PART A

Scientific Council Meeting, 3-17 June 2004

CONTENTS

Participants at Scientific Council Meeting, 3-17 June 2004 (Bottom to top – left to right):

Brian Petrie
Scott Tomlinson, Tissa Amaratunga
Margaret Treble, Johanne Fischer, Cindy Kerr
Joanne Morgan, Ole Jørgensen, Dorothy Auby
Karen Dwyer, Bruce Atkinson, Bill Brodie, Bjarne Lyberth, Gary Maillet, Eugene Colboune
Lisa Hendrickson, Dawn Maddock Parsons, Jean-Claude Mahe, Ross Hendry, Enrique De Cárdenas, David Kulka, Manfred Stein
Antonio Vazquez, Taras Igashov, Antonio Avila de Mello, Ricardo Alpoim, Kathine Sosebee
Brian Healey, Ralph Mayo, Konstantov Gorchinsky, Chris Darby
Hilario Murua, Don Power, Ray Bowering, Vladimir Babayan, Efim Gerber, David Cross, Fernando Gonzalez-Costas
Arni Nicolajsen

Not in Picture: Ken Frank, Susana Junquera, Leonid Kokovkin, Barb Marshall, Fred Serchuk, Peter Shelton, Helle Siegstad, Garry Stenson, Ed Trippel

The Chairs, Scientific Council Meeting, 3-17 June 2004:

Left to Right): Hilario Murua (Chair STACFIS), Antonio Vazquez (Chair STACREC), Joanne Morgan (Chair Scientific Council), Eugene Colboune (Chair STACFEN) and Manfred Stein (Chair STACPUB)

Scientific Council in session during 3-17 June 2004 Meeting.

REPORT OF SCIENTIFIC COUNCIL MEETING

3-17 June 2004

Chair: M. Joanne Morgan Rapporteur: Tissa Amaratunga

I. PLENARY SESSIONS

The Scientific Council met at the Alderney Landing, 2 Ochterloney Street, Dartmouth, Nova Scotia, Canada, during 3-17 June 2004, to consider the various matters in its agenda. Representatives attended from Canada, Denmark (in respect of Faroe Islands and Greenland), European Union (France, Germany, Portugal, Spain and United Kingdom), Russian Federation and United States of America. The Deputy Executive Secretary, Tissa Amaratunga, was in attendance and the Executive Secretary, Johanne Fischer, attended when available.

The Executive Committee met prior to the opening session of the Council, and the Provisional Agenda, plan of work and other related matters were discussed.

The opening session of the Council was called to order at 1015 hours on 3 June 2004.

The Chair welcomed everyone to this venue in Dartmouth and to this June Scientific Council Meeting in NAFO's 25th anniversary year.

The Deputy Executive Secretary was appointed rapporteur.

The Deputy Executive Secretary informed the Council that prior to the meeting, authorization had been received for proxy votes from Bulgaria, France (in respect of St. Pierre et Miquelon), Latvia and Norway to record their abstentions during any voting procedures.

The Chair noted there were no observers in attendance at this meeting. Noting new attendees around the table, the Chair extended a special welcome.

Considering the unforeseen delays encountered in finalizing the nomination of Designated Experts for 2004 during the September 2003 Meeting, the Chair proposed that Designated Experts for 2005 assessments be considered during this meeting when most participants are present.

Having reviewed the work plan, the Agenda (see Part D, this volume) was **adopted.**

The Council was informed that the Chair of the Working Group on Reproductive Potential (Ed Trippel) would present the report of the Working Group during this plenary session (see Section X.I below). The Council also welcomed Chairs of STACFIS and STACREC to address introductory matters regarding the work of their respective Committees.

The opening session was adjourned at 1500 hours on 3 June 2004.

The Council opened its next session at 0900 hours on 5 June 2004 to review the report of the Limit Reference Point Study Group (LRPSG) as presented by the co-Chair Peter Shelton. The Council also considered the recommendations made by the LRPSG (see Section X.3 below). The session was adjourned at 1245 hr on 5 June 2004.

The Council reconvened at 0900 hours on 7 June 2004, inviting NAFO Scientific Council Representative (Garry Stenson) of the Joint NAFO-ICES Working Group on Harp and Hooded Seals to present the report of the Working Group (see Section X.2 below).

The session was adjourned at 1100 hours.

The Council through 7-17 June 2004 addressed various outstanding agenda items as needed. The Standing Committee reports were **adopted** through the course of the meeting.

The concluding session was called to order at 1000 hours on 17 June 2004.

The Council considered and **adopted** the Report of the Scientific Council of this meeting of 3-17 June 2004, noting changes as discussed during the reviews would be made by the Chair and the Deputy Executive Secretary.

The meeting was adjourned at 1145 hours on 17 June 2004.

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 and Advisers/Experts are given in Part D, this volume.

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 2003

The Council noted recommendations made in 2003 pertaining to the work of the Standing Committees were addressed directly by the Standing Committees, while recommendations pertaining specifically to the Council's work were as follows:

From Scientific Council Meeting, 5-19 June 2003 Meeting

1. Noting the Request by Canada and Denmark (Greenland) that, given the bathymetry of Baffin Bay and its proximity to the NAFO boundaries of Div. 0A, 1A and 1B it would have been more appropriate to set the TAC for Div. 0A+1AB, the Scientific Council had **recommended** that Div. *1B be included in the management area with Div. 0A and 1A.*

   The Council noted this recommendation is reflected in this year's (2004) request for advice from Canada and Denmark (Greenland). The Scientific Council report that follows will address the stock accordingly.

2. Regarding further development of NAFO Scientific Council PA Methodology the Scientific Council **recommended** that *a meeting of the Joint Fisheries Commission/Scientific Council Working Group on the Precautionary Approach be held to discuss the implementation of the revised PA framework.*

   No such meeting was held and the PA framework remains unadopted by Fisheries Commission.

3. The Council had **recommended** that *the estimated $10 000 should be allocated from the 2004 budget, to accommodate the costs of the 2 proposed upcoming events of the Scientific Council.*

   Funds were allocated for these meetings in the 2004 budget.

From Scientific Council Meeting, 15-19 September 2003

4. The Scientific Council at both its meetings, in June and September 2003, had made this recommendation. Scientific Council had **recommended** that *a Study Group on the estimation of limit reference points be established. Peter Shelton (Canada) was named as a co-Chair with other co-Chairs to be selected, and the Co-Chairs explore with colleagues possible themes for a Study Group working session in 2004.*

The Study Group was established with P. Shelton (Canada) and J.-C. Mahe (EU-France) as co-Chairs. The Study Group on Limit References Point (LPRSG) met in Lorient, France during 15-20 April 2004.

III. FISHERIES ENVIRONMENT

The Council **adopted** the Report of the Standing Committee on Fisheries Environment (STACFEN), as presented by the Chair, Eugene Colbourne. The full report of STACFEN is at Appendix I.

The **recommendation** made by STACFEN at the June 2002 Meeting was again noted by the Scientific Council and is stated as follows:

1. *further studies be conducted attempting to link climate and fisheries and to bring forward such studies for review.*

IV. PUBLICATIONS

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

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

1. *the Secretariat begin the electronic publication of HTML versions of the Journal.*

2. *a second level of password protection be established for the Scientific Council members pages.*

3. *the addition of new information to the web site be highlighted or "advertised" in some way to ensure the members and general public are made aware of these new features.*

4. *a link to a distribution list of e-mail addresses for current Committee and members e-mails be established to facilitate communication of information.*

5. *a search function be added to the front page* (of the website).

6. *an Ad hoc group be formed to deal with the Journal cover issue intersessionally, and report on this to STACPUB at the September 2004 Meeting of the Committee.*

V. RESEARCH COORDINATION

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

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

1. *the Secretariat determine the resources required to complete the task of digitizing the observer data to enable its use by Scientific Council, and funding to support this work be requested during the September 2004 Meeting of STACFAD.*

2. *SCR Doc. 04/5 on yellowtail flounder (Limanda ferruginea) ageing manual be published in Studies.*

The Council noted three **recommendations** made by STACREC on the issue of catch data (see Appendix III, Section 3a, and 3.b.iii, on quality of catch statistics as needed for stock assessments) were superseded by the

Scientific Council recommendation given in Section XIV below. Accordingly these three STACREC recommendations were not endorsed by the Council.

VI. FISHERIES SCIENCE

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

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

VII. MANAGEMENT ADVICE AND RESPONSES TO SPECIAL REQUESTS

1. **Fisheries Commission** (Appendix V, Annex 1)

Fisheries Statistics. The availability of reliable fisheries catch statistics is a primary and key requirement for resource assessments. Without accurate and reliable data, assessments are compromised both regarding determination of current status and forecasting the future responses of the resource to fishing activity.

Scientific Council does acknowledge that under Rule 5.1 (b), STACREC has the mandate to:

i) develop and recommend to the Scientific Council policies and procedures for the collection, compilation, and dissemination of statistical and sampling information on the living resources and fisheries in the Convention Area;

ii) coordinate the compilation and maintenance of statistics and records and their dissemination, including liaison with coastal states in the Convention Area;

It is not the mandate of Scientific Council to determine the most appropriate estimates of catch derived from different sources. Regardless of this, due to concerns regarding the reliability of official statistics reported to NAFO *via* STATLANT forms, Scientific Council has, for many years as part of its June meetings, examined alternate sources of information in attempts to determine the most accurate estimates of catch so as to be able to provide Fisheries Commission with the best possible advice concerning resource status as well as harvest levels for the future.

This has become an increasingly difficult task as the differences in estimates from different sources have been steadily increasing as indicated for 2003 (see page 9).

Table 1. Summary of the catch information for 2003 available to Scientific Council pertaining to stocks of interest, as well as differences between the estimates and data from STATLANT 21A (submitted to Secretariat before 15 June 2004).

Stock	Upper	Lower	Average	21A	% Diff Upper	% Diff Lower	% Diff Mean
3NO Cod	5 459	4 280	4 870	1 009	441%	324%	383%
3LNO American plaice	10 599	6 855	8 727	2 949	259%	132%	196%
Roughhead grenadier	4 178	3 792	3 985	1 517	175%	150%	163%
3NO Witch flounder	2 239	809	1 524	511	338%	58%	198%
3LN Redfish	1 334	1 334	1 334	716	86%	86%	86%
Greenland halibut	38 377	31 925	35 151	26 657	44%	20%	32%
3LNO Yellowtail flounder	14 149	13 492	13 820	13 030	9%	4%	6%
3M American plaice	131	131	131	102	29%	29%	29%
3LNO Skates	14 018	13 767	13 892	12 031	17%	14%	15%
3M Skates	830	830	830	785	6%	6%	6%
3M Cod	16	16	16	9	73%	73%	73%
2J+3KL Witch flounder	785	785	785	452	74%	74%	74%
3O Redfish	18 419	16 073	17 246	15 208	21%	6%	13%
3LNO White Hake	5 727	4 314	5 020	2 266	153%	90%	122%
3M Redfish	849	849	849	870	-2%	-2%	-2%
Roundnose grenadier	1 073	1 073	1 073	3 768	-72%	-72%	-72%
Totals	118 183	100 324	109 254	81 880			

There is also insufficient information available to Scientific Council regarding the sources of data as well as the methods applied in the overall derivation of catch totals to allow Scientific Council to reasonably determine what best represents reality.

Scientific Council has concluded that STACREC is no longer able to fulfill its mandate of statistics compilation with the current situation. As such, Scientific Council **recommended** that *the Chair of Scientific Council formally communicate to the Chair of Fisheries Commission the concerns of Scientific Council regarding the derivation and accuracy of catch information available, and request that for the future, each year prior to the June meeting of Scientific Council, Fisheries Commission conduct its own evaluation of catch information derived from various sources under Rule 5.1 pertaining to STACTIC, and provide Scientific Council with their agreed estimates by Contracting Party/Country to be utilized by Scientific Council in the conduct of stock assessments.*

Scientific Council Responses. For stocks within or partly within the Regulatory Area, the Fisheries Commission requested the following scientific advice.

a) **Request for Advice on TACs and Other Management Measures for the Year 2005**

The Scientific Council and the Fisheries Commission during the Annual Meeting of September 2003 agreed to consider certain stocks in 2005. This section presents advice for which the Scientific Council provided scientific advice for 2005 during this meeting.

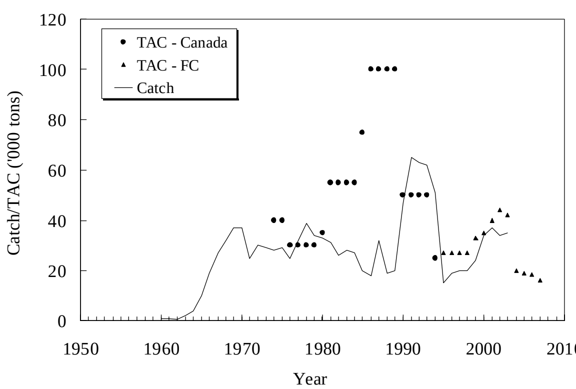
Greenland Halibut (Reinhardtius hippoglossoides) in Subarea 2 and Divisions 3KLMNO

Background: The Greenland halibut stock in Subarea 2 and Div. 3KLMNO is considered to be part of a biological stock complex, which includes Subareas 0 and 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 1991-94. The catch was only 15 000 to 20 000 tons 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 tons, the highest since 1994. The estimated catch for 2002 was 34 000 tons. The 2003 catch could not be precisely estimated, but was believed to be within the range of 32 000 tons to 38 500 tons. A fifteen year rebuilding plan has been implemented by Fisheries Commission for this stock.

	Catch ('000 tons)		TAC ('000 tons)	
Year	STACFIS	21A	Recommended	Agreed
2001	38	29[1]	40	40
2002	34	29[1]	40	44
2003	32-38.5[2]	27[1]	36	42
2004	-	-	16	20

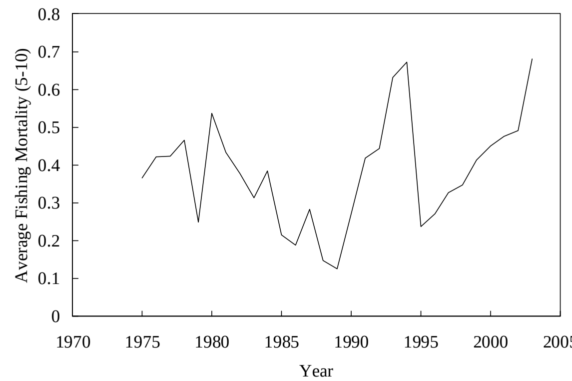
1 Provisional.
2 In 2003, STACFIS could not precisely estimate the catch.



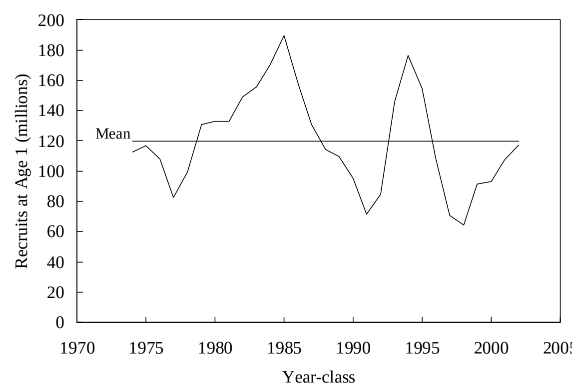
Data: CPUE data throughout the stock area were available from Canadian, EU-Portugal, and EU-Spain fisheries. Abundance and biomass indices were available from research vessel surveys by Canada in Div. 2J+3KLMNO (1978-2003), EU in Div. 3M (1988-2003) and EU-Spain in Div. 3NO (1995-2003). Commercial catch-at-age data were available from 1975-2003.

Assessment: An analytical assessment using Extended Survivors Analysis (XSA) tuned to the Canadian spring (Div. 3LNO), and autumn (Div. 2J, 3K) and the EU (Div. 3M) surveys for the years 1995-2003 was used to estimate the 5+ exploitable biomass, level of exploitation and recruitment to the stock. Natural mortality was assumed to be 0.20 for all ages.

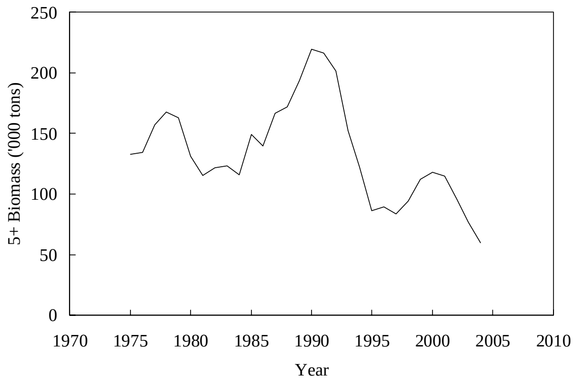
Fishing Mortality: High catches in 1991-94 resulted in $F_{5\text{-}10}$ exceeding 0.50. $F_{5\text{-}10}$ then dropped to about 0.20 in 1995 with the substantial reduction in catch. $F_{5\text{-}10}$ increased in recent years with increased catch, and the 2003 estimate is substantially higher; $F_{5\text{-}10}$ in 2003 is estimated to be 0.68.



Recruitment: The above average 1993-95 year-classes have comprised most of the fishery in recent years although their overall contribution to the stock was less than previously expected. Subsequent recruitment to the exploitable biomass over the next few years will be comprised of below average year-classes.



Biomass: The exploitable biomass (age 5+) was reduced to low levels in 1995-97 due to very high catches and high fishing mortality. It increased during 1998-2000 due to greatly reduced catches, much lower fishing mortality and improved recruitment. However, increasingly higher catches and fishing mortality since then accompanied by poorer recruitment has caused a subsequent decline. The 2003 and 2004 estimates are the lowest in the series.



State of the Stock: The exploitable biomass has been declining in recent years and is presently estimated to be at its lowest observed level. Recent recruitment has been below average, and fishing mortality has increased substantially in recent years.

Evaluation of the Management Strategy 2004-2007: Assuming that the catches in 2004 and 2005 do not exceed the TAC (20 000 tons, 19 000 tons) the 5+ exploitable biomass will remain stable at a low level. Fishing mortality, however, will remain high (~0.60).

Furthermore, if catches during 2006 and 2007 equal the TACs established for these years in the Rebuilding Strategy, there is a high probability that stock biomass increases will occur in 2007 and 2008 and that fishing mortality will decline by about 50% (see figures below). The target biomass in the rebuilding plan has very low probability of being achieved by 2008.

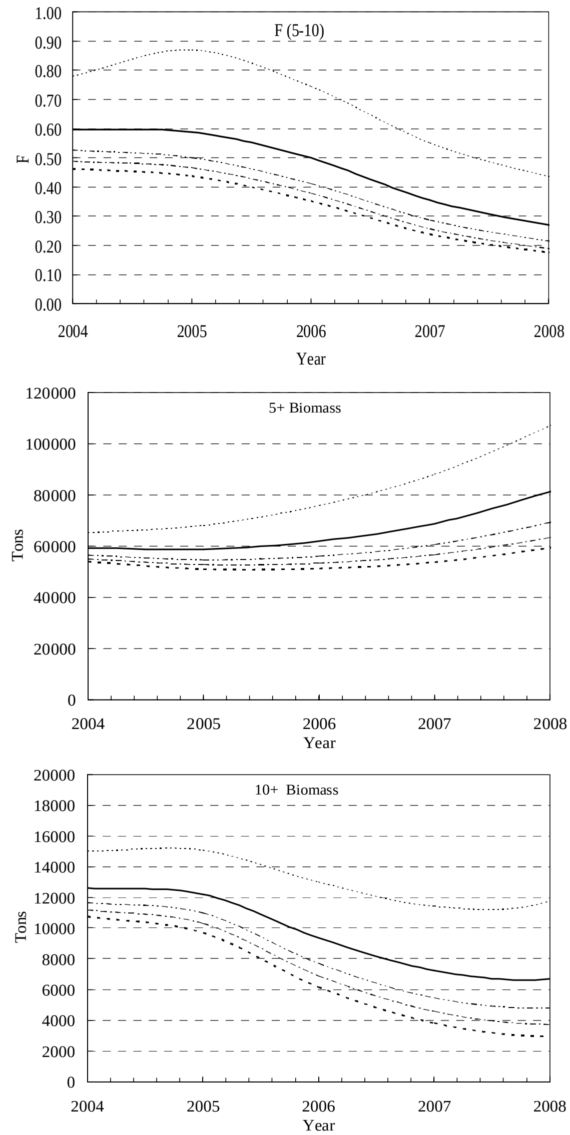
Reference Points: not determined.

Special Comments: 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.

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.
It is strongly recommended that Fisheries Commission take steps to ensure that any by-catches of other species during the Greenland halibut fishery are true and unavoidable by-catches.

Sources of Information: SCR Doc. 04/11, 16, 21, 33, 37, 46, 48, 55; SCS Doc. 04/03, 05, 08, 09.

Greenland halibut in Subarea 2 and Div. 3KLMNO: A stochastic projection (from top) fishing mortality, ages 5+ biomass, and ages 10+ biomass in 2004-2008, under the Fisheries Commission rebuilding plan. Plotted lines show 5, 10, 20, 50 and 90 percentiles.



b) **Request for Advice on TACs and Other Management Measures for the Years 2005 and 2006**

The Scientific Council at its meeting of September 2000 agreed to consider certain stocks on a multi-year rotational basis. This section presents those stocks for which the Scientific Council provided advice for the years 2005 and 2006. The next assessment of these stocks will be held in 2006.

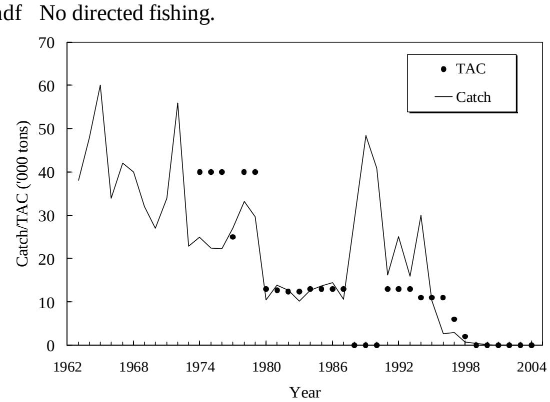
Cod (Gadus morhua) in Division 3M

Background: The cod stock on 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 the 1992-1994 period. By-catches were estimated to be low in the shrimp fishery since 1993. The fisheries since 1996 were very small compared with previous years. The fishery was closed in 1999.

	Catch ('000 tons)		TAC ('000 tons)	
Year	STACFIS	21A	Recommended	Agreed
2001	0.0	0.1[1]	ndf	ndf
2002	0.0	0.0[1]	ndf	ndf
2003	0.0	0.0[1]	ndf	ndf
2004			ndf	ndf

[1] Provisional.
ndf No directed fishing.

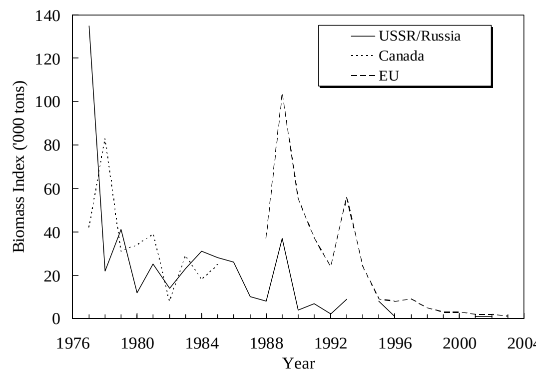


Data: Length and age composition of the 2002 and 2003 by-catches were not available. Data were available from the EU bottom-trawl and the Russian trawl surveys, both covering the whole distribution area of the stock.

Assessment: Analytical assessment was not attempted because, at the current low catch level, enough data were not available.

Recruitment: The 1992 and subsequent year-classes have been weak. Survey results from most recent years do not indicate any abundant recruitment to come.

Biomass: Estimates of the current spawning stock biomass, based on survey results, indicate that its level is well below B_{lim}.



State of the Stock: The stock remains at a very low level. Given the absence of recruitment to the stock after 1992, little improvement in this stock can be expected in the foreseeable future.

Recommendation: No directed fishery for cod in Div. 3M in years 2005 and 2006. Also, by-catch of cod in fisheries directed to other species on Flemish Cap should be kept at the lowest possible level.

Reference Points: A SSB of 14 000 tons has been identified as a preliminary B_{lim} for this stock.

Special Comments: The next Scientific Council assessment of this stock will be in 2006.

Sources of Information: SCR Doc. 04/21, 53; SCS Doc. 04/3.

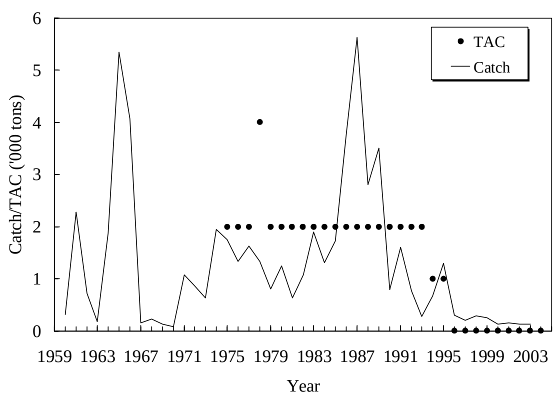
American Plaice (Hippoglossoides platessoides) in Division 3M

Background: The stock occurs mainly at depths shallower than 600 m on Flemish Cap.

Fishery and Catches: Catches are taken mainly by otter trawl, primarily in a by-catch fishery of the Contracting Parties since 1992.

	Catch ('000 tons)		TAC ('000 tons)	
Year	STACFIS	21A	Recommended	Agreed
2001	0.1	0.2[1]	ndf	ndf
2002	0.1	0.2[1]	ndf	ndf
2003	0.1	0.1[1]	ndf	ndf
2004			ndf	ndf

[1] Provisional.
ndf No directed fishing.

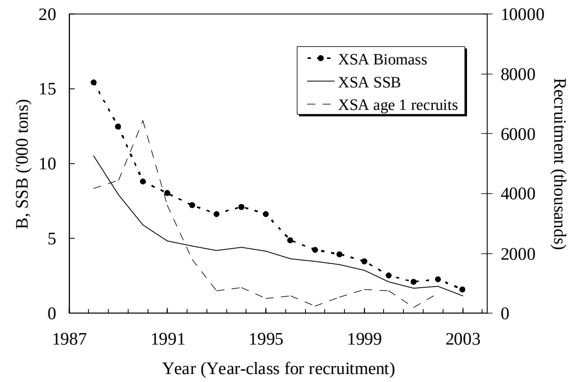


Data: Length compositions were available from the 1988 to 2003 fisheries. Abundance and biomass from surveys were available from USSR/Russia (1972-2002), EU (1988-2003) and Canada (1978-1986). Age-length keys were available from EU surveys (1988-2003).

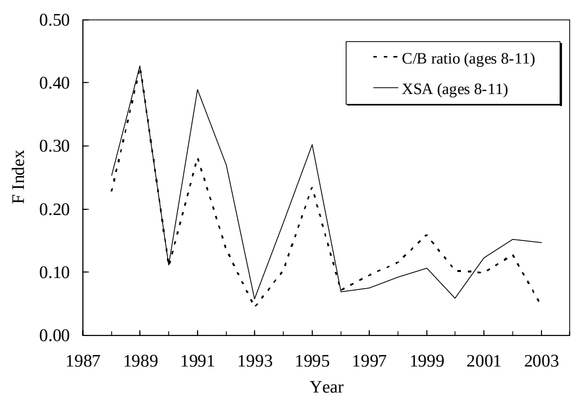
Assessment: An analytical assessment (XSA) was presented.

Recruitment: Only weak year-classes have been observed since 1991.

Biomass: Stock biomass and the SSB are at very low levels and there is no sign of recovery due to the consistent year-to-year recruitment failure since the beginning of the 1990s.



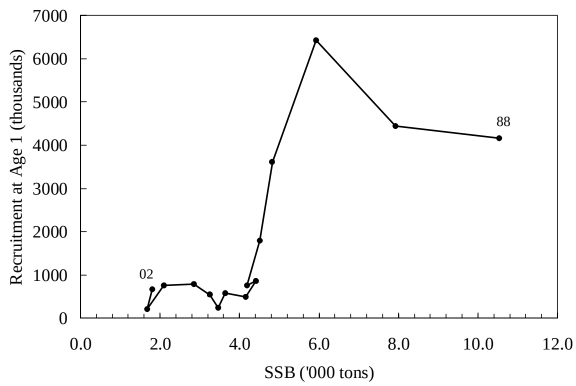
Fishing Mortality: The ratio of catch biomass to EU survey biomass (F index) and XSA fishing mortality declined from the mid-1980s to the mid-1990s, and fluctuated between 0.05 and 0.2 since 1996. F in 2003 estimated by XSA is at the level of the assumed natural mortality.



