ (median=0.062):						
2009	22424	33922	52691	1639	2445	3699
2010	36590	54010	82951	2734	4125	6497
2011	50221	76569	126445	3319	5639	10133
2012	58229	99110	206601	4075	7866	16419





Recommendation: Scientific Council considers that there is sufficient evidence to allow a small amount of directed fishing on this stock. Considering the relatively low number of mature individuals currently in the stock, Scientific Council advises that a fishing mortality for 2010 not to exceed F_{2008} will allow further recovery of the stock.

Special Comments: Since the current status and also short term development of this stock is dependent on recent year classes, Scientific Council has scheduled this stock for a full assessment in 2010.

As a redfish fishery has developed in recent years in depths shallower than 350 m, and as cod is a bycatch species in that fishery, it may be expected that fishing mortality levels will increase during the next few years and may cause stock decline.

Sources of Information: SCR Doc. 09/19, 34; SCS Doc. 09/5, 12, 14.

White hake in Div. 3NOPs

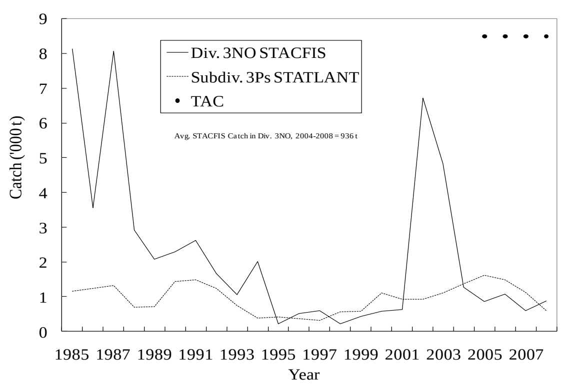
Background: The stock area, defined by Scientific Council as Div. 3NOPs, is mainly concentrated in southern Subdiv. 3Ps and on the southwestern Grand Bank. Scientific Council is asked to provide advice on the portion of the stock in Div. 3NO only.

Fishery and Catches: Catches in Div. 3NO peaked in 1985 at 8 100 t, then declined from 1988 to 1994 (2 090 t average). Average catch was at its lowest in 1995-2001 (464 t); then increased to 6 752 t and 4 841 t in 2002 and 2003, respectively. Total catch decreased to an average of 848 t in 2006-2008.

Catches of white hake in Subdiv. 3Ps were at their highest in 1985-1993, averaging 1 114 t, decreasing to an average of 668 t in 1994-2003. Subsequently, catches in Subdiv. 3Ps have averaged 1 068 t during the period 2006-2008.

	Catch ('000 t)			TAC ('000 t)
	Div. 3NO		Subdiv. 3Ps	Div. 3NO
Year	STACFIS	21A	21A	
2006	1.1	1.2	1.3	8.5
2007	0.6	0.6[1]	1.1[1]	8.5
2008	0.9	0.8[1]	0.6[1]	8.5
2009				8.5

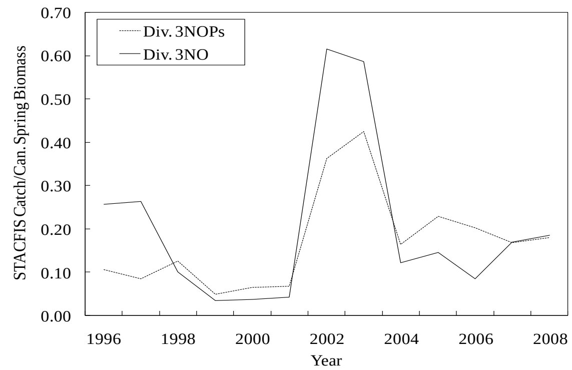
[1] Provisional.



Data: Length frequency data from the Canadian fishery (1994-2008), EU-Spain (2002, 2004), EU-Portugal (2003-2004, 2006-2008), and Russia (2000-2008) were available. Biomass and abundance indices were available from annual Canadian spring bottom trawl surveys in Div. 3NOPs (1972-2008), autumn in Div. 3NO (1990-2008), and Spanish Div. 3NO spring surveys in the NAFO Regulatory Area (2001-2008).

Assessment: No analytical assessment was possible.

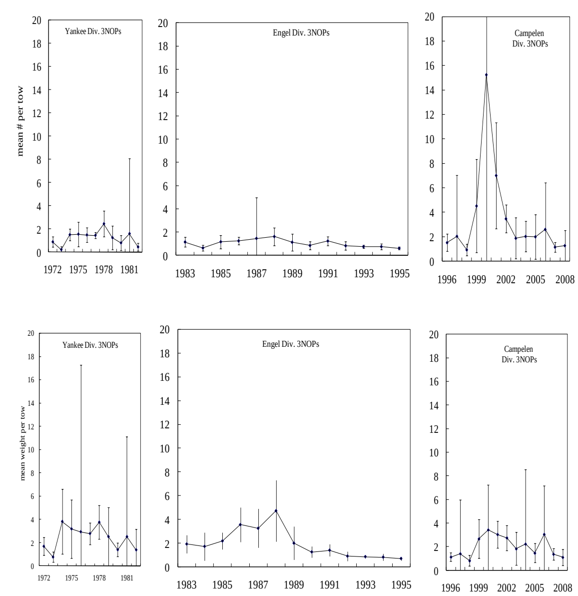
Fishing Mortality: *Relative F* (STACFIS catch/ Canadian spring survey biomass ratio) has fluctuated, but increased for 2002-2003. Current estimates of *relative F* are comparable to levels observed in 1996-2001.



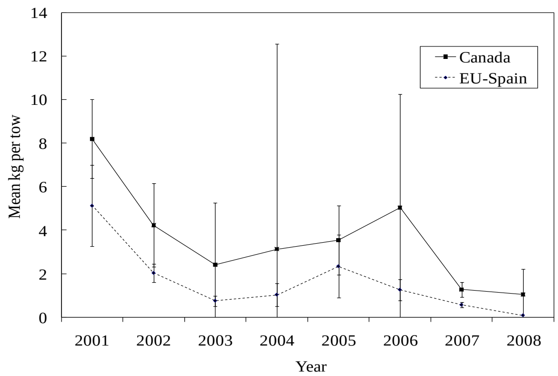
Recruitment: The 1999 year-class was large, but no large year class has been observed since then.

Biomass: The biomass of this stock increased in 2000 with the large 1999 year-class. Subsequently, the biomass index has decreased to levels comparable to those observed in 1996-1998 in the Canadian Campelen time series.

Canadian Spring Survey



Comparison of the Canadian Spring survey in all of Div. 3NO and the Spanish Div. 3NO Survey in the NRA



State of the Stock: The biomass of this stock increased in 2000 with the large 1999 year-class. Subsequently, the biomass index has decreased and remains at levels comparable to the beginning of the Canadian Campelen time series in 1996-1998.

Recommendation: Given the current level of recruitment, Scientific Council advises that catch of white hake in Div. 3NO, at the current TAC of 8 500 t, is unrealistic. Catches in Div. 3NO for 2010 and 2011 should not exceed the 2006-2008 average annual catch level of 850 t. Catches in Subdiv. 3Ps for 2010 and 2011 should not exceed the 2006-2008 average annual catch level of 1 050 t.

Reference Points: Scientific Council was unable to define reference points for this stock.

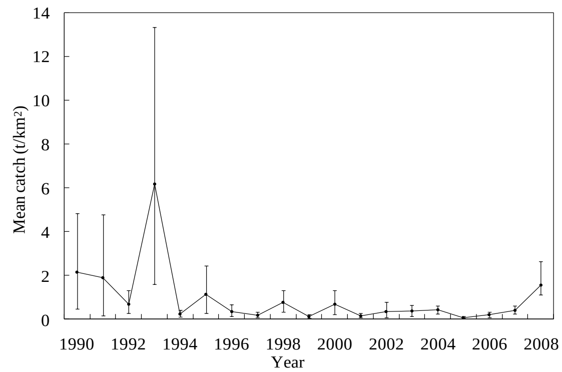
Special Comments: The next assessment of this stock will be in 2011.

Sources of Information: SCR Doc. 09/10, 28; SCS Doc. 09/5, 09, 12, 13.

Capelin in Div. 3NO

Fishery and Catches: There has not been a directed fishery since 1993 when a moratorium was established, and no commercial catches have been reported since then.

Year	Catch ('000 t)	TAC ('000 t)
2006	0	0
2007	0	0
2008	0	0
2009		0



Data: Capelin catches are from the Canadian bottom trawl surveys conducted in 1990-2008, as well as historical data sets from Russian and Canadian trawl-acoustic surveys directed to capelin.

Assessment: The only information available is a series of biomass estimates obtained during Canadian stratified-random bottom trawl surveys, but it is not clear that capelin indices from these surveys reflect the real stock distribution and stock status.

No analytical assessment was possible with current data.

State of the Stock: It is not clear that the data satisfactorily reflect the stock distribution and stock status. Nevertheless, and in spite of recent increases in survey indices, Scientific Council was unable to consider that the stock is at other than a relatively low level.

Recommendation: Scientific Council recommended no directed fishery on capelin in Div. 3NO in 2010-2011.

Reference Points: Scientific Council is not in a position to propose reference points at this time.

Special Comments: Scientific Council recognizes the role that capelin play in the Northwest Atlantic ecosystem as a very important prey species for fish, marine mammals and seabirds.

Historically, the spawning biomass was determined through the use of hydroacoustics.

The next assessment will be in 2011.

Source of Information: SCR Doc. 09/14.

c) Monitoring of Stocks for which Multi-year Advice was Provided in 2007 or 2008

(i) Finfish

The Scientific Council previously provided multi-year advice for the following stocks:

In 2008: 2-year advice (for 2009 and 2010) for thorny skate in Div. 3LNOPs; 3-year advice (for 2009, 2010 and 2011) for witch flounder in Div. 3NO, and American plaice in Div. 3M.

In 2007: 3-year advice (for 2008, 2009 and 2010) was provided for redfish in Div. 3O, cod in Div. 3NO, and witch flounder in Div. 2J+3KL.

The Scientific Council reviewed the status of these stocks (interim monitoring) at this June 2009 meeting, and found no significant change in any of these stocks to alter the multi-year advice previously provided. Accordingly, the Council reiterates this previous advice as follows:

Recommendation for thorny skate in Div. 3LNOPs: To promote recovery of thorny skate, Scientific Council recommended that catches for 2010 should not exceed 6 000 t (the average catch during the past three years [2005-2007]) in NAFO Div. 3LNOPs.

Recommendation for witch flounder in Div. 3NO: No directed fishing on witch flounder in 2010 and 2011 in Div. 3NO to allow for stock rebuilding. Bycatches in fisheries targeting other species should be kept at the lowest possible level.

Recommendation for American plaice in Div. 3M: Scientific Council recommended that there should be no directed fishery on American plaice in Div. 3M in 2010 and 2011. Bycatch should be kept at the lowest possible level.

Recommendation for redfish in Div. 3O: Catches have averaged about 13 000 t since 1960 and over the long term, catches at this level appear to have been sustainable. The Scientific Council noted that over the period from 1960 to 2006, a period of 47 years, catches have surpassed 20 000 t in only three years. The Scientific Council noted there is insufficient information on which to base predictions of annual yield potential for this resource. Stock dynamics and recruitment patterns are also poorly understood. Scientific Council is unable to advise on an appropriate TAC for redfish in Div. 3O in 2010.

Recommendation for cod in Div. 3NO: There should be no directed fishing for cod in Div. 3NO in 2010. Bycatches of cod should be kept to the lowest possible level and restricted to unavoidable bycatch in fisheries directed for other species. Efforts should be made to reduce current levels of bycatch.

Recommendation for witch flounder in Div. 2J+3KL: No directed fishing on witch flounder in 2010 in Div. 2J+3KL to allow for stock rebuilding. Bycatches of witch flounder in fisheries targeting other species should be kept at the lowest possible level.

The Council also notes that for two other stocks on a multi-year schedule (yellowtail flounder in Div. 3LNO and cod in Div. 3M) a thorough assessment was completed at this meeting and advice is provided in section VII.1.b.

(ii) Northern shortfin squid in SA 3+4

It was noted that while an interim monitoring assessment of northern shortfin squid was requested by the Fisheries Commission, a designated expert is still not in place for this stock An interim monitoring report was completed and found no significant change in the status of this stock and therefore Scientific Council advises that the TAC for 2010 be set between 19 000 and 34 000 t. Owing to the special life history and biology of this species, Scientific Council will be unable to conduct further assessments or monitoring of this stock until an assessment expert with appropriate knowledge of the species can be designated.

d) Special Requests for Management Advice

i) The Precautionary Approach

The Fisheries Commission requested:

4. Noting the Precautionary Approach Framework as endorsed by Fisheries Commission, the Fisheries Commission requests that the Scientific Council provide the following information for the 2009 Annual Meeting of the Fisheries Commission for all stocks under its responsibility requiring advice for 2010:

a) the limit and precautionary reference points as described in Annex II of the UN Fisheries Agreement indicating areas of uncertainty (for those stocks for which precautionary reference points cannot be determined directly, proxies should be provided);

b) the stock biomass and fishing mortality trajectory over time overlaid on a plot of the PA Framework (for those stocks where biomass and/or fishing mortality cannot be determined directly, proxies should be used);

c) information regarding the current Zone the stock is within as well as proposals regarding possible harvest strategies to move the resource to (or maintain it in) the Safe Zone including medium term considerations and associated risk or probabilities which will assist the Commission in developing the management strategies described in paragraphs 4 and 5 of Annex II in the Agreement. (Item 4)

5. The following elements should be taken into account by the Scientific Council when considering the Precautionary Approach Framework:

a) References to "risk" and to "risk analyses" should refer to estimated probabilities of stock population *parameters falling outside biological reference points.*

b) Where reference points are proposed by the Scientific Council as indicators of biological risk, they should be accompanied by a description of the nature of the risk associated with crossing the reference point such as recruitment overfishing, impaired recruitment, etc.

c) When a buffer reference point is proposed in the absence of a risk evaluation in order to maintain a low probability that a stock, measured to be at the buffer reference point, may actually be at or beyond the limit reference point, the Scientific Council should explain the assumptions made about the uncertainty with which the stock is measured.

d) Wherever possible, short and medium term consequences should be identified for various exploitation rates (including no fishing) in terms of yield, stability in yield from year to year, and the risk or probability of maintaining the stock within, or moving it to, the Safe Zone. Whenever possible, this information should be cast in terms of risk assessments relating fishing mortality rates to the trends in biomass (or spawning biomass), the risks of stock collapse and recruitment overfishing, as well as the risks of growth overfishing, and the consequences in terms of both short and long term yields.

e) When providing risk estimates, it is very important that the time horizon be clearly spelled out. By way of consequence, risks should be expressed in timeframes of 5, 10 and 15 years (or more), or in terms of other appropriate year ranges depending on stock specific dynamics. Furthermore, in order to provide the Fisheries Commission with the information necessary to consider the balance between risks and yield levels, each harvesting strategy or risk scenario should include, for the selected year ranges, the risks and yields associated with various harvesting options in relation to Blim, and Flim and target F reference points selected by managers. (Item 5)

The Chair noted that the reference points indicated in the Fisheries Commission request, and the analyses of risks and associated projections, were being applied to individual stock assessments where possible.

ii) Evaluation of rebuilding and recovery plans

The Fisheries Commission requested: *Many of the stocks in the NAFO Regulatory Area are well below any reasonable level of B_{lim} or B_{buf}. For these stocks, the most important task for the Scientific Council is to inform on* *how to rebuild the stocks. In this context and building on previous work of the Scientific Council in this area, the Scientific Council is requested to evaluate various scenarios corresponding to recovery plans with timeframes of 5 to 10 years, or longer as appropriate. This evaluation should provide the information necessary for the Fisheries Commission to consider the balance between risks and yield levels, including information on the consequences and risks of no action at all.*

a) information on the research and monitoring required to more fully evaluate and refine the reference points described in paragraphs 1 and 3 of Annex II of the Agreement; these research requirements should be set out in the order of priority considered appropriate by the Scientific Council;

b) any other aspect of Article 6 and Annex II of the Agreement which the Scientific Council considers useful for implementation of the Agreement's provisions regarding the precautionary approach to capture fisheries; and

c) propose criteria and harvest strategies for new and developing fisheries so as to ensure they are maintained within the Safe Zone. (Item 6)

An evaluation of management strategies for Greenland halibut in SA 2+Div. 3KLMNO can be found in section XII.6. The results of this exercise show that management strategies incorporating feed-back harvest control rules performed better than those without feedback. In addition medium term projections from 2010-2012 were conducted based on the 2008 analytical assessment results. Assuming a fixed catch of 16 000 t (the current TAC under the rebuilding plan) showed that this does not result in improvements in the 5+ biomass, since the majority of the year-classes which recruit to the exploitable biomass during the projection period are estimated to be well below average. Projections conducted assuming a fishing mortality corresponding to $F_{0.1}$ being achieved, indicate the exploitable biomass is projected to grow in the medium term.

For cod in Div. 3NO, it was noted that the Fisheries Commission (FC Doc. 07/8) rebuilding plan for Div. 3NO cod states that “for 2008 and subsequent years, Contracting Parties shall seek to achieve a targeted reduction of 40% from the average annual catch during the 2004-2006 period or, through best efforts, specifically to keep incidental bycatch at the lowest possible level.” The catch for 2008 did not decrease from 2007 and is above the average for the 2004-2006 period.

iii) Review pelagic redfish distribution and stock-affinities

The Fisheries Commission requested: *Regarding pelagic S. mentella redfish in NAFO Subareas 1-3, the Scientific Council is requested to review the most recent information available on the distribution and abundance of this resource, as well as any new information on the affinity of this stock to the pelagic redfish resource found in the ICES Sub-area XII, parts of SA Va and XIV and to the shelf stocks of redfish found in ICES Sub-areas V, VI and XIV, and NAFO Subareas 1-3.* (Item 7)

ICES in 2008 provides advice for *S. mentella* fisheries as two distinct management units: 1) a demersal unit on the continental shelf and 2) a pelagic unit in the Irminger Sea and adjacent areas (Including NAFO Div. 1F and 2GH). However, these units were an interim procedure until a comprehensive review of stock identification information could be provided.

The Study Group on Redfish Stock Structure (WKREDS) met at ICES Headquarters on 22–23 January 2009 to review all reported material on the stock identity of the various redfish units (*Sebastes mentella*) in the Irminger Sea and adjacent waters and identify the most likely definition of biological stocks of *S. mentella* and suggest practical management units.

Based on genetic information, WKREDS concluded that there are four genetic stocks of *S. mentella* (three in the Irminger Sea and adjacent waters area):

1. ‘Western’ (NAFO 3+) – This stock extends south and west of the Flemish Cap. Synthesis of all genetic information suggests that *S. mentella* from Newfoundland and the Gulf of Saint Lawrence (NAFO SA 3 and SA 4) are genetically distinct from *S. mentella* in the rest of the North Atlantic because of strong evidence of adaptive local hybridization with *S. fasciatus*.

2. ‘Shallow Pelagic’ (NAFO 1-2, ICES Vb XII XIV <500 m) – This stock extends from Greenland and the Irminger Sea to the coast of Norway, perhaps to the Barents Sea (ICES I-II). The stock primarily consists of *S. mentella* in pelagic habitats (though demersal habitats east of the Faroe Islands appear to be part of this stock).

3. ‘Deep Pelagic’ (NAFO 1-2, ICES Vb XII XIV >500 m) – This stock also primarily consists of *S. mentella* in pelagic habitats, but includes demersal habitats west of the Faroe Islands. Note that this genetic stock does not necessarily equate to the ‘deep-sea’ phenotype.

4. ‘Icelandic Slope’ (ICES Va XIV) – The northwest Faroese Slope may be part of this stock.

Adult redfish on the Greenland Shelf have been attributed to several stocks and there remains a need to investigate the affinity of the adult *S. mentella* in this region. The east Greenland Shelf is most likely a common nursery area for the three Irminger Sea biological stocks.

Regarding the Western NAFO 3+ stock Scientific Council concluded that there is information that shows that *S. mentella* from Newfoundland and the Gulf of Saint Lawrence (NAFO SA 3 and SA 4) are genetically distinct from *S. mentella* in the rest of the North Atlantic. However this does not mean that there is only one stock in this area. Scientific Council notes that some genetic studies are being conducted to clarify the redfish stock structure in NAFO SA 3 and SA 4.

Sources of information

ICES. 2009. Report of the Workshop on Redfish Stock Structure (WKREDS). 22–23 January 2009. ICES Headquarters, Copenhagen. ICES CM 2009/ACOM:37.

Reference

Sigurdsson, T., Kristinsson, K., Rätz, H-J., Nedreaas, K. H., Melnikov, S. P. and Reinert, J. 2006. The fishery for pelagic redfish (*Sebastes mentella*) in the Irminger Sea and adjacent waters. ICES Journal of Marine Science, 63(4): 725–736.

iv) Bycatch reduction measures for cod in Div. 3NO

Noting the Fisheries Commission Rebuilding Plan for 3NO cod adopted in September 2007, Fisheries Commission requests Scientific Council: *to advise before September 2010, on possible measures the Commission may consider to ensure bycatch of cod is kept at the lowest possible level.* (Item 8)

Scientific Council responded:

In its 2008 report, Scientific Council provided information on measures to reduce bycatch of Div. 3NO cod in the yellowtail flounder fishery through changes in the timing of that fishery to avoid months with higher percentage cod bycatch.

Scientific Council asked the ICES FAO Working Group on Fishing Technology and Fish Behaviour (WGFTFB) to *advise NAFO Scientific Council on appropriate gear modification, or other technical measures relating to fishing gears, that would ensure that the bycatch of cod is kept at the lowest possible level*.

The WGFTFB reviewed the behavioural characteristics of cod and of other species which often mix with cod and considered strategies to separate cod (*Gadus morhua)* from flatfish species, including yellowtail flounder (*Limanda ferruginea)* as well as from other species (ICES, 2009). Behavioural reviews revealed that differences between cod and other species do exist, either in terms of natural separation or in their reaction to gear components. These differences and natural separation have been exploited in gear design and fishing operations. The WGFTFB identified several trawl modifications aimed at specifically separating cod from both yellowtail flounder and other flatfish species and also examined modifications to sort cod from other commercial species. WGFTFB cautions that in the absence of specific details such as gear descriptions, vessel types and management objectives, no single gear modification can be recommended at this time to NAFO.

The technical measures that can separate cod from other species rely on behavioural differences between cod and other species, either in terms of natural separation or in their reaction to gear components. The most promising measures are gear modifications of the front section of the trawl and installing a sorting device such as a rigid grid or separator panel. These do need, though, to be tailored to the specific requirements of a given fishery and limitations with all of these gears have also been identified and documented.

Trawls with modified front sections

From the gears reviewed there are a number of trawl designs such as the Faroese cutaway trawl, Ribas trawl, US Topless trawl, Danish Selective Flatfish trawl, that have adopted the same basic design principle of providing cod an escape route in the front section of the trawl. This has been achieved by either removal of the top sheet of the trawl and extension of the headline back behind the ground gear or alternatively by replacing the netting in the top sheet sections with very large mesh or rope panels. The results from these experiments seem quite variable with considerable haul to haul variation but reductions of cod of between 25-80% have been observed. In most of these trials reductions have been across all size classes, although in the Danish flatfish trawl, reductions were mainly for cod <35cm. In some of these trials there has been a reduction in flatfish catches. In the case of the US Ribas and Topless this was 30-56% for yellowtail and winter flounder above marketable size and between 75-82% for undersize flounder. Diel effects were also noted in these trials, with night tows resulting in the highest reductions in yellowtail flounder catches. Conversely in the other trials, mainly carried out in European fisheries, reductions in catches of target flatfish species such as lemon sole, plaice, dab and sole, were found to be negligible, suggesting possible differences in behaviour between flatfish species. In conclusion this type of gear modification does seem to be effective at reducing cod catches but there can be considerable variation due to diurnal conditions and haul effects such as catch size and catch composition. The one advantage of all of these gear modifications are that they are relatively simple and cannot be circumvented easily by fishermen. To incorporate these modifications it is inevitable that in some cases redesign and re-tailoring of the original net design are required. In most cases however, the changes required can be made relatively simply and practically.

Separator panels

Some success has been reported with separator panels to sort cod from flatfish, although traditional horizontal separator panels with dual codends developed in the 1980s in Scotland do not seem to work effectively. Variations of separator panels have also been tested and Danish and Belgian research using an inclined panel has given significant reductions in cod catches. These trials gave reductions in cod catches over all sizes of 72% and 39% respectively. However, the authors of the reports from these experiments both concede that further work is needed to make these modifications commercially acceptable, given that high losses of commercial flatfish species were also observed in these trials. Trials in other fisheries with similar panels, notably in Ireland and Scotland have also shown it is possible to divert cod using an inclined panel out through an escape opening with low swimming species such as *Nephrops* passing underneath the panel into the codend.

Therefore it is concluded that the use of inclined panels does seem encouraging and may provide a means of reducing cod catch while maintaining catches of marketable flatfish and other groundfish species. However, separator trawls are much more complex than standard nets. The inclusion of the separating panel requires some redesigning of the trawl and the height of the leading edge of the panel above the bottom sheet is critical for species separation (Main and Sangster 1985). The panel may also need fine-tuning to achieve good consistent separation and the panel also needs to be tailored to each particular trawl design. These are not insurmountable problems but should be noted.

Rigid Grids

Various designs of rigid grids (Nordmore grids) have been tested in a variety of fisheries specifically to sort cod from flatfish. The results from many of these experiments are encouraging but defining the correct bar spacing, bar orientation (i.e. vertical or horizontal), shape of fish opening, angle of attack and material seems still to be an issue and very much fishery dependent. The trials by Hickey *et al.* (1995) suggested a vertical bar orientation rather than a horizontal bar was more appropriate for sorting cod and flatfish. The best combination they found in their experiments was a bar spacing of 127 mm, set at 67º, which gave a reduction in cod catch of 88%, with corresponding reductions in plaice and yellowtail catches of 9-10%. He (2002) found a horizontal bar grid worked best for sorting roundfish from flatfish and also included a further modification to the grid with the addition of a large opening on the bottom sheet to release monkfish and skate. Michael and Lee (2009) found a horizontal grid to be best and in their experiments achieved a reduction in cod catch of 73%, with a loss of flounder of 12%. A slightly different approach has been taken in the Faroe Islands, where the use of the grid is mandatory in one particular inshore flatfish fishery. In this system there is a grid with a 40mm bar spacing and a two-tier codend arrangement with a codend of 180 mm mesh size placed over the escape opening at the top of the grid to retain big cod and species such as monkfish. The idea of this system is to sort fish and then size select them using different codend mesh sizes. A similar system is now being looked at in the Icelandic shrimp fisheries, where a codend of 135 mm mesh size has been placed over the escape opening to retain marketable cod, haddock and whiting (Einarsson pers. comm.). This is similar to the concept described by Graham and Fryer (2006) with a grid and a two-tier codend, whereby the target species in this case *Nephrops* passed through the grid and was retained in the bottom codend, while bigger fish were sorted into a top codend.

While the results from the trials with grids are not definitive they do show that grids can achieve the objective of sorting cod from flatfish and based on their widespread use in many other fisheries seem to be an option to be considered for the 3NO fishery. In some of the experiments almost the entire cod catch can be excluded from the catch using grids. However, the grids do need to be tailored to meet the requirements of the fishery and the bar spacing and orientation optimized to meet the management objectives and also respect the economic viability of the fishermen. It should also be noted that while grid technology has improved greatly in the last decade, the size and rigidity of grids may still pose problems under commercial conditions for certain classes of vessels. Many trawlers have only narrow net drums, causing stowage problems if the drum is narrower than the grid. Vessels with power blocks may also find it difficult to haul the grid through the power block.

Mesh size

By increasing the mesh size of the panels or codends larger fish can be released, but at a certain mesh size this will lead to unacceptable losses of other species. An example of this is the recent work in Denmark reported by Madsen *et al.* (2008). With a 150 mm square mesh panel, cod catches of all sizes were reduced by 36% with a corresponding loss of plaice greater than the minimum landing size of only 2%. When the mesh size of the panel was increased to 300-400 mm, cod catches were reduced by 61-85% but plaice catches were also reduced to 70%. In addition to mesh size position of the panel is important. For cod, research has indicated that the panels should be positioned close to the codend or as part of the codend to be effective. For other gadoid species such as haddock and whiting, position of the square mesh panel seems less important. It is concluded that square mesh codends and composite codends have been shown to be reasonably effective as size selection devices for cod without reducing catches of flatfish. The composite codends have the added benefit of being size selective for flatfish species. Large mesh square panels are a simple and cheap alternative and as shown by the experiences with the large mesh Danish windows, can be adapted to release cod over a wider size range than simple codends. Further work with these large mesh windows is needed to tailor the mesh size to the fishery and gear to minimize losses of marketable species including flatfish.

Other trawl modifications

The Eliminator trawl and raised footrope trawls can be used to eliminate cod catch entirely across all size classes. However, these gears are only applicable in targeted haddock fisheries as catches of other marketable species are also significantly reduced. The Scottish belly trawls and Orkney trawls are modifications of the Eliminator trawls and have been shown to reduce rather than eliminate cod catches. There is some evidence that they are more effective for smaller cod, although in the case of the Orkney trawls significant reductions in cod catches for fish up to a length of 78 cm was observed. These gears also have the advantage of retaining more groundfish species such as megrim and monkfish so have more potential in mixed fishery situations. It is concluded that these gears should be further tested in other fisheries to ascertain whether they are an effective “cod reducing” gear.

References

Graham, N., and Fryer R.J., 2006. Separation of fish from *Nephrops norvegicus* into a two-tier cod-end using a selective grid. Fish. Res 82(2006) 111-118.

He, P., 2002. Design and test of grid devices to reduce cod catch in flatfish trawls. Annual Report to University of New Hampshire. 10 p.

ICES. 2009. ICES WGFTFB Response to NAFO on reducing the bycatch of cod. Prepared by Dominic Rihan (WGFTFB Chair) in collaboration with an ad hoc group of WGFTFB Members. ICES Advice, 2009. Book 11.

Main, J. and G.I. Sangster, 1985. Trawling experiments with a two-level net to minimize the undersized gadoid bycatch in a *Nephrops* fishery. Fish. Res., 3:131-145.

Michael A., and B. Lee. 2009. Development of a (trawl) net to reduce bycatch of cod in the flounder fishery. Summary of Completed Collaborative Research Projects funded by Northeast Consortium. February 2009.

Madsen, N., Frandsen, R.P., Krag, L.A., Herrmann, B., Holst, R., and B. Lundgren. 2008. Development of selective trawls to Danish fisheries – SELTRA -. Report for the Danish Ministry of Food, Agriculture and Fisheries. [In Danish]. Report available at: www.aqua.dtu.dk/English/Service/Phonebook.aspx?lg=showcommon&id=233085

v) Protection of vulnerable marine ecosystem

Scientific Council received a Fisheries Commission request for advice during the 2008 annual meeting held in Vigo, Spain on 22-26 September 2008 (NAFO *Sci. Coun. Rep*., 2008, p. 309-310, and see below). Owing to the urgent nature of Item 9(a) of the request, Scientific Council requested its Working Group on the Ecosystem Approach to Fisheries Management (WGEAFM) to prepare a report, as soon as possible, for presentation to the October Scientific Council meeting held in Copenhagen, Denmark, on 22-30 October 2008. WGEAFM met by correspondence and produced their report (SCS Doc. 08/24) which formed the basis of the Scientific Council response to Item 9(a). The subsequent Items 9(b) and 9(c) of Fisheries Commission request were also considered by WGEAFM via correspondence and a report was presented to Scientific Council at this meeting. The Council considered this report as well as the report of the joint NAFO/ICES Working Group on Deepwater Ecology (WGDEC) in formulating its response to Items 9(b) and 9(c). This completes the response to the Fisheries Commission request.

Fisheries Commission Request

9. Recognizing the initiatives on vulnerable marine ecosystems (VME), and with a view to completing fishery impact assessments at the earliest possible date, Fisheries Commission requests the Scientific Council to:

a) Provide, as soon as possible in 2008, delineations, if any, of significant concentrations of corals in the NAFO Regulatory Area, by species, for the identification of VMEs. This should include the size and catch characteristics of corals obtained respectively from commercial fishing vessels and fisheries research vessels and the assessment of significant adverse impacts, with a particular focus on those species which involve interactions with commercial fisheries. The data should include absence/presence of corals as well as density. (Item 9)

The Scientific Council response to this was provided at the Scientific Council Meeting in October of 2008. The response is available in the *NAFO Sci. Coun. Rep*., 2008, p. 255.

b) Provide, by June 30, 2009, delineations, if any, of significant concentrations of sponges in the Regulatory Area by species, including the size and catch characteristics of sponges obtained respectively from commercial fishing vessels and fisheries research vessels, with a particular focus on those species which involve interactions with commercial fisheries. The data should include absence/presence of sponges as well as density. (Item 9)

c) With respect to corals and sponges in canyons denoted in the Scientific Council's response on the area denoted as "Southern Flemish Pass to Eastern Canyons", provide detailed information as soon as practicable or at least a report on progress by June 30, 2009, with a particular focus on those species which involve interactions with commercial fisheries. (Item 9)

Scientific Council responded as follows:

For Request 9b

Annex 1 of the FAO Guidelines for Management of Deep-Sea Fisheries in the High Seas (FAO, 2008) provides examples of species groups, communities and habitat-forming species which may contribute to forming *vulnerable marine ecosystems* (VMEs). These include "*some types of sponge dominated communities*". The guidelines also describe characteristics of VMEs to aid in their definition, including morphological and life-history traits amongst others.

Most of the sponge species found within fishing depths in the North Atlantic are common and widespread, occurring as isolated individuals over much of their distribution; however, in some locations environmental conditions permit the formation of dense, multi-species communities, referred to as sponge grounds (ICES, 2009). The foundation for these sponge grounds are often the large, erect sponges which can fill a trawl (Fig. 1) when encountered (ICES, 2009). This upright structure makes them especially vulnerable to the impacts of bottom tending gear (Freese *et al*., 1999; Freese, 2001). Klitgaard and Tendal (2004) suggest that the dominant species on these sponge grounds are slow growing and take at least several decades to reach the sizes commonly observed. The joint NAFO/ICES Working Group on Deepwater Ecology (WGDEC) provides a list of sponge species which are found on sponge grounds at fishing depths in the North Atlantic and further summarizes the potential effects of bottom fishing on such grounds (ICES, 2009). Consequently, Scientific Council concurred with the approach of WGDEC and WGEAFM in recognizing sponge grounds as the vulnerable component as opposed to individual species of sponge.

The Fisheries Commission request indicates that the focus of the response should be given to those species which have interactions with commercial fisheries. Although detailed and consistent quantitative information is only available from research surveys, it is reasonable to expect that locations of sponge grounds and their corresponding characteristics identified from this analysis are essentially what a fishing vessel may encounter during its commercial operations.

Fig. 1. Large catch (estimated to be about 120 kg) of *Geodia* spp. from the NRA. *Geodia* spp. are known to form dense sponge grounds in the North Atlantic (Photo courtesy of Instituto Español de Oceanografía (F. J Murillo)).

Summary of Data Used to Respond to the Fisheries Commission Request

A total of 1062 trawls with sponge records from four R/V survey programmes fell in the NRA (Div. 3LMNO) and form the basis of the analyses presented here. Details of the programmes are:

DFO NL Multi-species Surveys (R/V Campelen 1800 Bottom Trawl): 1995-2008 (NRA. Div. 3LMNO): 283 trawls, 257 confirmed records of sponge between 47 and 14 m, targeted 15 min tow. Provided by Fisheries and Oceans Canada, Northwest Atlantic Fisheries Centre (NAFC), St. John’s, NL;

Spanish Div. 3NO Survey (R/V Campelen 1800 Bottom Trawl): 2002-2008 (Div. 3NO): 846 trawls, 230 confirmed records of sponge covering the ‘Tail’ of the Grand Banks (NRA) between 42 and 1436 m, targeted 30 min tow. Provided by the Instituto Español de Oceanografía (IEO);

EU Flemish Cap Survey (R/V Lofoten Bottom Trawl): 2003-2008 (Div. 3M): 1033 trawls, 423 confirmed records of sponge covering all the Flemish Cap (NRA) between 131 and 1438 m, targeted 30 min tow. Provided by IEO;

Spanish Div. 3L Survey (R/V Campelen 1800 Bottom Trawl): 2003-2004 and 2006-2007 (Div. 3L): 248 trawls, 152 records of sponge covering the ‘Nose’ of the Grand Banks and Flemish Pass (NRA) between 116 and 1449 m, targeted 30 min tow. Provided by IEO.

Although there were differences in tow length between Canadian survey data (15 minute tows) and Spanish/EU survey data (30 minute tows), statistical tests indicated no significant difference comparing the catch distributions between surveys for sponge catch weight greater than 0.5 kg.

Defining Significant Concentrations of Sponges

In previously considering the term “significant” for delineating concentrations of coral in the NRA, the cumulative catch weight distribution from the research vessel surveys were utilized (SCS Doc. 08/26). The distribution of cumulative catch weights was highly skewed, with most trawls catching small quantities, and only small numbers of trawls with larger catches. The 97.5% and 90% quantiles were used as thresholds for corals (sea pens and small gorgonians and for large gorgonians respectively). However, Scientific Council recognized that although this selection of thresholds had a statistical relevance, there was no firm biological reason for choosing one threshold over another. This approach was independently used by the South Pacific Regional Fisheries Management Organization (SPRFMO; Penney *et al.* 2008), who also concluded that the choice of threshold was largely a management decision, although they ultimately used a more conservative 50% (median) value.

In defining threshold values of research vessel catches for delineating significant sponge grounds, new analyses have been introduced (SCR Doc. 09/6; SCS Doc. 09/6) which give a firmer basis for selection. These analyses relate the trawl catches to the spatial distribution of the sponge grounds. A range of 75 to 125 kg/ RV trawl was discussed and the WGEAFM adopted the 75 kg value because this value was indicated in three of the analyses produced. This selection was supported by the Scientific Council. Catches greater than or equal to 75 kg/ RV trawl were used to identify and delineate the sponge grounds in the NRA.

Delineating Significant Concentrations of Sponges in the NAFO Regulatory Area (Div. 3LMNO)

Using a 75 kg weight threshold to define significant concentrations of sponges from the R/V surveys catches, their locations were plotted (Fig. 2). All the geographical information was referenced to the WGS 1984 UTM Zone 23N. Bathymetric contours were exported from GEBCO Digital Atlas for approximate depth reference; however, these are not totally precise.

Among the four candidate VME areas originally identified by the Scientific Council on the basis of presence of sponges (cVME areas 1, 3, 4, and 5, SCS Doc. 08/6), all have emerged from this analysis as containing significant catches of sponges (Fig. 2).

Figures 3-5 show a close-up of each area where significant concentrations of sponges were identified. Locations of significant catches of sponge are shown with a 4 nm radial buffer following the same approach used for delimiting the coral concentrations in the NRA (NAFO, 2008). The start and end of the trawl positions from the Canadian surveys are indicated in Table 1. Trawl locations and their buffers were not grouped into key locations as was done for the coral, as there are various options on how to do this. The 4 nm buffer zone was considered conservative and precautionary by the Scientific Council until detailed mapping and or additional research on buffer areas becomes available. The NEREIDA international multibeam/habitat mapping survey in the NRA (2009-2010) should provide some of the information needed to further address this issue (STACREC).

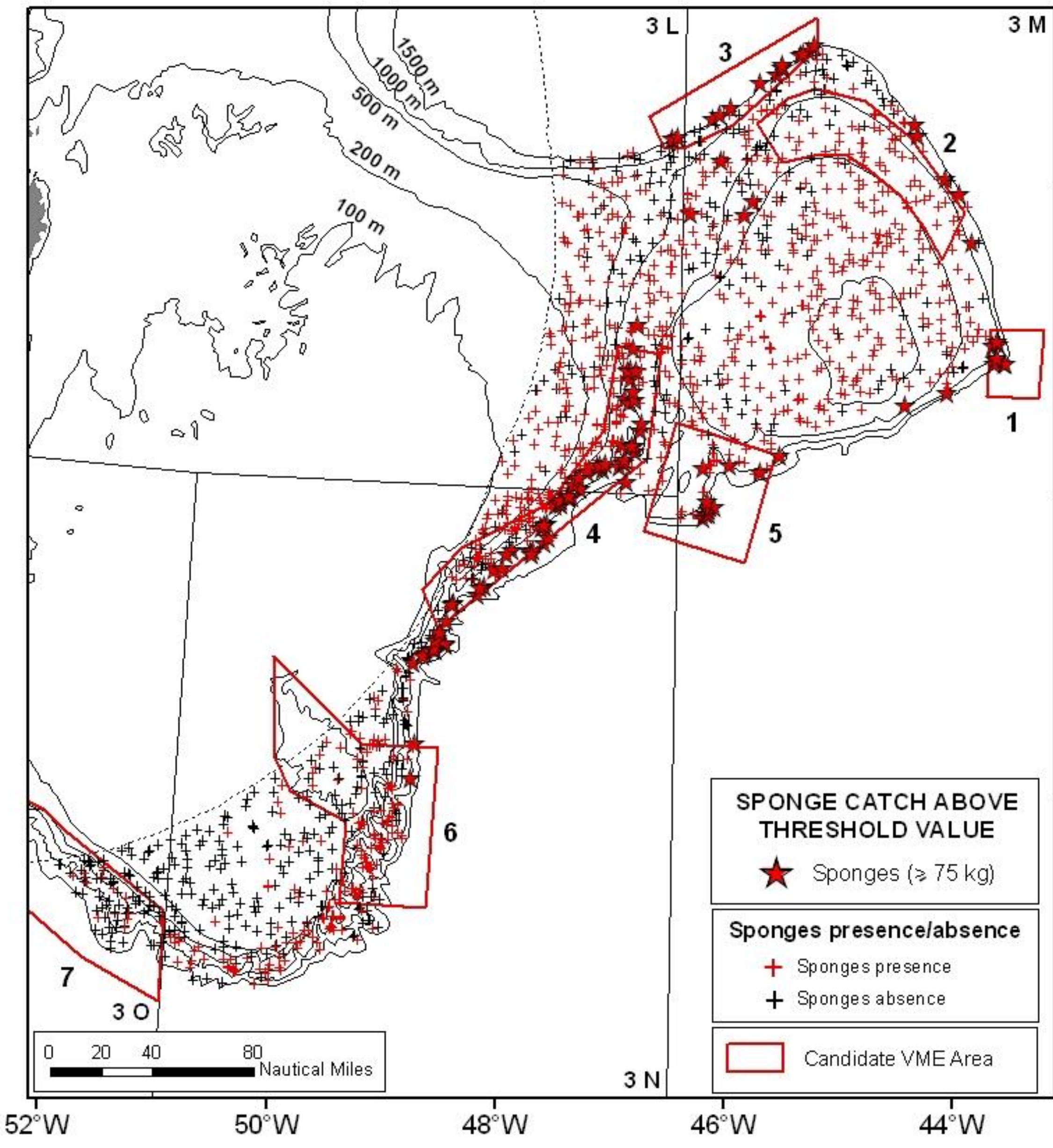


Fig. 2. Significant catches of sponges determined from research vessel survey data. The numbers refer to the candidate VME locations.

cVME Area 1: Flemish Cap East

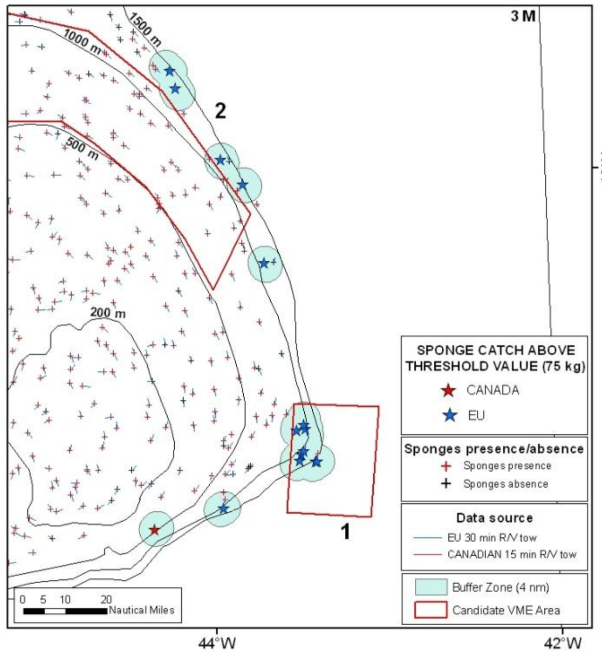


Fig. 3. Significant catches of sponges indicative of sponge grounds and associated buffer zones in the Flemish Cap East. Co-ordinates for these positions are provided in Table 1 associated with cVME areas 1 and 2.

cVME Area 3: Sackville Spur

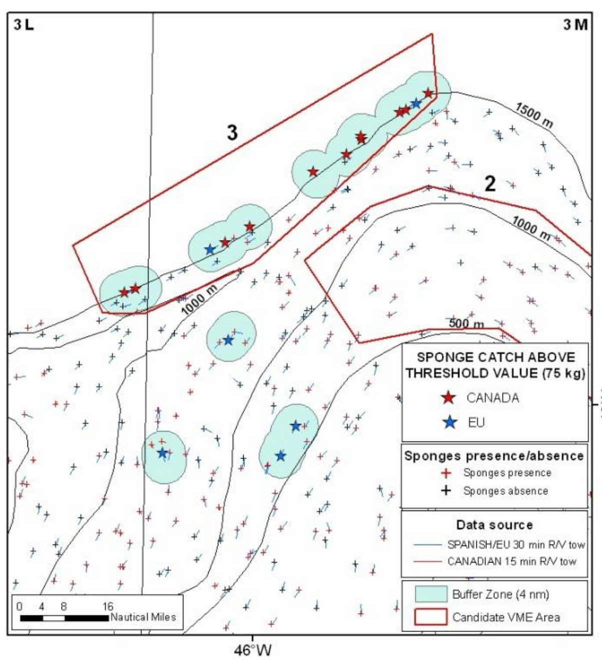


Fig. 4. Significant catches of sponges indicative of sponge grounds and associated buffer zones in the Sackville Spur. Co-ordinates for these positions are provided in Table 1 associated with cVME area 3.

cVME Areas 4 and 5: Southern Flemish Pass to Eastern Canyons and Beothuk Knoll

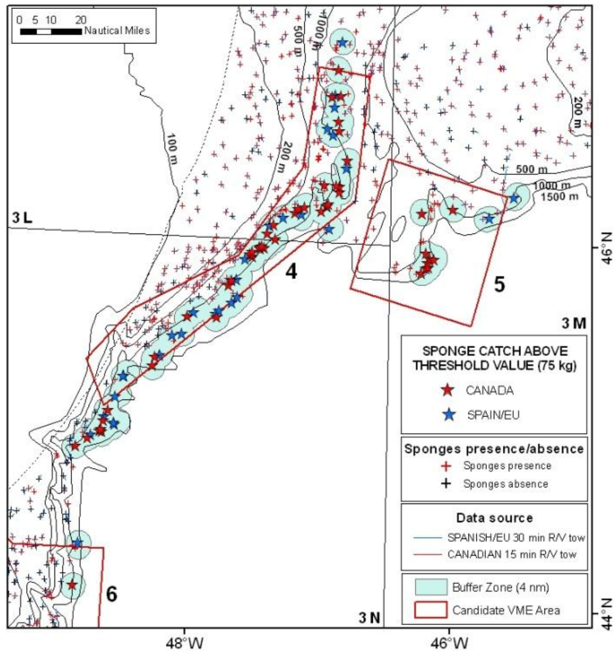


Fig. 5. Significant catches of sponges indicative of sponge grounds and associated buffer zones in the Flemish Pass to Eastern Canyons and Beothuk Knoll. Co-ordinates for these positions are provided in Table 1 associated with cVME areas 4, 5, and 6.

Table 1. Start and end positions of trawls with significant concentrations of sponges (≥75 kg) in the NRA (Div. 3LMNO). Trawls occurring within a candidate VME area (cVME) and those outside the area but nearby were grouped together.

cVME Area or Vicinity	**N**	**Survey**	**Start position**		**End position**	
			Latitude	**Longitude**	**Latitude**	**Longitude**
1-2	1-2.1	DFO-CAN	46° 35' 35" N	44° 21' 00" W	46° 36' 00" N	44° 20' 24" W
	1-2.2	SPAIN-EU	48° 25' 50" N	44° 14' 16" W	48° 26' 54" N	44° 15' 57" W
	1-2.3	SPAIN-EU	48° 21' 38" N	44° 12' 24" W	48° 20' 20" N	44° 11' 25" W
	1-2.4	SPAIN-EU	48° 04' 23" N	43° 56' 20" W	48° 03' 44" N	43° 55' 55" W
	1-2.5	SPAIN-EU	47° 58' 25" N	43° 48' 26" W	47° 57' 57" N	43° 47' 55" W
	1-2.6	SPAIN-EU	47° 39' 28" N	43° 41' 21" W	47° 38' 45" N	43° 40' 59" W
	1-2.7	SPAIN-EU	47° 00' 19" N	43° 28' 25" W	47° 01' 49" N	43° 28' 30" W
	1-2.8	SPAIN-EU	46° 59' 17" N	43° 27' 38" W	46° 57' 36" N	43° 27' 37" W
	1-2.9	SPAIN-EU	46° 59' 00" N	43° 30' 52" W	46° 59' 44" N	43° 30' 41" W
	1-2.10	SPAIN-EU	46° 53' 55" N	43° 28' 26" W	46° 55' 23" N	43° 27' 59" W
	1-2.11	SPAIN-EU	46° 53' 14" N	43° 29' 17" W	46° 52' 01" N	43° 30' 59" W
	1-2.12	SPAIN-EU	46° 51' 38" N	43° 30' 01" W	46° 50' 55" N	43° 31' 17" W
	1-2.13	SPAIN-EU	46° 51' 30" N	43° 24' 20" W	46° 51' 12" N	43° 25' 17" W
	1-2.14	SPAIN-EU	46° 51' 28" N	43° 23' 45" W	46° 50' 39" N	43° 25' 42" W
	1-2.15	SPAIN-EU	46° 40' 36" N	43° 57' 00" W	46° 40' 08" N	43° 58' 12" W
3	3.1	DFO-CAN	48° 57' 00" N	45° 13' 12" W	48° 57' 00" N	45° 14' 13" W
	3.2	DFO-CAN	48° 54' 00" N	45° 19' 19" W	48° 54' 29" N	45° 18' 25" W
	3.3	DFO-CAN	48° 53' 35" N	45° 21' 00" W	48° 53' 17" N	45° 22' 01" W
	3.4	DFO-CAN	48° 49' 12" N	45° 31' 48" W	48° 48' 47" N	45° 32' 35" W
	3.5	DFO-CAN	48° 48' 36" N	45° 31' 41" W	48° 49' 01" N	45° 30' 43" W
	3.6	DFO-CAN	48° 48' 36" N	45° 31' 41" W	48° 48' 18" N	45° 32' 35" W
	3.7	DFO-CAN	48° 45' 43" N	45° 35' 42" W	48° 46' 12" N	45° 34' 48" W
	3.8	DFO-CAN	48° 42' 29" N	45° 44' 53" W	48° 41' 42" N	45° 43' 59" W
	3.9	DFO-CAN	48° 32' 24" N	46° 02' 17" W	48° 32' 06" N	46° 03' 11" W
	3.10	DFO-CAN	48° 29' 24" N	46° 08' 53" W	48° 29' 06" N	46° 09' 47" W
	3.11	DFO-CAN	48° 20' 42" N	46° 33' 18" W	48° 20' 49" N	46° 32' 17" W
	3.12	DFO-CAN	48° 19' 59" N	46° 36' 18" W	48° 19' 41" N	46° 37' 19" W
	3.13	SPAIN-EU	48° 55' 11" N	45° 16' 27" W	48° 54' 43" N	45° 18' 31" W
	3.14	SPAIN-EU	48° 28' 02" N	46° 13' 06" W	48° 28' 48" N	46° 10' 52" W
	3.15	SPAIN-EU	48° 11' 41" N	46° 07' 44" W	48° 12' 50" N	46° 06' 17" W
	3.16	SPAIN-EU	47° 56' 05" N	45° 48' 56" W	47° 54' 42" N	45° 50' 07" W
	3.17	SPAIN-EU	47° 50' 50" N	46° 24' 58" W	47° 49' 11" N	46° 24' 37" W
	3.18	SPAIN-EU	47° 50' 34" N	45° 53' 01" W	47° 51' 55" N	45° 52' 15" W
4	4.1	DFO-CAN	46° 57' 07" N	46° 56' 13" W	46° 57' 36" N	46° 56' 49" W
	4.2	DFO-CAN	46° 48' 47" N	46° 54' 29" W	46° 48' 11" N	46° 54' 54" W

	4.3	DFO-CAN	46° 48' 25" N	46° 58' 41" W	46° 47' 42" N	46° 58' 19" W
	4.4	DFO-CAN	46° 40' 23" N	46° 55' 19" W	46° 40' 19" N	46° 54' 18" W
	4.5	DFO-CAN	46° 37' 19" N	46° 55' 01" W	46° 37' 30" N	46° 56' 06" W
	4.6	DFO-CAN	46° 27' 43" N	46° 50' 42" W	46° 27' 00" N	46° 50' 24" W
	4.7	DFO-CAN	46° 19' 30" N	47° 01' 19" W	46° 18' 54" N	47° 01' 59" W
	4.8	DFO-CAN	46° 19' 12" N	46° 55' 41" W	46° 18' 29" N	46° 55' 23" W
	4.9	DFO-CAN	46° 18' 54" N	46° 54' 25" W	46° 19' 30" N	46° 53' 49" W
	4.10	DFO-CAN	46° 17' 06" N	46° 54' 11" W	46° 17' 42" N	46° 54' 00" W
	4.11	DFO-CAN	46° 13' 19" N	46° 59' 24" W	46° 12' 29" N	46° 59' 31" W
	4.12	DFO-CAN	46° 12' 36" N	47° 00' 00" W	46° 13' 19" N	46° 59' 42" W
	4.13	DFO-CAN	46° 11' 53" N	47° 10' 37" W	46° 12' 36" N	47° 10' 23" W
	4.14	DFO-CAN	46° 11' 17" N	47° 13' 23" W	46° 11' 53" N	47° 12' 47" W
	4.15	DFO-CAN	46° 10' 41" N	47° 02' 31" W	46° 11' 24" N	47° 02' 35" W
	4.16	DFO-CAN	46° 10' 01" N	47° 14' 49" W	46° 09' 11" N	47° 15' 07" W
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	4.22	DFO-CAN	45° 58' 23" N	47° 28' 55" W	45° 58' 55" N	47° 28' 05" W
	4.23	DFO-CAN	45° 58' 05" N	47° 31' 01" W	45° 58' 41" N	47° 30' 29" W
	4.24	DFO-CAN	45° 56' 49" N	47° 34' 37" W	45° 57' 25" N	47° 33' 54" W
	4.25	DFO-CAN	45° 55' 59" N	47° 35' 31" W	45° 55' 12" N	47° 35' 35" W
	4.26	DFO-CAN	45° 55' 12" N	47° 34' 30" W	45° 54' 36" N	47° 34' 48" W
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	4.30	DFO-CAN	45° 34' 59" N	48° 03' 54" W	45° 34' 37" N	48° 04' 41" W
	4.31	DFO-CAN	45° 21' 18" N	48° 18' 25" W	45° 20' 49" N	48° 19' 12" W
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	4.33	DFO-CAN	45° 03' 18" N	48° 39' 00" W	45° 03' 29" N	48° 40' 01" W
	4.34	DFO-CAN	44° 59' 53" N	48° 41' 06" W	45° 00' 29" N	48° 40' 05" W
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	4.37	DFO-CAN	44° 56' 13" N	48° 41' 31" W	44° 55' 23" N	48° 41' 42" W
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	4.40	SPAIN-EU	47° 06' 20" N	46° 54' 31" W	47° 06' 54" N	46° 55' 15" W
	4.41	SPAIN-EU	46° 49' 00" N	46° 57' 22" W	46° 47' 31" N	46° 57' 31" W
	4.42	SPAIN-EU	46° 45' 05" N	46° 57' 22" W	46° 46' 32" N	46° 57' 22" W
	4.43	SPAIN-EU	46° 37' 49" N	47° 00' 39" W	46° 36' 33" N	46° 59' 26" W
	4.44	SPAIN-EU	46° 35' 50" N	46° 57' 51" W	46° 36' 40" N	46° 57' 51" W
	4.45	SPAIN-EU	46° 25' 03" N	46° 51' 11" W	46° 26' 26" N	46° 51' 47" W

	4.46	SPAIN-EU	46° 12' 18" N	47° 00' 05" W	46° 13' 47" N	47° 00' 05" W
	4.47	SPAIN-EU	46° 09' 30" N	47° 12' 05" W	46° 08' 26" N	47° 12' 18" W
	4.48	SPAIN-EU	46° 08' 23" N	47° 20' 35" W	46° 08' 48" N	47° 19' 08" W
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	4.50	SPAIN-EU	46° 05' 05" N	46° 58' 37" W	46° 05' 26" N	46° 58' 04" W
	4.51	SPAIN-EU	45° 54' 31" N	47° 37' 47" W	45° 55' 48" N	47° 36' 41" W
	4.52	SPAIN-EU	45° 47' 31" N	47° 41' 46" W	45° 48' 35" N	47° 40' 13" W
	4.53	SPAIN-EU	45° 41' 52" N	47° 41' 03" W	45° 42' 56" N	47° 39' 49" W
	4.54	SPAIN-EU	45° 40' 02" N	47° 43' 24" W	45° 39' 04" N	47° 44' 54" W
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	4.60	SPAIN-EU	45° 22' 04" N	48° 16' 05" W	45° 23' 23" N	48° 15' 29" W
	4.61	SPAIN-EU	45° 14' 52" N	48° 32' 17" W	45° 16' 02" N	48° 31' 05" W
	4.62	SPAIN-EU	45° 14' 46" N	48° 32' 49" W	45° 15' 46" N	48° 31' 30" W
	4.63	SPAIN-EU	45° 07' 55" N	48° 35' 51" W	45° 08' 34" N	48° 34' 19" W
	4.64	SPAIN-EU	45° 01' 13" N	48° 40' 52" W	45° 02' 31" N	48° 39' 51" W
	4.65	SPAIN-EU	44° 59' 13" N	48° 36' 10" W	44° 59' 53" N	48° 34' 19" W
	4.66	SPAIN-EU	44° 58' 47" N	48° 35' 56" W	44° 57' 37" N	48° 37' 12" W
	4.67	SPAIN-EU	44° 55' 08" N	48° 46' 30" W	44° 56' 25" N	48° 45' 50" W
5	5.1	DFO-CAN	46° 10' 48" N	46° 15' 07" W	46° 11' 31" N	46° 15' 11" W
	5.2	DFO-CAN	46° 12' 07" N	46° 00' 25" W	46° 12' 36" N	46° 01' 23" W
	5.3	DFO-CAN	45° 57' 47" N	46° 13' 01" W	45° 57' 00" N	46° 12' 36" W
	5.4	DFO-CAN	45° 55' 48" N	46° 10' 55" W	45° 56' 35" N	46° 10' 37" W
	5.5	DFO-CAN	45° 55' 41" N	46° 09' 00" W	45° 56' 31" N	46° 08' 53" W
	5.6	DFO-CAN	45° 54' 36" N	46° 12' 07" W	45° 54' 11" N	46° 13' 05" W
	5.7	DFO-CAN	45° 52' 59" N	46° 11' 49" W	45° 52' 30" N	46° 12' 36" W
	5.8	DFO-CAN	45° 52' 41" N	46° 13' 01" W	45° 52' 19" N	46° 13' 55" W
	5.9	DFO-CAN	45° 51' 11" N	46° 15' 11" W	45° 51' 25" N	46° 14' 13" W
	5.10	SPAIN-EU	46° 16' 10" N	45° 31' 46" W	46° 17' 15" N	45° 30' 14" W
	5.11	SPAIN-EU	46° 09' 28" N	45° 43' 20" W	46° 09' 05" N	45° 44' 54" W
6	6.1	DFO-CAN	44° 05' 35" N	48° 51' 36" W	44° 04' 59" N	48° 51' 47" W
	6.2	SPAIN-EU	44° 19' 33" N	48° 49' 57" W	44° 18' 04" N	48° 49' 59" W

<u>For Request 9c</u>

The Scientific Council interpreted Item 9(c) as asking for information on one specific candidate VME area (cVME 4), or "Southern Flemish Pass to Eastern Canyons", and focusing attention to any detailed information on corals and sponges in canyons within that area. Therefore, this response is essentially an integration of the results from the responses to items 9(a) and 9(b).

Figure 6 shows the significant concentrations of sponge, large gorgonians and sea pens (pennatulaceans) in the cVME. The head of Carson Canyon is the only canyon feature within the cVME and data show significant concentrations of sponges forming sponge grounds at its head.

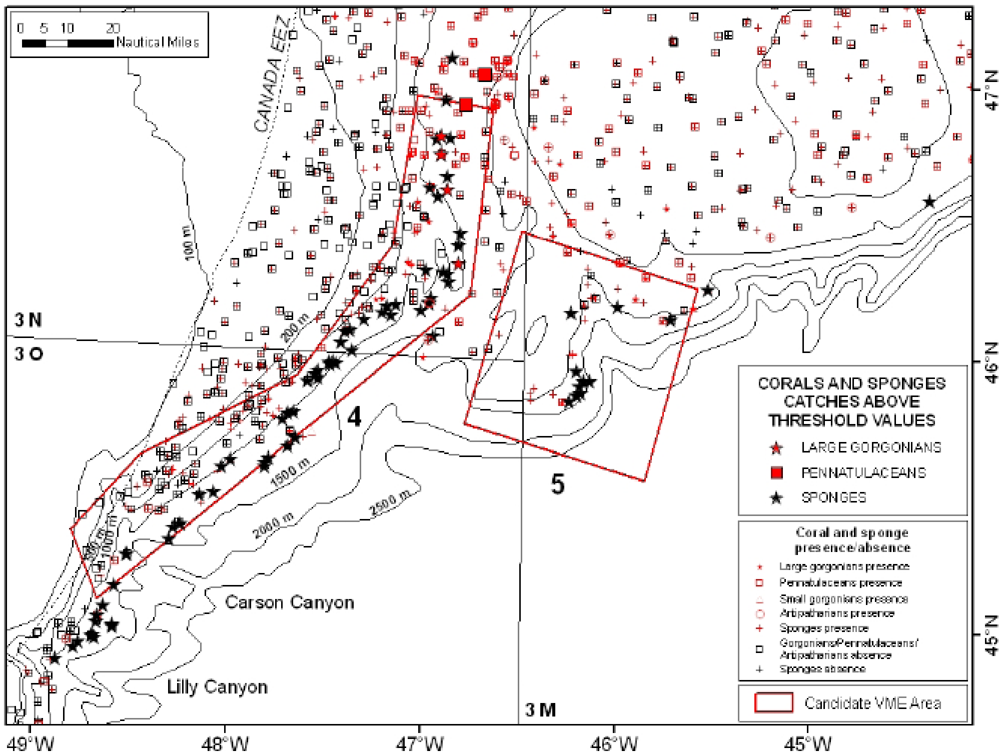

Fig. 6. Location of sponge grounds, large gorgonian coral and sea pens within the cVME 4 or "Southern Flemish Pass to Eastern Canyons" area. Significant concentrations are mapped using criteria established in response to FC Requests 9a and 9b.

Sources of Information: SCR Doc. 09/6, SCS Doc. 08/24, 09/6.

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vi) Evaluation of alternative assessment models for Greenland halibut in SA 2 + Div. 3KLMNO

With respect to Greenland halibut in SA 2 + Div. 3KLMNO, Fisheries Commission requests Scientific Council, in its 2009 assessment of this stock:

a) To complete an evaluation of alternate assessment models for this stock. This evaluation will enable the determination of the robustness of the assessment model currently used.

b) To advise Fisheries Commission, if catches of this stock are 16,000 tons in 2009 and in subsequent years, what is the biomass trajectory over these years, based on the most recent assessment? (Item 10)

Regarding Greenland halibut in SA 2 + Div. 3KLMNO, Canada request the Scientific Council:

3.3) Recognizing FC request 10 a) "To complete an evaluation of alternate assessment models for this stock. This evaluation will enable the determination of the robustness of the assessment model currently used", the Scientific Council is also requested to consider alternative formulations of any assessment models it evaluates that would include acceptable fishery-based CPUE indices.

The Scientific Council created an *ad hoc* working group under the direction of STACFIS Chair Michael Kingsley to address the Fisheries Commission request 10.a, and the Canadian request 3.3. The working group met immediately preceding the Scientific Council meeting on 1-3 June 2009. A preliminary report was tabled (agenda item X.6) which provided the basis for the Scientific Council response.

Scientific Council responded:

a) Evaluation of alternate assessment models

Scientific Council considered a suite of different models for the assessment of Greenland halibut in SA 2 + Div. 3KLMNO, using data up to 2007 as used in the 2008 assessment. The models could be divided into four classes: surplus-production models, including ASPIC and ASPM; a small number of VPA methods (XSA and ADAPT); Statistical Catch at Age; Survey-based analysis (SURBA).

In terms of an evaluation of "robustness", a robust model is one that performs well even if its assumptions are somewhat violated by the true dynamics of the fish population it is applied to. The assessment models considered have a long history of use in fish stock assessments and their reliability is generally well established. Although a formal evaluation of model robustness could possible include testing against a suite of simulated datasets, the Working Group, in its three-day meeting, could only consider runs of different models with the available data for the stock under consideration. However, of the four classes of model presented to the Working Group, there were differences in model diagnostics, parameters fitted, fitting technique and model construction that precluded direct quantitative comparisons between them.

In terms of the data available for the 2008 assessment, three survey series cover different areas, or depth ranges, or both. Nonetheless, some models considered take each series to be a proportional index to the stock over its entire range. There was generally good agreement between the different survey series but this was less obvious in recent years than it had been earlier. A preliminary examination of the survey data for this stock showed that some cohort structure could be traced up to ages of about 6-8 years, but was much less evident at greater ages. Recent surveys had caught some fish from older cohorts that had not been evident at lesser ages in earlier years.

Some models had strong or erratic retrospective patterns, possibly revealing inconsistencies in the data series. The results given by assessment models differed mainly in biomass levels in early years and at the oldest modelled ages. When different models were run with similar or the same data sets, their results converged to more similar values. However, there was still a divergence in trend in the most recent three years, between the XSA (with F-shrinkage) accepted in 2008 that showed a decline, whereas most other models showed either stability or a slight decline, and the SCAA and ASPIC that showed increasing trends in biomass (Fig. 7). This is largely due to an option in the accepted XSA model ('shrinkage') that averages fishing mortality over the most recent years in order to stabilize the results and reduce year-to-year variations that otherwise reveal themselves not only as strong retrospective effects in assessments, but also as unstable and continually varying advice. If in reality there is a trend in fishing mortality, shrinkage might not be advisable, but retrospective analyses have shown that estimates of fishing mortality on this stock have been unstable.

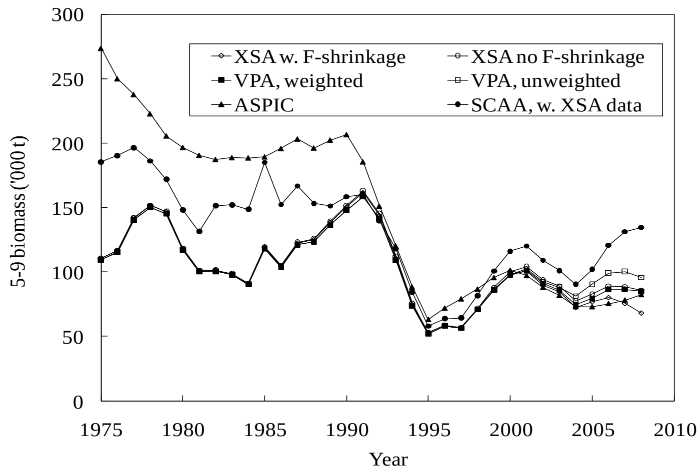


Fig. 7. Trajectories of the biomass of Greenland halibut in SA 2 + Div. 3KLMNO estimated by different stock-dynamic models.