State of the Stock: The stock biomass and the SSB are at very low levels and there is no sign of recovery.

Recommendation: There should be no directed fishery on American plaice in Div. 3M in 2005 and 2006. By-catch should be kept at the lowest possible level.

Reference Points: From the 15 points available from the XSA to examine a stock/recruitment relationship, very poor recruitment occurs at SSB below 5 000 tons.



The yield-per-recruit analysis gave $F_{0.1}$ = 0.163 and F_{max} = 0.355.

Special Comments: Although catches have declined to low levels, *F* is near the level of both *M* and $F_{0.1}$, and this is a matter of concern for a stock in a very poor condition and under moratorium.

The next Scientific Council assessment of this stock will be in 2006.

Sources of Information: SCR Doc. 04/21, 50; SCS Doc. 04/5, 9.

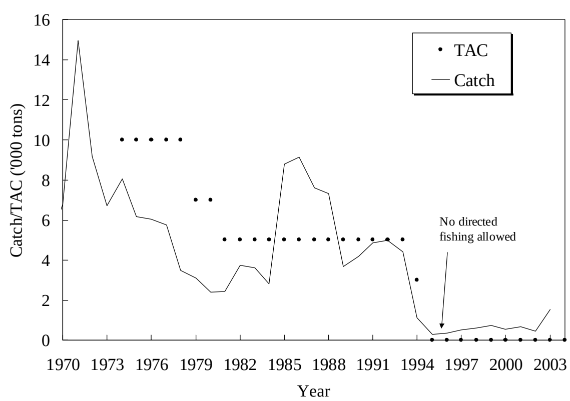
Witch Flounder (Glyptocephalus cynoglossus) in Divisions 3N and 3O

Background: The stock mainly occurs in Div. 3O along the deeper slopes of the Grand Bank. It has been fished mainly in winter and springtime on spawning concentrations.

Fishery and Catches: Catches exceeded the TAC by large margins during the mid-1980s. The catches from 1995-2002 ranged between 300-800 tons including unreported catches. Catch for 2003 was estimated to be between 844 and 2239 tons.

	Catch ('000 tons)		TAC ('000 tons)	
Year	STACFIS	21A	Recommended	Agreed
2001	0.7	0.5[1]	ndf	ndf
2002	0.4	0.7[1]	ndf	ndf
2003	0.8-2.2[2]	0.5[1]	ndf	ndf
2004			ndf	ndf

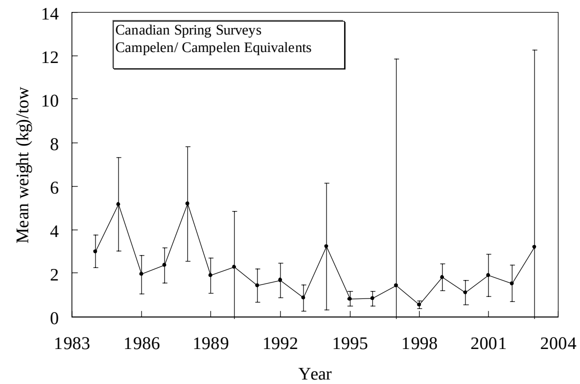
[1] Provisional.
[2] In 2003, STAFCIS could not precisely determine catches.
ndf No directed fishing.



Data: Abundance and biomass data, as well as mean numbers and weights (kg) per tow, were available from Canadian spring surveys during 1984-2003 and autumn surveys during 1990-2003.

Assessment: No analytical assessment was possible with current data.

Biomass: Survey mean weights (kg) per tow in the Canadian spring series trended downwards from the mid-1980s until 1998, which has the lowest observed value. Some increase in the index has occurred since then. Although the index in Div. 3NO appears higher in 2003 than in recent years, it is driven by one large set.



Recruitment: No information.

State of the Stock: Stock remains at a low level.

Recommendation: No directed fishing on witch flounder in the years 2005 and 2006 in Div. 3N and 3O to allow for stock rebuilding. By-catches in fisheries targeting other species should be kept at the lowest possible level.

Reference Points: Not determined.

Special Comments: The next Scientific Council assessment of this stock will be in 2006.

Sources of Information: SCR Doc. 04/43; SCS Doc. 04/3, 5, 9.

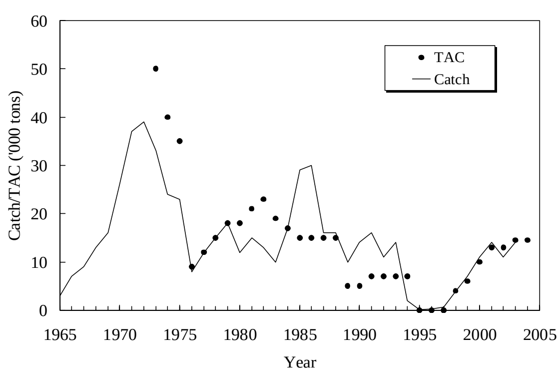
Yellowtail Flounder (Limanda ferruginea) in Divisions 3L, 3N and 3O

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, and small catches were taken as by-catch in other fisheries. The fishery was re-opened in 1998 and catches have increased from 4 400 tons in 1998 to 13 800 tons in 2003. TACs were exceeded each year from 1985 to 1993, and 1998-2001, but not in 2002 and 2003.

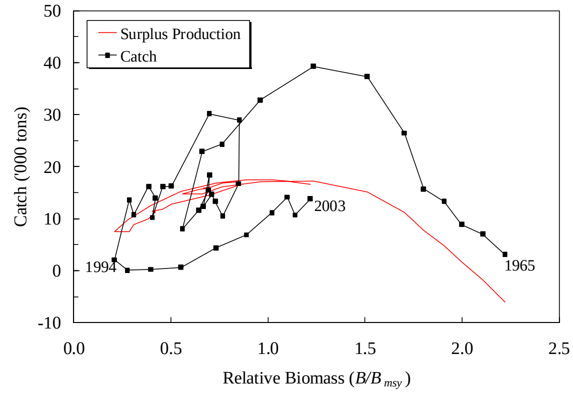
	Catch ('000 tons)		TAC ('000 tons)	
Year	STACFIS	21A	Recommended	Agreed
2001	14	13[1]	13	13
2002	11	10[1]	13	13
2003	13.5-14.1[2]	13[1]	14.5	14.5
2004			14.5	14.5

[1] Provisional.
[2] STACFIS could not precisely estimate catches.

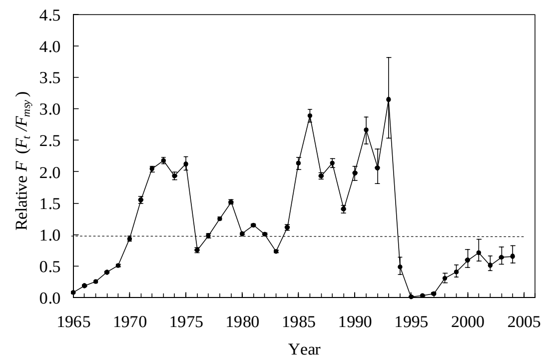


Data: CPUE from Canadian trawlers were available from 1965 to 2003. For 2003, length frequency data from the Canadian fishery and from by-catches of Portuguese trawlers were available. Abundance and biomass indices were available from: annual Canadian spring (1971-82; 1984-2003) and autumn (1990-2003) bottom trawl surveys; annual USSR/Russian spring surveys (1972-91); co-operative Canadian Department Fisheries and Oceans/Canadian fishing industry surveys (1996-2003); and Spanish surveys in the NAFO Regulatory Area of Div. 3NO (1995-2003).

Assessment: An analytical assessment using a stock production model was presented to estimate stock status in 2004. Since the moratorium (1994-97), the catches have been low enough each year to allow the stock to grow.

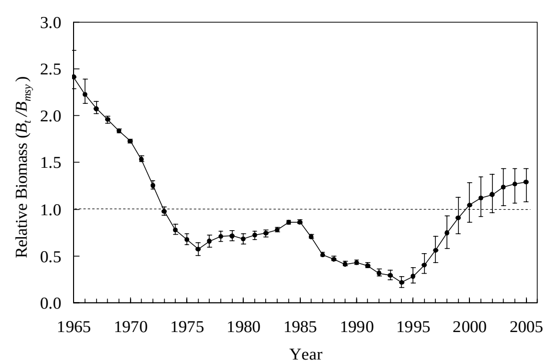


Fishing Mortality: Has been below F_{msy} since 1994 and is projected to be about 65% of F_{msy} in 2004 with an assumed catch of 14 500 tons (TAC).



Recruitment: Based on the 2002 assessment, recruitment has improved in the 1990s and cohorts since 1992 are the highest in the series.

Biomass: Biomass estimates in the Spanish and both Canadian 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 about 25% above B_{msy} in 2004.



State of Stock: Stock size has increased slightly since 2002 and is perceived to be at a level well above that of the mid-1980s.

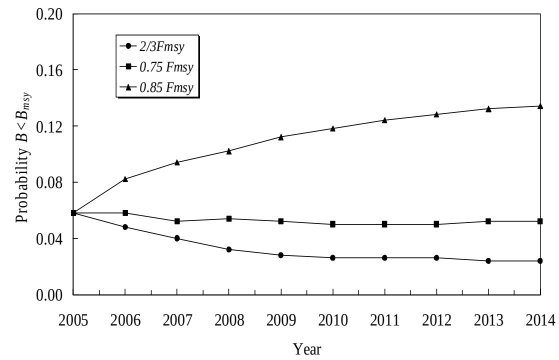
Catch Projections in 2005-06: Catch projections (in '000 tons) at various levels of *F* are shown below.

Projected F	Catch 2005	Catch 2006
F_{2004} (catch=14.5)	14.7	14.9
2/3 Fmsy	15.0	15.2
75% Fmsy	16.7	16.7
85% Fmsy	18.8	18.4
Fmsy	21.8	20.8

Recommendation: Scientific Council recommended that total catches should not exceed 15 000 tons in 2005 and 2006. This corresponds to catch projections based on F = 2/3 F_{msy} and an assumed catch of 14 500 tons (= TAC) in the year 2004. Scientific Council noted that catches exceeded TACs in 1998-2001, but were lower than the TACs in 2002 and 2003. Scientific Council again notes that the advice applies to all removals (directed plus by-catch).

Reference Points: Scientific Council considers 2/3 F_{msy} to be a fishing mortality target. By definition in the Scientific Council Precautionary Approach Framework, the limit reference point for fishing mortality (F_{lim}) should be no higher than F_{msy}. Scientific Council recommends that B_{lim} be set at 30% B_{msy}, following the recommendation of the Limit Reference Point Study Group in April 2004. 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 Scientific Council's Precautionary Approach Framework (SCS Doc. 04/12).

Medium Term Considerations: Projections were made to estimate catch for each year from 2005 to 2014 at a range of fishing mortalities. The results at 2/3F_{msy} suggest there would be a small and very gradual increase in catch, to a maximum of 15 600 tons in the year 2014. At 0.75 F_{msy} and 0.85 F_{msy}, catch and biomass are projected to decrease slightly over the 10 years. At 2/3 F_{msy}, the estimated probability of biomass falling below B_{msy} decreases over the 10 years. At 0.75 F_{msy}, the probability of biomass falling below B_{msy} remains stable, and at F = 0.85 F_{msy}, the probability increases. The probabilities were low under all projected levels of fishing mortality. It was not possible at this time to quantify the risk of stock size being below B_{lim} (30% B_{msy}), but these probabilities are likely to be very low under all 3 projected levels of *F*.



Special Comment: Age-based reference points are not available for this stock at this time. Scientific Council noted that considerable progress has been made on ageing of yellowtail in recent years and recommends that priority be given to restore the Council's ability to do age-structured analyses on this stock.

The next Scientific Council assessment of this stock will be in 2006.

Sources of Information: (SCR Doc. 04/10, 13, 36, 41, 49, 54; SCS Doc. 04/3, 5, 9)

Thorny skate (Amblyraja radiata) in Divisions 3L, 3N and 3O

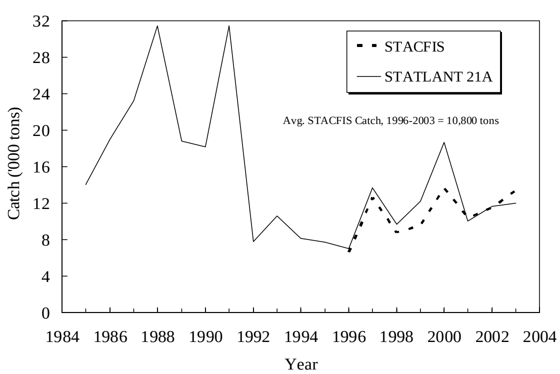
Background: Commercial catches of skates comprise a mix of skate species. However, thorny skate represents about 95% of the skates taken in the catches. Thus, the skate fishery on the Grand Banks can be considered as directed for thorny skate.

Although the stock structure of thorny skate in the NAFO area is unknown, thorny skate in Div. 3LNO have been treated as an assessment unit. Thorny skate in Div. 3LNO have a length at 50% maturity of about 50 cm, low fecundity and long reproductive cycles.

Fishery and Catches: The main participants in this fishery are EU-Spain, Canada, Russia and EU-Portugal. There are substantial uncertainties in the catch levels prior to 1996. Nominal catches increased in the mid-1980s with the commencement of a directed fishery for thorny skate. Catches peaked at about 31 500 tons in 1991, averaged 22 300 tons from 1985 to 1991, and averaged 8 600 tons from 1992 to 1995. Catch levels as estimated by STACFIS have averaged 10 800 tons since 1996. This species has not been regulated by quota, except within Canadian waters.

	Catch ('000 tons)	
Year	STACFIS	STATLANT 21A
2000	13.7	18.7[1]
2001	10.4	10.0[1]
2002	11.5	11.7[1]
2003	13.3-13.5[2]	12.0[1]

[1] Provisional
[2] STACFIS could not precisely estimate the catches.



Data: Canadian spring and autumn surveys in Div. 3L, 3N and 3O used the Engel trawl prior to the autumn of 1996 and the Campelen 1800 trawl since. Thus, the two survey series, using different trawl gears, are not directly comparable. Maximum depth surveyed in the spring was 366 m before 1991 and ~750 m thereafter. Maximum survey depth in the autumn was ~1 450 m.

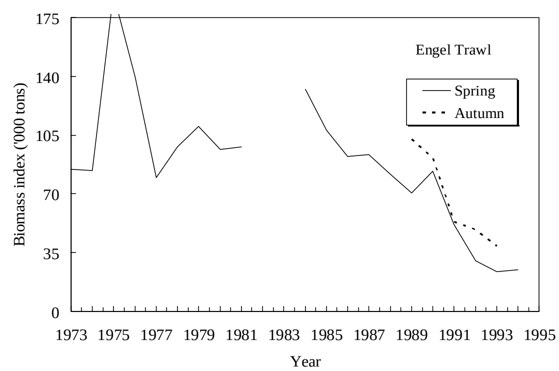
Spanish survey biomass indices in Div. 3NO were available for 1997-2003.

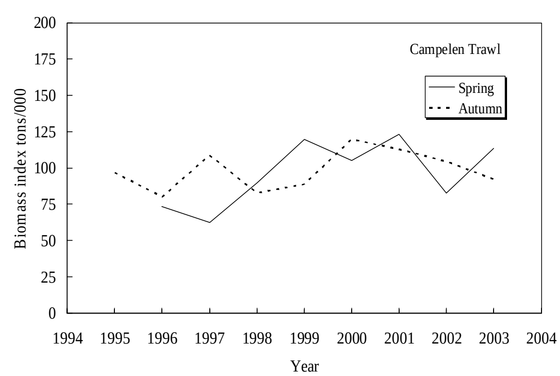
Catch rates were available for Russia in 2003 and for EU-Spain from 1998-2002.

Length frequencies were available for EU-Spain (1996-2003), EU-Portugal (2002-2003), Canada (1994-2003) and Russia (1998-2003).

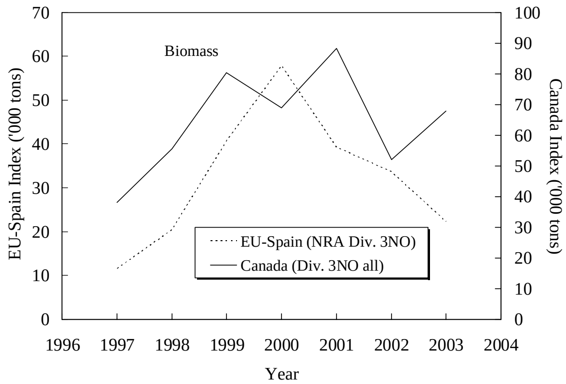
Assessment: No analytical assessment could be performed.

Biomass. The Canadian spring survey biomass indices fluctuated without trend prior to the mid-1980s then declined rapidly until the early-1990s. During the spring Campelen series, 1996 to 2003, the biomass has been stable or has increased slightly. The pattern from the Canadian autumn survey, for comparable periods, was similar.





The Spanish survey was conducted in the NRA portion of Div. 3NO while the Canadian survey covered the entire extent of Div. 3NO. The biomass trajectory from the Spanish survey was very similar to that of the Canadian spring survey.



Fishing Mortality. Level unknown.

Recruitment. No information available.

State of the Stock: Although the state of the stock is unclear, the biomass has been stable from 1996 to 2003 at an average catch as estimated by STACFIS of about 11 000 tons.

Recommendation: Scientific Council advised that catches in 2005 and 2006 not exceed 11 000 tons.

Reference Points: Not determined.

Special Comments: While the biomass has remained relatively constant since the mid-1990s, the spatial dynamics have not. The density of skate continued to increase within the area on the southwest Grand Bank where >80% of the biomass has concentrated in recent years.

The life history characteristics of thorny skate result in low intrinsic rates of increase and are thought to lead to low resilience to fishing mortality.

The next Scientific Council assessment will be in 2006.

Sources of Information: SCR Doc. 02/11, 118, 121, 03/39, 57, 04/35; SCS. Doc. 04/3, 5, 9, 12, 24, 03/6, 7 and 11

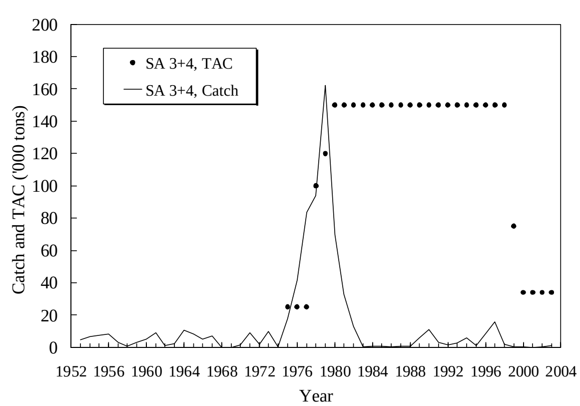
Northern Shortfin Squid (Illex illecebrosus) in Subareas 3 and 4

Background: Northern shortfin squid is an annual species (1-year life cycle) that is considered to comprise a unit stock throughout its range in the Northwest Atlantic Ocean, from Newfoundland to Florida, including Subareas 3-6.

Fishery and Catches: Catches in Subareas 3+4 increased during the late-1970s, averaging 80 600 tons during 1976-1981, and reached a peak of 162 100 tons in 1979. Thereafter, catches in Subareas 3+4 declined sharply to 100 tons in 1986, then subsequently increased to 11 000 tons in 1990. During 1991-1995, catches in Subareas 3+4 ranged between about 1 000 tons and 6 000 tons, then increased to 15 600 tons in 1997; the highest level since 1981. Catches declined from 1 900 tons in 1998 to 60 tons in 2001, then subsequently increased to 1 100 tons in 2003. A TAC for Subareas 3+4 was first established in 1975 at 25 000 tons, but was increased in 1978, 1979 and 1980. The Subareas 3+4 TAC remained at 150 000 tons during 1980-1998 and was set at 75 000 tons for 1999 and 34 000 tons for 2000-2003.

	Catch ('000 tons)		TAC ('000 tons)	
Year	STACFIS	21A	Recommended	Agreed
2001	<0.1	<0.1[1]	19-34	34
2002	0.2	0.2[1]	19-34	34
2003	1.1	1.1[1]	19-34	34
2004			19-34	34

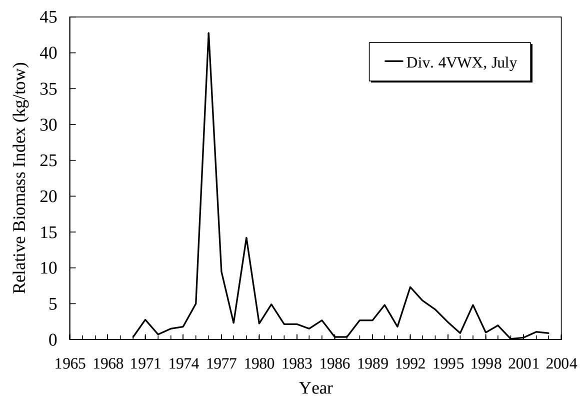
[1] Provisional.



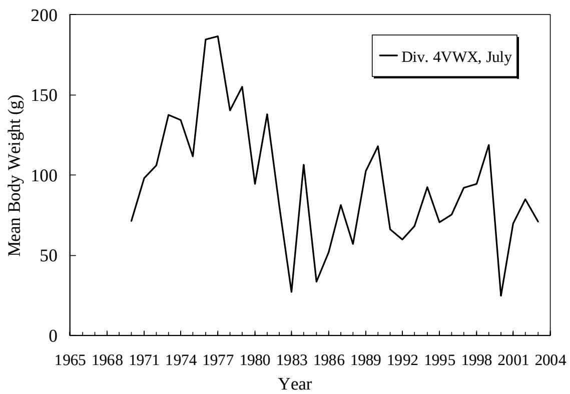
Data: Relative biomass and abundance indices were available from annual Canadian bottom trawl research surveys conducted in Subarea 4 in July on the Scotian Shelf (Div. 4VWX, 1970-2003) and in September in the southern Gulf of St. Lawrence (Div. 4T, 1971-2002). The July survey indices are assumed to reflect relative biomass at the beginning of the fishing season. Mean mantle lengths of squid caught in September during 2001-2003 were available from one of the Subarea 3 inshore jig fishery sites.

Assessment: Absolute biomass and recruitment estimates for northern shortfin squid in SA 3+4 were not available.

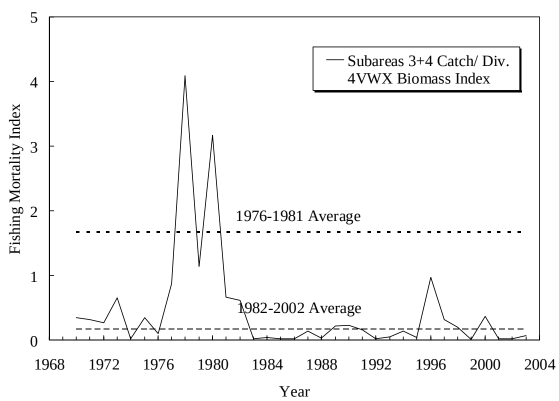
Biomass: Research survey biomass indices from Div. 4VWX reached peak levels during the late-1970s, indicating that this was a period of high squid productivity. Since 1982, survey biomass indices have been markedly lower, and during 1998-2003, were below the 1982-2002 average for the low productivity period.



Body Size: Annual mean body weights of squid from the Div. 4VWX survey declined markedly during 1982-1983, following a period of much higher mean weights during 1976-1981. Mean weights increased gradually thereafter, and in 1991, reached the highest value since 1981. Mean body weight was the lowest on record in 2000, and during 2001-2003, mean weights were similar to the 1982-2002 average for the low productivity period. The range of mean mantle lengths of squid caught in the Newfoundland inshore jig fishery at New Bonaventure, during September of 2003, were much smaller and males less mature than those caught during 2002.



Fishing Mortality: Fishing mortality indices were highest during 1978-80 and averaged 1.67 during the period of highest catch (1976-81). During 1982-2002, fishing mortality indices were much lower and averaged 0.18. During 2003, the fishing mortality index was well below the 1982-2002 average for the low productivity period.



State of the Stock: Based on the low biomass index and the small mean size of squid in the Div. 4VWX survey during 2003, the northern shortfin squid resource in Subareas 3+4 remained in a state of low productivity in 2003.

Recommendation: Based on available information (including an analysis of the upper range of yields that might be expected under the present low productivity regime), the Council advises that the TAC for years 2005 and 2006, for northern shortfin squid in Subareas 3+4, be set between 19 000 tons and 34 000 tons.

The advised TAC range (19 000-34 000 tons) is applicable only during periods of low productivity. In periods of high productivity, higher catches and TAC levels are appropriate.

Reference Points: Not determined.

Special Comments: It is important to note that northern shortfin squid in Subareas 3-6 (and further south to Florida) are considered to comprise a unit stock and that the current assessment only applies to part of the area.

The 2004 assessment applies to the period 2005-2006. The next Scientific Council assessment of this stock will be in 2006.

Sources of Information: SCR Doc. 98/59, 75, 04/38, 52.

c) **Special Requests for Management Advice** (see Part D, Annex 1, Items 4-9)

i) **Greenland halibut in Subarea 2 and Divisions 3KLMNO Rebuilding Strategy** (see Item 4)

The Fisheries Commission requested the Scientific Council *with the concurrence of the Coastal State requests Scientific Council, at a meeting in advance of the 2004 Annual Meeting, to provide information on the status of the Greenland halibut in SA 2+ Div. 3KLMNO in relation to the Rebuilding Strategy including commentary on progress in relation to targets described in the Strategy.*

The Scientific Council responded:

Scientific Council noted that the results of the current assessment are consistent with the analyses and projections accepted in the 2003 assessment (SCR Doc. 03/64).

Assuming that the catches in 2004 and 2005 do not exceed the TAC (20 000 tons, 19 000 tons) the 5+ exploitable biomass will remain stable at a low level. Fishing mortality, however, will remain high (~0.60).

Furthermore, if catches during 2006 and 2007 equal the TACs established for these years in the Rebuilding Strategy, there is a high probability that stock biomass increases will occur in 2007 and 2008 and that fishing mortality will decline by about 50%. The target biomass in the rebuilding plan has very low probability of being achieved by 2008.

ii) **Formulation of Advice Under the Precautionary Approach** (Items 6 and 7) (note: Report of Limit Reference Point Study Group (LRPSG), 15-20 April, Lorient, France)

The Fisheries Commission noting the progress made by the Scientific Council on the development of a framework for the implementation of the Precautionary Approach requested the Scientific Council, at a meeting in advance of the 2003 Annual Meeting to: *provide certain information on, and to take into account some elements, when considering the Precautionary Approach.*

The Council noted that significant progress had been made on this item through the efforts of the Limit Reference Point Study Group (LRPSG) and that it is addressed in detail under the Agenda Item on the Report of Working Groups, as reported below under Section X, Item 3.

iii) **Pelagic *Sebastes mentella* (Redfish) in Subareas 1-3 and Adjacent ICES Area** (see Part D, Annex 1, Item 8)

Scientific Council was requested by the Fisheries Commission to: *review the most recent information on the distribution of pelagic S. mentella in NAFO Subareas 1-3, as well as 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 the shelf stocks of redfish found in ICES Sub-areas V, VI and XIV, and NAFO Subareas 1-3*

The Council responded as follows:

Scientific Council was provided a report on the deliberations of the ICES North-Western Working Group (NWWG) meeting that took place from 29 April to 8 May 2003. Based on the fisheries information, it was concluded that the fishing pattern in 2003 was similar to that in the past five years, both seasonally and geographically. Total landings in 2003 are estimated to be about 150 000 tons and 14% of this amount was taken within the NAFO Regulatory Area (NRA) in Div. 1F, Div. 2J, and Div 2H.

A trawl-acoustic survey on pelagic redfish (*S. mentella*) in the Irminger Sea and adjacent waters was carried out by Germany, Iceland and Russia in late May/June 2003. Approximately 405 000 nm^2 were covered. The estimate of biomass derived from the survey suggest about 8% resides in the NAFO area at this time of year. Previous surveys indicated 34% (1999) and 40% (2001) of the survey biomass in the NAFO area. However, results of the 2003 survey may not be comparable to surveys in 1999 and 2001. There were slight changes in the survey design in 2003 and it was conducted about 4 weeks earlier than the 2001 survey. In addition, the 2001 and 2003 surveys covered about 40% more area than the 1999 survey.

The Scientific Council noted that an ICES Study Group on Stock Identity and Management Units of Redfishes [SGSIMUR] will meet in Bergen, Norway, from 31 August to 3 September 2004 to a) review all reported material on the stock identity of the various redfish units (*S. mentella*) in the Irminger Sea and adjacent waters; b) identify the most likely definition of biological stocks of *S. mentella* as well as suggest practical management units. SGSIMUR will provide a report to ACFM by 8 September 2004. Subsequently, a sub-group of the NWWG will meet right after the SGSIMUR meeting to complete the assessment of the *S. mentella* stock(s) based on the outcome of the SGSIMUR report. The Scientific Council hopes to have further information on this in September 2004.

iv) **White hake (*Urophycis tenuis*) in Divisions 3N and 3O** (SCR Doc. 01/78, 04/24, 40, 57; SCS Doc. 04/3, 5, 9,) (see Part D, Annex 1, Item 9)

Introduction

Scientific Council responded to eight requests as follows for white hake in Div. 3NO. Scientific Council noted that little is known about stock structure and Div. 3NO may not be the most appropriate management unit.

a) **Information on the fishing mortality on white hake in Div. 3NO in recent years, as well as information on by-catches of other groundfish in the Div. 3NO white hake fishery.**

No estimates of fishing mortality were available. However, catches of white hake in Div. 3NO are summarized in the following Table 1. Between 1985 and 1993, catches were substantially higher than in the following 8 years (1994 to 2001) (Fig. 1). While there was no directed fishery during that early period, groundfish fisheries that captured significant amounts of white hake incidentally during that period, were directed toward cod, redfish, Atlantic halibut and Greenland halibut. A small white hake directed fishery by Canada began in 1994. Catches then increased substantially in 2002 as a directed fishery developed in the Regulatory area. Most of the catches came from Div. 3O.

Table 1. Reported catches of white hake in Div. 3NO, 1985-2003. Zero means <1 ton.

	Division 3N			Division 3O			Divisions 3NO	
Year	**Canadian**	**non-Canadian**	**All**	**Canadian**	**non-Canadian**	**All**	**STATLANT 21A**	**STACFIS**
1985	110	1542	1652	1672	2835	4507	6159	8129
1986	394	473	867	2169	1569	3738	4605	3550
1987	1321	4019	5340	1731	990	2721	8061	8064
1988	830	866	1696	954	111	1065	2761	2921
1989	878	5	883	1103	23	1126	2009	2075
1990	832	228	1060	1053	7	1060	2120	2291
1991	20	1507	1527	960	0	960	2487	2613
1992	19	0	19	1647	0	1647	1666	1658
1993	18	0	18	1004	0	1004	1022	1054
1994	16	20	36	253	4	257	293	2017
1995	0	5	5	276	1	277	282	222
1996	0	28	28	311	1	312	340	519
1997	0	92	92	329	6	335	427	587
1998	0	81	81	188	8	196	277	222
1999	43	51	94	322	13	335	429	422
2000	21	124	145	393	29	422	567	578
2001	17	52	69	519	49	568	637	633
2002	0	1220	1220	1014	3133	4147	5367	6718
2003	0	2688	2688	417	3053	3470	2068 [1]	4823

[1] Data available to 15 June 2004 (excldes EU-Portugal).

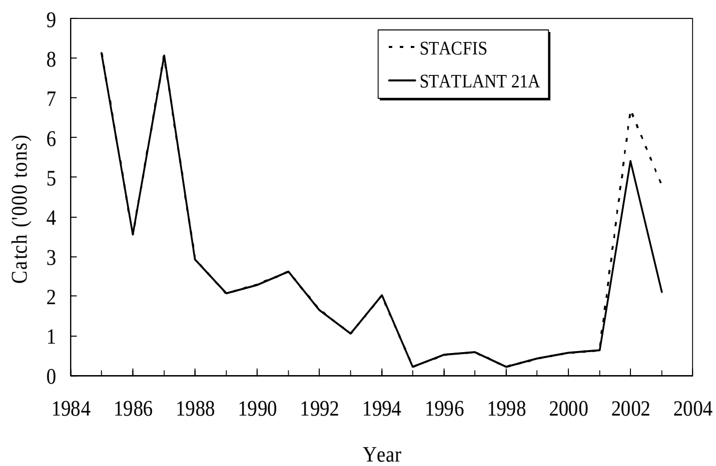


Fig. 1. Catch history for white hake in Div. 3NO, 1985-2003.

Canadian fisheries observer data from 1997-2003 shows that white hake comprised 85% of the catch in the Canadian gillnet fishery and 55% in the Canadian longline fishery (Table 2). Monkfish was the dominant by-catch in the gillnet fishery. For species under moratorium, cod dominated in longline catches but American plaice by-catch was negligible. Estimated amounts of cod taken as by-catch averaged 109 tons annually from 1994-2003 given that the Canadian longline fishery took an average of 332 tons of white hake annually during that period.

Table 2. Catch composition the Canadian white hake fishery. Data from the Canadian Fishery Observer Program.

	% of Total Catch	
Species	Gillnet	Longline
White hake	85.20%	54.90%
Monkfish	10.60%	0.00%
Haddock	1.10%	3.70%
Cod	0.60%	17.70%
Pollock	0.50%	0.00%
Lithodes maja	0.40%	8.90%
Halibut	0.30%	8.30%
American plaice	0.20%	0.00%
Spiny dogfish	0.20%	0.10%
Snow crab	0.10%	0.00%
Skates NS	0.10%	3.70%
Swordfish	0.10%	0.00%
Thorny skate	0.10%	0.10%
Other	0.40%	2.60%

EU-Spain reported by-catches of other species in tows which caught white hake. In Div. 3O white hake was the main species caught in 2003 with redfish the second highest at 22%. Other species, including witch flounder (3%) and American plaice (4%) each comprised less than 6% of the total.

b) **Information on abundance indices and the distribution of the stock in relation to groundfish resources, particularly for the stocks which are under moratorium.**

Data from the Canadian spring survey (Fig. 2) show that white hake biomass and abundance fluctuated widely. During the period observed, both abundance and biomass peaked fairly regularly in the late-1970s, the late-1980s and lastly in the early-2000s. Due to a change in the survey gear in 1996 from Engel to Campelen 1800 trawl, the relative magnitude of the most recent peak in relation to the earlier peaks cannot be determined. There were peaks in abundance in the autumn of 1999 and the spring of 2000 which represent the 1999 year-class.

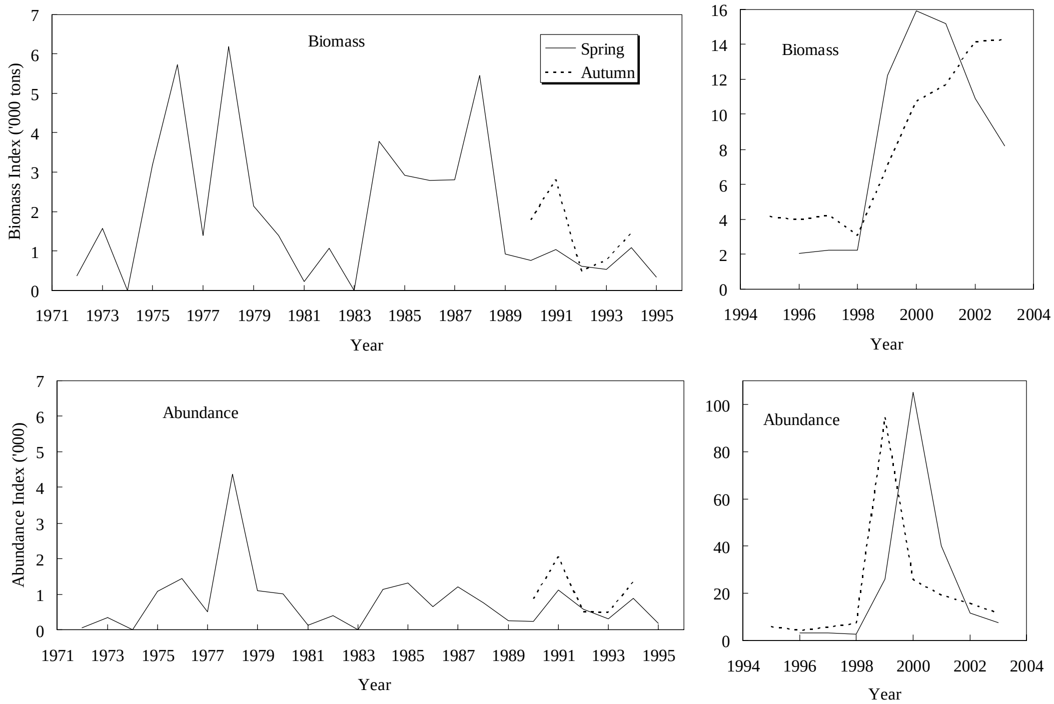


Fig. 2. Biomass and abundance indices for white hake in Div. 3NO. Campelen gear was used from 1996 onward, Engel before that time. The two time periods are not standardized.

White hake is a temperate species and juveniles and adults are restricted to a narrow band along the southwest slope of the Grand Bank in Div. 3NO, corresponding with warm bottom waters (Fig. 3). Kulka and Simpson (MS 2002)[1] showed that the distribution of white hake has varied little over time going back to the 1950s.

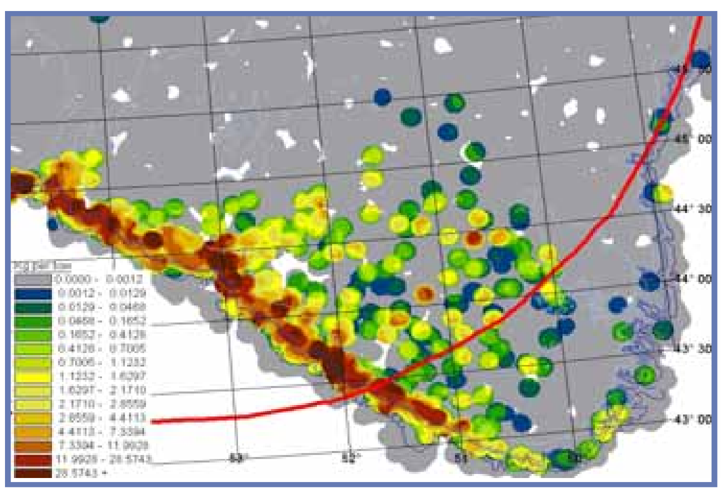


Fig. 3. Distribution of white hake in Div. 3NO based on Canadian spring and autumn surveys, 1996-2003. Red areas denote areas of highest density of white hake. Grey denotes surveyed areas with no catch.

[1] KULKA and SIMPSON. MS 2002. The status of white hake (*Urophysis tenuis*) in NAFO Div. 3L, 3N, 3O and Subdivision 3Ps. *DFO Atl. Res. Doc.*, No. 02/055, 76 p.

There was a significant degree of overlap in the distribution of cod and American plaice and much less overlap with yellowtail flounder (Fig. 4). This suggests that there is potential for significant by-catch of cod and American plaice in the area where white hake were most densely concentrated.

Fig. 4. Degree of overlap of white hake with yellowtail flounder, Atlantic cod and American plaice in Div. 3NO. Data are based on Canadian spring and autumn survey data, 1996-2003. High (red area) refers to areas where the top 10% of catch rates of the two species co-occurred.

c) **Information on the distribution of white hake in Divisions 3NO, as well as a description of the relative distribution inside and outside the NAFO Regulatory Area.**

White hake straddle the Canadian 200-mile zone in Div. 3N and 3O (Fig. 3). Canadian survey data from 1996 to 2003 suggest considerable variability in the proportion of Div. 3NO white hake inside and outside 200 miles by both time and season. Percentages varied from <1% to about 26% in the NRA with an overall average of about 12% in the NRA from 2001 to 2003.

Table 4. Proportion of white hake in Div. 3NO outside Canada's 200-mile EEZ, based on Canadian spring and autumn surveys.

Spring			Autumn		
Year	% Inside	% Outside	Year	% Inside	% Outside
1996	99.74	0.26	1996	79.62	20.38
1997	99.57	0.43	1997	75.05	24.95
1998	98.4	1.6	1998	74.19	25.81
1999	95.51	4.49	1999	76.34	23.66
2000	97.03	2.97	2000	79.61	20.39
2001	84.94	15.06	2001	85.56	14.44
2002	89.05	10.95	2002	82.46	17.54
2003	89.97	10.03	2003	94.62	5.38

d) **Advice on reference points and conservation measures that would allow for exploitation of this resource in a precautionary manner.**

There is little known about white hake in Div. 3NO and reference points have not been determined. To avoid potential overfishing and by-catch problems, catches in the directed fishery for white hake should be limited to catches of the recent two years which averaged 5 800 tons. The objective is to prevent the development and deployment of excessive fishing effort, which might outpace the ability of scientists and management to understand the effects of exploitation on the stock.

To ensure long-term productivity and sustainability of the white hake stock, the directed fishery should avoid catching juvenile fish, thereby allowing such fish to grow, reproduce and contribute to the spawning stock.

e) **Information on annual yield potential for this stock in the context of (d) above;**

There is no information on yield potential.

f) **Identification and delineation of fishery areas and exclusion zones where fishing would not be permitted, with the aim of reducing the impact on the groundfish stocks which are under moratorium, particularly juveniles.**

Although there is overlap in the distribution of white hake and the distributions of cod and American plaice (see Fig. 4), juvenile distributions of cod and American plaice may differ from adult distributions of white hake. Information was not available to address this question.

g) **Determination of the appropriate level of research that would be required to monitor the status of this resource on an ongoing basis with the aim of providing catch options that could be used in the context of management by Total Allowable Catch (TAC)**:

- White hake extend continuously over a wide area, well beyond Div. 3NO. Research is required to determine stock structure of the species.
- Fishing mortality and its effects on the population are not well understood. Continued and enhanced collection of information on levels of catches as well as size, sex and maturity of commercial catches of white hake is required to define the effects of fishing on the population.
- The application of assessment models may allow Scientific Council to provide quantitative fisheries management advice.
- Age determination would allow eventual utilization of age-based analysis for this population.
- There should be further work on the maturity of this species.
- Spatial dynamics of various population components should be examined in relation to environmental and fishery related influences to better understand the factors that affect the population status.
- Analysis of detailed, geo-referenced commercial fishery data for NAFO Div. 3NO corresponding to the directed white hake fishery in the NRA is required to quantify by-catch levels and to spatially define species interactions.

h) **Information on the size composition in the current catches and comments on these sizes in relation to the size at sexual maturity**

Annual estimates of maturity were highly variable. Therefore a single ogive was fit to the data from 1996 to 2003 for Div. 3NO and gave an L_{50} of 55 cm for females (Fig. 5). Information was unavailable for males to fit a combined ogive.

Length frequencies were available for the Spanish fishery by sex to evaluate the effect of using a female L_{50} for the unsexed catch length frequencies. Fifteen percent of the female portion of the catch was greater than 55 cm while 11% of the total catch was greater.

Application of this L_{50} to the length frequencies of the various fisheries results in the estimates of proportion mature in Table 5.

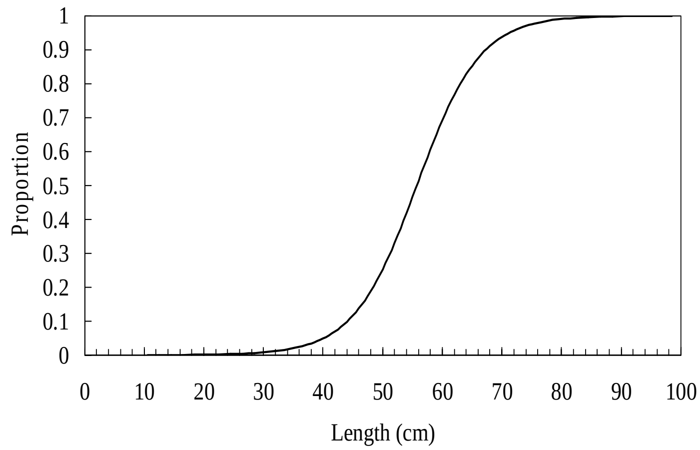


Fig. 5. Maturity ogive for female white hake in Div. 3NO, 1996-2003.

Table 5. Size range and size-at-maturity of white hake in the commercial fishery. Percent mature is in abundance.

Country	Area	Gear	Year	Size Range (cm)	Percent mature at 55 cm
Canada	Div. 3O	Gillnet	2001	33-106	97
	Div. 3O	Longline	2001	45-100	90
EU-Portugal	Div. 3NO	Otter trawl	2003	16-87	7
EU-Spain	Div. 3O	Otter trawl	2002	31-83	11
Russia	Div. 3NO	Otter trawl	2003	12-100	17

v) **Redfish in Divisions 3LN and Division 3O** (see Part D, Annex 1, Item 10)

Scientific Council was requested by the Fisheries Commission with regard to redfish in Divisions 3L, 3N and 3O to: *review all available information and provide advice regarding whether the current management units (3LN and 3O) or any alternative may be the most appropriate.*

The Council responded as follows:

A paper was presented to the Scientific Council (SCR Doc. 04/8) discussing this issue. The Council concluded that the issue of the relationship of redfish in Divisions 3L, 3N and 3O remains complicated and unclear. The Council noted that although recent studies on this issue have suggested a closer connection between Div. 3N and Div. 3O, in the absence of more definitive information, managing these as separate stocks is still appropriate.

A genetic study is currently being conducted within Canada that may provide useful results for the determination of the most appropriate management unit(s) in Div. 3L, 3N and 3O. It is anticipated that the results of this study will be made available to the Scientific Council in June 2005.

d) **Monitoring of Stocks for which Multi-year Advice was Provided in 2003**

The Scientific Council in 2003 provided 2-year advice (for 2004 and 2005) for eight stocks (cod in Div. 3NO; American plaice in Div. 3LNO; witch flounder in Div. 2J+3KL; Redfish in Div. 3M; Redfish in Div. 3LN, Redfish in Div. 3O, Roughhead grenadier in SA 2+3, and Capelin in Div. 3NO). The Scientific Council reviewed the status of these eight stocks at this meeting of June 2004, and found no significant change in status for any of the stocks. Therefore, the Scientific Council has not provided updated/revised advice for 2005 for these stocks and the next Scientific Council assessment of these stocks will be in 2005.

However, Scientific Council expressed grave concern over the increase in catch for two of these stocks, cod in Div. 3NO and American plaice in Div. 3LNO. Both of these stocks are below B_{lim} and under moratoria to directed fishing, yet fishing mortality over the last number of years has been at a level that will not allow the stocks to recover. In 2003, catch is estimated to have at least doubled on these stocks, likely resulting in a further increase in fishing mortality.

2. **Coastal States**

a) **Request by Canada and Denmark (Greenland) for Advice on TACs and Other Management Measures** (see Part D, Annexes 2A and 3)

i) **Greenland halibut in Divisions 0A + 1AB and Divisions 0B + 1C-F**

The Council noted the Canadian request (Item 1) and Denmark Greenland request (Item 3) pertained to Greenland halibut in Div. 0A + 1AB, and also in Div. 0B + 1C-F.

Canada requested: *subject to the concurrence of Denmark (on behalf of Greenland) as regards Subarea 1, to provide and overall assessment of status and trends in the total stock throughout its range and comment on its management in Subareas 0 + 1 for 2005* and to specifically: *advise on appropriate TAC levels for 2005, 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* (Annex 2A, Item 1).

and

Denmark (Greenland) noted: *subject to the concurrence of Canada as regards Subarea 0, the Scientific Council is requested to provide advice on the scientific basis for the management of Greenland halibut in the offshore area of Divisions 0A+1AB and Divisions 0B+1C-F in 2005 and as many years ahead as data allow.* (Annex 3, Item 3).

The Council undertook to respond to both requests in the following summary sheet. The Council noted additional specific requests from Canada and Denmark (Greenland) were addressed separately under Council responses to Coastal State requests below (under Section 2b and c).

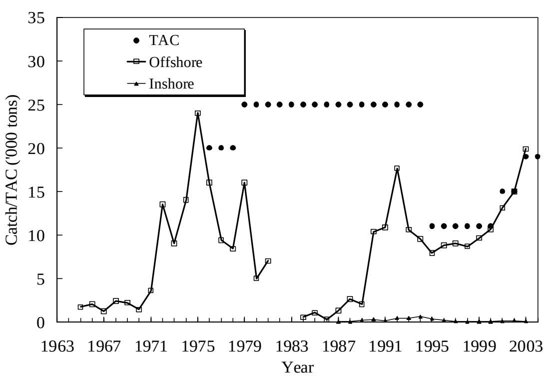
Greenland Halibut (Reinhardtius hippoglossoides) in Subarea 0 + Division 1A Offshore and Divisions 1B-1F

Background: The Greenland halibut stock in Subarea 0 + Div. 1A offshore and Div. 1B-1F is part of a common stock distributed in Davis Strait and southward to Subarea 3.

Fishery and Catches: Due to an increase in offshore effort, catches increased from 2 000 tons in 1989 to 18 000 tons in 1992 and remained at about 10 000 tons annually until 2000. Since then catches have increased gradually to 20 000 tons in 2003 primarily due to increased effort in Div. 0A and in Div. 1A.

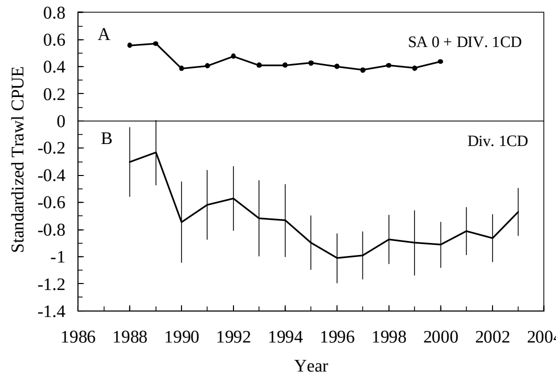
	Catch ('000 tons)		TAC ('000 tons)	
Year	STACFIS	21A	Recommended	Agreed
2001	13	13[1]	15[2]	15
2002	15	12[1]	15[2]	15
2003	20	14[1]	19[2]	19
2004			19[2]	

[1] Provisional.
[2] Including 4 000 tons allocated specifically to Div. 0A and 1A in 2001 and 2002 and 8 000 tons in 2003 and 2004.



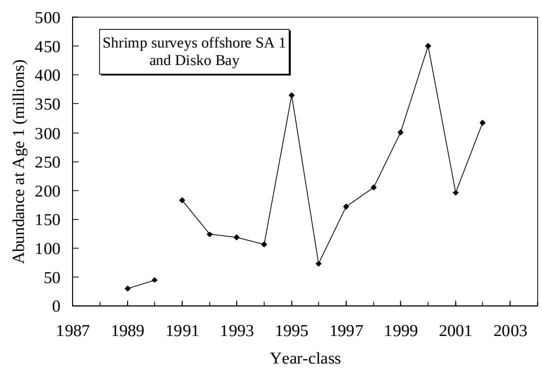
Data: Length distributions were available for assessment from SA0 and SA1. Standardized and unstandardized catch rates were available from Div. 0A, Div. 1A and 1CD. Biomass estimates from 2001 surveys were available from Div. 1A-D and Div. 0AB. Biomass estimates from 2003 surveys were available from Div. 1CD, only. Recruitment data were available from surveys in Div. 1A-1F from 1989-2003.

Assessment: No analytical assessment could be performed. Combined standardized catch rates for SA 0 + Div. 1CD during 1990-2000 and standardized catch rates from Div. 1CD during 1990-2003 have been stable. Unstandardized catch rates in Div. 0A increased between 2001 and 2003 while they decreased in Div. 1A between 2002 and 2003.

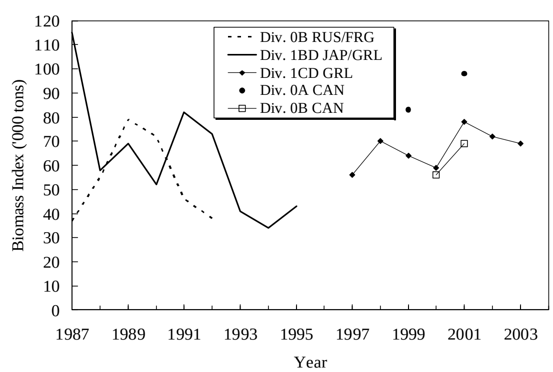


Fishing Mortality: Level not known.

Recruitment: Recruitment of the 2000 year-class at age 1 was the largest in the time series, while the 2002 year-class was well above average.



Biomass: The biomass in Div. 1CD in 2003 was estimated at 69 000 tons, slightly above the average in the seven year time series.



State of the Stock: Length compositions in the catches has been stable in recent years. Based on survey indices the stock has been increasing since 1994 and is now at the level of the late-1980s and early-1990s

Recommendation: Considering the relative stability in biomass indices and CPUE rates, for Greenland halibut in Div. 0B and 1C-1F the TAC for 2005 should not exceed 11 000 tons

In 2002, Scientific Council advised a catch of 8 000 tons for the developing fisheries in Div. 0A+1A. This was considered to generate a relatively low *F* based on available data. Until sufficient data are available to more fully evaluate the state of this stock, Scientific Council advises that this level of catch not be exceeded. Scientific Council therefore advises a TAC of 8 000 tons for Greenland halibut in Div. 0A+1AB for 2005.

Reference Points: Not determined.

Sources of Information: SCR Doc. 04/18, 19, 23, 44, 45; SCS Doc. 04/3, 9, 10, 14.

b) **Request by Canada for Advice** (see Part D, Annex 2A and 2B)

i) **Greenland halibut in SA 0+1 and SA 2+3**

With respect to SA 0+1 Canada requested the Council to: *comment on the relationship between Greenland halibut in inshore waters of Cumberland Sound and the offshore waters of Division 0B and advise whether or not a separate management unit would be appropriate for Cumberland Sound Greenland halibut* (Item 1b).

The Council responded:

Scientific Council concluded that Greenland halibut in the Cumberland Sound traditional winter fishing grounds do not move beyond these grounds. Given the similarities in the bathymetry between the northwest Greenland fjords and Cumberland Sound it is conceivable that there is an isolated inshore stock in the inner part of Cumberland Sound as there is in the Greenland fjords.

Tagging programs have been conducted in the summer of 1994 and from 1997 to 2000 during the winter on the traditional fishing grounds. Fifteen recaptures have occurred in Cumberland Sound despite very low catch and effort, and when the fishery catch and effort increased so did the number of recaptures. During the same period there has been fairly consistent effort and catches of approximately 5 000 tons in the offshore waters adjacent to Cumberland Sound with no recaptures from the winter tagging program.

Two recaptures that have occurred in the offshore area came from the summer tagging effort that captured and released the tagged fish on the shelf near the mouth of the Sound well outside the winter fishing grounds of the inner part of the Sound.

Based on available information, Scientific Council recommends that a separate stock management area be established for the traditional winter fishing grounds for Greenland halibut in the inner portion of Cumberland Sound.

With respect to SA 2+3 Canada, in the request for advice from Scientific Council for 2005, included a specific request as follows: *Scientific Council has, in the past, advised that fishing effort for Greenland halibut in SA2 + 3KLMNO should be distributed in relation to biomass. Scientific Council is requested to comment on:*

a) the current distribution of the resource between SA2 + 3K and 3LMNO and comment on how this compares with the current distribution of quota allocation; and
b) the appropriate distribution of quota allocation if it was based on the distribution of biomass.

The Scientific Council responded:

a) Canadian research survey data covering depths to 1 500 m suggest reasonable stability in the proportion of biomass in SA2+Div. 3K and Div. 3LMNO, ranging between 75% and 84% in SA2+Div. 3K, and averaging about 80% SA2+Div. 3K: 20% Div. 3LMNO over the 8 years for which data are available. The quota table information indicates that the distribution of quota is in the proportion of 26% SA2+Div. 3K: 74% Div. 3LMNO.

b) If the 2005 quota for Greenland halibut in SA2+Div. 3KLMNO was apportioned according to biomass distribution, the split would be 15 200 tons (80%) from SA2+Div. 3K and 3 800 tons (20%) from Div. 3LMNO.

ii) **Redfish in Division 3O** (see Part D, Annex 2B, Items 1-4)

The Scientific Council was asked to provide responses to the following questions:

1. *Would catches in the range of 13 000-20 000 tons be detrimental to the Div. 3O redfish stock?*

   Due to uncertainty in stock dynamics and overall stock status, Scientific Council cannot determine whether catches in the range of 13 000 tons-20 000 tons would be detrimental to the stock.