Some variants of VPA-based models (ADAPT and B-ADAPT) were run and compared with XSA with and without shrinkage. A NOAA Fisheries Toolbox (NFT) version of ADAPT with model fitting by inverse-variance weighting gave similar results to those of XSA without shrinkage. An XSA with shrinkage gave lower estimates of recent stock size while unweighted NFT ADAPT gave higher estimates. The unweighted NFT ADAPT and XSA without shrinkage had slightly better residual patterns than the other formulations noted, although their retrospective patterns became more severe. None of these formulations improved the trends observed in Canadian survey-index residuals for the most recent six years.

Most formulations of a Statistical-Catch-at-Age model included data that had been discarded from the most recent assessments of this stock. Estimated biomass levels from these formulations were several to many times higher than those estimated by VPA-based models, including the accepted XSA. There was some tendency for these differences to be most striking for the oldest population segment, comprising fish at least 10 years old, indicating that the SCAA model included a 'cryptic' biomass of older fish that was relatively larger than that included by VPA-type models. The SCAA model was highly parameterized, and appeared sensitive to slight changes in certain input parameter settings. There were also differences between XSA and SCAA in trajectories of fishable (5-9 years old) biomass, which were however much reduced under certain settings for the SCAA model that were more similar to the XSA formulation. SCAA trajectories diverged greatly going back in time, which may indicate an effect of assumptions about starting conditions for the model.

A stock-production model (ASPIC) was applied to age-aggregated biomass indices drawn from the same surveys and covering the same period as those used in the accepted XSA. The model was sensitive to starting values for some parameters, having two distinct solutions that included very different trajectories of both relative biomass and fishing mortality. One of the trajectories of biomass was close to those estimated by other assessment models using data from the same sources, and was also consistent with the known history of fishery catches and survey biomass indices (Fig. 7). Retrospective patterns were noted for the two solutions.

The Working Group also considered formulations of models that used fishery CPUE as input data. A revised standardization of the fishery CPUE appeared to show that recent increases in nominal CPUE might have been partly due to relocation of the fishery to areas of higher density. However, while the three survey series were positively correlated with one another (*r* from 0.59 to 0.80), as were the three CPUE series (0.56-0.75), only two correlations between the CPUE series and the survey series were strong, five were weak (0.02-0.32) and 2 were negative (–0.07 and –0.31); as a result, prospects for successfully fitting age-aggregated assessment models to CPUE and survey series simultaneously were poor.

When a CPUE series from the Canadian fishery was plotted against a series of survey results from the same area it appeared that at higher values of the survey index the CPUE was roughly proportional to it (with considerable scatter), but that at low values of survey index this fishery could maintain catch rates at higher-than-proportional levels (Fig. 8). Some models could not be tried with the inclusion of CPUE as it was not available to the Working Group in age-specific form.

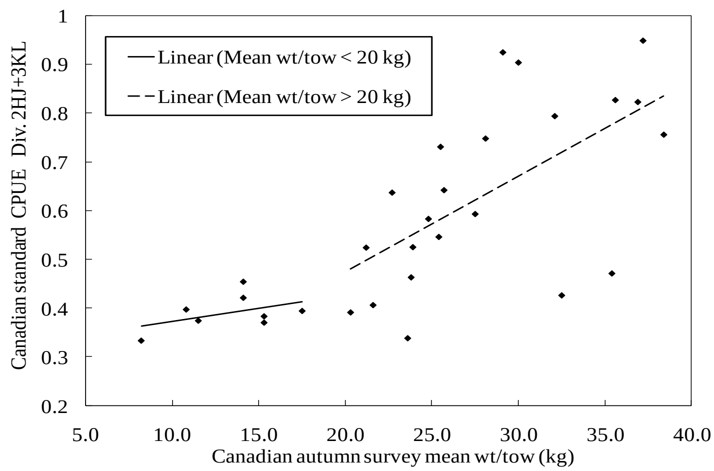


Fig. 8. Canadian Div. 2HJ+3KL CPUE and Canadian autumn survey mean weight per tow, showing difference relationships at low and high values of survey index.

A stock-production model (ASPIC) was tested both with CPUE data alone and with CPUE and survey data together, but the results did not appear reliable. The SCAA model can use age-aggregated CPUE, and its results using only CPUE data were similar to those obtained when using survey data only. This was thought to show that the differences between results from these models were due more to their different structures than to using only survey data as input to XSA.

Scientific Council has found this evaluation of different models a useful exercise; however, the uncertainties with the present assessment may stem primarily from the structure of the input data and the underlying dynamics of the stock. Scientific Council noted that all of the models applied could broadly reproduce the trends when run with similar or the same data sets, and continued use of the XSA model is not considered to be invalidated by this exercise. The major divergences between the XSA with 'shrinkage' and other models occur in the most recent years and this warrants continuing investigation.

b) Advice on 16 000 t catches

Scientific Council responded:

Given that Scientific Council did not consider it appropriate to update the analytical assessment, overall stock status and projections thereof have been based upon estimates from the previous assessment in 2008.

Projections conducted assuming a fixed catch of 16 000 t is taken in 2009 and in subsequent years do not result in improvements in the 5+ biomass, since the majority of the year-classes which recruit to the exploitable biomass during the projection period are estimated to be well below average.

16,000 t			
Year	5+ Biomass (t)	Yield	Fbar (5-10)
2008	79050	21178	0.414
2009	71579	16000	0.274
2010	68635	16000	0.313
2011	70580	16000	0.369
2012	73194	16000	0.399
2013	76506		

vii) Specific projections for recovering stocks (cod in Div. 3M, American plaice in Div. 3LNO)

For stocks currently under moratorium, but showing recent increases as assessed by Scientific Council, such as Div. 3M cod and Div. 3LNO American plaice, Scientific Council is asked *to provide catch, biomass, and fishing mortality projections where possible, for as many years as the data will allow, at the following levels of fishing mortality: F=0; $F_{0.1}$; and F_{2008}, in addition to any projections requested in other requests*. (Item 11)

The above projections have been included in the summary sheets for cod in Div. 3M and American plaice in Div. 3LNO under agenda item VII.1.b.

viii) Assessment schedule change for yellowtail flounder in Div. 3LNO

Noting that the Scientific Council assessments of American plaice and yellowtail in Div. 3LNO are currently scheduled to be done in alternate years, Fisheries Commission requests that Scientific Council *provide full assessments of both these stocks in the same year. Noting the schedule of assessments currently followed, this would require an additional assessment of yellowtail flounder to be conducted in 2009.* (Item 12)

Scientific Council provided an assessment of yellowtail flounder in Div. 3LNO in 2009 to fulfill this request and advice for 2010 and 2011 was provided under section VII.1.b. The next full assessment for yellowtail flounder will be in 2011.

ix) Consequences of mid-water trawl mesh size reduction to 100 mm or lower

Fisheries Commission requests Scientific Council to *examine the consequences resulting from a decrease in mesh size in the mid-water trawl fishery for redfish in Div. 3M, to 100 mm or lower*. (Item 13)

This agenda item was deferred to the Annual Meeting of Scientific Council to be held in September 2009.

x) Overview of role of seals in the marine ecosystem and impact on fish stocks

Noting the desire of NAFO to apply ecosystem considerations in the conservation and management of fish stocks in the NAFO area, the Scientific Council is requested *to provide the Fisheries Commission at its next annual meeting in 2009 with an overview of present knowledge related to role of seals in the marine ecosystem of the Northwest Atlantic and their impact on fish stocks in the NAFO area, taking into account the proceedings at the September 29 – October 1, 2008 Symposium in Dartmouth.* (Item 14)

A review of the current state of our knowledge on the potential impact of seals on fish stocks in the northwest Atlantic was presented to the NAFO Scientific Council in 2007 (*NAFO Sci. Coun. Rep*., 2008, p. 33). In 2008, a symposium, sponsored by NAFO, ICES and NAMMCO, and attended by approximately 70 scientists from around the world, was held to explore how marine mammals interact with other components of their ecosystem. Presentations addressed the biological and environmental factors affecting life histories, foraging strategies and energetic requirements, marine mammal- fisheries interactions and theoretical considerations on apex predators and multispecies models. Preliminary estimates of prey consumption by cetaceans in SA 0, 2, 3 and 4 (~1.7 million t/yr, *c.f.* ~4 million t consumed by seals), based upon new estimates of abundance obtained from surveys carried out in 2007 along the Canadian continental shelf, suggest that cetaceans are important predators in this ecosystem and should be included in future models. Relatively little is known about the diets of cetaceans in the Northwest Atlantic although they are known to consume important commercial fish species. For example, sperm and northern bottlenose whales have been reported depredating fish from Greenland halibut longlines in the Davis Strait area.

In addition to research presented at the symposium, studies have continued to determine the impact of harp seal predation on Div. 2J + 3KL cod. Consumption was estimated by integrating information on abundance, age specific energy requirements, seasonal distribution and diet of harp seals in the Newfoundland area. The diet of harp seals was estimated using reconstructed stomach contents, a multinomial regression approach and fatty acid signatures. Although specific diets varied with season, location, year and method of estimation, forage fish such as capelin, Arctic cod, sandlance (sand eel) and herring were the primary prey consumed. Using these three methods of estimating diets resulted in very different estimates of Atlantic cod consumption, although all were highly imprecise. Based upon the average diet obtained from reconstructed hard parts in the stomachs, Atlantic cod consumption was estimated to be approximately 80 000 t/yr since the mid 1990s. Using the diet estimated from the multinomial regression method resulted in estimates of Atlantic cod consumption approximately three times higher while only 1 000 t/yr of Atlantic cod are estimated to have been consumed by harp seals based upon the diets obtained from the fatty acid signatures. Incorporating these different estimates into a bioenergetic-allometric biomass dynamic model that incorporates seal predation, capelin availability, and fisheries catches as external drivers of the Northern cod dynamics, indicated that consumption of cod by harp seals does not appear to be an important driver of Div. 2J+ 3KL cod dynamics during the study period. The model that best fit the data was one including capelin and fisheries catches, but without seal consumption.

Traditional diet analyses of hooded seals, the second most abundant pinniped in the northwest Atlantic, indicate that the main prey species are squid (*Gonatus* sp.), Greenland halibut, Atlantic cod, other Pleuronectidae and redfish. Recent analyses using fatty acid signatures suggests that adult hooded seals fed primarily upon redfish, amphipods, capelin and Atlantic argentine while juveniles fed mainly upon capelin and, to a lesser extent, argentine, sandlance (sand eel), amphipods and herring. In contrast to data obtained from hard part analyses, fatty acids suggest that amphipods and argentine are important prey for hooded seals. The latter species has never been seen in the stomach contents although this may be due to its off-shelf distribution. This may be a factor of the longer integration period represented in the blubber.

In 2008, Canada sponsored a workshop to summarize available data on the impact of seals on cod stocks in eastern Canada. They found that although the reasons for the lack of recovery vary among stocks, elevated natural mortality of adult cod is an important factor for many stocks. Seals, particularly grey seals, may be a contributing factor in some areas, but there is still considerable uncertainty in the factors affecting cod dynamics and in the magnitude of stock-specific seal predation mortality on cod. Tracking the movements of harp, hooded and grey seals using satellite telemetry indicates that these species are not common in Div. 3NO, suggesting that seal predation is unlikely to be a significant factor in the dynamics of fish stocks in this area. However, recent surveys indicate that cetaceans are abundant along the Grand Banks and the Scotian Shelf.

After reviewing recent advances in multispecies modelling and techniques for estimating marine mammal diets and/or consumption, a NAMMCO working group concluded that current models are not sufficient to address management questions such as the impact of changes in the abundance of certain marine mammal populations on allowable catch levels for commercial fish species. The use of new techniques to estimate diets such as fatty acid signature analyses may improve our understanding of what marine mammal eat but the methodology has to be further developed and validated as there are indications that the assimilation rates of prey fatty acids in the blubber vary among species and among fatty acids. Furthermore, the incorporation of the dietary fatty acids into the blubber profile and the differential utilization of the blubber profile by different species must be considered. Current Canadian research on the use of genetic (PCR) analyses of stomach contents may provide additional information on diets, particularly the degree to which belly biting (i.e the consumption of soft parts without consumption of the head) occurs.

xi) Work arising via the NAFO Conservation and Enforcement Measures (CEM)

Scientific Council was informed that within the NAFO Conservation and Enforcement Measures (CEM) there are extensive references to the Scientific Council in what essentially a document outlining fishery regulations. The Council noted these generally fall into five categories:

- Type 1: References related to the normal operating protocol of Fisheries Commission and Scientific Council,
- Type 2: References that would normally reach Scientific Council via the annual Fisheries Commission "requests for advice",
- Type 3: References to Scientific Council meeting dates,
- Type 4: Scientific Council/Fisheries Commission responsibilities,
- Type 5: Appropriate reference to Scientific Council.

The Council noted that paragraph 9 of the recent "Report of the Standing Committee on International Control (STACTIC), 5-7 May 2009 Saint Pierre, St. Pierre et Miquelon (FC Doc. 09/3) raises concerns regarding the clarity of the CEM and has proposed the establishment of a drafting committee to work with the Secretariat on a review of the wording of CEM. It is hoped that the above concerns will be addressed by this drafting group.

The Council further noted that Chapter 1bis of CEM contains many instances of requests of the Scientific Council. The Scientific Council notes that the normal process within NAFO is for Fisheries Commission to refer requests via the Fisheries Commission Document "Requests for advice" developed at the September Annual NAFO meeting. Scientific Council supports and endorses the mechanism as being the proper means to convey requests and **recommended** that *Fisheries Commission provides both the request and guidance on how these requests should be addressed by Scientific Council through the "Requests for Advice"*.

Nevertheless, Scientific Council attempted to address some of the requests embedded in the Chapter 1bis of the CEM at this meeting. In accordance with Article 2bis "Identification of existing bottom fishing areas (footprint)" of the CEM, the Council reviewed the map of the existing fishing areas compiled by the Secretariat and reported this under agenda item XII.7. Scientific Council, in accordance with Article 4bis "Assessment of bottom fishing" paragraph 3.i of the CEM, received fishing plans from Japan and Iceland. However, Scientific Council was unable to review these fishing plans as their contents appeared structured more in terms of compliance. Scientific Council will discuss this issue with the Fisheries Commission. Other aspects of this agenda item were deferred to the Annual Meeting of Scientific Council to be held in September 2009.

2. Coastal States

a) Request by Canada for Advice on Management in 2010

The Scientific Council noted that the requests for advice on northern shrimp (northern shrimp in Div. 3M and Div. 3LNO (Appendix V, Annex 2, Item 1)) will be considered during Scientific Council Meeting on 21-29 October 2009.

i) TAC for Greenland halibut in SA 2 and Div. 3KLMNO: Separate TAC and rebuilding plan

Canada requested the Scientific Council to *advise on appropriate TAC levels for 2010, based on biomass distribution, for Greenland halibut in these areas separately: SA 2+ Division 3K and Divisions 3LMNO.* (Appendix V, Annex 2,Item 3.1)

Scientific Council responded:

Canadian research survey data covering depths to 1 500 m suggest reasonable stability in the proportion of biomass in SA 2 + Div. 3K and Div. 3LMNO. On average, over 80% of the biomass occurred in SA 2 + Div. 3K and 20% in Div. 3LMNO and future quotas based upon biomass distribution could be allocated accordingly.

Canada requested the Scientific Council to *provide information on the status of Greenland halibut in SA 2 + Div. 3KLMNO in relation to the Greenland halibut Rebuilding Plan and Strategy, including commentary on progress in relation to the targets described in the Strategy.* (Appendix V, Annex 2,Item 3.2)

Scientific Council responded:

Given that Scientific Council did not consider it appropriate to update the analytical assessment, overall stock status and projections thereof have been based upon estimates from the previous assessment.

Projections conducted assuming a fixed catch of 16 000 t is taken in 2009 and in subsequent years do not result in improvements in the 5+ biomass, since the majority of the year-classes which recruit to the exploitable biomass during the projection period are estimated to be well below average.

16,000 t			
Year	5+ Biomass (t)	Yield	Fbar (5-10)
2008	79050	21178	0.414
2009	71579	16000	0.274
2010	68635	16000	0.313
2011	70580	16000	0.369
2012	73194	16000	0.399
2013	76506		

ii) Alternative formulations of assessment models including fishery-based CPUE

Recognizing Fisheries Commission request 10 a) "To complete an evaluation of alternate assessment models for this stock. This evaluation will enable the determination of the robustness of the assessment model currently used", the Scientific Council is also requested to: *consider alternative formulations of any assessment models it evaluates that would include acceptable fishery-based CPUE indices.* (Appendix V, Annex 2,Item 3.3)

The Scientific Council created an *ad hoc* working group under the direction of STACFIS Chair Michael Kingsley to address the FC request 10.a, and the Canadian request 3.3. The working group met immediately preceding the Scientific Council meeting on 1-3 June 2009. A preliminary report was tabled (SC agenda item X.6) which provided the basis for the Scientific Council response for both requests. The reader is directed to section VII.1.d.vi of this report where the results of formulations of some models with CPUE data are noted.

Scientific Council reviewed the issue of using CPUE indices in the assessment of Greenland halibut in SA 2 + Div. 3KLMNO and confirmed its view that CPUE indices for this stock should not be interpreted to reflect stock size.

b) Request by Denmark (Greenland) for Advice

i) Roundnose grenadier in SA 0+1

In the Scientific Council Report of 2008, scientific advice on the management of roundnose grenadier in subarea 0+1 was given as 3-year advice (for 2009, 2010 and 2011). Denmark, on behalf of Greenland, requests the Scientific Council to: *monitor the status of Roundnose grenadier in Subarea 0+1 annually and, should significant change in stock status be observed (e.g. from surveys), the Scientific Council is requested to provide updated advice as appropriate*. (Appendix V, Annex 3,Item 1)

The Scientific Council responded as follows:

The Scientific Council reviewed the status of this stock at this June 2009 meeting and found no reason to consider that the status of the resource has changed. Therefore, Scientific Council has not changed its advice for 2010 or 2011, that there should be no directed fishing for roundnose grenadier in SA 0+1 and that catches should be restricted to bycatches in fisheries targeting other species. The next Scientific Council assessment of this stock will be in 2011.

ii) Redfish and other finfish in SA 1

Advice for redfish (*Sebastes* spp.) and other finfish, (American plaice (*Hippoglossoides platessoides*), Atlantic wolffish (*Anarhichas lupus*), spotted wolffish (*A. minor*) and thorny skate (*Amblyraja radiata*)) in SA 1 was in 2008 given for 2009, 2010 and 2011. Denmark, on behalf of Greenland, requests the Scientific Council to: *to continue to* *monitor the status of Redfish (Sebastes spp.) and other finfish in Subarea 1 annually and, should significant change in stock status be observed (e.g. from surveys), the Scientific Council is requested to provide updated advice as appropriate.* (Appendix V, Annex 3, Item 2)

The Scientific Council responded as follows:

Redfish

Scientific Council reviewed the status of redfish stocks at this June 2009 meeting and found no reason to consider that the status of the resource has changed. Therefore, Scientific Council has not changed its advice for 2010 or 2011, that there should be no directed fishery on demersal redfish in SA 1 in 2010 and 2011 and that bycatches in the shrimp trawl fishery should be kept at the lowest possible level. The next Scientific Council assessment of these stocks will be in 2011.

Other finfish

Scientific Council reviewed the status of other finfish stocks as noted above at this June 2009 meeting and found there is no indication of change in the status of the stocks of American plaice, Atlantic wolffish and thorny skate in SA 1. These stocks remain depleted. Therefore, Scientific Council has not changed its advice for 2010 or 2011, that there should be no directed fishery on American plaice, Atlantic wolffish and thorny skate in SA 1 in 2010 and 2011 and that bycatches of these species in the shrimp fisheries should be kept at the lowest possible level.

The spotted wolffish stock has shown improvements since 2002 and is above or at average levels. There is not, however, a significant change in the state of the stock since the 2008 assessment. The Scientific Council is unable to advice on the catch level for spotted wolffish.

The next Scientific Council assessment of these finfish stocks will be in 2011.

iii) Greenland halibut in Div. 1A inshore

Advice for Greenland halibut in Div. 1A inshore was in 2008 given for 2009-2010. Denmark, on behalf of Greenland, requests the Scientific Council to: *continue to monitor the status of Greenland halibut in Subarea 1A inshore annually and, should significant change in stock status be observed (e.g. from surveys), the Scientific Council is requested to provide updated advice as appropriate.* (Appendix V, Annex 3, Item 4)

The Scientific Council responded as follows:

Scientific Council reviewed the status of Greenland halibut in Div. 1A inshore at this June 2009 meeting and was unable to conclude that there is a significant change in status of any of these stocks since the most recent full assessment in 2008. Therefore, Scientific Council has not changed its advice for 2010 and reiterates its previous advice as follows:

Scientific Council still considers that separate TACs are appropriate for each of the three areas (Disco Bay, Uummannaq and Upernavik).

Disko Bay: Scientific Council recommended that catches should be 8 800 t for 2010 in an attempt to restore the growth potential of the stock.

Uummannaq: Scientific Council recommended that TAC for 2010 should be 5 000 t.

Upernavik: Due to the lack of information from surveys, no advice can be given.

The next Scientific Council assessment of this stock will be in 2010.

c) Request by Canada and Denmark (Greenland) for Advice on TACs and Other Management Measures

The Scientific Council noted that the requests for advice on northern shrimp (northern shrimp in Div. 3M and Div. 3LNO) will be undertaken during Scientific Council meeting on 21-29 October 2009.

Canada (Appendix V, Annex 2, Item 1a) and Denmark (on behalf of Greenland) (Appendix V, Annex 3, Item 3) as regards Greenland halibut in SA 1, requested Scientific Council to provide an overall assessment of status and trends in the total stock throughout its range and comment on its management in SA 0+1 for 2010, and to specifically:

advise on appropriate TAC levels for 2010, separately, for Greenland halibut in the offshore area of Divisions 0A+1AB and Divisions 0B+1C-F. The Scientific Council is also asked to advise on any other management measures it deems appropriate to ensure the sustainability of these resources.

The Scientific Council responded as follows:

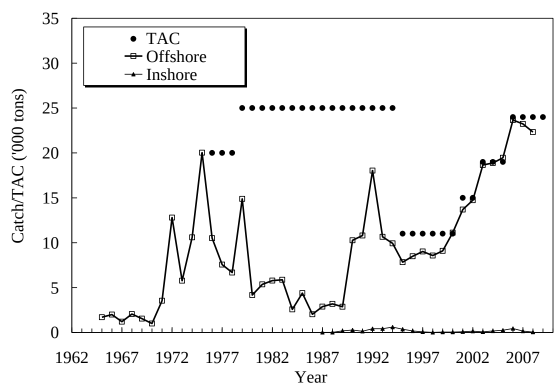
Greenland halibut in SA 0 + Div. 1A offshore and Div. 1B-1F

Background: The Greenland halibut stock in SA 0 +Div. 1A offshore and Div. 1B-1F is part of a common stock distributed in Davis Strait and southward to SA 3. Since 2002 advice has been given separately for the northern area (Div. 0A and Div. 1AB) and the southern area (Div. 0B and 1 C-F).

Fishery and Catches: Due to an increase in offshore effort, catches increased from 3 000 t in 1989 to 18 000 t in 1992 and remained at about 10 000 t until 2000. Since then catches increased gradually to 24 000 t in 2006 primarily due to increased effort in Div. 0A and in Div. 1A. Catches were 22 000 t in 2008.

	Catch ('000 t)		TAC ('000 t)	
Year	STACFIS	21A	Recc.	Agreed
2006	24	24	24[2]	24
2007	23	16[1]	24[2]	24
2008	22	15[1]	24[2]	24
2009			24[2]	24

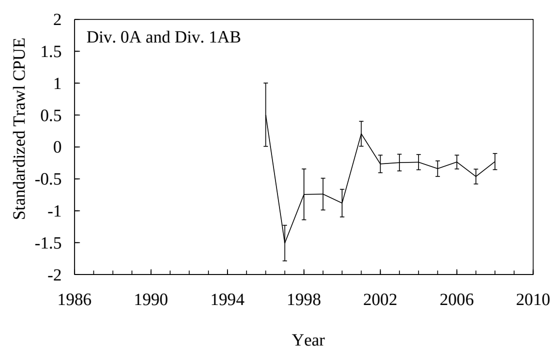
[1] Provisional
[2] Including 13 000 t allocated specifically to Div. 0A and 1AB since 2006.

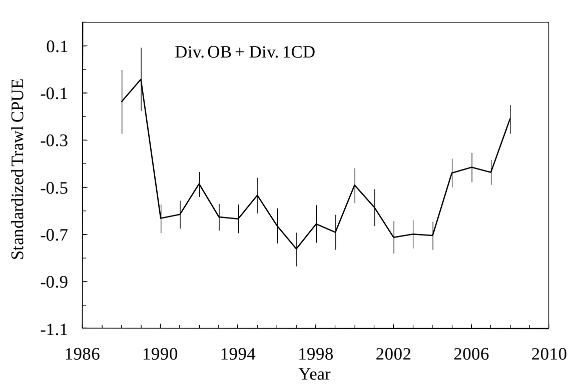


Data: Length distributions were available for assessment from SA0 and SA1. Unstandardized and standardized catch rates were available from Div. 0A, 0B, 1AB and 1CD. Biomass estimates from deep sea surveys in 2007 were available from Div. 1CD and Div. 0A. Further, biomass and recruitment data were available from shrimp surveys in Div. 1A-1F from 1989-2008.

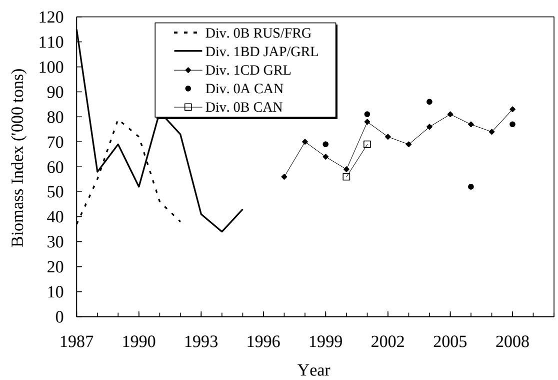
Assessment: No analytical assessment could be performed.

Commercial CPUE indices: Combined standardized catch rates in Div. 0A and Div. 1AB have been stable since 2002. The combined Div. 0B and 1CD standardized catch rates have been stable in the period 1990-2001, declined somewhat in 2002 remained at that level in 2003 and 2004. Since then the standardized catch rates have increased gradually and were in 2008 at the highest level seen since 1989.

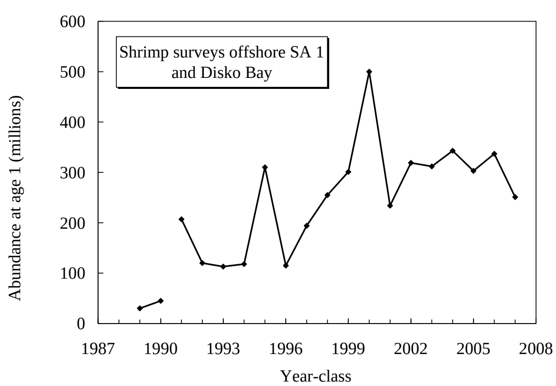




Biomass: The biomass in Div. 0A was in 2008 estimated at 77 000 t which is at the level seen in the previous four surveys conducted since 1999. The biomass in Div. 1CD increased gradually since 1997 and was estimated at 83 000 t which is the highest in the twelve year time series. The biomass in the shrimp survey, which is almost exclusively found in Div. 1AB, has decreased during 2004-2007 but increased slightly in 2008 and is above the average of the time series (1991-2008).



Recruitment: Recruitment of the 2000 year-class at age 1 in the entire area covered by the Greenland shrimp survey was the largest in the time series, while the 2002-2006 year-classes were well above average. The recruitment of the 2007 year-class in the offshore nursery area (Div. 1A (South of 70°N) - Div. 1B) was below average.



Fishing Mortality: Level not known. The relative fishing mortality (catch/survey biomass) in Div. 1CD was in 2008 the lowest seen since 1991.

State of the Stock: Div 0A+1AB: Length compositions in the catches have been stable in recent years. Survey biomass in Div. 0A and CPUE indices in Div. 0A and 1AB have been stable in recent years.

Div. 0B+1C-F: Survey biomass in Div. 1CD and CPUE indices in Div. 0B and 1CD have shown an increasing trend in recent years and are at the level observed in the late 1980s.

Recommendation: Div 0A+1AB: Considering the relative stability in biomass and CPUE indices, for Greenland halibut in Div. 0A and 1AB Scientific Council advises that there is no basis to change advice for Div. 0A and Div. 1A off shore + Div. 1B for 2010 and the TAC should not exceed 13 000 t.

Div. 0B+1C-F: Taking into account the increasing trends in survey and CPUE indices for Greenland halibut in Div. 0B and Div. 1C-F an increase in TAC can be considered. A 25% increase in catch would raise an index of F to 96% of the long-term mean. Scientific Council advises that the TAC for Greenland halibut in Div. 0B and 1C-F for 2010 should not exceed 14 000 t.

Reference Points: Scientific Council is not in a position to propose reference points at this time.

Special Comments: The next Scientific Council assessment of this stock will be in 2010.

Sources of Information: SCR Doc. 09/13, 16, 20, 25, 26, 30; SCS Doc. 09/11, 12, 13, 17.

Scientific Council is also requested to: *provide advice on the impact on the Greenland halibut in Subarea 0 and Divisions 1A (offshore) + 1B-F of increases in the catch in Divisions 0B + 1C-F, in 2010, of 10%, 25%, and 50% above the 2009 TAC.* (Appendix V, Annex 2, Item 1b; and Appendix V, Annex 3, Item 3)

The Scientific Council responded as follows:

Scientific Council is not in the position to give an answer to the request based on analytic methods.

The present TAC for Div. 0B + Div 1C-F is 11 000 t. Since 1992, catches have been around 5 500 t in Div. 1CD and catches reached that level in Div. 0B in 2000. Survey results show that the distribution of biomass between Div. 0B and Div. 1CD is about 50:50. A relative fishing mortality (catch/survey biomass) estimated for Div. 1CD can therefore be used as a proxy for fishing mortality for the whole of Div. 0B + Div. 1C-F, there being very little biomass or fishery in Div. 1EF.

The mean relative fishing mortality in relation to 2008 (F_r) in Div. 1CD for 1992-2007 was 1.34 (STD 0.42, min 1.01 max 2.67). F_r was in 2008 the lowest seen since 1991. An increase in TAC of 10%, 25% and 50%, respectively will lead to an increase in F_r to 1.13, 1.28 and 1.54, respectively. Therefore, the impact on the sub-stock in Div. 0B and Div. 1CD would likely be within historic mean values of F_r for increases in TAC of 10% and 25% but would exceed mean values of F_r for an increase of 50%, under the assumptions that: 1) the biomass remains at the current level; 2) that the biomass is distributed 50:50 between Div. 0B and Div. 1CD; and 3) the increased fishery in Div. 0B and Div. 1AB is not affecting the sub-stock in Div. 0B and 1CD in a negative direction.

F_r with different TAC and F_r in percent of the mean of F_r 1992-2007 (1.34) in Div. 1CD.

	TAC	F_r	F_r (% of long term mean of 1.34)
2008	11 000	1	74.6%
10%	12 100	1.13	84.4%
25%	13 750	1.28	95.9%
50%	16 500	1.54	115.0%

The analysis of F_r for Div. 1CD covers a time period during which the fishery has expanded to include Div. 0A and 1AB (2001-2007). Catches in the overall stock have increased by 60% since 2003 and since 2005 are the highest in the time series (1965-2008). Greenland halibut are long-lived and slow growing and therefore, it may be too early to determine if the Div. 0A and 1AB fishery is having an affect or not on the Div. 0B and 1CD sub-stock and the third assumption noted above may not be valid.

d) Request by France (Saint-Pierre et Miquelon) for Advice on Management of Certain Stocks in Div. 3LNOPs

France (in respect of Saint-Pierre et Miquelon), in its capacity as Coastal State at the zone of regulation of the NAFO, asks the Scientific Council the *formulation of an opinion on the management of certain stocks in 2010, in Divisions 3LNOPs (part of Division 3Ps being under French jurisdiction) for Thorny skate (Amblyraja radiata) and White hake (Urophycis tenuis).* (Appendix V, Annex 4).

The Scientific Council responded as follows:

Analytic assessments for these stocks are not currently possible with the available information. However, Scientific Council conducts a review of all available data to assess the status of these stocks on a two-year cycle. It should be noted that Subdiv. 3Ps is managed as a separate unit by Canada and France, while NAFO manages those portions of the stocks in NAFO Div. 3LNO (thorny skate) or Div. 3NO (white hake).

Thorny skate in NAFO Div. 3LNOPs was last assessed in 2008. Scientific Council determined that during recent years, with a reduced exploitation index relative to previous years, the biomass of thorny skates has increased slightly. Biomass of thorny skate in NAFO Div. 3LNOPs had remained stable at low levels from 1996-2004. An Interim Monitoring update of the abundance and biomass indices for this stock indicated there was no significant change in the status for 2009. The current TAC for thorny skate is 13 500 t in NAFO Div. 3LNO with an additional 1 050 t in Subdiv. 3Ps. Scientific Council recommended that the total catch in Div. 3LNOPs in 2010 should not exceed 6 000 t to promote recovery. Thorny skate will be re-assessed in 2010. A description of the full assessment of thorny skate is in the 2008 Scientific Council report (*NAFO. Sci. Coun. Rep*., 2008, p. 18-19), with the interim update reported under Appendix IV agenda item III.16 of this 2009 Scientific Council report.

White hake in NAFO Div. 3NOPs was assessed in 2009. Scientific Council noted that following the dominance of 1999-year-class fish in 2000, which led to increased catches in the white hake fishery in 2002-2003, catches have declined in recent years. Currently, survey abundance and biomass indices remain at levels comparable to those observed prior to the appearance of the 1999 year class. White hake will be re-assessed in 2011. It should be noted that Scientific Council is not in a position to provide science advice on white hake in NAFO Div. 3L, as part of the request, since that is not part of the stock unit assessed. The current TAC in NAFO Div. 3NO is 8 500 t and considered unrealistic by Scientific Council. Scientific Council recommended that catches for 2010 and 2011 should not exceed their current levels of 850 t in NAFO Div. 3NO. Furthermore, catches for 2010 and 2011 should not exceed their current levels of 1 050 t in Subdiv. 3Ps. A description of the full assessment of white hake can be found in the STACFIS report (Appendix IV agenda item III.17) of this 2009 Scientific Council report.

3. Scientific Advice from Council on its own Accord

a) Oceanic (Pelagic) Redfish

Pelagic redfish (*Sebastes mentella*) in NAFO SA 1 and SA 2, and adjacent ICES areas V, VI and XIV, is not assessed by the NAFO Scientific Council. ICES receives a request from NEAFC each year to undertake an assessment and it is in the ICES North-Western Working Group (NWWG) that the assessment is made. NWWG met during 29 April - 5 May 2009 (ICES CM 2009/ACOM:04).

In early 2009 the stock structure of the Oceanic redfish (*S. mentella*) was reviewed by the Study Group on Redfish Stock Structure (WKREDS) met at ICES Headquarters 22-23 January 2009 and based on their review ICES advice is now given separately for shallow pelagic *S. mentella* and deep pelagic *S. mentella*. Adult *S.mentella* on the Greenland continental slopes likely belongs to more of the newly identified stock.

The NWWG was not able to evaluate the state of either of these stocks. Based on a scheduled acoustic-trawl survey in June 2009, an assessment and advice will be provided in the autumn 2009. Therefore, Scientific Council will not able to review and comment on the advice for these stocks for 2010 until after ICES provides the assessment in autumn 2009.

The ICES advice for the 2008 fishery (ICES Advice 2007, Book 2, p. 12) was: "ICES advises that a management plan be developed and implemented which takes into account the uncertainties in science and the properties of the fisheries. ICES suggests that catches of *S. mentella* are set at 20 000 t as a starting point for the adaptive part of the management plan."

In 2008 NAFO Scientific Council reviewed in its June meeting (*NAFO Sci. Coun. Rep*., 2008, p. 59) the 2008 ICES advice to NEAFC for 2009 and, given the difficulties with the assessment of this stock (or stocks), supported the conclusions and advice. However, Scientific Council noted that the ICES advice to NEAFC is cast within a two-stage sequential process: (a) develop a management plan and (b) then set an annual TAC of 20 000 t as a starting point when implementing the plan. However, there was no assurance that such a management plan will be developed prior to 2009. Therefore, the Scientific Council advised Fisheries Commission in 2008 that it would be prudent for NEAFC to implement a total TAC of 20 000 t in 2009 for pelagic redfish in NAFO SA 1-3 (and adjacent ICES areas V, VI and XIV), irrespective of any progress made in developing and implementing a management plan for this resource.

NEAFC approved a Total Allowable Catch (TAC) for pelagic redfish fishery in the Irminger Sea and adjacent waters for 2009 shall not be set higher than that set for 2008, i.e. 46 000 t. In view of the above the 2009 TAC for redfish in SA 2 and Div. 1F+3K remains at 12 516 t.

b) Monitoring of Stocks for which Multi-year Advice was Provided in 2007

Roughhead grenadier in SA 2 and SA 3

The Scientific Council reviewed the status of this stock (interim monitor) at this June 2009 meeting. Based on overall indices for the current year, Scientific Council found no significant change in the status of this stock. The next full assessment of this stock is planned to be in 2010.

VIII. REVIEW OF FUTURE MEETINGS ARRANGEMENTS

1. Scientific Council and Special Session, September 2009

Scientific Council noted that the Annual Meeting will be held 21-25 September 2009. The Special Session of Scientific Council in 2009 is the symposium entitled “Rebuilding Depleted Fish Stocks – Biology, Ecology, Social Science and Management” to be held on 3-6 November 2009 in Warnemünde, Rostock, Germany. (see agenda item IX.1 for further information).

2. Scientific Council, October/November 2009

The Scientific Council agreed that the dates and venue of the next Scientific Council /NIPAG meeting will be held from 21–29 October 2009 at the NAFO Headquarters, Dartmouth, Nova Scotia, Canada.

3. Scientific Council WG EAFM, November 2009

The next meeting of the Working group will be held at the Institute of Marine Research, Vigo, Spain during 9-13 November 2009.

4. Scientific Council, June 2010

Scientific Council agreed that its June meeting will be held on 3-17 June 2010 with the meeting venue being the Alderney Landing, Dartmouth, Nova Scotia, Canada.

5. Scientific Council, September 2010

Scientific Council noted that the Annual Meeting will be held on 20-24 September 2010. The meeting will be in Halifax, N.S., Canada unless an invitation to host the meeting is extended by a Contracting Party. No decision was made on the dates of the 2010 special session.

6. Scientific Council, October/November 2010

The dates and venue of the Scientific Council/NIPAG meeting will be decided at the 2009 Meeting. Provisional dates and venue are 20–28 October 2010 at the ICES Headquarters, Copenhagen, Denmark (*NAFO Sci. Coun. Rep.*, 2008, p. 267).

7. ICES/NAFO Joint Groups

a) WGHARP, 24-28 August 2009

The next meeting of the ICES/NAFO Working Group on Harp and Hooded Seals (WGHARP) will be in Copenhagen, Denmark, on 24-28 August 2009.

b) NIPAG, 21-29 October 2009, Dartmouth

This meeting is scheduled to take place in conjunction with the Scientific Council meeting at the NAFO Headquarters in Dartmouth, NS, Canada.

c) WGDEC, 2010

The next meeting will be held in Copenhagen, Denmark in 2010.

d) NIPAG, October/November 2010

The dates and venue will be decided at the October 2009 meeting.

IX. ARRANGEMENTS FOR SPECIAL SESSIONS

1. Special Session in 2009: Symposium on "Rebuilding Depleted Fish Stocks"

Update on the ICES-UNCOVER Symposium on Rebuilding Depleted Fish Stocks – Biology, Ecology, Social Science and Management Strategies Warnemünde, Germany 3-6 November 2009

NAFO is a co-sponsor of this symposium and is providing a financial contribution. Peter Shelton (Canada) represents NAFO as a co-convenor of this symposium and Fred Serchuk (USA) represents NAFO on the steering committee. A number of papers from scientists involved in research on NAFO stocks are anticipated, including papers on Greenland halibut and yellowtail flounder. Planning of the symposium is at an advanced stage. The submission date for abstracts has passed and authors are currently being informed regarding whether their paper has been accepted for oral or poster presentation. The main keynote speaker is Dr. Steve Murawski (US National Marine Service, NOAA). There are 5 sessions: (i) Fisheries and environmental impacts on stock structure, reproductive potential and recruitment dynamics; (ii) Trophic controls on stock recovery; (iii) Methods for analysing and modelling stock recovery; (iv) Social and economic aspects of fisheries management and governance; and (v) Management & Recovery strategies. Key-note speakers have been selected for each session. The Symposium will conclude with a panel discussion which will highlight progress with regard to meeting the 2002 World Summit on Sustainable Development commitment to restore fish stocks to BMSY by 2015. Selected, peer-reviewed papers will be published in a special issue of the ICES Journal of Marine Science.

2. Topics for Future Special Sessions

Scientific Council further discussed the special session for 2010 that would take the form of a workshop dealing with new assessment methods that may be applicable to NAFO stocks. Scientific Council is of the view that the most appropriate methods are currently being applied to NAFO stocks and that DEs are generally aware of the other available methods. However, it was also appreciated that new methods, particularly statistical catch-at-age and Bayesian approaches, are increasingly being developed for assessments in various fora. The Council discussed that the workshop would take the form of presentations, practical exercises and documentation in the application of new methods on finfish or shellfish stocks to the level where DEs could actually use these methods independently.

In view that no one has stepped forward to coordinate this special session, Scientific Council requested that the Scientific Council Coordinator contact representatives and DEs to investigate new methods currently being used within their labs with the idea that this may provide a means to go forward with a workshop. Results will be reported at the September meeting.

X. MEETING REPORTS

1. Working Group on Reproductive Potential, Nov 2008

Progress of the NAFO Working Group on Reproductive Potential was provided by E.A. Trippel (Chair). The establishment of the Working Group on Reproductive Potential followed a recommendation of the Symposium on "Variations in Maturation, Growth, Condition and Spawning Stock Biomass Production in Groundfish" hosted by NAFO Scientific Council from 9-11 September 1998, Lisbon, Portugal. The Working Group consisted of 21 members representing 9 countries (Canada, Denmark, Greece, Iceland, Norway, Russia, Spain, United Kingdom, and USA).

The 8th Meeting of the NAFO WG on Reproductive Potential was held at the Ai Cavalieri Hotel in Palermo, (Sicily) Italy, 17-21 November 2008 to address the ToRs approved by Scientific Council in June 2008. There were 18 WG participants spanning 9 countries: Richard Nash (Norway), Olav Kjesbu (Norway), Gerd Kraus (Denmark), Joanne

Morgan (Canada), Rosario Dominguez (Spain), Loretta O'Brien, (USA), Nathalia Yaragina (Russia), Yvan Lambert (Canada), Rick Rideout (Canada), Peter Witthames (UK), Hilario Murua (Spain), Peter Wright (UK), Holger Haslob (Germany), Alexandre Alonso-Fernández, Richard McBride (USA), Stylianos Somarakis (Greece), Fran Saborido-Rey (Spain) and Ed Trippel (Canada). A meeting of the EU COST Research Network Action Fish Reproduction and Fisheries (FRESH) (Coordinator: Fran Saborido-Rey) was also held during this period. Mutual benefits of having the two groups meet together were achieved as both have complimentary science and management advice objectives. To facilitate this arrangement the meeting was co-chaired by Ed Trippel and Fran Saborido-Rey. Local arrangements were greatly appreciated for the meeting of 37 participants (16 specific to FRESH) and were provided by Walter Basilone (Consiglo Naszionale Ricerche (CNR), Istituto Ambiente Marino Costiero (IAMC-CNR), Mazara del Vallo, Italy).

The objectives of the WG meeting were to enable the ToR Co-Leaders, selected during inter-session by the Chair, to discuss with WG members the proposed set of milestones and deliverables associated with their respective Term of Reference. The meeting consisted of plenary and break-out group sessions with scientific presentations made to conceptually introduce specific work areas related to the ToRs. The break-out groups defined as a first draft the specific deliverables and interested contributors.

The joint meetings with FRESH allowed the WG to be aware of the planned work of FRESH and the WG will follow this closely and incorporate the results of that group into its own work where appropriate. This will avoid duplication of effort between the groups and allow the WG to bring more results to the attention of Scientific Council. It was recommended that the two groups maintain an informal working relationship as this type of relationship is adequate to develop the collaborations among scientists that would be beneficial towards addressing the ToRs.

A brief summary of progress and future plans of each ToR are given below. It was decided due to the busy conference schedule in autumn 2008 that it would be best to work inter-sessionally by correspondence and *ad hoc* meetings during these scheduled autumn conferences.

FUTURE ACTIVITIES

The 9th Meeting of the NAFO Working Group on Reproductive Potential is proposed to be held in Greece in March, 2010 (further details to be defined by local organizers). This will be the second meeting for the 3rd Set of ToRs.

3rd Set of Terms of Reference

ToR 1: Explore and conduct evaluation of underlying assumptions of protocols used to estimate total realized egg production of selected marine species and stocks

Co-Leaders: Rick Rideout (DFO, Canada) and Rosario Dominguez (CSIC, Spain)

Several marine laboratories in the North Atlantic have initiated routine fecundity estimation for key fish stocks. This information is being used to (i) help improve the estimation of stock reproductive potential (ii) understand population productivity and (iii) predict stock recovery rates. However, there is a lack of standarization and calibration of various methods to estimate fecundity among laboratories. For example, some laboratories have only recently initiated the autodiametric method and are developing appropriate calibration curves. On the other hand, observations have been made that indicate atresia and timing of sampling can influence estimates of total egg production. Techniques to quantify atresia (vitellogenic oocyte resorption) will be developed and evaluated in this ToR. This will involve histological analyses accompanied by computerized image analysis.

<u>Establish Standard Operating Procedures</u>:

Provide uniform and standarized procedures for routine fecundity analyses in laboratories using a variety of methods, i.e. autodiametric method, image analysis

Evaluate histological techniques for assessment of atresia

Validation of Assumptions:

Test assumptions of different fecundity methods (i.e. the autodiametric method) and parameters associated with fecundity estimation

Estimate down regulation of fecundity and quantification of atresia and non-annual spawning

Deliverables: - Review paper on reproductive strategies

- Methodology/manual for working with fish maturity/fecundity.

- Review paper on atresia

- Primary publication on potential of autodiametric method for studying oocyte recruitment dynamics in various species

- Workshop on gonadal histology of fishes

The 4th Workshop on Gonadal Histology of Fishes is scheduled to be held in Cádiz, Spain, June 16-19, 2009. The following contributions are being made by WG Members (underscored).

Skipped spawning: A strategy for maximizing reproductive output in a variable environment. Rick Rideout

The utility of gonadal histology in studies of fish reproduction and the subsequent management of fisheries and ecosystems. Olav Kjesbu

Understanding temporal reproductive patterns in marine fish: a review of histological approaches and emerging methodology. Susan Lowerre-Barbieri, Konstantinos Ganias, Hilario Murua, Fran Saborido-Rey and John Hunter

The reproductive biology of female winter flounder (*Pseudopleuronectes americanus*): validating classification schemes to assess the importance of 'skip spawning'. Mark J. Wuenschel, Richard S. McBride, Grace M. Thornton and Paul Nitschke

Standardization of methods and terminology applied in maturity determination of gadoids and other marine fish species in the Northeast Atlantic. Jonna Tomkiewicz, Rikke Hagstrøm Bucholtz and Fran Saborido-Rey

The assessment of maturity stage in Greenland halibut (*Reinhardtius hippoglossoides*). James Kennedy, Agnes C. Gundersen, Åge S. Høines and Olav S. Kjesbu

Proceedings "book" with extended Abstracts and a Proceedings "volume" in Transactions of the American Fisheries Society are planned. The NAFO WG RP and FRESH will be acknowledged in both.

In addition, research related to a Canada-Spain collaboration was targeted on the subject of generating an autodiametric calibration curve for fecundity estimation for gadoids of Georges Bank and was recently published:

Alonso-Fernández, A., A.C. Valllejo, H. Murua, F. Saborido-Rey and E.A.Trippel. 2009. Fecundity estimation of Atlantic cod (*Gadus morhua*) and haddock (*Melanogrammus aeglefinus*) of Georges Bank: Application of the autodiametric method. Fish. Res. 99: 47-54.

ToR 2: Explore and investigate the potential effects of changes in water temperature and food supply on reproductive success in selected marine species and stocks

Co-Leaders: Richard McBride (NMFS, USA) and Stylianos Somarakis (HCMR, Greece)

Environmental factors can modify the reproductive potential of fish stocks and thereby influence recruitment. Annual variations in water temperature and potential temperature increase due to climatic warming will presumably act strongly to influence gonadal development and reproductive success. Prey resources also vary and influence fish condition which in turn affects reproductive output. In this ToR, using data on specific stocks and laboratory experiments, the influence of specific abiotic and biotic factors on gonadal development and spawning will be evaluated pending available data.

Abiotic: Examine changes in water temperature (short and long-term) and their effects on timing and duration of spawning, fecundity, egg size and fertilization success

Biotic: Assess variation in prey resource type and abundance and their effects on egg production and gamete quality

ToR 2 was divided into two components

(a) Explore and investigate the potential effects of changes in water temperature on reproductive success in selected marine species and stocks. For this Sub-ToR, it is proposed to conduct a review of published predictive equations between water temperature and the reproductive attributes/processes described above (laboratory and field data based) and conduct research on stock-specific responses. Key Contributors: Ed Trippel (Canada) and several others. Specifically, this includes (i) examining the effects of water temperature and feeding level on seasonal allocation of energy of cod (growth and reproduction), (ii) effects of temperature on egg incubation of Greenland halibut (iii) effects of temperature on sperm motility of Atlantic cod, and (iv) analyses the effect of temperature on energy allocation (growth and reproduction) in 3NO cod.

(b) Explore and investigate the potential effects of changes in food supply on reproductive success in selected marine species and stocks. This effort to date as led to an annotated reference list (>100 citations) and generation of a summary table. Key Contributors: Nathalia Yaragina (Russia), Stelios Katsanevakis (Greece), Walter Basilone (Italy), Gary Fitzhugh (USA), Mark Wuenschel (USA)

ToR 3: Undertake appraisal of methods to improve fish stock assessments and fishery management advice that incorporate new biological data for highly exploited and closed fisheries

Co-Leaders: Joanne Morgan (DFO, Canada) and Loretta O'Brien (NMFS, USA)

The depressed and age-altered state of many marine fish stocks has led to reduced landings and in some instances fishery closures. New biological data associated with these altered states will be used to forecast recruitment and improve the accuracy of stock assessment advice. Building on information from previous WG ToRs, the intrinsic rate of population increase will be utilized to assess the timeframe for selected stocks to recover under various fishing and environmental conditions.

Recruitment prediction: Improve prediction of incoming year class size and develop new stock-recruitment models and biological reference points based on better estimates of stock reproductive potential. This includes testing whether more complex indices of reproductive potential result in better estimates of recruitment and limit reference points. Develop scenarios which model population reproductive responses to extrinsic factor data developed in ToR 2.

Key Contributor: Joanne Morgan (Canada)

Stock recovery: Evaluate the intrinsic rate of increase of selected stocks under differing conditions of reproductive potential and levels of fishing mortality to aid in the development of reopening criteria. Estimate recovery time for specific stocks to achieve target biomass levels.

- The relative importance of reproductive characteristics on stock resiliency to fishing mortality, both within and between stocks, will be evaluated by comparing *r* estimates between scenarios of differing RP.

- Current estimates of reproductive potential, mortality, and population size will be applied in a Leslie matrix population model to provide a current estimate of *r*. The time period required to rebuild a stock will be determined for three projection scenarios 1) in the absence of fishing, 2) with current fishing effort, and 3) with the maximum fishing effort allowable to rebuild a stock in a fixed period of time.

Key Contributors: Loretta O'Brien (USA) and Yvan Lambert (Canada)

Egg production methods can estimate spawner biomass and/or stock numbers independently of commercial fisheries data. Improved information on stock reproductive potential is improving the accuracy of these methods. The daily egg production method is being explored to evaluate adult stock size for determinate spawning species in the Baltic and North Seas. For this ToR a meta analysis/review of this topic will be conducted to inform Scientific Council of advances in this area.

Key Contributor: Gerd Kraus (Germany)

ToRs will be explored for stocks in the NAFO area where possible (e.g. 3LNO American plaice 3NO cod, 3M cod, , Georges Bank cod, and others) but stocks from the northeast Atlantic will be included as additional sources of information (e.g., Baltic cod, North Sea plaice and others).

NAFO Scientific Council noted the progress made and approved the annual work plan. Moreover, attention was placed on the development of a Workshop on ToR 3. This Workshop should be held in ~2 years (2011) to help facilitate the transfer of techniques developed by WG members to stock assessment personnel that routinely conduct NAFO stock assessments. It is anticipated that one of the outputs of this workshop will be a manual on the integration of data on reproductive potential into stock assessments.

2. Special Session in 2008: Marine Mammals Symposium, Dartmouth, Sep 2008

The Symposium was successfully concluded and the full report is available at Annex 1.

3. *Ad hoc* Working Group of Fisheries Managers and Scientists, Vigo March 2009

The Chair of the Working Group of Fisheries Managers and Scientists (WGFMS), Bill Brodie (Canada), gave Scientific Council a brief summary on the background and activities of the working group. This working group was formed by Fisheries Commission in May 2008, to provide recommendations to Fisheries Commission on implementation of measures to prevent significant adverse impacts on vulnerable marine ecosystems. It met in September 2008, and March 2009, to deal with specific items on Vulnerable Marine Ecosystems (VME), with the March meeting focusing primarily on corals, and the information provided by Scientific Council on this topic in October 2008. Reports of this working group are available as FC Doc. 08/8 and 09/2, and recommendations of the working group will be considered by Fisheries Commission in September 2009 at the Annual Meeting. The next meeting of the working group is scheduled to occur in September 2009, immediately prior to the Annual Meeting.

4. WGDEC, Copenhagen, March 2009

The WGDEC met from 9-13 March 2009 in Copenhagen, Denmark to address 11 terms of reference, many of relevance to NAFO. Thirteen scientists from 9 countries participated. The meeting was held jointly with the Working Group on the Biology and Assessment of Deep Sea Fisheries Resources (WGDEEP), with 5 terms of reference (ToRs) shared between the groups. The full WGDEC report will be available online at: http://www.ices.dk/workinggroups/ViewWorkingGroup.aspx?ID=15.

WGDEC made significant contributions to a number of important NAFO issues. Their ToR f) produced a list of 25 sponge species which are habitat-forming and can be considered indicators of sponge VMEs in the North Atlantic. The WGDEC further examined the types of damage that fishing operations can inflict on sponges and assessed their impact. These impacts were classified as due to mechanical damage, dislodgement and sedimentation. From this report it is clear that sponges brought on deck and returned to the sea will not survive, nor will sponges dislodged from the seabed. The large sponges take decades to achieve their size and so sponges certainly are at risk of significant adverse impacts due to fishing. WGDEC also recommended that sponge grounds, rather than individual species, be considered as the operational unit for conservation. Most of the sponge species found within fishing depths in the North Atlantic are relatively common and widespread. Over much of their distribution they occur as isolated individuals, however, in some locations, where environmental conditions are favorable, they form dense, multi-species communities and these sponge grounds require protection. This means that while information on species composition of catches is desirable, it is not essential. Sponge bycatch weights alone are good indicators of sponge grounds in the North Atlantic. Canadian data on the location of sponges from the Northwest Atlantic was mapped for the first time allowing trans-Atlantic overview of the occurrence of these habitats. The report also shows detailed maps for some locations. It was noted that the upper limits of some of the sponge grounds in the NW Atlantic have been heavily modified by past fishing. A call for data on sponge catches from the west coast of Greenland along the southern part of the Davis Strait, the eastern coast of the United States north of 40°N, and the eastern side of the Faroe/Shetland Channel was made to fill in gaps so that investigations on the physical factors which produce sponge grounds can begin.

The WGDEC (ToR h) also identified "Serpulid reefs", specifically reefs formed by the tube-building worm *Filograna implexa*, as structure-forming benthic habitat vulnerable ot fishing gear. These reefs are on the order of 10-50 cm high and have been reported from the Gulf of Maine, Georges Bank and off Norway.

The WGDEC offers valuable expertise in deepwater ecology and both in 2008 and 2009 has produced reports which have greatly assisted the work of the Scientific Council. NAFO should continue to provide ToR to the WGDEC and encourage participation by experts from member countries. ICES will consider the ToRs for its working groups at its business meetings held in Berlin, Germany 21-25 September, 2009.

ToR for WGDEC 2010

Assess the association of fish species with sponge grounds using trawl survey data where available. Summarize the environmental factors influencing sponge distribution in the North Atlantic based on the distribution of sponge taxa. Update maps of sponge grounds using any new data provided. Provide a description of sponge species occurring at depths greater than 1500 m.

Justification: WGDEC has reviewed the literature on the association of sponge grounds with fish and other fauna. With the location of the sponge grounds now mapped it should be possible to evaluate the association of fish within these areas through analyses of the trawl survey data. Specifically, comparisons of fish catch and diversity inside and outside of sponge grounds at similar depths and areas could be statistically analyzed. It is expected that further information on the sponge species constituting the sponge grounds on the NW Atlantic will be available in 2009. This will allow for biogeographical assessment and examination of the environmental factors responsible for creating sponge habitat and determining community composition. WGDEC feels that there is now sufficient data to produce a summary of the sponge species inhabiting depths below 1500 m in the North Atlantic and that such a summary would be useful, in particular to researchers working at such depths. Data gaps from western Greenland and the NE USA have been identified. Should more information from those areas be provided maps on the distribution of sponge grounds should be updated. Sponges have been identified as key components of vulnerable marine ecosystems by FAO. It is expected that the work produced under this and previous ToRs will have direct relevance to NAFO, NEAFC, ICES and other organizations concerned with the protection of VME.

5. WGEAFM, by Correspondence, May 2009

The Working Group on the Ecosystem Approach to Fisheries Management (WGEAFM) met by correspondence to prepare information to address a September 2008 Fisheries Commission request (FC Doc. 08/19, item 9b and 9c). The report (SCS Doc. 09/6), which focused on the distribution of sponges within the NRA, was presented to the Scientific Council and formed the basis of the response to the Fisheries Commission request 9b and 9c. The full response is given above under Scientific Council agenda item VII.1.d.v. The Scientific Council acknowledged the considerable effort of WGEAFM in meeting this June deadline as well as playing an important role in advancing NAFOs position to meet commitments of those aspects of UNGA Resolution 61/105 (principally paragraphs 80-92) that relate to Vulnerable Marine Ecosystems. Scientific Council was impressed with the quality and timeliness of the tasks addressed by WGEAFM, in particular that this was conducted by correspondence, and wishes to express its gratitude to all the members.

WGEAFM was created by Scientific Council in September 2007 with the spirit of providing a fertile forum for discussions of tools, methods and approaches that can be used in consideration of ecosystem approaches to fisheries management within NAFO.

WGEAFM had its first meeting in May 2008, but has also held several meetings by correspondence after May 2008. Initially this working group devoted most of its time addressing the identification and delineation of Vulnerable Marine Ecosystems (VMEs) largely in response to urgent specific "requests for advice" from Fisheries Commission. Its work has provided the basis for the Scientific Council's identification of candidate VME areas, as well as further work intended to define and map significant concentrations of corals and sponges.

Although it is expected that specific and topical requests will always be part of its workload, Scientific Council supported the proposal put forward by WGEAFM co-chairs Mariano Koen-Alonso and Andrew Kenny, that the next working group meeting in November 2009 should be devoted, as much as possible, to advancing general ecosystem issues that will support Scientific Council with the advancement of an Ecosystem Approach to Fisheries Management (EAFM). When possible, topic-specific and urgent requests will be dealt with by correspondence.

Considering that advancing the general ecosystem approach will require multiple meetings, Scientific Council re-organized the Terms of Reference (ToR) for WGEAFM. The new ToRs are intended to provide a general envelope and reference grid for WGEAFM work with minimal modification of ToRs between meetings, or at least to provide some degree of ToR stability over the next few years. The re-organized ToRs are grouped within themes as follows:

Theme 1: Take stock of past and planned WGEAFM related work

ToR 1*: Update on identification and mapping of sensitive species and habitats in the NAFO area*. This ToR is intended to provide a place to summarize the work done by correspondence between meetings, as well as to discuss advancements made to address identified gaps. In the 2009 Annual Meeting this ToR will be focused on the VME work and later developments (e.g. the multinational effort, led by Spain, to map NAFO VMEs).

Theme 2: Status and functioning of NAFO marine ecosystems (empirical evidence)

ToR 2*: Synthesis of current understanding of the dynamics of Large Marine Ecosystems (LMEs) in the NAFO area.* This ToR is intended to summarize our understanding on the dynamics of these ecosystems, but focused on the possibility of regime shifts and its potential mechanisms if indeed such shifts have occurred. Here ecosystem regime shifts are loosely defined when ecosystem change is large, abrupt and difficult to reverse. Do we understand the cause(s) for such shifts and, more importantly, what are the drivers (tipping points) for such shifts?

ToR 3*: Scope of Marine Protected Areas and VMEs in the context of habitat and spatial functioning*. This ToR is intended to examine examples of what does and what does not work, e.g. links between scale, biodiversity and sustainability of ecosystem goods and services – what is the evidence to propose a workable and pragmatic solution.

Theme 3: Practical application (synthesizing the evidence and theory)

ToR 4*: Systems level modelling and assessment approaches*. This ToR is intended to discuss alternative modelling and assessment approaches which can provide the outputs for overall objective fisheries based risk assessments. Can we set out a framework for the integration of modelling and assessment approaches to be developed/adopted?

ToR 5*: Ecosystem indicators and how they can be used in management advice.* This ToR is aimed to discuss, given the present understanding of LME dynamics (including the impacts of fishing), what are the most promising types of indicators, either now or in the future, and how they could be used for informing management decisions?

ToR 6*: Methods for the long-term monitoring of VME status and functioning.* This ToR is aimed to begin the discussion on how to incorporate the monitoring and management of VMEs within a larger ecosystem-based management framework.

Additional ToR for WGEAFM from this Scientific Council meeting

Scientific Council noted that no biomass index is available for coral or sponges aggregations within the NAFO Regulatory Area. Therefore, the detection of trends over time and the monitoring schemes to assess impact/recovery that are required by the FAO Deep Sea Fisheries guidelines is problematic. Further, it is not possible to analyse the relationship between the occurrence of coral or sponge aggregations and commercial bottom trawl fishing effort. Scientific Council requests that WGEAFM investigate cost and time effective methods to monitor the health of the VME areas. Further, and subject to the above and data availability, Scientific Council further requests that the relationship between historical commercial bottom trawl fishing effort and the occurrence of VME indicator species be investigated.

Scientific Council noted the next WGEAFM meeting will take place on 9-13 November 2009 at the Instituto de Investigaciones Marinas in Vigo, Spain.

6. *Ad hoc* Working Group on Assessment Methods for SA 2 + Div. 2J+3KLMNO Greenland Halibut, Dartmouth, June 2009

A Working Group met on 1-3 June to evaluate alternative assessment models to aid in determining the robustness of the XSA used for the assessment of Greenland Halibut in SA 2 + Div. 3KLMNO (see Scientific Council response under agenda item VII.1.d.vi).

The most recent assessments based on the XSA model have been accepted by STACFIS and Scientific Council, but at some times in the past Scientific Council has expressed reservations about using the results from this model. Thus, in both 2000 and 2001, although Scientific Council formulated management advice with the help of forward projections of the stock based on the assessment model, the model fit was considered to be poor and indicative of trends rather than absolute estimates, and in 2002 the recent trends in survey indices conflicted to such an extent with the estimates of biomass trend from the XSA model that it was not used to project the population forward. In 2003, the survey series used were shortened to include only data since 1995; the model fit improved and forward projections were used in formulating advice. Since then, the XSA model has been used for the assessment, for projections and as the basis for the advice, but has been checked in different ways from time to time. *Inter alia*, its sensitivity - or robustness - has, in recent years, repeatedly been investigated and compared with other VPA-type formulations.

Age-structured assessment models have long histories of use in fish stock assessments and their reliability is in general well established. They are based on a common stock-dynamic assumption, that cohorts should be traceable through survey and fishery catches as they age, grow, and decrease in numbers through fishery and natural mortality. However, if age-structured models are presented with data that apparently does not conform to this underlying structure, they can be expected to have difficulty in fitting to it and, depending on their specific structures, may resolve those difficulties in different ways. In such circumstances, the differences between differently structured models might usefully be seen as informative and helpful rather than vexatious and obstructive.

The Working Group considered a suite of different models for the assessment of Greenland halibut in SA 2 + Div. 3KLMNO. The models could be divided into four classes: stock-production models, including ASPIC based on aggregate indices and age-structured production model (ASPM); a small number of VPA-based models (XSA and ADAPT); Statistical Catch at Age; survey-based assessment (SURBA). Their diagnostics of model fit were different and difficult to compare. Comparison of such diverse models, and determination of their robustness to different anomalies in the data or infractions of the stock-dynamic assumptions on which they are based, might be possible with comprehensive suites of synthetic data from artificial populations with known properties. The Working Group only considered runs of different models with the available data for the stock under consideration, or different selections from that data, and did not compare different model types with synthetic data. It was unable to find a logical way to compare quantitatively the fits of such differently constructed models to the data now available for this stock, and concluded that none was immediately available.

Three survey series cover different areas, or depth ranges, or both, but most of the models considered take all the series to be proportional indices to the stock over its entire range. Agreement between the different survey series - generally good - was less good in recent years than it had been earlier. A preliminary examination of the survey data for this stock showed that some cohort structure could be traced up to ages of about 6–8 years, but was much less evident at greater ages. Recent surveys had caught some fish from older cohorts that had not been evident at lesser ages in earlier years, while the fishery had caught few older fish in recent years.

Some models had strong or erratic retrospective patterns, possibly showing inconsistencies in the data series. The results given by assessment models differed mainly in biomass levels in early years and at the oldest modelled ages. When different models were run with similar or the same data sets, their results converged to more similar values. However, there was still a divergence in trend in the most recent years, between the XSA accepted in 2008 that showed stability and other models that showed increasing trend in biomass. This is largely due to an averaging of fishing mortality (F) over the most recent years (‘shrinkage’) that is used in the accepted XSA in order to stabilise the results and reduce year-to-year variations that otherwise reveal themselves as strong retrospective effects and an unstable basis for advice.

Some variants of VPA-based models (ADAPT and B-ADAPT) were run and compared with XSA. National Fisheries Toolbox (NFT) ADAPT with inverse-variance weighting gave similar results to those of XSA without *F*-averaging, but XSA with F-averaging gave lower estimates of recent stock size and unweighted NFT ADAPT gave higher estimates. Unweighted NFT Adapt and XSA without *F*-averaging fitted better than the other formulations, although measures of fit are not fully comparable. None of these formulations reduced the trends in Canadian survey-index residuals for the most recent ten years (Fig. 9).

B-Adapt, estimating a bias in the last ten years' landings, improved the fit significantly. However, the 'bias-corrected' catches were outside any reasonable estimates, showing that the observed trends in residuals were probably due to changes in survey catchability. Since the surveys had constant sampling methods, these changes were probably related to changed availability of the fish to the gear.

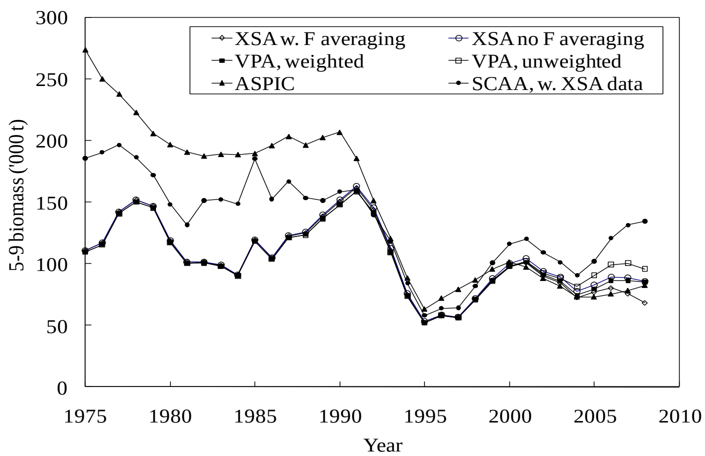


Fig. 9. Greenland halibut in SA 2 + Div. 3KLMNO: trajectories of fishable biomass estimated by different stock-dynamic models.

Most formulations of a Statistical-Catch-at-Age model estimated biomasses that were several to many times higher than those estimated by VPA-based models, including the accepted XSA. There was some tendency for these differences to be most marked for the oldest population segment, comprising fish at least 10 years old, indicating that the SCAA model included a 'cryptic' biomass of older fish that was relatively larger than that included by VPA-type models. There were also differences between XSA and SCAA in trajectories of fishable (5-9 years old) biomass, which were however much reduced under certain settings for the SCAA model that were more similar to the XSA formulation: *e.g.* natural mortality set at 0.15/yr and also sensitivities starting in 1975. SCAA trajectories diverged greatly going back in time, which may indicate an effect of assumptions about starting conditions for the model. Higher recent and present biomass levels estimated by SCAA than by XSA were associated with somewhat greater resilience to future catch.

An objective of the Working Group was to consider formulations of models that used fishery CPUE as input data. CPUE is used by most models as a proportional index to the fishable biomass over the ranges both of the stock and the index. However, a revised standardization of the fishery CPUE appeared to show that recent increases in nominal CPUE might have been partly due to relocation of the fishery to areas of higher density, and although in years when the Canadian fall survey catch averaged over 20 kg/tow the aggregate Canadian CPUE in Div. 2HJ+3KL was roughly proportional to it (with considerable scatter), at lower values of the survey index this fishery appears to have maintained higher catch rates than those proportions would predict (Fig. 10).

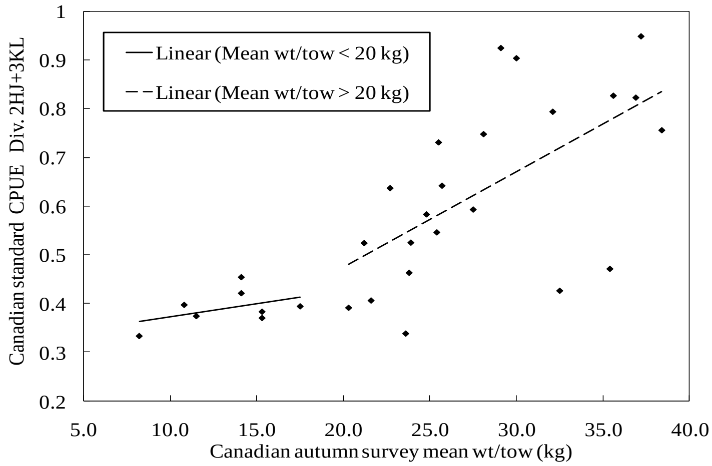


Fig. 10. Greenland halibut: Canadian standardised CPUE in Div. 2HJ+3KL and Canadian autumn survey mean weight per tow, 1980–2007.

Some models could not be tried with the inclusion of CPUE as it was not available to the Working Group in age-specific form. Some models that could use age-aggregated CPUE were tested with fishery CPUE data. However, while the three survey series were positively correlated with one another (*r* from 0.59 to 0.80), as were the three CPUE series (0.56-0.75), only two correlations between the CPUE series and the survey series were strong, five were weak (0.02-0.32) and two were negative (–0.07 and –0.31). Given these weak and negative correlations age-aggregated assessment models would have poor prospects for successfully fitting to CPUE and survey series simultaneously.

A stock-production model (ASPIC) was applied to age-aggregated biomass indices drawn from the same surveys and covering the same period as those used in the accepted XSA. The model was sensitive to starting values for some parameters, having two distinct solutions that included very different trajectories of both relative biomass and fishing mortality. One of the trajectories of biomass was close to those estimated by other assessment models using data from the same sources, and was also consistent with the known history of fishery catches and survey biomass indices. Retrospective patterns were noted for the two solutions. The SCAA model can use age-aggregated CPUE. Its CPUE-based results differed from those of the XSA model in much the same way as when it used only survey data. This was thought to show that the differences between results from these models were due more to their different structures than to using only survey data as input to XSA.

7. ICES/NAFO Working Group on Harp and Hooded Seals (WGHARP)

The ICES/NAFO Working Group on Harp and Hooded Seals (WGHARP) met in Tromsø, Norway, on 27-30 August 2008. No ToRs were submitted by NAFO and NAFO no longer assesses harp and hooded seal populations in the NRA. However, and of note, is that seals are important components of the ecosystem and an understanding of their population biology remains of relevance in the NAFO Convention Area.

The next meeting of WGHARP will take place in August 2009 in Copenhagen, Denmark. The primary issue they will address is the apparent decline in harp pup production in the White Sea and they will review a survey carried out in March 2009. Data collected during the 2008 Northwest Atlantic harp seal pup production is being analyzed and preliminary results may be presented to WGHARP if available.

The joint ICES/NAFO nature of this working group was discussed in Council, since NAFO will no longer be active in seal assessments. However, it was noted that seals are important components of the marine ecosystem, especially as predators of fish and shellfish populations, in the convention area. This will be discussed further at the September Scientific Council meeting.

8. Meetings Attended by the Secretariat

a) Fishery Resources Monitoring System (FIRMS)

The Fishery Resources Monitoring System (FIRMS) is a unified partnership of international organizations, regional fishery bodies and, in the future, national scientific institutes, collaborating within formal agreements to report and share information on fisheries resources. There are three main bodies. The FIRMS Steering Committee (FSC) comprising of representatives from partners, the FIRMS Technical working groups comprising of more technical experts, and the FIRMS Secretariat provided by FAO.

The primary aim of FIRMS is to provide access to a wide range of high-quality information on the global monitoring and management of fishery marine resources. FIRMS also participates in the development and promotion of agreed standards.

FIRMS system is part of the Fisheries Global Information System (FIGIS). Information provided by the partners is organized in a database and published in the form of fact sheets. This system provides the data owner with tools to ensure controlled dissemination of high quality and updated information.

The NAFO Secretariat has been involved in this project since its inception. Since 2005 NAFO has been a partner in FIRMS and data submission has been taking place since about 2002. The Scientific Council Summary Sheets form the basis of the contributions for the Marine Resources module and this has put NAFO ahead of many other Partners who have had to create their inventories from scratch. Recently the NAFO CEM has been submitted as part of the NAFO contribution to the Fisheries Module but this is not as straightforward and will require more effort. The NAFO Executive Secretary was the most recent Chair of the Steering Committee.

In 2008, two meetings related to FIRMS were held. The Technical Working Group met in April to discuss technical details and make recommendations to the Steering Committee. Barbara Marshall and George Campanis represented NAFO. The Steering Committee met in July at the NAFO Secretariat and was attended by Johanne Fischer, Barbara Marshall and George Campanis. As well other members of the Secretariat were able to observe the meeting.

At the Steering Committee meeting in July, 2008 decisions made were based on recommendations made by the Technical Working Group. Most specifically it was agreed to release the Fisheries Module to the public. Some other technical issues were adopted as well. There was also some discussion about creating an Ecosystem Module in order to present information used in the Ecosystem Approach but this will be further discussed and elaborated at future meetings.

In July this year a week-long training session will be conducted at the NAFO Secretariat by Gentile Aureliano, a member of the FIRMS team from FAO. We will be learning learn how to use conversion tool developed by FIRMS for transforming MSWord to XML. The XML is how FIRMS publishes the information on the FIRMS website. This has been opened to the IATTC as well.

b) Coordinating Working Party on Fishery Statistics (CWP)

The Coordinating Working Party on Fishery Statistics (CWP) provides a mechanism to coordinate fishery statistical programs of regional fishery bodies and other inter-governmental organizations with a remit for fishery statistics. Functional since 1960, the CWP purpose is to:

- continually review fishery statistics requirements for research, policy-making and management,
- agree on standard concepts, definitions, classifications and methodologies for the collection and collation of fishery statistics,
- make proposals for the coordination and streamlining of statistical activities among relevant intergovernmental organizations.

The CWP is composed of experts nominated by intergovernmental organizations which have a competence in fishery statistics. There are currently 17 participating organizations in the CWP, including NAFO, which was a founding member (as the predecessor organization, ICNAF). CWP generally meets every two years, and informal intersessional meetings are held when needed.

The 22nd Session of the CWP, Rome, Italy, 27 February - 2 March 2007 was attended by the former Executive Secretary. The Fisheries Commission Coordinator presented the highlights of the report of the meeting (FAO Fisheries Report No. 834). Among other items discussed at this CWP meeting were issues relating to integrating the regional databases and the removal of the basis for discrepancies. There were considerable discussions on the comparison of the STATLANT 21 data held by NAFO Secretariat with the FAO data on Area 21 and the identification on the sources of discrepancies. The CWP meeting participants agreed that "priority should firstly be given to improving future data collection and validation rather than to rectifying historical discrepancies".

In view of the complex issues concerning the reliability of STATLANT 21 data and need for improvement on the manner of reporting STATLANT 21 fishery statistics, the NAFO Secretariat highlighted the role of CWP in instituting changes in STATLANT 21, particularly: "changes in the nature of the fisheries and in the needs of users of fishery statistics necessitate frequent reviews of the statistical systems…" . (paragraph 28 on the role of CWP in FAO Fisheries Circular 903 – The Coordinating Working Party on Fishery Statistics: Its Origin, Role and Structure).

Intersessional Meeting of the CWP, Dartmouth, Canada, 8-9 July 2008, was chaired by the former Executive Secretary. Four other staff members of the Secretariat were in attendance (Ricardo Federizon, Anthony Thompson, Barbara Marshall, and George Campanis). Major topics discussed covered areas of data requirements for Monitoring, Control and Surveillance (MCS) and Ecosystem management approach, Regional Fisheries Bodies databases. George Campanis presented a paper on VMS analysis and Anthony Thompson presented information on the NAFO initiative with the Ecosystem Approach to Fisheries Management.

The Secretariat informed the Scientific Council that the 23rd Session of the CWP will be held in Hobart, Australia in February 2010. It requested the Scientific Council for inputs and ideas regarding the improvement of STATLANT21, which would be presented by the NAFO Secretariat at the next CWP meeting.

Scientific Council thanked Ricardo Federizon for his presentation on the background of CWP and for the two meetings reports. Scientific Council has had a long interest in CWP and has attended CWP meetings in the past. Scientific Council felt that it was unnecessary for NAFO to send two representatives to CWP meetings and decided that it was no longer necessary for the STACREC Chair to attend. Scientific Council representation will therefore now be through the Secretariat and asks that the Secretariat discusses relevant issues with the STACREC Chair in advance of the next meeting.

XI. REVIEW OF SCIENTIFIC COUNCIL WORKING PROCEDURES/PROTOCOL

1. Election of Chairs

A nomination committee, established by the Council at the beginning of this meeting composed of Antonio Vázquez (EU-Spain), Bill Brodie (Canada) and Manfred Stein (EU-Germany), proposed the following candidates. The Scientific Council noted these positions will be for a two year period beginning immediately after the September 2009 Annual Meeting.

For the office of Chair of Scientific Council, Ricardo Alpoim (EU-Portugal) was nominated by the Committee. The Council elected him by unanimous consent.

For the office of Chair of the Standing Committee on Fisheries Science (STACFIS), Joanne Morgan (Canada) was nominated by the Committee. The Council elected her by unanimous consent.

For the office of the Chair of the Standing Committee on Publications (STACPUB), Margaret Treble (Canada) was nominated by the Committee. The Council elected her by unanimous consent.

Nominations for the office of the Vice-Chair of Scientific Council, the Chair of the Standing Committee on Research Coordination (STACREC), and the Chair of the Standing Committee on Fisheries Environment (STACFEN), will be announced at the September 2009 meeting of Scientific Council. These positions are being held open until the nominating committee receives confirmation of the acceptance from the two elected people for the above offices.

The Rules of Procedure determine that the elected Vice-Chair of Scientific Council would take the office of the Chair of the Standing Committee on Research Coordination (STACREC).

2. General Plan of Work for September 2009 Annual Meeting

No new issues were raised that will affect the regular work plan for the September meeting.

3. Review of Structure of Scientific Council

Scientific Council noted that the catch estimates used in the STACFIS stock assessments would now be coordinated by the STACREC Chair with the intention of easing the duties of the STACFIS Chair during the early part of the June meeting. The review of other changes to the structure and working procedures of Scientific Council (*NAFO Sci. Coun. Rep.*, 2008, p. 238) was deferred to the September 2009 meeting of Scientific Council.

4. Rules of Procedure

a) Harmonization of Observers among NAFO Constituent Bodies

Scientific Council, at its June 2008 meeting, accepted the concept of modifying the rules of procedures for observers to Scientific Council meetings, and made several suggestions regarding the development of a common application process among the three constituent bodies of NAFO (*NAFO Sci. Coun. Rep*., 2008, p. 235). The Secretariat presented a proposed draft “harmonized” Rules of Procedure for Observers at NAFO meetings (SCS Doc. 09/22). This was accepted by Scientific Council who asked the Secretariat to forward the proposal to General Council at the 2009 Annual Meeting.

Scientific Council discussed various aspects of the proposal and noted that there may still be differences in the actual application of the rules at different meetings, and that these would need to be openly displayed. The Secretariat drew the attention of Council to Rule 3 regarding the meaning of “non-restrictive” sessions and to Rule 6e) regarding activities approved by the Chair. The Secretariat explained that clarifications as to the interpretation of the rules, and of these two rules in particular, would be posted on the “observers” page of the NAFO website. Scientific Council noted that presentations and extended pre-planned interventions by observers were generally not permitted at Scientific Council, and if appropriate a statement to this effect could be added to the webpage.

5. Other Matters

No items were raised.

XII. OTHER MATTERS

1. Designated Experts

Council approved Diana Gonzalez Troncoso as the new Designated Expert (DE) for cod in Div. 3M and Michael Kingsley as Designated Expert for Northern shrimp in SA 0+1. The Council further noted that a DE for northern short-finned squid in SA 3+4 has still to be identified and until such time would not be providing assessments or interim monitoring updates on this stock

2. Meeting Highlights for NAFO Website

The Chairs of each Committee submitted highlights of the meeting to the Secretariat. These will be placed on the website after the meeting.

3. Sponsorship of Two Climate Change Meetings

ICES/PICES “Climate change effects on fish and fisheries: forecasting impacts, assessing ecosystem responses and evaluating management strategies” 26-30 April 2010: NAFO was invited by ICES and PICES to sponsor this symposium. Scientific Council discussed the symposium and agreed that the topic was of interest to members of Scientific Council. The Council noted that it can only sponsor symposia that it organizes or jointly organizes with other bodies. For this reason, Scientific Council regrets that NAFO will not be able to sponsor this ICES/PICES symposium.

ICES "Hydrobiological and ecosystem variability in the ICES area during the first decade of the XXI century" held during the spring/summer of 2011 in Santander, Spain. NAFO was invited by ICES to sponsor this symposium. Scientific Council was unclear about the current area of coverage of this symposium and felt that the inclusion of the north-west Atlantic was necessary in understanding the processes occurring in the whole North Atlantic. NAFO is therefore exploring possibilities with ICES of making this a joint ICES/NAFO symposium and is hoping for a response from ICES around mid-July 2009. Sponsorship will be further discussed at the Scientific Council meeting in September 2009.

4. ICES Working Group on Operational Oceanographic Products for Fisheries and Environment (WGOOFE)

"There are many sources of oceanographic *hindcast*, *real time* and *forecast* data available to scientists investigating fisheries and environmental variability. This web site provides a one source route to *access* these data from oceanographic contributors across the European marine science community. It provides a link [from the WGOOFE website (http://www.wgoofe.org)] direct to the oceanographic products held on the web sites of the providers."

A short presentation was given (M. Stein, during STACFEN) on the ToRs of a newly formed ICES Working Group on Operational Oceanographic Products for Fisheries and Environment [WGOOFE] which had met in Hamburg, Germany, 24-26 November 2008 to:

- Refine and evaluate a list of products to the needs of the users, including format and timing, and identify gaps in the products available.

- Initiate the process on identifying who is to regularly produce and disseminate what products and when.

- Promote and ensure exchange with operational organizations and services to stimulate development of products appropriate for the ICES user base.

Within the framework of WGOOFE, the Institute of Sea Fisheries, Hamburg provides temperature indices for statistical rectangles (Strata 1 - 7) off East and West Greenland through the internet. The data are based upon the German Demersal Trawl Survey in Greenland waters, performed during autumn, since 1982. For the individual Strata, temperature indices are given (XLS-files) for the sea surface and the bottom water layer.

Since this product might also be of interest to NAFO scientists, the access to the data sets is given via the above website.

5. Update on Executive Secretary position

The Executive Secretary resigned from the NAFO Secretariat effective 1 May 2009. Mr Stan Goodick will be the Interim Executive Secretary until a new Executive Secretary is recruited. The position was widely advertised with a closing date for applications of 15 May 2009. Interviews will be held during the 2009 Annual Meeting with the intention of filling the vacancy by 1 January 2010.

6. Greenland Halibut Management Strategy Evaluation

Scientific Council (SCR Doc. 07/58, 08/25, 09/37), has applied management strategy evaluation (MSE) to evaluate the likely outcomes of various alternative management strategies. This has to date been applied to the NAFO SA 2 + Div. 3KLMNO Greenland halibut fishery, during the NAFO Study Group on Rebuilding Strategies for Greenland halibut in Vigo in 2008 (SCS Doc. 08/13) and subsequent work. MSE involves the evaluation of alternative management strategies encompassing clearly defined harvest control rules against a range of simulated realizations of the true fishery and fish stock dynamics (the operating models). The aim is to find those management strategies that are robust to the uncertainties while achieving the performance statistics required by the managers.

Development of alternative operating models and management strategies and deciding on performance statistics requires input from various stakeholders, such as scientists, managers and the fishing industry. Results of this process provide an insight in to those management strategies that are likely to be successful, and those that will likely fail. Management strategies are evaluated over the short, medium and long-term and so are useful when considering medium-term rebuilding plans, of the type that currently exist within NAFO for cod in Div. 3NO and halibut in SA 2 + Div. 3KLMNO. In this sense, the MSE approach follows the same process that currently happens with discussions between scientists, managers and industry. It provides a basis for formalising these discussions within sets of equations and allows for a more complete analysis of the consequences of various actions.

Results were presented for seven alternative management strategies applied to eight different operating models for the Greenland halibut stock. Management strategies incorporating feed-back harvest control rules performed better than those without feedback. Two management strategies outperformed all others – one based directly on the recent trend in the survey data and the TAC in the previous year (model free) and one based on the recent trend in the annual XSA assessment of stock size and the TAC in the previous year. The XSA-based strategy attempts to take into account some elements of the Fisheries Commission rebuilding plan by making TAC adjustments only every second year and constraining these to be less than 15%. The analysis showed that Greenland halibut had considerable scope for rebuilding under either of these strategies. It was proposed that these would outperform the current *ad hoc* approach taken to manage the stock.

Discussions on technical aspects included concern regarding the large “cryptic biomass” that builds up under some of the management strategies. It was noted that this biomass may be largely unavailable to the fishing industry using current gear, however, if the fishery changes as the stock rebuilds and develops the ability to catch older fish, then the results would have to be reconsidered. While biomass levels of 2-3× B_{MSY} in a rebuilt stock was considered acceptable, biomass levels as much as 6× B_{MSY} which resulted in some cases seemed unrealistic. It was revealed that these high levels of rebuilding were a function of the low mortality and the segmented stock-recruit function being used. These assumptions could be re-evaluated as the stock rebuilds. In the meantime, it was agreed that exploitable biomass (biomass resulting from the application of the fishery selectivity) would provide a more realistic measure of rebuilding. The derivation of the acceptable risk levels and percentiles used in the analysis were discussed. It was agreed that more input from managers, industry and stakeholders could lead to a revision of the risks and percentiles.

Scientific Council endorsed their previous support of this approach and are firmly committed to its use in the provision of advice. It was recognized that these types of analyses require substantial commitment of human resources and specialized expertise, however, it was not considered that a lack of current capacity should limit the process.

Council recognized that this is a complex process that requires careful explanation. This will be again presented this year to Fisheries Commission by the Scientific Council Chair at the Annual Meeting in Bergen and supported in advance by suitable description of the approach in general and the results obtained with respect to SA 2 + Div. 3KLMNO Greenland halibut study. It is also expected that this information, with supporting documentation, will be presented by representatives to their Delegations ahead of the September Annual Meeting. The specific results of this study on SA 2 + Div. 3KLMNO Greenland halibut will also be presented. It should be noted that development and testing of prescribed management strategies is being increasingly widely applied by governments and RFMOs to meet standards put forward by the UNFSA and the FAO Code of Conduct. This approach also meets Marine Stewardship Council Eco-certification standards.

Council thanked the authors of SCR Doc. 09/37, David Miller and Peter Shelton, for their substantial efforts on this project over the last few years.

7. Bottom Fishing Areas

The Secretariat presented the compilation of the existing bottom fishing activities within the NRA from data submitted by CPs covering the period 1987-2007 (SCS Doc. 09/21). The footprint delineation included data from 10 flag States for a 20 year period (1987-2007). As requested in the NCEM (2008), this was reviewed by Scientific Council for onward transmission to Fisheries Commission. Scientific Council made the following comments:

- the data presented to and analyzed by the Secretariat, including the two new submissions of Spain and Russia made in March 2009, was point data that identified fishing locations;
- the submitted data represented bottom fishing activity but did not distinguish between trawls, longlines or gillnets;
- that the NCEM only specified that inclusion of a fishing location was based on fishing in two separate years (the unit area or grid-size was not specified);
- that some pre-filtering was necessary in order to satisfy the fishing intensity criteria given in the NCEM. Hence, fishing points were filtered by criteria of occurrence (fishing points in at least two different years) and speed (1.0-4.0 knots);
- that the method used to create the footprint delineation was done using presence/absence points and not swept area;
- that the extent of the existing bottom fishing area was dependent upon the unit grid size chosen, and that a 5nm×5nm grid would seem to provide a compromise in providing the finest resolution of the data without over- or under representing fishing activity;
- that Scientific Council is satisfied that the data presented, the analysis undertaken and the conclusions described in the paper, are sound and reasonable.

8. Other Business

a) Scientific Merit Awards

In June 2008, Scientific Council considered two classes of award. One award recognizes outgoing Chairs for their leadership in accepting these roles. A second award recognizes an outstanding scientific contribution to the Council. Decisions on the latter award would be made by the Chair and Scientific Council Coordinator supported by nominations from Council members. Based on a request for nominations submitted to Council members in September 2008, Scientific Council awarded the inaugural “Outstanding Scientific Contribution” award to Ralph Mayo (USA) at this June meeting in recognition of his outstanding scientific contributions to the assessment, conservation, and management of fish stocks in the Northwest Atlantic.

Ralph has had a career in Fisheries Science that has spanned 40 years. Ralph was first involved with the International Commission for the Northwest Atlantic Fisheries (ICNAF) in 1975, the predecessor organization to NAFO. Since then he continued to contribute to NAFO and eventually completed the full succession of chairing for the Scientific Council from 1997-2003 as Chair of STACFIS, Chair of STACREC and then Chair of Scientific Council. Ralph also chaired many working group meetings over the years and contributed to the development of the scientific basis for the NAFO framework on the Precautionary Approach (PA) to Fisheries management and chaired an important workshop on the PA in 2003. He also played a key role in a 2000 workshop on Assessment Methods that provided enhanced competence to assessment scientists. His longstanding desire and commitment to providing “the best possible scientific advice” is his trademark and because of this he is kept in highest regard amongst his colleagues.

On behalf of the Scientific Council and the Secretariat, we extend our best wishes to Ralph and sincerely thank him for his many contributions to this Council over the years.

b) TXOTX

Scientific Council worked on the questionnaire related to the TXOTX project. Owing to time constraints, this item was deferred to the September Scientific Council meeting.

c) Budget

The 2009 budget was discussed by Scientific Council and will be presented to STACFAD in September 2009 for consideration.

d) Minority statement by Japan

The Scientific Council noted the difficulty to reach consensus on the basis for provision of advice on Greenland halibut in SA 2 + Div. 3KLMNO due to one dissenting view from Japan. The following minority statement is recorded in this report as received from the representative:

Japan has reservations about accepting the results of the projections based solely on XSA with shrinkage as the basis for scientific advice to managers. This is especially because the report of the Greenland halibut working group meeting suggests that it is not possible to evaluate the best model; thus it is uncertain if XSA with shrinkage is the most robust and reliable model.

In addition the report suggests that all stock assessment models except XSA with shrinkage show similar results (a gradual recent increasing trend in abundance while XSA with shrinkage shows a slightly decreasing trend). Furthermore these consistent results also correspond to the recent survey trends, while results from XSA with shrinkage do not. Therefore results from other assessment models are likely more robust and realistic than XSA with shrinkage. Under such circumstances, Japan cannot support the XSA with shrinkage projection results as the best advice option.

Japan agrees with the Scientific Council's view that the cause of this problem is due to the uncertain quality of the data. But Japan also considers that this problem affects all the models as discussed. Thus Japan considers that problems exist in both data and models as is frequently experienced in stock assessments.

To overcome such problems a "risk assessment" or "decision table" approach" is often applied. Details are explained in documents such as Punt and Hilborn (1997): Fisheries stock assessment and decision analysis: the Bayesian approach. Reviews in Fish Biology and Fisheries. 7: 35-63, and in the famous book by Hilborn and Walters on Quantitative Fisheries Stock Assessment – Choice, Dynamics & Uncertainty (Chapman and Hall).

This risk assessment approach suggests that at least 2 different stock assessment models need to be considered to properly cover uncertainties. Abundance projections based on all these models under the same future catch scenarios need to be presented in order to advise managers on a sound scientific basis.

This risk assessment approach is the common practice in many RFMOs (Regional Fisheries Management Organization). It is like asking for a 2nd or 3rd opinion from different medical doctors when a person has a serious and complex sickness. Simply we cannot live with only one opinion.

Therefore such steps (i.e., providing at least 2 "opinions", with their consequences) is a necessary and essential practice in fisheries recourse management, in the same way as in human health management, to make people such as fishery managers aware of the implications of mis-diagnosis. In this way decision makers can understand the situation in a more objective, scientific and transparent manner. Japan thinks that this is the best option.

XIII. ADOPTION OF COMMITTEE REPORTS

The Council, during the course of this meeting, reviewed the Standing Committee recommendations. Having considered each recommendation and also the text of the reports, the Council **adopted** the reports of STACFEN, STACREC, STACPUB and STACFIS. It was noted that some text insertions and modifications as discussed at this Council plenary will be incorporated later by the Council Chair and the Secretariat.

XIV. SCIENTIFIC COUNCIL RECOMMENDATIONS TO GENERAL COUNCIL AND FISHERIES COMMISSION

The Council Chair undertook to address the recommendations from this meeting and to submit relevant ones to the General Council and Fisheries Commission.

XV. ADOPTION OF SCIENTIFIC COUNCIL REPORT

At its concluding session on 18 June 2009, the Council considered the draft report of this meeting, and adopted the report with the understanding that the Chair and the Secretariat will incorporate later the text insertions related to plenary sessions of 4-18 June 2009 and other modifications as discussed at plenary.

XVI. ADJOURNMENT

The Chair thanked the participants for their hard work and cooperation, noting particularly the efforts of the Designated Experts and the Standing Committee Chairs. The Chair thanked the Secretariat for their valuable support. There being no other business the meeting was adjourned at 1430 hours on 18 June 2009.

ANNEX 1. REPORT OF SCIENTIFIC COUNCIL SPECIAL SESSION 2008 "THE ROLE OF MARINE MAMMALS IN THE ECOSYSTEM IN THE 21ST CENTURY"

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The role of marine mammals in the ecosystem, and particularly how they interact with human activities, has been a topic of great interest for a long time. In many parts of the world, marine mammals have been exploited and continue to be hunted for commercial or subsistence. Populations have also been controlled because they were perceived to be competitors for fish. Meanwhile, there are concerns that populations are being adversely affected by incidental catches, contaminants or reduce food supplies due to overfishing. In recent years, the recovery of many marine mammal populations, overfishing, the lack of recovery of numerous fish stocks and climate change, has made questions about how marine mammals are affected by their environment and how they influence other components of their ecosystem critical.

In 1995 NAFO and ICES sponsored a very successful symposium on ecological role of marine mammals. Many of the papers presented were published in an issue of the J. Northwest Atlantic Fisheries Science in 1997. Since that time, significant new research has been carried out to address many of the knowledge gaps identified. In 2006, NAFO Scientific Council recommended that another symposium on the same topic be held to review the current state of our knowledge. They approached ICES who agreed to co-sponsor the symposium. The North Atlantic Marine Mammal Commission (NAMMCO) also expressed an interest in the topic and agreed to become the third sponsor. The NAFO Secretariat agreed to supply logistical support for the symposium.

The Symposium "The Role of Marine Mammals in the Ecosystem in the 21st Century" was held on 29 September – 1 October 2008 in Dartmouth, Canada. G. Stenson (Canada) and T. Haug (Norway) were identified as the co-convenors and were assisted by a scientific committee that included M. Hammill (Canada), P. Hammond (UK) and A. Thompson (NAFO). The objective of this Symposium was to bring together scientists from a variety of fields to examine the gains that we have made over the past 13 years in understanding the role of marine mammals in the ecosystem.

A total of 54 abstracts were submitted to the steering committee for consideration. Of these 53 (34 oral, 19 poster) were accepted. A total of 46 (32 oral, 14 poster) papers were presented at the symposium. Approximately 70 scientists from 11 countries attended representing Australia, Canada, Faroe Islands, Iceland, Japan, Norway, Russia, Spain, Sweden, UK and USA. The wide range of countries present reflects the global nature of the questions addressed at the symposium.

The symposium presented new findings on the syntheses of information over ecosystem components, on biological and physical aspects of the environment, and on new research approaches to understanding the role of marine mammals. It was organised in four theme session, each session starting with an invited key-note speaker and followed by both contributed oral and poster presentations from participants. The session chairs were G. Stenson, T. Haug, C. Lockyer and M. Hammill.

Session 1: Biological and environmental factors affecting life history traits

The keynote talk in this session, "Factors affecting Life History Traits" was presented by Dr. Mark Hindell (University of Tasmania, Australia) who examined the complex interplay between phylogenetic history and environmental factors in shaping life history traits in marine mammals. The session included 6 oral and 2 poster presentations that addressed issues ranging from trends in reproductive parameters and recruitment in hooded and grey seals to patterns of mortality of harbour seals. The results of research on growth rates and sexual maturity of captive and wild beluga whales, and the effects of contaminants were also presented.

Of particular importance to the NRA is the observation that reproductive rates of northwest Atlantic hooded seals appear to be declining, possibly as a result of environmental changes (Frie et al). Also, a simulation study exploring the impact of pup mortality due to poor ice conditions in Northwest Atlantic harp seals (Hammill and Stenson) showed that mortality can have a significant effect on future populations. However, due to the way in which abundance is estimated, the impact may not be identified for 15-20 years, by which time a significant reduction in the population may have occurred.

Session 2: Foraging strategies and energetic requirements

The second session addressed research related to how much energy marine mammals require and what strategies they use to obtain it. Dr. Dan Costa (University of Santa Cruz, USA) provided the key note talk, entitled 'Foraging Ecology and Energetics of Pinnipeds: Conservation Implications', where he asked what would be the management and conservation implications of species specific foraging strategies and energetic requirements. Contributed papers in this session explored foraging behavior, strategies and ecology of baleen whales and dolphins and habitat use and seasonal changes in energy intake and body condition in seals.

A comparison between the detailed energy model developed by Hammill Ryg and Chabot to a simple model indicated that temporal variation in energy requirements must be incorporated into consumption models in order to accurately reflect the amount of prey eaten, particularly in cases where diets vary seasonally. Using satellite transmitters to monitor movements of diving behaviour of northwest Atlantic hooded seals (Anderson et al) has provided the first estimates of seasonal habitat use for this population. Preliminary modelling indicates that depth, and to a lesser extent ice cover, were important factors affecting distribution of hooded seals. A comparison between the condition of harp and hooded seals collected in the northwest Atlantic during the 1980s and 1990s (Chabot and Stenson) found that condition of both species was less in the more recent time period.

Session 3: Marine mammal – fisheries interactions

Session 3 explored the impact of marine mammals on fisheries, as well as the impact of fisheries on marine mammals. The key-note speaker was Dr. John Harwood (University of St Andrews, UK) who used his talk, 'Quantifying Marine Mammal-Fisheries Interactions' to discuss how such interactions can be incorporated into the ecosystem approach to fisheries. The session included 9 oral and 5 poster presentations, addressing bycatch, direct interactions between seals marine mammals and particular fisheries, and the consumption of resources of interest to fishers by marine mammals. The wide range of locations where these observations took place (e.g. US, UK, South Atlantic, Baltic, Spain, Canada) illustrates the wide ranging impact of marine mammals.

In the northwest Atlantic, Traditional ecological knowledge (TEK) was used to determine the likelihood of harp seals impacting salmon in Newfoundland (Lemky and Sjare). They found that the likilhood of an interaction was high in approximately one half of the rivers examined. However, they also found that although information from resource users suggested that the potential for harp seal predation on salmon had increased since the mid-to late 1990s, diet observations of stomach contents indicated that seals were feeding on prey species and not necessarily on salmon when these species co-occurred. Lawson and Gosselin presented estimates of cetacean abundance along the Canadian continental shelf form Hudson Strait to the Scotian Shelf based upon a recent sighting survey. Preliminary estimates of consumption, in the order of 1.7 million tones, indicated that cetaceans could have significant controlling effects on the biomass of other consumers as well as the prey.

Session 4: Theoretical considerations on apex predators and multispecies models

In his key-note address, 'Marine Mammals and the Theoretical Considerations Associated with Apex Predators and Multi-Species Models', Dr. Andrew Trites (University of British Columbia, Canada) suggested that, although it is evident that the interaction between marine mammals and their prey influence the structure and dynamics of marine ecosystems and, similarly, that predators and prey have shaped each other's behavior and life history traits, there is little empirical evidence of these influences. However, ecosystem models are valuable tools to better understand these problems. The session included 7 oral and 5 poster presentations including papers describing methods of estimating diets, prey selection, spatial distribution, uncertainty in abundance estimation and multispecies modeling.

Buren and colleagues presented a method of estimating the diet of harp seals in 2J3KL using a multinomial regression approach to fill in sampling gaps. Comparing the diets of Atlantic cod, Greenland halibut and harp seals using this approach, they found that all three predators relied heavily on capelin, but the cod diet showed a higher consistency over time, suggesting that cod has less trophic plasticity than Greenland halibut and seals. This lack of trophic flexibility could not only be a contributing factor in the lack of recovery of cod, but also suggest that other generalist predators like Greenland halibut, and possibly seals, may be better positioned to utilize a changing resource base. Research in Norway on methods to estimate prey selection by harp seals (Lindstrøm et al.) and quantify competition between baleen whales and pelagic fish in the Barents Sea (Mauritzen et al.) are providing interesting techniques that may be applied to similar situations in the NRA. Finally, a study in the southern Ocean (Lavery and Mitchell) illustrated the importance of marine mammals to transfer nutrients within marine systems.

The symposium ended with a general discussion where the participants identified the progress that had been made in the past 13 years and discussed future research that will advance our understanding of the role of marine mammals in the ecosystem. The participants agreed that we have improved our understanding of the role marine mammals, particularly cetaceans, have in the ecosystem. The scale at which marine mammals function has been found to be much larger than previously considered and often exceeds that of the fisheries of interest. Much of the improvement in our understanding has been a result of new technologies such as satellite telemetry and new methods of estimating diets. Generally, there is a more holistic approach to the questions being asked and the studies undertaken. Also, the statistical approaches being used are much more sophisticated and improve the way in which uncertainty is incorporated. Multi-disciplinary studies, especially studies including oceanographers, have advanced our understanding significantly. However, in many areas, significant progress is still needed to involve fisheries scientists in collaborative projects.

After the symposium all contributors were invited to submit final papers which, if accepted after peer review, will be published in a special symposium issue of the Journal of Northwest Atlantic Fishery Science. To date, 12 papers have been submitted and sent out for review. Of these 2 have already been accepted for publication. A few authors have asked for an extension to the deadline for submission of papers and it is anticipated that we may received 2-3 more papers. The final deadline for submission is now 1 September 2009.

The Co-conveners wish to thanks the participants for their contributions and in making this a most informative and enjoyable Symposium. We also wish to thank the sponsors and the on-site support given by the NAFO Secretariat.

Symposium

The Role of Marine Mammals in the Ecosystem in the 21st Century
29 September -1 October, 2008
Alderney Landing, Dartmouth, NS, Canada

Monday, 29 September

0830-0900 Registration, set-up Posters and load presentations

0900-0915 Introduction (Scientific Council Chair, Convenors)

Session 1. **Biological and environmental factors affecting life history traits** (Garry Stenson)

0915-1000 Mark Hindell ***Keynote - Factors affecting Life History Traits***

1000-1020 A. K. Frie, V. Svetochev, G. Stenson and T. Haug Trends in reproductive parameters of female hooded seals *Cystophora cristata* in the Northeast and the Northwest Atlantic

1020-1040 D. Thompson, A. J. Hall, B. J. McConnell, C. D. Duck, P. P. Pomeroy, S. E. W. Moss, and M. E. Lonergan, Patterns of mortality of harbour seal pups from declining and stable populations in Scotland

1040-1110 **Break** (30 min)

1110-1130 P. P. Pomeroy, S. E. W. Moss, S. D. Twiss, S. Smout and R. King. Low and delayed apparent recruitment rates in UK grey seal colonies

1130-1150 P.Brodie , K. Ramirez and M. Haulena Growth rates and age of sexual maturity of Beluga (*Delphinapterus leucas*) from a wild population in Cumberland Sound, Canada, compared to those raised in captivity.

1150-1210 S. Murphy, G. J. Pierce, R. J. Law, M. B. Santos, J. A. Learmonth, M. Addink, W. Dabin, E. Rogan, P. D. Jepson, R. Deaville, A. F. Zuur, P. Bustamante, F. Caurant, V. Lahaye, V. Ridoux, B. N. Zegers, A. Mets, C. Smeenk, T. Jauniaux, A. López, J. M. Alonso Farré, A. F. González, A. Guerra, M. García-Hartmann, S. P. Northridge, R. J. Reid, C. Lockyer, J. P. Boon Assessing the effect of contaminants on reproductive success.

1210-1230 H. Frouin, M. Fournier, M. Lebeuf, R. St.-Louis, E. Pelletier, M. Hammill. Toxic effects of tributyltin and its metabolites on harbor seal (*Phoca vitulina*) immune cells.

1230-1400 **Lunch (1.5 hours)**

Session 2. **Foraging strategies and energetic requirements**(Tore Haug)

1400-1445 Dan Costa ***keynote - Foraging Ecology and Energetics of Pinnipeds: Conservation Implications***

1445-1505 T. Tamura, K. Konishi Foraging Ecology and Energetics of Pinnipeds: Conservation Implications.

1505-1525 G. A. Víkingsson Feeding ecology of common minke whales (*Balaenoptera acutorostrata*) in Icelandic waters.

1525-1555 **Break** (30 min)

1555-1615 T. S. Stevens and J. W. Lawson. Using recent distribution and behavioural data for killer whales (*Orcinus orca*) in Atlantic Canada to assess the influence of predation pressures on the movement and social patterns of minke whales

1615-1645 M. O. Hammill, M. Ryg and D. Chabot. Seasonal Changes in Energy Requirements of Harp Seals.

1700-1830 Reception/Poster Display

Tuesday, 30 September

0900-0920 G. B. Stenson, M. Koen-Alonso and A. D. Buren Recent Advances on the Role of Seals in the Northwest Atlantic Ecosystem

0920-0940 J. M. Andersen, Y. Wiersma and G. Stenson. Habitat Selection By Hooded Seals (*Cystophora cristata*) In A Dynamic Marine Ecosystem.

0940-1000 K.T.A. Davies, C. T. Taggart and K. Smedol. The role of physical oceanography and zooplankton in controlling the spatiotemporal distribution of the North Atlantic right whale.

1000-1050 **Break** (50 min)

1050-1110 K. Konishi, T. Tamura, T. Isoda, R.Okamoto, K. Matsuoka, T. Hakamada. Prey consumptions and feeding strategies of three baleen whale species around the Kuroshio-current extension.

1110-1130 P. Brodie and G.Vikingson Observations of the feeding mechanics of the Sei whale (*Balaenoptera borealis*), based on the examination of hunted specimens off Nova Scotia and Iceland.

1130-1150 A. I. Mackay and P. C. Stephenson. An assessment of the foraging behaviour of bottlenose dolphins interacting with a bottom trawl fishery.

1150-1320 **Lunch (1.5 hours)**

Session 3. **Marine mammal – fisheries interactions** (Christina Lockyer)

1320-1405 John Harwood, J. Matthiopoulos and S. Smout ***keynote - Quantifying marine mammal-fisheries interactions***

1405-1425 C. D. Orphanides Comparison of Methods for Estimating the Bycatch of Protected Species: Estimating the Bycatch of Harbor Porpoise (*Phocoena phocoena*) in U.S. Gillnet Fisheries in the Northwest Atlantic

1425-1445 M.-Y. Lee. Whale-watching and Herring Fishing: Joint or Independent?

1445-1505 S. Goetz, G. Hernandez-Milian; C. Varela-Dopico, J. Rodriguez-Gutierrez, J. Romón, J. R. Fuertes-Gamundi, E. Ulloa, N. J. C. Tregenza, A. Smerdon, M. G. Otero, V. Tato, J. Wang, M. B. Santos, A. López, R. Lago, J. Portela, G. J. Pierce, Results of a Short Study of Interactions of Cetaceans and Longline Fisheries in Atlantic Waters: Environmental Correlates of Catches and Depradation Events

1505-1525 I. Payá and P. Brickle Changes of fishing gear design for reducing whale interference: Impacts on stock assessment and management of toothfish off Falkland Islands.

1525-1605 **Break** (30 min)

1605-1625 T. Aho, A. Gårdmark, K. Lundström and J. Pönni Effects of grey seals on the herring population in the Baltic Sea area.

1625-1645 S. Gunnar Lunneryd, S. Königson and K. Lundström The grey seal- fishermen cod competition in the Baltic Sea.

1645-1705 C. Lenky and B. Sjare Interactions between harp seals and salmon in coastal habitats of Newfoundland and Labrador.

1705-1725 F. L. Read, J. Martínez-Cedeira, Á. F. González, A. López, B. S. and G. J. Pierce Understanding marine mammal and fisheries interactions in Galicia, north-west Spain: Past, present and future.

1725-1745 J.W. Lawson and J.-F. Gosselin Don't Ignore The Whales: Cetacean Biomass Consumption Estimates Based On The Recent TNASS Aerial Survey of Atlantic Canada

Wednesday, 1 October

Session 4. **Theoretical considerations on apex predators and multispecies models** (Mike Hammill)

0900-0945 Andrew Trites ***keynote Marine Mammals and the Theoretical Considerations Associated with Apex Predators and Multi-Species Models***

0945-1005 U. Lindstrøm, K.T. Nilssen, L.M.S. Pettersen and T. Haug Use and selection of prey by harp seals in the northern Barents Sea.

1005-1025 A. D. Buren, M. M. Koen-Alonso, G. B. Stenson. Reconstructing diet composition using a multinomial regression approach

1025-1055 **Break (30 minutes)**

1055-1115 L. Morissette, K. Kaschner, J. L. Melgo and L. Gerber Declining fish stocks: are whales the culprits?

1115-1135 T. A. Øigård, T. Haug, K. T. Nilssen and A.-B. Salberg Reducing uncertainty in estimated harp and hooded seal pup production using Generalized Additive methods: Results from aerial surveys in the Greenland Sea in 2007.

1135-1155 T. J. Lavery and J. G. M. Mitchell. Marine Mammals Stir the Ocean.

1155-1325 **Lunch (1.5 hours)**

1325-1345 M. Mauritzen, E. Johannesen, P. Fauchald, A. Bjørge, E. Olsen and N. Øien Large-Scaled Distribution Of Baleen Whales In The Barents Sea: The Role Of Competitive And Trophic Inteactions With Pelagic Fish.

1345-1405 A. D. Buren, M. Koen-Alonso, K. S. Dwyer and G. B Stenson. Is there room for competition among fish top predators and harp seals in the Northwest Atlantic (NAFO Div. 2J3KL)?

1405- **General Discussion**

How have we improved our understanding in the past 13 years?

What is our current understanding of the role of marine mammals?

What needs to be done next to improve our understanding?

Posters

Session 1

M. Hammill and G. B. Stenson. Potential impacts of ice related mortality on trends in the northwest Atlantic harp seal abundance.

T. Stevens and J. Lawson. Distribution and Movement patterns of killer whales (*Orcinus orca*) in the northwest Atlantic.

Session 2

B. H. Witteveen and K. M. Wynne. Consumption and prey removals by humpback whales (*Megaptera novaeangliae*) near Kodiak Island, Alaska: A revision of previous estimates.

Session 3

M. Rossman. Estimated Bycatch of Small Cetaceans in Northeast U.S. Bottom Trawl Fishing Gear During 2000-2005.

G. Pierce, S. Goetz, S. Lens, U. Pena, S. Goetz, M. Laporta, J. L. del Río, J. Portela, S. Iglesias. Observer programmes to record marine mammal and seabird distribution and interactions with fishing operations in Southwest Atlantic waters.

D. Belden, G. T. Waring, J. R. Gilbert, A. VanAtten and D. L. Palka. Characteristics of phocid seal bycatch in New England fisheries.

A. Caskenette, M. Hammill, S. Crawford, and D. Duplisea. Grey seal and Atlantic cod interaction in the southern Gulf of St. Lawrence.

W. Ledwell, S. Benjamins, J. Huntington and C. Hood. Incidental entrapments of large whales in Newfoundland Region from 1999-2007.

Session 4

H. Murase, T. Kitakado, K. Matsuoka, T. Hakamada, S. Nishiwaki and M. Naganobu Predator-prey relationship in spatial context -Is the distribution pattern of krill the determinant factor of the distribution pattern of Antarctic minke whale?

T. J. Lavery, B. Roundnew, S. Goldworthy. J. Middleton, L. Seuront and J. G. Mitchell. Seals transport nutrient rich water across the thermocline.

S. Lens, M. B. Santos, D. Oñate, A. Miranda., G. Casas, A. Cañadas, J. M. Cabanas, M. Iglesias, R. Fernández and J. A. Vázquez. Distribution of fin whales and krill aggregations off the Galician coasts observed during the CODA-IEO survey.

C.C.A. Martins, P. Lamontagne, L. Parrott, J. A. Landry,D. Marceau, C. Chion, S. Turgeon, R. Michaud, N. Menard, S. Dionne, and G. Cantin. Conceptualizing an individual-based model to simulate marine mammal behaviour in the Saint Lawrence Estuary, Canada

K. A. Hart, H. D. Marshall, G. B. Stenson, D. McKinnon, E. A. Perry. Molecular identification of prey species in the stomach content of harp seals (*Pagophilus groenlandicus*) using species-specific oligonucleotides.

B. Branton and M. Murray. Data management development plan for the Ocean Tracking network.

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APPENDIX I. REPORT OF THE STANDING COMMITTEE ON FISHERIES ENVIRONMENT (STACFEN)

Interim Chair: Manfred Stein Rapporteur: Phil Large

The Committee met at Alderney Landing, 2 Ochterloney Street, Dartmouth, Nova Scotia, Canada, on 5 June 2009, to consider environment-related topics and report on various matters referred to it by the Scientific Council. Representatives attended from Canada, Denmark (in respect of Greenland), European Union (France, Germany, Portugal, Latvia, Lithuania, United Kingdom and Spain), Russian Federation and Japan.

1. Opening

The Chair opened the meeting by welcoming participants to this June 2009 Meeting of STACFEN. The Chair welcomed Dr. Erica Head, Ecosystem Research Division, Department of Fisheries and Oceans, Bedford Institute of Oceanography (BIO) as this year's invited speaker.

The Committee adopted the agenda and discussed the work plan and noted the following documents would be reviewed: SCR Doc. 09/1, 2, 3, 15, 17, 27, and SCS Doc. 09/9, 11, 17

Phil Large (EU- United Kingdom) was appointed rapporteur.

2. Invited Speaker

The Chair introduced this year's invited speaker Dr. Erica Head. Dr Head's presentation focused on the spatial and temporal variability in plankton abundance and composition in the NW Atlantic, as indicated by observations from BIO cruises on the L3 (AR7W) line in the Labrador Sea and from Continuous Plankton Recorder sampling in the southern Labrador Sea and on the Newfoundland and Scotian shelves.

Observations along the L3 line between 1995 and 2006 indicate that temperatures have increased, the abundance/proportion of large phytoplankton has decreased, that the phytoplankton bloom started earlier and that *Calanus finmarchicus* reproduction/development occurred earlier. There were no obvious trends in zooplankton biomass.

Regarding spatial variability, different regions had different annual cycles of SST and SSChl. Recruitment rates for *C. finmarchicus* also varied regionally due in part to variability in mortality rates for eggs. Regions of the Labrador Sea that have high phytoplankton production probably also have high *C. finmarchicus* recruitment rates and provide source populations to less productive regions.

The results from CPR observations for phytoplankton and zooplankton seasonal cycles of abundances in the NW Atlantic indicate that on the Scotian Shelf after 1990 diatoms started to bloom earlier in the year, the PCI increased earlier in the year and dinoflagellate abundance increased in the first half of the year. Young *Calanus* appeared earlier in the year implying reproduction/development started earlier, although overall recruitment was lower.

On the Newfoundland Shelf after 1990, phytoplankton indices showed changes in seasonality similar to those on the Scotian Shelf. *Calanus* I-IV abundance decreased mainly in summer and fall, when previously values had been highest. In the deep ocean after 1990 there were minor or no changes in seasonality of the phytoplankton indices or of *Calanus* young or late stages.

Overall concluding comments were that temperature affects the timing of the spring bloom in the central Labrador Sea, which in turn influences the timing of reproduction of the dominant zooplankton species, *C. finmarchicus* and there is some CPR evidence for the latter on the Scotian Shelf. Spring bloom intensity affects the survival of eggs and hence recruitment of *C. finmarchicus* in the Labrador Sea - and there is some CPR evidence for this in the deep ocean regions of the NW Atlantic. In the deep NW Atlantic small copepods, young stage *C. finmarchicus* and copepod nauplii respond positively to increasing phytoplankton concentrations. For NW Atlantic shelf regions, increases in phytoplankton concentrations in the 1990s were accompanied by decreases in levels of *C. finmarchicus* in the 1990s, but in the same regions In the 2000s phytoplankton levels remained high, while *C. finmarchicus* levels generally returned to near pre-1990 levels. And finally that satellites and CPRs see phytoplankton differently!

The presentation stimulated both specific and general questions and comments from the Committee. There was a question asking if the proportion of small phytoplankton was related to increasing temperature and Dr Head answered that any correlation appeared to vary between areas. It was further asked if that plankton blooms were occurring earlier in the year, would this impact on fish stocks in general and spring-spawners in particular? The general consensus was that this was difficult to answer at the present time. There was a general discussion on correlation (or lack of correlation) between satellite and CPR data, the outcome of which was inconclusive.

3. Integrated Science Data Management (ISDM) Report for 2008

(SCR Doc. 09/18)

ISDM is the regional environmental data centre for NAFO and as such is required to provide an inventory of all environmental data collected annually by contracting countries of NAFO within the convention area. A representative from ISDM was not available and Estelle Couture (Canada, DFO) gave a presentation on behalf of ISDM.

The following is the inventory of oceanographic data obtained by ISDM during 2008 and updates on other activities in the NAFO Convention area.

i) “Real-time” temperature and salinity profiles

“Real-time” temperature and salinity profiles from 252 863 stations were received, processed, archived and were made available in 2008. These stations consist of low resolution profile data that were transmitted on the Global Telecommunication System (GTS) within 30 days of collection.

ii) Delayed-mode profiles

High depth resolution CTD, towed CTD, bathy thermographs, oxygen data were processed and archived in 2008 from 1082 stations. Additional data on nutrients, oxygen, plankton and other parameters were available from bottles. Delayed-mode profiles collected before 2007 from 7 371 stations were processed in 2008. These data were received from the responsible institutions.

iii) Surface thermosalinograph data

Surface temperature and salinity data were processed from 37 377 stations in 2008, collected from “ships of opportunity” i.e. cargo ship and other ships. The data were acquired on the Global Telecommunication System.

iv) Drifting buoy data

Data in 2008 comprised 283 721 data points from 367 buoys. A large proportion of buoys provide data for marine meteorology (air temperature, pressure, surface water temp) and a smaller proportion provide oceanographic data (surface currents and temperature).

v) Wave data

These data were available from 14 wave buoys in NAFO area and are available online.

vi) Tides and water levels

Data were collected from 52 tide gauges in 2008, some every minute and others every hour.

vii) Argo data

Argo is an international program to deploy profiling floats on a 3 by 3 degree grid in the world’s oceans. The floats measure temperature, salinity and oxygen with depth down to 2000 m. Data were available in 2008 from 37 active and 39 inactive floats.

viii) Atlantic Zone Monitoring Program

Chemical, physical and biological oceanographic data were available from 7 fixed stations and from 13 standard sections. Information on water levels was also collected, as were data on SST and ocean colour (by remote sensing). Each year, data are analysed and synthesized into "State of the Ocean" report.

Data availability

All data are available either directly online (http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/index-eng.html) or by request and is free of charge.

It was enquired if German data on MEDS was subjected to quality control and calibrated. The Chair confirmed that this is and has always been the case. The Chair and the representative of Denmark (in respect of the Faroe Islands and Greenland) confirmed that the data for 2008 from Germany and Denmark should now be accessible. In response to a further question enquiring if data from ARGO profiles were incorporated into the standard CTD database or held separately, E. Couture replied that in the past these data had been held separately but she would confirm this. A general point was made that ISDM and ICES may not be working together optimally, however the consensus was that this was an ongoing issue that was being addressed.

4. Review of the Physical, Biological and Chemical Environment in the NAFO Convention Area during 2008

Subareas 0 and 1. The pattern of sea level atmospheric pressure over the North Atlantic during winter 2007/2008 indicated one distinct negative pressure anomaly cell, located off East Greenland. A weak positive anomaly cell was located in the western Atlantic area, a strong positive anomaly cell stretched from the Tyrrhenian Sea in the west, to the Caspian Sea in the east. As a consequence of this pattern, the North Atlantic Oscillation (NAO) index for the winter 2007/2008 was positive (+0.65). As a consequence, anomalous strong westerlies over the North Atlantic Ocean resulting in extensive cooling over the Labrador Sea / Davis Strait area was observed, and extensive west-ice coverage was formed during the winter 2007/2008. In addition, cold surface waters already in 2007 may have had a positive effect on the sea-ice formation. The extension of multi-year-ice ("Storis") was also high, and the two types of sea-ice met during late winter 2008, which is seldom found. Warmer-than-normal conditions were observed around Greenland during most of the year 2008, except for January and February. Air temperature climatic conditions around Greenland are still warmer-than-normal, although the mean annual temperature anomaly amounted to only +0.3K.

Based on data from standard sections along the west coast of Greenland, data retrieved during trawl surveys and data from five Southwest Greenland fjords, the observations indicate that the presence of Irminger Water in the West Greenland waters was above normal in 2008. The Irminger water was warmer than normal, and their salinities were above normal and even 35 or more at Cape Farewell and Cape Desolation. The mean (400-600 m) salinity and temperature west of Fyllas Bank was both above normal. The presence of Polar Water was also above normal in 2008. The extension of multi-year-ice encountered during the survey was above normal. The salinity above the entire shelf was low with generally low surface and subsurface temperatures. West of Fyllas Bank a clear cold Polar Water core was observed, which had very low temperature and salinity. All together this suggest above normal presence of Polar Water.

Subareas 2 and 3. As a result of the slightly positive NAO index in both 2007 and 2008, the outflow of arctic air masses to the Northwest Atlantic was stronger than in 2006 giving broad-scale cooling of air temperatures throughout the Northwest Atlantic from West Greenland to Baffin Island to Labrador and Newfoundland. Sea-ice extent and duration on the Newfoundland and Labrador Shelf increased in 2008 but remained below average for the 14^{th} consecutive year. As a result of these factors, water temperatures on the Newfoundland and Labrador Shelf generally cooled compared to 2006 but remained above normal in most areas in 2008, continuing the warmer than normal conditions experienced since the mid-to-late 1990s. Salinities in general on the NL Shelf, which were lower than normal throughout most of the 1990s, increased to the highest observed since the early 1990s during 2002 and have remained mostly above normal during the past 7 years. The area of the Cold-Intermediate-Layer (CIL) water mass on the eastern Newfoundland Shelf during 2008 was below normal for the 14^{th} consecutive year and the 5^{th} lowest since 1948. The average temperature and salinity during the summer of 2008 along the Bonavista section has remained significantly above normal by 2.4 and 3.3 SD, respectively. Bottom temperatures during the spring of 2008 remained slightly above normal on the Grand Banks (3LNO) but were below normal on St. Pierre Bank (3Ps).

During the autumn they were above normal in NAFO Div. 2J and 3K and slightly below normal in 3LNO. The area of the bottom on the Grand Banks covered by <0°C water during the spring decreased from near 60% in 1991 to <5% in 2004 but increased to near-normal at about 30% in 2007-2008. A composite climate index derived from several meteorological, ice and oceanographic time series indicate a continuation of warm-salty conditions with 2008 ranking 6th warmest in 59 years of observations.

Subarea 4. Physical oceanographic conditions on the Scotian Shelf and in the eastern Gulf of Maine and adjacent offshore areas indicated an overall balance between positive and negative anomalies. The climate index, a composite of 18 selected, normalized time series, had 12 variables within 0.5 standard deviations of their normal values and 3 each that were more than 0.5 SD above or below normal. The overall average of the 18 normalized anomalies was 0.06±0.97. However, there was systematic variability within the region: 7 of the 10 series from the eastern half (Halifax and eastward) were negative, with the 10 variables having an average value of -0.17 SD; whereas, 6 of the 8 from the western half were positive, with an average value of the 8 variables of +0.35 SD. Deep temperatures in Emerald and Georges Basins were 0.88 and 0.65 SD less than normal; Cabot Strait 200-300 m temperature was 0.45 SD below normal. This indicates colder than normal slope water conditions. These below normal temperatures were also reflected in the bottom temperatures in areas 4W and 4X which were 1.8 and 0.72 SD below normal.

5. Interdisciplinary Studies

There were no written or verbal submissions.

6. An Update of the On-line Annual Ocean Climate Status Summary for the NAFO Convention Area

The Chair and E. B. Colbourne agreed to working in conjunction with the NAFO Secretariat on an update of the on-line annual ocean climate status summary for the NAFO Convention Area.

7. Environmental Indices (Implementation in the Assessment Process)

There was little new progress to report. It was enquired if there was any evidence of stocks responding the recent warming. Views were expressed that survey estimates possibly indicated a response from cod and Greenland halibut in certain areas. It was highlighted that there seems to exist a possible link between warming at Greenland and the observed increase in recruitment of cod (mainly the 2003 year-class). It was further commented that the 2006 year appeared to be good in a number of stocks and that 2006 was a warm year. It was observed that there appeared to be some synchronicity in the strength of the 2006 and 2007 recruitments over a number of cod stocks. However, it was also commented that there had been good environment conditions over the last 15 years and yet there was no large-scale recovery of cod stocks, so perhaps recovery may not be related to environmental conditions. STACFEN agreed to draft a research recommendation on this topic (see below).

8. Formulation of Recommendations based on Environmental Conditions during 2008

STACFEN noted that in recent years good year-classes have been observed in a number of populations in the northwest Atlantic. STACFEN therefore **recommended** that *the appearance of good year-classes be explored in relation to environmental conditions*.

9. National Representatives

The Committee was not informed of any changes in the national representative responsible for hydrographic data submissions. They are: E. Valdes (Cuba), S. Narayanan (Canada), E. Buch (Denmark), J.-C Mahé, (France), F. Nast (Germany), H. Okamura (Japan), H. Sagen (Norway), J. Janusz (Poland), J. Pissarra (Portugal), M. J. Garcia (Spain), B. F. Pristehepa (Russia), L. J. Rickards (United Kingdom), and K. J. Schnebele (USA).

10. Other Matters

The Chair reported that NAFO has been requested by ICES to participate and possibly co-sponsor a forthcoming ICES Symposium “Hydrobiological and ecosystem variability in the ICES area during the first decade of the XXI century, spring/summer of 2011 in Santander, Spain.

R. M. Hendry (Canada, BIO) commented that he was a member of the ICES Working Group on Oceanic Hydrography and could provide some background information on the symposium in a non-official capacity. The Working Group convenes a symposium every 10 years and the aim for this symposium will be to attract interest from a wide range of disciplines including chemistry and biology. Similar hydrographical challenges are being faced in the northwest and northeast Atlantic and ICES is therefore keen for NAFO to participate and be a co-sponsor. The provisional dates for the symposium are 10-12th May 2011.

There was then discussion as to the name of the symposium (ICES/NAFO area etc) but it was considered that this could be addressed at a later stage. NAFO usually convenes a symposium on environmental issues every 10 years, and as the last one was held in 2002, E. B. Colbourne (Canada, DFO) suggested that the forthcoming ICES Symposium could take the place of the next NAFO symposium. STACFEN therefore **recommended** *Scientific Council to support participation and possible co-sponsorship in ICES Symposium – "Hydrobiological and ecosystem variability in the ICES area during the first decade of the XXI century*". The NAFO Scientific Council Coordinator commented that there was a need to resolve if NAFO should be a co-sponsor or co-organiser and he suggested that the best way forward might be to ask ICES how they wish to proceed. R. M. Hendry indicated that he was happy to go back to the ICES Working Group on an un-official basis, however the NAFO Secretariat indicated that such matters would normally be dealt with by the NAFO and ICES Secretariats. A formal letter from ICES was expected but had not yet been received.

No other matters were brought forward or discussed by the Committee.

11. Adjournment

Upon completing the agenda, the Interim Chair thanked the STACFEN members for their contributions and invited speaker, the Secretariat and the rapporteur for their support and contributions. The meeting was then adjourned at 1550 hrs.

APPENDIX II. REPORT OF THE STANDING COMMITTEE ON PUBLICATIONS (STACPUB)

Chair: Manfred Stein Rapporteur: Margaret Treble

The Committee met at the Alderney Landing, 2 Ochterloney Street, Dartmouth, Nova Scotia, Canada, on 6 June 2009, to consider publication-related topics and report on various matters referred to it by the Scientific Council. Representatives attended from Canada, Denmark (in respect of Faroe Islands and Greenland), European Union (Estonia, France, Germany, Latvia, Lithuania, Portugal, Spain and United Kingdom), Japan and Russian Federation. The Scientific Council Coordinator was in attendance as were other members of the Secretariat staff.

1. Opening

The Chair opened the meeting at 0900 hours by welcoming the participants. The agenda as presented in the Provisional Agenda was adopted with the addition of a discussion on the development of a coral key under Other Matters. Margaret Treble (Canada) was appointed rapporteur.

2. Review of Recommendations in 2008

Recommendation from June

STACPUB **recommended** that *to widen the scope of JNAFS in order to cover the fields of benthic ecology and the Ecosystem Approach, it was agreed to create two new Associate Editor positions and to identify potential candidates to join the Editorial Board.*

STATUS: To date, mainly due to the lack of need resulting from a low number of manuscript submissions, no further Associate Editor positions have been identified or filled. This will be kept under review and positions made when required.

3. Report on "pre-STACPUB meeting" – NAFO Headquarters - 4th June 2009

This year the meeting provided a useful forum for reviewing Journal and technical issues that are noted below.

4. Review of Publications

a) Journal of Northwest Atlantic Fishery Science

STACPUB was informed that: Volume 40 (Regular) had one article published in 2008 and after consultation with the Chair of STACPUB and the Associate Editors it was decided to keep this volume open until the end of 2009. There have been 3 articles published to the web, 2 have been accepted and are in proof stage and 4 others are at review.

Volume 41 is a symposium issue for the joint NAFO, PICES and ICES symposium on "Reproductive and recruitment processes of exploited marine fish stocks". A total of 19 papers have been published. In addition to the regular soft-cover version, a hard-copy version was printed and made available at cost to participants. The publication was published on the web and in paper form within 18 months of the symposium.

Volume 42 is also a symposium issue on "The role of marine mammals in the ecosystem in the 21st century". A total of 11 papers were submitted with two being in the technical editing and proof stages. The other 9 are at review. The paper copy is expected to be published in April 2010.

It was noted that a journal that combines the fields of fisheries science, social science and economics may find a niche and it will be interesting to see how a recent submission to JNAFS in the area of fisheries and economics will be received.

b) NAFO Scientific Council Studies

STACPUB was informed that: A NAFO identification guide on wolfish, hake and rockling has been produced and will be useful aboard commercial vessels (No. 40). The report of the Scientific Council Greenland halibut Ageing Workshop (No. 41) held in St. John's was published in 2008.

All past volumes of the Studies have been uploaded to the NAFO website and are available in the open access section.

c) NAFO Scientific Council Reports

STACPUB was informed that: A total of 80 printed copies of the NAFO Scientific Council Reports 2008 (Redbook) volume (328 pages) were produced in April 2009. The Redbook contained reports of the June, September, and November 2008 Scientific Council meetings, along with a list of NAFO publications relevant to the meetings and contact details for participants. Also included, were the NAFO shrimp stocks assessed at the NAFO/ICES *Pandalus* Assessment Group (NIPAG) meeting. This book was distributed to participants of Scientific Council meeting of June 2009.

The website publication of Reports of all Scientific Council Meetings held in 2008 was prepared as meeting reports were finalized. It differs from the print versions mentioned in above paragraph in that it contains navigation tools to access various sections of the reports of meetings that took place in 2008.

Changes have been made to the way the Redbook is compiled which has resulted in a more efficient and timely production of the document while keeping the final format relatively unchanged. The CD that is placed in the back of the Redbook now contains the minutes and other reference information for the 3 most recent years.

d) Index and Lists of Titles

STACPUB was informed that: The provisional index and lists of titles of 79 research documents (SCR Doc) and 20 summary documents (SCS Doc) that were presented at the Scientific Council Meetings during 2008 were compiled and presented in SCS Doc. 09/19 for this June 2009 Meeting.

5. Editorial Matters Regarding JNAFS

a) General Editors Report

JNAFS strives to publish one regular and normally one symposium issue per year. However, JNAFS has been under constant pressure resulting from the general tardiness of submitted manuscripts. The production quality, web access, publication time, etc, are as good if not better than many journals. JNAFS receives fair support from NAFO Scientific Council participants, though many articles about NAFO stocks are submitted to other peer reviewed journals. The main competitors are the *Canadian Journal of Fisheries and Aquatic Science* and the *ICES Journal of Marine Science*. Both of these publish articles approximately monthly and have a citation impact factor. Discussions with many scientists, particularly those more active in the research, are increasingly reluctant to publish in journals that lack an impact factor. This has also applied to participants at both the last two symposia, where the percentage of submissions could have been higher.

b) Review of Editorial Board

The current members of the editorial board are one General Editor (Anthony Thompson) and six Associate Editors (Ken Drinkwater, Thomas Bjorndal, Doug Wilson, Joanne Morgan, Hans Rätz and Dave Kulka). All have been extremely dedicated and are a real asset. The Associate Editors, in addition to coordinating the review process, are often called upon to provide advice to the General Editor on various aspects of the publication process. All give their time willingly and are the journals strongest assets.

c) Publications Initiatives

STACPUB was informed that: several approaches have been initiated to enhance publication of JNAFS over the last year or two but they haven't yet resulted in an increase in the number of submissions. However, the quality of the submissions have been good and the editors have received comments indicating that the journal is generally well received.

d) General Discussion

STACPUB members held a discussion on whether or not JNAFS should publish symposium volumes only. There was general agreement that the current approach continue and that STACPUB members continue to encourage submission of manuscripts to regular issues as well as symposium issues.

6. Other Matters

A guide to corals is proposed for publication in 2009. The intent is to publish this guide as a water proof version, that can be used by observers onboard vessels. An electronic version would also be available on the website.

STACPUB **recommended** that *a coral guide be published in the NAFO Studies Series in a waterproof format as well as an electronic format that would be available to on the website*.

The Chair thanked the participants for their valuable contributions, the rapporteur for taking the minutes and the Secretariat for their support. The meeting was adjourned at 1000 hours on 6 June 2009.

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

Chair: Ricardo Alpoim Rapporteur: Margaret Treble

The Committee met at Alderney Landing, at 2 Ochterloney Street, Dartmouth, Nova Scotia, during 8-15 June 2009 to discuss matters pertaining to statistics and research referred to it by the Scientific Council. Representatives attended from Canada, Denmark (in respect of Faroe Islands and Greenland), European Union (France, Germany, Latvia, Lithuania, Portugal, Spain and United Kingdom), Japan, Russian Federation, and United States of America. The Scientific Council Coordinator was in attendance as were other members of the Secretariat staff.