2. *Would catches above 20 000 tons be detrimental to the Div. 3O redfish stock?*

   Scientific Council cannot determine whether catches above 20 000 tons would be detrimental to the stock. It was noted that over the period of 1960-2003 (44 years), catches only exceeded 20 000 tons in 3 years.

3. *What is the relative strength of the 1988 year-class in relation to other strong year-classes that have supported this fishery?*

   Scientific Council cannot precisely determine the relative strength of the 1988 year-class in relation to other strong year-classes. It is, however, one of only five above average year-classes that have occurred between 1970 and 2003.

4. *Considering that there has not been any good recruitment since the 1988 year-class and given the slow growth of redfish, when is the earliest possible time that good recruitment could be expected to enter into this fishery?*

   Scientific Council estimates that it would take about six years before recruitment first enters the fishery and about eight years to become fully recruited to the fishery, based on the sizes caught in the current fisheries.

c) **Request by Denmark (Greenland) for Advice** (see Part D, Annex 3)

i) **Demersal redfish and other finfish in Subarea 1** (monitor) (Item 2)

In the Scientific Council report of 2003 scientific advice on management of redfish (*Sebastes* spp.) and other finfish in Subarea 1 was given for 2004 and 2005. Denmark on behalf of Greenland, requested the Scientific Council to: *continue to monitor the status of these stocks and, should significant changes in stock status be observed (e.g. from surveys), the Scientific Council is requested to provide updated advice as appropriate.*

The Scientific Council responded:

At its June 2003 Meeting Scientific Council provided 2-year advice for 2004 and 2005 for demersal redfish and other finfish (American plaice, Atlantic wolffish, spotted wolffish and thorny skate) in SA 1. The Scientific Council reviewed the status of these stocks at this June 2004 Meeting and found no significant changes in the status of these stocks. Therefore, Scientific Council has not provided updated/revised advice for 2005. The next Scientific Council assessment of these stocks will be in 2005.

ii) **Roundnose grenadier in Subareas 0 and 1** (see Part D, Annex 3, Item 1, monitor)

In the Scientific Council report of 2002, scientific advice on the management of roundnose grenadier in Subareas 0+1 was given as a 3-year advice (for 2003, 2004 and 2005). Denmark, on behalf of Greenland, requests the Scientific Council to: *continue to monitor the status of roundnose grenadier in Subareas 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.*

The Scientific Council responded:

At its June 2002 Meeting, Scientific Council provided 3-year advice for 2003, 2004 and 2005 for roundnose grenadier in Subareas 0+1. The Scientific Council reviewed the status of this stock at this June 2004 Meeting and found no significant changes in the status. Therefore, Scientific Council has not provided updated/revised advice for 2005. The next Scientific Council assessment of this stock will be in 2005.

iii) **Greenland halibut in Subareas 0+1** (see Part D, Annex 3, Item 3)

With respect to Subarea 1A inshore, the Council was asked to: *provide advice on allocation of TACS distributed in the areas Illulissat, Uummanaq and Upernavik, respectively*.

The following is a summary of the Scientific Council advice:

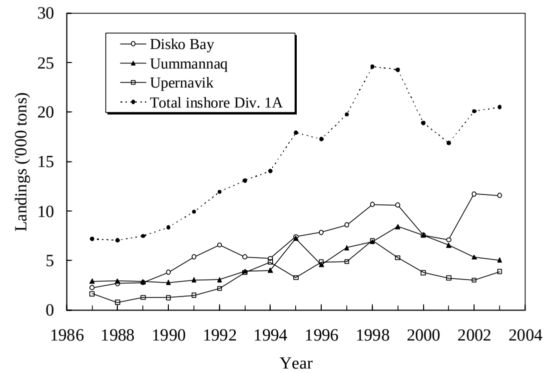
Greenland Halibut (Reinhardtius hippoglossoides) in Division 1A inshore

Background: The inshore stock is dependent on the spawning stock in Davis Strait and immigration of recruits from the offshore nursery grounds in Div. 1A and 1B. Only sporadic spawning seems to occur in the fjords, hence the stock is not considered self-sustainable. The fish remain in the fjords, and do not appear to contribute back to the offshore spawning stock. This connection between the offshore and inshore stocks implies that reproductive failure in the offshore spawning stock for any reason will have severe implications for the recruitment to the inshore stocks.

Fishery and Catches: The fishery is mainly conducted with longlines and to a varying degree gillnets. Total landings in all areas were around 7 000 tons in the late-1980s but then increased gradually until 1998 when the landings were almost 25 000 tons. Landings then declined to 16 900 tons in 2001 but increased again to 20 000 tons in 2002, and remained at the same level in 2003. The decline in landings observed in most recent years continued in Uummannaq. Landings have increased by around 25% in Upernavik 2003 compared to 2002. In Disko Bay catches were at same level as in 2002.

		Catch ('000 tons)	TAC ('000 tons)
Area	Year	STACFIS	TAC
Disko Bay	2001	7.0	7.9
	2002	11.7	7.9
	2003	11.7	7.9
	2004		na[1]
Uummannaq	2001	6.6	6.0
	2002	5.4	6.0
	2003	5.0	6.0
	2004		na[1]
Upernavik	2001	3.2	4.3
	2002	3.0	4.3
	2003	3.9	2.4
	2004		na[1]

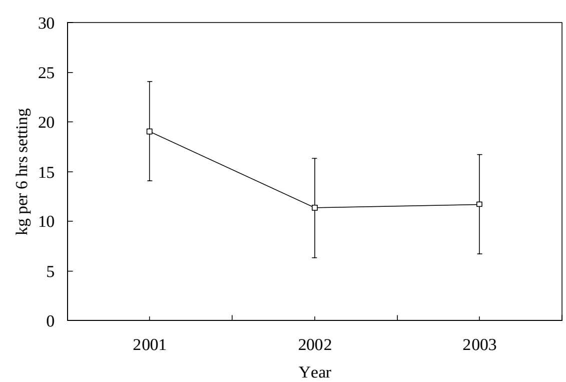
[1] No advice



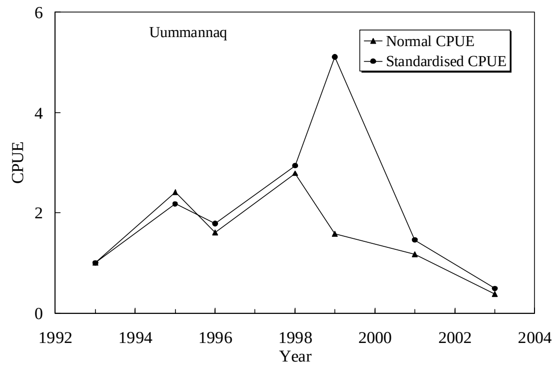
Data: Data on length frequency from commercial sampling were available for all three areas. Catch rate and length frequency data were available from the longline survey in Uummannaq and gillnet survey in Disko Bay. A recruitment index for age 1 was available from the Greenland shrimp trawl survey. Catch-at-age data were available from Disko Bay and Uummannaq from 1988 to 2003, and from Upernavik from 1988 to 2001

Assessment: The lack of information on fishing effort makes it difficult to evaluate trends in landings relative to stock biomass.

Disko Bay: A new gillnet survey (2001-2003) shows stable catch rates over the last two years. Mean length in commercial catches shows an overall stability over the entire time series.

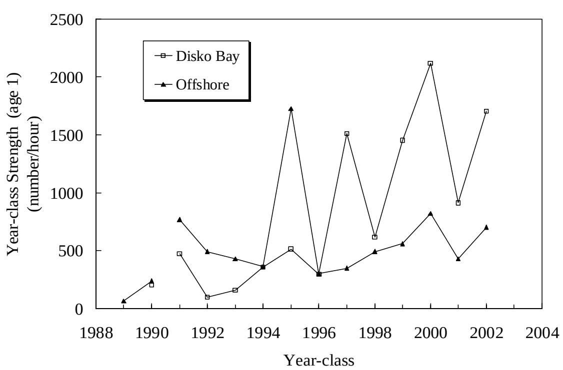


Uummannaq. Survey results indicate a decrease in abundance since 1999, and in the same period landings declined. However, mean lengths from both the surveys and in the fishery are relatively stable over the entire period, indicating that the decrease in catch rates is for all lengths groups.



Upernavik. Surveys have not been conducted in Upernavik since 2000 and there has been no sampling from the commercial landings recently.

Recruitment: In recent years, indices of recruitment, at age one, from the shrimp survey seem to have been good, especially in Disko Bay. There is, however, uncertainty as to what degree these year-classes will contribute to the inshore fishery in the future.



State of the Stock: The age compositions in catches in all three areas have been reduced to fewer age groups compared to the early-1990s and the stock has thus become more dependent of incoming year-classes.

Disko Bay: Indices of abundance have been relatively stable since 1993.

Uummannaq. Indices indicate an increase in abundance until 1999, but have decreased significantly since 2001. In the same period landings have declined.

Upernavik. There is no basis to evaluate the state of the Greenland halibut stock in that area.

Recommendation: Scientific Council still considers that separate TACs are appropriate for each of the three areas.

Disko Bay: In 2002 and 2003 catches have been at a record high level. Survey gillnet CPUE, has been stable between 2002 and 2003, but the survey primarily measures the pre-recruits to the fishable stock. Length distributions in the summer fishery have been stable, while the mean length distributions in the winter fishery have decreased slightly.

Scientific Council is therefore not able to evaluate the impact of the recent increase in catches on the stock status, but expresses concern about the increase in catches. Scientific Council therefore recommends that effort should not increase further in 2005.

Uummannaq: Catches have been steadily decreasing since 1999. In the same period the CPUE in the longline survey also decreased indicating that recent years' catch levels of 6 200 tons (average catches 2000–03) have been too high. Scientific Council therefore advise that catch level in 2005 should not exceed the 2003 catch level at 5 000 tons.

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

Reference Points: not determined.

Special Comments: The lack of information on fishing effort makes it difficult to fully evaluate whether the change in catches is a result of a change in stock biomass or changing fishing effort.

Because the stock is dependent on recruitment from Davis Strait, exploitation of the spawning stock and by-catches in the shrimp fishery should be taken into account when managing the fishery in the fjords.

Sources of Information: SCR Doc. 04/18, 51; SCS Doc. 04/14.

VIII. FUTURE SCIENTIFIC COUNCIL MEETINGS 2004 AND 2005

1. **Scientific Council Meeting and Special Session, September 2004 Dartmouth, Nova Scotia, Canada**

The Council reconfirmed that the Annual Meeting will be held during 13-17 September 2004 in the Holiday Inn, Harbourside in Dartmouth, Nova Scotia, Canada. The Scientific Council Symposium on "The Ecosystem of the Flemish Cap" will be held during 8-10 September 2004 at the same venue.

2. **Scientific Council Meeting, October/November 2004 (Assessment of Shrimp Stocks) Copenhagen, Denmark**

The Scientific Council agreed to the dates 27 October to 4 November 2004 for this meeting to be held jointly with the ICES Pandalus Assessment Working Group (WGPAND) at ICES Headquarters in Copenhagen, Denmark. This continues the practice of having the Scientific Council Meeting 'away from NAFO headquarters' every second year.

This will be a joint meeting of STACFIS and WGPAND with specific arrangements to be determined by the Chairs of Scientific Council, STACFIS and WGPAND. The Scientific Council and WGPAND meetings may be opened separately with STACFIS and WGPAND meeting together to assess the various shrimp stocks. The work of STACFIS and WGPAND will be covered in reports of the respective groups. The report of STACFIS will not contain a report of the shrimp stocks in the ICES area. The respective Secretariats will produce the reports of the two groups. Although this is a much different meeting plan than agreed previously by Scientific Council, the importance of increasing the participation of shrimp scientists in the assessments was deemed great enough to agree to this meeting plan. As usual the Scientific Council agenda will be issued 60 days prior to the meeting. The Chairs of Scientific Council and STACFIS contacted the Chair of WGPAND in February 2004, to begin the process of arranging the logistics of the meeting. Scientific Council hopes that in future STACFIS and WGPAND will be able to work together as a single body on the assessment of shrimp stocks.

The Council notes this will prove to be a challenging meeting. The agenda is expanded with the addition of the stocks assessed by WGPAND. The format of the meeting is totally new and essentially entails two meetings being held simultaneously in the same room. The on-site support of the NAFO Secretariat will be vital to the successful completion of the Scientific Council agenda.

3. **Scientific Council Meeting, June 2005**

The Scientific Council agreed to the dates 2–16 June 2005 for this meeting to be held at Alderney Landing, 2 Ochterloney Street, Dartmouth, Nova Scotia, Canada.

4. **Scientific Council Meeting and Special Session, September 2005**

The Council noted that the Annual Meeting will be held during 19-23 September 2005 and the Scientific Council Meeting will be held during the same dates. The venue has not been determined.

5. **Scientific Council Meeting, October/November 2005 (Assessment of Shrimp Stocks)**

The Scientific Council tentatively agreed to the dates 25 October to 2 November 2005 for this meeting to be held at NAFO Headquarters, Dartmouth, Nova Scotia, Canada. Dates and location will be reviewed in November 2004, at the joint NAFO/ICES shrimp assessment meeting.

IX. ARRANGEMENTS FOR SPECIAL SESSIONS

1. **Progress Report on Special Session in 2004: The Ecosystem of the Flemish Cap**

The co-convenors Antonio Vazquez and Joanne Morgan reported significant progress in planning the Special Session, the Symposium on *The Ecosystem of the Flemish Cap* to be held 8-10 September 2004, in advance of the 13-17 September 2004 Annual Meeting, Holiday Inn, Dartmouth, Nova Scotia, Canada.

A first announcement and Call for Papers was issued in October, 2003, with a second announcement in February, 2004. With the support of the Secretariat, a section of the NAFO web site has been set up for Symposium information and registration. The deadline for the submission of titles and abstracts has been set as 30 June 2004.

Four excellent keynote speakers have agreed to participate in the Symposium:

- J. Shaw, Geological Survey of Canada (Atlantic), Bedford Institute of Oceanography, Dartmouth, N.S, Canada - The paleogeology of the continental shelf of Atlantic Canada
- E.B. Colbourne, Science Branch, Department of Fisheries and Oceans, Newfoundland & Labrador, Canada - An overview of the oceanography of the Flemish Cap
- E. de Cardenas, Secretaria General de Pesca Maritima, Madrid, Spain - Relative isolation of the Flemish Cap cod population
- G. R. Lilly, Science Branch, Department of Fisheries and Oceans, Newfoundland & Labrador, Canada - The role of cod in the ecosystem of the Flemish Cap

To date 27 titles have been submitted for consideration. Decisions on the acceptability of papers for the Symposium will be transmitted to authors in early July 2004. A schedule for the Symposium would be ready by early August 2004.

The Council extended its appreciation to the co-convener for progress so far. The Council anticipated that papers from the Symposium will be published in a special volume of the Journal of Northwest Atlantic Fishery Science, with the co-Convenors serving as editors.

2. **Topics for Special Sessions in 2005 and 2006**

No new topics were considered by the Council at this meeting.

X. REPORTS OF WORKING GROUPS

1. **Working Group on Reproductive Potential**

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 (WG) is comprised of members representing 8 countries (Canada, Denmark, Iceland, Norway, Russia, Spain, United Kingdom, and USA). Previous updates of progress of the WG are provided in Annual Scientific Council Reports since 2001.

Two publications were completed to meet the goals of the first set of Terms of References. A special volume of the Journal of Northwest Atlantic Fishery Science was published in December 2003 that contained 9 peer-reviewed articles authored by members of the Working Group. Secondly, a large volume of the NAFO Scientific Council Studies was published containing short summaries and citation sources on stock structure and reproductive potential data (e.g., abundance, length-at-age data, maturation, condition, and fecundity) for 53 fish stocks (all of the NAFO stocks and several ICES stocks). This publication will likely serve as a good reference source for reproductive data pertaining to each stock. Both publications are available on the NAFO website.

The 3rd Meeting of the NAFO WG on Reproductive Potential was held at the Northeast Fisheries Science Center, National Marine Fisheries Service, Woods Hole, MA, 15-18 October 2003. A total of 13 Working Group members were in attendance. Ed Trippel (Canada) (Chair), Gudrun Marteindottir (Iceland), Loretta O'Brien (USA), Joanne Morgan (Canada), Jay Burnett (USA), Tara Marshall (UK), Nathalia Yaragina (Russia), Yvan Lambert (Canada), Chris Chambers (USA), Jonna Tomkiewicz (Denmark), Peter Wright (UK), Gerd Kraus (Germany) and Fran Saborido-Rey (Spain). Additionally, Pauline King (Ireland), Catriona Clemmesen (Germany), Paul Rago (USA), Lisa Hendrikson (USA), and Katherine Sosebee (USA) participated in the meeting bringing the total to 18 from 9 countries. Local arrangements were provided by Jay Burnett and Loretta O'Brien (Woods Hole Institute) which were greatly appreciated.

Through the efforts of the ToR Co-Leaders, other WG Members and participants, significant progress was made at this meeting on the second set of ToRs. A brief summary of progress and future plans of each ToR are given below.

ToR 1: Co-Leaders: Jonna Tomkiewicz (Denmark) and Jay Burnett (USA)

Complete inventory of available data in standardized format on reproductive potential for fish stocks of the North Atlantic and Baltic Sea.

Members: all WG members

The objective is to extend the tabulated information to comprise pelagic and demersal fish stocks in the North Atlantic, the Baltic Sea and the Western Mediterranean Sea. An additional 159 stocks have been identified. The existing 53 stock tables need to be updated to reflect the modified tabular format. Once all are completed there will be up to 212 stocks. The data availability will be analysed and presented. The WG is collaborating with the ICES Study Group on Growth, Maturity and Condition in Stock Projections (SGGROMAT) that has a shared interest in completing this ToR. Clearly, to date, fecundity data are lacking for almost all stocks. It is recommended that research institutes launch fecundity monitoring programs according to the methods outlined by Murua et al. in Vol. 33 of the Journal of Northwest Atlantic Fishery Science.

ToR 2: Co-Leaders: Yvan Lambert (Canada) and Gerd Kraus (Germany)

Explore the use of correlation analysis to estimate the reproductive potential of fish stocks having limited data availability.

Members: Hilario Murua (Spain), Nathalia Yaragina (Russia), Gudrun Marteinsdottir (Iceland), Peter Wright (UK), Peter Witthames (UK)

Identify proxies of fecundity/reproductive potential from ToR 3 (1st mandate of the WG) to be used in correlation analysis. Identify potential explanatory variables. At the stock level, these include stock identity (as a genetic variable), water temperature, prey abundance/availability, growth and surplus production. At the individual level, they include length, weight, condition (K), and liver index. Select multivariate statistical methods (e.g. cluster analysis, PCA) to group similar fecundity data and identify the most important explanatory variables of fecundity. Identify candidate stocks and species. Create databases including all standardized data. Build one or more fecundity models based on selected multivariate methods. Validate the use of selected models.

ToR 3: Co-Leaders: Hilario Murua (Spain) and Gerd Kraus (Germany)

Model the inter-annual and inter-stock variability in size-dependent fecundity for stocks having multi-year estimates.

Members: Olav Kjesbu (Norway), Peter Witthames (UK), Rick Rideout (Canada), Tara Marshall (UK), Yvan Lambert (Canada), Gudrun Marteinsdottir (Iceland)

Two cod stocks (Baltic and Northeast Arctic cod) have interannual variability in size-specific fecundity which are correlated with prey availability. Such relationships are useful for hindcasting fecundity for these stocks. Stocks lacking fecundity data have on occasion extrapolated fecundity models from data-rich stocks, a practice that is unverified and potentially misleading. Compile fecundity data for cod stocks and assess the degree of inter-annual and inter-stock variation in size-specific fecundity assessed.

ToR 4: Co-Leaders: Tara Marshall (UK) and Joanne Morgan (Canada)

Explore how the current use of biological reference points and medium-term projections can be adapted to include new information on reproductive potential.

Members: Loretta O'Brien (USA), Chris Chambers (USA), Hilario Murua (Spain), Gudrun Marteinsdottir (Iceland), Gerd Kraus (Germany), Coby Needle (UK)

Present several examples on the topic of how current management can be adapted to use information on reproductive potential. Examples were completed for Icelandic cod, Northeast Arctic cod, cod in NAFO Div. 3NO and spiny dogfish. Progress has been made in the development and implementation of supporting software. The incorporation of data on reproductive potential in NAFO stock assessments will likely be a gradual process consisting of several steps. This includes introducing scientists to the benefits of incorporating such information, providing software and assistance with interpretation of results. Given the anticipated rate of progress on these issues NAFO Scientific Council should consider sponsoring (or co-sponsoring with ICES) a workshop to explore the effects of incorporating data on reproductive potential on stock assessments.

ToR 5: Co-Leaders: Peter Wright (UK) and Chris Chambers (USA)

Explore the consequences of fishery-induced changes in the timing and location of spawning to reproductive success.

Members: Jonna Tomkiewicz (Denmark), Fran Saborido-Rey (Spain), Rick Rideout (Canada), Ed Trippel (Canada), Gudrun Marteinsdottir (Iceland)

Three components will be conducted: (i) theory, (ii) retrospective analyses using select data sets, and (iii) evaluation of consequences via cohort simulation. Focus of first year's work is on timing of spawning. Literature review of spawning time and evidence of selection on birth date. In retrospective analyses, a simulation framework is being developed in which key parameters are being varied to determine their effects on offspring fitness and population size. Key parameters include spawning characteristics (frequency distribution of spawning, size and age structure of females, and the dependency of fecundity and egg quality on female attributes), dependency of fecundity and egg quality on female attributes, egg and larval characteristics (life-stage duration, growth, and mortality), and the intensity/selectivity of fishing mortality on adults.

ToR 6: Co-Leaders: Fran Saborido-Rey (Spain) and Joanne Morgan (Canada)

Provide recommendations for the collection of required data in existing research surveys, sentinel fisheries and captive fish experiments that are required to improve annual estimates of reproductive potential for stocks varying in data availability.

Members: Anders Thorsen (Norway), Rick Rideout (Canada), Ed Trippel (Canada), Jonna Tomkiewicz (Denmark), Jay Burnett (USA).

Type, quantity and quality of data that should be collected to estimate reproductive potential will be considered. Classification of the relevance of each variable will be provided varying with the capability of obtaining the specific data and its relevance for the estimation of stock reproductive potential. Sampling strategies will differ depending on the fecundity type, i.e., for determinate and indeterminate species. Examples will be given.

ToR 7: Co-Leaders: Loretta O'Brien (USA) and Nathalia Yaragina (Russia)

Explore the effects of the environment on Stock Reproductive Potential (SRP) and how these relate of ToRs 2, 3 and 4.

Members: Chris Chambers (USA), Gerd Kraus (Germany), Rick Rideout (Canada), Yvan Lambert (Canada), Olav Kjesbu (Norway), Anders Thorsen (Norway), Tara Marshall (UK), Coby Needle (UK).

Scenario modelling will be applied to determine how SRP responds in different environments (e.g., high, medium, or low temperatures, high or low age diversity). The effect of environment on SRP of about 20 stocks will be investigated using the final model (8 cod, 3 haddock, 3 herring, 2 American plaice, anchovy, sprat, redfish, and skate).

Future Activities

Scientific Council welcomed the progress to date of the WG and endorsed its future directions in completing the second set of ToRs. A Workshop to illustrate how reproductive data can be further integrated into NAFO stock assessments was discussed. The format for publication of results for the second set of ToRs will likely include both peer and non-peer reviewed outlets and has yet to be determined for each specific ToR.

There was some discussion of expanding the role of the WG to include growth and condition, and to change the status to that of a NAFO Scientific Council Subcommittee. While this idea was thought to have merit, it would entail some changes to WG membership. Given the success of the WG to date, it was decided to make no changes at this time but to consider this idea again in the future.

The 4th Meeting of the NAFO Working Group on Reproductive Potential will be held at FAO Headquarters in Rome, Italy on 20-23 October 2004. Invitations to interested FAO staff to take part in the meeting will be made. Local arrangements will be organized by Fran Saborido-Rey (Spain) and Jorge Csirke, Chief of Marine Resources, Fishery Resources Division, FAO (Italy).

Scientific Council expressed it satisfaction with the work of the WG and hopes that it continues. Scientific Council thanked the Chair and the WG members for their efforts.

2. **Joint ICES-NAFO Working Group on Harp and Hooded Seals**

The Scientific Council Representative (Garry Stenson, Canada) of the Joint ICES/NAFO Working Group on Harp and Hooded Seals (WGHARP)[2], presented the complete progress report. The WGHARP, chaired by T. Haug, and comprised of scientists from Canada, Greenland, Norway, Russia, and USA met at SevPINRO, Archangelsk, Russia, 2 to 6 September 2003. The terms of references for the meeting were:

- review of recommendations from the "Workshop to Develop Improved Methods for Providing Harp and Hooded Sea Harvest Advise" (Workshop 2003)[3], NEFSC, Woods Hole, MA, USA., possibly also apply recommended models to existing data on harp and hooded seals;
- identify possible Biological Reference Points for harp and hooded seals;
- review and discuss existing methods applied in seal diet and consumption studies;
- review results from surveys of the 2002 harp and hooded seal pup production in the Greenland Sea;
- calculate biological limits of yields for Greenland Sea harp seals, Greenland Sea hooded seals, and White Sea/Barents Sea harp seals and assess the impact (over a 10-year period) of annual harvests of: a) current catch levels, b) sustainable catches, c) twice the sustainable catches.

---

[2] ANONYMOUS. 2004. Report of the Joint ICES/NAFO Working Group on Harp and Hooded Seals, Arkhangelsk, Russia, 2-6 September 2003. *ICES C.M. Doc*., No. 2004/ACFM:6.

[3] ANONYMOUS. 2003. Report of the Workshop to Develop Improved Methods for Providing Harp and Hooded Seal Harvest Advice, Woods Hole, MA, USA 11-13 February 2003. *ICES C.M. Doc*., No. 2003/ACFM:13.

Workshop and Precautionary Approach

WGHARP discussed the report of the Workshop 2003. A recent approach on the application of the Precautionary Approach and conservation reference points to the management of harp and hooded seals, originally developed for the stocks in the Northwest Atlantic (Hammill and Stenson, MS 2003) [4] was discussed. As well the recommendations from the Workshop 2003 to develop improved methods for providing harp and hooded seal harvest advice (ICES, CM 2003/ACFM:13) [2], were considered and WGHARP came to agreement on a number of points that will help define Biological Reference Points for harp and hooded seals:

- There is a common management framework that can be applied to different stocks though reference points and control rules may be different for different stocks. As such, a hierarchy of reference points can be defined for different stocks
- Abundance is the metric to be used in establishing the reference points, though other population metrics (e.g., condition) will be useful in establishing management response.
- The use of N_{MSY} and N_{LOSS} is inappropriate for marine mammals.
- The carrying capacity of the environment ('K') is difficult to estimate for seals and therefore should not be used as an upper reference point for these populations
- Some stocks will be considered data poor and will be managed under a different set of control rules. This argues for frequent (every 5 years or less), precise (CV <30%) abundance surveys.
- The method of assessing harp and hooded seals demands periodic estimates of pup production. Given the high proportion of pups in the current harvest, there will be a time lag between a harvest and when the effects of that harvest will be evident in the breeding population (owing to the delay between birth and sexual maturity), it is important to ensure that there are precautionary reference levels that allow for this time lag.

The WGHARP agreed numerous technical issues have yet to be resolved. These include:

- How should the reference points be defined? For example, should N_{CRIT} be defined on a purely biological basis or are both biology and economics relevant?
- How are data rich, poor and inadequate stocks defined and what rules should be applied for dealing with them?
- What control rules are appropriate for the various states of the stocks?

WGHARP concluded that if ICES ACFM accepts the general framework proposed, the members will work through correspondence to develop a proposal defining the reference points to be discussed at the next WGHARP meeting.

Diet Studies

The methods used to examine the diet and estimate consumption by seals in different areas of the North Atlantic were described and compared. Generally, the methods are similar although some details differed due to local conditions. A variety of methods can be used to determine the diet of seals. Each of these methods has specific advantages and disadvantages and provides data to answer different questions. Understanding the strengths and limitations of each method allows researchers to combine data from each to answer the questions posed. The WGHARP made a number of recommendations with respect to diet studies and these are contained in the report of the WGHARP[2].

Information on Northwest Atlantic harp and hooded seals

The information available on catches, research and current status of Northwest Atlantic harp and hooded seal populations were also discussed by WGHARP.