1. Opening

a) Appointment of Rapporteur

The Chair opened the meeting at 0900 hours on 8 June 2009. He welcomed all the participants, and thanked the Secretariat for providing support for the meeting. Margaret Treble was appointed as rapporteur. The Chair proposed some minor adjustments to the agenda, which was then adopted.

2. Review of Previous Recommendations

Acquisition of STATLANT 21A and 21B reports for recent years

During 2007 the Secretariat began a review of the accessibility of the STATLANT 21 data on the website and the feasibility of harmonizing the 21A and 21B databases. STACREC noted that there are additional sources of information concerning catches that may be used in the assessments and that this should be indicated on the web site. STACREC **recommended** that *data be easily accessible on the web site in both aggregated (as in 21A) and dis-aggregated (as in 21B) formats*. In addition STACREC **recommended** that *the website contain information on missing data and information on additional sources of catch data, collated on the basis of stock, that are used by Scientific Council*.

STATUS: The Secretariat found these recommendations to involve larger issues than initially thought and over the last number of months have developed a work plan to address them in the coming year.

STACREC **recommended** that *the Secretariat discuss the following with Contracting Parties: i) dropping the numeric codes for species and using the appropriate alpha codes provided by FAO ASFIS species list; ii) the harmonization of electronic data submissions*.

STATUS: This recommendation has been extensively discussed and incorporated in the above STATLANT work plan.

Information collected by the NAFO Secretariat

The Secretariat presented a summary of data sources and information that is available upon request from the Secretariat; STATLANT 21, list of biological sampling, list of tagging activities, research vessel surveys, commercial fisheries sampling, biological surveys, provisional catches by month, at-sea inspection reports, port inspection reports, observer reports, VMS, vessel registry and NAFO publications. Some of these data sources contain confidential information and therefore have restrictions placed on their distribution. STACREC noted that not all research activities have been reported to the Secretariat for example research surveys done by non-government parties using commercial vessels.

STACREC **recommended** that *the Secretariat maintain a list of information sources and this list be made more accessible on the web site. In addition STACREC encourages Contracting Parties to continue reporting research activities in the NRA, including those conducted by commercial vessels*.

STATUS: This recommendation was implemented by the Secretariat.

Stock Assessment Spreadsheets – update

Almost nothing has changed since the last meeting with only 10 of 26 stocks having completed spreadsheets. This is still considered to be an important source of information for Scientific Council. STACREC reiterates the importance of maintaining a database of data used in stock assessments and **recommended** that *when there is a change in Designated Expert the Secretariat and Chair of Scientific Council contact the past Designated Experts to ensure that the stock assessment data is submitted to the Secretariat so this data continues to be available to STACFIS and Scientific Council.*

STATUS: This recommendation was implemented by the Secretariat and the Scientific Council Chair.

3. Fishery Statistics

a) Progress Report on Secretariat Activities in 2008/2009

i) Acquisition of STATLANT 21A and 21B reports for recent years

In accordance with Rule 4.4 of the Rules of Procedure of the Scientific Council, as amended by Scientific Council in June 2006, the deadline dates for this year's submission of STATLANT 21A data and 21B data for the preceding year are 1 May and 31 August, respectively. The Secretariat produced a compilation of the countries that have submitted to STATLANT along with historical STATLANT catches and made this available to the meeting. This will be made into an SCS document to be a record of the catches available to this meeting. This includes the table of which countries have submitted to STATLANT at the date the working paper was compiled (Table 1). This will be useful in checking historic catches and in determining if zero catch from a country represents no catch or no submission.

TABLE 1. Dates of receipt of STATLANT 21A and 21B reports for 2005-2008 at the Secretariat up to 4 June 2009.

Country/ Component	STATLANT 21A (deadline, 1 May)				STATLANT 21B (deadline, 31 August)		
	2006	2007	2008		2006	2007	2008
CAN-CA		22 Feb 08	30 Mar 09		23 May 07	3 Jul 08	
CAN-M CAN-SF CAN-G	 22 May 07 26 May 08	 7 Nov 08 26 May 08	 15 May 09		 8 Jun 08 4 Nov 08	 10 Nov 08 4 Nov 08	
CAN-N	21 Jun 07	21 May 08	29 May 09		3 Oct 07	29 Aug 08	
CAN-Q	Dec 06	Dec 07	27 Apr 09		7 Nov 08	7 Nov 08	
CUB	24 Sep 07	30 Apr 08			22 Feb 08		
EU/EST**	2 May 07	8 Apr 08	4 May 09		04 Sep 07	8 Apr 08	
EU/DNK	15 May 07	21 May 08	25 May 09		15 May 07	21 May 08	25 May 09
EU/FRA-M							
EU/DEU	27 Apr 07	23 Apr 08	27 Apr 09		30 Aug 07	28 Aug 08	
EU/NLD							
EU/LVA**	24 Apr 07	8 Apr 08	1 Aprl 09		27 Jun 07	28 Jul 08	
EU/LTU**	27 Apr 07	24 Apr 08			29 Jan 08		
EU/POL**	28 Feb 07		2 Jun 09 (n.f.)		28 Feb 07		
EU/PRT	2 May 07	29 Apr 08	29 Apr 09		28 Aug 07	4 Sep 08	
EU/ESP	10 Oct 07	4 Jun08	2 Jun 09		10 Oct 07	4 Jun 08	2 Jun 09
EU/GBR	4 Oct 07 (n.f.)	21 May 08 (n.f.)	2 Jun 09			-	
FRO	17 Jun 08	30 May 08			17 Jun 07	30 May 08	
GRL	10 Nov 08				10 Nov 08		
ISL	31 May 07	30 May 08 (n.f.)	11 May 09		31 May 07	-	
JPN	13 Jun 07	25 Apr 08	1 May 09		21 Nov 07	25 Apr 08	
KOR							

NOR	2 May 07	30 Apr 08	4 Jun 09		28 Apr 08	3 Oct 08	
RUS	26 Apr 07	20 May 08	18 May 09		3 Jul 07		
USA							
FRA-SP	21 Feb 07	10 Sep 08	11 May 09		21 Feb 07	11 May 09	11 May 09
UKR	13 Apr 07				13 Apr 07		

* Note Bulgaria has not reported in recent years but records indicate there was no fishing.
** Accession to the European Union (EU) 1 January 2005.

ii) Information collected by the NAFO Secretariat

The Secretariat presented a summary of data sources and information that is available upon request from the Secretariat; STATLANT 21, list of biological sampling, list of tagging activities, research vessel surveys, commercial fisheries sampling, biological surveys, provisional catches by month, at-sea inspection reports, port inspection reports, observer reports, VMS, vessel registry and NAFO publications. Some of these data sources contain confidential information and therefore have restrictions placed on their distribution.

4. Research Activities

a) Biological Sampling

i) Report on activities in 2008/2009

STACREC reviewed the list of Biological Sampling Data for 2008 (SCS Doc. 09/15) prepared by the Secretariat and noted that any updates will be inserted during the summer, prior to finalizing the SCS Document which will be published for the September 2009 Meeting.

ii) Report by National Representatives on commercial sampling conducted

Canada-Newfoundland (SCS Doc. 09/13**):** Information was obtained from the various fisheries taking place in all areas from Subareas 0, 2, 3 and portions of SA 4. Information on fisheries and associated sampling for Greenland halibut (SA 0 + 1 (except Div. 1A inshore), SA 2 + Div. 3KLMNO), Atlantic salmon (SA 2+3+4), Arctic charr (SA 2), Atlantic cod (Div. 2GH, Div. 2J+3KL, Div. 3NO, Subdiv. 3Ps), American plaice (SA 2 + Div. 3K, Div. 3LNO, Subdiv. 3Ps), witch flounder (Div. 2J+3KL, 3NO, 3Ps), yellowtail flounder (Div. 3LNO), redfish (SA 2 + Div. 3K, 3LN, 3O, Unit 2), northern shrimp (SA 2 + Div. 3K, 3LMNO), Iceland scallop (Div. 2HJ, Div. 3LNO, Subdiv. 3Ps, Div. 4R), sea scallop (Div. 3L, Subdiv. 3Ps), snow crab (Div. 2J+3KLNO, Subdiv. 3Ps, Div. 4R), squid (SA 3), thorny skate (Div. 3LNOPs), white hake (Div. 3NOPs), lobster (SA 2+3+4), and capelin (SA 2 + Div. 3KL), was included.

EU-Portugal (SCS Doc. 09/5): Data on catch rates were obtained from trawl catches for Greenland halibut (Div. 3L and 3M), redfish (Div. 3M and 3O) and roughhead grenadier (Div. 3L and 3O). Data on length composition of the catch were obtained for cod (Div.3M and 3O), redfish (Div. 3MNO), American plaice (Div. 3L), Greenland halibut (Div. 3Land 3M), roughhead grenadier (Div. 3L and 3M), white hake (Div. 3O) and skates (Div.3L and 3M).

EU-Spain (SCS Doc. 09/9): The Spanish fleet has, at least, four different fisheries in NAFO SA 3 characterized by different mesh size, target species, depth and fishing area. The Spanish fleet effort in NAFO SA 3 is mainly directed to Greenland halibut (mostly in Div. 3LM), alternating with the skate fishery in the second half of the year (Div. 3NO), shrimp fishery (Div. 3LM), and in less degree redfish (Div. 3O and 3M). A total of 14 Spanish trawlers operated in NAFO Regulatory Area, Div. 3LMNO, during 2008, amounting to 1 406 days (21 408 hours) of fishing effort. Total catches for all species combined in Div. 3LMNO were 17 364 t in 2008.

All effort and catch information in the Spanish Research Report are based on information from NAFO observers on board. In 2008 information from 1 384 days was available while total effort of the Spanish fleet in NAFO Regulatory Area was 1 406 days (98% coverage). In addition to NAFO observers (NAFO Observers Program), 6 IEO scientific observers were onboard the Spanish vessels, comprising a total of 290 observed fishing days, around 21% coverage of the total Spanish effort. Besides recording catches, discards, and effort, these observers carried out biological sampling of the main species taken in the catch. In 2008, 315 length samples were taken, with 45 024 individuals of different species examined to obtain the length distributions. For Greenland halibut, roughhead grenadier and American plaice this includes recording weight at length, sex-ratio, maturity stages, performing stomach contents analyses, and collecting material for reproductive studies. Otoliths of these three species were also taken for age determination.

Denmark/Greenland (SCR Doc. 09/30): Length frequencies and CPUE data were available from the Greenland trawl fishery in Div. 1A and 1CD. Length and age compositions were available from the inshore long line and gill net fishery in inshore in Div. 1A.

EU-Estonia: In 2008, as in earlier years, the fishery was mainly directed on northern shrimp. Observers (employed by the Estonian Marine Institute) measured and sexed 155 547 specimens of shrimp from 823 hauls. Bycatch of redfish (50 924 specimens measured, 983 aged, 666 sexed) and capelin (2 382 measured) was analyzed in shrimp fishery. In addition, Greenland halibut in Div. 3LMN (2 230 specimens measured, 1 467 aged, 2 224 sexed), cod in Div. 3M (116, 58, 116) and redfish in Div. 3LMNO (1 011, 619, 967) were sampled.

EU-Germany (SCS Doc 09/11): From 2007 to 2008, demersal fishing effort decreased in Div. 1D inside the Greenland EEZ from 2 230 hours in 2007 to 1 891 hours in 2008. The fishery was directed towards Greenland halibut (*Reinhardtius hippoglossoides*). By end of the year, reported landings amounted to 1 551 t of Greenland halibut. The bycatch of roundnose grenadiers was <1 t in 2008 compared to 2.2 t (2006) to about 4 t (2007). Wolffish and skates were not reported as bycatch (presumably less than 1 t). In 2008, commercial German cod fisheries commenced again in Div. 1F. The catch was 2 415 t.

EU-Latvia (SCS Doc. 09/10): Latvian fishery in NAFO area in 2008 was conducted by two vessels. Catches: redfish in Div. 1F – 226.6 t, Pandalid shrimp in Div. 3M – 1 285.1 t and in Div. 3L-278 t.

Latvia length\weight measurements of catches were carried out by NAFO\scientific observers. From bottom trawl Pandalid shrimp fishery in Div. 3M and 3L the total number of 15 samples were taken with 2 835 individual shrimp measurements. From pelagic trawl redfish fishery in Div. 1F the total number of 25 samples were taken with 2 500 individual redfish measurements.

EU-Lithuania (SCS Doc. 09/20): In 2008 Lithuanian fleet in the NAFO area operated with three vessels. One of vessels operated in Div. 1F and 2J targeting redfish by pelagic trawl (OTM 110 mm). The second one was targeting Pandalid shrimps in Div. 3LM by bottom trawl (OTB 45 mm). The third vessel operated in Div. 3NO and targeted demersal species by bottom trawls (OTB 130 mm and 280 mm). Lithuania landings (t) in NAFO area in 2008 by species, Division and months are given. Effort summary of Lithuanian fisheries was also presented.

Sampling was performed by observers who have been employed by Fisheries Department under the Ministry of Agriculture on regular basis. In total 3 699 shrimps from landed part of catch in Div. 3M were measured during the year. 2 311 length measurements of redfish from in Div. 3NO were performed. Also information on amount of discarded species was collected routinely.

Russia (SCS Doc. 09/12): In 2008 Russian fishing vessels operated in SA 1 and SA 3. The fishery was mainly directed on Greenland halibut in Div. 1A, 1CD, and 3LM and deep-water redfish in Div. 1F, 3MO. Data on catch, sex, maturity, age, individual weight and length composition were obtained from trawl catches for Greenland halibut (Div.1AD, Div. 3LMNO) and redfish (Div. 1F, 3M) was available. Data on catch and length composition were presented for redfish (Div. 3LMNO), Atlantic cod (Div. 3LMNO), roughhead grenadier (Div. 3LMNO), American plaice (Div. 3LMNO), threebeard rockling (Div. 3LMN), thorny skate (Div. 3LMO), witch flounder (Div. 3LMNO), American plaice (Div. 3LMNO), white hake (Div. 3NO), black dogfish (Div. 3LMNO), Northern wolfish (Div. 3LMNO), blue hake (Div. 3LMN), Atlantic halibut (3LMNO), yellowtail flounder (Div.3NO) and common grenadier (Div. 3LMNO).

iii) Report on data availability for stock assessments

Designated Experts were reminded to provide available data from commercial fisheries to the Secretariat for inclusion on the shared network drive.

b) Biological Surveys

i) Review of survey activities in 2008 (by National Representatives and Designated Experts)

Canada (SCS Doc. 09/13): Research survey activities carried out by Canada (N) were summarized, and stock-specific details were provided in various research documents associated with the stock assessments. The major multispecies surveys carried out by Canada in 2008 include a spring survey of Div. 3LNOP, and an autumn survey of Div. 2J+3KLMNO. The spring survey was conducted from mid-April to late June, and consisted of 442 tows, (273 in Div. 3LNO) with the Campelen 1800 trawl, by the research vessels *Wilfred Templeman* and *Teleost*. This survey continued a time series begun in 1971. The autumn survey was conducted from early October to January, and consisted of 533 tows with the Campelen 1800 trawl. Three research vessels were used: *Teleost,Alfred Needler,* and *Wilfred Templeman,*. This survey continued a time series begun in 1977. Additional surveys during 2008, directed at various species using a variety of designs and fishing gears, were described in detail in SCS Doc. 09/13 and in other documents. Oceanographic surveys were discussed in detail in STACFEN.

Canada (CA) conducted two stratified-random otter trawl surveys with the Greenland Institute of Natural Resources research vessel *Pâmiut* in southern Div. 0A (Baffin Bay) in 2008. The surveys were conducted on the same cruise, using two different trawl gears, between 8 October and 4 November 2008 (SCR Doc. 09/26). A Cosmos shrimp trawl was used at randomly selected stations between 100 m and 800 m. An Alfredo III trawl was used at randomly selected stations between 400 m and 1500 m. For the shallow water survey all 75 stations were successfully completed. A new stratification scheme was introduced for the deep water survey in 2008 which resulted in an increase in the stratified area from 49 834 km^2 to 56 445 km^2. In the deep water survey 86 of 91 planned stations were successfully completed. 2008 was year 4 of a NAFO Div. 0B survey conducted by the Northern Shrimp Research Foundation in partnership with DFO.

Canada (SCR Doc. 09/12) B.P. Healey and W.B. Brodie: Brief notes on the execution of Canadian multi-species surveys in 2007 and 2008.

Brodie and Stansbury (2007) reviewed the performance of the Canadian multi-species spring and autumn surveys over 1995-2006. We update some basic survey performance statistics and document any coverage deficiencies in the four multi-species surveys conducted by the Department of Fisheries and Oceans, Newfoundland Region since 2006: the spring and autumn surveys of 2007 and 2008. The most significant issue over this time period is the lack of deepwater coverage for practically the entire edge of the Continental Shelf during the autumn 2008 survey. The impact of the coverage deficiencies during the 2007 and 2008 spring and fall surveys on stock assessments is briefly discussed.

EU-Spain (SCS Doc. 09/8, 09, 10, 24, 25): The Spanish bottom trawl survey in NAFO Regulatory area Div. 3NO was conducted in May and June 2008 on board R/V *Vizconde de Eza* using Campelen gear with a stratified design. A total of 123 hauls were carried out up to a depth of 1 446 m, one of which was null. The results of the Spanish Div. 3NO bottom trawl survey, including biomass indices with their errors and length distributions, as well as the calculated biomass based on conversion of length frequencies for Greenland halibut and American plaice; Atlantic cod and yellowtail flounder; thorny skate, white hake and roughhead grenadier are presented as Scientific Council Research documents. As in the years 1995 and 1996 few deeper strata were surveyed, the data obtained in those surveys are not representative for most of the species, so the data is presented since 1997 to 2008 for all the species, except for yellowtail flounder, whose data are presented for the whole period, and for white hake, presented for the period 2001-2008 because before 2001 there are no data available. Feeding studies on the main species continued to be conducted. Material for histology and aging (cod, American place and Greenland halibut) studies were taken. One hundred twenty two hydrographic profile samplings were made in a depth range of 33-1420 m.

In 2003 it was decided to extend the Spanish Div. 3NO survey toward Div. 3L (Flemish Pass). In 2008, the bottom trawl survey in Flemish Pass (Div. 3L) was carried out on board R/V *Vizconde de Eza* using the usual survey gear (Campelen 1800) from July 24th to August 11th. The area surveyed was Flemish Pass to depths up 800 fathoms (1 463 m) following the same procedure as in previous years. The number of hauls was 103 and 3 of them were nulls. Survey results including abundance indices and length distributions of the main commercial species are presented as Scientific Council Research documents. Survey results for Div. 3LNO of the northern shrimp (*Pandalus borealis*) were presented in SCR Doc. 08/66.

Feeding studies on Greenland halibut and American plaice continued to be performed and samples for histological (Greenland halibut, American plaice) and ageing (Greenland halibut, American plaice and cod) studies were taken. One hundred one hydrographic profile samplings were made in a depth range of 95-1 411 m.

In 2007 the Spanish administration obtained a license from Canadian Authorities to carry out a research survey inside of the Canadian waters in Div. 3L. In 2008 this survey was made by the R/V *Vizconde de Eza*, covering 14 strata in the north of Div. 3L, using a Campelen survey gear up to 1 420 m depth and following the same procedures as in Div. 3NO survey. Initial plan could not be completed neither, due to the bad meteorological conditions and the travels to pick up and drop off the Canadian participants and 33 valid fishing operations instead of the 44 initially planned were carried out. Total biomass, calculated by swept area method, for the main species is shown in the Table 20. Due to the low number of hauls these results should be considered with caution. Eight hydrographic profile samplings were made in a depth range of 343-1 070 m.

EU–Spain and Portugal (SCS Doc. 09/19): The EU bottom trawl survey in Flemish Cap (Div. 3M) was carried out on board R/V *Vizconde de Eza* using the usual survey gear (Lofoten) from 18 June to 22 July 2008. The area surveyed was Flemish Cap Bank to depths up to 800 fathoms (1 400 m) following the same procedure as in previous years. The number of hauls was 176 and nine of them were nulls. Survey results including abundance indices of the main commercial species and age distributions for cod, redfish, American plaice, roughhead grenadier and Greenland halibut are presented as Scientific Council Research documents. Flemish Cap survey results for northern shrimp (*Pandalus borealis*) were presented in SCR Doc. 08/68. Samples for histological assessment of sexual maturity of cod, redfish, Greenland halibut and roughhead grenadier were taken. Oceanography studies continued to take place.

Denmark/Greenland: The West Greenland standard oceanographic stations were surveyed in 2007 as in previous years. Further, a number of oceanographic stations were taken in four different fjord systems at Southwest Greenland (SCR Doc. 09/3).

A series of annual stratified-random bottom trawl surveys, mainly aimed at shrimps, initiated in 1988 was continued in 2008. In July-August 252 research trawl hauls were made in the main distribution area of the West Greenland shrimp stock, including areas in SA 0 and the inshore areas in Disko Bay and Vaigat. The surveys also provide information on Greenland halibut, cod, demersal redfish, American plaice, Atlantic and spotted wolffish and thorny skate (SCR Doc. 09/20).

A Greenland deep sea trawl survey series for Greenland halibut was initiated in 1997. The survey is a continuing of the joint Japanese/Greenland survey carried out in the period 1987-1995. In 1997-2008 the survey covered Div. 1C and 1D between the 3 nautical mile line and the 200 nautical mile line or the midline against Canada at depths between 400 and 1 500 m. In 2008 70 valid hauls were made. During the survey about 1 600 Greenland halibut were tagged with floy-tags. (SCR Doc. 09/16).

A longline survey for Greenland halibut in the inshore areas of Disko Bay, Uummannaq and Upernavik was initiated in 1993. In 2006 the longline survey was conducted in Uummannaq and Disko Bay (SCR Doc. 08/39) (no longline survey in 2008).

Since 2001 a gillnet survey has been conducted annually in the Disko Bay area. In 2008 a total of 30 gillnet settings were made along 4 transect. Each gillnet was composed of four panels with different mesh size (46, 55, 60 and 70 mm stretched mesh).

EU-Germany (SCS Doc. 09/11): Since 1982, annual groundfish surveys were conducted. During the fourth quarter, stratified random surveys covered shelf areas and the continental slope off West Greenland (Divisions 1B-1F) outside the 3-mile limit to the 400 m isobath. In October-November 2008, 50 valid hauls were carried out while covering about 88 % of the standard survey area. Based on this survey information, assessments of the stock status for demersal redfish (*Sebastes marinus, S. mentella*), American plaice (*Hippoglossoides platessoides*), Atlantic wolffish (*Anarhichas lupus*), and thorny skate (*Amblyraja radiata*) are documented.

(SCR Doc. 09/11): Based on the German Bottom Trawl Survey (1982-2008), abundance, biomass estimates and length compositions for golden and deep sea redfish ≥17 cm (*Sebastes marinus* and *S. mentella*), juvenile redfish <17 cm, American plaice (*Hippoglossoides platessoides*), Atlantic and spotted wolfish (*Anarhichas lupus* and *A.*

minor) and thorny skate (*Raja radiata*) in Div. 1C to 1F are presented. For golden redfish, American plaice and both wolffishes, stocks sizes have declined significantly until the early 1990s and remained at a low level since until 2000. Since then, abundances increased only slightly. For thorny skate, abundances increased in the early 1990s and for deep-sea redfish in the late 1990s. All upward trends observed until 2004-2007 have reversed since then. For thorny skate, the lowest biomass estimate for the whole times series was found. All stocks considered are presently composed of small and mainly juvenile specimens except for spotted wolffish. Near bottom water temperature continued to be high (since 1996), the maximum of the time series was observed in 2003.

ii) Surveys planned for 2009 and early 2010

- The international Scientific Research Survey on VMEs in the NRA

A coordinated scientific research project named North West Atlantic VME Survey was organized by CEFAS (UK), Fisheries & Oceans Canada, Instituto Español de Oceanografía (Spain), Instituto de Investigaciones Marinas (Spain), Research Institute of Oceanography of the Russian Academy of Sciences (Russian Federation) and Secretaría General del Mar (Spain). The main objective is: to identify and quantify the location and spatial extent of VMEs in the NAFO Regulatory Area (Div. 3L, 3M, 3N and 3O) at depths less than 2 000 m, as agreed in the first meeting of the consortium on 23–24 March 2009 in Vigo, Spain.

The project includes several surveys in two consecutive years: 2009 and 2010, using the Spanish RV *Miguel Oliver* and the Canadian CCGS *Hudson*. The objective in the first year is to carry out a seabed multibeam survey along with ground truth sampling to describe the broad scale physical and biological characteristics of the seabed. The objective in the second year will be to target areas for quantitative biological and habitat assessment and to extend acoustic surveys of the seabed in these areas if needed.

The survey by the RV *Miguel Oliver* in 2009 is scheduled for 23 May – 22 August. Multibeam and seismic mapping will focus on obtaining 100% coverage of the seabed between the depths of 700 m and 2 000 m for the majority of the survey area but with additional coverage at targeted locations in shallower water (between 200 m and 700 m). The acoustic data will be processed initially onboard in real time to enable ground truthing for determination of sediment type and the identification of locations of conspicuous mega fauna.

The survey by the CCGS Hudson is planned for 10 July – 21 July 2009 and will focus on carrying out Campod and CTD transect lines, and possibly NRCan camera observations, at selected locations considered by WGEAFM to be candidate VME sites. Benthic communities in selected areas will be investigated using a video-grab.

A workshop will be organized in February 2010 to bring together all parties to discuss data analysis and interpretation. Biological, geophysical and environmental data, together with fishing effort and VMS data will be jointly assessed at the workshop. The output of the workshop will also refine the scope and the planning of the 2nd year surveys.

The survey by the RV *Miguel Oliver* in 2010 is planned for 18 May – 17 August, and will focus on obtaining quantitative data on the biological and habitat characteristics identified as priority areas of interest from the first year survey results. Biological and sedimentological samples will be collected using, among other methods, dredges, mega box cores, and underwater cameras.

A survey of CCGS *Hudson* using ROV and ROPOS is scheduled for 5 July – 27 July 2010. Data from the multibeam surveys, analyses of trawl survey catch of corals and sponges, fishing footprint and other sources will be used to efficiently plan the survey design to optimize the collection of data on benthic organisms in the VME areas. At least 5 days of this survey will be spent on Orphan Knoll, in the NAFO closed area.

- Other surveys

An inventory of biological surveys planned for 2009 and early 2010, as submitted by the National Representatives and Designated Experts, was compiled by the Secretariat. An SCS document summarizing these surveys will be prepared for review at the September 2009 Meeting.

c) Other Research Activities

Canada (SCS Doc. 09/13): A summary was presented for a Canadian research initiative (International Governance Strategy) to increase knowledge of marine ecosystems, sensitive marine areas and species, and straddling and highly migratory fish stocks, This program began in 2005, continued in 2008, and additional projects are underway and/or planned for 2009-2010.

USA (SCS Doc. 09/18): USA conducted a number of research projects on a variety of topics in 2008. The review of the current state of 15 species or species complex is presented as in past years. We noted continued high biomass of Acadian redfish, haddock, Atlantic sea scallops and several species of skates. A number of environmental studies were also reported. A total of 1 841 CTD (conductivity, temperature, depth) profiles were collected on Northeast Fisheries Science Center (NEFSC) cruises during 2008. Of these, 1 811 were obtained in NAFO SA 4, 5, and 6. During 2008, zooplankton community distribution and abundance were monitored using 661 bongo net tows taken on five surveys. The Milford Laboratory is engaged in a cooperative research project with the East Coast Shellfish Growers, their Research Institute, and commercial shellfish growers to investigate interactions between shellfish cultivation and habitat. The NEFSC's James J. Howard and Woods Hole Laboratories, U. S. Geological Survey (USGS), and several collaborating academic institutions conducted an extensive field program to develop methods for mapping, characterizing and developing hypotheses regarding benthic habitats and their macrobenthic and demersal communities during 2008.

During 2008, staff from the Woods Hole Laboratory staged and supported the spring and fall multispecies bottom trawl, spring and autumn trawl calibration, and northern shrimp trawl surveys. Additional staff and gear support was provided for the sea scallop dredge, sea scallop gear comparison, surfclam/ocean quahog, Atlantic herring hydroacoustic, and cooperative surveys for a total of 406 research and charter vessel sea days. NOAA scientific staff participated on a total of 3,528 sea days and volunteers contributed another 1 097 sea days. Cruises occupied 2 845 stations in an area extending from Cape Hatteras, North Carolina to Nova Scotia including the Gulf of Maine. A total of 3 712 301 length measurements were taken from 406 species during these cruises. On 20 November 2008, after 45 years of faithful service, *R/V Albatross IV* was decommissioned during a ceremony at the Woods Hole Laboratory wharf. She was replaced by FSV Henry B. Bigelow commencing with the spring 2009 bottom trawl survey.

Approximately 85 000 age determinations for 14 species of finfish and shellfish were completed in 2008 by Woods Hole Laboratory staff in support of resource assessment analyses. Cod, haddock, and mackerel age structures were exchanged with age readers from Fisheries & Oceans Canada laboratories in a continuing effort to maintain comparability of age determinations between laboratories. The Woods Hole Laboratory continued a study with Fisheries & Oceans Canada (St. Andrews Biological Station) and Maine's Department of Marine Resources to standardize ageing methodologies among agencies and institutions ageing Atlantic herring, and to examine generic herring ageing research issues. The 36 year time series (1973-2008) of food habits data collected during NEFSC bottom trawl surveys continued. The majority of the time series is now available for analysis, including data from over 600 000 stomach samples. During the 2008 spring and autumn surveys, 5 910 stomachs from 56 species, and 6 416 stomachs from 60 species were examined respectively. Diet sampling emphasized small pelagics, elasmobranchs, gadiformes, flatfishes, and lesser known species. Processing of the 2008 bottom trawl survey food habits data is scheduled for completion in 2009.

The NEFSC Cooperative Atlantic States Shark Pupping and Nursery (COASTSPAN) survey continued to investigate known and putative shark nursery areas along the US east coast to describe their species composition, habitat preferences, and determine the relative abundance, distribution and migration of sharks through longline and gillnet sampling and mark-recapture data. A right whale survey was conducted between 16 February and 11 March 2008 aboard the NOAA R/V Delaware II. Cruise objectives included charting right whale (*Eubalaena glacialis*) distribution in the vicinity of Jordan Basin and Cashes Ledge, identifying food resources and oceanographic conditions in these areas, and photographing individual right whales for mark-recapture analyses.

Atlantic salmon populations in eastern Maine have been formally listed as endangered under the United States Endangered Species Act, and a biological review of the remaining Atlantic salmon populations in the State has recently been finalized that recommends expanding the area to larger watersheds. Field research in 2008 focused on obtaining smolt production estimates, marine telemetry, and monitoring of fishery removals on the high seas. Smolt production in various rivers is monitored through the use of in river traps. These trapping programs either generate population estimates via mark-recapture techniques or provide qualitative estimates via index monitoring. Between March 2003 and July 2005, over 140 000 cod were tagged from 106 commercial vessels in the Gulf of Maine, Georges Bank, and Scotian Shelf management areas, with more than 6 500 recaptures recorded by the start of 2008. Between 2003 and 2006, a total of 45 661 yellowtail flounder tags were released from seven commercial vessels in the Gulf of Maine, Georges Bank and Southern New England-Mid Atlantic regions with over 3 700 recaptures by the end of 2008.

The NOAA Fisheries Toolbox (NFT) incorporates a wide range of methods, such as virtual population analysis, reference point estimation, surplus production and forward-projection methods, into a stable environment with tested software products. The NFT is used for many routine assessment tasks. Work on the package continues to incorporate more modules, to test software for reliability, and to make the NFT more user-friendly. No major developments occurred in 2008. The complete package may be accessed at http:/nft.nefsc.noaa.gov (note that a password is no longer required).

d) Stock Assessment Spreadsheets – Update

STACREC discussed the compilation of the stock assessment spreadsheets and concluded that this was an important exercise and the Designated Experts should be encouraged to continue this practice. STACREC further discussed the merits of implementing additional requirements, for example the provision of model information that could facilitate assessment reviews. STACREC suggested it would be more appropriate for Scientific Council to discuss as it could impact on Scientific Council operating procedures.

5. Cooperation with other Organizations

a) Coordinating Working Party on Fishery Statistics (CWP)

The next meeting of CWP is in February 2010 in Hobart, Australia in conjunction with the FIRMS meeting. Scientific Council will be represented by a member of the NAFO Secretariat, who will discuss any relevant agenda items with the STACREC Chair in advance of the meeting.

b) Fisheries Resources Monitoring System (FIRMS)

The next meeting of FIRMS is in February 2010 in Hobart, Australia in conjunction with the CWP meeting. Scientific Council will be represented by a member of the NAFO Secretariat, who will discuss any relevant agenda items with the STACREC Chair in advance of the meeting.

6. Review of SCR and SCS Documents

The following paper was available to the STACREC but was not presented or discussed.

SCR Doc. 09/4. V.V. Paramonov. Comparative length-weight characteristics of beaked redfish *Sebastes mentella* in the different regions of fishing in the opened part of North Atlantic.

One of major fisheries commercial objects of North Atlantic is beaked redfish Sebastes mentella. Author generalized information of the own measurements of sizes and weight of redfish in 2002-2008 in three basic fishing regions in the opened part of ocean: Irminger Sea, Labrador Sea and Norwegian Sea. Conclusions are done about the features of seasonal, interannual and regional changeability of length and weight separately for females and males.

7. Other Matters

a) Tagging Activities

Information on tagging activities in the Northwest Atlantic will be published by the Secretariat in SCS Doc. 09/8. Participants were reminded to submit any information on tagging activities to the Secretariat for the completion of this document.

b) Other Business

i) Consideration of a revisited edition of the Manual of Groundfish Surveys

At the June 2007 meeting it was decided that the "Manual on Groundfish Surveys in the Northwest Atlantic" (Doubleday, 1981) does not reflect the current status of surveys in the NAFO areas and it was decided that it should be revised. A Working Group was struck that is currently chaired by Bill Brodie (Canada). As a first step it was decided to establish a template and fill it in using the Canadian surveys as an example but no progress has been made since 2007. STACREC expressed continued interest in this project and encouraged the Working Group to develop this survey manual.

ii) Oceanic (Pelagic) redfish catch data

The ICES North-Western Working Group (NWWG), in their 2008 report (19.3.3, p. 562), requested that NAFO provide information to ICES that will improve the reliability of the catch estimates. This was recorded by the NAFO Scientific Council in their June 2008 report (Appendix III. 7.d.i, p. 111), where the following was noted in Appendix III (STACREC): "The Scientific Council Coordinator will contact the Scientific Council Chair and the ICES North-Western Working Group regarding the provision of catch data from additional sources, such as provisional letters and the VMS catch-on-entry and catch-on-exit." There was correspondence on the above and appropriate data sharing occurred as necessary.

iii) Sampling of commercial fisheries

STACREC noted that sampling of commercial fisheries has become sporadic for some stocks, creating difficulties in producing representative catch-at-age. Given the importance of commercial sampling to the assessments, STACREC **recommended** that *Contracting Parties make greater efforts to ensure that sampling of commercial fisheries is representative for all stocks, whether taken in directed fisheries or as bycatch.*

iv) Other matters

There were no other additional items.

v) Closing

The Chair thanked the participants for their valuable contributions to the Committee. Special thanks were extended to the rapporteur and to the Scientific Council Coordinator and all other staff of the NAFO Secretariat for their invaluable assistance in preparation and distribution of documents. There being no other business the Chair closed the June 2009 STACREC Meeting.

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

Chair: Michael Kingsley Rapporteurs: Various

I. OPENING

The Committee met at the Alderney Landing, 2 Ochterloney Street, Dartmouth, Nova Scotia, Canada, from 4 to 18 June 2009, to consider and report on matters referred to it by the Scientific Council, particularly those pertaining to the provision of scientific advice on certain fish stocks. Representatives attended from Canada, Denmark (in respect of the Faroe Islands and Greenland), the European Union (France, Germany, Latvia, Lithuania, Portugal, Spain and United Kingdom), Japan, the Russian Federation, and the United States of America. Various members of the Committee, notably the designated stock experts, were significant in the preparation of the report considered by the Committee.

The Chairman, Michael Kingsley (Denmark in respect of the Faroe Islands and Greenland), opened the meeting by welcoming participants. The agenda was reviewed and a plan of work developed for the meeting. The provisional agenda was adopted. STACFIS was informed by Scientific Council about changes in Designated Experts for certain stocks and noted that an assessment expert has still not been designated for Northern shortfin squid in SA 3+4. The Designated Expert for Capelin in Div. 3NO was unable to attend the meeting; submitted documents relating to the stock were reviewed in his absence.

STACFIS noted the request to conduct a full assessment of yellowtail flounder in Div. 3LNO in 2009 (Annex 1.12) and concluded that this implied that the assessment cycles for this stock and for American plaice in Div. 3LNO were to remain synchronized. The next full assessment for yellowtail flounder was therefore expected to be in 2011.

II. GENERAL REVIEW

1. Review of Recommendations in 2006 and 2007

STACFIS agreed that relevant stock-by-stock recommendations from previous years would be reviewed during the presentation of a stock assessment or the tabling of an interim monitoring report as the case may be.

Responses to general recommendations and stock specific recommendations were as follows:

A **recommendation** made by STACFIS for the work of the Scientific Council as **endorsed** by the Council, is as follows: *all Contracting Parties take measures to improve the accuracy of their catch estimates and present them in advance of future June Meetings.*

STATUS: The Chair noted that most catch estimates were available before the meeting and were reviewed by correspondence by an *ad hoc* working group comprising representatives from Canada, EU-Spain, EU-Portugal, and the Russian Federation, and convened by the Chairman of STACFIS. Differences in catch estimates were resolved for all stocks with little difficulty. However, some STATLANT 21A reports were received as late as the middle of the meeting, some were obviously incorrect, and some were not received at all, so that catch data also had to be supplied by Provisional Letters, Research Reports, and other sources. It was noted by STACREC that many STATLANT 21A reports are received after the nominal deadline of 1 May.

STACFIS agreed that for all stocks, survey indices should be subject to quality validation, prior to inclusion into any population model and, accordingly, STACFIS **recommended** in 2006 that *candidate indices for inclusion in population models should be subject to analyses of their ability to indicate trends in population size and that, suggestions for appropriate analyses be presented and evaluated at the June 2007 meeting.*

STATUS: It was reported in 2007 that the stock assessments of Greenland halibut in SA 2 and Divisions 3KLMNO and of American plaice in Divisions 3LNO had both incorporated presentations generated by FLEDA, an exploratory data analysis package within the FLR. In 2008, standardized indices were presented in the assessments of Greenland halibut in SA 2 and Div. 3KLMNO, cod in Div. 3M and of redfish in Div. 3LN. No additions to this set of verified indices were reported in 2009.

Greenland halibut (*Reinhardtius hippoglossoides)* in Div. 1A inshore

It was noted that in 2001 an annual gillnet survey with small-mesh nets was started in the Disko Bay in order to estimate relative year-class strength of pre-recruits to the fishery. STACFIS reiterated its **recommendation** that *the study to calibrate the gillnet surveys, in relation to previous years' longline surveys, should be continued in order to allow use of the whole time series for Greenland halibut in Disko Bay.*

STATUS: the data so far available is inadequate for a satisfactory calibration; more may be acquired.

STACFIS reiterated its **recommendation** that *investigations of bycatch of juvenile Greenland halibut in the commercial shrimp fishery in Subareas 0 & 1 be continued.*

STATUS: no further progress since the study reported in SCR Doc. 07/88.

STACFIS reiterated its **recommendation** that *the discard rate of 'small Greenland halibut' in the Greenland halibut fishery in Div. 1A be investigated.*

STATUS: data on length distributions both in the catch and in the landings exists for some segments of the fishery, so comparative analyses are possible, but there has been no progress since 2008.

Demersal Redfish (*Sebastes* spp.) in SA 1

STACFIS **recommended** that *the species composition and quantity of redfish discarded in the shrimp fishery in Subarea 1 be further investigated.*

STATUS: no further progress since the study reported in SCR Doc. 07/88.

Other Finfish in SA 1

STACFIS **recommended** that *the species composition and quantity of other finfish discarded in the shrimp fishery in Subarea 1 be further investigated.*

STATUS: no further progress since the study reported in SCR Doc. 07/88.

STACFIS **recommended** that *the distribution of these species in relation to the main shrimp-fishing grounds in SA1 be investigated, in order to further discover means of reducing the amount of discarded bycatch.*

Cod (*Gadus morhua*) in Div. 3M

STACFIS **recommended** that *retrospective analyses be performed as a standard diagnostic of the assessment with the Bayesian model.*

STATUS: retrospective analyses were presented as a diagnostic tool for the fit of the model in the 2009 assessment.

Following from the recommendation made last year, STACFIS **recommended** that *efforts be made to increase the levels of commercial sampling for this stock.*

STATUS: In 2008 length sampling of commercial catches was conducted by Portugal, Russia and Estonia, but the Estonian samples were not used in the assessment because they were few. For the assessment presented in 2009, an attempt was made to derive catch numbers at age for 2008 from the commercial length samples, using age-length keys derived from scientific samples taken in the survey executed by EU.

STACFIS noted that the short-term development of this stock will be dependent on recent year-classes and therefore it **recommended** that *the stock be fully assessed in 2009*.

STATUS: a full assessment was presented to and accepted by STACFIS in 2009.

Redfish (*Sebastes mentella* and *Sebastes fasciatus*) in Div. 3M

STACFIS **recommended** that *an update of the Div. 3M redfish bycatch information be compiled on an annual basis, including the estimated weights and numbers of redfish caught annually in the Div. 3M shrimp fishery as well as their size distribution.*

STATUS: No progress reported.

STACFIS **recommended** that *an update of the recent Div. 3M golden redfish fishery information be compiled on an annual and fleet basis, including estimated catch and size distribution of the golden redfish catches.*

STATUS: catch estimates for golden redfish are now available, and length distributions of the golden redfish catch have been presented.

American Plaice (*Hippoglossoides platessoides*) in Div. 3M

Average *F* in recent years has been very low relative to *M*. Therefore in 2006 STACFIS **recommended** that *the utility of the XSA must be re-evaluated and the use of alternative methods (eg. survey-based models stock-production models) be attempted in the next assessment of Div. 3M American plaice.*

Efforts have been made to apply to this stock the survey-based method that was used in previous Div. 3M cod assessments, but so far this task has not yet been completed. At the same time, work was done trying to run an Aspic model, but in order to go further with this more exploratory research of the available data in order to create a CPUE time series must be done.

At this moment the use of other methods than XSA is not expected to change the perception of the Div. 3M American plaice stock due to its very poor condition. Nevertheless STACFIS reiterates this research recommendation.

Because ages below 3 are not well selected in the EU survey series STACFIS also **recommended** that *exploratory runs of the XSA should be done with the input data starting at age 3 or 4.*

STATUS: effects of both these recommendations will be explored in the next full assessment, planned for 2011.

American plaice (*Hippoglossoides platessoides*) in Div. 3LNO

In 2007, STACFIS reiterated its **recommendation** that *investigation be carried on the sensitivity of the estimation of* F_{msy} *to PR, S-R and M.*

STATUS: Values of F_{msy} were estimated for a spectrum of possible partial recruitment functions and stock-recruitment relationships (SCR Doc. 09/36). STACFIS concluded that 0.4 was the best value to use for F_{msy} for this stock.

Yellowtail flounder (*Limanda ferruginea*) in NAFO Div. 3LNO

In 2007, STACFIS **recommended** that *other sources of survey and fishery data for the time period before 1971 be explored to gather information on the state of the stock which could affect the choice of model formulation that best describes the period 1965–1970.*

STATUS: no progress has been reported.

Capelin (*Mallotus villosus*) in Div. 3O

STACFIS reiterates its **recommendation** that *initial investigations to evaluate the status of capelin in Div. 3NO utilize trawl-acoustic surveys to allow comparison with the historical time series*.

STATUS: this recommendation has not been acted on.

STACFIS **recommended** that *for Capelin in Div. 3NO investigations be undertaken to incorporate survey sets which do not contain Capelin, including analyses of Capelin distribution.*

STATUS: this recommendation has not been acted on.

Redfish (*Sebastes mentella* and *Sebastes fasciatus*) in Div. 3O

In 2007, STACFIS **recommended** that *additional work be undertaken to explore the application of surplus production models to this stock.*

STATUS: No progress to date: this recommendation may be acted on as a part of the next full assessment of the stock, planned for 2010.

Thorny Skate (*Amblyraja radiata*) in Div. 3LNOPs

STACFIS **recommended** that *further testing of quantitative models be conducted on this stock.*

STATUS: no progress was reported on this recommendation.

STACFIS reiterates its **recommendation** that *further work be conducted for the estimation of reference points.*

STATUS: further work and simulation are presently in progress.

White hake (*Urophycis tenuis*) in Div. 3NOPs

In previous years, STACFIS has repeatedly **recommended** that *the genetic analyses in 2003 of Div. 3NO versus Subdiv. 3Ps samples be continued in order to help determine whether Div. 3NOPs white hakes comprise a single breeding population.*

STATUS: Work on genetic analysis and stock identification is continuing, but results are not yet available.

In previous years, STACFIS has repeatedly **recommended** that *age determination should be conducted on otolith samples collected during annual Canadian surveys (1972-2005 and later); thereby allowing age-based analyses of this population.*

STATUS: White hake otoliths continue to be collected but have not been read.

Roughhead grenadier (*Macrourus berglax*) in SA 2+3

In 2007, STACFIS made a **recommendation** to *explore the XSA model configuration of the analytical assessment presented (definition of the plus group, catchability model and the shrinkage options), as well as the incorporation of new survey information into the model.*

STATUS: an investigation of configurations of the XSA model was reported in SCR Doc. 09/21 and discussed by STACFIS. Results suggest establishing the plus group at 17+ and defining the F_{bar} age range as 6-13 years. More analysis in the catchability model and the shrinkage options will be made when new survey data has been incorporated.

Greenland halibut (*Reinhardtius hippoglossoides*) in SA 2 + Div. 3KLMNO

STACFIS **recommended** that *research continue on age determination for Greenland halibut in Subarea 2 and Div. 3KLMNO to improve accuracy and precision.*

STATUS: Research on this topic is continuing.

Previous survey experiments have noted that the depth distribution of Greenland halibut extends beyond 1 500 m, the maximum depth of the survey information currently available to assess this stock. In addition, fisheries for Greenland halibut have at times fished at depths beyond 1 500 m. Therefore, STACFIS **recommended** that *exploratory deep-water surveys for Greenland halibut in Subarea 2 and Divisions 3KLMNO be conducted using gears other than bottom trawls to complement existing survey data.*

STATUS: No progress was reported on this recommendation.

2. General Review of Catches and Fishing Activity

As in previous years STACFIS conducted a general review of catches in the NAFO SA 0–4 in 2008. In order to confirm estimates of catches for the various stocks, various other sources of information were considered along with reported catches available to 8 June 2009 as compiled from STATLANT 21 reports.

STACFIS agreed to continue documenting the tabulation of preliminary catch data from STATLANT 21 reports and the best estimate of catches as agreed by STACFIS. A series of these tabulations from 2000–2008 will be found in the introductory catch table within the report for each stock. A summary for 2008 is as follows:

Stocks	21A	STACFIS
STOCKS OFF GREENLAND AND IN DAVIS STRAIT		
Greenland halibut in SA 0, Div. 1A offshore. & Div. 1B–F	14 713	21 699
Greenland halibut in Div. 1A inshore.		19 723
Roundnose grenadier in SA 0+1	1	5
Demersal redfish in SA 1	10	38
Redfish in Div. 1F (pelagic)	2 229	2 229
Other finfish in SA 1	13[1]	1165
STOCKS ON THE FLEMISH CAP		
Cod in Div. 3M	398	889
Redfish in Div. 3M	6 672	8 466
American plaice in Div. 3M	57	68
STOCKS ON THE GRAND BANKS		
Cod in Div. 3NO	647	921
Redfish in Div. 3LN	403	597
American plaice in Div. 3LNO	1 863	2 515
Yellowtail flounder in Div. 3LNO	11 303	11 403
Witch flounder in Div. 3NO	230	264
Capelin in Div. 3NO	0	0
Redfish in Div. 3O	3 689	4 020
Thorny skate in Div. 3LNOPs (Div. 3LNO portion)	5 527	7 407
White hake in Div. 3NOPs (Div. 3NO portion)	879	882
WIDELY DISTRIBUTED STOCKS		
Roughhead grenadier in SA 2+3	414	847
Witch flounder in Div. 2J+3KL	81	83
Greenland halibut in SA 2 & Div. 3K–O	14 783	21 178
Short-finned squid in SA 3+4	2 671	2 671

STACFIS noted that an *ad hoc* working group had deliberated on catch estimates before the meeting, thereby enabling finfish catch estimates by stock, Division and Contracting Party to be available soon after the meeting commenced. In order to expedite the work of the Scientific Council, STACFIS **recommended** that *all Contracting Parties take measures to improve the accuracy of their catch estimates and present them as far in advance of future June Meeting as possible.*

III. STOCK ASSESSMENTS

A. STOCKS OFF GREENLAND AND IN DAVIS STRAIT: SA0 AND SA1

Environmental Overview

Hydrographic conditions in this region depend on a balance of atmospheric forcing, advection and ice melt. Winter heat loss to the atmosphere in the central Labrador Sea is offset by warm water carried northward by the offshore branch of the West Greenland Current. The excess salt accompanying the warm inflows is balanced by exchanges with cold, fresh polar waters carried south by the east Baffin Island Current. Within the 1 500 m depth range over much of the Labrador Sea temperatures have become steadily higher and salinity also higher over the past number of years compared with the early 1990s. The low temperature and salinity values in the inshore region of southwest Greenland reflect the inflow of Polar Water carried by the East Greenland Current. Water of Atlantic origin with temperatures >3^{o}C and salinities >34.5 is normally found at the surface offshore off the shelf break in this area. Historical data from the Fyllas Bank revealed cold "polar events" in 1983, 1992 and 2002. During these years, cold and diluted waters from the West Greenland banks reached well out to the slope regions of Fyllas Bank in the upper water column.

At intermediate depths pure Irminger Water (T ≥4.5^{o}C; S ≥34.95) was traced north to the Paamiut section. Modified Irminger Water (T ≥3.5^{o}C ; 34.88 ≤S <34.95) was observed all the way north to Sisimiut section. The northward extension of Irminger Water may indicate intensified inflow of water of Atlantic origin to the West Greenland area. The temperature of the Irminger Water was in general higher than normal but not as pronounced as in 2007. As the Irminger Water is not in direct contact with the atmosphere in West Greenland waters, local heat gain is not a likely explanation, instead elevated temperatures may be linked to the recent maximum of heat in the North Atlantic currents feeding the Irminger current in addition to slightly warmer air temperatures than normal over the North Atlantic.

The average salinity and temperature at 400-600 m depth west off Fyllas Bank amount to 4.31°C which is only 0.15°C higher than normal, and the average salinity of 34.84 was above normal by 0.03. Temperatures and salinities above normal may indicate that the presence of Irminger Water was higher than normal.

The presence of Polar Water was also above normal in 2008. The extension of multi-year-ice (“Storis”) encountered during the survey was above normal. At Fyllas Bank, the trend of the water temperature data during recent years points at another “polar event” off Fyllas Bank. Thermohaline conditions in the near-surface layer reveal cold diluted water masses stretching from the coast to the offshore parts of the section.

The central Labrador Sea saw the coldest winter (January–March) surface air temperatures in 16 years. Cooling and densification of the upper levels of the west-central Labrador Sea during the 2008 winter produced winter mixed layers extending to 1 350-1 600 m depths. Decreases in average temperature and salinity compared to 2007 were observed in the 200-1 600 m layer in the central Labrador Sea. This interrupted a recent warming trend at intermediate depth levels and rolled temperature and salinity properties back to those observed 2–3 years previously, but conditions remain generally warm and saline. The rest of the year saw above-normal surface air and sea temperatures in the central Labrador Sea. Summer (July–September) surface air temperatures were the third warmest in the 61-year period. Annual average surface air temperatures were the coolest since 2000 but still remained above normal. Near-record-high sea surface temperatures in spring and summer 2008 led to the 5th warmest annual average in the 1960-2008 period.

1. Greenland halibut (*Reinhardtius hippoglossoides*) in SA 0, Div. 1A offshore and Div. 1B-F

(SCR Doc. 09/13, 16, 20, 25, 26, 30; SCS Doc. 09/11, 12, 13, 17)

a) Introduction

During the period 1982-1989 nominal catches of Greenland halibut in SA 0 and Div. 1A offshore + Div.1B-F fluctuated between 300 and 4 500 t. Catches increased from 3 000 t in 1989 to 10 500 t in 1990. Catches remained at that level in 1991 but increased again in 1992 to 18 500. During 1993-2000 catches have fluctuated between 8 200 and 11 200 t. Catches increased to 13 800 t in 2001 and increased further to 19 700 t in 2005. In 2006 catches increased to 24 200 t, remained at that level in 2007 but decreased slightly to 22 400 t in 2008 (Fig. 1.1).

In SA 0 catches peaked in 1992 at 12 800 t, declined to 4 700 t in 1994 and remained at that level until 1999. Catches increase to 5 400 t in 2000 and further increased to 8 100 t in 2001, primarily due to an increase in effort in Div. 0A. Catches remained at that level in 2002 but increased again in 2003 to 9 200 t and remained at that level in 2004-2005. Catches increased to 12 200 t in 2006 due to increased effort in Div. 0A. Catches decreased slightly to 11 500 t in 2007 and further to 10 800 t in 2008.

Catches in Div. 0A increased gradually from a level around 300 t in the late 1990s and 2000 to 4 100 t in 2003, declined to 3 800 t in 2004 but was back at the 2003 level in 2005. In 2006 catches increased to 6 600 t, due to increased effort. Catches decreased slightly in 2007 to 6 200 t and further to 5 100 t in 2008.

Catches in Div. 1A offshore and Div. 1B-F fluctuated between 1 000 and 2 500 t during the period 1987-1991. Then catches fluctuated between 3 900 and 5 900 t until 2001. Catches increased gradually from 5 700 t in 2001 to 9 500 in 2003, primarily due to increased effort in Div. 1A. Catches remained at that level in 2004 and 2005. In 2006 catches increased to 12 000 due to increased effort in Div. 1A. Catches were at the same level in 2007 and 2008, - 11 600 t.

Prior to 2001 catches offshore in Div. 1A and in Div. 1B were low but they increased gradually from 110 t in 2000 to 4 000 t in 2003 and remained at that level in 2004-2005. Catches in that area increased further in 2006 to 6 200 t. Catches were at the same level in 2007 and 2008.

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

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Recommended TAC	11	15[1]	15[1]	19[2]	19[2]	19[2]	24[3]	24[3]	24[3]	24[3]
TAC	11	15[1]	15[1]	19[2]	19[2]	19[2]	24[3]	24[3]	24[3]	24[3]
SA 0	5	8	7	9	10	10	12	11	11	
SA1 exl. Div. 1A inshore	6	6	7	10	10	10	12	12	12	
Total STATLANT 21A	8	13	16[5]	20[6]	19	22[7]	24[8]	16	15	
Total STACFIS	11	14	15	19	19	20	24	23	22	

[1] Including a TAC of 4 000 t allocated specifically to Div. 0A and 1A.
[2] Including a TAC of 8 000 t allocated specifically to Div. 0A and 1AB.
[3] Including a TAC of 13 000 t allocated specifically to Div. 0A and 1AB
[4] Including 7 603 t reported by error from SA 1.
[5] Including 780 t reported by error from Div. 0A.
[6] Including 1 366 t reported by error from Div. 1A.
[7] Excluding approximately 2 000 t reported by error from Div. 1D.
[8] Excluding approximately 3 300 t reported by error from Div. 1D.

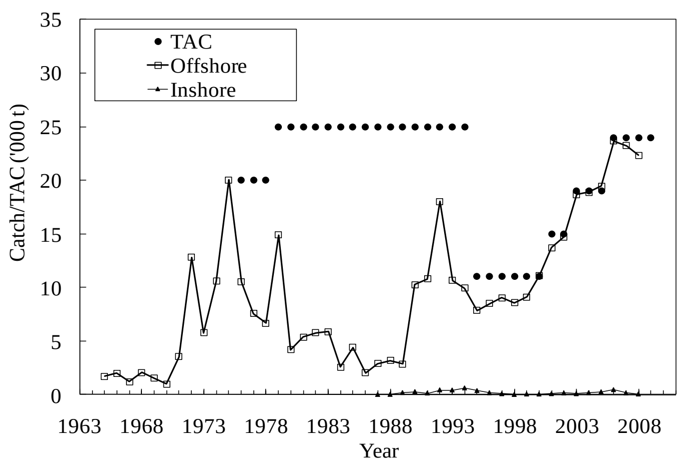

Fig. 1.1. Greenland halibut in SA 0+1 (excluding Div. 1A inshore): catches and TACs.

The fishery in SA 0. Before 1984, USSR and GDR conducted trawl fisheries in the offshore part of Div. 0B. In the late 1980s catches were low and mainly taken by the Faroe Islands and Norway. In the beginning of the 1990s catches taken by these two countries increased and Canada, Russia and Japan entered the fishery. In 1995 a Canadian gillnet fishery began. Since 1998 the fishery in Div. 0B has been executed almost exclusively by Canadian vessels. In 2008, 1 150 t were taken by gillnet and 4 628 t by trawl.

Besides Canadian trawlers, a number of different countries participated in the trawler fishery in Div. 0A from 2001 to 2003 through charter arrangements with Canada. Since then all catches have been taken by Canadian vessels. In 2008, trawlers caught 2 970 t and 2 124 t were taken by gillnetters. The longline fishery in the area, which took about ⅓ of the catches in 2003, has apparently ceased.

The fishery in Div. 1A offshore + Div. 1B-F. Traditionally the fishery in SA 1 has taken place in Div. 1D and to a minor extent Div. 1C. Catches have mainly been taken by trawlers from Japan, Greenland, Norway, Russia, Faroe Islands and EU (mainly Germany). These countries, except Japan, were also engaged in the fishery in the area in 2008. A gillnet fishery was started by Greenland in 2000 but the catches only amounted to 87 t in 2004 and there has not been any gill net fishery in the area since then. An offshore longline fishery in Div. 1CD took place during 1994-2002. Since then longline fishery has only taken place irregularly and with small catches, about 20 t in the recent three years. Inshore catches in Div. 1B-F amounted to 51 t, which were mainly taken by gillnets.

Throughout the years there have been a certain amount of research fishing offshore in Div. 1A but the catches have always been less than 200 t per year. Catches increased gradually from about 100 t in 2000 to about 6 200 t in 2006-2008. All catches in recent years were taken by trawlers from Greenland, Russia and Faroe Islands.

b) Input Data

i) Commercial fishery data

Information on length distribution was available from gill net and trawl fishery in Div. 0AB. The bulk of the catches in the gillnet fishery in Div. 0AB were between 50 and 80 cm with a mode around 63 in Div. 0A and 65 cm in Div. 0B. The modes in the gillnet fishery have been in this range in recent years. The length distributions in the trawl fishery showed a mode of 48-50 cm which resembled the length frequency seen in previous years.

Information on length distribution of catches was available from trawlers from Russia and Greenland fishing in Div. 1A, from Greenland, EU-German, Russian and Norwegian trawlers fishing in Div. 1D.

The length distribution in the Russian and Greenland fishery in Div. 1A showed modes at 50 cm and 44-46 cm, respectively. In Div. 1CD the mode was around 49-50 cm in the fishery by all countries. The mode in the trawl fishery in Div. 1D has been at 47-51 cm in the last decade.

Age distributions were available from the Russian fishery in Div. 1A and 1D. Age 5-7 dominated the Russian trawl catches in Div.1A and ages 8-9 in Div. 1D, respectively.

Unstandardized catch rates from Div. 0A have generally increased between 2000 and 2004, decreased between 2004 and 2005 but increased again in 2006 for both single- and twin trawl, and catch rates were among the highest in the time series, which dates back to 1996 and 2000 for single and twin trawl, respectively. Catch rates declined in 2007 but increased again in 2008 to the highest level seen in the times series. The standardized catch rate also showed a minor increase between 2007 and 2008 but has generally been stable since 2002.

Unstandardized catch rates in Div. 1A from single trawlers <2000 Gross tons have been relatively stable since 2004. Catch rates for single trawlers >2000 GT have been increasing since 2001 and peaked in 2006 with catches slightly above 1.1 t/hr. Twin trawl catch rates peaked in 2005 also with a catch rate slightly above 1.1 t/hr. Since then catch rates have declined to slightly above 0.9 t/hr in 2008. Standardized catch rates increased from 2002 to 2006 but have declined in the last two years and the catch rates are in 2008 back at the 2004 level.

The combined Div. 0A+1AB standardized CPUE series before 2001 is based on catches <300 t from research fisheries. Since 2002 standardized catch rates have been stable (Fig. 1.2).

The unstandardized CPUE series for single trawlers from Div. 0B, decreased in 2006 and 2007 but increased in 2008 to a level similar to that seen in 2006 and during 1995-2002. Catch rates for twin trawlers were stable during 2005-2007 but increased to a record high level in 2008. The standardized index decreased gradually from 1995 to 2002, but increased again until 2005. Catch rates have declined slightly during 2006 and 2007, but increased in 2008 to the highest level seen in the time series which dates back to 1990.

The unstandardized CPUE series for all fleets (grouped by Gross Tonnage, not by country as in previous years) fishing in Div. 1CD has shown an increasing trend since 1999 and catch rates also increased between 2007 and 2008 and are now among the highest seen in the time series. Standardized catch rates in Div. 1CD declined gradually from 1989-1996, increased between 1997 and 2000 but declined slightly again until 2002. Since then standardized catch rates have increased gradually and in 2008 were the highest seen since 1989.

The combined Div. 0B+1CD standardized CPUE series has been stable in the period 1990-2001, declined somewhat in 2002, remained at that level in 2003 and 2004. Since then standardized catch rates have increased gradually and in 2008 were at the highest level seen since 1989. Catch rates in 1988 and 1989 are from one 4000 GT vessel fishing alone in the area (Fig. 1.2).

It is not known how the technical development of fishing gear, etc. has influenced the catch rates. There are indications that the coding of gear type in the log books is not always reliable, which also can influence the estimation of the catch rates. Further, due to the frequency of fleet changes in the fishery in both SA0 and SA1 and change in fishing grounds in Div. 0A and 1A, both the unstandardized and the standardized indices of CPUE should be interpreted with caution.

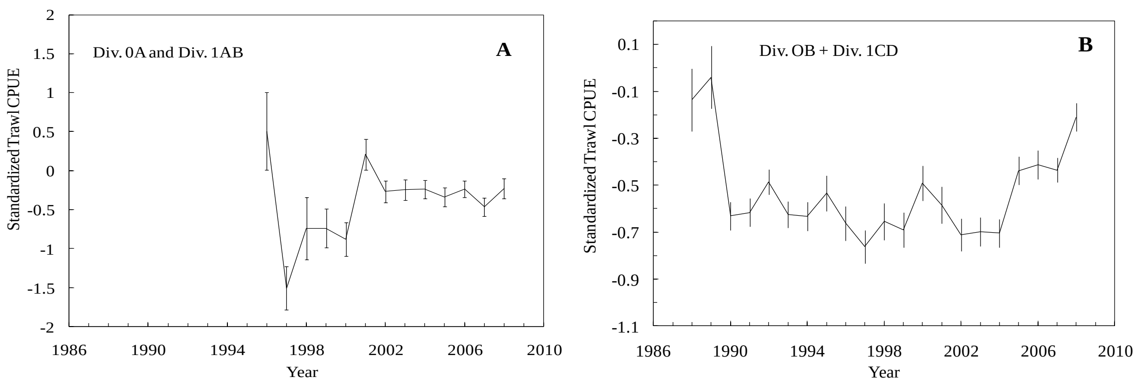

Fig. 1.2. Greenland halibut in SA 0+1 (excluding Div. 1A inshore): **A**: Combined standardized trawler CPUE from Div. 0A and Div. 1AB with ± S.E. **B**: Combined standardized trawler CPUE from Div. 0B and Div. 1CD.

ii) Research survey data

Japan-Greenland and Greenland Deep-sea surveys. During the period 1987-1995 bottom trawl surveys were conducted in SA 1 jointly by Japan and Greenland (the survey area was re-stratified and the biomass estimates were recalculated in 1997). In 1997 Greenland initiated a new survey series covering Div. 1CD. The survey is conducted as a stratified-random bottom trawl survey covering depths between 400 and 1 500 m. The trawlable biomass in Div. 1CD has shown an increasing trend since 1997 and the biomass was estimated to be 83 000 t in 2008 which is an increase compared to 2007, and the highest in the time series (Fig. 1.3). The abundance increased between 1997 and 2001 and has been stable since 2002.

Canadian deep sea survey in Baffin Bay (Div. 0A). Canada has conducted surveys in the southern part of Div. 0A in 1999, 2001, 2004 and 2006. The biomass has increased gradually from 68 700 t via 81 000 t to 86 200 t in 2004. The biomass decreased to 52 271 t in 2006 (Fig. 1.3). However, the survey coverage was not complete and two of the four strata missed fell within the depths 1001-1500 m and accounted for 11 000-13 000 t of biomass in previous surveys. Biomass was in 2008 estimated to be 77 182 t. Mean biomass per tow was 1.67 t/ km^2, higher than in 2006 and 1999 but lower than was observed in 2001 and 2004. The overall length distribution ranged from 6 cm to 99 cm with a relatively flat top on the distribution (the mode stretched between 33 cm and 39 cm) and is most similar to that seen in 2006 and 1999.

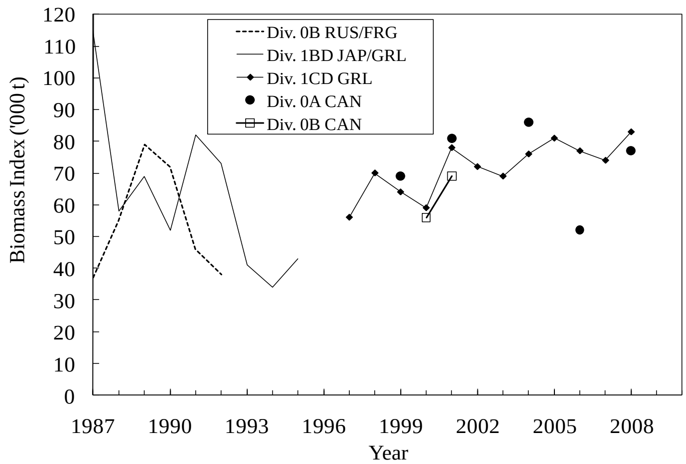

Fig. 1.3. Greenland halibut in SA 0+1 (excluding Div. 1A inshore): biomass estimates from bottom trawl surveys. Note, incomplete coverage of the 2006 survey in Div. 0A.

Greenland shrimp survey. Since 1988 annual surveys have been conducted with a shrimp trawl off West Greenland between 59°N and 72°30'N from the 3-mile boundary to the 600 m depth contour line. The biomass in the offshore area has been stable at a relatively high level in recent years and the estimate for 2004 (31 100 t) was the highest in the time series. The biomass decreased gradually to 19 000 t in 2007, but increased again in 2008 to 21 000 t which is above the average for the time series (17 000 t). The survey gear was changed in 2005, but the 2005-2008 figures are adjusted for that. The biomass and abundance estimates were recalculated in 2004 based on better depth information and new strata areas.

The number of one-year-old fish in the total survey area including Disko Bay increased gradually from 1996 to a peak of 500 million in the 2001 survey. The number of one-year-olds declined in 2002, increased in 2003 to 319 million and has stayed at that level until 2007, but declined to 251 million in 2008. The reduction in recruitment in the total survey area was caused by a reduction in recruitment in the inshore Disko Bay. (Fig.1.4). The figures were recalculated in 2007, based on the new strata, but it did not change the over all trends in the recruitment.

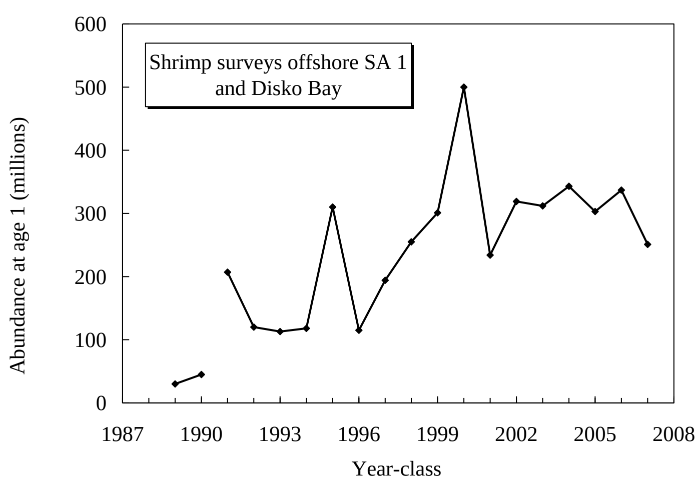

Fig. 1.4. Greenland halibut in SA 0+1: recruitment index at age 1 in SA 1 derived from the Greenland shrimp trawl surveys. Note that the survey coverage was not complete in 1990 and 1991 (the 1989 and 1990 year-classes are poorly estimated as age 1).

A recruitment index (number caught per hour of age 1) for the traditional offshore nursery area in Div. 1AS-1B has declined since the relatively large 1991 year-class, but the recruitment has been above the level in the 1980s. The recruitment increased again with the 1995-year-class, which was the largest on record. The 1996 year-class seemed to be small but the recruitment has increased gradually until the 2000 year-class. Since then the recruitment has been around or a little above average. The recruitment of the 2007 year-class was estimated as 412 age-1 caught per hour, somewhat below the average for the time series (559). However, this is likely an underestimate because in 2008 the abundance doubled in Div. 1AN, and about half the abundance in the off shore area was found there. The abundance is mainly composed of 1 year old fish and these fish are not included in the recruitment index that only includes the traditional nursery area (1AS-1B).

c) Estimation of Parameters

An Extended Survivors Analysis (XSA) stock assessment model fitted to the stock data from SA 0+1 was presented in 2003. The analysis was considered to be provisional due to problems with the catch-at-age data and the short time series, but the outcome was considered to reflect the dynamics of the stock. The XSA has not been updated in recent years due to lack of catch-at-age data.

A Greenland halibut age determination workshop concluded that the current production methods underage old fish. About one third of the catches in SA 0 come from gill net that generally catches larger and older fish. Therefore, no ages will be determined for SA 0 until we have a method that is reliable for catches from both trawl and gillnet.

In connection to a tagging experiment conducted in the southern part of Baffin Bay in 2007 about 3 500 Greenland halibut had $SrCl_2$ injected in the stomach cavity. $SrCl_2$ is incorporated in the otoliths as a mark visible using scanning electron microscopy and it should be possible to investigate growth of otoliths and relate this to growth of the fish. Different staining methods are also being tested in order to improve age reading of older Greenland halibut.

An update of the unsuccessful ASPIC from 1999 was attempted again in 2009, but results were not tabled as the outcome of the analysis did not improve significantly. The ASPIC fails primarily because of lack of contrast in the input data.

d) Assessment Results

Div. 0A+1A offshore + Div. 1B

The southern part of Div. 0A was surveyed in 1999, 2001, 2004, 2006 and 2008 and the southern part of Div. 1A and Div. 1B was surveyed in 2001. The biomass increased gradually from 68 700 t via 81 000 t to 86 200 t in 2004. The biomass decreased to 52 271 t in 2006. However, the survey coverage was not complete and two of the four strata missed fell within the depths 1 001-1 500 m and accounted for 11 000-13 000 t of biomass in previous surveys. In 2008 the biomass was estimated 77 182 t. In 2004 Canada and Greenland conducted surveys in the northern part of Baffin Bay (Div. 0A+1A), that had not been previously surveyed. The trawlable biomass was estimated to be 46 000 t and 54 000 t, respectively, in the two areas. These surveys in the northern part of Baffin Bay have not been repeated since then. Further, the Greenland Shrimp Survey has covered, among others, Div. 1B and part of Div. 1A (to 72°30'N) annually since 1992. The biomass, which is mainly found in Div. 1AB, estimated in the Greenland Shrimp Survey has been decreasing gradually between 2004 and 2007 but increased again in 2008 to 21 000 t which is above the average for the time series (17 000 t).

The length distribution in the trawl fishery in Div. 0A has been stable during 2002-2008 (no data from 2007) with a mode around 48-50. The mode in the gill net fisheries has been around 63 cm in recent years. The length distribution in the trawl fishery in Div. 1A has been stable during 2002-2008, with a mode around 48-54 cm except in 2006 where the mode in the Russian fishery was 42 cm and in 2008 where the mode was around 44-46 cm in the Greenland fishery.

A standardized catch rate for Div. 0A has been stable since 2002.

A standardized catch rate for Div.1A showed a gradual increase from 2002 to 2006 but has decreased in 2007 and 2008 and is now at the 2004 level.

The combined catch rates from Div. 0A and Div. 1AB have been stable since 2002.

Div. 0B + 1C-F

The bottom trawl survey biomass index in Div. 1CD has shown an increasing trend since 1997 and the biomass was estimated to be 83 000 t in 2008 which is an increase compared to 2007, and the highest in the time series (Fig. 1.3). The abundance increased between 1997 and 2001 and has been stable since 2002.

Although the survey series from 1987-1995 is not directly comparable with the series from 1997-2008, the SA 1 stock seems to be back at a level observed in the late 1980s and early 1990s.

The modal length in the 2008 trawl and gillnet fishery catches from Div. 0B was at 48-50 cm and 65 cm in length, respectively, and resembled the length frequency seen in previous years. For all countries fishing in Div. 1CD the mode was around 49-50 cm in 2008. The mode in the trawl fishery in Div. 1D has been at 47-51 cm in the last decade.

A standardized CPUE index from Div. 0B decreased gradually from 1995 to 2002, but increased again until 2005. The catch rates have declined slightly during 2006 and 2007, but increased in 2008 to the highest level seen in the time series which dates back to 1990. The standardized catch rates in Div. 1CD declined gradually from 1989-1996, increased between 1997 and 2000 but declined slightly again until 2002. Since then standardized catch rates have increased gradually and in 2008 were the highest seen since 1989.

The combined Div. 0B+1CD standardized CPUE series has been stable in the period 1990-2001, declined somewhat in 2002 and remained at that level in 2003 and 2004. Since then the standardized catch rates have increased gradually and in 2008 were at the highest level seen since 1989.

The present TAC for Div. 0B + Div. 1C-F is 11 000 t. Since 1992, catches have been around 5 500 t in Div. 1CD and catches reached that level in Div. 0B in 2000. Survey results show that the distribution of biomass between Div. 0B and Div. 1CD is about 50:50. A relative Fishing mortality (catch/survey biomass) estimated for Div. 1CD can therefore be used as a proxy for Fishing mortality for the whole of Div. 0B + Div. 1C-F, there being very little biomass or fishery in Div. 1EF.

The mean relative fishing mortality in relation to 2008 (F_r) in Div. 1CD for 1992-2007 was 1.34 (STD 0.42, min 1.01, max 2.67). F_r was in 2008 the lowest seen since 1991. An increase in TAC of 10%, 25% and 50%, respectively will lead to an increase in F_r to 1.13, 1.28 and 1.54, respectively, under the assumption that the biomass is evenly distributed between Div. 0B and Div. 1CD and that the biomass remains at the same level as in 2008 and the higher TAC is completely taken.

F_r with different TAC and F_r in percent of the mean of F_r 1992-2007 (1.34) in Div. 1CD.

	TAC	F_r	F_r (% of long-term mean of 1.34)
Current	11 000	1	74.6%
10%	12 100	1.13	84.4%
25%	13 750	1.28	95.9%
50%	16 500	1.54	115.0%

SA 0 + Div. 1A offshore + Div. 1B-F

Assessment: No analytical assessment could be performed.

Commercial CPUE indices. Combined standardized catch rates in Div. 0A and Div. 1AB have been stable since 2002. The combined Div. 0B and 1CD standardized catch rates have been stable in the period 1990-2001, declined somewhat in 2002 remained at that level in 2003 and 2004. Since then the standardized catch rates have increased gradually and were in 2008 at the highest level seen since 1989.

Biomass: The biomass in Div. 0A was in 2008 estimated at 77 000 t which is at the level seen in the previous four surveys conducted since 1999. The biomass in Div. 1CD increased gradually since 1997 and was estimated at 83 000 t which is the highest in the twelve year time series. The biomass in the shrimp survey, which is almost exclusively found in Div. 1AB, has decreased during 2004-2007 but increased slightly in 2008 and is above the average of the time series (1991-2008).

Recruitment: Recruitment of the 2000 year-class at age 1 in the entire area covered by the Greenland shrimp survey was the largest in the time series, while the 2002-2006 year-classes were well above average. The recruitment of the 2007 year-class in the offshore nursery area (Div. 1A (South of 70°N) - Div. 1B) was below average.

Fishing Mortality: Level not known. Relative *F* (Catch/Biomass) in Div. 1CD was in 2008 at the lowest seen since 1991.

e) Precautionary Reference Points

Age-based or production models were not available for estimation of precautionary reference points. CPUE and survey series were short, showed little variation and covered too little of the assessment area to be used for estimation of reference points.

f) Research Recommendation

STACFIS **recommended** that *catch rates in the gill net fisheries in Div. 0A and 0B should be made available before the assessment in 2010.*

2. Greenland halibut (*Reinhardtius hippoglossoides*) Div. 1A inshore

Interim Monitoring Report (SCR Doc. 09/20, SCS Doc. 09/17)

a) Introduction

The inshore fishery for Greenland halibut in NAFO Div. 1A is concentrated in Disko Bay, and around Uummannaq and Upernavik. There is little migration between the areas. The stocks do not contribute to the spawning in Davis Strait, and no significant spawning has been observed in the areas, hence the stocks are dependent on recruitment from offshore spawning areas.

Total landings in the three areas have fluctuated around 20 000 t. In 2001 landings decreased to 17 000 t but have since then increased again to 23 000 t in 2004-2006. The increases in landings were mainly seen in Disko Bay, where yearly landings have increased from around 7 000 t in 2001 to around 12 000 t in 2002. Landings stayed at that level until 2006, but gradually decreased to 8 800 t in 2008.

Recent landings and advice ('000 t) are as follows:

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Disko Bay	7.6	7.1	11.7	11.6	12.9	12.5	12.1	10.4	8.8	
Recomm TAC		7.9	7.9	7.9	na	ni	ni	ni	ni	8.8
TAC									12.5	8.8
Uummannaq	7.6	6.6	5.4	5.0	5.2	4.9	6.0	5.3	5.4	
Recomm TAC		6.0	6.0	6.0	na	5.0	5.0	5.0	5.0	5.0
TAC									5.0	5.0
Upernavik	3.8	3.2	3.0	3.9	4.6	4.8	5.1	4.9	5.5	
Recomm TAC		4.3	4.3	4.3	na	na	na	na	na	na
TAC									5.0	5.0
Unknown[1]	-	2.2				0.8			0.3	
STATLANT 21A	21.0	16.5	17.6	20.6	25.2	21.6	24.2			
STACFIS	20.0	16.9	20.1	20.5	22.7	22.9	23.2	20.6	20.0	

na no advice.
ni no increase in effort.
[1] Landings from unknown areas within Div. 1A.

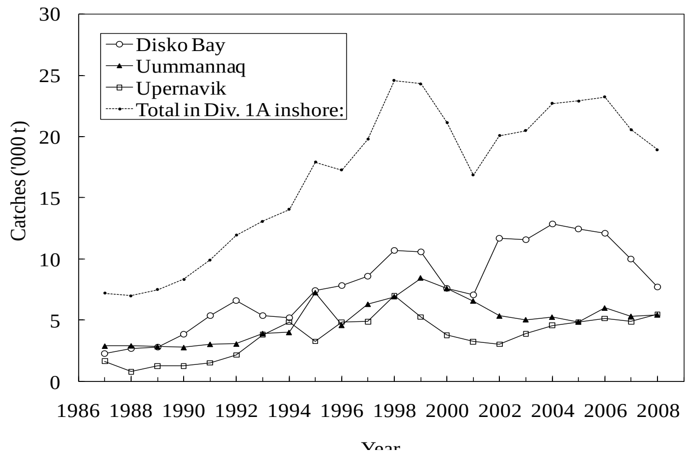

Fig. 2.1. Greenland halibut in Div. 1A inshore: Total landings and landings distributed on the three main fishing areas.

b) Data Overview

Research survey data

An inshore Greenland halibut longline survey has been conducted since 1993 in Disko Bay and Uummannaq, and a gillnet survey in Disko Bay has been conducted since 2001. No surveys have been conducted in Upernavik since 2001. Since 1991 the Greenland survey for shrimp has also included the Disko Bay. This survey also estimates the biomass and abundance of, mainly, juvenile (1- 3 years old) Greenland halibut.

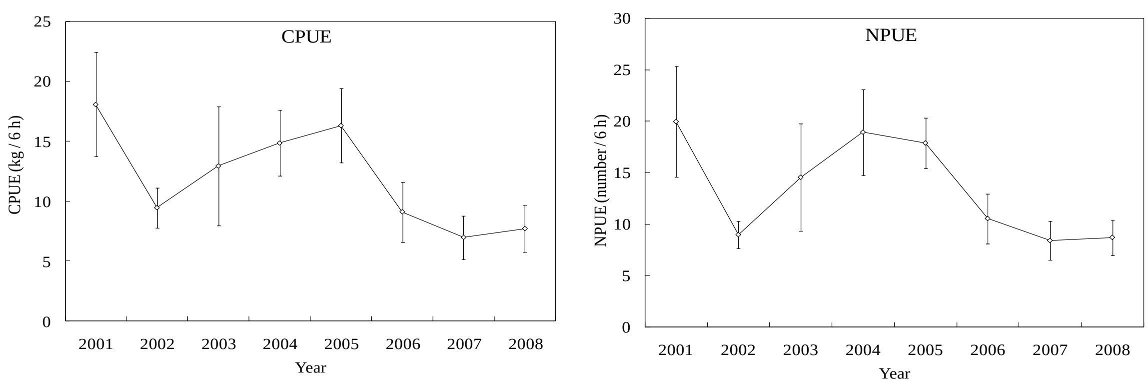

Fig 2.2. Greenland halibut in Div. 1A inshore: CPUE/NPUE for gillnet survey in Disko Bay 95% CI indicated.

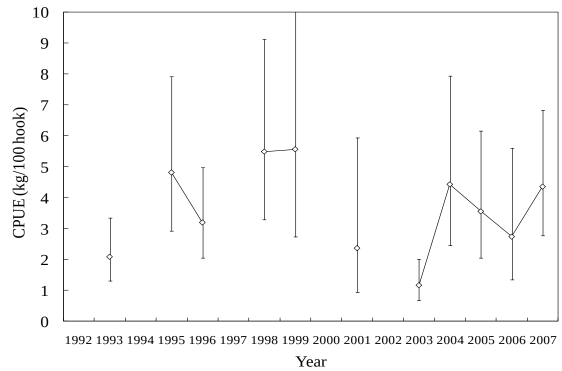

Fig 2.3. Greenland halibut in Div. 1A inshore: Longline survey index (CPUE) for Uummannaq 1993-2007 95% CI indicated

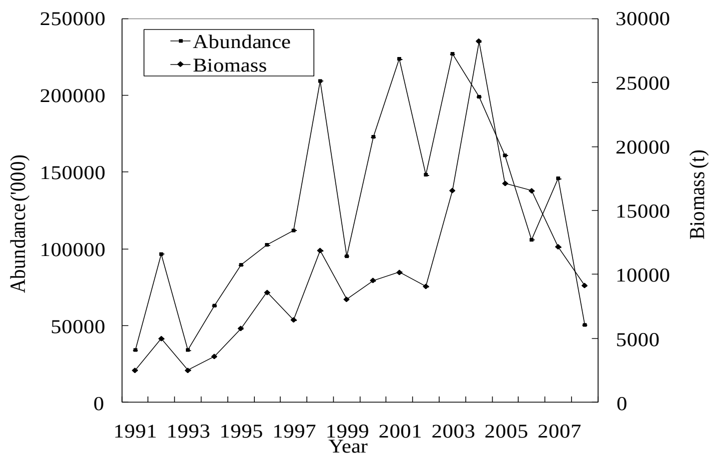

Fig 2.4 Greenland halibut in Div. 1A inshore: Abundance ('000) and Biomass (t) indices of Greenland halibut from the Greenland trawl survey in Disko Bay

c) Conclusion

Landings in Uummannaq and Upernavik are at the same level as previous years, while landings in Disko Bay have decreased around 25% compared to 2002-2006. In Disko Bay biomass and abundance indices from the gillnet survey have declined from 2005 to 2006 and have remained low in 2007-2008. The trawl abundance and biomass indices have also declined. It is not possible to evaluate the current status in Uummannaq and Upernavik due to lack of survey data.

STACFIS was unable to conclude that there is a significant change in status of any of these stocks since the most recent full assessment in 2008.

The next full assessment is planned for 2010.

3. Roundnose grenadier (*Coryphaenoides rupestris*) in SA 0+1

Interim Monitoring Report (SCR Doc. 09/16; SCS Doc. 09/11, 12, 17)

a) Introduction

There has been no directed fishery for roundnose grenadier in SA 0+1 since 1978. Roundnose grenadier is taken as bycatch in the Greenland halibut fishery. A total catch of <5 t was estimated for 2008 compared to 30 t for 2007.

Catches of roundnose grenadier have been reported from inshore areas and Div. 1A where roundnose grenadier is known not to occur. These catches must be roughhead grenadier and are therefore excluded from totals for roundnose grenadier, but it is also likely that catches from the offshore areas south of Div. 0A-1A reported as roundnose grenadier may include roughhead grenadier.

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

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Agreed TAC	3.4	3.4	4.2	4.2	4.2	4.2	4.2			
Recommended TAC	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf
STATLANT 21A	0.1	0.06	0.03	0.04	0.02	0.01	0.02	0.01	0.00	
STACFIS	0.1	0.06	0.03	0.04	0.02	0.01	0.02	0.03	0.00	

ndf No directed fishing.
No TAC set for 2007-2009.

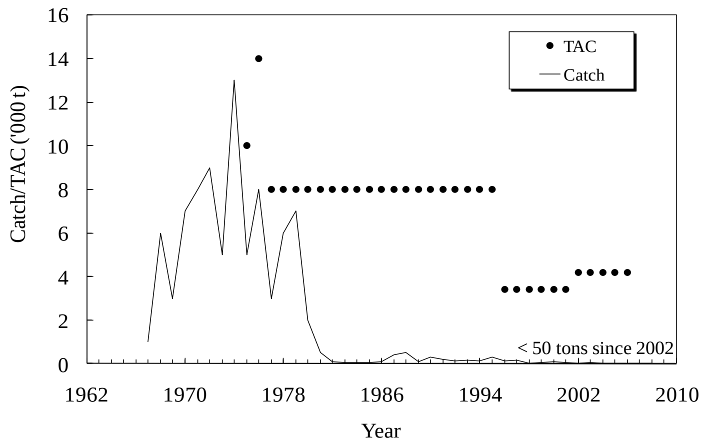

Fig. 3.1. Roundnose grenadier in SA 0+1: nominal catches and TACs. No TAC set for 2007-2009.

b) Data Overview

Research survey data

In the period 1987-1995 Japan in cooperation with Greenland has conducted bottom trawl research surveys in SA 1 covering depths down to 1 500 m. (The survey area was re-stratified and the biomasses recalculated in 1997). Russia has in the period 1986-1992 conducted surveys covering Div. 0B and Div. 1CD at depths down to 1 250 m until 1988 and down to 1 500 m from then on. The surveys took place in October-November. During 1997-2008 Greenland has conducted a survey in September - November covering Div. 1CD at depths between 400 and 1 500 m. Canada conducted surveys in Div. 0A in 1999, 2001, 2004, 2006 and 2008 and Div. 0B in 2000 and 2001 at depths down to 1 500 m. Roundnose grenadier has very seldom been observed in Div. 0A.

In the Greenland survey in 2008 the biomass in Div. 1CD was estimated at 546 t, which is the lowest on record. The biomass has since remained at the very low level observed since 1993. Most of the biomass was found in Div. 1D, 1 201-1 500 m. The fish were generally small, between 3 and 8 cm pre-anal fin length. The Canadian surveys in Div. 0B in 2000 and 2001 also showed very low biomasses, 1 660 and 1 256 t, respectively.

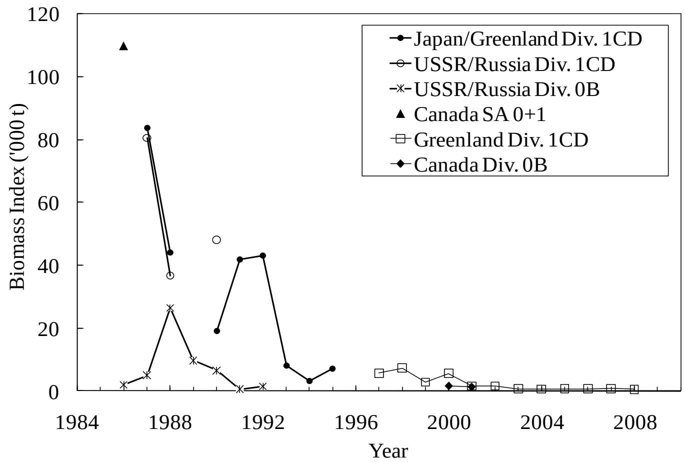

Fig. 3.2. Roundnose grenadier in SA 0+1: biomass estimates from Russian, Japan/Greenland, Canadian and Greenland surveys in Div. 0B and Div. 1CD

c) Precautionary Reference Points

STACFIS is not in a position to determine biological reference points for roundnose grenadier in SA 0+1 at this time. Previously STACFIS has considered a survey estimate of 111 000 t from 1986 as $B_{virgin.}$ However, given that roundnose grenadier is probably a long living species and that fishery stopped around 1979, it is uncertain whether the stock could be considered as virgin in 1986. Although the biomass estimates from the 1980s and early 1990s are not directly comparable with recent estimates these are far below what was seen previously. The survey time series from the 1980s and the early 1990s are, however, too short to be used for estimation of reference points.

d) Conclusion

In the Greenland survey in 2008 the biomass in Div. 1CD was estimated at 546 t, which is the lowest observed estimate. The biomass has since remained at the very low level seen since 1993, and there is no reason to consider that the status of the stock has changed.

The next full assessment of this stock will take place in 2011.

4. Demersal redfish (*Sebastes* spp.) in SA 1

Interim Monitoring Report (SCR Doc. 09/11, 16, 20; SCS Doc. 09/17)

a) Introduction

There are two redfish species of commercial importance in SA 1, golden redfish (*Sebastes marinus*.) and deep-sea redfish (*Sebastes mentella*). Relationships to other north Atlantic redfish stocks are unclear. Both redfish species are included in the catch statistics since no species-specific data are available.

Reported catches of golden redfish and redfish (unspecified) in SA 1 has been less than 1 000 t since 1987 and less than 500 t since 2001 and only 38 t were reported for 2008 (28 t in SCS Doc. 09/17 and 10 t in STATLANT 21A). Recent and historical catch figures do not include the weight of substantial numbers of small redfish discarded by the trawl fisheries directed to shrimp. Redfish caught in the Greenland shrimp fishery are discarded, amounting to ~0.6% of the shrimp catch and composed mainly of small redfish between 6 and 13 cm. A minor amount of mainly golden redfish are taken inshore by smaller vessels.

Recent catches ('000 t) are as follows:

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
TAC	19	19	19	8	1	1	1	1	1	1
STATLANT 21A	1.0	0.1	0.1	0	0.3	0.2	0.4	0.1[1]	0[1]	
STACFIS Catch	1.0	0.3	0.5	0.5	0.3	0.2	0.4	<.05	0	

[1] Greenland has not submitted STATLANT 21A data for 2007 and 2008.

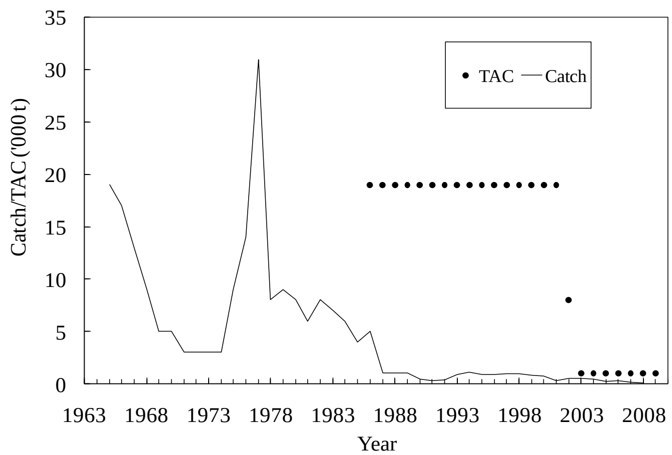

Fig. 4.1. Redfish in SA 1: catches and TAC.

b) Input Data

The EU-Germany groundfish survey, the Greenland-Japan/Greenland deep-sea survey and the Greenland groundfish/shrimp survey where all conducted in 2008. The Greenland deep-sea survey showed an increase in biomass of deep-sea redfish, while both the EU-Germany groundfish survey and the Greenland groundfish/shrimp survey showed decreases in biomass and abundance indexes. The increase in biomass index in the Greenland deep-sea survey was caused by a better coverage of relevant depths and to a large extent driven by a few large catches which mainly consisted of what are believed to be two-year-old redfish. These fish were not especially abundant at age one in the 2007 survey.

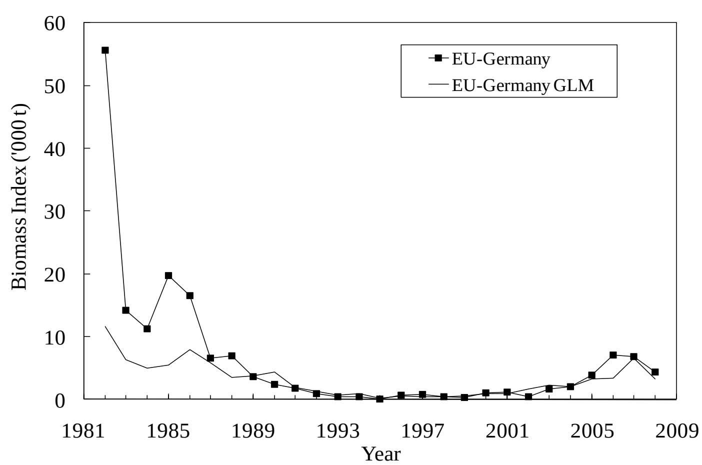

Fig. 4.2. Golden redfish in NAFO SA 1: survey biomass index.

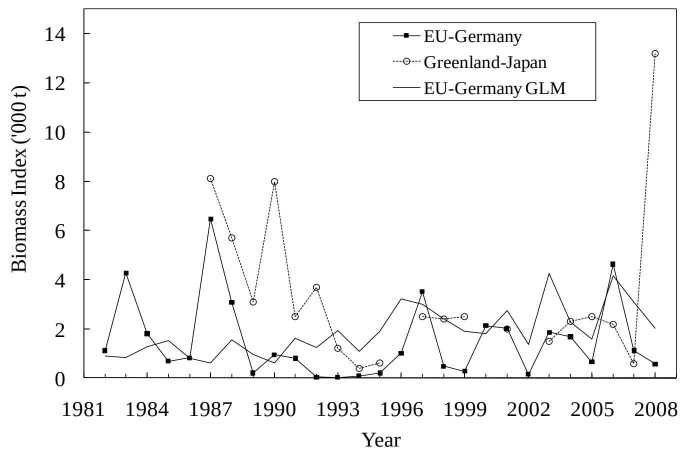

Fig. 4.3. Deep-sea redfish in SA 1: survey biomass indices.

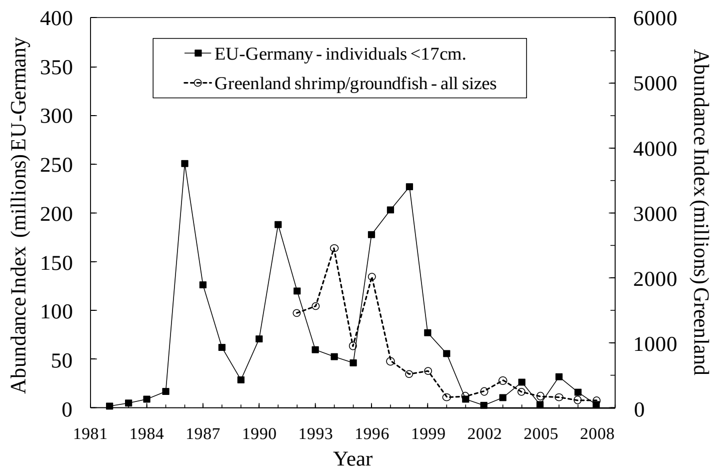

Fig. 4.4. Juvenile redfish (deep-sea redfish and golden redfish combined) in SA 1: survey abundance indices.

c) Conclusion

When combined with the low and decreasing levels of the other survey indices, the observed increase in deep-sea redfish biomass index in the Greenland deep-sea survey is not considered to show a significant change in the status of the stock. Indices for golden redfish also remain low. Both stocks are considered to be in poor condition.

STACFIS reiterated the **recommendation** that *the species composition and quantity of redfish discarded in the shrimp fishery in Subarea 1 be further investigated.*

This stock will next be assessed in 2011

5. Other finfish in SA 1

Interim Monitoring Report (SCR Doc. 09/11, 09/20; SCS Doc. 09/17)

a) Introduction

Other finfish in SA 1 includes American plaice (*Hippoglossoides platessoides*), Atlantic wolffish (*Anarhichas lupus*), spotted wolffish (*Anarhichas minor*) and thorny skate (*Amblyraja radiata*). Catch statistics for the two wolffish species are combined, since no species-specific data are available. In recent years, no catch data was available for American plaice and thorny skate.

Recent nominal catches (t) for wolffish are as follows:

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
STATLANT 21A	31	39	87	306	313	515	764	2[1]	4[1]	
STACFIS	64	82	118	393	313	515	764	644	1152	

[1] Greenland has not submitted STATLANT 21A data for 2007 and 2008.

b) Data Overview

i) Research survey data

The Greenland groundfish/shrimp survey and the EU-German survey were conducted in 2008. Stocks of American plaice, Atlantic wolffish and thorny skate all show decreasing and below average biomass in both the EU-German survey and the Greenland survey. Biomass indices for spotted wolffish have increased between 2002 and 2008 to a level above average. The stock shows no sign of dominating year-classes (SCR Doc. 09/20). Abundance estimates for spotted wolffish have however decreased substantially since 2005 in the Greenland survey.

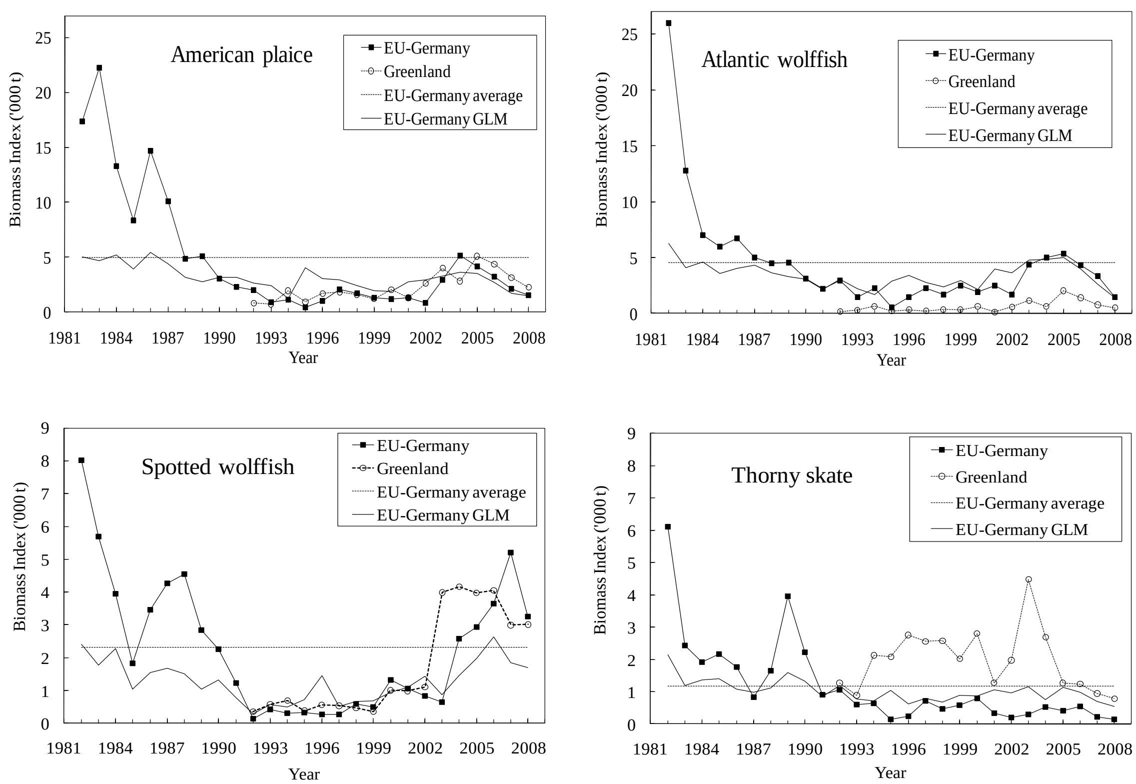

Fig. 5.1. Other finfish in SA 1: survey biomass indices.

c) Conclusion

With the extension of the indices including the 2008 survey results there is no indication of change in the status of the stocks of American plaice, Atlantic wolffish and thorny skate in SA 1. These stocks remain depleted. The spotted wolffish stock has shown improvements since 2002 and is above or at average levels. There is not, however, a significant change in the state of the stock since the most recent full assessment.

d) Research Recommendation

STACFIS reiterated the **recommendation** that *the species composition and quantity of other finfish discarded in the shrimp fishery in Subarea 1 be further investigated.*

STACFIS reiterated the **recommendation** that *the distribution of these species in relation to the main shrimp-fishing grounds in SA1 be investigated, in order to further discover means of reducing the amount of discarded bycatch.*

These stocks will next be assessed in 2011.

B. STOCKS ON THE FLEMISH CAP: SA 3 AND DIV. 3M

Environmental Overview

The water masses characteristic of the Flemish Cap area are a mixture of Labrador Current Slope Water and North Atlantic Current Water, generally warmer and saltier than the sub-polar shelf waters with a temperature range of 3-4^{o}C and salinities in the range of 34-34.75. The general circulation in the vicinity of the Flemish Cap consists of the offshore branch of the Labrador Current which flows through the Flemish Pass on the Grand Bank side and a jet that flows eastward north of the Cap and then southward east of the Cap. To the south, the Gulf Stream flows to the northeast to form the North Atlantic Current and influences waters around the southern areas of the Cap. In the absence of strong wind forcing the circulation over the central Flemish Cap is dominated by a topographically induced anticyclonic gyre. The stability of this circulation pattern may influence the retention of ichthyoplankton on the bank and is probably a factor in determining the year-class strength of various fish and invertebrate species, such as cod, redfish and shrimp.

Along the Flemish Cap section surface temperatures increased over 2007 values and were above normal. On the Flemish Cap, surface salinities were slightly higher than normal during 2008. Salinities on the Flemish Cap have been above normal from 2001 to 2008. On the Grand Bank along the 47^{o}N section, the summer CIL area was below normal for the 11th consecutive year (1998-2008) and along the southeast Grand Bank section the spring CIL area was above normal, similar to 2007.

6. Cod (*Gadus morhua*) in Div. 3M

(SCR Doc. 09/19, 34; SCS Doc. 09/5, 12, 14)

a) Introduction

i) Description of the fishery

The cod fishery on Flemish Cap has traditionally been a directed fishery by Portuguese trawlers and gillnetters, Spanish pair-trawlers and Faroese longliners. Cod has also been taken as bycatch in the directed redfish fishery by Portuguese trawlers. Small amounts of cod were taken as bycatch in the shrimp fishery by Canada and Norway. The bycatch of cod in the past Russian pelagic fishery for redfish was also low. The directed fishery has been under moratorium since 1999.

ii) Nominal catches

From 1963 to 1979, the mean reported catch was 32 000 t, showing high variations between years. Reported catches declined after 1980, when a TAC of 13 000 t was established, but Scientific Council regularly expressed its concern about the reliability of some catches reported in the period since 1963, particularly those since 1980. Alternative estimates of the annual total catch since 1988 were made available in 1995 (Fig. 6.1), including non-reported catches and catches from non-Contracting Parties.

In 1999 the fishery was closed and catches were estimated in that year as 353 t, most of them taken by non-Contracting Parties based on Canadian Surveillance reports. Those fleets were not observed since 2000, and the current reduced catches are mainly obtained as bycatch of the redfish fishery. Yearly bycatch between 2000 and 2005 were below 60 t, rising to 339 and 345 t in 2006 and 2007, respectively. In year 2008 the bycatch increased to 889 t.

Recent TACs and catches ('000 t) are as follow:

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
TAC	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf
STATLANT 21A	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1[1]	0.4[1]	
STACFIS	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.9	

[1] Provisional
ndf No directed fishery

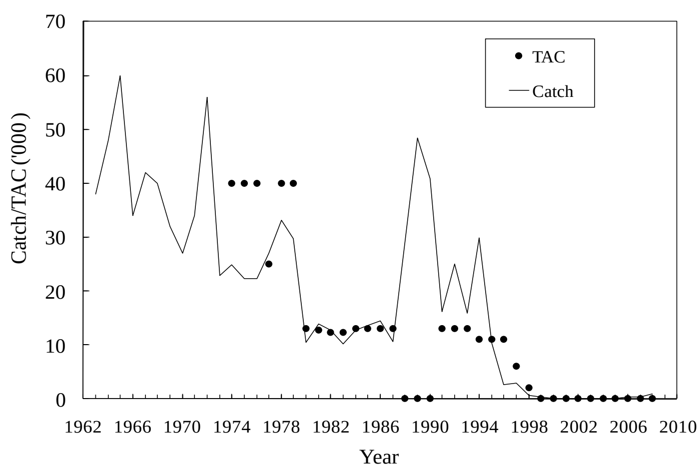

Fig. 6.1. Cod in Div. 3M: catches and TACs, catch figures include estimates of misreported catches since 1988.

b) Input Data

i) Commercial fishery data

Length and age compositions from the 2002 to 2005 commercial catches were not available. That information is available for the 1973 to 2001 period and for years 2006 to 2008. In 2008 length distribution for Portugal, Russia and Estonia are available. As the length distribution of Estonia was based only in 5 samples, it was decided not to use it to obtain a general length distribution. The length distributions of Portugal and Russia are quite different. Portugal catches smaller individuals, having a tri-modal distribution in 36, 48 and 66 cm. Russia has a two-modal distribution between 54 and 75 cm. Length to age conversions were performed using age-length keys from the EU Flemish cap survey, since they were the only ones available. In 2008 ages 2 to 4 were the most abundant in the catch.

ii) Research survey data

Biomass and abundance estimates were available from bottom trawl surveys conducted by Canada from 1977 to 1985. The estimates of bottom trawlable biomass showed a maximum level of 83 000 t in 1978 and a minimum of 8 000 t in 1982.

Biomass and abundance estimates were also available from bottom trawl surveys conducted by USSR/Russia from 1977 to 1996, with the exception of 1994, and in 2001 and 2002 (Fig. 6.2), and with a concurrent acoustic survey from 1985 to 1993. The estimates of bottom trawlable biomass in the most recent period showed a maximum level of 37 000 t in 1989; a minimum 2 500 t in 1992, and a decline from 8 300 t in 1995 to 700 t in 1996. The estimates in 2001 and 2002 were 800 and 700 t, respectively.

A stratified-random bottom trawl survey was conducted by Canada in 1996, as part of an overall survey of Div. 2GHJ and 3KLMNO. Trawlable biomass was estimated at 9 300 t. Biomass estimates for cod in the Canadian survey and the EU survey in 1996 were similar.

Stratified-random bottom trawl surveys have been conducted by the EU since 1988. Since 2003 the survey has used a new vessel and in order to make the series comparable fishing trials were performed with both vessels in 2003 and 2004 (Casas and González-Troncoso, 2005). The EU Flemish Cap survey indices also showed a decline in trawlable biomass going from a peak value of 114 000 t in 1989 to 27 000 t in 1992. This was followed by an increase to 61 000 t in 1993, then a decrease to around 10 000 t for the 1995 to 1997 period and then a steady decrease until the lowest observed level of 1 600 t in 2003. Biomass increased in 2004 and 2005 to around 5 000 t. The indices for 2006, 2007 and 2008 show a strong increase in biomass, especially in 2008, with values of 13 000, 24 000 and 44 000 t, respectively. There is also a general increase in abundance, but it is less strong, reflecting the fact that stock weight at age has generally increase in recent years; the growth of the strong 2005 year-class has also contributed to the increase in biomass.

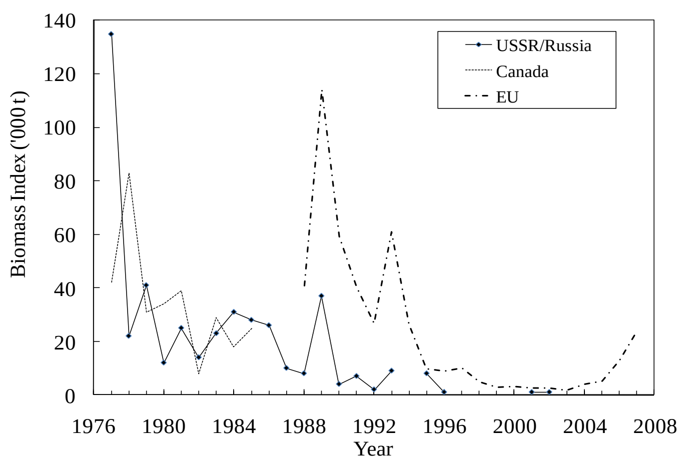

Fig. 6.2. Cod in Div. 3M: total biomass estimates from surveys.

After a consistent series of above average recruitments (age 1) during 1988-1995, the EU Flemish Cap survey indicates poor recruitments during 1996-2004, even obtaining observed zero values in 2002 and 2004. Since 2005 above average recruitments have again been observed. In particular, the age 1 index in 2006 is the fourth largest in the EU series.

iii) Biological data

Mean weight at age in the stock, derived from the EU Flemish Cap survey data, shows a strong increasing trend since the late 1990s. In 2008 all the ages decreased its mean weight-at-age, but still remain higher than at the beginning of the series.

In 2008 assessment new annual maturity ogives were provided for years 2000-2006. There are no major differences between the new maturity ogives provided in 2008 and the ones used until 2007. In years 2007 and 2008 maturity ogives were not available yet, so 2006 maturity ogive was used for those years. There has been a continuous decline of the A_{50} (age at which 50% of fish are mature) through the years, going from above 5 years of age in the late 1980s to just above 3 years of age since about year 2000.

c) Estimation of Parameters

In 2007 a VPA-type Bayesian model for the assessment of this stock was briefly presented to STACFIS, which recommended that the method be developed and its potential for the assessment of this stock explored. This recommendation had been followed and the method had been developed, presented and approved in 2008. This year the assessment was made following this method and updating the data inputs.

The model is age structured and follows cohorts. Modelling starts by setting prior distributions on survivors at age at the end of the final assessment year and survivors from the last true age (age 7) at the end of each year prior to the final assessment year. From the survivors, cohort abundances at age are reconstructed backwards in time until reaching either the beginning of the cohort (recruitment at age 1) or the first assessment year. When reconstructing cohorts, a distinction is made between years for which catch numbers at age are available and years for which they are not, as described next:

If catch numbers at age are available in year y, then abundances at age in that year are found from the usual cohort analysis equation: $N(y,a) = N(y+1,a+1) \exp(M) + C(y,a) \exp(M/2)$, where M is the assumed natural mortality rate and $C(y,a)$ catch numbers at age a in year y. Uncertainty in M was setting via a log normal, trying to reflect biological knowledge about the stock.

If y is a year for which catch numbers at age are not available, abundances at age in that year are derived from the equation $N(y,a) = N(y+1,a+1) \exp(M + F(y,a))$, where $F(y,a)$ is fishing mortality at age a in year y. The value of this fishing mortality is unknown and must be estimated. As this is a Bayesian model, a (log-normal) prior distribution is set on $F(y,a)$. For the Div. 3M cod stock, in years when no catch numbers at age are available, total catch in weight is nevertheless known. This information is used by setting a (log-normal) observation equation linking the known catch weight to the value predicted by the model, similarly to what is done in statistical catch at age models. The observation equation for catch weight complements the abundance index coming from the EU Flemish Cap survey, hence aiding in the estimation of fishing mortality for years in which no catch numbers at age are available.

The EU Flemish Cap survey provides abundance at age relative indices, which are linked to the average population abundances at age during the survey period by log-Normal observation equations. Examining the survey indices (in log scale) standardized by age (each age standardized separately to have 0 mean and standard deviation 1 through time) shows that the survey tracks cohorts very well.

Hence, the input data for the Bayesian model are: catch numbers at age for the years in which they are available, total catch weight as well as some proxy for mean weight at age in the catch for the remaining years and indices of abundance at age from the EU Flemish Cap survey. Model parameters are survivors at age at the end of the final assessment year, survivors from the last true age at the end of every year prior to the final assessment year, fishing mortalities at age for years without catch numbers at age, catchabilities at age and precisions at age of the survey. In a Bayesian analysis prior distributions must be set for all unknown parameters. These priors have been chosen to be centred at values that were considered reasonable according to the knowledge had about this stock, while incorporating a fair amount of dispersion so as to prevent them from having unduly strong influence on the assessment results.

d) Assessment Results

Spawning stock biomass: Model estimates of SSB (Fig. 6.3) indicate yearly increases starting from 2004, with the biggest increase taking place during 2008. Whereas SSB at the beginning of 2008 is estimated to be 15 332 t with 90% probability interval of 10 702-22 343 t, current SSB (that is, SSB at the start of 2009) is estimated to be 33 805 t with 90% probability interval of 22 452-53 260 t, that is, well above B_{lim}, which is 14 000 t. The big increase in the last three years is largely due to three reasonably abundant year-classes, those of 2004-2006, and to their early maturity.

Very substantial contributors to the rise in SSB are the larger weight at age and the younger age of maturity observed in recent years with respect to what is assumed to have applied in the earlier period. As an example, if SSB in 2009 had been computed using the weight at age and maturity at age values average from 1988 to 1995, its estimated value would have been 9 001 t, much lower than the current estimate of 33 805 t. As a result of these changes, it is unclear whether the meaning of SSB as an indicator of stock status in recent years is the same as in the earlier period.

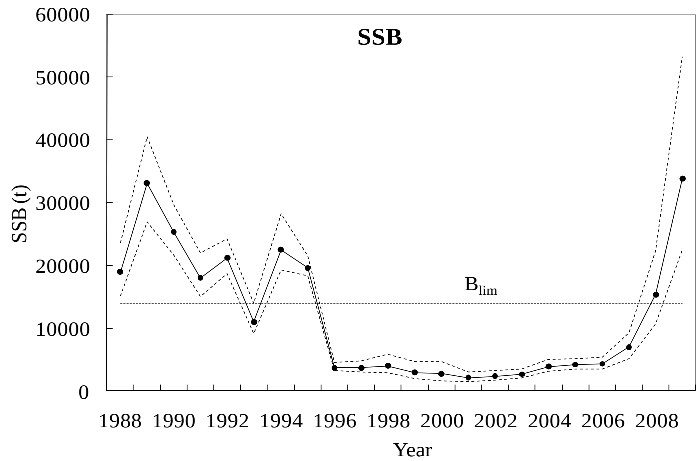

Fig. 6.3. Cod in Div. 3M: SSB estimates and 90% probability intervals for years 1988 to 2009. The horizontal dashed line is the B_{lim} level of 14 000 t.

Recruitment: After a series of recruitment failures between 1996 and 2004, recruitment values in 2005-2008 are better, although still below the levels estimated for the earlier period (Fig. 6.4). There is considerable uncertainty associated with these four most recent values, as indicated by the wide 90% probability limits.

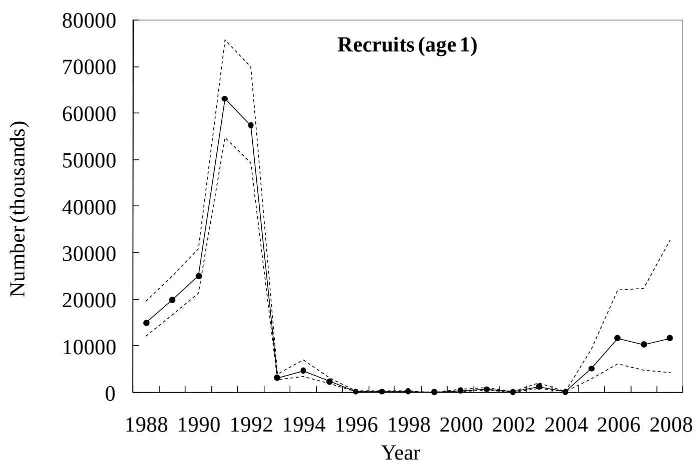

Fig. 6.4. Cod in Div. 3M: Recruitment (age 1) estimates and 90% probability intervals for years 1988 to 2008.

Fishing mortality: F_{bar} (ages 3-5) is estimated to have been at very low levels since 2001 (Fig. 6.5). An increase is observed in 2006, which is mainly due to high fishing mortality rates at ages 3 and 4 (posterior medians at 0.4 and 0.13, respectively). In 2007, the F_{bar} level was again very low, with a slight increase in 2008 but still below the 2006 value.

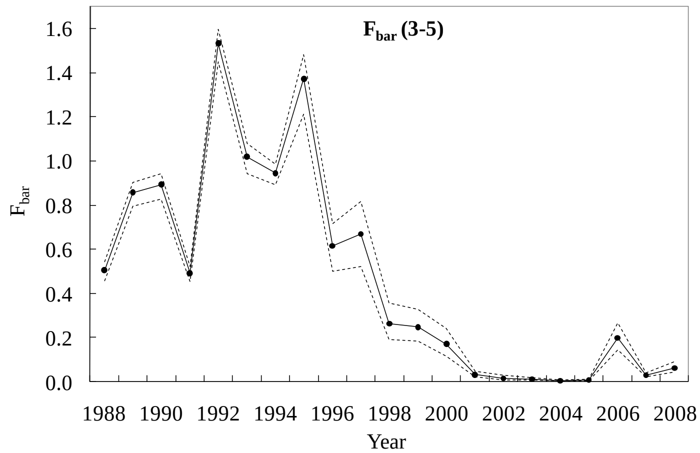

Fig. 6.5. Cod in Div. 3M: F_{bar} (ages 3-5) estimates and 90% probability intervals for years 1988 to 2008.

e) Retrospective Analysis

A six-year retrospective analysis of the Bayesian model was conducted by eliminating successive years of catch and survey data. Fig. 6.6 to 6.8 present the retrospective estimates of age 1 recruitment, SSB and F_{bar} at ages 3-5.

In recent years recruitment have been overestimated (Fig. 6.7), while the SSB and fishing mortality in recent years do not show a clear retrospective patterns (Fig. 6.6 and 6.8).

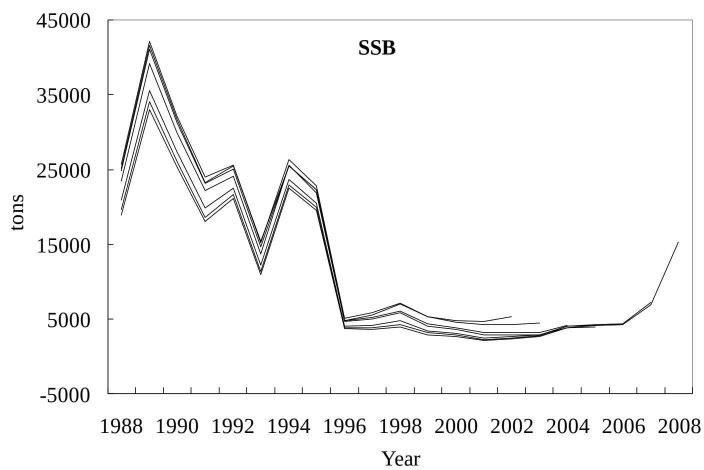

Fig. 6.6. Cod in Div. 3M: Retrospective results for SSB.

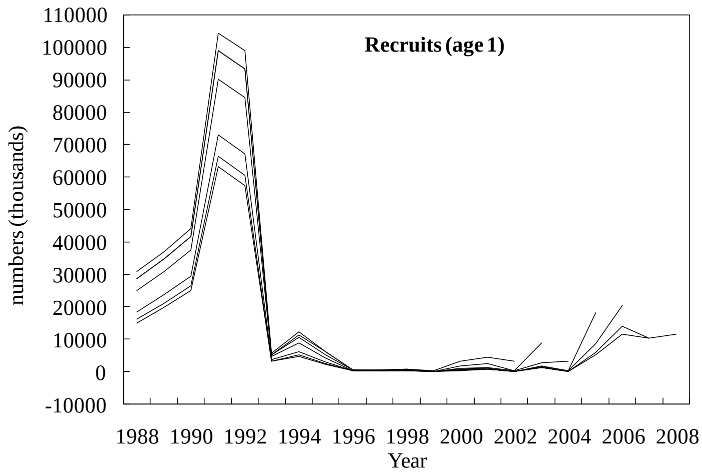

Fig. 6.7. Cod in Div. 3M: Retrospective results for recruitment.

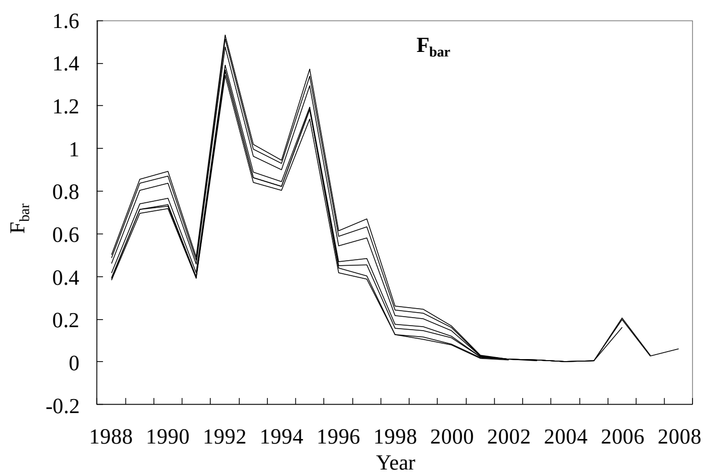

Fig. 6.8. Cod in Div. 3M: Retrospective results for F_{bar}.

f) Reference Points

B_{lim} was estimated at 14 000 t from the results of the earlier XSA model. As the Bayesian model now used for the assessment of the stock gave last year very similar answers to XSA for the common period, the validity of the current B_{lim} value would not seem to be in question. Fig. 6.9 shows a stock-recruitment plot, with 14 000 t indicated by the dashed vertical line. The value still appears as a reasonable choice for B_{lim}: only low recruitments have been observed with SSB below this level whereas both high and low recruitments have been observed at higher SSB values.

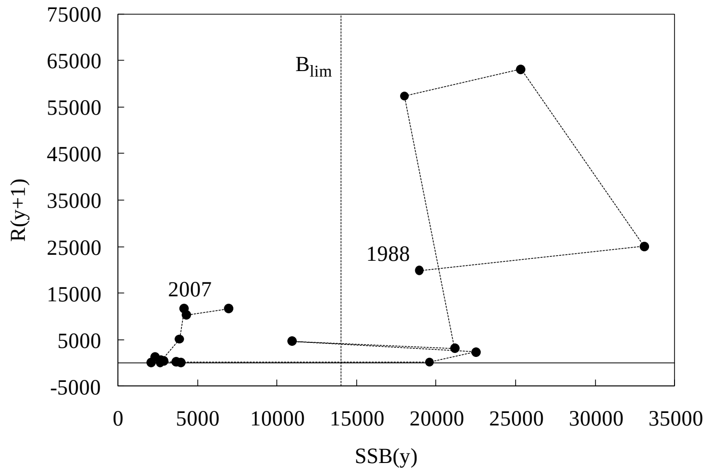

Fig. 6.9. Cod in Div. 3M: Stock-Recruitment (posterior medians) plot.

Fig. 6.10 shows the yield per recruit with respect to F_{bar}, in which we can see the estimated values for $F_{0.1}$, F_{max} and F_{2008}.

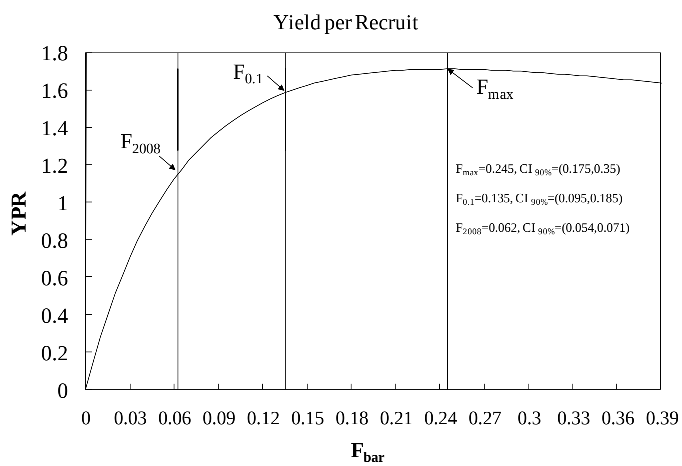

Fig. 6.10. Cod in Div. 3M: Yield per recruit.

g) Stock Projections

Stochastic projections of the stock dynamics over a 3 year period (2010-2012) have been performed. The variability in the input data is taken from the results of the Bayesian assessment. Input data for the projections were chosen on the basis of the last three years of this assessment (2006-2008), except when there was some reason to consider this unrealistic. Input data are as follows:

Numbers aged 2 to 8+ in 2009: estimates from this assessment.

Recruitments for 2010-2012: Recruits per spawner were estimated for each of the assessment years. As the last 3 years have a much higher value than the average, recruits per spawner were drawn randomly from the values in all of the assessment years.

Maturity ogive: Drawn randomly from the maturity ogives (with their associated uncertainty) of years 2004-2006 (2007 and 2008 were not used since no data were available to estimate an ogive for those years).

Weight-at-age in stock and weight-at-age in catch: Drawn randomly from the values in 2006-2008.
Partial recruitment: average of the PR estimated from 2006-2008.
The following F_{bar}(ages 3-5) were considered:

$F_{bar} = F_{0.1}$ (median estimate 0.135)	Projection results are in Fig. 6.11 and 6.12.
$F_{bar} = F_{max}$ (median estimate 0.245)	Projection results are in Fig 6.13 and 6.14.
$F_{bar} = 0$ (no fishing mortality)	Projection results are in Fig. 6.15 and 6.16.
$F_{bar} = F_{2008}$. (median estimate 0.062)	Projection results are in Fig. 6.17 and 6.18.

Projection results indicate that fishing at any of the considered values of F_{bar}, SSB during the next 3 years has a very high probability of reaching levels higher than those estimated for the late 1980s (Fig. 6.11, 6.13, 6.15 and 6.17). However, similarly to what was indicated in the presentation of the assessment results, the huge increase predicted for SSB does not have a counterpart in terms of population abundances, which are projected to remain at levels below those of the late 1980s. This mismatch is largely due to the fact that weight-at-age and maturity-at-age values used for the projection period are much higher than those assumed to have applied at the end of the 1980s. The removals associated with these F_{bar} levels are lower than those in the period before 1995 (Fig. 6.12, 6.14, 6.16 and 6.18).

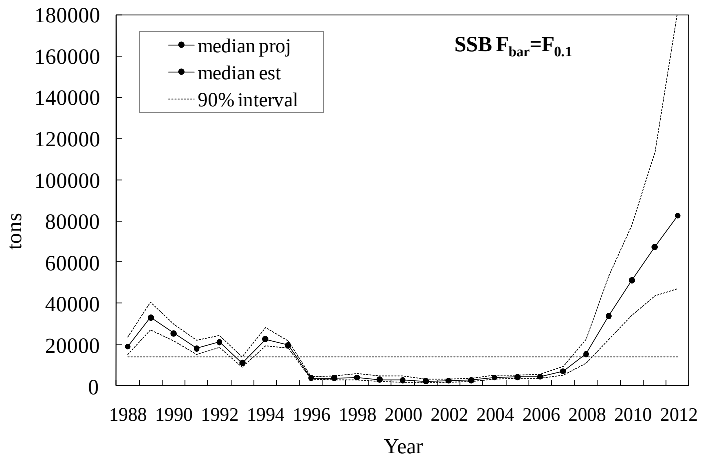

Fig. 6.11. Cod in Div. 3M: Projected SSB with F0.1 for Fbar (medians and 90% probability intervals).

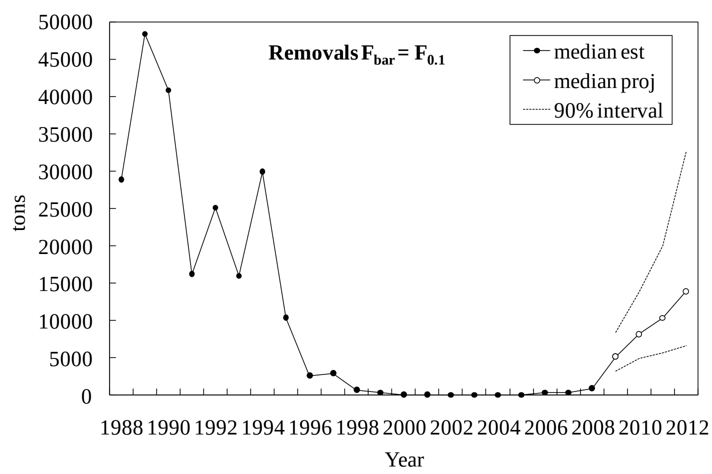

Fig. 6.12. Cod in Div. 3M: Projected removals with $F_{0.1}$ for F_{bar} (medians and 90% probability intervals).

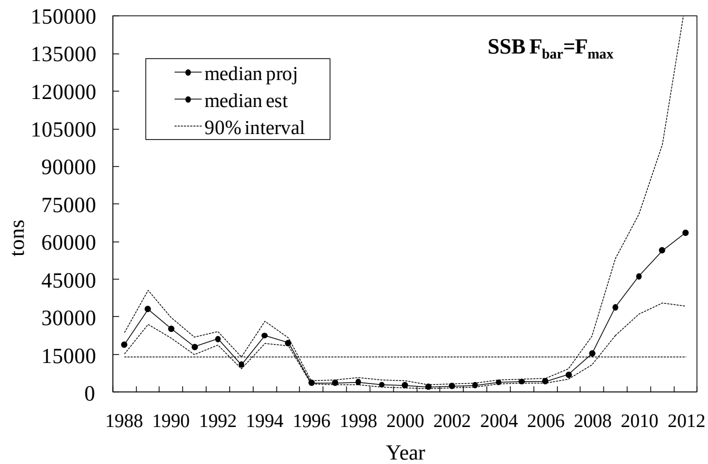

Fig. 6.13. Cod in Div. 3M: Projected SSB with F_{max} for F_{bar} (medians and 90% probability intervals).

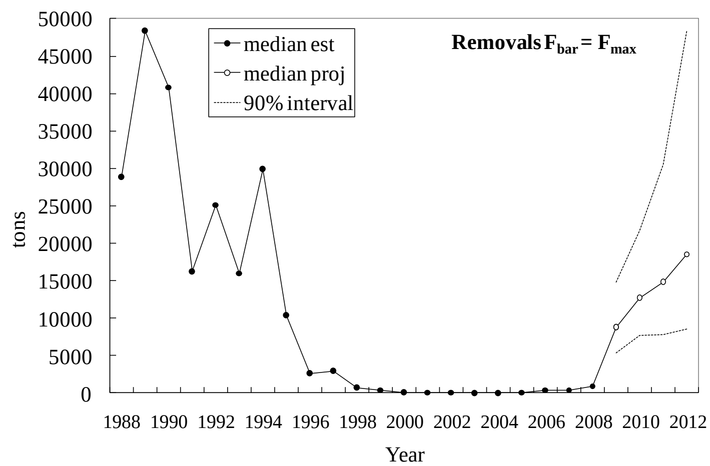

Fig. 6.14. Cod in Div. 3M: Projected removals with F_{max} for F_{bar} (medians and 90% probability intervals).

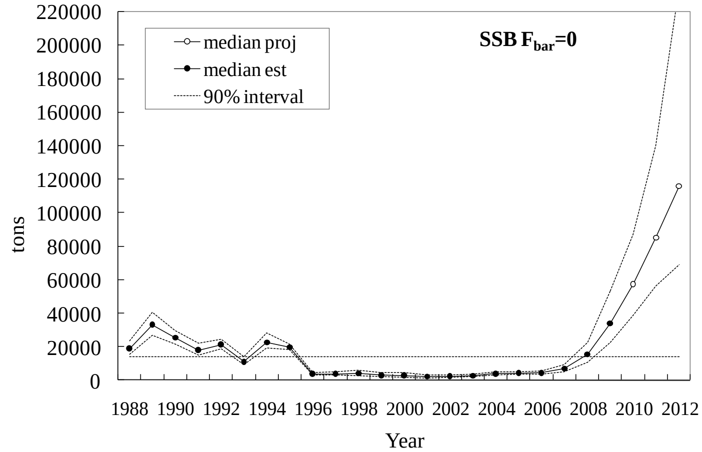

Fig. 6.15. Cod in Div. 3M: Projected SSB with no fishing mortality (medians and 90% probability intervals).

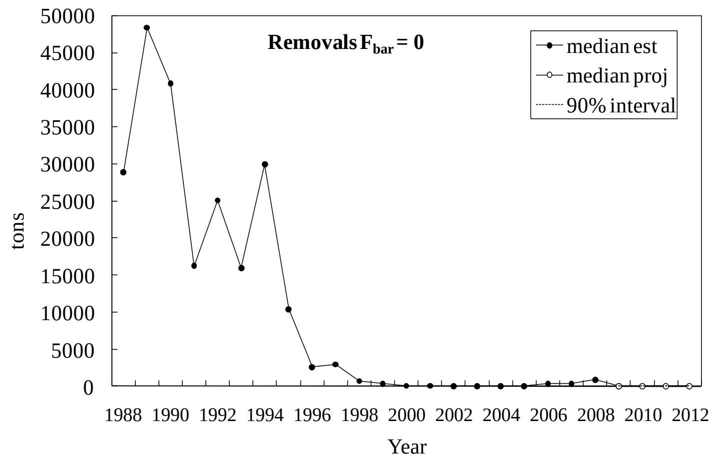

Fig. 6.16. Cod in Div. 3M: Projected removals with no fishing mortality (medians and 90% probability intervals).

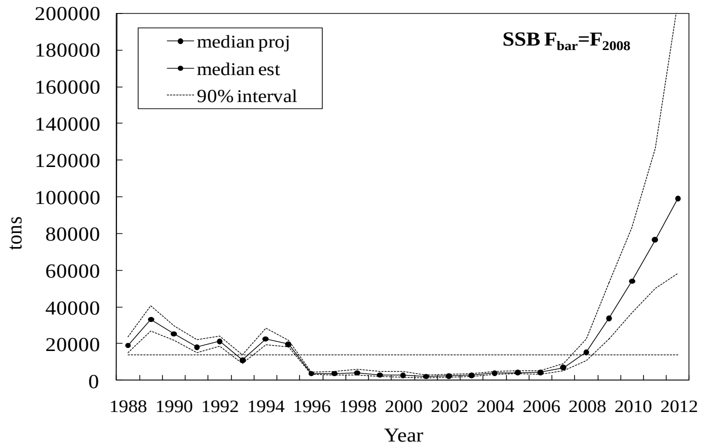

Fig. 6.17. Cod in Div. 3M: Projected SSB with F_{2008} for F_{bar} (medians and 90% probability intervals).

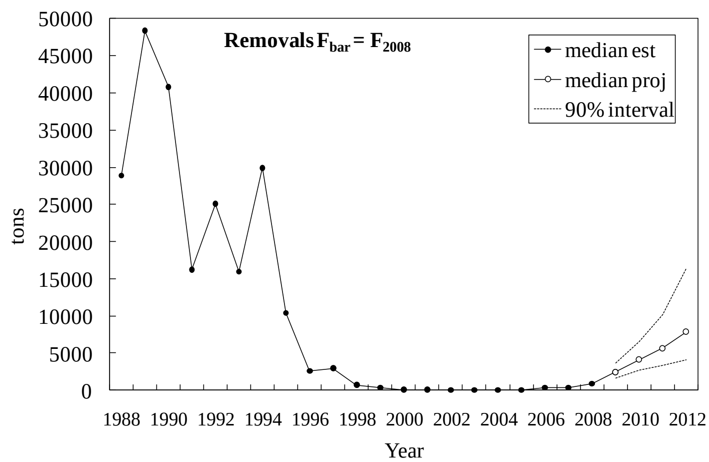

Fig. 6.18. Cod in Div. 3M: Projected removals with F_{2008} for F_{bar} (medians and 90% probability intervals).