[4] HAMMILL, M. O., and G. B. STENSON. MS 2003. Application of the precautionary approach and conservation reference points to the management of Atlantic seals: A discussion paper *Can. Sci. Adv. Res. Doc.*, No. 2003/067.

Harp Seals

Up until 2003, the Northwest Atlantic harp seal stock management objective was to maintain the population at a constant level (i.e. Replacement Yield). From 1997 until 2002 the quota was set at 275 000. In 2003, a new management approach was implemented. This approach established a Precautionary Approach framework involving precautionary reference points established at 70% and 50% of the estimated maximum population size of 5.5 million animals. A lower limit reference point was set at 30% of the estimated maximum population size. Under the 3 year management plan a total harvest of 975 000 over three years will be allowed with a maximum of 350 000 in any one year.

After a low catch in 2000 (92 000) the harvest increased to over 226 000 in 2001. In 2002, catches (312 000) exceeded the TAC (275 000). Harvests remained high (289 000) in 2003 although the quota was not reached. As in the past, the vast majority of the harvest was directed towards young of the year with the proportion of pups in the commercial harvest remaining over 90%.

To determine the impact of the current management plan, simulation studies were carried out. It was assumed that Greenland and Canadian Arctic catches, by-catch levels and struck and loss correction factors did not change and that no unusual ice years resulting in unusual mortality events would occur over the period of the projections. Using the point at which the lower 60% C.I. of the population estimates crosses the precautionary reference point, N_{70}, the population is predicted to decline, but will remain above the precautionary level in the short term. However, the population would decline to the reference level by 2011 assuming that the entire quota of 975 000 was taken and that harvests returned to 275 000 after the 3 year period.

There is no quota for harp seals in Greenland. Catches increased steadily from ~15 000 in the 1980s up to ~100 000 in 2000. However, in 2001 catches declined ~20% to ~79 000. There are no estimates for 2002 or 2003.

The Canadian government has recently approved funding for two-year study on the impact of seals on the recovery of Atlantic cod (*Gadus morhua*) in Canadian waters. This program will focus on harp, hooded and grey seals. Included in this program are a harp seal pup production survey (scheduled for March 2004), satellite tracking studies to determine movements and diving behaviour, expanded collections of diet data from seals in offshore areas and a pilot study of the feasibility of reducing the number of seals present in a fjord area of Newfoundland where large amounts of cod are known to winter.

Hooded Seals

Canadian catches of hooded seals remained low (14-151 over the last four years) and well below the Total Allowable Catch of 10 000. It is illegal to take "blue backs" in Canada and there are no markets for older hooded seals.

Greenland catches have remained around 6 000 (range 5-10 000) in recent years. There are currently no quotas on the number of seals taken.

No new information on the status of this stock was presented. This stock has not been surveyed since 1990. However, a pup production survey is scheduled for March 2005.

Future Activities

The WGHARP will discuss by correspondence during 2004. The next physical meeting is tentatively planned for late summer-early autumn of 2005 in St. John's, Newfoundland, Canada.

The modelling subgroup agreed that additional studies to address the recommendations of the Workshop 2003 on Providing Improved Advice proceed on two fronts intersessionally. The first, led by H. Skaug (Norway), will continue development of the current Northeast Atlantic model to explicitly incorporate uncertainty from biological parameters. The second, led by A. Karbitz (Norway), will conduct the sensitivity analyses recommended by the Workshop 2003. A brief progress report will be presented to WGHARP by September 2004 (*via* correspondence) and the full results will be discussed at the 2005 WGHARP meeting.

A small group will work via correspondence to further develop ways to apply the Precautionary Approach to providing advice for harps and hooded seals. One of the first issues to be addressed is to develop definitions for biological reference points. The sub-group would consist of Filin (Russia), Hammill (Canada), Haug (Norway), Merrick (USA) and Stenson (Canada).

Issues that will be addressed by the WGHARP at the next meeting (2005) may include, but are not limited to:

- Further development of biological reference points for harp and hooded seals
- Review of the results of intersessional modelling studies to look at sensitivity analyses and comparisons among models.
- Review of results of proposed pup production surveys in the NW Atlantic.
- Address requests for advice from parent organizations (ICES/NAFO), as required.

Scientific Council thanked Garry Stenson for presenting the report of the WGHARP. Council noted the substantial contribution of the WG to the study and assessment of harp and hooded seals and particularly the progress in scientific consideration on the Precautionary Approach for seal fisheries.

3. **Limit Reference Point Study Group (LRPSG)**

The Limit Reference Point Study Group (LPRSG) met 15-20 April, 2004 at IFREMER in Lorient, France, to address the following terms of reference: 1) Review the properties of alternative Limit Reference Points (LRPs), including the ability to quantify risk, and determine strengths and weaknesses of various alternatives. 2) Provide guidance regarding the most appropriate approaches for stocks ranging from data rich to data poor and for a range of life-history strategies. 3) Provide example applications to Subarea 2 + Div. 3KLMNO Greenland halibut, Div. 3LNO yellowtail flounder and Div. 3LNO thorny skate based on existing and recent biological, fisheries and survey data; recent stock assessments; and management measures (SCS 04/12). The co-Chair (Peter Shelton – Canada) of the LPRSG presented the following overview.

The Study Group (SG) meeting comprised of plenary sessions on concepts, estimation, evaluation and implementation, and on the background to the three case studies, break-out groups to discuss the case studies in detail, and a final plenary session to review conclusions and formulate recommendations.

The SG took the approach of being prescriptive with respect to defining LRPs and the rules for deciding how they should be estimated. An attempt was made to reflect current best practice and it is anticipated that further work will be undertaken, particularly in the area of harvest control rule simulations, incorporating the definitions and rules described in the report.

The SG endorsed the concept of "serious harm" being the state in which spawning stock biomass is below B_{lim}. There should be only a very low probability of B_{lim} being transgressed when the stock is considered to be in the "Safe Zone". For stocks for which there is an age-disaggregated assessment and a compensatory stock-recruit relationship exists, the SSB corresponding to 50% of the maximum recruitment based on a fitted model was considered by the SG to provide a definition of B_{lim}. For stocks with age-aggregated assessments and a compensatory production function, SSB (or as a proxy, total biomass) corresponding to 50% of MSY, i.e. 30% B_{msy} under the Schaefer production model, provides a definition of B_{lim}. Where it can be estimated, F_{msy} provides a definition of F_{lim}. Serious harm occurs when F_{lim} is exceeded for a number of consecutive years. For stocks with less data, or for stocks for which compensatory functional relationships are not evident, the derivation of LRPs is more complex. The SG provided a number of recommendations for deriving proxy B_{lim} and F_{lim} reference points for such cases.

The SG reviewed a number of technical aspects related to the estimation of LRPs. Segmented regression has been considered as one way to model stock-recruit data as a basis for determining LRPs. A simulation study showed that biases associated with delta (SSB corresponding to the break-point) in segmented regression are relatively small unless the breakpoint is located to the far right in the data scatter. A second simulation study showed that segmented regression estimates of SSB corresponding to 50%R_{max} are more robust with respect to the addition or deletion of data points than either the Ricker or Beverton-Holt derived estimates.

Estimates of LRPs generally have low precision. Given that estimates of current SSB and projected future SSB levels are also uncertain, the conclusion was drawn by the SG, based on analyses reviewed at the meeting, that the use of ratio estimators is advisable where possible (i.e. current SSB expressed as a proportion of B_{lim}), since at least some of the uncertainty is cancelled.

Further simulation studies evaluated the statistical properties of the Serebryakov approach, and SSB corresponding to 50%R_{max} based on the Beverton-Holt model (BH50). Results showed that the Serebryakov approach is unreliable as an LRP estimator and its use should be discontinued. BH50 appeared to be a better LRP estimator, however estimates become negatively biased with both increasing sigma (increasing error) and, at high sigma, with decreasing data contrast (expressed in terms of SSB corresponding to a proportion of R_{max}). These are undesirable properties for a LRP estimator.

SG reviewed methods based on production models (REPAST) and the replacement ratio method (RPM). Both methods were considered to be useful in the context of NAFO LRP estimation. Other approaches, based on percentage spawner-per-recruit, percentage declines in relative abundance indices, changes in spatial distribution of the stock and time to recover to above B_{buf} were found by the SG to have application in some situations. The SG developed an expert system for ordering the process of deciding on an appropriate approach for estimating LRPs under different conditions. It attempts to capture the knowledge base of the experts in the SG. The intent is that it would be updated as knowledge develops. The SG considered that the expert system could provide a useful tool in NAFO stock assessments.

The SG considered that it was highly desirable to evaluate LRPs through simulations in which the reference points are linked with harvest control rules. This is not a trivial undertaking technically. It requires input from managers and resource users in addition to fisheries scientists. Yellowtail flounder in NAFO Div. 3LNO, which is assessed with an age-aggregated production model, would be a good initial case study for evaluating harvest control rules.

Scientific Council was pleased with the work to the LRPSG and concluded that the report of the SG will provide a useful basis for the estimation of LRPs. Scientific Council made some suggestions with respect to the report of the LRPSG (which was still being finalized at the time of the June 2004 Scientific Council meeting). In particular, Scientific Council suggested that a list of acronyms and their meanings would be helpful to readers of the report. In addition Scientific Council suggested the inclusion of some additional features for the decision trees used in determining a means of setting LRPs and encouraged the members of the LRPSG to work further on these decision trees before finalizing their report. The LPRSG report will be finalized as an SCS Document.

The Council observed that the SG had agreed, by consensus, on 15 recommendations on LRPs. These were discussed by Scientific Council at this meeting. The Council **endorsed** the following **recommendations** without alteration:

- *F_{lim} should be accepted as a non-arbitrary definition of a fishing mortality which, if exceeded for a number of consecutive years, would constitute serious harm to the stock.*

- *The SSB corresponding to 50% of the maximum recruitment (B 50% R_{max}) for stocks for which such estimation is reliable, should be considered to provide a definition of B_{lim} under current best practice.*

- *The biomass giving production of 50% of MSY should be considered as an appropriate B_{lim} for stocks assessed using production models. Under the Schaefer model this is 30% of B_{msy}.*

- *For populations which provide no clear indication of compensation in the recruitment or overall stock production function, there is no clear basis for defining a B_{lim}, and maintaining fishing mortality at a level sufficiently below the replacement fishing mortality when the stock is considered to be low becomes* *a primary concern. Under the circumstances where stock size is outside of the Safe Zone and no compensation is evident,* F_{lim} *should be taken to equal* F_{med}.

- *For stocks where compensatory stock recruitment (SR) or production functions cannot be determined, the point at which a valid index of stock size has declined by 85% from the maximum observed index level should be used as a proxy for* B_{lim}*. If the highest index of stock size is equal to* B_{msy}*, then it would be consistent for* B_{lim} *to be 30% of that level. If the highest observed survey index is considered to be below* B_{msy}*, then this should be taken into account in a similar way.*

- *Apparent evidence of regime shifts should be treated with caution and the implications should be examined. Invoking regime-shift changes as an explanation for changes in recruitment may not be precautionary in some cases.*

- *Whether or not* F_{msy} *and 30%* B_{msy} *would be considered useful as LRPs for skate type species (K-selected), it was agreed that, if the Schaefer model holds for such species,* F_{msy} *and 30%* B_{msy} *as LRPs be used for these stocks.*

- *When a stock recruitment (SR) relationship or a production relationship cannot be determined from the available data and replacement ratio method (RRM) cannot be applied, consideration should be given to spawner-per-recruit (SPR) analysis as a means of determining* F_{lim}*. F giving % SPR of 35% should be used as a default* F_{lim} *for such stocks in the absence of meta-analysis considerations or other considerations to suggest it should be higher or lower.*

- *LRPs put forward by the SG should be incorporated into HCR simulations. Divisions 3LNO yellowtail flounder should be selected as an initial case study.*

- *It was agreed that the Scientific Council should continue to provide advice to FC on the adoption of Precautionary Approach in decision making and should make use of the best current scientific practice as outlined in this report, and encoded in the rule-based expert system provided, until better advice is provided to update the expert system.*

For the following recommendations of the LRPSG, Scientific Council had some comment:

- *There should be only a very low probability of a* B_{lim} *being transgressed when the stock is in the "Safe Zone".* F_{lim} *should only be exceeded occasionally The LRPs should be estimable and the estimates should be reasonably robust.*

Scientific Council agreed with this in principle, but noted that although it is desirable that LRPs should be estimable they will in reality sometimes be set by non-estimable means.

- *When other methods cannot be applied, it may be possible to express* B_{lim} *terms of the SSB for which there is no less than a 20% probability that the stock could recover to the "Safe Zone" (above* B_{buf}*) in one generation under good productivity conditions.*

Scientific Council considered that it should be possible to set a B_{lim} for most stocks.

- *Where possible an SPA-SR approach or a production model approach would be used preferentially over the replacement ratio method (RRM) because the RRM cannot determine a* B_{lim} *(it has to be provided externally). For stocks where the SR relationship or the production relationship cannot be determined, 50% of the relative F at replacement ratio=1 should be used as a temporary proxy for* F_{lim}.

Scientific Council endorsed this recommendation, but noted that the use of "50% of the relative *F* at replacement ratio = 1 should be used as a temporary proxy for F_{lim}" requires further evaluation.

- *On the circumstances under which spatial patterns of distribution would be a factor into the determination of limit reference point, it was considered for species in which there is no dispersal stage* *or very limited dispersal, of the early life history stages, then a metric of spatial pattern has particular importance in determining and LRP. A decrease in the area of distribution (presence/absence) of more than 75% should be considered to be consistent with serious harm.*

Scientific Council endorsed this recommendation for stocks where stock distribution decreases with stock size in accordance with the McCall basin theory. However, it noted that measures that account for both density and area of distribution would be preferred and attempts should be made to derive LRPs from such measures.

- *The SG strongly urged that NAFO SC recommend to Fisheries Commission that the 2003 NAFO SC PA framework be endorsed and implemented by FC without further delay.*

Considering the progress made by the Limit Reference Point Study Group (LPRSG) which was held in Lorient, France, 15-20 April 2004, the Scientific Council strongly **recommended** that *the Precautionary Approach Framework developed by Scientific Council be endorsed and implemented by the Fisheries Commission without further delay.*

XI. REVIEW OF SCIENTIFIC COUNCIL WORKING PROCEDURES/PROTOCOL

1. NAFO Scientific Council Observership at ICES ACFM Meetings

A presentation to Scientific Council reviewed the report from the ICES ACFM October 2003 Meeting. Scientific Council noted the ICES objective of providing mixed fisheries advice and the difficulties that ICES is experiencing collating the disaggregated fleet and discard data required to support such an advisory framework. Scientific Council also discussed the research that ICES is undertaking into the development of harvest control rules for robust stock management and the ICES deliberations on transparency in the Working Group and advisory process. Scientific Council will continue to monitor the development that ICES is making in these areas. Scientific Council noted there were no observer data available for the 2004 ICES ACFM meeting but that Chris Darby (EU-UK) would be in a position to obtain details.

2. General Plan of Work for Annual Meeting in September

Council noted that there were two items that would need to be completed on the first day of the annual meeting. The first is the request for advice on Pelagic *S. mentella* (redfish) in Subareas 1-3 and adjacent ICES area. There will be a meeting of the ICES Study Group on Stock Identity and Management Units of redfishes (SGMISUR) 31 August to 3 September 2004 in Bergen, Norway. The ICES Northwestern Working Group will not provide advice on this stock until after meeting of SGMISUR in a meeting ending 10 September 2004. Fernando Gonzalez (EU-Spain) will attend this meeting and report to the Scientific Council. Following this, the Council will finalize its advice on this item.

In addition, the interim monitoring reports on northern shrimp in Div. 3M and Div. 3LNO will need to be completed during the first day of the September 2004 Meeting of the Council to determine if there is any need to change the advice provided on these stocks given in November 2003.

3. Facilities, Technological and General Secretariat Support

Scientific Council discussed its needs for support with respect to its three Council meetings held each year. In particular issues were raised about the annual June Scientific Council Meeting and the October/November Scientific Council Meeting on the assessment of shrimp. Scientific Council noted that although the level of Secretariat support at this June 2004 Meeting was very good with respect to the preparation, logistic support and compilation and distribution of reports, there were a number of issues with the venue, meeting server and public address system that need to be addressed. Details will be relayed to the Secretariat in a letter from the Chair of Scientific Council.

There was considerable concern expressed regarding the proposed level of NAFO Secretariat support at the 2004 October/November Meeting of Scientific Council on shrimp assessments, in that it may be less than the level of NAFO Secretariat support that has been made available in the past. Although there will also be support from the ICES Secretariat during the meeting, several past participants and Chairs of past shrimp assessment meetings voiced their opinions that the meeting required the usual support of two members of the Secretariat.

It is recognized that some of the technical and support issues may have budgetary implications. They are, however, important to the Scientific Council's ability to fulfill its mandate. The Secretariat may wish to discuss the budgetary implications with the Executive Committee of Scientific Council during budget preparations. In addition Scientific Council invites the Executive Secretary to discuss Secretariat support for the Scientific Council at the September 2004 Scientific Council Meeting.

4. **Other Business**

a) **Intersessional Role of Executive Committee**

Between meetings of Scientific Council (and its Standing Committees) there are often issues that need to be addressed. These are often technical issues but may be related to specific recommendations that have been made by Scientific Council. In accordance with the Rules of Procedure, the Chairs of the Scientific Council and the Standing Committees form the Executive Committee of Scientific Council. When issues arise needing input of the Executive Committee, the Council agreed that intersessional discussions of the Executive Committee will be held as necessary.

It was agreed that discussions on matters that may impact Scientific Council will occur between the Executive Committee and the Secretariat, during intersessional periods of Scientific Council Meetings. The purpose of these discussions will be to ensure that the views of Scientific Council are adequately considered. In particular it was agreed that discussions for preparation of the annual budget during June-September would be important.

b) **Dialogue between Chairs of Scientific Council, General Council and Fisheries Commission**

The Scientific Council observed regularized dialogue between the heads of Scientific Council, General Council and the Fisheries Commission would be useful in fulfilling the mandate of NAFO. The Council agreed the Chair of Scientific Council will write to the other Chairs to discuss this issue.

XII. OTHER MATTERS

1. **Report of CWP Intersessional Meeting, Rome, Italy, 2-5 February 2004**

The CWP Intersessional Meeting was held at FAO Headquarters during the course of 2-5 February 2004. The Executive Secretary attended.

The Executive Secretary at the STACREC sessions reported on major topics of interest to NAFO. She noted the provisional agenda for CWP-21 Session was drafted.

The Council noted that the intersessional meeting had addressed the recommendations from the CWP-20th Session and its proposed intersessional work. The Council noted the complete CWP 20th Session Report (which was not prepared in time for Scientific Council in June 2003), is now available at http://www.fao.org/fi/meetings/cwp/cwp20/default.asp.

The Council also noted the complete report of this CWP Intersessional was also available at http://www.fao.org/DOCREP/006/AD659E/AD659E00.HTM.

2. **Report from the FIRMS Steering Committee (FSC) Meeting of 2-5 February 2004**

The Council noted the Executive Secretary attended the first meeting of the FIRMS Steering Committee (FSC) as an observer. The meeting represented the inaugural meeting of FSC, where organizations that had signed the

FIRMS Partnership Arrangement developed the text for the FSC Rules of Procedure. The complete report of the FSC is now available for Scientific Council consideration at http://www.fao.org/fi/meetings/figis-firms/2004/default.asp.

3. **The FSC and CWP 21st Meeting, Copenhagen, February 2005**

The Council was informed by the STACREC deliberations that the next meeting of the FIRMS Steering Committee (FSC) and the CWP 21st Session will be held at the ICES Headquarters, Copenhagen, Denmark, through the period 25 February to 4 March 2005, with a Workshop on implementation strategy – STF taking place from 28 February to 1 March 2005.

The Council noted, in accordance with the Scientific Council Rules of Procedure, that the Scientific Council Vice-Chair/STACREC Chair will attend the CWP 21st Session of 1-4 March 2005, supported by the NAFO budget.

The Council considered it a valuable financial commitment from the NAFO budget to extend the Vice-Chair/STACREC Chair's travel to Copenhagen, to include participation in the FSC meeting of 25-28 February 2005.

The Council also noted that certain matters from this June 2004 Meeting, and possibly matters to be discussed at the September 2004 Meeting may need to be submitted to the CWP 21st Session. Accordingly the Council **recommended** that *the STACREC Chair is consultation with the Secretariat ensure any Scientific Council related matters be submitted to CWP Secretariat for inclusion in the CWP 21st Agenda.*

The Council noted the use of new gear in fisheries, e.g. the twin bottom trawl in Greenland halibut fisheries, need to be clearly recorded in statistical data, with appropriate specific gear codes assigned to them. The Council noted this issue needs to be addressed with CWP and FAO gear specialists and invited the STACREC Chair, in consultation with Council members to arrange for CWP considerations.

4. **The FIRMS/NAFO Arrangement**

The Council was pleased to receive from STACREC the revised text for the proposed FIRMS/NAFO Arrangement. The Council had reviewed the Preamble text during the September 2003 Meeting. The text for Annex 1 and 2, approved by STACREC at this meeting was considered appropriate for Scientific Council purposes.

The Scientific Council views that the FIRMS/NAFO Arrangement is an institutional arrangement between FAO/FIRMS and NAFO. Accordingly the Scientific Council **recommended** that *the General Council approve the FAO/FIRMS and NAFO Partnership Arrangement.*

5. **Meeting Highlights for NAFO Website**

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

6. **Other Business**

There was no other business.

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 the Council plenary will be incorporated later by the Council Chair and the Deputy Executive Secretary.

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, as follows to the General Council and Fisheries Commission:

Scientific Council has concluded that STACREC is no longer able to fulfill its mandate of statistics compilation with the current situation. As such, Scientific Council **recommended** that *the Chair of Scientific Council formally communicate to the Chair of Fisheries Commission the concerns of Scientific Council regarding the derivation and accuracy of catch information available, and request that for the future, each year prior to the June meeting of Scientific Council, Fisheries Commission conduct its own evaluation of catch information derived from various sources under Rule 5.1 pertaining to STACTIC, and provide Scientific Council with their agreed estimates by Contracting Party/Country to be utilized by Scientific Council in the conduct of stock assessments.*

Considering the progress made by the Limit Reference Point Study Group (LPRSG) which was held in Lorient, France 15-20 April 2004, the Scientific Council strongly **recommended** that *the Precautionary Approach Framework developed by Scientific Council be endorsed and implemented by the Fisheries Commission without further delay*.

The Scientific Council views that the FIRMS/NAFO Arrangement is an institutional arrangement between FAO/FIRMS and NAFO. Accordingly the Scientific Council **recommended** that *the General Council approve the FAO/FIRMS and NAFO Partnership Arrangement.*

XV. ADOPTION OF SCIENTIFIC COUNCIL REPORT

At its concluding session on 17 June 2004, the Council considered the Draft Report of the meeting, and **adopted** the report with the understanding that the Chair and the Deputy Executive Secretary will incorporate later the text insertions related to plenary sessions of 3-17 June 2004 and other modifications as discussed at plenary.

XVI. ADJOURNMENT

The Chair thanked the participants for their hard work and co-operation, noting particularly the efforts of the Designated Experts and the Standing Committee Chairs. The Chair thanked the Secretariat for their valuable support. The Chair also noted that Dr. V. Rikhter (Russia) had notified Scientific Council that he would no longer be attending Council meetings. The Chair thanked Dr. Rikhter for his many years of valuable service to the Scientific Council. There being no other business, the meeting was adjourned at 1145 hr on 17 June 2004.

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

Chair: Eugene B. Colbourne Rapporteur: Gary L. Maillet

The Committee met at Alderney Landing, 2 Ochterloney Street, Dartmouth, Nova Scotia, Canada, on 4 and 10 June 2004, 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 Faroe Islands and Greenland), European Union (France, Germany, Portugal, Spain, and United Kingdom), Russian Federation and United States of America.

1. Opening

The Chair opened the meeting by welcoming participants to this June Meeting of STACFEN. The Chair welcomed Dr. Kenneth Frank from the Bedford Institute of Oceanography in Dartmouth, Canada 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. 04/01, 03, 04, 15, 25, 26, 27, 29, 30, 32, 34; SCS Doc. 04/03, 07, 08, 10, and 14.

Gary L. Maillet (Canada) was appointed rapporteur.

2. Review of Recommendations in 2003

No recommendations were made by STACFEN during its meeting in June of 2003. However an informal recommendation made by Scientific Council in September 1998 proposed that a brief overview of the fishery for each NAFO Division should be included in the STACFIS report and it was recommended that this overview include a paragraph on the environment for that particular area. This recommendation was last implemented at the November 2003 Scientific Council northern shrimp assessment meeting for Div. 3M and 3LNO. It was agreed by STACFEN that the environmental summaries will be included in the June 2004 and in future STACFIS reports.

3. Progress Report on Publication of Proceedings of the Mini-symposium on Hydrographic Variability in NAFO Waters 1991-2000.

STACFEN noted the special issue of the *Journal of the Northwest Atlantic Fisheries Science* containing 7 out of the 8 papers presented at the mini-symposium in June if 2002 is now published on the NAFO website (http://www.nafo.ca/publications/frames/PuFrJour.html) as Volume 34. This publication upholds a tradition of decadal and special reviews of ocean climate in the Convention Area by ICNAF and NAFO spanning fifty years and as such represents the 6th review.

4. Invited Speaker

The Chair introduced this year's invited speaker, Dr. Kenneth Frank (Bedford Institute of Oceanography, Dartmouth, Canada). The Committee was informed his research includes assessing the status of large ecosystems from data sets describing fisheries, environment and human activities. Specific objectives were to assess the current state of the ecosystem of the Scotian Shelf in NAFO Subarea 4 from all available data sets relative to its mean state. His talk entitled "Assessment of the State of a Large Marine Ecosystem – the Eastern Scotian Shelf", presented here is submitted to STACFEN as an abstract (SCR Doc. 04/34), is based in part on the DFO, 2003 State of the Eastern Scotian Ecosystem. DFO Can. Sci. Advis. Sec. Ecosystem Status Report 2003/04. http://www.dfo-mpo.gc.ca/CSAS/CSAS/English/Publications/Stock_Report_e.htm. The Committee invited Ken Frank to publish the results of his work in the *Journal of the Northwest Atlantic Fisheries Science.* The following is a summary of his talk.

Many features of the Eastern Scotian Shelf ecosystem have changed dramatically during the past thirty years. A major cooling event of the bottom waters occurred in the mid-1980s that persisted for a decade and recent intensive stratification in the surface layer has been apparent; both phenomena are associated with flow from upstream areas. The index of zooplankton abundance was low in the decade of the 1990s when phytoplankton levels were high and the opposite pattern was evident in 1960s/early-1970s. Major structural changes have occurred in the fish community. Groundfish have declined while small pelagic species and commercially exploited invertebrate species have increased. Range expansion of some species as well as the occurrence of species new to the area was evident and associated with changes in the physical environment. Reductions in average body size of groundfish have occurred and there are currently very few large fish – a situation likely to have never been witnessed in the past. Condition and growth of several groundfish species has remained low during the past decade contrary to expectations for improvement. It is not yet possible to predict how long the current situation will persist and whether or not the system will return to its previous groundfish-dominated state. The fishery is increasingly targeting species at lower levels in the food web because there now exists a lack of availability of groundfish at the higher trophic levels.

The state of the Northwest Atlantic fisheries was assessed by examining trends in survey and model-based estimates of recruitment (R), spawning stock biomass (SSB) and recruitment rate (*ln* R/SSB). The species/stocks examined included cod, haddock, pollock, silver hake, skates (winter, smooth, thorny, little), redfish, flatfish (American plaice, yellowtail flounder and turbot), white hake and mackerel. All data were expressed as standardized anomalies and were sorted using Principal Components Analysis with the first axis scores displayed to show generalized trends. In general, among those stocks where both survey and model based estimates of R and SSB were available, temporal trends were in close agreement. The analyses revealed species-specific differences particularly among cod, haddock, and herring stocks. Declining trends in both R and SSB were evident among most cod stocks while R/SSB was somewhat more variable. Herring recruitment was variable among stocks with recent positive SSB anomalies evident on the Scotian Shelf and Georges Bank. R/SSB anomalies were mainly positive among most herring stocks in the recent past suggesting future increases in SSB are to be expected. Recent R and R/SSB anomalies were positive among all haddock stocks and SSB has exhibited a striking transition from strong negative anomalies to moderately positive during the recent past decade. Among flatfish species/stocks, recent R and SSB anomalies were positive in the south while R/SSB anomalies were negative among all stocks in the past few years that were preceded by strong positive anomalies. Generalizations of the trends among all species based on the first axis scores of the principal components analysis revealed relative stability in R from the 1950s to the mid-1980s followed by a sharp transition to the early-1990s. The first axis for R can be considered representative of a ground fish versus pelagic gradient. Similarly, SSB was stable until a transition in late-1970s, possibly due to a density dependent effect and by the early-1990s a strong divergence was evident. R/SSB was stable until the mid-1960s and then began to oscillate with increasing amplitude.