The projected values for the period 2010-2012 are heavily reliant on relatively abundant recent cohorts, rather than on healthy population abundances across all ages, making the stock much more fragile than suggested by SSB values alone.

h) Research Recommendations

STACFIS **recommended** that *retrospective analyses be performed as a standard diagnostic of the assessment with the Bayesian model.*

STATUS: This recommendation was followed in this assessment.

Seeing that the biomass of Div. 3M cod is increasing and the distribution of redfish fishery appears to be changing, STACFIS **recommended** that *cod bycatch should be more thoroughly investigated and the levels of commercial sampling increase.*

STACFIS noted that the short term development of this stock will be dependent on recent year-classes and therefore it **recommended** that *the stock be fully assessed in 2010.*

7. Redfish (*Sebastes mentella* and *Sebastes fasciatus*) in Div. 3M

(SCR Doc. 09/29; SCS Doc. 09/5, 9, 10, 14)

a) Introduction

There are three species of redfish that are commercially fished on Flemish Cap; deep-sea redfish (*Sebastes mentella*), golden redfish (*Sebastes marinus*) and Acadian redfish (*Sebastes fasciatus*). The term beaked redfish is used for *S. mentella* and *S. fasciatus* combined. Because of difficulties with identification and separation, all three species are reported together as 'redfish' in the commercial fishery. All stocks have both pelagic and demersal concentrations as well as a long recruitment process to the bottom, extending to lengths up to 30-32 cm. All redfish species are long lived with slow growth. Female sexual maturity is reached at a median length of 26.5 cm for Acadian redfish, 30.1 cm for deep-sea redfish and 33.8 cm for golden redfish.

i) Description of the fishery

The redfish fishery in Div. 3M increased from 20 000 t in 1985 to 81 000 t in 1990, falling continuously since then until 1998-1999, when a minimum catch around 1 000 t was recorded mostly as bycatch of the Greenland halibut fishery. The drop in the Div. 3M redfish catches from 1990 until 1999 was related both to the decline of the stock biomass and abrupt decline of fishing effort.

There was a relative increase of the catch on 2000-2002 to a level above 3 000 t but in 2003 the overall catch didn't reach 2 000 t. In 2004, catch raised again near 3 000 t and Portugal consolidated its major role in the fishery.

A new golden redfish fishery occurred on the Flemish Cap bank from September 2005 onwards on shallower depths above 300 m, basically pursued by Portuguese bottom trawl and Russia pelagic trawl. This new reality implied a revision of catch estimates, in order to split recent commercial catch from the major fleets on Div. 3M (Portugal, Russia and Spain) into golden and beaked redfish catches and to have for each of the main fleets the available length sampling separated as well between these two "species". In order to estimate a proxy of the beaked redfish catch by fleet, a 2005-2008 revision of the logbooks from the monitored vessels has been carried by the national sampling programmes of Portugal, Spain and Russia.

The sudden expansion 1993 of a shrimp fishery on the Flemish Cap led to high levels of redfish bycatch in 1993-1994. From 1995 onwards bycatch in weight fell to apparent low levels but since 2001 increase again, reaching 1006 t in 2003. That increase does not reflect any expansion of the 3M shrimp fishery and was supported by above average year-classes occurring since 2000. From Canadian observer data, the redfish bycatch on the Div. 3M shrimp fishery declined to 471 t in 2004 and again to 80 t in 2005, reflecting an important reduction of the Div. 3M shrimp catch observed in recent years, but remains unknown for 2006-2008. Length sampling of this bycatch is also unavailable.

Recent TACs, catches and bycatch ('000 t) are as follows (Fig. 7.1):

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Recommended TAC	5	5	5	5	5	5	5	5	5	5
TAC	5	5	5	5	5	5	5	5	8.5	8.5
STATLANT 21A	3.8	34	3.0	2.0	3.1	6.4	6.3	5.6	6.8	
STACFIS Catch[1]	3.7	3. 2	2.9	1.9	2.9	4.8	6.3	5.5	3.2	

[1] Estimated beaked redfish catch.

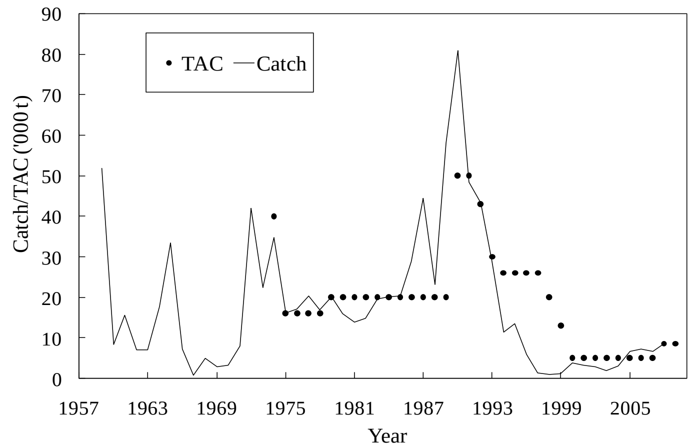

Fig. 7.1. Redfish in Div. 3M: catches and TACs.

b) Input Data

The 3M redfish assessment is focused on the beaked redfish, regarded as a management unit composed of two populations from two very similar species: the Flemish Cap *S. mentella* and *S. fasciatus*. The reason for this approach is the historical dominance of this group in the Div. 3M redfish commercial catch until 2005. During the entire series of EU Flemish Cap surveys (1988-2008) beaked redfish also represents the majority of redfish survey biomass (76%). But at present this majority is down to 63% due to the rise of golden redfish survey indices on recent years (2003-2008).

i) Commercial fishery and bycatch data

Sampling data. Most of the commercial sampling data available for the Div. 3M redfish stocks since 1989 are from the Portuguese fisheries. Length sampling data from Russia, Japan and Spain were also available for several years and used to estimate the length composition of the commercial catches for those fleets in those years. The annual length composition of the Portuguese trawl catch was applied to the rest of the commercial catches. The 1998-2008 Div. 3M beaked redfish commercial length weight relationships from the Portuguese commercial catch were used to compute the mean weights of all commercial catches and corresponding catch numbers at length.

Redfish bycatch in numbers at length for the Div. 3M shrimp fishery is available for 1993-2004, based on data collected on Canadian and Norwegian vessels. The commercial and bycatch length frequencies were summed to establish the total removals at length. These were converted to removals at age using the *S. mentella* age-length keys from the 1990-2007 EU surveys. Annual length weight relationships derived from Portuguese commercial catch were used for determination of mean weights-at-age.

On the first years of the assessment, before 1993, age group 8 was the most abundant in the commercial catch, moving back to age 4 and 5 in 1993-1995 at the beginning of the Div. 3M shrimp fishery. The expansion of the shrimp fishery with sorting grids and the decline of the redfish fishery led to even younger modal age groups between 1996 and 2004, when age 2 was the most abundant in the redfish catch most of the years. Catch at age doesn’t include redfish bycatch since 2005 but nevertheless age 2 was still the most abundant age group in the commercial catch that year, reflecting the above average size of the pre recruited 2003 cohort. The most abundant age group in the redfish catch increased afterwards to ages 6 and 7.

ii) Research survey data

In June 2003 a new Spanish research vessel, the *RV Vizconde de Eza* (VE) replaced the *RV Cornide de Saavedra* (CS) that had carried out the EU survey series with the exception of the years of 1989 and 1990. In order to preserve the full use of the 1988-2002 time series the original survey indices for beaked redfish have been converted to the new vessel units so that each former time series could be comparable with the correspondent new indices obtained from 2003 onwards.

Survey bottom biomass and survey female spawning biomass of Div. 3M beaked (*S. mentella* plus *S. fasciatus*) redfish were calculated based on the abundance at length from EU bottom trawl survey for the period 1988-2008 and on the Div. 3M beaked redfish length weight relationships from EU survey data for the same period. Female spawning biomass was calculated applying length maturity ogives derived from data collected during the 1992-1994 and 1999 EU surveys.

Age compositions for Div. 3M beaked redfish EU survey stock and mature female stock in 1989-2008 were obtained using the *S. mentella* age length keys from the 1990-2007 EU surveys with both sexes combined. Mean weights-at-age were determined using the EU survey annual length weight relationships.

Survey results. The 1988-2008 interval covered by the EU Flemish Cap survey, started with a decline of bottom biomass till 1991, and then fluctuated without trend until 2003. From 2004 onwards survey biomass rose to a 2006 maximum. Both exploited and total survey biomasses declined in 2007 and 2008, but stayed well above their level at the beginning of the series (92% increase as regards total biomass and 70% increase as regards exploited biomass). Female spawning survey biomass continues to grow : in 2005-2008 the portion of young maturing females at age 6 and 7 from the 1999, 2000 and 2001 year-classes, together with the increasing biomass of these cohorts pull up again the SSB survey index to the high 1989-1990 level (Fig. 7.2).

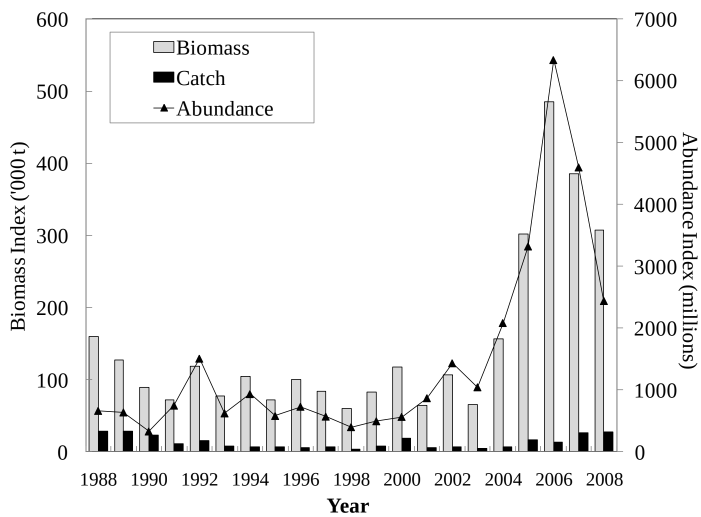

Fig. 7.2. Beaked redfish in Div. 3M: survey biomass, female spawning biomass and abundance from EU (1988-2008) surveys.

A similar pattern is observed on survey abundance. From 2002 onwards a sequence of average (1998) and above average (2001-2004) year-classes, together with high survival rates through the age spectrum supported a rapid increase in stock (and exploited stock) survey abundance to the 2006 high. Despite the drop observed in the last couple of years, directly related to a severe reduction in the number of juveniles (as should be expected after a period when good cohorts showed up every year), total and 4 plus abundance stayed at high levels in 2008.

c) Estimation of Parameters

The expected proportion of mature females found at each age for Div. 3M beaked redfish was calculated using the mean proportion of mature females found in survey stock abundance-at-age. This female "maturity ogive" was used in the Extended Survival Analysis to get female spawning biomass estimates.

An Extended Survivors Analysis (XSA) (Shepherd, 1999) for the period 1989-2008 was run. Natural mortality was assumed constant at 0.1. The input catch-at-age was as described above as was the observed female mature proportion at age. The month of peak spawning (larval extrusion) for Div. 3M *S. mentella*, was taken to be February, and was used for the estimate of the proportion of fishing mortality and natural mortality before spawning. EU survey abundance at age was used for calibration. The XSA model specifications are given below:

Catch data from 1989 to 2008, ages 4 to 19+

Fleets	First year - last year	First age - last age
EU summer survey (Div. 3M)	1989-2008	4-18
Natural mortality is assumed 0.1 for all years, ages. Tapered time weighting not applied Catchability independent of stock size for all ages Catchability independent of age for all ages Terminal year survivor estimates not shrunk towards a mean *F* Oldest age survivor estimates not shrunk towards the mean *F* of previous ages Minimum standard error for population estimates from each cohort age = 0.5		

Reference

SHEPHERD, J. G. 1999. Extended survivors analysis: an improved method for the analysis of catch-at-age data and abundance indices. *ICES J. Mar. Sci.*, **56**(5): 584-591.

d) Assessment Results

XSA diagnostics show high standard errors associated with the average catchability at age and year patterns in catchability residuals, reflected in retrospective bias on fishing mortality, biomass and recruitment at age 4 (namely on the 2002 year-class, the most abundant cohort so far). But at the same time results of the present XSA assessment are in line with the 2007 and 2005 assessments: exploitable biomass and abundance near (or above) the high 1989-1990 level, female spawning biomass increasing, above average recruitments from 2000 onwards and a low level of fishing mortality that since 1997 gave room to stock recovery.

Taking into account both the consistency of the results with XSA in 2005 and 2007, and the poor diagnostics, the assessment was accepted but STACFIS considered that the uncertainty associated with its results on the terminal year made it inadvisable to use them to initialize short or medium term projections.

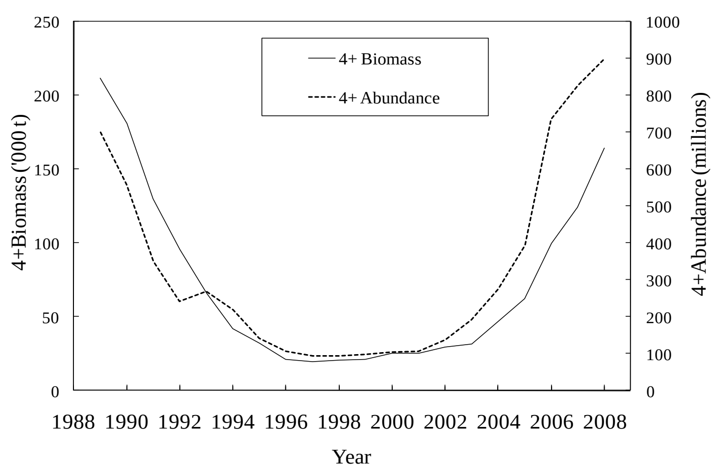

Fig. 7.3. Beaked redfish in Div. 3M: age 4+ biomass and Age 4+ abundance trends from XSA.

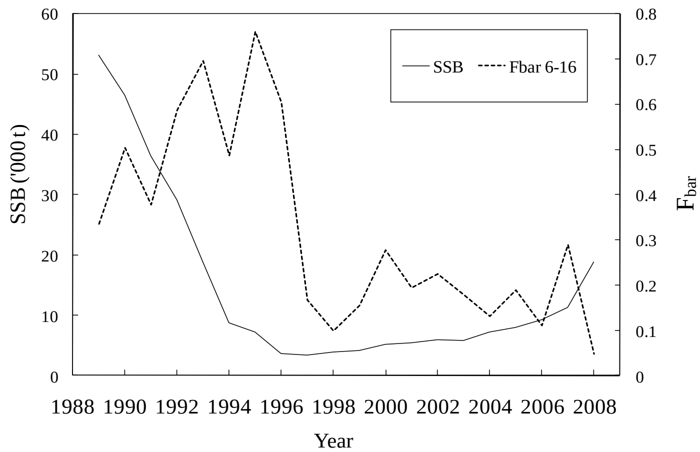

Fig. 7.4. Beaked redfish in Div. 3M: female spawning biomass and fishing mortality trends from XSA.

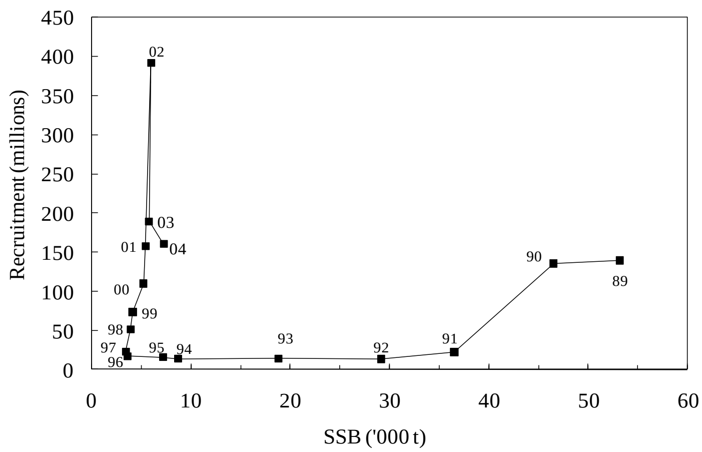

Fig. 7.5. Beaked redfish in Div. 3M: relative recruitment from XSA (year-classes indicated).

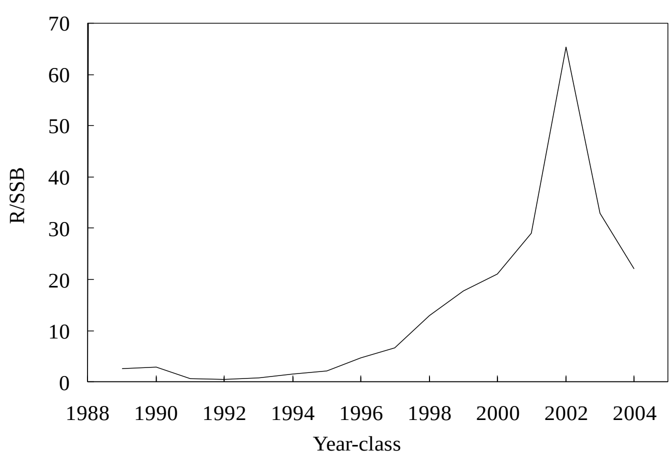

Fig. 7.6. Beaked redfish in Div. 3M: recruitment per thousand tons of SSB trend from XSA (recruits at age 4 four years later than SSB).

Biomass and abundance (Fig. 7. 3): The fishable biomass experienced a steep decline from the 1989 till 1996. Biomass is growing since 1998 but at a slow rate until 2003, basically still supported by the biomass of those 1989 and 1990 cohorts and the biomass growth of incoming weak year-classes (1991-1997), that despite their small size survived at much higher rates than their predecessors. Abundance was stable at low level between 1996 and 2001. Over the most recent years biomass and abundance are increasing faster, putting exploitable biomass at a level only surpassed in 1989 and 1990 and abundance at the beginning of 2009 on the maximum of the assessment interval.

Spawning stock biomass (Fig. 7.4 and 7.5): Female SSB is growing continuously from 1998 onwards and has reached the level of the early 1990s.

Recruitment (Fig. 7.5 and 7.6): Since 2002 recruitment at age 4 has been above the 1985-2004 average. Meanwhile recruits per thousand tons of SSB have increase substantially and these above-average year-classes are being generated by parental female stock with biomass sizes well below the ones that produced the previous abundant 1989-1990 cohorts.

Fishing Mortality (Fig. 7. 4): High commercial catches, at an historical maximum level between 1989 and 1993, led to high fishing mortalities through the first half of the 1990s. Between 1996 and 1997 fishing mortality dropped and since then has been kept at a low level.

These trends from the XSA don't change the perception of previous assessments that this is still an unbalanced stock strongly leaning to the younger age groups, and that female spawning stock biomass should be allowed to recover to the former 1989-1990 level in order to stabilize the stock and the fishery at a safe zone.

e) Reference Points

No updated information on biological reference points was available.

f) Research Recommendations

STACFIS reiterated its **recommendation** that *an update of the Div. 3M redfish bycatch information be compiled on an annual basis, including the estimated weights and numbers of redfish caught annually in the Div. 3M shrimp fishery as well as tables showing their size distribution*.

The next full assessment for this stock is planned to be in 2011.

8. American plaice (*Hippoglossoides platessoides*) in Div. 3M

Interim Monitoring Report (SCR Doc. 09/19; SCS Doc. 09/10, 12, 14)

a) Introduction

A total catch of 68 t was estimated for 2008 (Fig. 8.1).

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

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Recommended TAC	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf
TAC	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf
STATLANT 21A	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1[1]	0.1[1]	
STACFIS	0.1	0.1	0.1	0.1	0.1	0.05	0.05	0.1	0.1	

ndf No directed fishing.
[1]Provisional

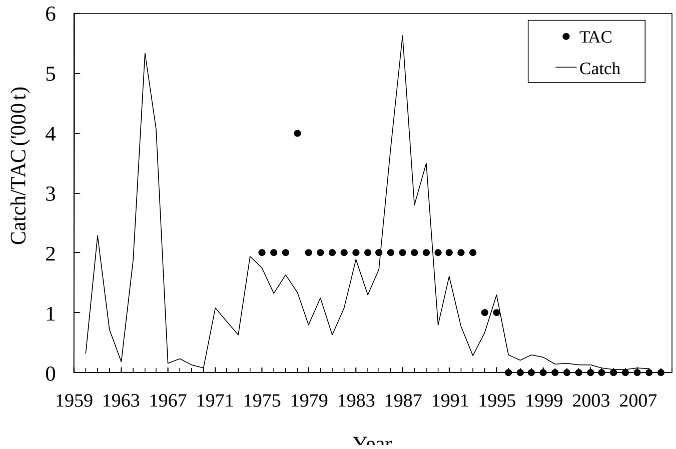

Fig. 8.1. American plaice in Div. 3M: nominal catches and agreed TACs.

b) Data Overview

The EU bottom trawl survey on Flemish Cap was conducted during 2008. The survey estimates remained at low levels as previous years (Fig. 8.2 and 8.3).

Recruitment from 1991 to 2005 was very weak. 2006 year-class for two years consecutively (2007 and 2008) appears to be strong, 2007 year-class strength at age 1 is above those from the 1991-2005 period but only 25% as abundant as the 2006 year-class (SCR Doc. 09/19).

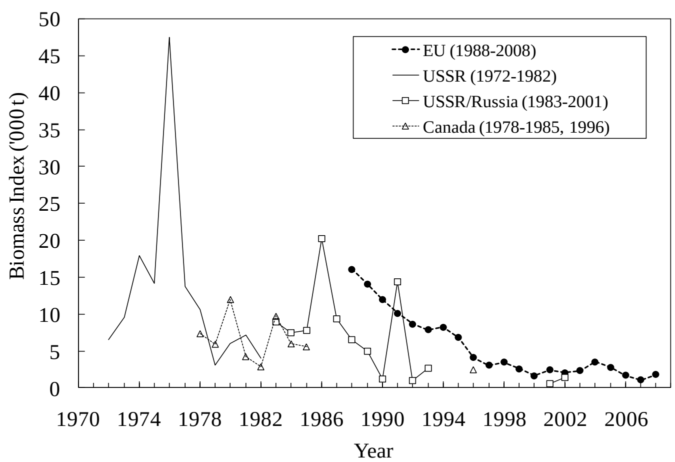

Fig. 8.2. American plaice in Div. 3M: trends in biomass index in the surveys.

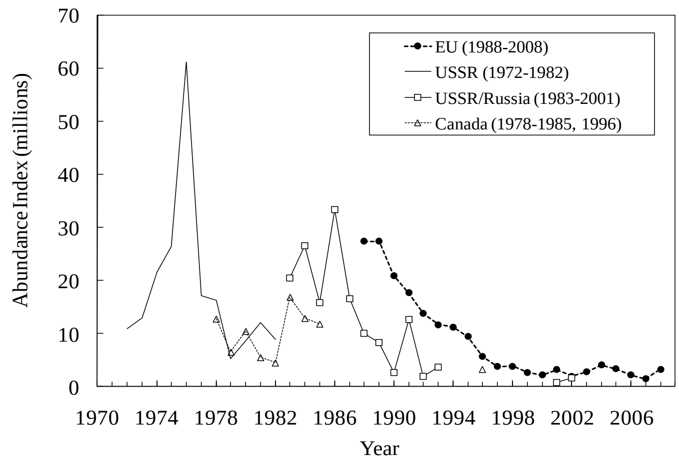

Fig. 8.3. American plaice in Div. 3M: trends in abundance index in the surveys.

c) Conclusion

STACFIS noted that this stock continues to be in very poor condition, with only poor year-classes expected to recruit to the SSB (50% of age 5 and 100% of age 6 plus) for at least three years. Level of catches and fishing mortality since 1992 appear to be relatively low and survey data indicate that the stock biomass and the SSB remained at a very low level. Although there are signs that the stock may be starting to improve, there is no major change to the perception of the stock status.

The next full assessment is expected to be in 2011.

d) Research Recommendations

Average F in recent years has been very low relative to M. Therefore STACFIS reiterates its **recommendation** that *the utility of the XSA must be re-evaluated and the use of alternative methods (e.g. Survey-based models or stock production models) be attempted in the next full assessment of Div. 3M American plaice.*

Because ages below 3 are not well selected in the EU survey series STACFIS also reiterates its **recommendation** that *exploratory runs of the XSA should be done with the input data starting at age 3 or 4*.

C. STOCKS ON THE GRAND BANK: SA 3 AND DIV. 3LNO

Environmental Overview

The water masses characteristic of the Grand Banks are typical Cold-Intermediate-Layer (CIL) sub-polar waters which extend to the bottom in northern areas with average bottom temperatures generally <0^{o}C during spring and through to autumn. The winter-formed CIL water mass is a reliable index of ocean climate conditions in this area. Bottom temperatures increase to 1-4^{o}C in southern regions of 3NO due to atmospheric forcing and along the slopes of the banks below 200 m depth due to the presence of Labrador Slope Water. On the southern slopes of the Grand Banks in Div. 3O bottom temperatures may reach 4-8^{o}C due to the influence of warm slope water from the south. The general circulation in this region consists of the relatively strong offshore Labrador Current at the shelf break and a considerably weaker branch near the coast in the Avalon Channel. Currents over the banks are very weak and the variability often exceeds the mean flow. The proportion of bottom habitat on the Grand Banks covered by <0^{o}C water has decreased from near 50% during the first half of the 1990s to <15% during 2004 and 2006.

The annual surface temperatures at Station 27 have been above normal since 2002, reaching a 61-year high in 2006, decreased below normal in 2007, and increased significantly in 2008 to 1°C above normal. Bottom temperatures at Station 27 remained above normal for the 13th consecutive year. Surface summer salinities at Station 27 were above normal for the 7th consecutive year, by 0.35 in 2008.

Bottom temperatures during the spring of 2008 remained slightly above normal on the Grand Banks (3LNO). The area of bottom on the Grand Banks covered by <0°C water during the spring decreased from near 60% in 1991 to <5% in 2004 but increased to near-normal at about 30% in 2007-08. The summer CIL area on the Grand Bank was below normal for the 11th consecutive year (1998-2008) and along the southeast Grand Bank section the spring CIL area was above normal, similar to 2007.

9. Cod (*Gadus morhua*) in NAFO Div. 3NO

Interim Monitoring Report (SCR Doc. 09/9; SCS Doc. 09/5, 9, 12, 13, 14)

a) Introduction

The cod stock in Div. 3NO has been under moratorium to directed fishing both inside and outside the Regulatory Area since February 1994. Catches increased steadily from the implementation of the moratorium to 2003 (Fig 9.1). The total catch of cod for 2008 in Div. 3NO from all fisheries was estimated to be 921 t.

The Fisheries Commission (FC Doc. 07/8) rebuilding plan for Div. 3NO cod states that for 2008 and subsequent years, Contracting Parties shall seek to achieve a targeted reduction of 40% from the average annual catch during the 2004-2006 period or, through best efforts, specifically to keep incidental bycatch at the lowest possible level. The catch for 2008 did not decrease from 2007 and is above the average for the 2004-2006 period.

Recent nominal catches and TACs ('000 t) are as follows:

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Recommended TAC	ndf	ndf	Ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf
STATLANT 21A	0.5	0.9	1.2	1.6	0.8	0.6	0.3	0.6[1]	0.6[1]	
STACFIS	1.1	1.3	2.2	4.3-5.5[2]	0.9	0.7	0.6	0.9	0.9	

[1] Provisional.
[2] STACFIS could not precisely estimate the catch. Figures are the range of estimates.
ndf No directed fishery and bycatches of cod in fisheries targeting other species should be kept at the lowest possible level.

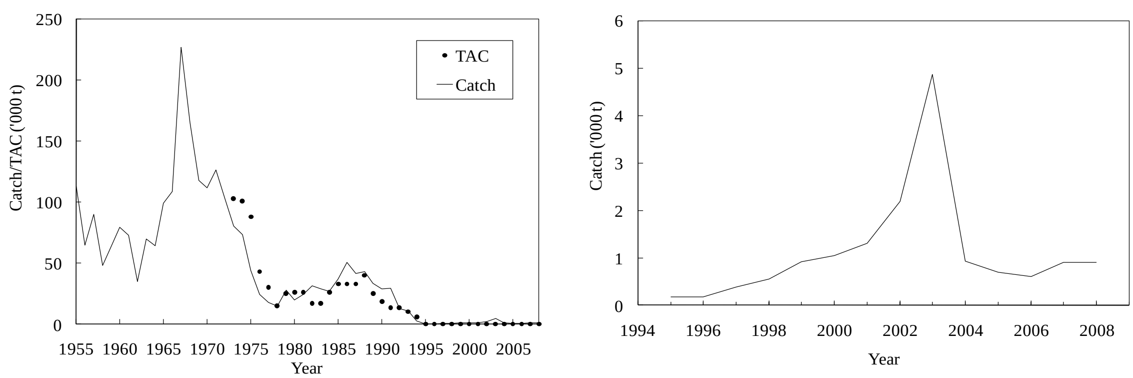

Fig. 9.1. Cod in Div. 3NO: total catches and TACs. Panel at right highlights catches during the moratorium on directed fishing.

b) Data Overview

Canadian stratified-random bottom trawl surveys. Stratified-random research vessel surveys have been conducted in **spring** by Canada in Div. 3N during the 1971-2008 period, with the exception of 1983, and in Div. 3O for the years 1973-2008 with the exception of 1974 and 1983. Survey coverage of Div. 3NO in 2006 was poor and the results are not considered to be representative of stock size. A new survey trawl (Campelen 1800) was introduced to the Canadian survey starting with the autumn 1995 survey. The survey time series was converted to Campelen equivalents from 1984 to spring 1995.

The Canadian spring mean number per tow series declined from 1984 to 1989, with the exception of 1987, when the largest value in the time series was observed. The 1991 and 1993 spring surveys indicated increased catches of cod. Over the period from 1994 to 1997, the Canadian spring indices were the lowest observed in the series, showed improvement from 1998 to 2000 then subsequently declined to 2004. The 2008 and 2007 survey estimates are the highest since 1993. However the indices are still at a very low level compared to earlier in the time series (Fig. 9.2). Both the 2007 and 2008 surveys show the 2005 and 2006 year-classes to be stronger than cohorts seen since the early 1990s.

Stratified-random surveys have been conducted by Canada during autumn since 1990. A new survey trawl (Campelen 1800) was introduced to the Canadian survey starting with the autumn 1995 survey. The survey time series was converted to Campelen equivalents from 1990 to autumn 1994. Results from 1990 to 1992 surveys were the largest in the time series (Fig 9.2). The trend since 1993 is similar to the spring series. The period from 1996-1997 was the lowest in the series showing an increase to 2000 then a subsequent decline to 2004. The 2008 survey estimate is lower than the 2007 survey but is still the second highest since 1992. However survey estimates are still at a very low level compared to earlier in the time series (Fig. 9.2). Both the 2007 and 2008 surveys show the 2005 and 2006 year-classes to be stronger than cohorts seen since the early 1990s.

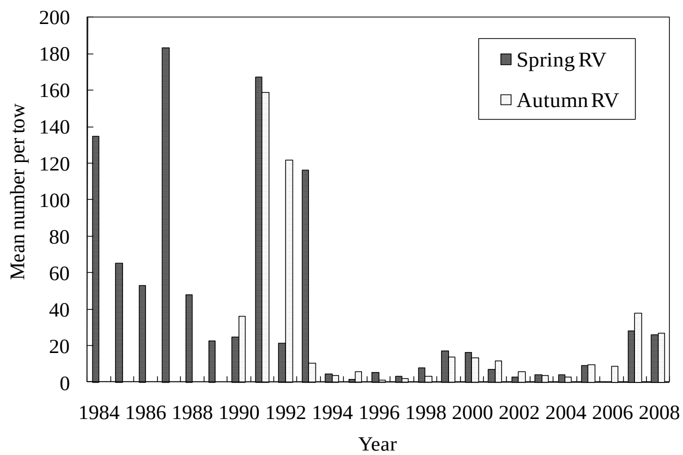

Fig. 9.2. Cod in Div. 3NO: mean number per tow from Canadian spring and autumn research surveys.

Survey by EU-Spain. Stratified-random surveys were conducted by Spain in the NRA area of Div. 3NO in June from 1995-2008 to a maximum depth of 1 462 m (since 1998). The series began utilizing a Pedreira trawl on the C/V *Playa de Menduiña* then converted to a Campelen 1800 trawl on the R/V *Vizconde de Eza* in 2001. The 1997-2000 data were converted into Campelen units by modeling data collected during comparative fishing trials in 2001. The data for 1995-1996 are not presented because the deeper strata in the area of coverage were not sampled.

The time series has been quite variable with no clear trend (Fig. 9.3). The estimate from the 2008 survey is the highest in the time series. The 2006 and 2005 year-classes appear strong compared to most previous cohorts in the survey by EU-Spain for 2008.

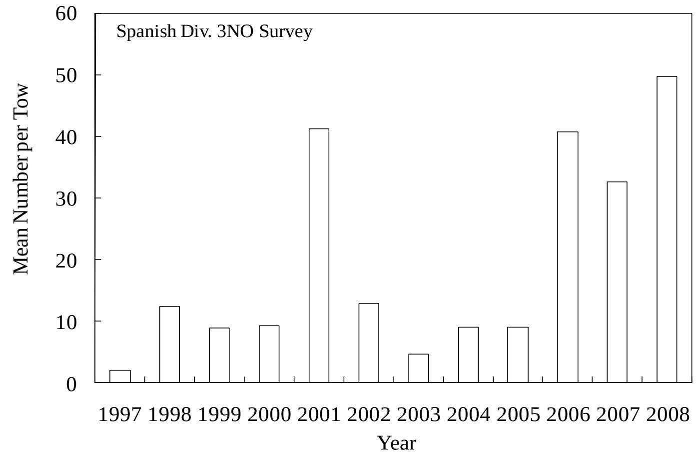

Fig. 9.3. Cod in Div. 3NO: mean number per tow from EU-Spain spring surveys.

c) Conclusion

In 2007 STACFIS concluded that the total biomass and spawning biomass were estimated to be at extremely low levels. Despite evidence of improved recruitment, recent values of survey indices are not considered to indicate a significant change in the status of the stock relative to B_{lim}.

The next full assessment of this stock is planned to be in 2010.

10. Redfish (*Sebastes mentella* and *Sebastes fasciatus*) in Div. 3LN

Interim Monitoring Report (SCS Doc. 09/5, 9, 10, 14)

a) Introduction

There are two species of redfish that have been commercially fished in Div. 3LN, the deep-sea redfish *(Sebastes mentella)* and the Acadian redfish *(Sebastes fasciatus*). The external characteristics are very similar, making them difficult to distinguish, and as a consequence they are reported collectively as "redfish" in the commercial fishery statistics.

The average 1959-1985 reported catch from Div. 3LN was about 22 000 t, ranging between 10 000 t and 45 000 t. Catches increased sharply to a 1987 high of 79 000 t and fell steadily afterwards to 450 t in 1996. Catch increased to 900 t in 1998, the first year under a moratorium on directed fishing, with a further increase to 2 600 t in 2000. Catches declined gradually in 2001-2003 and stabilized in 2004-2005 at 650 t level. Catch almost reached the historic low level in 2006 with 496 t, recorded over a three times fold increase in 2007 with 1 664 t, but drop again in 2008 to 600 t.

Recent nominal catches and TACs ('000 t) for redfish are as follows:

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Recommended TAC	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf
TAC	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf
STATLANT	1.5	0.9	1.0	1.3	0.7	0.7	0.2	0.2	0.4	
STACFIS	3.1	1.4	1.2	1.3	0.6	0.7	0.5	1.7	0.6	

[1] No directed fishing.

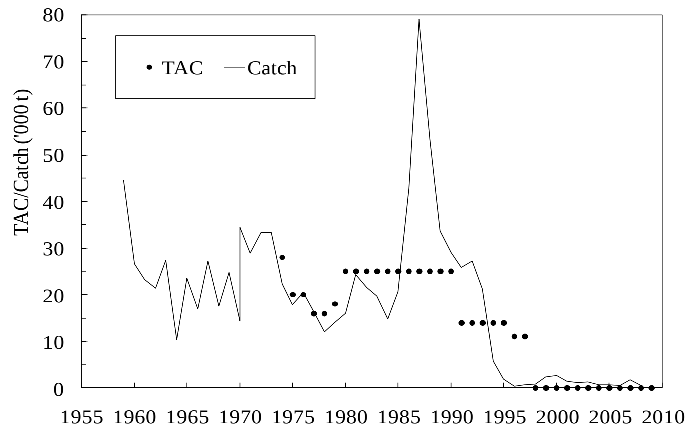

Fig. 10.1. Redfish in Div. 3LN: catches and TACs.

b) Data Overview

i) Research surveys

Results of bottom trawl surveys for redfish in Div. 3LN indicated a considerable amount of variability. From 1978 onwards several stratified-random bottom trawl surveys have been conducted by Canada in various years and seasons in Div. 3L and in Div. 3N. Since 1991 two Canadian series of annual stratified-random surveys covered both Div. 3L and Div. 3N on a regular annual basis: a spring survey (May-Jun) and an autumn survey (Sep-Oct in Div. 3N and Nov-Dec in Div. 3L for most years). No survey was carried out in spring 2006 on Div. 3N.

Since 1983 Russian bottom trawl surveys in Div. 3LMNO turn to stratified-random, following the Canadian stratification for Sub area 3. On 1995 the Russian bottom trawl series in SA 3 was discontinued.

Div. 3L and Div. 3N biomass indices from Canadian spring and autumn surveys have been combined to give a picture of their relative sizes for this redfish management unit as a whole. In order to smooth the wide inter annual variability of the indices, turn the survey series comparable and facilitate the detection of trends within stock dynamics, the available survey biomass series was standardized (difference between each observation and the mean scaled to the standard deviations of the series) and so presented on Fig. 10.2.

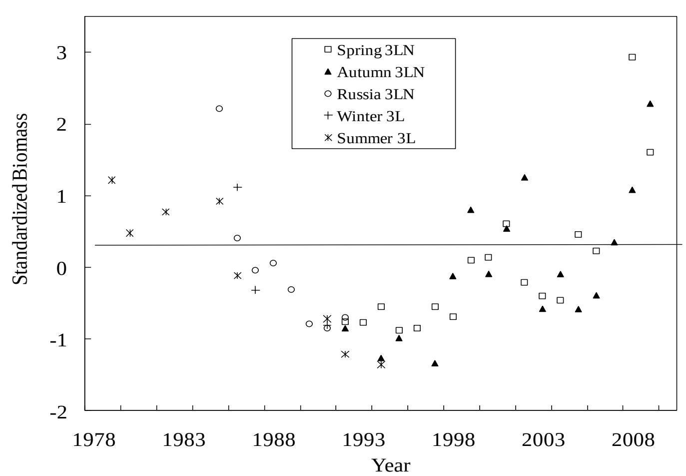

Fig. 10.2. Redfish in Div. 3LN: standardized survey biomass (1978-2008).

From the mid-1980s to the beginning of the 1990s, when catches quickly raised from a previous average level of 21 000 t (1965-1985) to a much higher level of 41 500 t (1986-1992), Canadian survey data in Div. 3L and Russian bottom trawl surveys in Div. 3LN suggests that stock size suffered a substantial reduction. Redfish survey biomass in Div. 3LN remained bellow the average level until 1998 and increase to above average level afterwards. A punctual decline is observed in 2002-2004, followed by a consistent increase of the remaining biomass indices over the most recent years.

b) Estimation of Stock Parameters

i) Relative exploitation

Ratios of catch to spring survey biomass were calculated for Div. 3L and Div. 3N combined and are considered a proxy of fishing mortality. Spring survey series was chosen since is usually carried out on Div. 3L and Div. 3N during May till the beginning of June, and so can give an index of the average biomass at the middle of each year. The Div. 3LN STACFIS catch was used together with a spring survey biomass series smoothed by 3-year interval moving averages (Fig. 10.3).

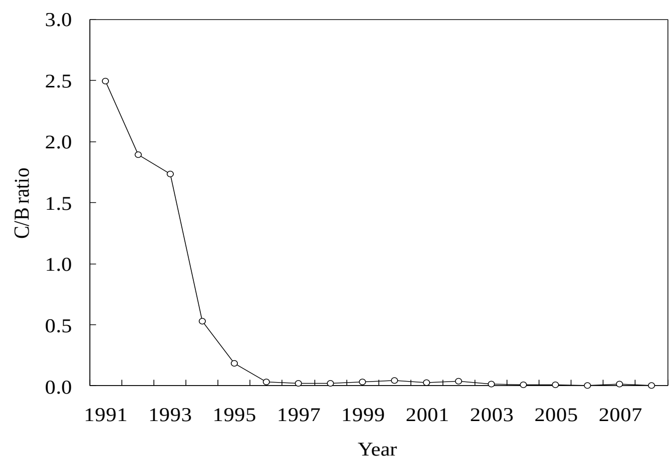

Fig. 10.3. Redfish in Div. 3LN: C/B ratio using STACFIS catch and Canadian spring survey biomass (moving average biomass, 1991-2008).

Catch/Biomass ratio declined continuously from 1991 to 1996, with a dramatic drop between 1993 and 1994. From 1996 onwards this proxy of fishing mortality is kept at a level close to zero.

c) Conclusions

There is nothing to indicate a change in the status of the stock. Recent levels of catches have not altered the upward trend of the stock, as shown by both spring and autumn surveys.

The next full assessment of this stock is planned for 2010.

STACFIS **recommended** that *an update of the Div. 3L redfish bycatch information from the shrimp fishery be compiled on an annual basis, including the estimated weights and numbers of redfish caught annually as well as their size distribution.*

11. American plaice (*Hippoglossoides platessoides*) in Div. 3LNO

(SCS Doc. 09/2, 5, 9, 12, 14; SCR Doc. 09/8, 23, 35, 36)

a) Introduction

This fishery has been under moratorium since 1995. Total catch in 2007 was 3 606 t, and in 2008 was 2 515 t, mainly taken in the Regulatory Area (Fig. 11.1). Catch increased from 1995 to 2003 and then decreased.

Recent nominal catches and TACs ('000 t) are as follows:

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Recommended TAC	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf
STATLANT 21A	2.6	3.0	3.1	3.8	2.9	2.3	0.9	1.0[1]	1.9[1]	
STACFIS	5.2	5.7	4.9	6.9-10.6[2]	6.2	4.1	2.8	3.6	2.5	

[1] Provisonal
[2] In 2003, STACFIS could not precisely estimate catch
ndf No directed fishing

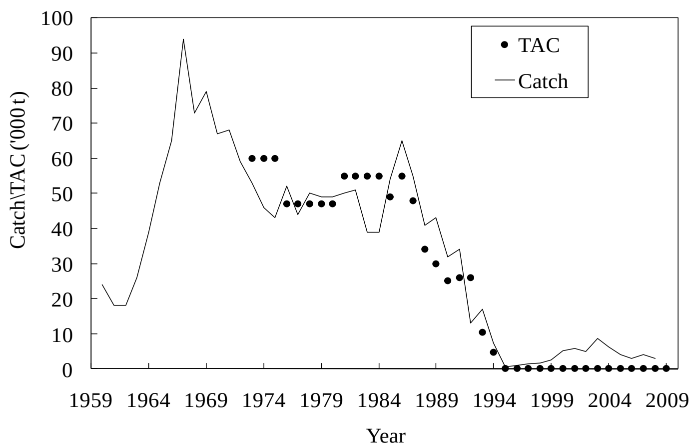

Fig. 11.1. American plaice in Div. 3LNO: catches and TACs.

b) Input Data

i) Commercial fishery data

Catch and effort. There were no recent catch per unit effort data available.

Catch-at-age. There was age sampling of the 2007 and 2008 bycatch in the Canadian fishery and length sampling of bycatch in the Canadian, Spanish and Russian fisheries. In 2008 there was also length sampling from Estonian fisheries. There was only one length frequency sample of bycatch from the Portuguese fishery in 2008; the Russian sampling was applied to the Portuguese catch to get a catch-at-age. Catch-at-age in the Canadian bycatch was mainly age 7 to 11 with a peak at age 8 in 2007 and 9 in 2008. In 2007, the Canadian catch of A. plaice was 434 t and in 2008 it was 878 t.

In 2007 catches from the Spanish and Russian bycatch for Div. 3LNO were made up of fish mainly between 38-42 cm in length. The Portuguese fleet was dominated by slightly smaller fish, with a large peak in length at 35 cm. There were more large fish (>50 cm) in the bycatch of the Spanish and Russian fleets than in the Portuguese catch.

In 2008, the peak in length for the Spanish trawler fleet was 44 cm, with some smaller peaks at 51 and 56 cm, whereas the Russian catch was dominated by fish 40 cm.

Total catch-at-age for 2007 and 2008 was produced by applying Canadian survey age-length keys to length frequencies collected each year by countries with adequate sampling and adding it to the catch-at-age calculated for Canada. This total was adjusted to include catch for which there were no sampling data. Overall, ages 7-10 dominated both the 2007 and 2008 catches.

ii) Research survey data

Canadian stratified-random bottom trawl surveys. Data from **spring surveys** in Div. 3LNO were available from 1985 to 2008. Surveys prior to 1991 generally had a maximum depth of 366 m. From 1991 to 2008, the depth range has been extended to at least 731 m in each survey. The spring survey from 2006 did not adequately cover many of the strata in Div. 3NO and therefore results were not reliable.

In the spring survey, the 2007 and 2008 the biomass (mean weight per tow) estimates for Div. 3LNO continue the increasing trend overall since the mid-1990s. Prior to 2004, the estimate of biomass for Div. 3N was either less or approximately equal to the estimate of Div. 3O. However, from 2005 onwards the biomass estimate from Div. 3N has been at least double the biomass estimate from Div. 3O. Biomass in Div. 3LNO combined in 2008 was the highest it has been since 1996 but is still only 32% (Campelen estimates compared to Campelen equivalents) of that of the mid-1980s (Fig. 11.2).

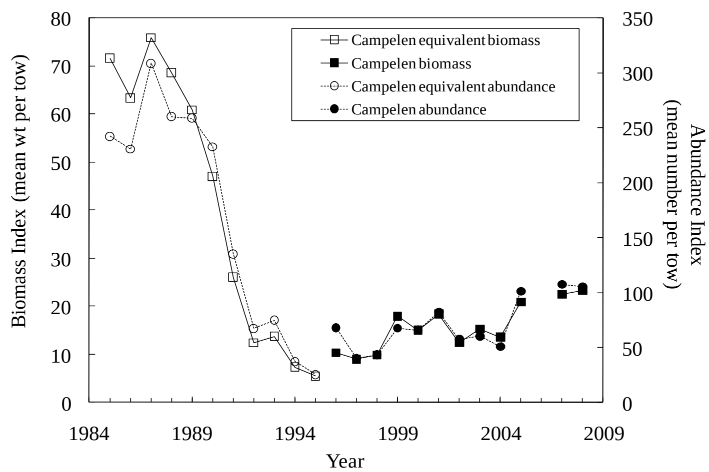

Fig. 11.2. American plaice in Div. 3LNO: biomass and abundance indices from Canadian spring surveys.

Abundance (mean number per tow) for Div. 3LNO declined during the late 1980s-early 1990s. Abundance has fluctuated since 1996 with a slight increase over the period (Fig. 11.2). As with the biomass estimate, mean number per tow has shown the greatest decline in Div. 3L. The proportion of fish that are ages 0 to 5 has been increasing and in recent years remain amongst the highest in the time series. However, these ages are probably ‘under converted’ to varying degrees in the 1985 to 1995 data.

There is no conversion of the Canadian spring and autumn survey data series to Campelen equivalents prior to 1985. However, the index from the spring survey using Engel-equivalent data indicates that the biomass level in the mid-1980s was slightly lower than that in the late-1970s (Fig. 11.3).

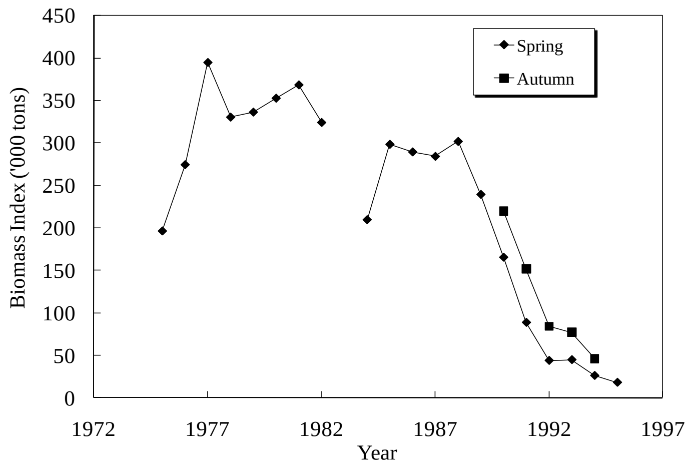

Fig 11.3.American plaice in Div. 3LNO: biomass index as swept area estimates from Canadian spring and autumn surveys using Engel and Engel equivalent units.

In 2004, coverage of strata from Div. 3L in the Canadian **autumn survey** was incomplete, and results were not used in the 2009 assessment. This point was examined with respect to abundance at age by stratum to evaluate the importance of the missing strata to the overall index was found to significantly change the age composition for that data point.

From Canadian **autumn surveys** the biomass (mean weight per tow) index for Div. 3LNO in the autumn has shown an increasing trend since 1995 but remains well below the level of the early 1990s with the average of the 2008 estimate being 50% of that of 1990 (Fig. 11.4). The 2008 value is the highest since 1991. Mean weight-per-tow showed the largest decline in Div. 3L but has been fairly stable since the late 1990s. During 1995 to 1997, Div. 3N constituted on average 40% of the Div. 3NO total while the average since 2000 has been about 70% of the Div. 3NO total.

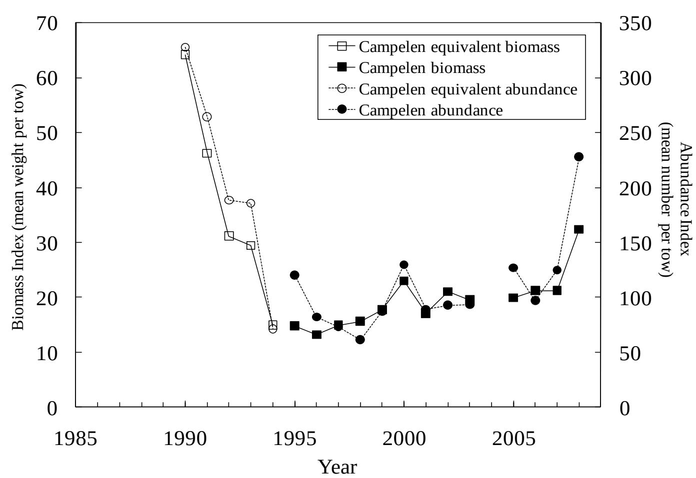

Fig. 11.4. American plaice in Div. 3LNO: biomass and abundance indices from autumn surveys.

Abundance showed a substantial decline from 1990 to 1998, mainly in Div. 3L, but has been increasing since 1998 (Fig. 11.4). The 2008 value is the highest since 1991. The age composition has been fairly stable over the 1990-2008 time period.

Spanish Div. 3NO Survey. From 1998-2008, surveys have been conducted annually by EU-Spain in the Regulatory Area in Div. 3NO to a maximum depth of 1 462 m. In 2001, the trawl vessel (CV *Playa de Menduiña*) and gear

(*Pedreira*) were replaced by the RV *Vizconde de Eza* using a *Campelen* trawl. Annual Canadian spring RV age length keys were applied to Spanish length frequency data (separate sexes, mean number per tow) to get numbers at age except in 2006 where there were problems with the Canadian spring survey and the combined 1997-2005 age length keys were applied to the 2006 data. The age composition for this survey was similar to the Canadian RV spring survey. There has been a general increase in this index for both biomass and abundance since the beginning of the time series (Fig. 11.5).

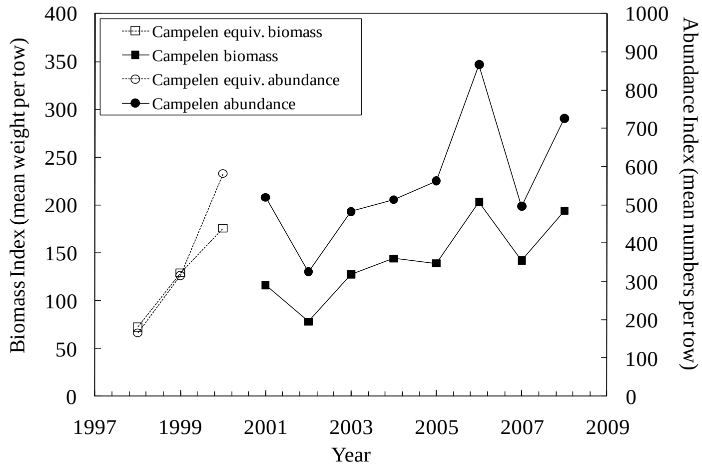

Fig. 11.5. American plaice in Div. 3LNO: biomass and abundance indices from the Spanish Div. 3NO survey.

iii) Biological studies

Maturity. Age (A_{50}) and length (L_{50}) at 50% maturity were produced from spring research vessel data. For males, A_{50} were fairly stable for cohorts of the 1960s to mid-1970s, with perhaps a slight increase over that time period. Male A_{50} then began a fairly steady decline to the 1991 cohort which had an A_{50} of just over 3 years. Male A_{50} is still below the 1960s and 1970s with an A_{50} of about 4 years compared to 6 years at the beginning of the time series. For females, estimates of A_{50} have shown a large, almost continuous decline, since the beginning of the time series. For females the A_{50} for recent cohorts is about 7 years compared to 11 years for cohorts at the beginning of the time series.

L_{50} declined for both sexes but recovered in recent cohorts. The current L_{50} for males of 18 to 19 cm is 3 to 4 cm lower than the earliest cohorts estimated. The L_{50} of most recent cohorts for females is in the range of 34-35 cm, somewhat lower than the 39 cm of the earliest cohorts.

Size-at-age. Mean weights-at-age and mean lengths-at-age were calculated for male and female American plaice for Div. 3LNO using spring survey data from 1990 to 2008, except for 2006 when survey coverage was too poor to be considered representative. Means were calculated accounting for the length stratified sampling design. Although there is variation in both length and weight-at-age there is little indication of any long-term trend for either males or females.

Mortality from surveys. Estimates of total mortality (Z) from the Campelen or equivalent, spring and autumn survey data were calculated for ages 1 to 16. The spring survey indicates an increase in mortality up to the mid-1990s for most ages. This trend is also in the autumn data but is not as evident. Mortality declined after the mid-1990s in both surveys. This was followed by an increase in the early 2000s. In both surveys, estimates are lower in the last few years for most ages.

c) Estimation of Parameters

Virtual population analysis (VPA) was conducted using the ADAPTive framework based on the 2007 formulation with catch-at-age and survey information from the following:

Catch at age (1960-2008) (ages 5-15+);
Canadian spring RV survey (1985-2008) (no 2006 value) (ages 5-14);
Canadian autumn RV survey (1990-2007) (no 2004 value) (ages 5-14); and
Spanish Div. 3NO survey (1998-2008) (ages 5-14).

Both Canadian RV autumn 2004 and spring 2006 survey data points were removed from the assessment due to incomplete coverage in both surveys. The Canadian autumn 2008 survey data has not been used in the assessment because age data was not available.

There was a plus group at age 15 in the catch-at-age and the ratio of *F* on the plus group to *F* on the last true age was set at 1.0. *M* was assumed to be 0.2 on all ages except 0.53 on all ages from 1989 to 1996 (NAFO, 2001; 2008).

d) Assessment Results

The VPA analyses showed that population abundance and biomass declined fairly steadily from the mid-1970s to 1995. Biomass and abundance have been increasing over the last number of years (Fig 11.6). Average *F* on ages 9 to 14 showed an increasing trend from about 1965 to 1985. There was a large unexplained peak in *F* in 1993. *F* increased from 1995 to 2001 and has since declined (Fig. 11.7).

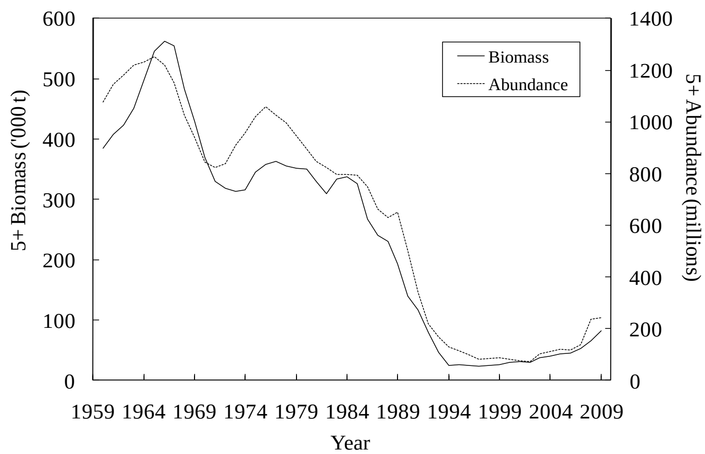

Fig. 11.6. American plaice in Div. 3LNO: population abundance and biomass from VPA

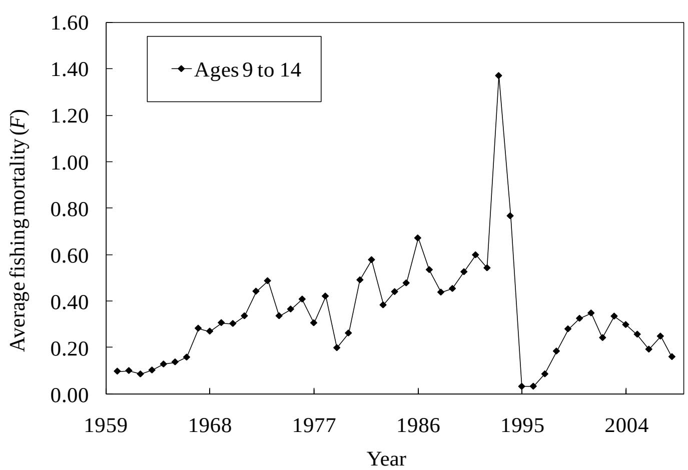

Fig. 11.7. American plaice in Div. 3LNO: average fishing mortality from VPA.

Spawning stock biomass has shown two peaks, one in the mid-1960s and another in the early to mid-1980s. It declined to a very low level (less than 10 000 t) in 1994 and 1995 (Fig. 11.8). Since then the SSB has been increasing, reaching about 41 000 t in the current year. Recruitment has been generally poor for the past two decades; however, the 2003 year-class is the largest since the 1985 year-class (Fig. 11.8).

Biomass: The biomass is very low compared to historic levels.

Spawning stock biomass: SSB has been increasing since 1995, and reached 41 000 t in 2009. B_{lim} for this stock is 50 000 t.

Recruitment: Estimated recruitment at age 5 indicates that the 2003 year-class is the largest since the 1985 year-class.

Fishing mortality: From 1995-2003, the average fishing mortality on ages 9 to 14 increased but since then has declined.

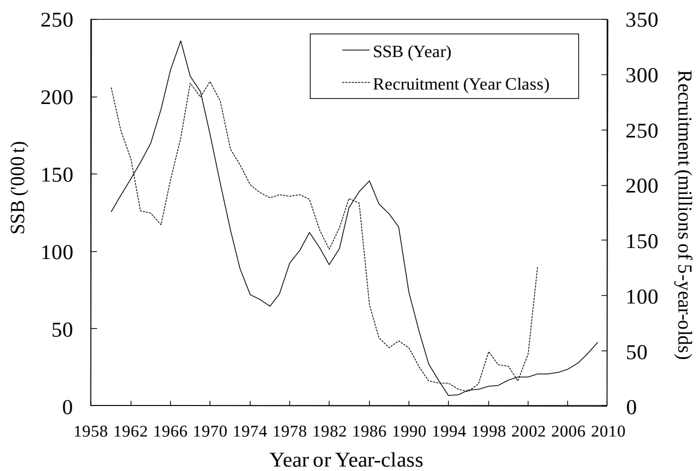

Fig. 11.8. American plaice in Div. 3LNO: spawning stock biomass and recruitment from VPA.

Retrospective patterns: A five year retrospective analysis was conducted by sequentially removing one year of data from the input data set (Fig. 11.9). There is little retrospective pattern evident in the analysis.

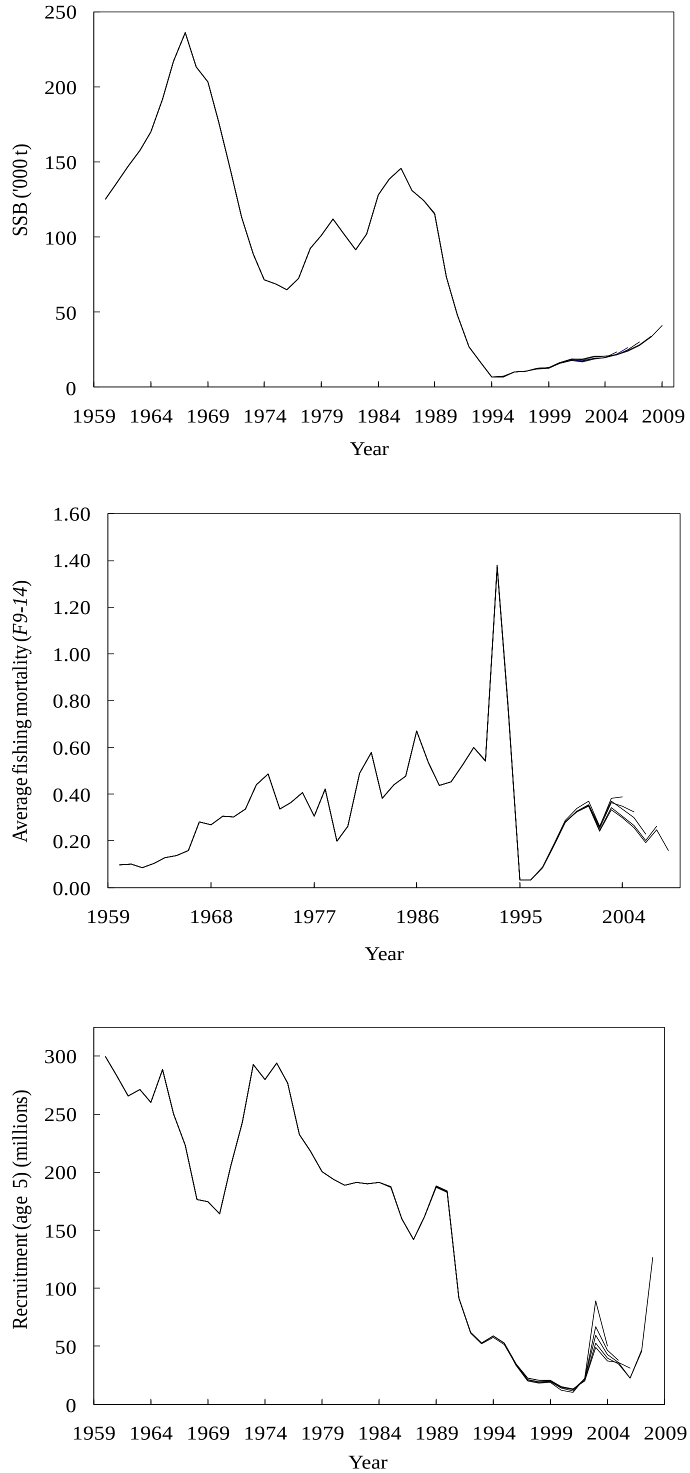

Fig 11.9 American plaice in Div. 3LNO: retrospective analysis of SSB, average *F* (ages 9-14) and recruitment (age 5).

e) Precautionary Reference Points

An examination of the stock recruit scatter shows that good recruitment has been rarely been observed at SSB below 50 000 t, with the possible exception of the 2003 year-class (Fig. 11.10) which is therefore the best estimate of B_{lim}. The current estimate of biomass (41 000 t) is approaching B_{lim}.

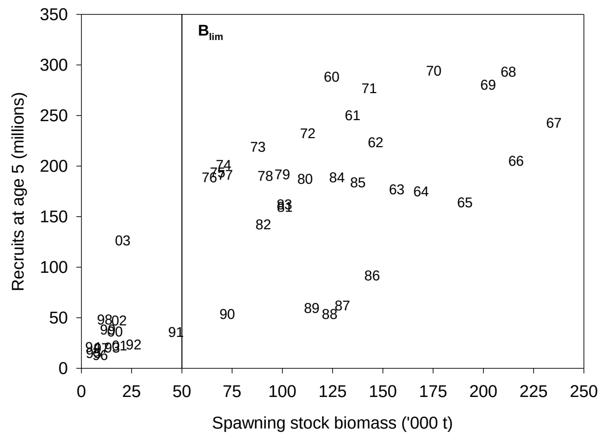

Fig. 11.10. American plaice in Div. 3LNO: stock recruit scatter. The vertical line is B_{lim}.

There is currently no F_{lim} for Div. 3LNO American plaice. Analyses were conducted to evaluate the impact of choice of stock recruit model (S/R) and partial recruitment vector (PR) on estimates of F_{msy}. Four S/R models (Beverton-Holt, Ricker, Segmented Regression and Loess smoother) were fitted to the S/R data for this stock derived from the 2007 assessment. Three different PR were also used which captured the range of PR observed over the history of the stock. These were the average of 2005-2007 (most recent 3 years), average over all years and the average of 1997-1999, a period when the PR was quite different from that during the rest of the stock history. All PR vectors were rescaled to the average over ages 9-14. Maturity and weights-at-age were the average of the 3 years prior to the last assessment. Settings were as follows:

Age	weight	maturity	PR recent 3 years	PR all years	PR 1997-1999
5	0.141	0.03	0.015	0.035	0.006
6	0.255	0.15	0.07	0.103	0.0465
7	0.38	0.5	0.18	0.244	0.193
8	0.489	0.82	0.39	0.417	0.497
9	0.582	0.95	0.79	0.625	0.767
10	0.699	0.99	0.99	0.767	0.898
11	0.863	1	1.13	0.969	1.333
12	1.001	1	1.07	1.145	1.289
13	1.213	1	1.05	1.206	1.132
14	1.493	1	0.96	1.288	0.58
15	1.908	1	0.96	1.288	0.58

The estimated F_{msy} varied from 0.19 to 1.03, however this variation was mainly the result of the difference in the S/R curve. For a given S/R model there was little variation across PR with regard to $F_{msy.}$

Estimates of F_{msy} for different S/R models and PR vectors.

PR/SR	Loess	Ricker	Beverton-Holt	Segmented
Recent 3 years	0.42	0.31	0.2	1.03
All years	0.41	0.3	0.19	0.93
1997 to 1999	0.47	0.32	0.21	1.01

Preliminary investigations indicate that the Loess smoother gives the best fit to the S/R data and the best prediction of recruitment. F_{msy} using this model ranged from 0.41 to 0.47. This level of F as F_{msy} is consistent with the stock history. STACFIS concluded that a F_{lim} of 0.4 would be a reasonable choice for American plaice in Div. 3LNO.

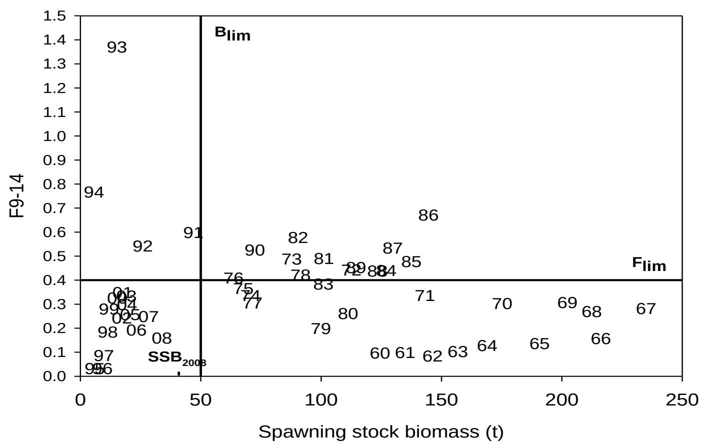

Fig. 11.11. American plaice in Div. 3LNO: stock trajectory within the NAFO PA framework.

f) Short Term Considerations

Projections were limited to 3 years as extended projections are increasingly driven by recruitment assumptions. Deterministic projections were carried out for 3 years to examine the trajectory of the spawning stock biomass, 5+ biomass, and catch under 3 scenarios of fishing mortality: $F = 0$, $F = F_{2008}$ (0.16) and $F = F_{0.1}$ (0.2). F_{max} is difficult to determine for this stock and highly labile but since STACFIS has been able to determine F_{lim} (0.4), projections were provided for that limit reference point as well.