5. **Marine Environmental Data Service (MEDS) Report for 2003** (SCR Doc. 04/20)

Since 1975, MEDS has been the regional environmental data centre for ICNAF and subsequently NAFO and as such is required to provide an inventory of all environmental data collected annually by Contracting Parties of NAFO within the Convention Area. It was noted that, as of June 2004, only Canada and the USA have submitted high resolution water column profile data for 2003 in the NAFO Convention Area.

For the NAFO area, subsurface vertical profiles as well as surface observations, sample a variety of parameters such as temperature, salinity, oxygen, nutrients and other chemical and biological variables. MEDS receives these data either in real-time (within one month of observation) via the Global Telecommunications System reporting system or in delayed-mode directly from responsible institutions, and indirectly from national Cruise Summary Reports and other reports of marine activities. The following is the inventory of oceanographic data obtained by MEDS during 2003 and information on several recent activities.

i) **Hydrographic data collected in 2003**

Data from 5 891 oceanographic stations collected in the NAFO area sent in delayed mode to MEDS in 2003 have been archived, of which 4 129 were CTDs, 1 266 were BTs and 497 were bottles. A total of 9303 stations were received through IGOSS (Integrated Global Ocean Service System) and have been archived, of which 1 329 were BTs and 7 974 were TESAC messages. This represents a 27% increase in delayed mode data and a 45% increase in IGOSS stations over 2002.

ii) **Historical hydrographic data holdings**

Data from 13 796 oceanographic stations collected prior to 2003 were obtained and processed during 2003, of which 1 391 were vertical CTDs, 5 784 were towed CTDs, 1 478 were BTs and 5 143 were bottle data.

iii) **Thermosalinograph data**

A number of ships have been equipped with thermosalinographs to collect surface temperature and salinity data while the vessels are under way. These are transmitted as station data via satellite and radio links with 592 stations in the Northwest Atlantic being received during 2003, down significantly over the 1 389 stations received in 2002 and the 28 130 stations received during 2001.

iv) **Drift buoy data**

A total of 88 drift-buoy tracks within NAFO waters were received by MEDS during 2003 representing 75 001 buoy messages and approximately 300 buoy months of data. The total number of buoys tracks increased by 11 over 2002.

v) **Wave data**

During 2003, MEDS continued to process and archive operational surface wave data on a daily basis around Canada. One-dimensional and directional wave spectra, calculated variables such as the significant wave height and peak period, concurrent wind observations, if reported, and the raw digital time series of water surface elevations were stored. A total of 8 wave buoy stations were operational in the NAFO area during 2003 which is the same as 2002 but lower when compared to 2001 where there were 15.

vi) **Tide and water level data**

During 2003, MEDS continued to process and archive operational tides and water level data that are reported on a daily to monthly basis from the Canadian water level network. MEDS archives observed 15-minute heights, hourly heights and monthly instantaneous extremes collected around Canada. Approximately 70 000 new readings are updated every month from the network. The historical tides and water level data archives presently hold over 30 million records with the earliest dating back before 1900. A total of 28 stations were processed during 2003.

vii) **Current meter data**

A total of 63 current meter instruments were recovered in the NAFO area during 2003 and an additional 27 instruments were deployed. These included both conventional current meters and Acoustic Doppler Current Profilers (ADCPs). The recovered data are processed at the Bedford Institute of Oceanography (BIO) and are available on the web (http://www.maritimes.dfo.ca/science/ocean/welcome.html).

viii) **Recent activities**

MEDS reported on two other initiatives during 2003:

a) Argo is an international program to deploy profiling floats on a 3° by 3° grid in the oceans of the world. Each profiling float samples and reports both temperature and salinity from 2000 m to the surface every 10 days. Data are distributed both on the Global Telecommunications System (GTS) and from two Internet servers within 24 hours of the float reaching the surface. MEDS carries out the processing of the data received from Canadian floats, to distribute the data on the GTS, to distribute the data to the Argo servers and to handle the delayed mode processing. As well, MEDS has developed a Canadian web site (http://www.meds-sdmm.dfo-mpo.gc. ca/meds/Prog_Int/ argo/ArgoHome_e.html) that contains information about the Canadian floats, as well as some general information and statistics about the global array. General information is also available from the Argo Information Centre in Toulouse, France. In 2003, Canada deployed 31 floats in total which include 16 in the North Atlantic.

b) The Canadian DFO's Atlantic Zone Monitoring Program (AZMP) activities include regular sampling for 6 fixed stations and 13 standard sections, and research surveys in the AZMP area to collect other physical, chemical and biological data. As part of MEDS activities in the data management team, MEDS continues to build and maintain the AZMP website: http://www.meds-sdmm.dfo-mpo.gc.ca/ zmp/main_zmp_e.html. Physical and chemical data from 1999 to the present are currently available on the web site. Graphical representations of physical and biological data (phytoplankton) are currently being displayed on the website. New developments for this year include bottom temperature data, zooplankton graphs, and Labrador Current transport indices and 20 year average sea surface temperature climatologies.

6. Review of the Physical, Biological and Chemical Environment in the NAFO Convention Area During 2003

i) General meteorological, sea-ice and sea-surface temperature conditions

A review of meteorological, sea ice and sea surface temperature conditions in the Northwest Atlantic in 2003 was presented (SCR Doc. 04/25). During 2003, the NAO index was slightly below normal for the third consecutive year and close to the 2002 value. Air temperatures over the Northwest Atlantic region were above normal, with annual values ~2ºC above normal in the northern Labrador Sea decreasing to the south to ~0.2ºC above normal at Sable Island. There was about 20% less ice coverage than normal during the ice season (December 2002–May 2003) for the southern Labrador-Newfoundland Shelf region. In the Gulf of St. Lawrence the seasonal coverage was about 10% above the long-term mean, the first year above normal since 1995. The Scotian Shelf had twice the long-term January-May coverage and was dominated by March, when coverage approached the long-term maximum. This also was the first year since 1995 with the ice season coverage above the long-term mean. The 927 icebergs that reached the Grand Bank were about equal to the 877 counted in 2002. The analysis of satellite data indicates a north-south gradient of sea surface temperatures with above normal annual anomalies as large as 1.2ºC from the northern Labrador Sea to the northeast Newfoundland Shelf and Flemish Pass and generally below normal values on the Grand Banks, in the Gulf of St. Lawrence and over the Scotian Shelf.

A review of meteorological and sea ice conditions around Greenland during 2003 was presented (SCR Doc. 04/03). Air pressure patterns during the winter of 2002/2003 indicate an east-west oriented dipole structure. The NAO index as given for the last and present decade shows mostly positive values. The index for winter 2002/2003 (December-February) referenced to the 1961-1990 mean was near-normal. During the second half of the last century the 1960s were generally "low-index" years while the 1990s were "high-index" years. There was a major exception to this pattern occurring between the winter preceding 1995 and the winter preceding 1996, when the index flipped from being one of its most positive values to its most negative value this century. The direct influence of NAO on Nuuk winter air temperatures indicates that "low-index" year corresponds with warmer-than-normal conditions. Colder-than-normal climatic conditions at Nuuk are linked to "high-index" years. This indicates a negative correlation of Nuuk winter air temperatures with the NAO. Correlation between both time series is significant ($r = -0.73$, $p << 0.001$). The annual air temperature cycles referenced to the climatic means at the three sites off West and East Greenland were examined. At Egedesminde air temperatures during 2003 were above the climatic mean during all months. Nuuk experienced colder-than-normal conditions only during February. Air temperature anomalies during February were +3.2ºC at Egedesminde and –1.2ºC Nuuk. Angmagssalik experienced climatic conditions which were well above the climatic mean throughout the year. The annual mean air temperature anomaly at Nuuk for 2003 was +2.0ºC. This is a continuation of a series of warmer-than-normal years (0.2ºC to 1.3ºC) which started in 1996, with the exception of 1999 which was colder-than-normal (-0.3ºC). Winter sea ice conditions were light during 2003 off West Greenland. The sea ice drift has a significant offshore component which is called the "West Ice". The southernmost location of the ice edge of "West Ice" was found around 20 March off Maniitsoq/Sukkertoppen. Multi-year sea ice coming from the Arctic Ocean via the East Greenland current to the Cape Farewell area is called "Storis". By late-May the East Greenland coast was surrounded by sea ice with concentrations ranging from 7-10th. Sea ice formed again in Baffin Bay by mid-November when 4-8th of ice concentration was observed north off Baffin Island. Off East Greenland first sea ice formation was encountered in the Angmagssalik area during mid-November.

In 2003 the monitoring of sea-surface temperature and different water mass boundary locations in the Labrador and Gulf Stream currents were completed (SCS Doc. 04/03). As before, the mean monthly SST at 13 points selected in NAFO Div. 2J, 3KLMN, 4VWX and in the adjacent open ocean (data for February 2003 are not available) were used, as well as the mean monthly indices of the cold Shelf Water, Slope Water and northern edge of Gulf Stream frontal boundary location at the surface in the area between 55ºW and 70ºW. In 2003 the predominance of positive anomalies during the second half of the year in all mentioned areas became the main feature of SST in the surface layer. Negative SST anomalies were mainly observed in February-June. The stable pattern of these anomalies was observed northwards of the Grand Bank, at the Bank and on the eastern Scotian Shelf. Analysis of water mass boundary locations, estimated from long-term monthly mean values for the period from 1962 to 2000, reveals a continuation of the trend of southwards shift evidenced by the prevalence of negative anomalies indices of all three boundaries. In the New England Area, Div. 5YZe (66º-70ºW), the boundary of the cold Shelf Water mass shifted southwards of the long-term position in April-August and in October-December. The Slope water boundary was located southwards of the usual level in January-April and in August-December, while the northern edge of the Gulf Stream front boundary in this area was located southwards of the long-tern mean level during the whole year. In the Scotian Shelf area Div. 4VWX (59º-66ºW) the cold Shelf Water mass boundary was located southwards of the long-term mean position in March-April and October-December. During some periods it shifted 40-60 nm southwards and approached directly the Slope Water mass boundary in the open ocean. The Slope Water boundary in this area was shifted southwards of the long-term mean in May-October and December, while the Gulf Stream frontal boundary was located southwards of long-term mean in March-April, June-December and October. In the St. Laurentian Channel area Div. 4Vs (55º-58ºW) the cold shelf water mass boundary was unstable during the year, while the Slope Water boundary was shifted northwards for most of the year. The boundary of the Gulf Stream front northern edge was located slightly southwards of the long-term mean position in January-February and May-August, and distinctly shifted northwards in September-December.

ii) **Results of physical, biological and chemical oceanographic studies**

Hydrographic studies were conducted along the standard sections off the west coast of Greenland during an oceanographic survey in the summer of 2003. The 2003 survey was carried out according to the agreement between the Greenland Institute of Natural Resources and Danish Meteorological Institute during the period June 29 to July 6, 2003. In mid-July to early-August the Greenland Institute for Natural Resources also carried out trawl surveys in the Disko Bay area and further north on board F/V *Paamiuit*. During these surveys CTD measurements were carried out on national oceanographic standard stations (SCR Doc. 04/01, SCS Doc. 04/14). During the German groundfish survey off Greenland (20 October to 27 November 2003), oceanographic measurements were performed at 39 fishing stations off West Greenland using a CTD/Rosette system. Additionally, temperature and salinity at stations along two NAFO standard oceanographic sections off West Greenland (Cape Desolation and Fyllas Bank) were measured in order to describe climatic trends (SCS Doc. 04/10).

Subareas 0 and 1. Results of the 2003 Danish summer surveys to the standard sections along the west coast of Greenland were presented together with CTD data gathered during their trawl surveys (SCR Doc. 04/01**)**. The surface temperatures and salinities observations during 2003 show cold and low salinity conditions close to the coast off southwest Greenland that reflect inflow of Polar Water carried by the East Greenland Current. Water of Atlantic origin (T> 3ºC; S> 34.5) is found at the surface at the two outermost stations on the Cape Farewell Section, at the mid and outermost station on the Cape Desolation section and on the outermost station on the Paamiut section. Surface salinities were in general close to normal, except for the innermost stations on the southern sections where the surface salinities were higher than normal. This indicates low inflow of Polar Water, which additionally is seen by the lack of "Storis" (ice transported by the East Greenland Current), west of Greenland at this time of the year. In general, the concentration of "Storis" measured in 2003 was extremely low. Temperature and salinity observations at greater depths showed that pure Irminger Water (T ~4.5ºC, S > 34.95) was present at the Cape Farewell section and up to the Fylla Bank section, where a small area of it was observed along the outer section. Modified Irminger Water (34.88 < S < 34.95) was traced up to the Sisimiut section. In the surface layer (0–100 m) weak gradients between the cold, low-saline Polar Water and the warm, high-saline water of Atlantic origin were observed. This indicates a low intensity in the East Greenland Current component but a normal or high inflow of water of Atlantic origin, as pure Irminger Water is seen up to the Fylla Bank section. Normally there is a very pronounced core of Polar Water, revealed by its low temperatures, just west of Fylla Bank at depth of 50–100 m, but in 2003 this core was hardly recognizable, i.e. another sign of reduced inflow of Polar Water in 2003.

The time series of mid-June temperatures on top of Fylla Bank was about 1ºC above average conditions, while the salinity was slightly higher than normal. The temperature of the Polar Water was higher than normal and the front between Polar Water and Irminger Water was weak, indicating a reduced inflow of Polar Water to the West Greenland area in 2003. Pure Irminger Water was observed from Cape Farewell to the Fylla Bank section, and Modified Irminger Water could be traced as far north as the Maniitsoq (Sukkertoppen) section. The inflow of Irminger Water seems to be much higher than the previous two years, which most likely can be a consequence of reduced inflow of Polar Water.

Two very different kinds of fjords systems were measured around Sisimiut. These fjords have deep sills allowing relatively warm and saline water of Atlantic origin to enter at the bottom. The density of this bottom water is higher than the surface Polar Water at its freezing point preventing winter convection to the bottom. The other type of fjord has a shallow sill preventing the warm Atlantic water from entering at the bottom. Therefore cold and fresh bottom water was measured below sill depth, which is surface water transformed by convection during winter, as the salinity of the whole fjord system was very homogeneous. At the surface of both fjord systems solar heated Polar Water was found.

Results of the 2003 German autumn survey to the standard sections along the west coast of Greenland were presented in SCR Doc. 04/03. Oceanographic data from Fyllas Bank revealed considerable warming in the upper 200 m of the water column during autumn 2003. It was shown that cold "polar events" during 1983, 1992 and 2002 characterize the long term ocean temperature time series. During these years, cold and diluted waters from the West Greenland banks reached well out to the slope regions of e.g. Fyllas Bank where these waters cooled the upper layer of the water column. The major heat input to the water column off West Greenland is derived by advection, i.e. the warm Irminger component of the West Greenland Current. Temperature and salinity profiles obtained along two NAFO Standard Oceanographic Sections, Cape Desolation and Fyllas Bank show the presence of Irminger Water during autumn 2003. At Fyllas Bank, the characteristic parameters of Irminger Water (4°C < T < 6°C, 34.95 < S < 35.1) were found at depths between 366-822 m. These data show that the layer of the warm water mass of Irminger Current origin slopes down from offshore to inshore of the sections. An analysis of historical data on the presence of Irminger Water at Fyllas Bank during autumn, reveals that this water mass is mostly found at depths between 400 and 800 m. The data indicate that Irminger Water was not found during all years at this site, but was present during the 1960s, the second half of the 1980s, the early-1990s, during 1999, 2000 and 2003. In the near-bottom water layer off Cape Desolation West Greenland, at about 3 000 m depth, the Denmark Strait Overflow water mass was observed with salinities of 34.865, a value which has been maintained since 2000.

Subareas 1 and 2. Hydrographic conditions in the Labrador Sea (SCR Doc. 04/32) depend on a balance of atmospheric forcing, advection and ice melt. Wintertime heat loss to the atmosphere in the central Labrador Sea is offset by warm waters 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 by the Labrador Current, freshwater from river run-off and ice melt. Wintertime cooling and evaporation increase the density of surface waters in the central Labrador Sea. Wind mixing and vertical overturning form a mixed layer whose depth increases through the cooling season. The winter heat loss, the resulting density increase, and the depth to which the mixed layer penetrates vary with the severity of the winter. In extreme winters, mixed layers deeper than 2 000 m have been observed. Labrador Sea Water (LSW) formed by these deeper overturning events spreads throughout the northern North Atlantic. During milder years, the vertical stratification of temperature, salinity, and density is re-established. The late-1980s and early-1990s saw relatively cold winters and high heat fluxes over the Labrador Sea. Recent years have shown generally warmer conditions. Heat fluxes from the NCEP/NCAR re-analysis averaged over 12-month June-May periods for 2001-2002 and 2002-2003 were both about 20% less than normal. The upper 1 000 m of the west-central Labrador Sea warmed during the 12-month interval between surveys in July 2002 and July 2003, continuing the general trend noted since 1994. These waters also became saltier. Changes in potential vorticity and apparent oxygen utilization between the July 2002 and July 2003 surveys suggest that convective overturning during the winter of 2002-2003 reached depths of at least 1 000 m. A rare early-winter survey in December 2002 provides supporting evidence. Below the developing winter mixed layer, the upper water column to depths of 1000 m was warmer and saltier in December 2002 than in either July 2002 or July 2003. This is a signature of a possibly seasonal increase in the input of warm and saline waters originating in the West Greenland Current. Intense surface cooling and convective overturning subsequent to the December 2002 survey provide a means to return the water column to the relatively cooler conditions observed in July 2003.

Subareas 2 and 3. A description of environmental information collected in the Newfoundland and Labrador Region during 2003 was presented (SCS Doc. 04/08). This included physical, chemical and biological data collected as part of the Atlantic Zonal Monitoring Program (AZMP), which began in 1998. This program was established to include biological and chemical oceanographic monitoring at a fixed coastal station (Station 27) at biweekly intervals and on cross-shelf sections. The Newfoundland and Labrador Region of DFO conducted three annual physical/biological oceanographic surveys during 2003 along several cross-shelf NAFO and AZMP sections from the Southeast Grand Bank to Nain Bank on the mid-Labrador Shelf. These surveys were conducted during mid-spring, summer and during autumn. The main objectives were to establish the seasonal and spatial distribution and abundance of nutrients, plant pigments (phytoplankton) and micro and mesozooplankton in relation to the physical environment. Physical, biological and chemical variables being monitored include temperature, salinity, dissolved oxygen and ocean currents as well as measures of primary and secondary production and biomass, species composition of phytoplankton and zooplankton and nutrients.

Oceanographic observations in Subareas 2 and 3 on the Newfoundland and Labrador Shelf during 2003 referenced to their long-term (1971-2000) means were presented in SCR Doc. 04/15. The annual water-column averaged temperature at Station 27 for 2003 remained above the long-term mean and increased over 2002 values at all depth ranges. The annual surface temperature at Station 27 was 0.7ºC above normal, while the annual bottom temperature remained similar to 2002 at 0.2ºC above normal. Bottom temperatures were above normal during January and February, below normal during spring and above normal during the remainder of the year. Water-column averaged annual salinities at Station 27 remained above normal, similar to 2002 values, the highest in over a decade. Surface salinities at Station 27 were above normal for 11 of 12 months, while bottom salinities were generally below normal, particularly during the period April to July. The cross-sectional area of <0ºC (CIL) water on the Newfoundland and Labrador Shelf during the summer of 2003 increased slightly over 2002 values but remained below the long-term mean. The CIL areas were below normal along all sections from the Flemish Cap section on the Grand Bank, to the Seal Island section off southern Labrador. Off Bonavista for example, the CIL area was below normal for the ninth consecutive year. In general, the cold temperatures observed along the standard sections during the spring moderated by summer and were generally above normal by autumn. Bottom temperature anomalies in southern areas of the Grand Bank and St. Pierre Bank during the spring of 2003 were generally below normal. Autumn bottom temperatures for the shallow waters of the southeast Grand Bank where similar to 2002, up to 2ºC below normal, however, in Div. 3L, 3K and 2J they were above normal by up to 2ºC on Hamilton Bank and up to 1ºC on Funk Island Bank. The spatially averaged spring bottom temperature during 2003 in NAFO Divisions 3PLNO continued to decline, while autumn values remained above normal. In general, over all areas of the Newfoundland Shelf the near-bottom thermal habitat continued to be warmer than that experienced from the mid-1980s to the mid-1990s. In general, the below-normal trends in temperature and salinity, established in the late-1980s reached a minimum in 1991. This cold trend continued into 1993 but started to moderate during 1994 and 1995. During 1996 temperature conditions were above normal over most regions, however, summer salinity values continued to be slightly below the long-term normal. During 1997 to 1999 ocean temperatures continued to warm over most areas, with 1999 one of the warmest years in the past couple of decades. During 2000 to 2002 ocean temperatures were cooler than 1999 values, but remained above normal over most areas continuing the trend established in 1996. The past year was one of extremes in many areas, with the below normal temperatures during the spring increasing to above normal values by autumn. From 1991 to 2001 the trend in salinities on the Newfoundland Shelf was mostly below normal, however, during 2002 there was a significant increase with surface values the highest observed in over a decade. Annual salinity measurements at Station 27 during 2003 continued to show above normal values.

Biological oceanographic observations from a fixed coastal station and oceanographic sections in Subareas 2 and 3 during 2003 were presented and referenced to previous information from earlier periods when data were available (SCR Doc. 04/27). Information concerning the seasonal and interannual variations in the concentrations of chlorophyll a, major nutrients, as well as the abundance of major taxa of phytoplankton and zooplankton measured from Station 27 and along standard transects of the Atlantic Zone Monitoring Program in 2003 was reviewed. The vertical attenuation coefficient at Station 27 was consistent with previous observations but was reduced relative to the Spring Bloom in 2002. Water column stability was weaker than in previous observations, a trend consistent across most of the Newfoundland Shelf. The reduction in the upper and lower water column inventories of the major limiting nutrients at Station 27 observed in earlier years, continued to decline in 2003. This trend was not apparent along the seasonal section occupations. The magnitude and duration of the Spring Bloom at Station 27 in 2003 was comparable with previous years, a pattern confirmed for the Avalon Channel using SeaWiFS remote sensing data. The cell densities of major taxanomic groups of phytoplankton consisting of Diatoms, Dinoflagellates and Flagellates declined in 2003, continuing a trend noted since 2000. This decline may be the result of a change in collection methodology and is currently being evaluated. Overall, phytoplankton biomass on the Newfoundland and Labrador Shelves was lower in 2003 relative to the average of 2000-2002. In 2003, the overall abundance of zooplankton at Station 27 was comparable to previous years. The relative abundance of cold water (*Calanus glacialis, C.melgolandicus, Microcalanus* sp.) and warm water species (*Temora longicornis*) appeared to have returned to conditions found in the late-1990s after showing a shift toward cold water species in recent years. The most notable changes in zooplankton community during the spring and summer of 2003 involved the lower abundance of large calanoid nauplii throughout the region (~33-50% of average) and the near absence of *Aglantha digitalea* (~10-30% of average). With respect to other changes, the Newfoundland-Labrador shelf boundaries appeared to delineate areas of change. In the southern region, larvaceans were substantially lower than the previous years' average (~50%) whereas abundance in the northern region we slightly above normal. On the Labrador shelf, species of *Oncea, Calanus* and *Metridia* were generally 2-3 times more abundant than the average for previous years.

Subarea 4. A review of physical oceanographic conditions on the Scotian Shelf and in the Gulf of Maine and adjacent offshore areas during 2003 has shown some broad scale changes from previous years (SCR Doc. 04/26). Cool conditions tended to dominate the Scotian Shelf and to a lesser extent the eastern Gulf of Maine in 2003. Mean annual sea-surface temperature at Boothbay Harbor was 2.4ºC above normal, the 7th warmest in 98 years. St. Andrews was 0.6ºC below normal, ranking 47th in 83 years from warmest to coldest. At Prince 5, 0-90 m, monthly mean temperatures were generally below normal by 0.1 to 0.3ºC. Salinities were generally 0-0.6 above normal throughout the year. Halifax sea surface temperature was 1.8ºC below normal, making 2003 the 4th coldest in 78 years. At Halifax Station 2, 0-100 m temperature anomalies were 0 to –2ºC; salinity was typically 0-0.5 above normal. Sydney Bight, Misaine Bank and Emerald Basin (to 75 m) featured anomalies of –1 to –2ºC. At depths greater than 75 m, Emerald Basin temperatures were about 0.5ºC above normal. Lurcher Shoals temperature anomalies were varied but slightly above normal for the year. Georges Basin showed an anomaly reversal like Emerald Basin with temperatures about 1ºC below normal 0-100 m and 0.5ºC above normal deeper. Eastern Georges Bank temperature anomalies varied through the year, negative early, positive late with amplitudes less than 1^{o}C. Standard sections in April, July, October and December on the Scotian Shelf support the overall conclusion of temperatures ~2ºC below normal, salinities ~0.5 above normal and a more intense and extensive cold intermediate layer on the shelf. Cabot Strait deep-water (200-300 m) temperatures were near normal. The temperatures from the July ground fish survey were exceptional with the outstanding feature being a very broad cold intermediate layer with below normal temperatures. The July surface temperatures were generally 0º-3ºC above normal for the survey region except for the Bay of Fundy, where below normal temperatures by up to 2ºC prevailed. However, at the deeper layers of 50 m, 100 m and at the bottom, below normal temperatures of up to 3ºC, 2ºC and 1ºC dominated. Break-up of the strong stratification pattern established in the late 20th and early 21st century continued in 2003. Though overall stratification was slightly above normal for the Scotian Shelf region, there was considerable variability at small spatial scales. The Shelf/Slope front and the Gulf Stream moved in opposite directions in 2003 with the former moving onshore on average by 22 km compared to its position in 2002 and the latter offshore by 32 km.

Subareas 5 and 6. The United States Research Report listed several ongoing oceanographic, plankton and benthic studies conducted by the Northeast Fisheries Science Center (NEFSC) in NAFO Subareas 5 and 6 (SCS Doc. 04/07). During 2003 over 1300 CTD (conductivity, temperature, depth) profiles were made on NEFSC cruises. The data were processed and made available via an anonymous FTP site. A report on the oceanographic conditions indicated by these observations is being prepared and will be available via the NEFSC website (http://www.nefsc.noaa.gov/nefsc/publications/crd) by the summer of 2004. Similar reports have been issued each year since 1991. Preliminary results indicate that while the winter and spring period was somewhat cool, the remainder of 2003 continued the generally warmer conditions (relative to the 1978-1987 reference) experienced since 1999 throughout Subareas 5 and 6. Salinity throughout the region continued a trend to lower values that began in mid-2002, but returned to higher values by the end of 2003. During 2003, zooplankton community distribution and abundance was also monitored using 480 bongo net tows taken on six surveys. Each survey covered all or part of the continental shelf region from Cape Hatteras northeastward through the Gulf of Maine. The Georges Bank GLOBEC program is now in a synthesis phase in which the results from the various components of the program will be integrated to provide a greater understanding of how environmental variability influences the GeorgesBanks ecosystem, particularly the plankton populations. A number of studies are in progress focusing on both the zooplankton populations and the early life stages of the cod and haddock stocks on the Georges Bank.