F_{2008} was set as the average F on ages 9-14 for 2008 and was 0.16. PR and weights were averaged over the last 3 years. Recruitment was the average R/S for the last 3 year-classes and was equal to 3.21. The assumed recruit values have been considerably higher in recent years (especially for 2008) and thus the assumed recruitment value used in projections is higher than in 2007 projections. In addition the following values were used:

Age		5	6	7	8	9	10	11	12	13	14	15+
M		0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
PR		0.01	0.03	0.14	0.20	0.36	0.54	0.87	1.27	1.40	1.55	1.55
Stock Weight		0.15	0.24	0.35	0.47	0.58	0.68	0.84	1.06	1.22	1.43	1.42
Maturities												
	2010	0.036	0.114	0.317	0.632	0.470	0.985	0.987	0.994	0.999	1.000	1.000
	2011	0.036	0.114	0.317	0.632	0.866	0.834	0.997	0.997	0.998	1.000	1.000
	2012	0.036	0.114	0.317	0.632	0.866	0.960	0.992	0.999	0.999	0.999	1.000

The outcomes of these projections are in the following tables.

	SSB ('000 t)			
Year	F=0	F_{2008} = 0.16	$F_{0.1}$ = 0.2	F_{lim} = 0.4
2010	55	52	51	47
2011	73	65	63	55
2012	91	76	73	61

	Biomass ('000 t)			
Year	F=0	F_{2008} = 0.16	$F_{0.1}$ = 0.2	F_{lim} = 0.4
2010	100	96	93	91
2011	119	110	108	99
2012	139	123	120	108

	Catch (t)			
Year	F=0	F_{2008} = 0.16	$F_{0.1}$ = 0.2	F_{lim} = 0.4
2010	0	5640	6756	11058
2011	0	6657	7795	11611
2012	0	7857	9050	12746

The stock is estimated to increase and will likely surpass B_{lim} by 2010 under all fishing mortality scenarios considered (except for F_{lim}) (Fig. 11.12).

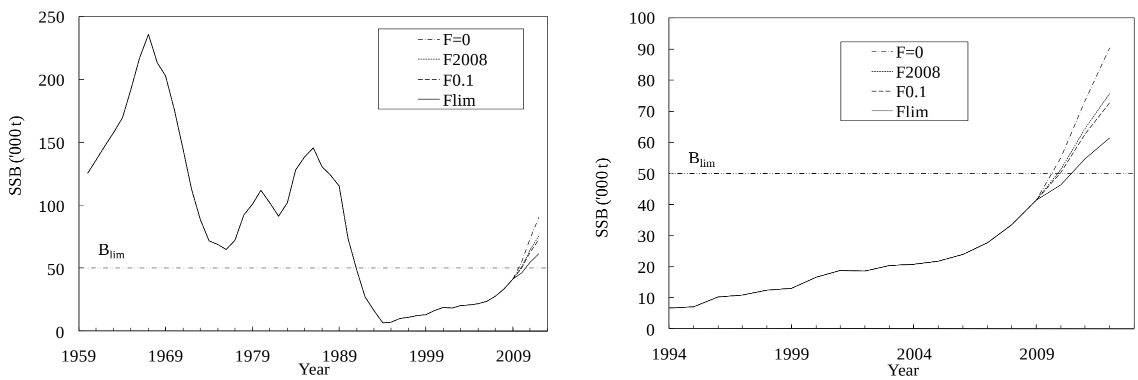

Fig. 11.12. American plaice in Div. 3LNO: projected spawning stock biomass at *F*=0, $F_{0.1}$, F_{2008} and F_{lim}.

The next full assessment of this stock is expected to be in 2011.

12. Yellowtail flounder (*Limanda ferruginea*) in Div. 3LNO

SCR Doc. 09/9, 12, 31, 32; SCS Doc. 09/5, 9, 12, 13

a) Introduction

Since the fishery re-opened in 1998, catches have increased from 4 400 t to 14 100 t in 2001 (Fig 12.1). Catches since then have ranged from 11 000 to 14 000 t, except in 2006 and 2007, when catches were well below the TACs due to corporate restructuring and a labour dispute in the Canadian fishing industry. In 2008, the catch was 11 400 t, close to the 2000-2005 average.

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

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Recommended TAC	10.0	13.0	13.0	14.5	14.5	15.0	15.0	15.5	15.5	< 85% F_{msy}[3]
TAC	10.0	13.0	13.0	14.5	14.5	15.0	15.0	15.5	15.5	17
STATLANT 21A	10.6	12.8	10.4	13.0	13.4	13.9	0.6	4.4[1]	11.3[1]	
STACFIS	11.0	14.1	10.8	13.5-14.1[2]	13.4	13.9	0.9	4.6	11.4	

[1] Provisional.
[2] In 2003, STACFIS could not precisely estimate the catch.
[3] Scientific Council recommended any TAC up to 85% F_{msy} in 2009 and 2010.

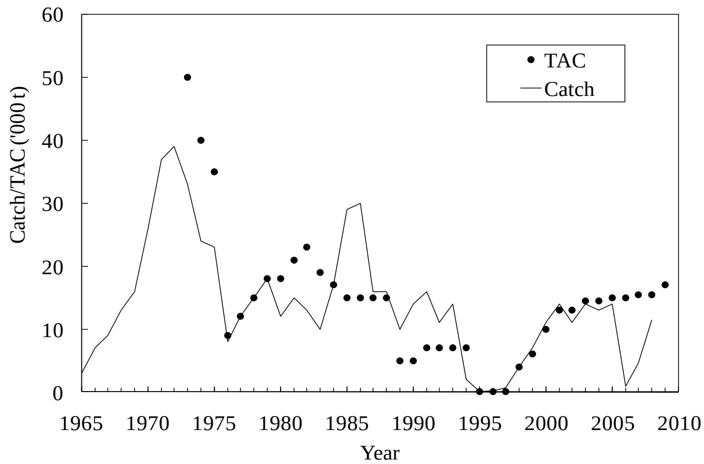

Fig. 12.1. Yellowtail flounder in Div. 3LNO: catches and TACs.

b) Input Data

i) Research survey data

Canadian stratified-random spring surveys (SCR Doc. 09/31). Problems with the Canadian survey vessel resulted in incomplete coverage, particularly in Div. 3N, in the 2006 spring survey, and survey results in that year may not be comparable with those in other years. In 2008, most of the trawlable biomass of this stock continued to be found in Div. 3N. The index of trawlable biomass in 2008 was the highest in the series.

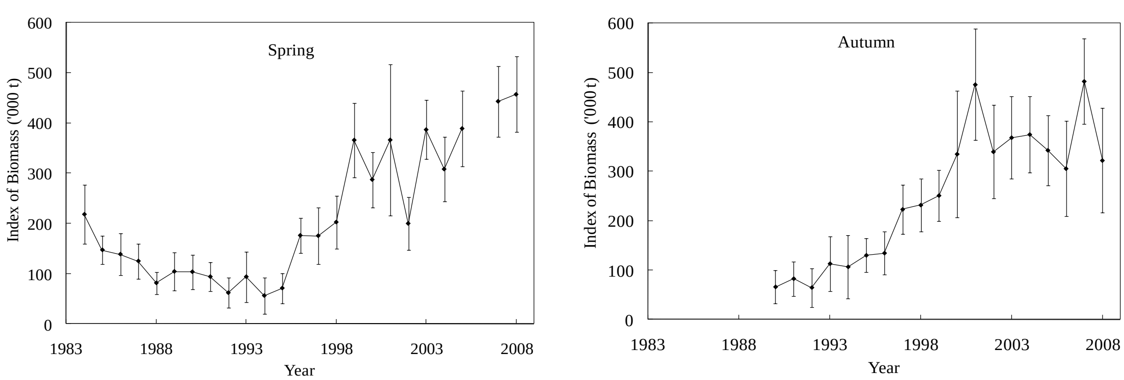

Fig.12.2. Yellowtail flounder in Div. 3LNO: indices of biomass with approx 95% confidence intervals, from Canadian spring and autumn surveys.

Canadian stratified-random autumn surveys (SCR Doc. 09/31). Most of the biomass from the autumn survey in 2008 was found in Div. 3N. The index of trawlable biomass for Div. 3LNO increased steadily from the early 1990s (Fig. 12.2). Following a decline in 2002 from a peak value in 2001, biomass in 2002-2006 remained relatively stable, and then increased to the series high in 2007. In 2008, however, the biomass index decreased to about the 2006 level. Although there was reduced coverage in the 2008 autumn survey, all of the offshore strata in depths less than 184 m were surveyed. Estimates of biomass and abundance, then, for yellowtail flounder, are still comparable to results of previous surveys.

Spanish stratified-random spring surveys in the Regulatory Area of Div. 3NO. (SCR Doc. 09/9) Beginning in 1995, Spain has conducted stratified-random surveys for groundfish in the NAFO Regulatory Area (NRA) of Div. 3NO. These surveys cover a depth range of approximately 45 to 1 464 m. In 2001, extensive comparative fishing was conducted between the old vessel, C/V *Playa de Menduiňa* (using *Pedreira* trawl) with the new vessel, R/V *Vizconde de Eza*, using a Campelen 1800 shrimp trawl as the new survey trawl.

The biomass of yellowtail flounder increased sharply up to 1999, and has been relatively stable from 2000-2008 (Fig. 12.3). The 1995-2002 results are in general agreement with the Canadian spring series for all of Div. 3LNO. Most (81%) of the biomass comes from strata 360 and 376 similar to other years. Length frequencies in the 2006-2008 Spanish surveys showed a peak around 32-34 cm. As in the Canadian spring surveys, this survey shows the same progression of the peak in the length frequencies from 1998 to 2005.

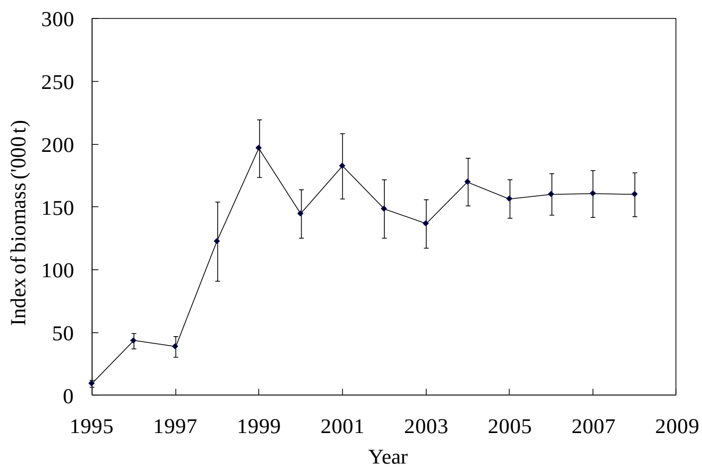

Fig. 12.3. Yellowtail flounder in Div. 3LNO: index of biomass from the Spanish spring surveys in the Regulatory Area of Div. 3NO. Data are in Campelen equivalents ±1SD.

Stock distribution (SCR Doc. 09/31). In all surveys, yellowtail flounder were most abundant in strata on the Southeast Shoal and those immediately to the west (360, 361, 375 and 376), which straddle the Canadian 200 mile limit. Yellowtail flounder appear to be more abundant in the Regulatory Area of Div. 3N in the 1999-2008 surveys than from 1984-1995, and the distribution of the stock has continued to extend northward into Div. 3L, similar to the mid-1980s when overall stock size was also relatively large. The vast majority of the stock was still found in waters shallower than 93 m in both seasons.

Recruitment (SCR Doc. 09/32). Analyses of length composition data indicated a correlation in the total number of juveniles (<22 cm) in the Canadian spring and fall surveys from 1996-2003 which breaks down when 2004-2005 estimates were added. High catches of juveniles in the fall of 2004 and 2005 were not evident in either the Canadian or Spanish spring series (Fig. 12.4). Although no clear trend in recruitment is evident, the number of small fish in the last 3 years was slightly below average in all three surveys.

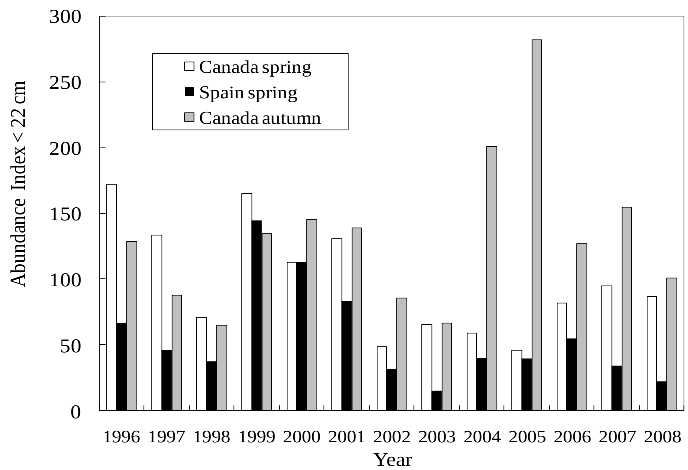

Fig.12.4. Yellowtail flounder in Div. 3LNO: Juvenile length index estimated from 1996 to 2008 annual spring and fall surveys by Canada and annual spring surveys by Spain.

c) Estimation of Parameters

The assessment of Div. 3LNO yellowtail flounder in 2008 used a non-equilibrium surplus production model (ASPIC; version 5.24). In order to investigate potential differences in estimation of parameters using an updated version of ASPIC (version 5.33), the 2008 assessment formulation and indices were input into the new version. Parameter estimates and population trajectories from this comparison run were nearly identical to the 2008 assessment. In addition, two model specifications in 2008 were modified (starting guess for *B1/K* was set to 1 and the Monte Carlo search was turned off), and only the early part of the population trajectory was affected. STACFIS accepted version 5.33 of ASPIC, with two minor changes to the model specification, to assess the current state of this stock. (SCR Doc. 09/32).

The accepted model formulation for 2009 was: Catch data (1965-2008, with catch set to the TAC, 17 000 t, in 2009), Russian spring surveys (1984-1991), Canadian spring (Yankee) surveys (1971-1982), Canadian spring (1984-2008 omitting 2006) surveys, Canadian autumn (1990-2008) surveys and the Spanish spring (1995-2008) surveys.

d) Assessment Results

The surplus production model results are very similar to the 2008 assessment results, and indicate that stock size increased rapidly after the moratorium in the mid-1990s and has now begun to level off. Bias-corrected estimates from the model suggests that a maximum sustainable yield (*MSY*) of 19 540 t can be produced by total stock biomass of 78 550 t (B_{msy}) at a fishing mortality rate of 0.25 (F_{msy}). The analysis showed that relative population size (B/B_{msy}) was below 1.0 from 1973 to 1998. Biomass (B) has been estimated to be above B_{msy} since then, and the ratio is estimated to be 1.62 at the beginning of 2009 (Fig. 12.5). The parameter estimates and fit indicators for the 2008 and the 2009 accepted assessments are given in Table 12.1.

Table 12.1. Parameter estimates from the 2008 accepted assessment (SCR doc. 08/45) and the 2009 accepted formulation.

	2008 Assessment ASPIC 5.24	2009 Assessment version 5.33
starting guess B1/K*	2	1
B1/K	0.868	0.494
K	147.200	157.100
MSY	18.820	19.540
Bmsy	73.580	78.550
Fmsy	0.256	0.249
B/Bmsy	1.637	1.619
Y(Fmsy)	30.800	31.620
Ye	11.190	12.060
F/Fmsy	0.494	0.527
q (Can. Spring)	3.372	3.225
q (Yankee)	0.997	1.001
q (Can. Fall)	3.581	3.309
q (Russian)	1.176	1.157
q (Spanish)	1.307	1.224
R^2 FC/Can. Spring	0.873	0.891
R^2 Yankee	0.804	0.802
R^2 Can Fall	0.852	0.818
R^2 Russian	0.558	0.542
R^2 Spanish	0.616	0.617
Tot Obj Function	6.096	6.192
MSE	0.092	0.090

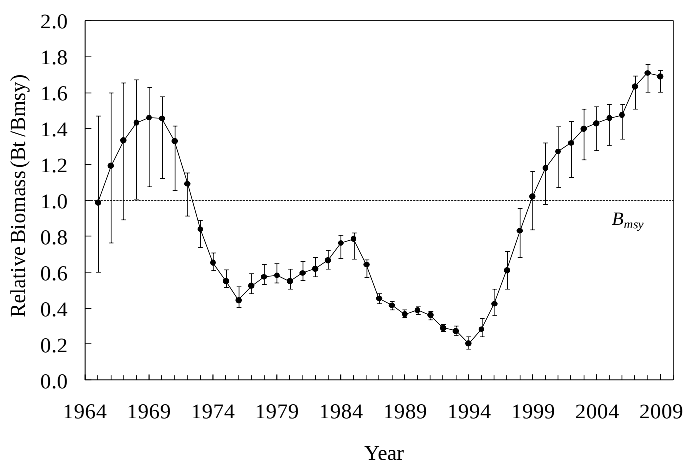

Fig. 12.5. Yellowtail flounder in Div. 3LNO: bias corrected relative biomass trends with approximate 80% confidence intervals.

Relative fishing mortality rate (F/F_{msy}) was above 1.0, in particular from the mid-1980s to early 1990s when the catches exceeded or doubled the recommended TACs (Fig. 12.6). After 1993, F has remained below F_{msy}. In 2008, F is estimated to be 34% of F_{msy}, and if the TAC of 17 000 t is caught in 2009, F is projected to be 53% of F_{msy}.

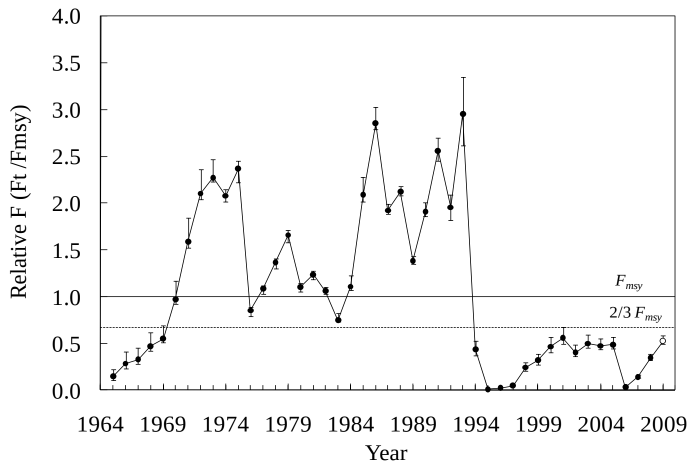

Fig. 12.6. Yellowtail flounder in Div. 3LNO: bias corrected relative fishing mortality trends with approximate 80% confidence intervals. The 2009 estimate is projected if the catch in 2009 = 17 000 t (TAC).

Since the moratorium (1994-1997) was put in place, the catch remained below the estimated surplus production levels until 2008, when the catch slightly exceeded surplus production (Fig. 12.7).

Medium-term projections were carried out by extending the ASPIC bootstrap projections (500 iterations) forward to the year 2014 under an assumption of constant fishing mortality at several levels of F (status quo F, 2/3 F_{msy}, 75% F_{msy}, 85% F_{msy}, and F_{msy}). STACFIS considered that the increasing uncertainty of projections for a period longer than five years makes them unnecessary given that this stock is assessed on a two year cycle. The projections are conditional on the estimated values of r, the intrinsic rate of population growth and K, the carrying capacity. Catch and biomass decrease slightly over the projection period at all levels of F considered (Table 12.2). At all levels of F considered for medium term, projections indicate that the probability that the biomass in 2010 and 2011 will below B_{msy} is negligible. Cumulative catch at all levels of F considered are given in Table 12.3 and shown in Fig. 12.8.

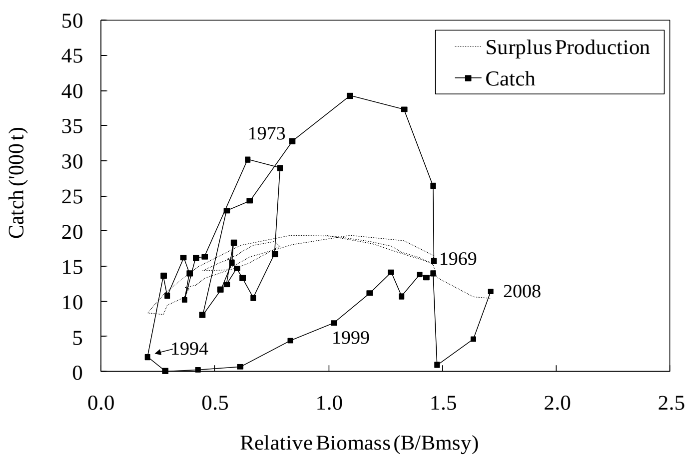

Fig. 12.7. Yellowtail flounder in Div. 3LNO: catch trajectory.

Table 12.2. Medium-term projections for yellowtail flounder. The 5th, 50th and 95th percentiles of projected biomass, catch and relative biomass B/B_{msy}, are shown, for projected F values of status quo F, 2/3 F_{msy}, 75% F_{msy} and 85%$F_{msy.}$ The results are derived from an ASPIC bootstrap run (500 iterations) with a catch constraint of 17 000 t (TAC) in 2009. F_{msy} =0.2487.

		Projected Biomass					Projected Catch (000 tons)					Projected Relative Biomass (B/B_{msy})				
		2010	2011	2012	2013	2014	2010	2011	2012	2013	2014	2010	2011	2012	2013	2014
Status quo *F*	5	115.51	111.70	109.31	107.78	106.80	16.29	15.86	15.59	15.41	15.29	1.54	1.51	1.49	1.47	1.46
	50	125.91	122.28	119.81	118.18	117.10	16.39	15.99	15.73	15.55	15.43	1.62	1.58	1.54	1.52	1.51
	95	170.07	167.47	165.75	164.55	163.71	16.69	16.46	16.30	16.18	16.09	1.66	1.61	1.59	1.57	1.56
2/3 F_{msy}	5	115.51	108.25	103.76	100.88	98.99	20.35	19.31	18.64	18.20	17.90	1.54	1.47	1.42	1.37	1.34
	50	125.91	118.74	113.94	110.79	108.58	20.49	19.51	18.86	18.42	18.13	1.62	1.53	1.47	1.43	1.40
	95	170.07	163.65	159.12	156.04	153.70	20.93	20.24	19.76	19.40	19.12	1.66	1.58	1.53	1.49	1.47
75% F_{msy}	5	115.51	106.37	100.76	97.17	94.78	22.54	21.08	20.15	19.53	19.08	1.54	1.45	1.38	1.32	1.29
	50	125.91	116.78	110.78	106.78	103.95	22.71	21.33	20.41	19.80	19.39	1.62	1.50	1.43	1.38	1.34
	95	170.07	161.57	155.51	151.47	148.46	23.25	22.24	21.50	20.98	20.62	1.66	1.55	1.49	1.45	1.42
85% F_{msy}	5	115.51	104.03	97.06	92.59	89.40	25.27	23.19	21.86	20.98	20.32	1.54	1.42	1.33	1.26	1.21
	50	125.91	114.36	106.87	101.82	98.44	25.47	23.49	22.21	21.35	20.75	1.62	1.47	1.38	1.32	1.27
	95	170.07	158.96	151.04	145.85	141.84	26.14	24.65	23.60	22.88	22.33	1.66	1.53	1.45	1.40	1.36
F_{msy}	5	115.51	100.55	91.61	85.71	81.65	29.29	26.13	24.11	22.74	21.76	1.54	1.38	1.25	1.17	1.11
	50	125.91	110.74	101.06	94.69	90.29	29.56	26.54	24.59	23.27	22.35	1.62	1.43	1.30	1.22	1.17
	95	170.07	155.04	144.87	137.59	132.22	30.46	28.09	26.51	25.39	24.54	1.66	1.49	1.39	1.32	1.27

Table 12.3. Table of cumulative catch ('000 t) of yellowtail flounder under three projected F scenarios in the medium term (2010-2014). The results are median values derived from an ASPIC bootstrap run (500 iterations) with a catch constraint of 17 000 t (TAC) in 2009.

	2010	2011	2012	2013	2014
2/3 Fmsy	20.49	39.99	58.85	77.28	95.41
75% Fmsy	22.71	44.04	64.45	84.26	103.65
85% Fmsy	25.47	48.96	71.17	92.52	113.27

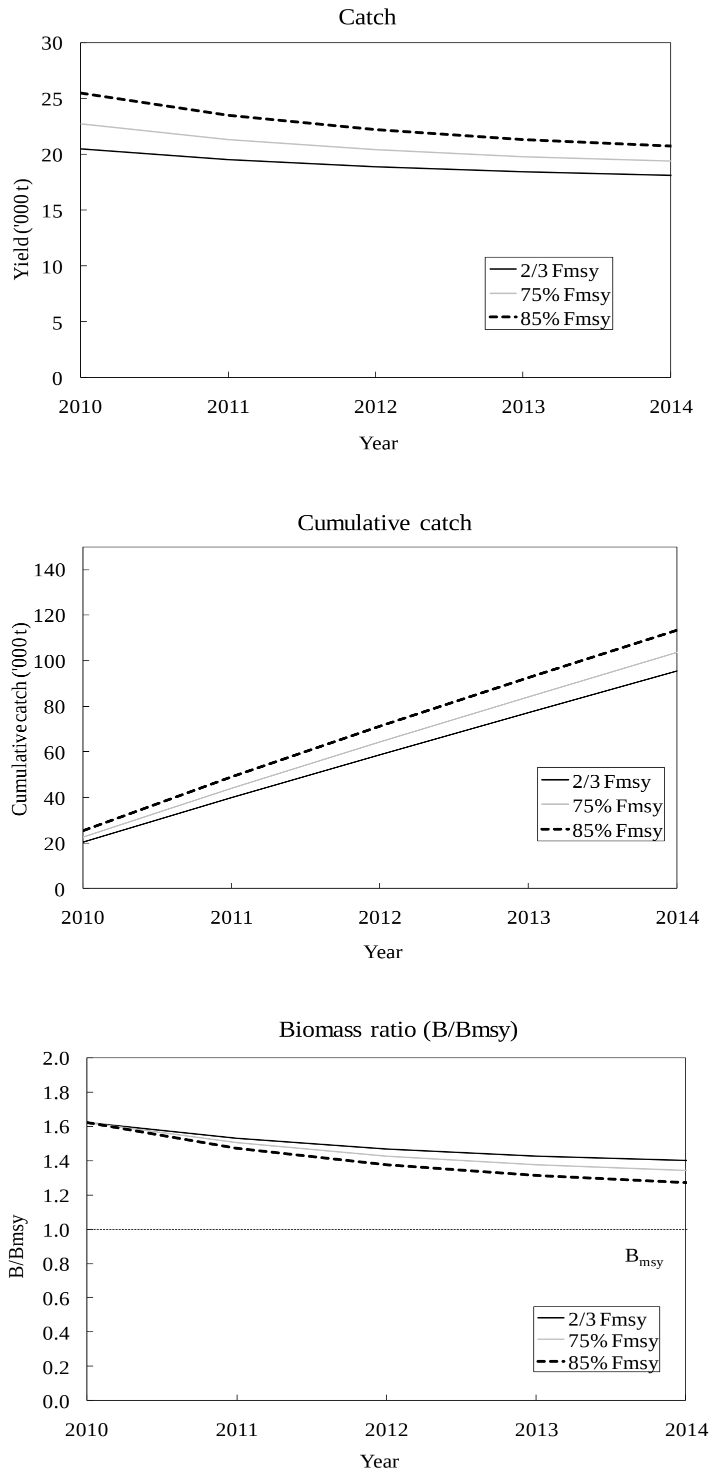

Fig. 12.8. Yellowtail flounder in Div. 3LNO: medium term projections at three levels of F (2/3 F_{msy}, 75% and 85% F_{msy}). Top panel shows projected catch, middle panel gives projected cumulative catch, and lower panel is projected relative biomass ratios (B/B_{msy}). Results are median values derived from an ASPIC bootstrap run (500 iterations) with a catch of 17 000 t assumed in 2009.

e) Reference Points

Precautionary approach. The surplus production model outputs indicate that the stock is presently above B_{msy} and F is below F_{msy}. Results are displayed within the NAFO precautionary approach framework in Fig. 12.9. Scientific Council considers that 30% B_{msy} is a suitable limit reference point (B_{lim}) for stocks where a production model is used. The current assessment results indicate that the stock was below B_{lim} from 1993 to 1995, and then increased rapidly during and after the moratorium, exceeding B_{msy} from 1999 onward. At present, the risk of the stock being below B_{lim} = 30% B_{msy} is approximately zero.

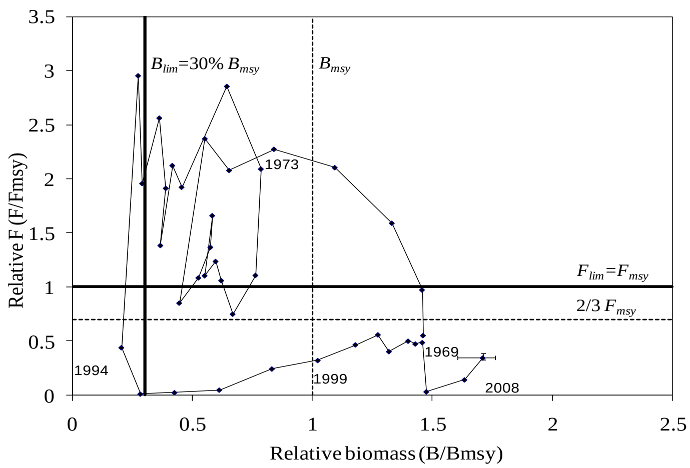

Fig. 12.9. Yellowtail flounder in Div. 3LNO: stock trajectory estimated in the surplus production analysis, under a precautionary approach framework.

f) Conclusion

Based on results of the ASPIC production model, STACFIS concluded that the yellowtail flounder stock in NAFO Div. 3LNO is above B_{msy} and F is below 2/3 F_{msy}.

The next full assessment of this stock will be in 2011.

13. Witch flounder (*Glyptocephalus cynoglossus*) in Div. 3NO

Interim Monitoring Report

a) Introduction

Reported catches in the period 1972-1984 ranged from a low of about 2 400 t in 1980 and 1981 to a high of about 9 200 t in 1972 (Fig. 13.1). With increased bycatch in other fisheries, catches rose rapidly to 8 800 and 9 100 t in 1985 and 1986. The increased effort was concentrated mainly in the NAFO Regulatory Area (NRA) of Div. 3N. From 1987 to 1993 catches ranged between about 4 500 and 7 500 t and then declined in 1994 to less than 1200 t when it was agreed there would be no directed fishing on the stock. Since then, catches have averaged about 500 t; in 2008 the catch was 264 t, taken mainly in the NRA of Div. 3O.

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

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
TAC	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf
STATLANT 21A	0.7	0.5	0.7	0.9	0.6	0.3	0.5	0.2[2]	0.2[2]	
STACFIS	0.5	0.7	0.4	0.9-2.2[1]	0.6	0.3	0.5	0.2	0.3	

[1] In 2003, STACFIS could not precisely estimate the catch.
[2] Provisional
ndf No directed fishery
.

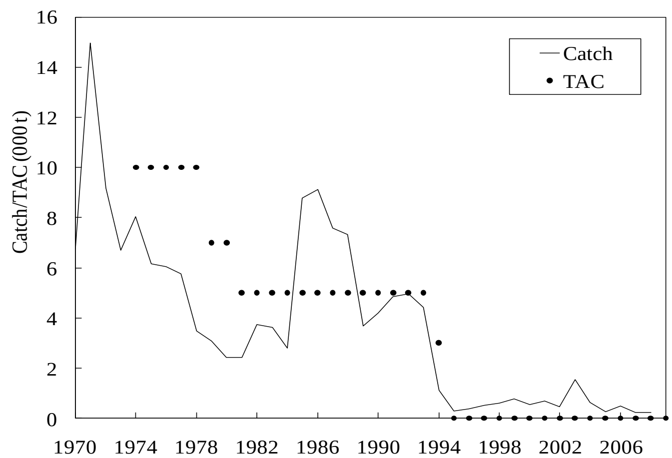

Fig. 13.1. Witch flounder in Div. 3NO: catches and TAC.

b) Data Overview

i) Research survey data

Canadian spring RV survey mean weight per tow. For Div. 3N, mean weights per tow in the Canadian spring survey ranged from as high as 0.96 kg in 1984 to a low of 0.07 kg in 1996 and have been variable since then with the 2008 value about 0.21 kg. In Div. 3O, the spring survey estimates also have been variable, but show a decreasing trend from 9.67 kg in 1985 to 0.83 kg in 1998. Since then mean weights per tow have remained variable but increased slightly in 2003 to 6 kg and then decreased to 3.3 kg in 2008. The combined Div. 3NO estimates of mean weight per tow have increased slightly from the mid-1990s (Fig. 13.2). The high value in 2003 was largely influenced by one large set; the 2006 survey estimate is biased due to substantial coverage deficiencies and is therefore not included.

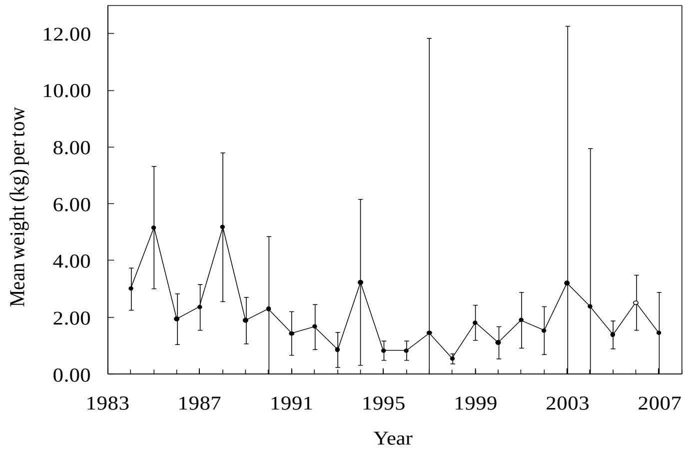

Fig. 13.2. Witch flounder in Div. 3NO: mean weights per tow from Canadian spring surveys (95% confidence limits are given). Values are Campelen units or, prior to 1996, Campelen equivalent units.

Canadian autumn RV survey mean weight per tow. Trends in the autumn survey are complicated by variable coverage of the deeper strata from year to year. Mean weights per tow in the autumn survey in Div. 3N ranged from 0.07 kg in 1996 to the high value observed in 2008 (2.8 kg/tow). The autumn survey index in Div. 3O increased from 2001 to 2004 but had decreased to about 2.3 kg per tow in 2007. However, similar to the large increase in Div. 3N, there has been a large increase in mean weight per tow in Div. 3O in 2008, at 6.3 kg/tow. With the exception of a low value of 1.4 kg/tow in 2007, the combined index in Div. 3NO autumn survey (Fig. 13.3) has shown a general increasing trend since 1996, reaching the highest value in the time series in 2008, at 4.6 kg/tow.

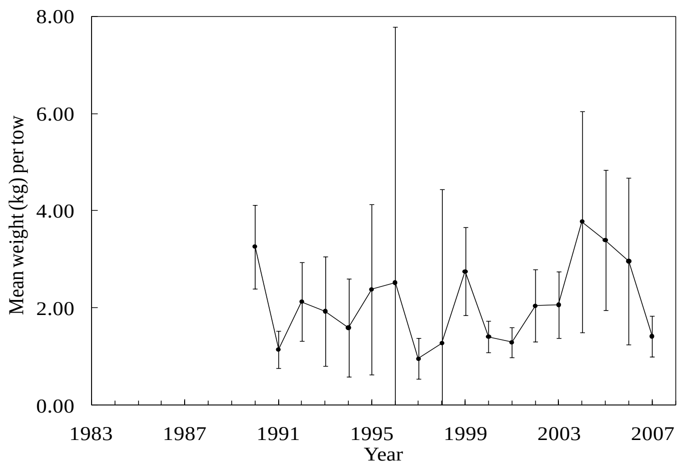

Fig. 13.3. Witch flounder in Div. 3NO: mean weights per tow from Canadian autumn surveys (95% confidence limits are given). Values are Campelen units or, prior to 1995, Campelen equivalent units.

Spanish Div. 3NO R/V survey biomass. Surveys have been conducted annually from 1995 to 2008 by EU-Spain in the Regulatory Area in Div. 3NO to a maximum depth of 1 462 m (since 1998). In 2001, the research vessel (R/V *Playa de Menduiña*) and survey gear (Pedreira) were replaced by the R/V *Vizconde de Eza* using a Campelen trawl (NAFO SCR 05/25). Data for witch flounder in Div. 3NO prior to 2001 have not been converted and therefore data from the two time series cannot be compared. In the Pedreira gear time series, the biomass increased from 1995-1999 but declined to 2001; in the Campelen gear time series, the biomass index has been variable but has been generally decreasing since 2004 (Fig. 13.4).

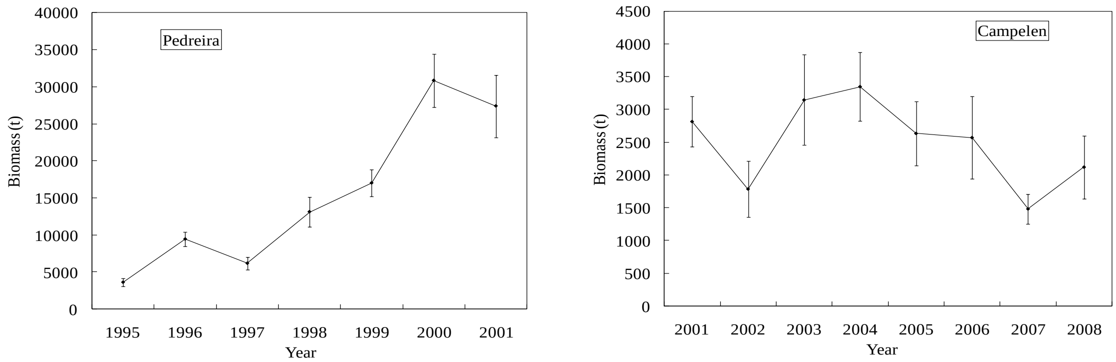

Fig. 13.4. Witch flounder in Div. 3NO: biomass indices from Spanish Div. 3NO surveys (±1 standard deviation). Data from 1995-2001 is in Pedreira units; data from 2001-2008 is Campelen units. Both values are present for 2001.

c) Conclusion

Based on available information for the current year, there is nothing to indicate a change in the status of the stock.

The next full assessment of this stock is planned for 2011.

14. Capelin (*Mallotus villosus*) in Div. 3NO

(SCR Doc. 09/14)

a) Introduction

The fishery for capelin started in 1971 and catch was highest in the mid-1970s with a maximum catch of 132 000 t in 1975. The directed fishery was closed in 1992 and the closure has continued through 2008 (Fig. 14.1). No catches have been reported for this stock since 1993.

Nominal catches and TACs (‘000 t) are as follows:

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Recommended TAC	na	na	na	na	na	na	na	na	na	na
Catch[1]	0	0	0	0	0	0	0	0		

[1] No catch estimated for this stock
na no advice possible.

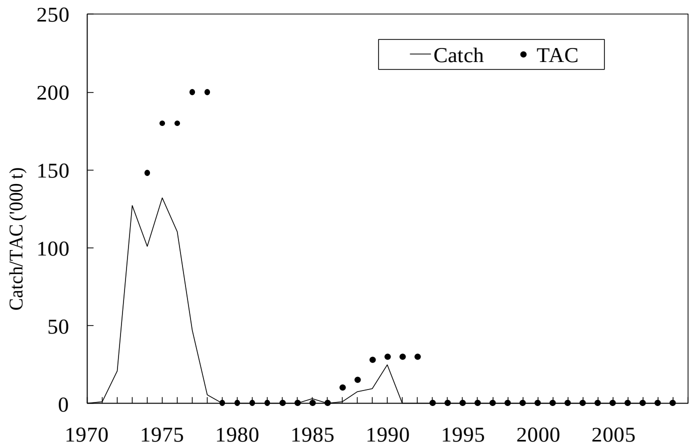

Fig. 14.1. Capelin in Div. 3NO: catches and TACs.

b) Data Overview

Research survey data

Trawl acoustic surveys of capelin on the Grand Bank previously conducted by Russia and Canada on a regular basis have not been repeated since 1995. In recent years, STACFIS has repeatedly recommended investigation of the capelin stock in Div. 3NO utilizing trawl-acoustic surveys to allow comparison with historical time series. However, this recommendation has not been acted upon. The only indicator of stock dynamics presently available may be capelin biomass indices obtained during Canadian stratified-random spring trawl surveys. In 1996-2008, when a Campelen trawl was used as a sampling gear, survey biomass of capelin in Div. 3NO varied from 3 900 to 114 652 t (Fig.14.2), at the average value for this period is 31 399 t. In 2005, survey biomass of capelin in Div. NO was 3 900 t, the lowest level since 1996; in 2006 and in 2007 survey biomass increased and was 9 600 and 29 300 t respectively. In 2008 the biomass index sharply increased to 114 600 t.

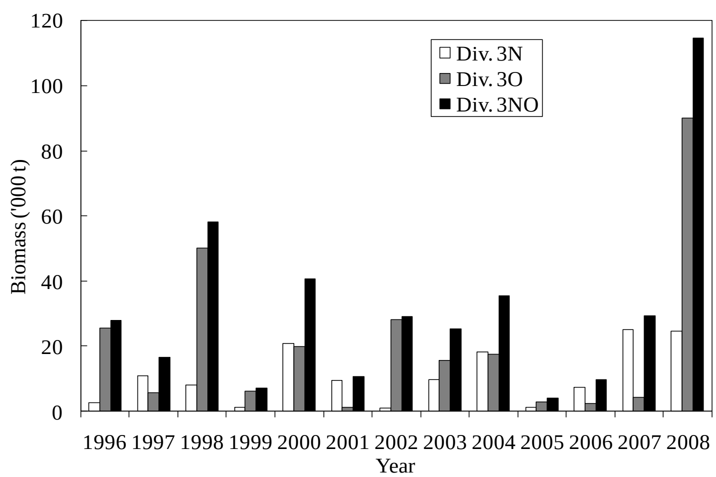

Fig. 14.2. Capelin in Div. 3NO: survey biomass estimates in 1996-2008.

c) Estimation of Stock Condition

Since interpolation by density of bottom trawl catches to the area of strata for such pelagic fish species as capelin can lead to significant deviation of the total biomass, the average value of all non-zero catches was used as an index for evaluation of the stock biomass in 1990-2008. However, if the proportions of zero and non-zero catches change, the index may not be comparable between years.

Survey catches were standardized to 1 km^2 for combining Engel and Campelen trawl data. Sets which did not contain capelin were not included in account. The confidence intervals around the average catch index were obtained by bootstrapping of standardized catch values. According to data from 1996-2008, the mean catch varied between 0.06 and 1.56. In 2007 and 2008, this parameter was 0.41 and 1.56, respectively (Fig. 14.3), thus reaching in 2008 its highest value in the period. Years when the stock supported a fishery had values for this index of 2 or more.

Bottom-trawling is not a satisfactory basis for a stock assessment of a pelagic species and survey results are indicative only.

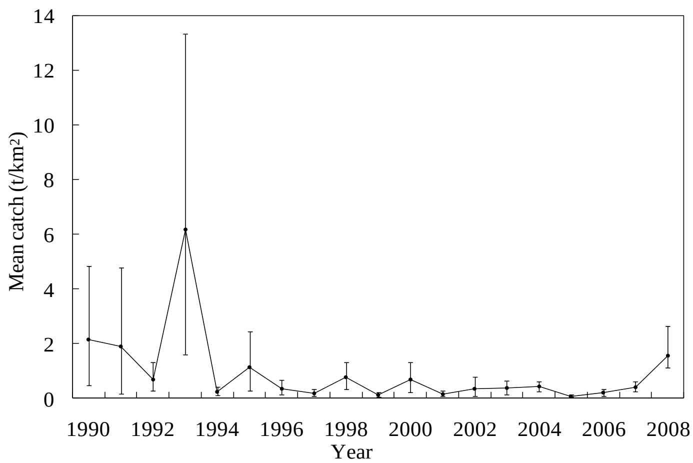

Fig. 14.3. Capelin in Div. 3NO: mean catch (t/km^2) in 1990-2008.

d) Assessment Results

It is not clear how that the data satisfactorily reflects the stock distribution and stock status. Nevertheless, and in spite of recent increases in survey indices, STACFIS was unable to consider that the stock is at other than a relatively low level.

e) Precautionary Reference Points

STACFIS is not in a position to determine biological reference points for capelin in Div. 3NO.

f) Research Recommendations

STACFIS reiterates its **recommendation** that *initial investigations to evaluate the status of capelin in Div. 3NO should utilize trawl acoustic surveys to allow comparison with the historical time series.*

This stock is expected next to be fully assessed in 2011.

15. Redfish (*Sebastes mentella* and *Sebastes fasciatus*) in Div. 3O

Interim Monitoring Report (SCS Doc. 09/5, 9, 12, 13, 14)

a) Introduction

There are two species of redfish that have been commercially fished in Div. 3O; the deep-sea redfish *(Sebastes mentella)* and the Acadian redfish *(Sebastes fasciatus*). The external characteristics are very similar, making them difficult to distinguish, and as a consequence they are reported collectively as "redfish" in the commercial fishery statistics. Within Canada's fishery zone redfish in Div. 3O have been under TAC regulation since 1974 and a minimum size limit of 22 cm since 1995, whereas catch was only regulated by mesh size in the NRA of Div. 3O. In September 2004, the Fisheries Commission adopted TAC regulation for redfish in Div. 3O, implementing a level of 20 000 t per year for 2005-2008. This TAC applies to the entire area of Div. 3O.

Nominal catches have ranged between 3 000 t and 35 000 t since 1960 and have been highly variable (Fig. 15.1). Up to 1986 catches averaged 13 000 t, increased to 35 000 t in 1988, exceeding TACs by 7 000 t and 21 000 t, respectively in 1987 and 1988. Catches declined to 13 000 t in 1989, increased gradually to about 16 000 t in 1993 and declined further to about 3 000 t in 1995, partly due to reductions in foreign allocations within the Canadian fishery zone since 1993. Catches increased to 20 000 t by 2001 and have been lower since then. Total catch of redfish in Div. 3O was estimated to be 4 020 t in 2008.

Nominal catches and TACs ('000 t) for redfish in the recent period are as follows:

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Recommended TAC						NR	NR	NR	NR	NR
TAC[1]	10	10	10	10	10	20	20	20	20	20
STATLANT 21A	12.8	22	19.4	21.5	6.4	11.9	12.9	7.6[1]	3.7[1]	
STACFIS	10	20.3	17.2	17.2	3.8	10.7	12.6	5.2	4.0	

2000-2004 only applied within Canadian EEZ.
[1] Provisional.
NR Scientific Council unable to advise on an appropriate TAC

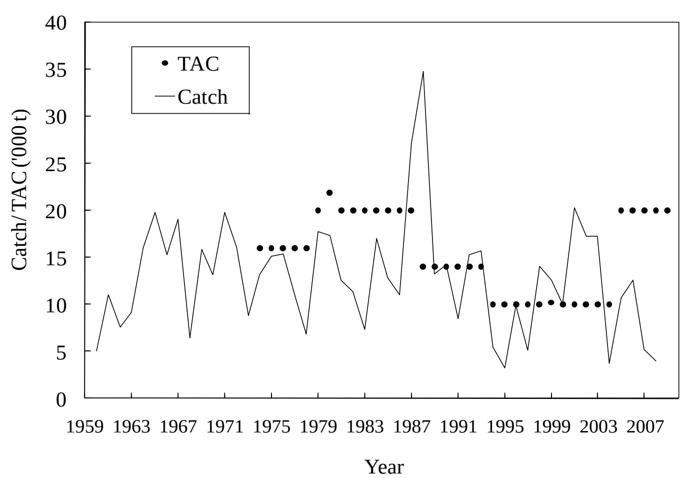

Fig. 15.1. Redfish in Div. 3O: catches and TACs. The TAC for 1997-2004 applied only within the Canadian EEZ

b) Data Overview

Surveys

Canadian spring and autumn surveys were conducted in Div. 3O during 2008. The survey mean weight (kg) per tow has been increasing in the autumn survey since 2004. Mean weight per tow from the spring survey was higher from 2004-2008 than during 2001-2003 (Fig. 15.2). The recent trend in abundance from the surveys is very similar to the trend in biomass.

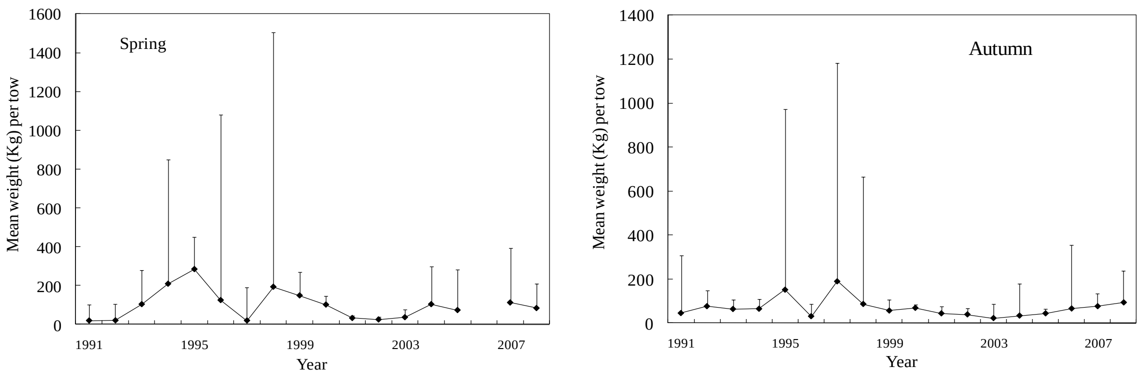

Fig. 15.2. Redfish in Div. 3O: Mean weight (kg + 97.5% CL) per tow from Canadian surveys in Div. 3O (Campelen or Campelen equivalents).

Catches declined in 2007 and 2008 while survey indices were higher, so fishing mortality likely declined in 2007 and 2008 compared to 2005 and 2006.

c) Conclusion

Based on survey indices for the current year, there is nothing to indicate a change in the status of the stock.

The next full assessment of this stock is planned to be in 2010.

16. Thorny skate (*Amblyraja radiata*) in Div. 3LNO and Subdiv. 3Ps

Interim Monitoring Report

a) Introduction

Thorny skate on the Grand Banks was first assessed for Canada by Atkinson (1995) for the stock unit Div. 3LNOPs. Subsequent Canadian assessments also provided advice for NAFO Div. 3LNOPs. However, Subdiv. 3Ps is presently managed as a separate unit by Canada and France (SPM), and Div. 3LNO is managed by the Northwest Atlantic Fisheries Organization.

Catch history

Commercial catches of skates comprise a mix of skate species. However, thorny skate compose about 95% of skate catch taken in the Canadian and EU-Spain fisheries. Thus, the skate fishery on the Grand Banks can be considered a directed fishery for thorny skate.

Prior to the mid1980s, thorny skate was commonly taken as bycatch in other fisheries. This species continues to be taken as bycatch: mainly in the Greenland halibut fishery, and the Canadian mixed fishery for thorny skate, White Hake, and Monkfish in Div. 3NOPs in the Canadian zone. Non-Canadian fisheries occur in the NRA of Div. 3NO.

Nominal catches increased in the mid1980s with the commencement of a directed fishery for thorny skate. The main participants in this new fishery were Canada, EU-Portugal, EU-Spain and Russia. Canada fished for thorny skate in the western portion of Div. 3O and in Subdiv. 3Ps, while the remaining countries fished primarily in Div. 3N and, to a lesser extent, in Div. 3O.

Catches in Div. 3LNOPs peaked at about 36 000 t in 1991 (STATLANT 21A). From 1985 to 1991, catches averaged 25 000 t, but were lower during 1992-1995 (9 600 t). There are substantial uncertainties in the catch levels prior to 1996. Catch levels in Div. 3LNO for 1999-2008, as estimated by STACFIS, averaged 8 950 t (Fig. 16.1). There is a TAC of 13 500 t for thorny skate in Div. 3LNO for 2005-2009, and 1 050 t in Subdiv. 3Ps (Canada). Recent catches of thorny skate in Div. 3LNO for 2005-2008 averaged 5 249 t.

Recent nominal catches and TACs ('000 t) in NAFO Div. 3LNO and Subdiv. 3Ps are as follows:

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Div. 3LNO:										
TAC						13.5	13.5	13.5	13.5	13.5
STATLANT 21A[1]	18.3	14.9	11.6	14.3	11.8	3.5	5.5	6.2	5.8	
STACFIS	14.7	9.2	11.8	11.6	9.3	4.2	5.8	3.6	7.4	
Subdiv. 3Ps:										
TAC						1.05	1.05	1.05	1.05	1.05
STATLANT 21A[1]	1.0	1.8	1.6	1.8	1.3	1.0	1.0	1.6	1.3[2]	
Div. 3LNOPs:										
STATLANT 21A[1]	19.2	16.7	13.3	16.0	13.1	4.5	6.5	7.8	7.1	
STACFIS	15.7	11.0	13.4	13.4	10.6	5.2	6.8	5.2	8.7	

[1] Provisional for 2008
[2] Based on ZIF landings (STATLANT 21A not available)

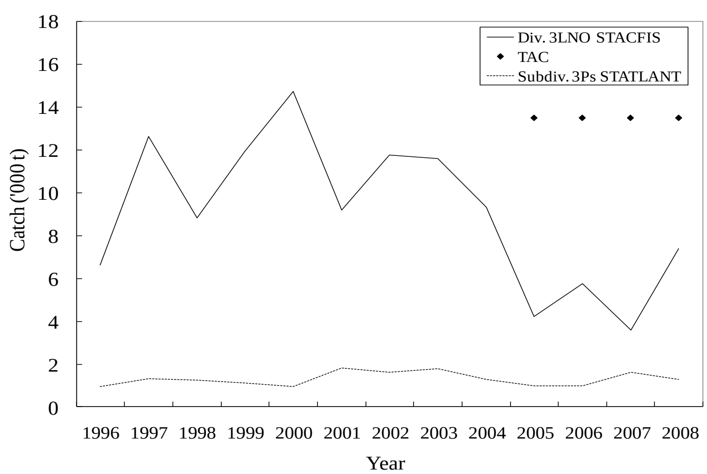

Fig. 16.1. Thorny skate in Div. 3LNO and Subdiv. 3Ps: catches in 1996-2008, and TAC for Div. 3LNO in the NRA.

b) Data Overview

i) Commercial fisheries

Thorny skate are currently not aged in either commercial or survey catches.

Length distributions from Canada, EU-Portugal, EU-Spain, and Russia in the directed skate (280 mm mesh size) and bycatch (130-135 mm mesh size) trawl fisheries of the NRA indicated that the overall range of sizes caught did not vary during 2006-2008, and were similar to those reported in previous years. EU-Spain usually catches 30-90 cm skates (no obvious modes in 2006-2007); with the exception of 2008 in Div. 3LNO, where a peak of 46-49 cm (with a main mode of 48 cm) was observed by EU-Spain in the directed skate fishery. Russia catches 24-93 cm fish (modes of 60-66 cm); with the exception of 2008 in Div. 3L, where a peak of 12-18 cm skates (young-of-the-year; mode of 15 cm) was observed by Russia in the Greenland Halibut fishery.

No standardized commercial CPUE exists for thorny skate.

ii) Research surveys

Canadian spring surveys. Stratified-random research surveys have been conducted in spring 1971-2008 by Canada in Div. 3LNO, and Subdiv. 3Ps using a Yankee-41.5 otter trawl in 1972-1983, an Engel-145 bottom trawl in 1984-spring 1995, and a Campelen-1800 shrimp trawl from 1996 to the present.

Standardized mean number and weight per tow are presented in Fig. 16.2 for Div. 3LNOPs. In 2005, STACFIS recommended adoption of a multiplicative model for conversion of thorny skate Engel trawl data (1984-spring 1995) to Campelen equivalents, in order to derive a standardized time series for thorny skate (NAFO SCR Doc. 05/49). Catch rates of thorny skate in Div. 3LNOPs declined from the mid1980s until the early 1990s. Since 1996, indices have been relatively stable at a low level (Fig. 16.2).

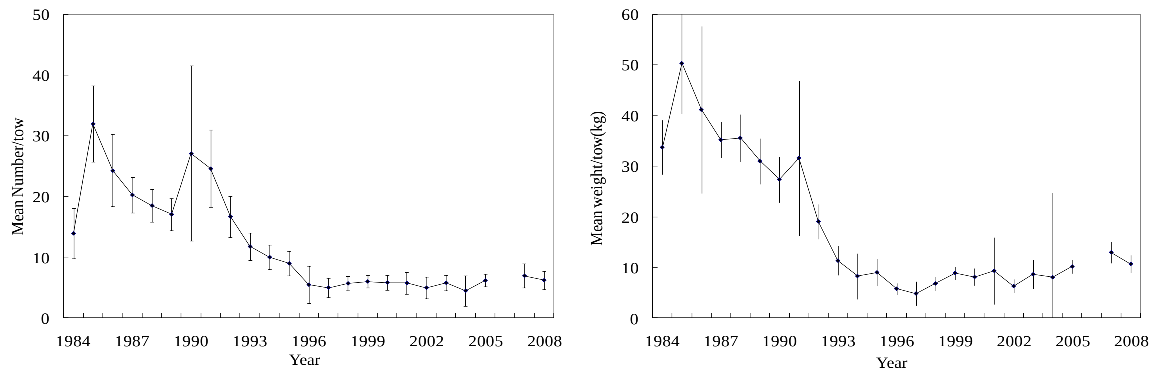

Fig. 16.2. Thorny skate in Div. 3LNOPs: estimates of Campelen equivalent mean numbers (left panel) and mean weights (right panel) per tow from Canadian spring surveys in 1984-2008. During 2006, Subdiv. 3Ps was not surveyed and the survey in 3NO was incomplete.

Canadian autumn surveys. Autumn stratified-random research surveys have been conducted by Canada in Div. 3LNO since 1990. From 1990-1994, an Engel-145 bottom trawl was employed, from 1995 to the present a Campelen-1800 shrimp trawl has been used.

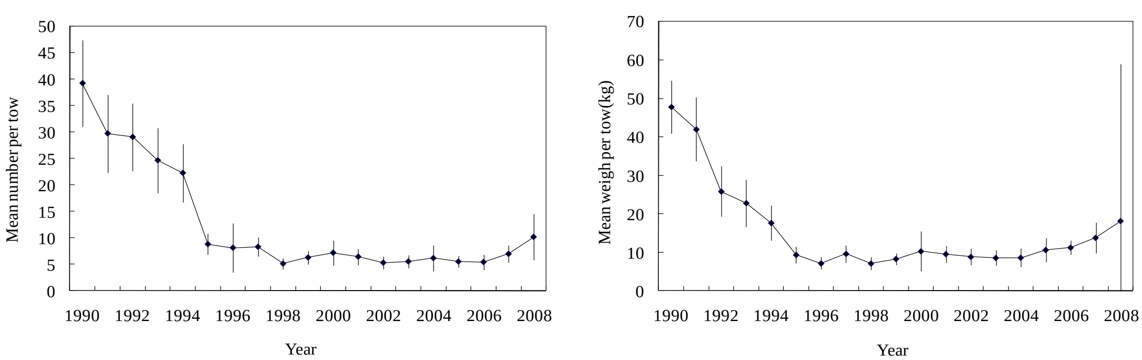

Fig. 16.3. Thorny skate in Div. 3LNO: estimates of Campelen equivalent mean numbers (left panel) and mean weights (right panel) per tow from Canadian autumn surveys in 1990-2008.

Standardized mean number and weight per tow are presented in Fig. 16.3 for Div. 3LNO from Canadian autumn survey. Catch rates of thorny skate in Div. 3LNO declined from the 1990 until the mid-1990s. Since 1996, indices have been relatively stable at a low level (Fig. 16.3).

Spanish spring surveys. Spanish survey biomass indices in Div. 3NO were available for 1997-2008. Spanish surveys were conducted in the NRA portion of Div. 3NO, while Canadian surveys covered the entire extent of Div. 3NO. The biomass trajectory from Spanish surveys was similar to that of Canadian spring surveys (Fig. 16.4).

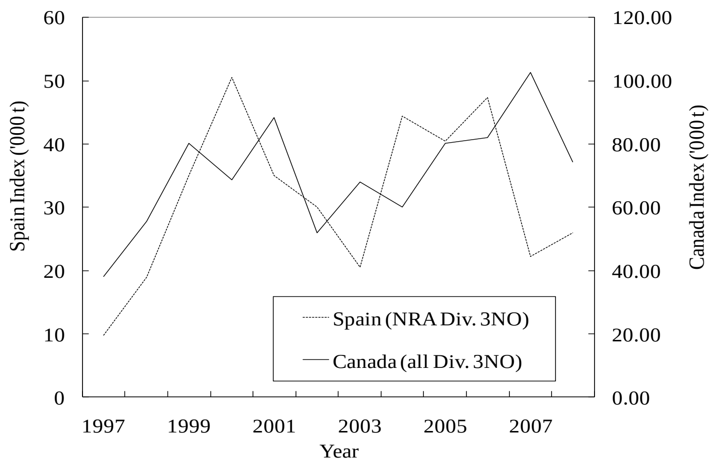

Fig. 16.4. Thorny skate in Div. 3NO: stimates of biomass from Spanish spring surveys compared to Canadian spring surveys in 1997-2008.

Results of the EU-Spain 2008 spring survey did not alter the perception of stock status by STACFIS.

c) Conclusion

With an update of abundance and biomass indices for 2008, there is nothing to indicate a significant change in the status of this stock.

The next assessment of this stock is planned to be in 2010.

17. White hake (*Urophycis tenuis*) in Div. 3NO and Subdiv. 3Ps

(SCR Doc. 09/10, 28; SCS Doc. 09/5, 9, 12, 13)

a) Introduction

The advice requested by Fisheries Commission is for Div. 3NO although the stock area is specified as Div. 3NO plus Subdiv. 3Ps. Previous studies indicated that white hake constitute a single unit within Div. 3NOPs and that fish younger than 1 year, 2+ juveniles, and mature adults distribute at different locations within Div. 3NO and Subdiv. 3Ps. This movement of fish of different stages between areas must be considered when assessing the status of white hake in Div. 3NO. Therefore, an assessment of Div. 3NO white hake is conducted with information on Subdiv. 3Ps included.

Canada commenced a directed fishery for white hake in 1988 in Div. 3NO and Subdiv. 3Ps. All Canadian landings prior to 1988 were as bycatch in various groundfish fisheries. EU-Spain and EU-Portugal commenced a directed fishery in 2002, Russia in 2003 in Div. 3NO in the NRA resulting in the 2003-2004 peak. There were no directed fisheries by EU-Spain in 2004 or by EU-Spain, EU-Portugal or Russia in 2005-2008. In 2003-2004, 14% of the total catches of white hake in Div. 3NO and Subdiv. 3Ps were taken by Canada but increased to 93% in 2006, mainly due to an absence of a directed fishery for white hake by other countries.

From 1970-2006, white hake catches in Div. 3NO fluctuated, averaging approximately 2 000 t, exceeding 5 000 t in only three years during that period. Catches peaked in 1985 at approximately 8 100 t then declined, averaging 2 090 t from 1988 to 1994 (Fig. 17.1). With the restriction of fishing by other countries to areas outside Canada's 200-mile limit in 1992, non-Canadian landings fell to zero. Average catch was at its lowest in 1995-2001 (464 t) but increased to 6 752 t in 2002 and 4 841 t in 2003 following the recruitment of the large 1999 year-class. Catches from 2004-2007 averaged 949 t, and were 882 t in 2008.

Catches in Subdiv. 3Ps were less variable, averaging 1 114 t in 1985-1993, then decreasing to an average of 668 t in 1994-2003. Subsequently, catches increased to an average of 1 338 t in 2004-2006. Catches of white hake in NAFO Subdiv. 3Ps were at their lowest (595 t) in 2008.

Recent nominal catches and TACs ('000 t) in NAFO Div. 3NO and Subdiv. 3Ps are as follows:

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Div. 3NO:										
TAC	-	-	-	-	-	8.5	8.5	8.5	8.5	8.5
STATLANT 21A	0.6	0.6	4.8	6.2	1.9	0.9	1.2	0.6	0.8	
STACFIS	0.6	0.7	6.8	4.8	1.3	0.9	1.1	0.6	0.9	
Subdiv. 3Ps:										
STATLANT 21A	1.1	0.9	0.9	1.1	1.3	1.5	1.3	1.1	0.6	

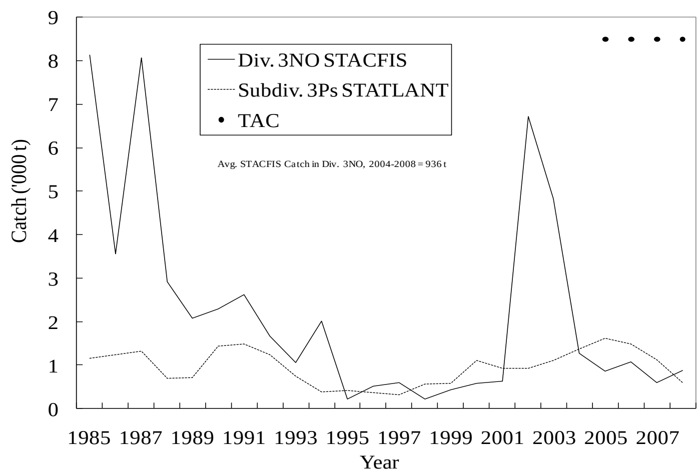

Fig. 17.1. White hake in NAFO Div. 3NO and Subdiv. 3Ps: total catches and TAC.

b) Input Data

i) Commercial fishery data

Length composition. Length frequencies are available for Canada (1994-2008), EU-Spain (2002, 2004), EU-Portugal (2003-2004, 2006-2008), and Russia (2000-2007). In the Canadian fishery in 2004-2008, peak lengths caught by longlines in Div. 3O and Subdiv. 3Ps were 58-70 cm; gillnets in Div. 3O and Subdiv. 3Ps were 68-78 cm; and trawls in Div. 3O and Subdiv. 3Ps were 57-77 cm. Sizes reported by EU-Spain and EU-Portugal were mainly in the 35-60 cm range. Russia reported a much wider range of sizes, mainly from 25-75 cm.

ii) Research survey data

Canadian stratified-random bottom trawl surveys. Data from spring surveys in Div. 3NOPs were available from 1975 to 2008. In the 2006 Canadian spring survey, most of Subdiv. 3Ps was not surveyed and only shallow strata in Div. 3NO (to a depth of 77 m in Div. 3N, to 103 m in Div. 3O) were surveyed and thus the survey estimates in the most recent year are not included in this analysis. Data from autumn surveys in Div. 3NO were available from 1990 to 2008. As well, estimates based on sets from strata that have been surveyed throughout the years, compared to estimates that include deep water and inshore strata, yield very similar results for white hake. Canadian spring and autumn surveys were conducted using a Yankee 41.5 bottom trawl prior to 1984, using an Engel 145 bottom trawl from 1984 to autumn 1995, and a Campelen 1800 trawl thereafter. There are no survey catch rate conversion factors for white hake among gears and thus are presented as separate series.

Abundance and biomass indices of white hake from the Canadian spring research vessel survey are presented in Fig. 17.2a. From 2003 to 2008, the population has remained at a level similar to that which was observed previously in the Campelen time series from 1996-1998. The dominant feature of the white hake abundance time series is the peak abundances observed from 2000-2001. This peak in abundance is also reflected in the very large 1999 year-class in the autumn research vessel survey index (Fig. 17.2b). The indices have since declined to levels similar to 1996-1998. Autumn survey catch rates remain at levels comparable to those observed from 1995 to 1998 in the Campelen time series.