7. Interdisciplinary Studies

An important role of STACFEN, in addition to providing climate summaries for the NAFO Convention Area, is to determine the response of fish and invertebrate stocks to the changes in the physical and biological oceanographic environment. It is felt that a greater emphasis should be placed on these activities within STACFEN and at the June 2002 Meeting STACFEN had recommended that *further studies be conducted attempting to link climate and fisheries and to bring forward such studies for review.*

The following presentations were made at this June 2004 Meeting:

a) Report of the Workshop on '*Transport of fish larvae between Iceland and Greenland waters – hydrography and biology*', Reykjavik 17-18 March 2004 by Manfred Stein. The West-Nordic Ocean Climate research programme (funded by the Nordic Minister Council) held a two day workshop in Reykjavik, Iceland during 17-18 March 2004 to consider research activities related to the transport of fish larvae between Iceland and Greenland waters. The meeting was attended by 17 scientists from Norway, Denmark, Germany, Iceland and Greenland. During the first day several presentations were given including (1) state-of-the-art modelling of ocean properties on different scales (by the Nansen Centre, Bergen, Norway), (2) on Cod and Climate Change: status and conclusions concerning recruitment of cod at Greenland (by the Nature Institute, Nuuk, Greenland), (3) on hydrographical and other factors influencing occurrence and recruitment of haddock and cod in Greenland waters (by the Federal Research Centre for Fisheries, Hamburg, Germany), (4) on the distribution of cod eggs, larvae and juveniles in the Greenland/Iceland area (by the Nature Institute, Nuuk, Greenland), (5) on Icelandic cod, timing and location of spawning, the distribution of pelagic 0-group and socio-economic considerations on cod/shrimp dominated ecosystems off West Greenland (by the Institute of Marine Research, Reyjavik, Iceland). These were followed by presentations on drift trajectories and temperature conditions in the East Greenland/Iceland area with special emphasis on cod larvae (by the Marine Research Institute, Hamburg, Germany), on drift modelling of pelagic stages of fish and shrimp (by the Danish Meteorological Institute, Copenhagen, Denmark), on drift and current data around Iceland (by the Institute of Marine Research, Reyjavik, Iceland), and on hydrographical conditions around Iceland (by the University of Akureyri, Akureyri, Iceland). During the second day of the workshop participants discussed questions on the likelihood that a project can increase our understanding of variation in the transport of cod larvae, climatic and biological factors and special year or year variation in biological and physical parameter.

b) *Transport of Juvenile Cod (Gadus morhua) and Haddock (Melanogrammus aeglefinus) from Iceland to Greenland – Is there Environmental Forcing? (SCR Doc. 04/04)* The first observations of Atlantic cod (*Gadus morhua*) in East and West Greenland waters date back to the 16th century. This paper analysed interactions of 0-group cod and one-year old cod with environmental data. The biological and oceanographic data sets used for the analysis were obtained during annual surveys of *RV Walther Herwig* to East and West Greenland waters (1982-2003). A negative significant correlation exist between one-year old cod, NAO index and the mean baroclinic flows of the cold polar component of the West Greenland Current. The distribution and abundance data of 0-group haddock (*Melanogrammus aeglefinus*) collected in autumn of 2003 indicated that the penetration of demersal fish into Greenland waters may depend on warming effects in the marine ecosystems of West and East Greenland. It is suggested that the advection of warm, saline water masses to banks and slopes off West Greenland created favourable environmental conditions under which gadoids, such as cod and haddock live in these waters. The paper concludes that the concurrent warming trends observed in air temperatures and ocean temperature since 1993 off West Greenland have led to temperatures exceeding 6°C in the bottom water layers off West Greenland. These temperatures appear to be suitable especially for haddock. The temperature at 200 m depth at Fyllas Bank section Station 4 as observed during autumn 2003 was the warmest on record. Recent warming in West Greenland waters is suggested to be responsible for the present high abundance of young gadoids around East and West Greenland.

c) *Assessing Phytoplankton and Zooplankton Taxa from the CPR Survey in NAFO Subareas 2 and 3 in the Northwest Atlantic (SCR Doc. 04/30).* The Continuous Plankton Recorder (CPR) Survey provides an assessment of long-term changes in abundance and geographic distribution of planktonic organisms ranging from small phytoplankton cells to larger macrozooplankton. CPR collections in the northwest Atlantic began in 1959 and continued with some interruptions during the latter period through until 1986. Collections were renewed in 1991 and continue to the present. The recorder is towed by ships of opportunity along a number of standard routes throughout the North Atlantic. The CPR device collects plankton at a nominal depth of 7m, and organisms are retained on a moving band of silk material and preserved. Using data collected by the Continuous Plankton Recorder Survey, the spatial and temporal dynamics of selected phytoplankton and zooplankton assemblages in the Northwest Atlantic bounded by the NAFO Div. 2HJ, 3K, 3M, 3LNO, and 3Ps (Subareas 2 and 3) were reviewed. Major shifts in the abundance, timing and duration of some phytoplankton and zooplankton taxa enumerated as part of the CPR in the Northwest Atlantic have been observed. The potential impact of climatic variation on the abundance of the selected CPR taxa was evaluated at annual and decadal time scales. The CPR Survey represents the longest spatial and temporal time series of phytoplankton and zooplankton taxa in the northwestern Atlantic and on the Canadian eastern continental shelf. There have been major changes in the abundance, timing and duration of major phytoplankton and zooplankton taxa in the NAFO Subareas 2 and 3. During the recent decade, most of the phytoplankton production is concentrated during the spring bloom, in contrast to the 1960-1970s, where blooms were observed during the summer and autumn. Evidence of earlier spring diatom blooms through the 1960-1970s and the proliferation of dinoflagellates in the 1990s were noted. Over the period of the 1960-1970s, delays in the seasonal occurrence of *Calanus finmarchicus* were observed, while during the 1990s a general reduction in abundance of this copepod was noted. A marked reduction in the abundance of *Temora longicornis* (warm water species) coincided with a general reduction in ocean temperatures in the early-1970s and 1990s. A consistent increase in the overall abundance of *Calanus hyperboreus* and copepod nauplii was noted in NAFO Subareas 2 and 3 during the past three decades. A shift in the seasonal timing of occurrence to earlier periods was noted for several taxa; *Paracalanus-Pseudocalanus* sp., *Temora longicornis*, *Oithona* sp., *Metrida* sp., *Hyperiidae*, *Euchaeata* sp., and Decapoda. Higher abundance and positive annual anomalies characterized the early-1990s in several CPR taxa including both phytoplankton and zooplankton; the phytoplankton colour index, diatom, *Paracalanus-Pseudocalanus* sp., *Oithona* sp., *Metrida* sp., Decapoda, Hyperiidae, Euphausiacea, and Echinodermata. An index representing the strength of the atmospheric circulation in the Northwest Atlantic (NAO) inducing changes in ocean climate and sea ice extent, and annual temperature anomalies, was weakly correlated in some cases with the annual anomalies in abundance of the different CPR taxa examined.

d) *A Preliminary Investigation of the Effects of Ocean Climate Variations on the Spring Distribution and Abundance of Thorny Skate (Amblyraja radiata) in NAFO Divisions 3LNO and Subdivision 3Ps. (SCR Doc. 04/29).* The spatial distributions and abundance of thorny skate were presented in relation to their thermal habitat for NAFO Div. 3LNO and Subdivision 3Ps during spring surveys from 1971-2003. As reported previously the distribution of thorny skate in this region has undergone significant changes since the early-1980s when they were widely distributed over the entire Grand Banks in all available temperature ranges. The distribution of skates retracted throughout the 1990s and early-2000s with the numbers and total weight per set decreasing in all temperature ranges, but most significantly in temperatures <2ºC. On average the most common temperatures where skates were found appear to be in the 3º to 4ºC temperature range. The cumulative distributions indicate that on average up to at least the mid-1990s catches rates were distributed across the entire thermal habitat but during the latter half of the 1990s there was an apparent shift towards warmer bottom temperatures. The cumulative frequency distributions based on weight in each temperature bin indicated a preference towards warmer temperatures throughout the time series, particularly during recent years, which may indicate that larger skates prefer the warmer portion of the available habitat. In general, the trend in population of skates both biomass and abundance is associated with changes in the bottom temperatures both at Station 27 and across Div. 3PLNO. After taking into account the change in survey gear in 1996 however, the response of the population to the warming trend during the latter part of the 1990s was not as great as expected based on earlier periods. While there appears to be a limited response to the warming of the late-1990s, it is clear that ocean temperatures are not the sole factor determining production in this species. It is noteworthy that salinities on the Newfoundland Shelf remained low throughout the 1990s and early-2000s. Changes in shelf stratification arising from variations in salinity likely play a fundamental role in overall ecosystem productivity affecting lower trophic level production and ultimately the food source for many species of marine organisms. Therefore, there are most likely, several possible reasons for the observed changes in the distribution and abundance of thorny skate, including broad scale environmental change and physical and biological interactions between prey species or a shift to a more suitable environment for prey species, in addition to fishery effects.

8. The NAFO Annual Ocean Climate Status Summary (NAOCSS) for 2003

At its June 2002 Meeting, STACFEN recommended that *beginning in 2003 an annual climate status report be produced to describe environmental conditions during the previous year.* This web-based annual summary for the NAFO area would include an overview that summarizes the overall general climate changes for the previous year and a regional overview that provided climate indices from each of the Subareas. M. Stein demonstrated the 2002 status summary that covered most of the NAFO Convention Area based on contributions received for Subareas 0-1, West Greenland (M. Stein and E. Buch), Subareas 2 and 3 (E. Colbourne), Subareas 4 and 5 (K. Drinkwater) and Subareas 5 and 6 (D. Mountain). This web-based report essentially replaces the traditional much larger environmental overview. It is intended that the current report will be posted on the NAFO website (http://www.nafo.int/activities/Science/ocs/index.html) shortly after this STACFEN meeting. No oceanographic information is currently available for Subarea 0. The Committee noted that B. Petrie (Canada) replaced K. Drinkwater (Canada) for reporting information from Subareas 4 and 5.

9. Environmental Indices (Implementation in the Assessment Process)

In addition to providing reviews of ocean climate and its effects on marine resources STACFEN provides advice on how relationships between ocean climate and marine production may be used to help improve the assessment process.

A review of how Atlantic Canada currently incorporates environmental information into the regional fish stock assessment process and how this information is disseminated to scientists, managers and stakeholders in the fishing industry was presented (E. Colbourne). The presentation focused on three aspects: (1) a review of environment-stock relationships between various fish and invertebrate species in NAFO waters (2) a demonstration of modeling efforts exploring relationships between invertebrate (snow crab (*Chionoecetes opilio))* production and changes in the oceanographic environment in Newfoundland waters, and (3) how this information is currently used in the assessment process and future requirements. In general, variations in the oceanographic environment appear to be associated with trends in production in several marine species inferred from commercial fisheries (CPUE) and assessment surveys. Results indicate that environmental factors may be important at early life history stages, particularly for crustacean populations. Statistical models were employed to explore relationships between invertebrate production and changes in the oceanographic environment in Newfoundland waters. It was shown that production (CPUE) in snow crab for example, can be modeled reasonably well and forecasts can be developed by including current and past values of environmental data in addition to using the auto-correlation within the stock response time series. The uncertainty however in the predictions is generally large, reflecting the relatively short time series and the magnitude of the correlation with the environment. Nevertheless, the information is a valuable addition to a suite of indicators used to assess current status and future prospects for a particular resource. A significant research effort however is required to move forward including identifying functional (causal) relationships underlying environment-stock associations, incorporating more information on primary and secondary production into stock assessments, and to evaluate the importance of environmental effects relative to fishing and natural mortality.

10. The Formulation of Recommendations Based on Environmental Conditions

STACFEN made no formal recommendations during this 2004 meeting.

11. National Representatives

The Committee was informed that J. M. Cabanas will replace J. Gil as the national representative responsible for hydrographic data submissions from Spain during 2004 and 2005. Other national representatives remained unchanged. 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), A. I. Boltnev (Russia), L. J. Rickards (United Kingdom), and K. J. Schnebele (USA).

12. Other Matters

The Committee was informed that current meters moored in Flemish Pass by Canada (Bedford Institute of Oceanography) during June 2002 will remain in place until at least the end of 2005. One mooring is on the slope of the Grand Bank position 47º0.07'N latitude 47º16.96'W longitude, at the 400 m depth and the other in the deep section (1 100 m) of the Flemish Pass position 47º0.09'N latitude 47º2.07'W longitude. Their purpose is to gain information on the variability in the strength and position of the Labrador Current. In addition an oceanographic mooring in Div. 3N at position 45º30.0'N latitude 50º0.0'W longitude was deployed during the autumn of 2003 and will remain in place until the autumn of 2004. STACFEN requested participants to remind their institutes of this deployment if any assessment surveys are carried out on the Grand Bank and in the Flemish Pass and Cap area. In addition, it was indicated that this notice would be posted on the NAFO website at (http://www.nafo.int/info/frames/infrweb.html) under web updates.

13. Acknowledgements

Upon completing the agenda, the Chair thanked the STACFEN members and invited guest, the Secretariat and the rapporteur for their support and contributions. The meeting was then adjourned.

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

Chair: Manfred Stein Rapporteur: Margaret A. Treble

The Committee met at the Alderney Landing, 2 Ochterloney Street, Dartmouth, Nova Scotia, Canada, on 8 and 12 June 2004, 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 (France, Germany, Portugal, Spain, and United Kingdom), Russian Federation and United States of America. The Executive Secretary and Deputy Executive Secretary were in attendance.

1. Opening

The Chair opened the meeting by welcoming the participants. The agenda as presented in the Provisional Agenda was adopted. Margaret A. Treble (Canada) was appointed rapporteur.

2. Review of Recommendations in 2003

Recommendations in September

i) STACPUB had recommended that *the 23 papers currently ready be placed on the NAFO Website by the beginning of October 2003, as part of Volume 31, ensuring a 2003 publication date.*

STATUS: Completed. Electronic copies (pdfs) of available papers were placed on the web in October. In this context, the Secretariat notes that publication of electronic copies (pdfs) of print products prior to the finalization of the volume might lead to undesirable compromises of the print product as was the case with this Journal volume dedicated to the proceedings of a symposium. To allow prompt electronic publication, papers had to be paginated as they became available which did not allow grouping of papers belonging to different sessions. The compromise found was to mark each paper with a symbol indicating the session it belonged to. In order to avoid such somewhat confusing results the Secretariat recommends publishing two versions of the Journal, an electronic version (html) and a print version. Details are given in a presentation by the Secretariat to Scientific Council in June 2004.

ii) STACPUB had recommended that *hard copy and web versions of Scientific Council Studies No. 37 be issued shortly.*

STATUS: Implemented in October 2003. This publication was issued with a publication date of August 2004.

iii) STACPUB had recommended that *for the Scientific Council Reports, the Secretariat return to printing its reports on a calendar year basis, and that color printing be used where warranted in Scientific Council Reports. The Scientific Council Reports for calendar year 2003 should therefore be printed as the next "Redbook".*

STATUS**:** Implemented. Secretariat has returned to publishing SC Reports on a calendar year basis. For 2003, this was achieved by printing a supplement (thus greatly reducing printing costs including manpower). All NAFO Meeting Reports (i.e. SC Reports and GC/FC Meeting Proceedings), starting with 2003, are now available in a user-friendly html version on CD ROM and on the Web (URL) that will be presented to SC by the Secretariat in June 2004.

iv) STACPUB had recommended that *all scanned versions of the Journal and Studies be placed on the NAFO website as soon as possible, as this is a vital reference tool for users.*

STATUS**:** Not yet implemented. Due to space restrictions on NAFO's web server it is presently impossible to archive all Journals and SC Studies on the website. Included in the Website are: Journal Volumes 22 (1997) to present and Studies 31 (1998) to present. The older volumes cannot be converted to the required formats and have been scanned with the result of extremely large file sizes for the articles concerned with repercussions regarding storage and downloading. The Secretariat aims at hosting the web on its own web server in the near future (possibly by 2005). NAFO will then have more flexibility regarding space. In this context, it might be of interest that the Secretariat has devised a separate website for scientific NAFO publications (http://journal.nafo.int) and will present its draft design to SC in June 2004.

v) STACPUB had recommended that *Scientific Council Studies continue to be produced in printed versions recognizing the number of hard copies has been reduced*.

STATUS: Implemented. The Secretariat printed 100 copies of the SC Studies No. 37. For libraries, CD ROMs were produced and distributed and, to avoid confusion, the libraries were informed about the status of our different print and CD ROMS publications by letter. Provided the Secretariat can invest in adequate printing equipment, printed copies can be reduced to smaller amounts (to be determined on a case by case basis by SC).

3. **Status of Scientific Publications** (All publications are placed on the NAFO Website www.nafo.int)

a) **Publications**

i) **Journal of Northwest Atlantic Fishery Science**

STACPUB was informed that:

Volume 31 containing 35 papers and 1 Abstract from the Symposium on **"***Deep-sea Fisheries*" and 2 notices (466 pages) was published with a publication date of October 2003.

Volume 32 containing 4 miscellaneous papers and 2 notices (72 pages) was published with a publication date of December 2003.

Volume 33 containing 9 papers from the working group on "*Reproductive Potential of Fish Populations of the North Atlantic*" and 2 notices (214 pages) was published with a publication date of December 2003.

Volume 34 containing 7 papers from the "*Mini-Symposium on Environmental Conditions*" and 1 notice (120 pages) was published with a publication date of March 2004

Volume 35 containing papers from the Symposium on "*Elasmobranch Fisheries: Managing for Sustainable Use and Biodiversity Conservation*". A total of 50 papers received at the Secretariat were sent during January and February 2003 to proceedings co-editors. One paper has been withdrawn by author and 5 have been rejected. To date 42 papers have been received for preparation of galleys with 2 still under review. This issue was initially suggested for publication by late-2003, but likely to be much later.

In addition, there have been 4 **independent** papers received to date at the Secretariat for publication in the Journal in 2004. These are under editorial review.

The Executive Secretary presented a proposal to create a parallel publication of HTML versions of the Journal papers on the web. These papers could be published electronically very shortly after they are finalized, while it is often desirable to delay the printed (pdf) versions until all papers in the volume are received and pagination can be finalized, this is particularly the case for those volumes with papers from Special Symposia.

STACPUB **recommended** that *the Secretariat begin the electronic publication of HTML versions of the Journal.*

ii) **NAFO Scientific Council Studies**

STACPUB was informed that:

Studies Number 37 (370 pages) containing the publication on "*Availability of Data for Estimating Productive Potential for Selected Stocks in the Northwest Atlantic*" and 2 notices was published with a publication date of August 2003.

iii) **NAFO Statistical Bulletin**

STACPUB was informed that:

Catches by country, species and Division are available on the NAFO website as text files for 1960-2002. This is the most up-to-date information available at the Secretariat and is updated as new information become available. Deadline for submission of STATLANT 21B reports 2000 and 2001 was 30 June of each subsequent year. For 2000 data are still outstanding from Canada (Central & Arctic), Greenland, Norway and USA. For 2001, data are still outstanding for Canada (Central & Arctic), Cuba, EU-Spain, Faroe Islands, Greenland, Lithuania, Norway, USA and Ukraine.

iv) **NAFO Scientific Council Reports**

STACPUB was informed that:

The *NAFO Scientific Council Reports 2002/2003* (Redbook) volume (383 pages) containing reports of the September and November 2002 Scientific Council Meetings, the Scientific Council Workshop of March-April 2003 and the June 2003 Scientific Council Meeting was printed and distributed to participants at the September 2003 Annual Meting. A supplement (pages 385-489) to the *NAFO Scientific Council Reports, 2002/2003* (Redbook) was printed as *NAFO Scentific Council Reports, 2002/2003* (Supplement) in January 2004. This book will be distributed to participants of Scientific Council Meeting of June 2004.

The Website publication of all Scientific Council Meetings held in 2003 was issued in January 2004. This electronic version was compiled following the Scientific Council recommendation in September 2003 that NAFO Scientific Council Reports for calendar year 2003 should be printed as the next "Redbook". It differs from the print versions mentioned in above paragraph in that it only contains the reports of meetings that took place in 2003. Part number references and pagination have been used as in the print version to avoid confusion in referencing.

v) **Index and Lists of Titles**

STACPUB was informed that:

The provisional index and lists of titles of 91 research documents (SCR Doc.) and 26 summary documents (SCS Doc.) which were presented at the Scientific Council Meetings during 2003 were compiled and presented in SCS Doc. 04/4 (excel format) for this June 2004 Meeting.

vi) **Others**

There was no other publications discussed.

4. NAFO Website

a) Web Statistics

Website usage was reported for the period May 2003 to May 2004. There was almost a threefold increase in visits in May 2004 over that observed in the previous year. A summary of the types of web documents requested during May 2004 was also reported.

b) Design of NAFO Website

The Secretariat staff has been involved in the redesign of the NAFO website and has worked closely with the Executive Secretary to improve the design and add new features. STACPUB viewed a presentation of the progress made on the member pages, including a discussion on password options that would allow only Scientific Council members access to information on their secured section of the website.

STACPUB **recommended** that *a second level of password protection be established for the Scientific Council members pages.*

STACPUB **recommended** that *the addition of new information to the web site be highlighted or "advertised" in some way to ensure the members and general public are made aware of these new features.*

STACPUB **recommended** that *a link to a distribution list of e-mail addresses for current Committee and members e-mails be established to facilitate communication of information.*

As more information is added to the web page it is becoming more complex to navigate. STACPUB **recommended** that *a search function be added to the front page*.

A section on news releases "What People Say about NAFO" has been added. The Secretariat requests that members comment on this site and provide information to help keep it up to date.

5. Promotion and Distribution of Scientific Publications

a) Invitational Papers

A suggestion for a special invitational paper commemorating the 25th Anniversary of NAFO was received. STACPUB Chair noted a general consensus amongst the Committee to pursue this idea intersessionally.

b) Scientific Citation Index (SCI)

STACPUB received a report from the Executive Secretary on the possibility of making an application to the ISI Current Contents Connect with searchable web content. The Secretariat will review the criteria, assess the likelihood of success and report back to the Committee at a future meeting.

c) CD-ROM Versions of Reports, Documents

All Journal issues are now on CD. The Secretariat is close to completing the process of scanning back issues of Scientific Council Studies and the entire series will be available on CD. The Secretariat staff have continued the process of burning CDs for reports and documents and are able to distribute these CDs as requested.

d) **New Initiatives for Publications**

STACPUB viewed a presentation on a proposal for the development of a web based NAFO FishGuide. After some discussion STACPUB Chair suggested that intersessional discussion take place and that this topic could be re-visited at a future meeting.

The Executive Secretary presented several new design options for the NAFO Journal and Studies publications. STACPUB Chair suggested Committee members to review these and provide their comments to the Secretariat. STACPUB **recommended** that *an ad hoc group be formed to deal with the cover issue intersessionally, and report on this to STACPUB at the September 2004 Meeting of the Committee*. The *ad hoc* group consists of A. Nicolajsen, L. Hendrickson, F. Serchuk, M. Stein and M. Treble.

6. **Editorial Matters Regarding Scientific Publications**

a) **Review of Editorial Board**

STACPUB has accepted the resignation of Dr. Bruce Atkinson, a long serving member of the Editorial Board of the Journal of Northwest Atlantic Fisheries Science (Associate Editor, Vertebrate Fisheries Biology). STACPUB expressed thanks to Dr. Bruce Atkinson for his years of long service on the Editorial Board. Dr. Joanne Morgan was nominated as a replacement and STACPUB unanimously approved this nomination.

b) **Progress Report of Publications of Reproductive Potential WG (Journal and Studies)**

Further to what was reported under agenda item 3, there was no additional information on this topic.

c) **Progress Report of Publications of 2002 STACFEN Mini-Symposium on Hydrographic Variability**

Further to what was reported under agenda item 3, there was no additional information on this topic.

d) **Progress Report of Publications of 2002 Elasmobranch Symposium Proceedings**

Further to what was reported under agenda item 3, there was no additional information on this topic.

e) **Preparation for the Publication of 2004 Symposium "The Ecosystem of the Flemish Cap"**

STACPUB was informed that Joanne Morgan and Antonio Vasquez have volunteered to act as co-editors for the papers presented at the 2004 Symposium "The Ecosystem of the Flemish Cap".

7. **Papers for Possible Publication**

a) **Review of Proposals Resulting from 2003 Meetings**

i) **Papers nominated by STACPUB**

STACPUB Chair reminded the Committee to review the research documents submitted to the June 2004 Meeting. The nomination of an age manual for yellowtail flounder (SCR Doc. 04/5) was received by STACPUB for consideration in the Studies series. STACPUB considered that SCR Doc. 04/5 be published as a separate issue of the *NAFO Scientific Council Studies*.

ii) **Up-date since June 2003**

At its meetings since 1980, STACPUB has nominated a total of 802 research documents. This includes 50 documents from the Symposium on Elasmobranchs in September 2002 and 8 papers nominated at the Mini-Symposium on Environment Conditions. Since 1980, a total of 684 papers have been published in the Journal (371) and Studies (313). No new documents were nominated in 2003.

8. **Other Matters**

There being no other matters, the Chair closed the meeting by thanking the participants for their contributions and co-operation, the rapporteur for taking the minutes, and the NAFO Secretariat for their assistance.

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

Chair: AntonioVázquez Rapporteur: David Cross

The Committee met at the Alderney Landing, 2 Ochterloney Street, Dartmouth, Nova Scotia, Canada, during 3-17 June 2004, 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, Portugal, Spain, and United Kingdom), Russian Federation and United States of America. The Executive Secretary and Deputy Executive Secretary were in attendance.

1. Opening

The Chair opened the meeting by welcoming the participants. David Cross was appointed rapporteur.

The agenda was **adopted**.

2. Review of Previous Recommendations

a) From June 2003 Meeting

Progress Report on Secretariat Activities in 2002/2003. STACREC had noted that a number of countries were failing to report the absence of fishing activities but that such reports were essential for a complete record of NW Atlantic catches. Accordingly STACREC had recommended that *the Notes for Completion of STATLANT 21A and 21B questionnaires be revised to include the requirement for national authorities to report the absence of fishing activities.* The Secretariat reported that FAO had been contacted and that the Notes for Completion has now been revised as recommended.

CWP Sessions 2003/2004, CWP Intersessional Meeting, 2004. Continuing the usual practice, STACREC had recommended that *the Deputy Executive Secretary attend the CWP Intersessional Meeting to be held in 2004.* This recommendation was revoked in September 2003: *Due to budgetary constraints noted by STACFAD during this meeting STACREC was informed the Deputy Executive Secretary would be unable to attend. STACREC recognizes the continued importance of the CWP to the business of NAFO and STACREC anticipates that the Deputy Executive Secretary will attend future meetings.* However, subsequently, due to the combination of a meeting of the FIRMS Steering Committee with the CWP Intersessional Meeting, the Executive Secretary attended both meetings.

NAFO Observer Program. STACREC had recommended that *the observer data be collected and archived on a set by set basis in a format consistent with SCS Doc. 00/23, as adopted by the Fisheries Commission, including all identifiers but that the data be made available to users without any identification of vessel name or country. Rather a unique identifier will be associated with each vessel and country and the user will not have access to the key to this code.* The Secretariat reported that this recommendation had not been implemented. Unique identifiers had been allocated but the Secretariat did not have the resources to computerise the voluminous data. STACREC stressed once again it cannot use observer data unless it is on a set-by-set basis and thus Scientific Council is still not able to utilize these detailed data to respond to requests from the Fisheries Commission.

b) From September 2003 Meeting

FAO Fisheries Global Information System (FIGIS). STACREC had recommended that *a draft version of Annex 2 (the section most pertinent to NAFO) of the FIRMS Partnership Arrangement should be prepared in advance of the June 2004 Scientific Council Meeting for review at that meeting.* The Secretariat reported that a draft Annex 2 had been prepared and STACREC noted this would be discussed under Agenda item 5(b).

Archival of Data Utilized in Stock Assessments. STACREC had recommended that *the Designated Experts would be asked to place electronic versions of their stock assessment data (including time series of catch, survey indices, numbers at age, catch at age, weights at age, and maturity at age) on the server, in formats currently available, at the Scientific Council Meetings. The data files provided should be annotated and include all survey indices available and catches in aggregate form. The Secretariat will archive these data following Scientific Council Meetings and make them available to members of the Scientific Council thereafter.* The Secretariat allocated the appropriate places in the NAFO server for Designated Experts to submit all the input data used in stock assessment, irrespectively of the format used. STACREC agreed a proposal to switch to harmonised ACCESS forms would be discussed under Agenda item 4(c).

Other Business. STACREC noted the tuna data were not required for the work of the Scientific Council, and STACREC had recommended that *the Secretariat need not report tuna catches in the data tabulations prepared at NAFO and that CWP (and FAO) will be informed that tuna catches will no longer be recorded in the STATLANT 21 data.* The Secretariat reported that this had been done.

c) **From the Meetings in 1979 to 2002**

The Chair introduced a review of the STACREC recommendations made over the past 25 years.

He noted there were various recommendations over a number of years regarding the importance of timely submissions of STATLANT 21A and 21B data for the work of the Scientific Council and suggested that the Fisheries Commission be reminded of this.

He also noted the recommendation on the publication of a Manual on Groundfish Surveys (June 1981) and suggested that a 2nd edition should be produced. STACREC agreed this topic would be discussed at the September 2004 meeting.