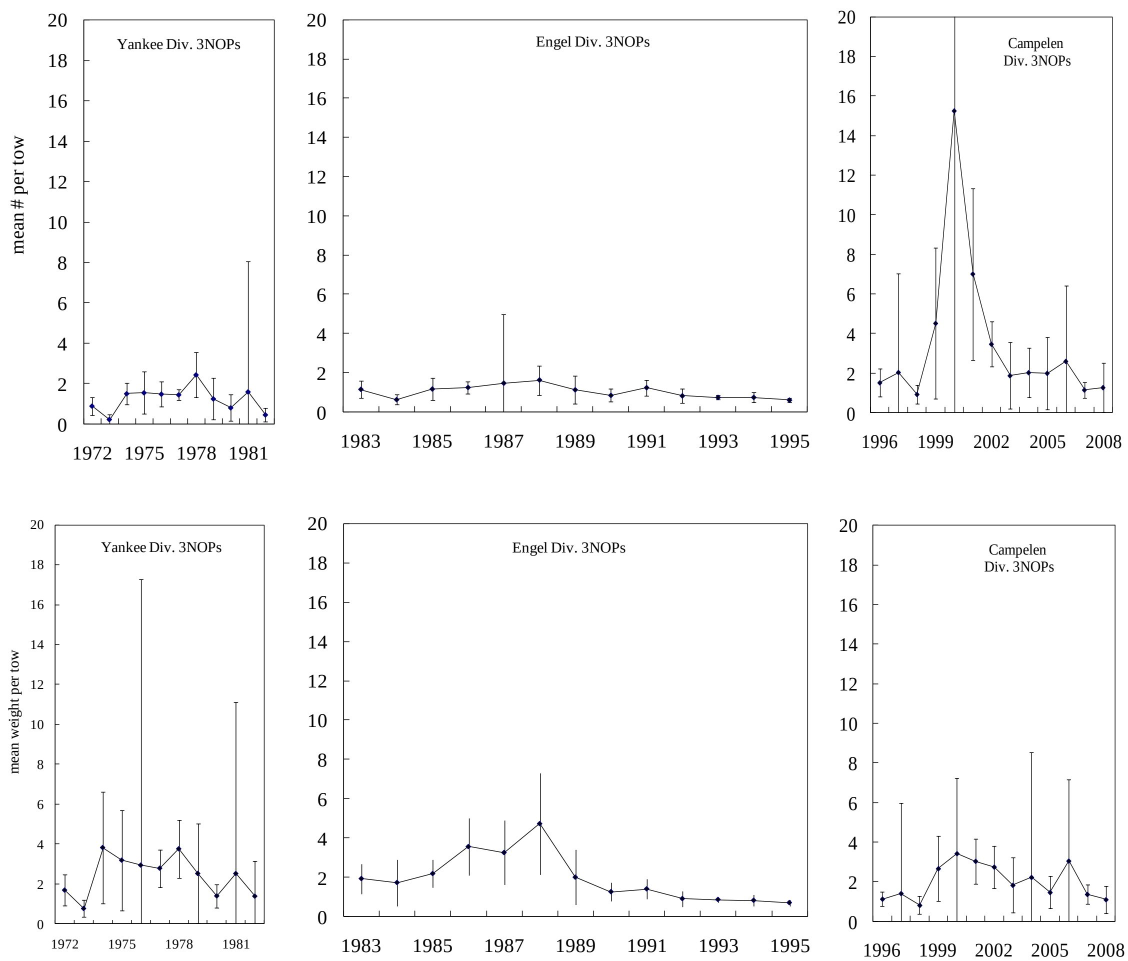

Fig. 17.2a. White hake in Div. 3NOPs: mean number and mean weight per tow from Canadian spring surveys, 1972-2008. The 2006 points are not shown since survey coverage in that year was incomplete. The Yankee, Engel and Campelen time series are not standardized and thus are presented on separate panels.

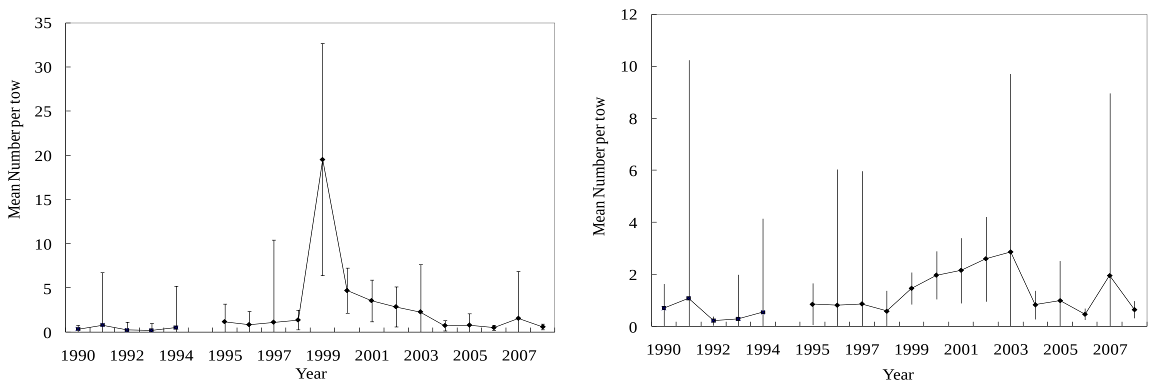

Fig. 17.2b White hake in Div. 3NO: mean number and mean weight per tow from Canadian autumn surveys, 1990-2008. The Engel and Campelen time series are not standardized and thus are presented separately.

EU-Spanish stratified-random bottom trawl surveys in the NRA. EU-Spain biomass indices in the NAFO Regulatory Area of Div. 3NO were available for white hake from 2001 to 2008 (Fig. 17.3). Spanish surveys were conducted with Campelen gear (similar to that used in Canadian surveys) in the spring to a depth of 1 400 m. EU-Spain biomass indices were highest in 2001, then declined to 2003, peaked slightly in 2005 and have since declined. The trend is similar to the Canadian spring survey index (Fig. 17.3).

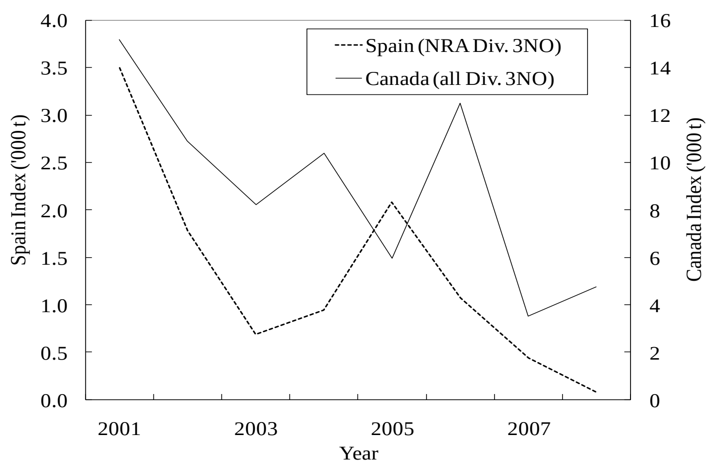

Fig. 17.3. White hake in the NRA of Div. 3NO: Biomass indices from Spanish Campelen spring surveys in 2001-2008 compared to Canadian spring survey indices in all of Div. 3NO.

iii) Biological studies

Distribution. White hake in Div. 3NO and Subdiv. 3Ps are confined largely to an area associated with the warmest bottom temperatures (4-8°C) along the southwest fringe of the Grand Banks, edge of the Laurentian Channel and southwest coast of Newfoundland.

White hake distribute at different locations during various parts of their life cycle. Fish <27 cm in length (1st year fish) occur almost exclusively on the Grand Bank in shallow water (nursery ground). Juveniles (2+ years) are widely spread and a high proportion of white hake in the Laurentian Channel portion of Subdiv. 3Ps are juveniles. Mature adults concentrate on the southwest slope of the Bank (spawning grounds) in both Subdiv. 3Ps and Div. 3NO.

Maturity. Maturity at size was estimated for each sex separately, using Canadian spring survey data from 1997-2008. Length (L_{50}) at 50% maturity is different between the sexes; with fifty percent of males maturing at 39 cm, and fifty percent of females maturing at 57 cm. However, L_{50} was very similar for each sex between Div. 3NO and Subdiv. 3Ps (Fig. 17.4).

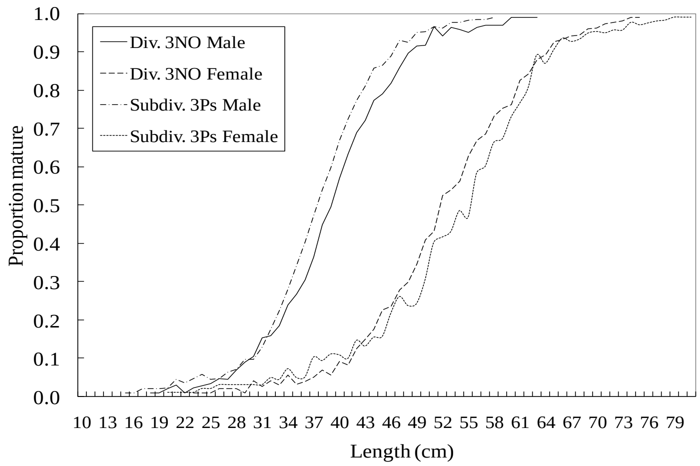

Fig. 17.4. White hake in Div. 3NOPs: Maturity ogives calculated for each sex from Canadian spring surveys and averaged over 1997-2008.

Life stages. Canadian spring survey trends in abundance for 1996-2008 were staged as one year olds, 2+ juveniles (IMM), and mature adults (MAT) (Fig. 17.5). Recruitment of one year old male and female white hake was highest in 2000 and has since declined. There are currently no indications of increased abundance of either mature or young of the year white hake.

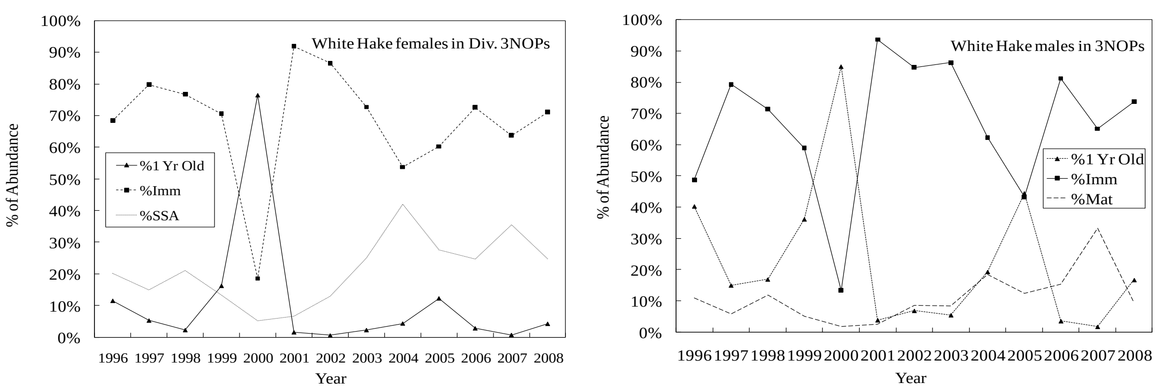

Fig. 17.5. White hake in Div. 3NOPs: proportion of stages in terms of abundance by sex from Canadian Campelen spring survey data in 1996-2008.

iv) Recruitment

Recruits per spawner varied between 0.07 and 48.7 fish for each adult female in 1997-2008 (Fig. 17.6). Two significant values were observed in this time series: 13.2 fish in 1998 and 48.7 in 1999. The largest value in recent years is 1.6 in 2004.

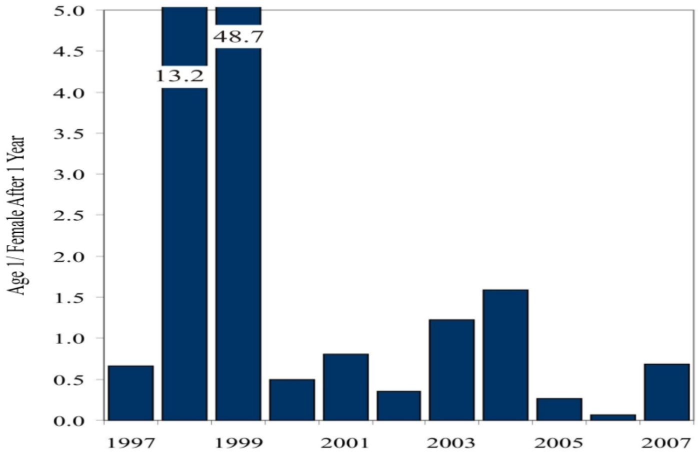

Fig. 17.6. White hake in Div. 3NOPs: recruit per spawner from Canadian Campelen spring surveys in 1997-2007. Females are from year-1.

c) Assessment Results

Biomass. The biomass of this stock increased in 2000 with the large 1999 year-class. Subsequently, the biomass index has decreased and remains at levels comparable to the beginning of the Campelen time series in 1996-1999.

Recruitment. The 1999 year-class was large, but no large year-class has been observed since then.

Relative F (catch/Canadian spring survey biomass). Using STACFIS agreed commercial catch and Canadian spring survey biomass index, estimates of relative *F* were calculated for white hake in Div. 3NO and Div. 3NOPs. Relative *F* has fluctuated, but increased for 2002-2003(Fig. 17.7). Current estimates of relative *F* are comparable to levels observed from 1996-2001.

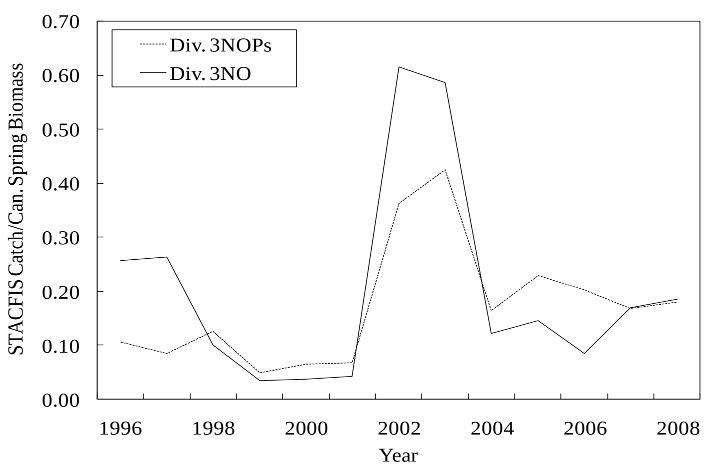

Fig. 17.7. White hake in Div. 3NOPs: estimates of relative *F* from STACFIS agreed commercial catches and Canadian spring surveys (1996-2008).

State of the stock. Following the dominance of 1999-year-class fish in 2000, a progression of this year-class is observed through subsequent years leading to increased catches in the white hake fishery in 2002-2003, when fish reached harvestable sizes, followed by a reduction in catches since. Survey biomass indices remain at levels comparable to those observed prior to the appearance of the 1999 year-class.

d) Reference Points

Reference Points with respect to a Precautionary Approach for this species have not been determined.

e) Research Recommendations

STACFIS **recommended** that *the genetic analyses in 2003 of Div. 3NO versus Subdiv. 3Ps samples be continued; in order to help determine whether Div. 3NOPs white hake comprise a single breeding population.*

STACFIS **recommended** that *the collection of information on commercial catches of white hake be continued and now include sampling for age, sex and maturity to determine if this is a recruitment fishery*.

STACFIS **recommended** that *age determination should be conducted on otolith samples collected during annual Canadian surveys (1972-2005+); thereby allowing age-based analyses of this population.*

D. WIDELY DISTRIBUTED STOCKS: SA 2, SA 3 AND SA 4

Environmental Overview

The water mass characteristics of Newfoundland and Labrador Shelf are typical of sub-polar waters with a sub-surface temperature range of -1-2ºC and salinities of 32-33.5. Labrador Slope Water flows southward along the shelf edge and into the Flemish Pass region, this water mass is generally warmer and saltier than the sub-polar shelf waters with a temperature range of 3°-4°C and salinities in the range of 34-34.75. On average bottom temperatures remain <0°C over most of the northern Grand Banks but increase to 1-4°C in southern regions and along the slopes of the banks below 200 m. North of the Grand Bank, in Div. 3K, bottom temperatures are generally warmer (1-3°C) except for the shallow inshore regions where they are mainly <0°C. In the deeper waters of the Flemish Pass and across the Flemish Cap bottom temperatures generally range from 3-4°C. Throughout most of the year the cold, relatively fresh water overlying the shelf is separated from the warmer higher-density water of the continental slope region by a strong temperature and density front. This winter-formed water mass is generally referred to as the cold intermediate layer (CIL) and is considered a robust index of ocean climate conditions. In general, shelf water masses undergo seasonal modification in their properties due to the seasonal cycles of air-sea heat flux, wind-forced mixing and ice formation and melt, leading to intense vertical and horizontal gradients particularly along the frontal boundaries separating the shelf and slope water masses. Temperature and salinity conditions over the Scotian Shelf are largely determined by advection of water from southern Newfoundland and the Gulf of St. Lawrence as well as offshore slope waters. In the northeast regions of the Scotian Shelf the bottom tends to be covered by relatively cold waters (1-4°C) whereas the basins in the central and southwestern regions have bottom temperatures that typically are 8-10°C.

Ocean temperatures on the Newfoundland and Labrador Shelf during 2008 cooled but remained above normal, continuing the warmer than normal conditions experienced since the mid-to-late 1990s. Salinities in general on the Newfoundland and Labrador Shelf, which were lower than normal throughout most of the 1990s, increased to the highest observed since the early 1990s during 2002 and have remained mostly above normal during the past 7 years. At Station 27 off St. John’s, the depth-averaged annual water temperature decreased from the record high observed in 2006 to about normal in 2007 and to above normal in 2008. Annual surface temperatures at Station 27 also decreased from the 61-year record of 1.7°C above normal in 2006 to about normal in 2007 and to 1°C above normal in 2008. Bottom temperatures at Station 27 remained above normal for the 13th consecutive year. From 2004-2006, they were significantly above normal but decreased to above normal during 2007-2008. Upper-layer salinities at Station 27 were above normal for the 7th consecutive year. Annual surface temperatures on Hamilton Bank were above normal, above normal on the Flemish Cap and near normal on St. Pierre Bank. Bottom temperatures on Hamilton Bank were normal, significantly above normal on the Flemish Cap and below normal on St. Pierre Bank. The area of the Cold-Intermediate-Layer (CIL) water mass on the eastern Newfoundland Shelf during 2008 was below normal for the 14th consecutive year and the 5th lowest since 1948. The average temperature and salinity during the summer of 2008 along the Bonavista section has remained significantly above normal. Bottom temperatures during the spring of 2008 remained slightly above normal on the Grand Banks (Div. 3LNO) but were below normal on St. Pierre Bank (Subdiv. 3Ps). During the autumn they were above normal in NAFO Div. 2J and 3K and slightly below normal in Div. 3LNO. The area of the bottom on the Grand Banks covered by <0°C water during the spring decreased from near 60% in 1991 to <5% in 2004 but increased to near-normal at about 30% in 2007-2008.

A review of the 2008 physical oceanographic conditions on the Scotian Shelf and in the eastern Gulf of Maine and adjacent offshore areas during 2008 indicates that there was an overall balance between positive and negative anomalies. However, there was systematic variability within the region: 7 of the 10 series from the eastern half (Halifax and eastward) were negative, whereas, 6 of the 8 from the western half were positive. Deep temperatures in Emerald and Georges Basins were colder than normal. Cabot Strait 200-300 m temperature was below normal. This indicates colder than normal slope water conditions. These below normal temperatures were also reflected in the bottom temperatures in Div. 4W and 4X which were below normal.

The volume of the CIL, defined as waters with temperatures <4^{o}C, was estimated for the region from Cabot Strait to Cape Sable. There is considerable variation in the volume of the CIL since 1998. In 2008, the observed volume of 6 600 km^3 was greater than the long-term mean value of 5 100 km^3 but down slightly from 2007.

18. Roughhead grenadier (*Macrourus berglax*) in SA 2+3

Interim Monitoring Report (SCR Doc. 09/10, 19 and 21; SCS Doc. 09/5, 9, 12, 13 and 14)

a) Introduction

A substantial part of the grenadier catches in SA 3 previously reported as roundnose grenadier have been roughhead grenadier. To correct the catch statistics STACFIS revised and approved roughhead grenadier catch statistics since 1987 for assessment purposes. The misreporting has not yet been resolved in the official statistics before 1996, but the species are considered to be reported correctly since 1997. Catches of roughhead grenadier increased sharply from 1989 (333 t) to 1992 (6 725 t); since then until 1997 total catches have been about 4 000 t. In 1998 and 1999 catches increased and were near the level of 7 000 t. Since then, catches decreased to 3 000-4 000 t in 2001–2004 and to 700 t in 2007. A total catch of 847 t was estimated for 2008 (Fig. 18.1). In the catch series available, less than 2% of the yearly catch has been taken in SA 2.

Recent catches ('000 t) are as follow:

	2000	2001	2002	2003	2004	2005	2006	2007	2008
STATLANT 21A	8.9	2.0	1.7	1.8	1.7	1.3	0.6[1]	0.4[1]	0.4[1]
STACFIS	4.8	3.1	3.7	4.2-3.8[2]	3.2	1.5	1.4	0.7	0.8

[1] Provisional.
[2] In 2003, STACFIS could not precisely estimate the catch.

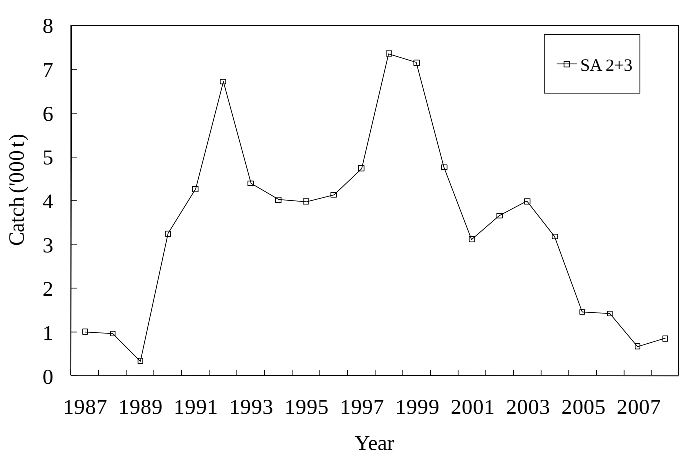

Fig. 18.1. Roughhead grenadier in SA 2+3: catches.

b) Data Overview

Surveys. Mean weights per tow from the Canadian autumn survey in Div. 2J3K, the Spanish Div. 3NO survey and the EU bottom trawl survey on Flemish Cap (down to 750 m) are presented in Fig. 18.2. Although the Canadian autumn survey (Div. 2J+3K) and the Spanish Div. 3NO survey do not cover the entire distribution of the stock, they are considered the best surveys to monitor trends in its status because they cover depths down to 1 500 m. The 2008 data of the Canadian autumn Div. 2J3K index has not been used in this assessment owing to incomplete survey coverage. The strata not surveyed in 2008 accounted for around 50% of Div. 2J+3K biomass indices in recent years.

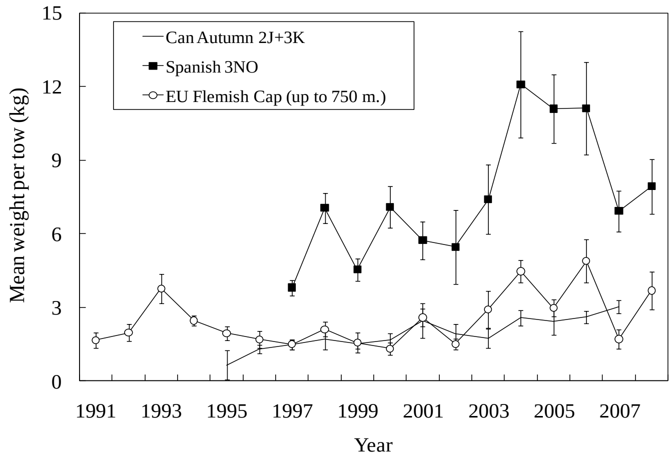

Fig. 18.2. Roughhead grenadier in SA 2+3: mean weight per tow from the Canadian autumn (Div. 2J+3K) survey, Spanish Div. 3NO survey and EU Flemish Cap survey.

The EU Flemish Cap and Spanish Div. 3NO 2008 survey results do not alter the perception of the state of the stock.

The catch/biomass (C/B) ratios have declined in recent years.

c) Conclusion

Based on overall indices for the current year, there is no significant change in the status of the stock to modify the most recent full assessment.

The next full assessment of this stock is planned to be in 2010.

d) Research Recommendation

STACFIS **recommended** in 2007 to *explore the eXtended Survivors Analysis (XSA) configuration of the analytical assessment presented (definition of the plus group, catchability model and the shrinkage options), as well as the incorporation of the new survey information into the model*.

STATUS: An analysis of the plus group definition, the F_{bar} range, the catchability model and the shrinkage options of the XSA model used in 2007 was made (SCR 09/21) and results suggest to establish the plus group in 17+ and to define the F_{bar} age range between 6 and 13 years. More analysis in catchability model and the shrinkage options will be made when new survey data been incorporated into the model.

STACFIS **recommended** to *explore the use the production models in this stock.*

19. Witch flounder (*Glyptocephalus cynoglossus*) in Div. 2J+3KL

Interim Monitoring Report (SCS Doc. 09/5, 9, 12, 13)

a) Introduction

The fishery for witch flounder in this area began in the early 1960s and increased steadily from about 1 000 t in 1963 to a peak of over 24 000 t in 1973 (Fig. 19.1). Catches declined rapidly to 2 800 t by 1980 and subsequently fluctuated between 3 000 and 4 500 t to 1991. The catch in 1992 declined to about 2 700 t, the lowest since 1964; and further declined to around 400 t by 1993. Until the late 1980s, the fishery was conducted by Poland, USSR and Canada mainly in Div. 3K. Since then, the regulated fishery had been mainly Canadian although EU (Portugal and Spain) has taken increased catches in the Regulatory Area of Div. 3L since the mid-1980s. Although a moratorium on directed fishing was implemented in 1995, the catches in 1995 and 1996 were estimated to be about 780 and 1 370 t, respectively. However, it is believed that these catches could be overestimated by 15-20% because of misreported Greenland halibut. The catches in 1997 and 1998 were estimated to be about 850 and 1 100 t, respectively, most of which was reported from the Regulatory Area of Div. 3L. From 1999 to 2004 catches were estimated to be between 300 and 800 t. Since 2005, catches have averaged less than 100 t (83 t in 2008).

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

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Recommended TAC	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf
STATLANT 21A	0.5	0.6	0.7	0.5	0.3	.2	.1	.1[1]	.1[1]	
STACFIS	0.7	0.8	0.4	0.7	0.8	.2	.1	.1	.1	

[1] Provisional.
ndf no directed fishing.

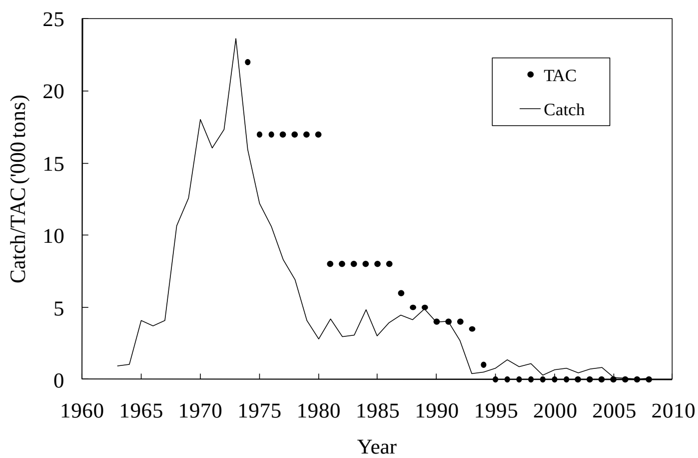

Fig. 19.1. Witch flounder in Div. 2J+3KL: catches and TAC.

b) Data Overview

i) Surveys

Canadian surveys were conducted in Div. 2J+3KL during autumn 2008 (Fig. 19.2). The survey biomass estimates continued to show very slight improvement over previous values, but abundance indices declined slightly in 2008, due mostly to fewer small fish in the survey. Survey coverage in Div. 3L was incomplete in 2004 and 2005, and in 2008 there were substantial survey coverage deficiencies in Div. 2J+3KL (SCR Doc. 09/12). Results in these years may, therefore, not be comparable to other years.

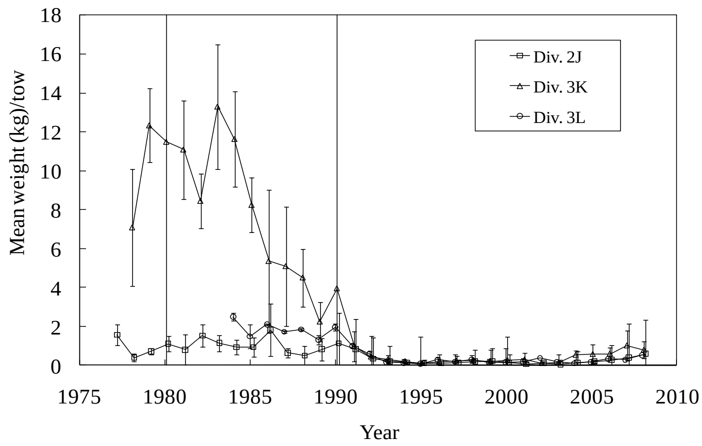

Fig. 19.2. Witch flounder in Div. 2J+3KL: mean weights (kg) per tow (with 95% confidence limits) from Canadian autumn surveys.

Abundance at length. Abundance at length from the Canadian autumn surveys 2005-2008 are given in Fig. 19.2. The slight increase, from 2005 to 2006, in biomass and mean weight (kg) per tow was not evident in the abundance indices, suggesting growth, and not recruitment, was responsible for the change. The length frequencies confirm this, and show a shift toward larger fish in 2006, while the peak of smaller fish seen in the 2005 survey, did not appear strong in the 2006 survey. In 2007, both abundance and biomass indices increased from 2006, and the length frequency shows three modes. The smallest fish are likely recruits; the middle mode shows growth of the smaller peaks seen in 2005-2006 and the mode of larger fish shifts to the right indicating growth. The smallest peak in 2007 (12-14 cm) shifted to about 20-22 cm in 2008 and the largest mode in 2008 represents growth of the middle mode from the previous year into the largest modal range.

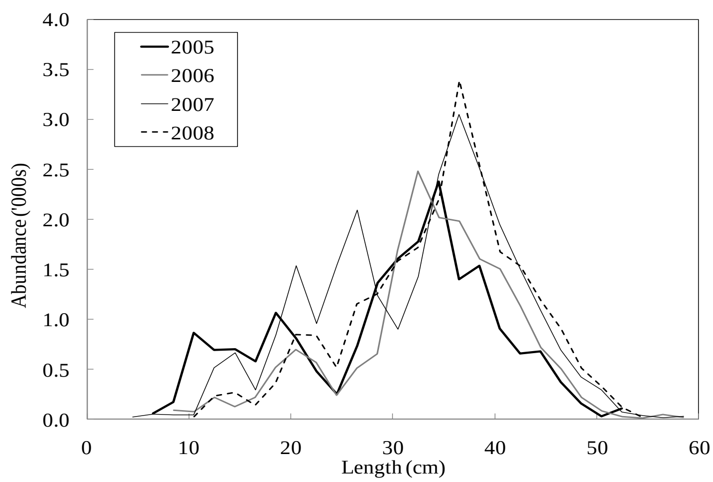

Fig. 19.3. Witch flounder in Div. 2J+3KL: abundance at length from Canadian autumn surveys in 2005-2008.

c) Conclusion

Based on survey indices for the current year, there is nothing to indicate a change in the status of the stock.

The next full assessment of this stock is scheduled for 2010.

20. Greenland halibut (*Reinhardtius hippoglossoides*) in SA 2 + Div. 3KLMNO

(SCR Doc. 09/8, 12, 19, 22, 33, 37, 38, 39; SCS Doc. 09/5, 9, 12, 13, 14, 20; FC Doc. 03/13)

a) Introduction

Catches increased from low levels in the early 1960s to over 36 000 t in 1969, and ranged from less than 20 000 t to 39 000 t until 1990 (Fig. 20.1). In 1990, an extensive fishery developed in the deep water (to at least 1 500 m) in the NAFO Regulatory Area (NRA), around the boundary of Div. 3L and Div. 3M, extending into Div. 3N by 1991. The total catch estimated by STACFIS for 1990-1994 was in the range of 47 000 to 63 000 t annually, although estimates in some years were as high as 75 000 t. Beginning in 1995, TACs for the resource were established by the Fisheries Commission, and the catch declined to just over 15 000 t in 1995, a reduction of about 75% compared to the average annual catch of the previous 5 years. The catch from 1996-1998 was around 20 000 t per year. Subsequently catches increased and by 2001 had reached 38 000 t before declining to 34 000 t in 2002.

Prior to the 1990s Canada was the main participant in the fishery followed by USSR/Russia, Denmark (Faroe Islands), Poland and EU-Germany (GDR before 1989) fishing primarily in SA 2 and Div. 3K. Since then the major participants in the fishery are EU-Spain, Canada, EU-Portugal, Russia and Japan. All except Canada fish the NRA mainly in Div. 3LM and to a lesser degree in Div. 3NO.

In 2003, Scientific Council noted that the outlook for this stock was considerably more pessimistic than in recent years, and that catches were generally increasing despite declines in all survey indices. In 2003 the Fisheries Commission implemented a fifteen year rebuilding plan for this stock, and established TACs of 20 000, 19 000, 18 500 and 16 000 t, respectively for the years 2004 to 2007. TACs for 2008 and 2009 have remained at 16 000 t. The STACFIS estimate of catch for 2008 is 21 180 t. Since the inception of the Fisheries Commission rebuilding plan, estimated catches for 2004-2008 have exceeded the TACs by 27%, 22%, 27%, 42%, and 32%, respectively.

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

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Recommended TAC	30	40	40	36	16	nr*	nr*	nr*	nr*	<10.5[*,4]
TAC	35	40	44	42	20[3]	19[3]	18.5[3]	16[3]	16[3]	16[3]
STATLANT 21A	32	34	31	31	16	18[1]	17[1]	15[1]	15[1]	
STACFIS	34	38	34	32-38[2]	25	23	24	23	21	

nr – no recommendation
* evaluation of rebuilding plan
[1] Provisional
[2] In 2003, STACFIS could not precisely estimate the catch
[3] Fisheries Commission rebuilding plan (FC Doc. 03/13)
[4] Scientific Council recommended that "fishing mortality should be reduced to a level not higher than $F_{0.1}$". This corresponded to a catch of not more than 10 500 t

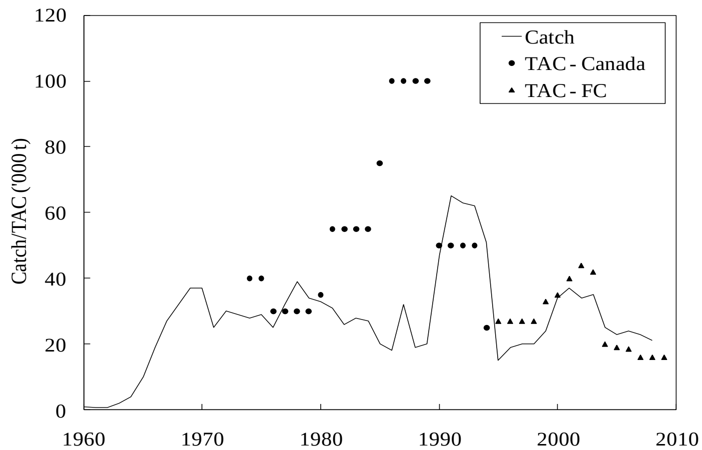

Fig. 20.1. Greenland halibut in SA 2 + Div. 3KLMNO: catches and TACs.

b) Input Data

i) Commercial fishery data

Catch and effort. Analyses of otter trawl catch rates from Canadian vessels operating inside of the Canadian 200 mile limit, using hours fished as the measure of effort, indicated a general decline from the mid-1980s to the mid-1990s. The 2006-2008 estimates of standardized CPUE for Canadian otter-trawlers indicate a sizeable increase compared to previous years, and the 2008 value exceeds all others in the time-series. At present, most of the Canadian landings come from Div. 2J+3K.

Catch-rates of Portuguese otter trawlers fishing in the NRA of Div. 3LMN over 1988-2008 declined sharply in 1991 from initial levels. Consistent increases were estimated over the mid-1990s until 2000. CPUE has increased substantially since 2004, with only a slight decline in 2008. In recent years, almost all of the Portuguese catches have been in Div. 3LM.

Spatial analysis of catch and effort trends of the Spanish fleet (SCR Doc. 09/22) indicated the area being fished by this fleet has contracted as effort has been substantially reduced since 2003 under the Fisheries Commission rebuilding plan. Fishing is now concentrated within Div. 3LM. The standardized CPUE for the Spanish fleet has also increased considerably over 2005-2007. The 2008 value, although lower, remains high.

Recent increases in CPUE have been detected in all fleets (Fig. 20.2).

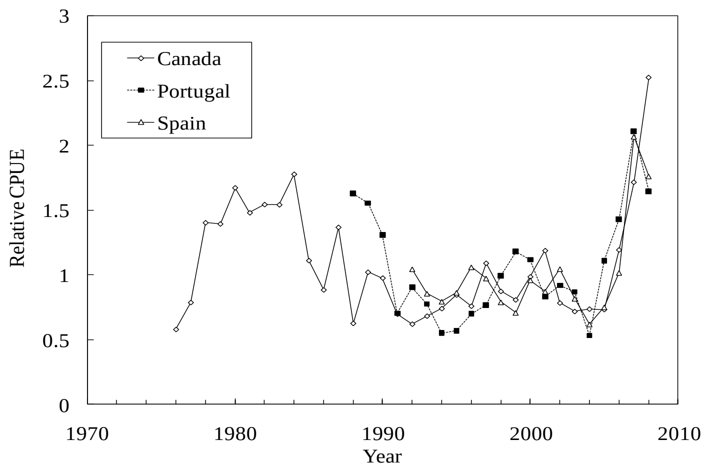

Fig. 20.2. Greenland halibut in SA 2 + Div. 3KLMNO: standardized CPUE from Canadian, Portuguese and Spanish trawlers. (Each standardized CPUE series is scaled to its 1992-2008 average.)

STACFIS previously recognized that trends in commercial catch per unit effort for Greenland halibut in SA 2 + Div. 3KLMNO should not be used as indices of the trends in the stock (*NAFO Sci. Coun. Rep*., 2004, p. 149). It is possible that by concentration of effort and/or concentration of Greenland halibut, commercial catch rates may remain stable or even increase as the stock declines.

Catch-at-age and mean weights-at-age. The catch-at-age data for Canadian fisheries in 2008 were presented. Length samples for the 2008 fishery were provided by EU-Spain, EU-Portugal, Russia and Canada. Aging information was available for Russian, EU-Spain and Canadian fisheries. Due to aging inconsistencies, an age-length key from Canadian commercial samples was applied to calculate catch-at-age for all catches in 2008 as in previous assessments.

Ages 6-8 dominated the catch throughout the entire time period and the proportion of the catch from these age groups has been increasing. Age groups 10+ currently contribute about 7% to the total annual landings, much lower than the long-term average (24%). Mean weights-at-age exhibit variable patterns in the earliest period likely due to poor sampling. Mean weights-at-age for age groups 5-7 during the recent period have increased slightly. For older fish they were variable but indicate a declining trend over the past decade.

ii) Research survey data

STACFIS reiterated that most research vessel survey series providing information on the abundance of Greenland halibut are deficient in various ways and to varying degrees. Variation in divisional and depth coverage creates problems in comparing results of different years (SCR Doc. 09/12). A single survey series which covers the entire stock area is not available. A subset of standardized (depth and area) stratified random survey indices have been used to monitor trends in resource status, and are described below.

Canadian stratified-random autumn surveys in Div. 2J + Div. 3KLMNO. The Canadian autumn survey index provides the longest time-series of abundance and biomass indices (Fig. 20.3; mean weight (kg) and numbers per tow) for this resource. Biomass declined from relatively high estimates of the early 1980s to reach an all-time low in 1992. The index increased substantially due to the abundant 1993-1995 year-classes, but this increase was not sustained, and the index decreased by almost 60% from 1999-2002. The index continually increased over the next five years. Mean numbers per tow were stable through the 1980s, but increased substantially in the mid-1990s, again due to the presence of the 1993-1995 year-classes. After this, abundance declined to the late 1990s and had been relatively stable except for the decline in 2005. The age-composition of the 2005-2007 surveys have shown relatively few recruits and unexpectedly high numbers of older individuals of cohorts which were estimated to be below average from survey information at younger ages. The 2008 survey was not fully completed as many deep water areas important to Greenland halibut indices were not surveyed. Thus, the 2008 values are not directly comparable with previous years (SCR Doc. 09/12, 33).

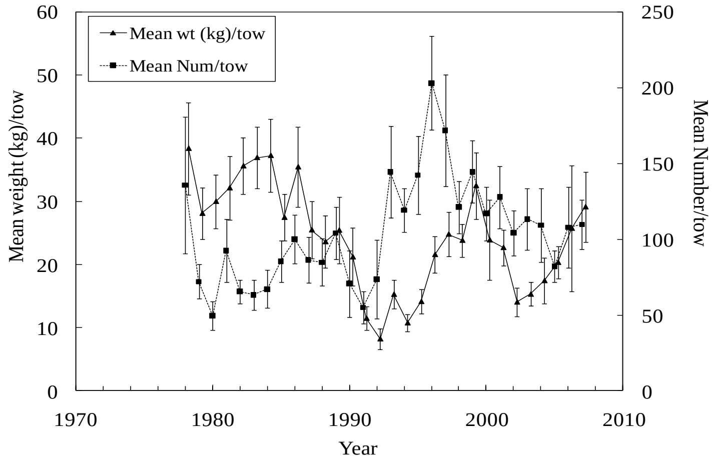

Fig. 20.3. Greenland halibut in SA 2 + Div. 3KLMNO: biomass and abundance indices (mean weight; mean number-per-tow with 95% CI) from Canadian autumn surveys in Div. 2J+3K.

Fig. 20.4 characterizes a significant increase in fish that are 30-70 cm which was not preceded by any evidence of recruitment in the <30 cm length class. The 2007 biomass per tow result for the 30-70 cm grouping is more than 2.5 times the 2002-2004 average. Such increases are consistent with indications of improvement in the commercial CPUE from various fleets throughout the stock area.

During the late 1970s and early 1980s large Greenland halibut (greater than 70 cm) contributed almost 20% to the estimated biomass (Fig. 20.4). However, after 1984 this size category declined and by 1988 virtually no Greenland halibut in this size range contributed to the index. Since then, the contribution to the index from this size group has been extremely low, often zero.

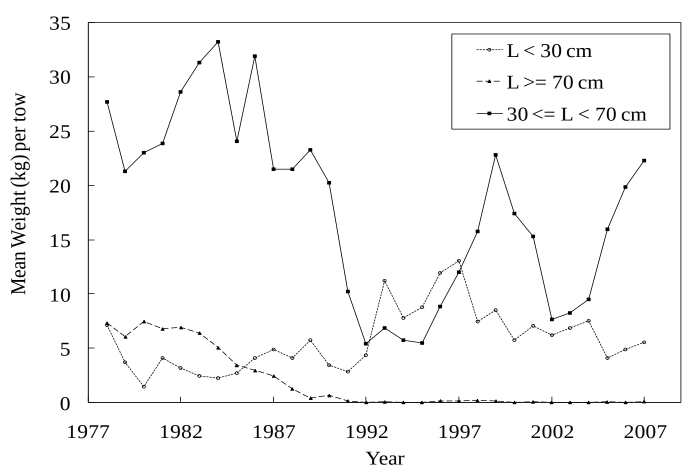

Fig. 20.4 Greenland halibut in SA 2 + Div. 3KLMNO: biomass indices (mean weight (kg) per tow) by size class from Canadian autumn surveys in Div. 2J+3K.

The Canadian autumn survey in Div. 3L has generally shown trends that are consistent with those from Div. 2J+3K. Autumn surveys within Div. 3NO had erratic deep-water coverage. Canadian autumn surveys in Div. 3M indicated a general decline over 1998 to 2003. Div. 3M was not surveyed in 2004, 2005, nor 2008; the 2006 and 2007 estimates of abundance and biomass are relatively low.

STACFIS previously noted (*NAFO Sci. Coun. Rep.*, 1993, p. 99-103) an apparent redistribution of the resource in the early 1990s. Thus, the declining trend in the Canadian autumn surveys in Div. 2J+3K from the mid-1980s to the early 1990s might have been more a reflection of Greenland halibut emigrating from the survey area to the deep waters of the Flemish Pass as opposed to a severe decline in the stock. However, since the mid-1990s, survey indices in the Regulatory Area and in Div. 2J+3K has generally shown similar trends suggesting that emigration does not currently appear be an influential factor to the overall trends in the indices. Given these observations, STACFIS concluded that it is inappropriate to use the Canadian autumn Div. 2J+3K survey index prior to the mid-1990s as a calibration index in VPA based assessments.

Canadian stratified-random spring surveys in Div. 3LNO. The biomass index (mean weight (kg) per tow) from the Canadian spring surveys in Div. 3LNO (Fig. 20.5) during 2007 and 2008 are higher than values over 2002-2005, but the recent estimates have been imprecise. Div. 3NO was not surveyed in the spring of 2006.

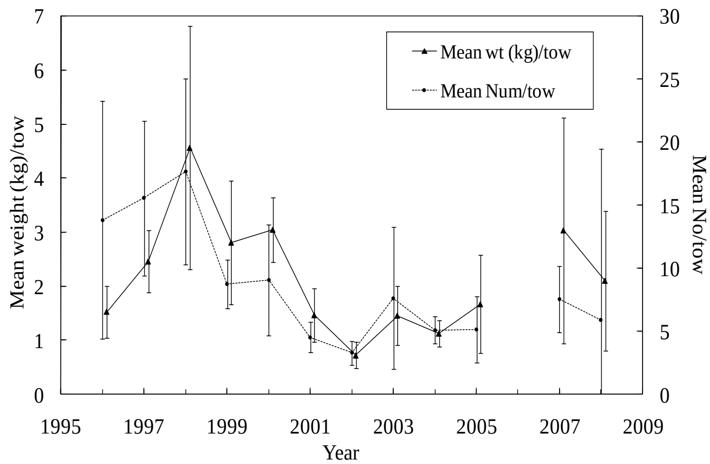

Fig. 20.5. Greenland halibut in SA 2 + Div. 3KLMNO: biomass and abundance indices (mean weight; mean number-per-tow with 95% CI) from Canadian spring surveys in Div. 3LNO.

EU stratified-random surveys in Div. 3M (Flemish Cap). Surveys conducted by the EU in Div. 3M during summer (SCR Doc. 09/19) indicate that the Greenland halibut biomass index (mean weight (kg) per tow) in depths to 730 m, increased in the 1988 to 1998 period (Fig. 20.6) to a maximum value in 1998. This biomass index declined consistently over 1998-2002. The 2002-2008 results have been relatively stable, with the exception of an anomalously low value in 2003. The Flemish Cap survey has covered depths to 1 460 m since 2004. Biomass estimates over all depths covered (i.e. to 1 460 m) has doubled over 2005-2008.

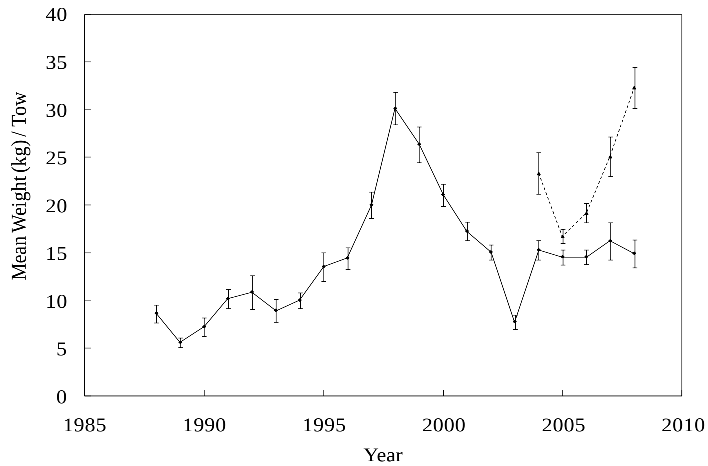

Fig. 20.6. Greenland halibut in SA 2 + Div. 3KLMNO: Biomass index (mean catch per tow ±1 S.E.) from EU summer surveys in Div. 3M. Solid line: biomass index for depths <730 m. Dashed line: biomass index for all depths <1 460 m.

EU-Spain stratified-random surveys in NAFO Regulatory Area of Div. 3NO. The biomass index (mean weight (kg) per tow; converted to Campelen trawl equivalents) for this survey of the NRA increased from 1997 to 1998, but there was been a general decline from 1999 to 2007 (Fig. 20.7). The 2008 biomass index is almost double the 2007 level.

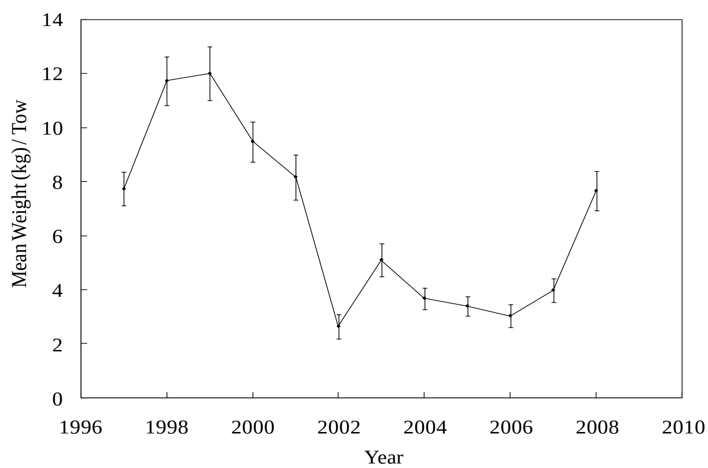

Fig. 20.7. Greenland halibut in SA 2 + Div. 3KLMNO: biomass index (±1 SE) from EU-Spain spring surveys in Div. 3NO.

Summary of research survey data trends. These surveys provide coverage of the majority of the spatial distribution of the stock and the area from which the majority of catches are taken. Over the past decade, indices from the majority of the surveys have generally provided a consistent signal as to the dynamics of the stock biomass (Fig. 20.8). Following an increase from 1996 to 1998, they generally have been decreasing at or below 1996 levels. Within the recent period however, the biomass indices from both the Canadian survey in Div. 2J+3K and the EU Div. 3M 0-1 400 m index have increased considerably. These increases are consistent with recent increases in commercial CPUE from Canadian, Spanish and Portuguese fleets (Fig. 20.4). At the same time, the EU Flemish Cap index to 730 m and Spanish Div. 3NO biomass indices have generally been stable in recent years.

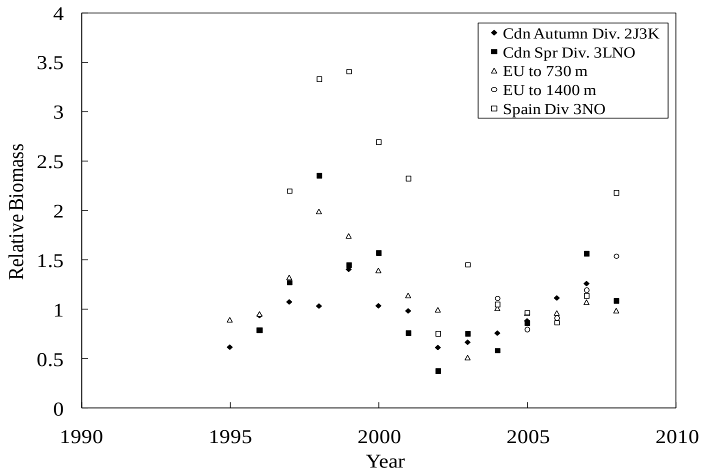

Fig. 20.8. Greenland halibut in SA 2 + Div. 3KLMNO: Relative biomass indices over 1996-2008 from Canadian autumn surveys in Div. 2J3K, Canadian spring surveys in Div. 3LNO, EU surveys of Flemish Cap (to both 730m, and since 2004, 1400m), and Spanish surveys of the NRA of Div. 3NO. Each series is scaled to its 2004-2007 average.

c) Estimation of Parameters

STACFIS reviewed the impact of the incomplete survey coverage of the Canadian autumn survey (SCR Doc. 09/12, 39). It was determined that the coverage deficiencies within Div. 2J+3K were such that the mean numbers per tow index from Div. 2J+3K could not be considered comparable to that of previous years. This survey index has been used to calibrate the XSA in recent years, along with the Canadian spring Div. 3LNO and EU Flemish Cap (0-730 m) data. The algorithm within XSA which estimates survivors generates and applies a weighting to estimates of terminal year survivors at each survey-age. In recent assessments of this stock (e.g. SCR Doc. 08/48), the Canadian Div. 2J+3K index has received the majority of the weight used to estimate the survivors. It is therefore critical to the XSA assessment that the indices from this survey are consistent from year to year. STACFIS concluded that it would not be appropriate to update that analytical assessment as the Canadian Div. 2J+3K data for 2008 were not comparable to those from previous years.

STACFIS concluded, after lengthy discussion and with the exception of one member (see SC agenda item XII.8.d), that revising the projections conducted during the 2008 assessment would give a better basis for advice than the other available options but emphasizes that the amount of uncertainty associated with these projections is thereby amplified.

d) Reference Points

i) Precautionary approach reference points

Precautionary approach reference points could not be determined for this stock at this time.

ii) Yield per recruit reference points

Using the results of the 2008 assessment, F_{Max} is computed to be 0.34 and $F_{0.1}$ is 0.18, assuming weights at age and a partial recruitment equal to the average of each of these quantities over the past three years.

e) Projections

STACFIS emphasizes that all projections are contingent on the accuracy of the estimates of survivors. This is especially so for the deterministic projections, which do not include uncertainties around the XSA estimates of terminal year survivors. In particular, assessments of year-class strength of this stock have been subject to retrospective revisions. Further, as the projection period lengthens, an increasing proportion of the age composition is comprised of year-classes that may be poorly estimated (limited survey data available) or are assumed (recruits in the projection period).

In order to re-evaluate the population trends in the medium term, five-year deterministic projections to 2013 were conducted. All projection scenarios apply the catch-at-age for 2008 as calculated during this assessment. For projected catch in years 2009-2012, two scenarios were evaluated:

constant fishing mortality at $F_{0.1}$ (0.180), and

constant landings at 16 000 t.

Deterministic projections were conducted assuming a recruitment value fixed at the 2000-2005 geometric mean of the age 1 XSA estimates. Scaled selection patterns are derived from the 2005 to 2007 average from the XSA. Weights at age in the stock and in the catch are computed from the 2005-2007 average input data. Natural mortality was fixed at 0.2 throughout. Given that the additional projection uncertainty noted previously could not be accounted for in the stochastic projection of stock dynamics, it was considered inadvisable to provide updated stochastic projections. These will be provided when the analytical assessment is updated in future years.

Deterministic Projection Results

Projected values of exploitable biomass (Fig. 20.9), fishing yield, and average fishing mortality (Fig. 20.10) are presented in Table 20.1. Note that in the $F_{0.1}$ projection, a status quo catch of 21 178 t is assumed caught in 2009, with subsequent catches (2010-2012) corresponding to a fishing mortality of $F_{0.1}$. The 16 000 t projection assumes that removals are 16 000 t annually over 2009-2012.

Results indicate that the 5+ biomass will increase when fishing mortality is reduced to the $F_{0.1}$ level. This is in part due to considerable increases in 10+ biomass. The 5+ biomass does not recover to the level estimated for 2008 assuming catches are constant at 16 000 t over the projection period. Average fishing mortality under 16 000 t catches continues to increase due to over-exploitation of the weak 2003-2005 year-classes. These projections differ slightly from the advice given last year due to differences in the projected catch for 2008: last year’s projections assumed 2008 removals of 24 154 t (computed from status quo fishing mortality) whereas these projections use the STACFIS agreed total catch for 2008 (21 178 t).

Table 20.1. Greenland halibut in SA 2 + Div. 3KLMNO: Deterministic projections.

F0.1 - Status quo catch in 2009				**16,000 t**			
Year	**5+ Biomass (t)**	**Yield**	**Fbar (5-10)**	**Year**	**5+ Biomass (t)**	**Yield**	**Fbar (5-10)**
2008	79050	21178	0.414	2008	79050	21178	0.414
2009	71579	21178	0.392	2009	71579	16000	0.274
2010	62332	8807	0.180	2010	68635	16000	0.313
2011	72496	9214	0.180	2011	70580	16000	0.369
2012	83457	9988	0.180	2012	73194	16000	0.399
2013	94691			2013	76506		

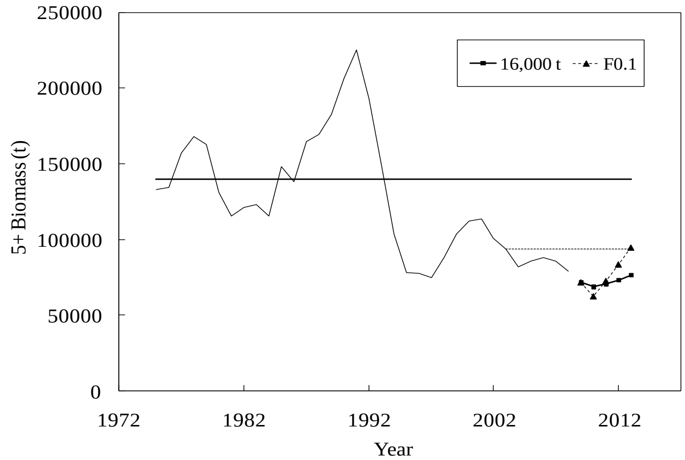

Fig. 20.9. Greenland halibut in SA 2 + Div. 3KLMNO: Deterministic projection of 5+ biomass to 2013. The solid horizontal line represents the rebuilding plan target biomass of 140 000 t; the dashed horizontal line is the level of the 5+ biomass in 2003, when the Fisheries Commission rebuilding plan was implemented.

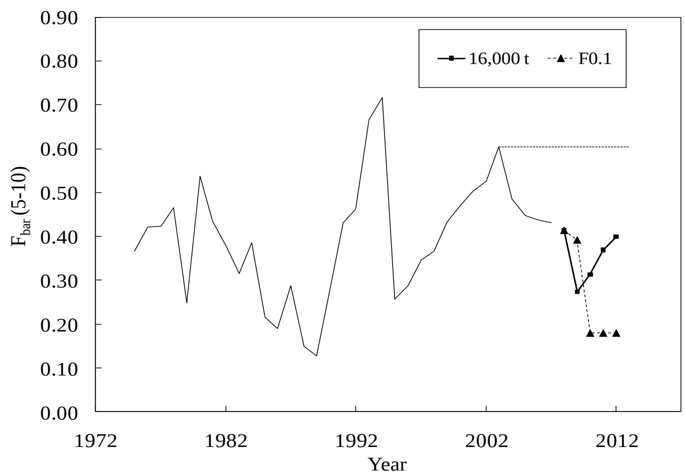

Fig. 20.10. Greenland halibut in SA 2 + Div. 3KLMNO: Deterministic projection of average fishing mortality to 2012. The horizontal dashed line indicates the level of fishing mortality when the rebuilding plan was implemented.

In summary, projections conducted assuming a fixed catch of 16 000 t do not result in improvements in the 5+ biomass, since the majority of the year-classes which recruit to the exploitable biomass during the projection period are estimated to be well below average. If a fishing mortality corresponding to $F_{0.1}$ is achieved, the exploitable biomass is projected to grow in the medium term.

f) Research Recommendations

STACFIS **recommended** that *research continue on age determination for Greenland halibut in SA 2 and Div. 3KLMNO to improve accuracy and precision*.

Previous survey experiments have noted that the depth distribution of Greenland halibut extends beyond 1 500 m, the maximum depth of the survey information currently available to assess this stock. Considering that very few age 10+ fish are captured in either commercial fisheries or in trawl surveys, STACFIS reiterated its **recommendation** that *exploratory deep-water surveys for Greenland halibut in Subarea 2 and Divisions 3KLMNO be conducted using gears other than bottom trawls to complement existing survey data.*

Tagging experiments could provide information on movement, growth rates and validate the current aging methods. STACFIS **recommended** that *tagging experiments of Greenland halibut in Subarea 2 and Divisions 3KLMNO be conducted.*

Recognizing that the available survey series, taken individually or in combination, do not cover the entire range of this stock, STACFIS **recommended** that *a synoptic survey of Greenland halibut in Subarea 2 and Divisions 3KLMNO be conducted over a series of years, to the maximum depth possible.*

STACFIS **recommended** that *the choice of assessment model be investigated in further assessment workshops that would first quantitatively analyze the impacts of data characteristics and model structure and formulation on the estimation of state variables of interest, and secondly evaluate qualitatively the relative merits of model assumptions once their effects were known.*

21. Northern shortfin squid (*Illex illecebrosus*) in SA 3+4

Interim Monitoring Report

a) Introduction

Catches in SA 3+4 over the past 10 years have ranged from 57 t in 2001 to about 6 900 t in 2006 but have generally been less than 600 t (Fig. 21.1). In 2008 the catch was 527 t and was mostly taken from Div. 3KL (98%).

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

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
TAC SA 3+4	75	34	34	34	34	34	34	34	34	34
STATLANT 21A SA 3+4	0.3	0.3	<0.1	0.2	1.1	2.3	0.6	6.9[2]	0.2[2]	0.5[1,2]
STATLANT 21A SA 5+6[3]										
STACFIS SA 3+4	0.3	0.4	<0.1	0.2	1.1	2.3	0.6	6.9	0.2	0.5
STACFIS SA 5+6	7.4	9.0	3.9	2.8	6.4	26.1	12.0	13.9	9.0	15.9
STACFIS Total SA 3-6	7.7	9.4	4.0	3.0	7.5	28.4	12.6	20.8	9.2	16.4

[1] Provisional.
[2] Includes amounts (ranging from 12-43 t) reported as either Unspecified Squid or *Illex* that may have been misidentified as *Loligo*.
[3] Statistics for SA 5+6 are included because there is no basis for considering separate stocks in SA 3+4 and SA 5+6

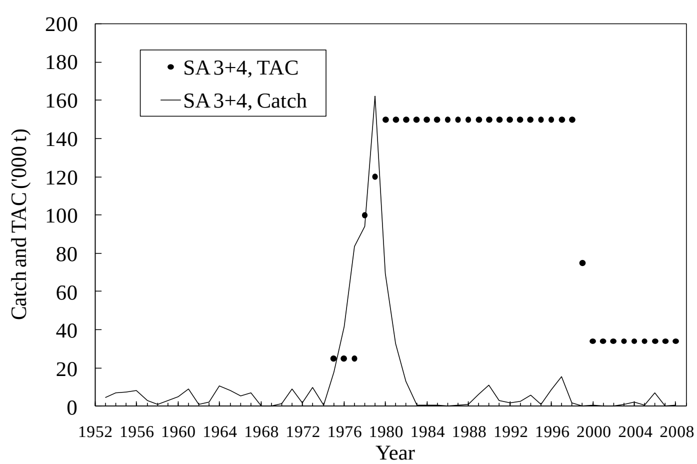

Fig. 21.1. Northern shortfin squid in SA 3+4: nominal catches and TACs.

b) Data Overview

The index of relative biomass is the Div. 4VWX July Canadian survey which has fluctuated widely in the most recent five years. The index has shown two of the highest values in the series in 2004 and 2006 followed by low values in 2005 and 2007. The 2008 value (3.1 kg/tow) increased from 2007 (1.5 kg/tow). (Fig. 21.2) and is within the range of low values typically observed during most years since 1982.

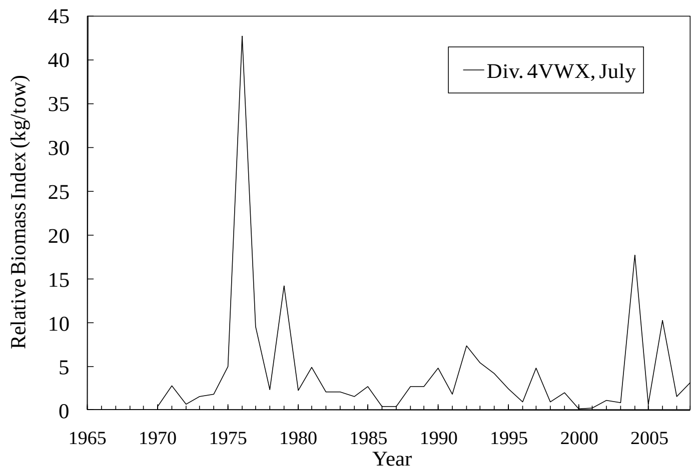

Fig. 21.2. Northern shortfin squid in SA 3+4: research survey biomass indices from the July survey in Div. 4VWX.

The mean weight of squid from the Div. 4VWX survey in 2008 (106 g) increased marginally from 2007 (98 g) and remained higher than most values since 1982 (Fig. 21.3).

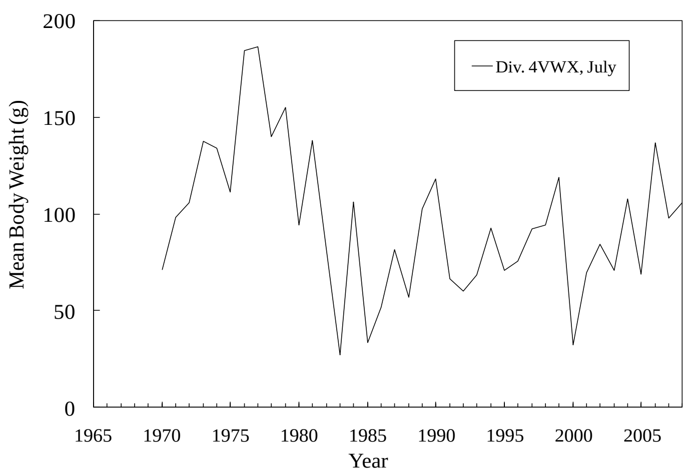

Fig. 21.3. Northern shortfin squid in SA 3+4: mean body weights of squid from the July survey in Div. 4VWX.

c) Conclusion

Although the survey biomass index has fluctuated greatly in recent years the most recent two values are more typical of the low-productivity period that began around 1982. Mean body weight increased marginally in 2008, and remains higher than most values observed since 1982. The available data do not show any major change in the state of the stock.

d) Special Comment

STACFIS will be unable to conduct further assessments or monitoring of this stock until an assessment expert with appropriate knowledge of the species can be designated.

IV. OTHER MATTERS

1. FIRMS Classification for NAFO Stocks

The revised table reflects changes made in the classification of stocks according to the judgement of STACFIS at the June meeting in 2009. The meeting continued to have difficulty in assigning stocks to a small number of qualitatively defined classes. The present table reflects greater recognition of the knowledge of stock status available at the meeting, even if partial, which resulted in greatly shortening the list of 'Unknown–Unknown' stocks in the lower right-hand corner. Some stocks were also moved from the 'Depleted–High' box through the recognition that recent catch records indicated fishing mortalities lower than those that guided previous entries in this classification scheme.

Stock Size	Fishing Mortality			
(incl. structure)	None–Low	Moderate	High	Unknown
Virgin–Large		3LNO Yellowtail flounder		
Intermediate	3M Redfish 3LN Redfish	3LNO Northern shrimp[1] SA0+1 Northern shrimp[1] 3M Northern shrimp[1] DS Northern shrimp[1]		
Small	3M Cod SA3+4 Northern shortfin squid		SA2+3KLMNO Greenland halibut	3NOPs White hake 3LNOPs Thorny skate
Depleted	3M American plaice 3LNO American plaice 2J3KL Witch flounder		3NO Cod	SA1 Redfish SA0+1 Roundnose grenadier 3NO Witch flounder
Unknown	SA2+3 Roughhead grenadier 3NO Capelin	0&1A Offsh. & 1B–1F Greenland halibut		1A Insh. Greenland halibut 3O Redfish SA2+3 Roundnose grenadier

[1] Shrimp will be re-assessed in Nov 2009

2. Other Business

a) Designated Experts

STACFIS noted with regret the continued lack of a designated expert for Northern shortfin squid in SA 3 & 4 and concluded that it would be unable to conduct further monitoring or assessment of this stock unless an assessment expert with appropriate biological knowledge of the species can be assigned. STACFIS welcomed Diana Gonzalez-Troncoso as Designated Expert for Cod in Div. 3M and noted that Michael Kingsley will be Designated Expert for Northern shrimp in SA 1+Div. 0A east of 60°30'W.

3. Adjournment

STACFIS thanks the Chairman of Scientific Council for assembling information on Northern Shortfin Squid in SA 3+4 and enabled the Committee to complete of an Interim Monitoring Report on this stock, and him and Dr V. Babyan for help in completing an assessment of Capelin in Div. 3NO in the absence of the Designated Expert. STACFIS thanks Designated Experts for their competence and hard work and the Secretariat for its untiring support. The Chairman of STACFIS thanks Designated Experts, the Chairman of Scientific Council, and the Scientific Council coordinator for their support and help.