3. Fishery Statistics

a) **Progress Report on Secretarial Activities in 2003/2004**

The Deputy Executive Secretary outlined the status of the STATLANT data submissions for recent years. Table 1 shows the dates when STATLANT 21A and 21B submissions were received at the Secretariat through to June 2004. Table 2 is a list of countries that have not submitted STATLANT 21A and 21B data through 2000-2003.

STACREC noted once again that there was a widespread lack of respect of the deadlines for the STATLANT submissions, and particularly for the submissions of the STATLANT 21B and **recommended** that *the General Council be reminded of the importance of these STATLANT data to the work of the Scientific Council.*

TABLE 1. Dates of receipt of STATLANT 21A and 21B reports for 2001-2003 at the Secretariat up to 7 June 2004.

	STATLANT 21A (deadline, 15 May)			STATLANT 21B (deadline, 30 June)		
Country/ Component	2001	2002	2003	2001	2002	2003
BGR*	No fishing	No fishing	No fishing	No fishing	No fishing	No fishing
CAN-CA**	17 May 02	26 May 03	-	-	-	-
CAN-M	15 May 02	01 May 03	13 May 04	29 Jun 03	15 Jan 04	-
CAN-N	15 May 02	15 May 03	20 May 04	21 Jan 03	16 Jan 04	-
CAN-Q	09 Apr 02	22 Apr 03	22 Mar 04	22 May 03	14 Jan 04	-
CUB	-	-	-	-	-	-
EST	30 Apr 02	09 May 03	17 Mar 04	27 Jun 02	30 Jun 03	17 Mar 04
E/DNK	14 May 02	14 May 03	13 May 04	27 Jun 02	13 Jun 03	-
E/FRA-M	No fishing	No fishing	-	No fishing	No fishing	-
E/DEU	25 Jul 02	12 May 03	11 May 04	25 Jul 02	-	-
E/NLD	No fishing	No fishing	-	No fishing	-	-
E/PRT	15 May 02	30 May 03	-	30 Aug 02	-	-
E/ESP	22 May 02	29 May 03	01 Jun 04	11 Jun 03	29 May 03	-
E/GBR	No fishing	No fishing	26 May 04	No fishing	No fishing	-
FRO	01 May 03	01 May 03	-	-	-	-
GRL	06 Nov 02	11 Jun 03	07 Jun 04	-	-	-
ISL	23 May 02	10 Apr 03	14 May 04	23 May 02	10 Apr 03	14 May 04
JPN	21 May 02	27 May 03	27 May 04	21 May 02	27 May 03	27 May 04
KOR	No fishing	No fishing	-	No fishing	No fishing	-
LVA	27 May 02	22 May 03	25 May 04	27 May 02	02 Jul 03	-
LTU	-	12 May 03	18 May 04	-	-	-
NOR	13 Jun 02	20 May 03	20 May 04	-	-	-
POL	24 May 02	09 May 03	-	19 Jun 02	13 May 03	-
RUS	07 Jun 02	14 May 03	26 May 04	25 Jun 02	03 Jun 03	-
USA	-	-	-	-	-	-
FRA-SP	17 Apr 02	31 Mar 03	20 Feb 04	23 Oct 02	31 Mar 03	28 Apr 04
UKR	27 Jun 02	-	-	-	-	

* Note Bulgaria has not reported in recent years but records indicate there was no fishing.
** Canada Central and Arctic (CAN-CA) began reporting in 2000 (note: in 1989-98 inshore catches only).

TABLE 2. List of countries that have not submitted STATLANT 21A and 21B data through 2000-2003. (N.B. Bulgaria has not reported in recent years and USA data from 1994- present are not available.)

STATLANT 21A			STATLANT 21B			
2001	2002	2003	2000	2001	2002	2003 (Due date 30 June 04)
Cuba	Cuba	Canada (C&A)	Greenland	Canada (C&A)	Canada (C&A)	
Lithuania	Ukraine	Cuba	Canada (C&A)	Cuba	Cuba	
		EU-France (M)		Faroe Islands	EU-Germany	
		EU-Portugal		Greenland	EU-Portugal	
		Faroe Islands		Lithuania	EU-France (M)	
		Korea		Norway	EU-United Kingdom	
		Poland		Ukraine	Faroe Islands	
		Ukraine		USA	Greenland	
		USA			Lithuania	
					Norway	
					Ukraine	
					USA	

b) **CWP Sessions 2004/2005**

i) **Report of the Intersessional CWP Meeting, Rome, 2-4 February 2004**

The NAFO Executive Secretary reported on the major topics of interest to NAFO discussed at the Intersessional CWP meeting noting particularly FAO's work on developing and updating field guides for species identification, the presentation of a consultant's report on fisheries data quality indicators and the drafting of the provisional agenda for the CWP-21 Session. It was noted that Chair of STACREC in consultation with the Secretariat may propose modifications to the CWP-21 Provisional Agenda.

The Executive Secretary also drew attention to the development by FAO of a FISHSTAT Plus version 3 and the undertaking by FAO to maintain support of version 2 (currently used by NAFO) until version 3 had been fully developed and tested. David Cross (EU-EUROSTAT) confirmed that he hoped to be able to support the NAFO Secretariat for version 2 until version 3 was available.

ii) **CWP-21st Session, Copenhagen 2005**

STACREC noted that the 21st Session of the CWP would be held at the ICES Headquarters, 1-4 March 2005 (3.5 days). This meeting would be preceded by meeting of the FIRMS Steering Committee (25-26 February 2005) and a Workshop on implementation Strategy-STF (28 February-1 March 2005 – 1.5 days). STACREC noted that STACREC Chair will attend this CWP Session.

iii) **Quality of catch statistics as needed for stock assessments**

STACREC noted that serious difficulties existed during this June 2004 Meeting with regard to determination of the best estimates of catch for the various species of concern to Scientific Council and Fisheries Commission.

Examination of the data from different sources show that alternate estimates when available indicate catches were as a rule higher than figures submitted in STATLANT 21A for species under moratoria or quota regulation, but they were lower for species not under any management regime.

STACREC expressed serious concerns that the alternate sources of information on catches did not include sufficient detail to allow STACREC to evaluate the relative merit of the data from different sources.

In order to minimize this situation into the future, STACREC **recommended** that *Contracting Parties providing data to Scientific Council regarding catch estimates that are alternate to the STATLANT 21A data provide sufficient detail to allow evaluation of the data calculations as well as validation of their accuracy. Detailed information should be provided for the 2005 June Meeting of Scientific Council for both the 2003 catch estimates and the 2004 catch estimates.*

STACREC noted that there is considerable additional information available within the NAFO Secretariat that Scientific Council could utilize in determining the best estimates of catches including such things as numbers of vessels, fishing days, VMS data, etc. STACREC **recommended** that *the Chair of Scientific Council communicate to the Chair of Fisheries Commission the value of these data to Scientific Council in carrying out it work and request that Scientific Council be provided access to these data for its own internal deliberations in support of Fisheries Commission.*

4. Research Activities

a) Biological Sampling

i) Report on Activities in 2003/2004

STACREC noted and reviewed the listings of Biological Sampling Data prepared by the Secretariat. These listings (SCS Doc. 04/6) include biological sampling data for 2003 reported to the Secretariat prior to the present meeting.

ii) Report by National Representatives on commercial sampling conducted

Canada-Central and Arctic (SCS Doc. 04/8): Data on catch rates, length and otolith samples for age determination were obtained from the Cumberland Sound winter long line fishery in Div. 0B.

Canada-Newfoundland (SCS Doc. 04/8): Information was obtained from the various fisheries taking place in all areas from SA 0, 2, 3 and portions of SA 4. Information on fisheries and associated sampling for, Greenland halibut (Div. 0AB, SA 2+ Div. 3KLMNO), Atlantic salmon, Arctic charr, Atlantic cod (Div. 2GH, Div. 2J+3KL, Div. 3NO, Subdiv. 3Ps), American plaice (SA 2 + Div. 3K, Div. 3LNO, Subdiv. 3Ps), witch flounder (SA 2+3KL, 3NO, 3Ps), yellowtail flounder (Div. 3LNO), redfish (Div. 3LN, Div. 3O, Unit 2), northern prawn (Div. 0AB, Div. 2GHJ, Div. 3LMNO), Iceland scallop (Div. 2HJ, Div. 3LN, Subdiv. 3Ps, Div. 4R), snow crab (Div. 2J+3KLNO, Subdiv. 3Ps, Div. 4R), squid (SA 2+3) and capelin (SA 2 + Div. 3KL) was included.

EU-Germany (SCS Doc. 04/10): There were no biological sampling data available for Greenland halibut and redfish from the commercial fishery in 2003.

EU-Portugal (SCS Doc. 04/5): Data on catch rates and length composition were obtained from trawl catches for Greenland halibut (Div. 3LMNO). Data on length composition of the catch were obtained for cod (Div. 3NO), redfish (Div. 3LMNO), American plaice (Div. 3LMNO), yellowtail flounder (Div. 3N), roughhead grenadier (Div. 3LMNO), witch flounder (Div. 3LMNO), Atlantic halibut (Div. 3NO), white hake (Div. 3NO), thorny skate (Div. 3LMNO), spinytail skate (Div. 3LMNO) and monkfish (Div. 3NO).

EU-Spain (SCS Doc. 04/9): Subarea 1 - An experimental fishing survey by a Spanish commercial vessel was carried out in Subarea 1, inside the territorial waters of Greenland, from October to December 2003. Complete information about this experimental fishing is available in SCR Doc. 04/23

Subarea 3 - A total of 31 Spanish trawlers operated in Div. 3LMNO, during 2003, amounting a fishing effort of 6 873 days (115 412 hours). Total catches for all species combined was 34 919 tons in 2003 and 30 244 tons in 2002. Total effort and catches was estimated based upon the information of the EU observers on board.

The Spanish fishery in NAFO area is mainly directed to Greenland halibut (mainly in Div. 3LM), alternating with the skate fishery in the second half of the year (Div. 3NO), shrimp fishery (Div. 3LM), and other species (Div. 3NO). Data on length and age composition of the trawl catches were obtained for Greenland halibut and roughead grenadier. Data on length composition of the trawl catches were obtained for witch flounder, American plaice, skate and redfish.

Greenland (SCS Doc. 04/14): Length frequency and catch-at-age data were available from the inshore fishery for Greenland halibut in Div. 1A. Length frequency data were availed from the gillnet fishery in Div. 1A and Div. 1C. CPUE data were available from the trawl and gill net fishery.

Russia (SCS Doc 04/3): Data on catch, length and age composition were obtained from trawl catches for Greenland halibut (Div. 1AD, 3LMN) and redfish (Div. 1F, 2J). Data on catch and length composition were obtained from trawl catches for redfish (Div. 3LMNO), American plaice (Div. 3LNO), Atlantic cod (Div. 3LMNO), roughhead grenadier (Div. 3LMNO), red hake (Div. 3LMNO), white hake (Div. 3LNO) and thorny skate (Div. 3LNO).

iii) **Report on data availability for stock assessment** (by Designated Experts)

Available data from commercial fisheries relevant for stock assessments on a stock-by-stock basis were prepared from inputs from Designated Experts. These will be compiled into a SCS document and reviewed for accuracy and updated prior to the September 2004 Meeting.

b) **Biological Surveys**

i) **Review of survey activities in 2003** (by National Representatives and Designated Experts)

Canada (SCS Doc. 04/08): Research survey activities carried out by Canada-N were summarized in the document and details were provided in the research documents (SCR Doc.) associated with the various assessments.

Denmark/Greenland (SCS Doc. 04/14): A survey of oceanographic stations along the West Greenland standard sections was carried out in 2003. Further, two different types of fjord systems around Sisimiut were investigated.

A series of annual stratified-random bottom trawl surveys, mainly aimed at shrimps, initiated in 1988 was continued in 2003. In July-August 197 research trawl hauls were made in the main e distribution area of the West Greenland shrimp stock, including areas in Subarea 0 and the inshore areas in Disko Bay and Vaigat. The surveys also provide information on Greenland halibut, cod, dermasal redfish, American plaice, Atlantic and spotted wolffish and thorny skate.

A Greenland offshore trawl survey for Greenland halibut was initiated in 1997. The survey is a continuing of the joint Japanese/Greenland survey carried out in the period 1987-95. In 1997-2000 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 2001 the survey area was expanded to include Div. 1B-1A (to 74°N). In 2003 the survey covered Div. 1CD and a total of 35 hauls were made. The survey was carried out as a stratified random bottom trawl survey.

A longline survey for Greenland halibut in the inshore areas of Disko Bay, Uummannaq, and Upernavik was initiated in 1993. No longline survey was conducted 2002 due to technical problems and in 2003 the longline survey was conducted in Uummannaq only.

Since 2001 a gillnet survey has been conducted in the Disko Bay area. In 2003 a total of 58 gillnet settings were made along 4 transect. Each gillnet was composed of four panels with different mesh size (46, 55, 60 and 70 mm stretch meshes). The highest densities of Greenland halibut were found in the mouth of the ice fjords. In 2003, young fish less than 35 cm seemed more abundant compared to previous years.

A series of annual gill-net surveys mainly targeting 2-3 years old cod was initiated in 1985. Survey results from 2002 and 2003 show an increased recruitment index for Div. 1B, which is the first sign of recovery since the 1993 year-class. No juvenile cod survey was conducted in 2001 due to technical problems.

An annual monitoring program (pot survey) targeting snow crab was initiated in 1997 in Disko Bay (Div. 1A) and Sisimiut (Div. 1B). In 2003 the survey was conducted in May/June with the

R/V *Adolf Jensen*. On the survey baited pots with large and small mesh are used. An annual offshore pot survey was initiated in 2001 in Div. 1D and 1E conducted by the R/V *Paamiut*.

EU-Germany (SCS Doc 04/10; SCR Doc 04/28): The annual groundfish survey off West Greenland was conducted during the fourth quarter. 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 (*Raja radiata*) are documented (Rätz and Stransky, 2004[1]).

During May/June 2003, Germany participated in the international hydro-acoustic pelagic trawl survey on the distribution of pelagic redfish in NAFO and ICES Divisions down to 1 000 m depth. The redfish abundance in NAFO Div. 1F was found very low in June 2003. However, the survey results were found inconsistent with earlier stock size estimates, and ICES recommended these not to be used for assessment purposes.

EU-Spain (SCS Doc. 04/23): An experimental fishing was carried out with a Spanish commercial vessel from October to December of 2003 in the Subarea 1 (see Section 7.e).

The information about the Spanish Trawl Survey in Div. 3NO can be found for American plaice in SCR Doc. 04/09, for yellowtail flounder in SCR Doc. 04/10, cod in SCR Doc. 04/12, Greenland halibut in SCR Doc. 04/11 and for skates SCR Doc. 04/24.

EU-Spain and EU-Portugal: The information of the EU bottom trawl survey on Flemish Cap (Div. 3M) for cod, redfish, American plaice and Greenland halibut is available in SCR Doc. 04/21 and for roughhead granadier in SCR Doc. 04/14.

Russia (SCS Doc. 04/3). Subareas 1+2. In May-June 2003, Russia, Germany and Iceland carried out international trawl-acoustic survey for the redfish in the Irminger Sea and adjacent waters of the Labrador Sea. Biological information on the pelagic redfish in the Regulatory Area was collected during the above survey onboard R/V *Smolensk* in June. During the survey the redfish biomass in the 0-500 m layer was estimated to be 0.1 million tons using acoustic method and in the 0-900 m layer at 0.8 million tons using trawl method. 12% of the pelagic redfish total biomass estimated using acoustic method in the 0-500 m layer was distributed within the Regulatory Area. The redfish biomass estimated with the use of the trawl method in the Regulatory Area in 0-500 m layer accounted for 19% and below 500 m it made up 6% of the total redfish biomass over the whole survey area.

Subarea 3. In 2003 trawlers *Remøyfjord* and *Kapitan Naumov* performed works to determine selectivity of trawl codend with mesh size of 150, 160 and 170 mm in relation to the Greenland halibut in Div. 3L (SCR Doc. 04/6). In December 2003 and February 2004, the trawler *Vladimir Gavrilov* performed research on selectivity of trawl bags with mesh size of 99.7 and 105.8 mm for redfish in Div. 3O. Results from the above experiments showed the following selectivity parameters of the trawl bags:

- For the trawl bag with mesh size of 99.7 mm $L_{50\%}$ = 25.5 cm, *S.R.*= 3.8 cm, *Ks* = 2.6
- For the trawl bag with mesh size of 105.8 mm $L_{50\%}$ = 25.6 cm, *S.R.*= 5.1 cm, *Ks* = 2.4

Further work on selectivity of trawl bags with larger mesh size in relation to the redfish were discontinued because of technical reasons. More detailed results will be presented in the June 2005 Scientific Council Meeting.

[1] RÄTZ, H.-J., and C. STRANSKY. Stock abundance indices and length compositions of demersal redfish and other finfish derived from the Greenland bottom trawl survey, 1982– 2003. *NAFO SCR Doc.*, No. 28, Serial No. N4977.

United States (SCS Doc. 04/7): The Research Report contained new information on the status of small elasmobranchs, including spiny dogfish and seven species of skates. There were also new research projects presented including work on scallops and age, growth and maturity of skates. Finally, an update was given on the status of the NOAA Fisheries Toolbox and contained the website to access this toolbox (http://nft.nefsc.noaa.gov (username: nft, password: nifty)).

ii) **Surveys planned for 2004 and early-2005**

An inventory of biological surveys planned for 2004 and early-2005 as submitted by National Representatives and Designated Experts was prepared by the Secretariat. These will be compiled into an SCS Document prior to the September 2004 Meeting and reviewed at that meeting

c) **Secretarial Stock Assessment Database**

The Secretariat introduced a proposal to develop a database of the information contained in fish stock assessment documents in a harmonised format (ACCESS or XML). This proposal was at an early stage but would require inputs from the Designated Experts.

STACREC discussed the proposal, noting the experiences of other organisations (e.g. ICES) and decided that, while there was a strong interest in the availability of the information, the present proposal was probably too ambitious. A working group was established (A. Vázquez, W. Brodie, C. Darby, B. Atkinson, R. Mayo and J. Fischer) to consider this topic and to report to the September 2004 Meeting.

5. **FAO Fisheries Global Information System (FIGIS)**

a) **Fisheries Resource Monitoring System (FIRMS) Steering Committee (FSC) Meeting, Rome, 2-5 February 2004**

The Executive Secretary reported on the first meeting of the FIRMS Steering Committee (FSC). Six organizations (ICES, ICCAT, IOT, IATTC CCSBT and FAO) have signed the Partnership Arrangement and 6 intending partners (NAFO, EUROSTAT, GFCM, CCAMLR, SPC and SEAFDEC) attended as observers. The FSC discussed and approved the Annex 2 to the Partnership Arrangement (which details the contribution of the Partner to FIRMS) for each of the 6 current Partners and approved a text of the FSC Rules of Procedure.

b) **Consideration of Proposal for FIRMS/NAFO Arrangement**

STACREC reviewed a draft of the Annex 2 to the FIRMS Partnership Arrangement prepared by the NAFO Secretariat and which would cover the NAFO contribution to FIRMS. Subject to a limited number of modifications and editorial changes, the Annex 2 as shown below was approved by STACREC:

Revised DRAFT Annex 2 to the
Partnership Arrangement between the
Northwest Atlantic Fisheries Organization
and the
Food and Agriculture Organization of the United Nations
(representing the FIGIS-FIRMS Partnership)

1. ***Data and statistical information***

The following applies to the stocks managed by the NAFO Fisheries Commission (Table 1 provides a list of stocks under quota management by NAFO in 2004)

Scope of information to be contributed

NAFO is mandated by its Contracting Parties to provide scientific advice and implement management measures for the NAFO Regulatory Area in the Northwest Atlantic (defined by the NAFO Convention). NAFO will contribute to FIGIS information on stocks for which it provides management advice is provided by NAFO Scientific Council to the NAFO Fisheries Commission.

Types of information to be contributed:

- **Reports**: NAFO Scientific Council Summary Sheets containing information on stock status, assessments and management advice for NAFO managed fish stocks (see Table 1) will be made available for upload to FIGIS. Links to supporting scientific documents, such as stock assessment documents, will be provided.
- **Data**: Catch and fishing effort data will be provided at public domain resolution as determined under the policies of NAFO. These data will be available for use by FIGIS in development of summary plots and statistics elsewhere presented within the FIGIS system.
- **Biology, ecology, fisheries, and other information**: Summary information from research and investigations specific to stocks and resources managed by NAFO will be provided in the form of links to reports available on the NAFO website.
- **Fishery Regulation and Management Measures:** Information on regulation and management of fisheries in the NAFO Regulatory Area will be included on FIGIS with links to relevant sections of the NAFO Conservation and Enforcement Measures maintained on the NAFO website.

Documentation and Standards to be used in this Partnership Agreement

Sources of information will be documented, and links to electronic versions of source material will be provided when available. A link to the NAFO website will be provided for detailed information not suitable for posting to FIGIS. The information to be contributed will conform to NAFO policy guidelines for confidentiality and information release and to the Information Management Policy established by the FIRMS/FIGIS Steering Committee.

2. ***Metadata and information management***

Methods of collection and processing: Details of the NAFO data collection and compilation are provided in the various Scientific Council reports, studies, and documents accessible on the NAFO WebPages.

Bibliographical sources: Bibliographical sources for the NAFO reports are listed in the stock summary sheets and in the Scientific Council Summary Documents. Most of the bibliographical source documents are stored on the NAFO website for a limited duration after which time they are available upon request from the NAFO Secretariat. From the FIGIS fact sheets, links will point to the relevant NAFO source documents.

Ownership and responsibilities: The information contributed to FIRMS resides under the full ownership and responsibility of NAFO. Therefore, the ownership presented as header of each stock fact sheet will clearly include "Northwest Atlantic Fisheries Organization" or its acronym "NAFO" as the organization and data owner institutional entity. The acronym for the Commission used throughout FIGIS-FIRMS will be "NAFO". Further, NAFO will be owner of all descriptions of itself, and all text outlining its responsibilities and accomplishments, wherever presented by pages linked to or referenced by FIGIS-FIRMS, including pages developed by other organizations or entities within such as UN/FAO/FIRMS. This shall be accomplished by establishment of appropriate editorial and ownership security privileges within FIGIS-FIRMS. In cases where an item has joint ownership, all entities shall show a clear indication of ownership on fact sheets.

Transmission protocols and dissemination channels: The NAFO Scientific Council Reports and the NAFO Conservation and Enforcement Measures which serve as background documentation for information published on FIGIS-FIRMS will be published on the NAFO web site. Links to these reports and relevant texts will be added in various topics of the FIGISFIRMS fact sheets under NAFO ownership using a combination of the tools offered by the system (XML editing uploading – on-line editing). Transmission schedule is planned to be within three months following publication by NAFO of its reports on the NAFO website.

3. ***Data and information security***

All contributions from NAFO will be on the public domain. Transparency of the information and results on status and trends of stocks and resources presented by NAFO are documented in the course of the scientific peer-review process followed to obtain the results, and the various meetings of the NAFO at which the results, and various options for management and resource conservation, are presented and discussed. Details on these meetings and processes are available at the NAFO website.

4. ***Collaborative institutions***

NAFO works closely together with numerous institutions both national and international on promoting marine science in the North Atlantic.

5. ***Additional entitlements***

NAFO staff and NAFO participants will be entitled to participate in workshops or special courses organized by the FIRMS Secretariat (FAO) in the use of electronic publishing tools used in the FIRMS-FIGIS.

When required, this Annex may be revised by mutual consent.

TABLE 1. Fish stocks under quota regulation by NAFO (Status in 2004). Information on additional stocks may be provided on a year-to-year basis.

		Assessment		
	Stock	Annual	Bi-annual	Occassional
1	Greenland halibut in SA 2 and Div. 3KLMNO	√		
2	Northern shrimp in Div. 3M	√		
3	Northern shrimp in Div. 3LNO	√		
4	American plaice in Div. 3LNO		√	
5	Cod in Div. 3NO		√	
6	Redfish in Div. 3LN		√	
7	Witch flounder in Div. 2J+3KL		√	
8	Redfish in Div. 3M		√	
9	Cod in Div. 3M		√	
10	American plaice in Div. 3M		√	
11	Witch flounder in Div. 3NO		√	
12	Yellowtail flounder in Div. 3LNO		√	
13	Squid *Illex* in Subareas 3 and 4		√	
14	Capelin in Div. 3NO			√

6. NAFO Observer Program

STACREC reiterated its need for access to set-by-set data from the NAFO Observer Program and, in view of the current discussions within STACTIC and the Fisheries Commission on the future of the Observer Programme, STACREC proposed that their attention be drawn to this need.

STACREC **recommended** that *the Secretariat determine the resources required to complete the task of digitizing the observer data to enable its use by Scientific Council, and funding to support this work be requested during the September 2004 Meeting of STACFAD.*

7. Review of SCR and SCS Documents

STACREC reviewed eight SCR and SCS documents as summarized below:

a) **The Stock-recruitment Relationship (SRR) was Analysed in 13 Stocks Units of Commercial Fish in the NAFO Area** (SCR Doc. 04/2). A simplified *ad hoc* method was used to investigate this relationship. The effect of SRR was evident in Subdiv. 3Ps cod, Subdiv. 5Ze and Subdiv. 5Zw + SA 6 silver hake, SA 2+3 Greenland halibut, Div. 3LNO yellowtail flounder, Div. 3LNO American plaice and SA 3+6 Atlantic mackerel. The results have been considered in view of the interpretation of SRR as one of the factors determining the abundance dynamics and fisheries management strategy for commercial fish populations. It has been discussed the role and impact of environmental factors to respective stocks units. The results of the study allowed proposing some general recommendations on the ways of the stock-units management. Within the discussion, the probable mechanism of SRR effect in the periods when the spawning biomass considerably differed from the optimal level was suggested and the opinion was expressed concerning further development of the precautionary approach strategy.

b) **Yellowtail Flounder (*Limanda ferruginea*) Ageing Manual** (SCR Doc. 04/5). This is a technical manual describing the methods and interpretations used for estimating age in yellowtail flounder (*Limanda ferruginea*). The paper gives a general overview of ageing and then discusses how yellowtail flounder are presently being aged at the Northwest Atlantic Fisheries Centre (NAFC) in St. John's, Newfoundland. It also provides information on the types of validation studies that are used to ensure accuracy of ageing and attempts to troubleshoot any difficult aspects of ageing. The thin-sectioning method used to age this species is discussed, and includes detailed information on how it is carried out. The structure of the whole otolith was discussed, along with the limitations for ageing yellowtail flounder using this structure. This manual contains a glossary and high quality photos and diagrams for use when ageing yellowtail flounder.

STACREC **recommended** that *SCR Doc. 04/5 on yellowtail flounder (Limanda ferruginea) ageing manual be published in Studies.*

c) **Selectivity Of Codends With Standard 150, 160 And 170 mm Mesh Size In Greenland Halibut Trawl Fishery in Division 3L Of The NAFO Regulation Area And Possible Results Of Mesh Size Increase In More Than 130 mm** (SCR Doc. 04/6). Given are the data on selectivity of codends with 152; 163 and 170 mm mesh size in the Greenland halibut target fishery. The results from investigations were processed using SELECT model, by logistic and generalized logistic function of the likelihood of studied fish retention depending on their size. The parameters of functions were obtained by minimizing the likelihood function. Selectivity parameters derived by authors for 152 mm mesh: fish length corresponding to 25% and 50% retention – L_{25} = 35.4 cm; L_{50} = 42.8 cm; selectivity coefficient K_S = 2.8; selectivity range SR = 14.8 cm; for 163 mm and 170 mm mesh: L_{25} = 39.1 and 40.2 cm; L_{50} = 47.4 and 48.4 cm; K_S = 2.8 and 2.9; SR = 15.9 and 15.4 cm, respectively. Calculations of instantaneous losses showed that enlarging mesh size from 130 to 173 mm would result in efficiency decrease almost in 5 times, and minor long-term profits of up to 1-3% might be only obtained with fishing mortality growing in not less than 2-4 times, as compared to the current one.

d) **Results of Comparative Age Reading of Greenland Halibut *Reinhardtius hippoglossoides* (Walbaum) by Scales and Otoliths** (SCR Doc. 04/7). Results of comparative reading of Greenland halibut age by otoliths and scale from three parts of the body are presented. Reliability of differences was assessed with the use of Fisher's Z-criterion. Discrepancies in age reading between various structures varied from 1 to 3 years, but in most cases age difference did not exceed 1 year. A number of variant readings was quite large in all discussed cases and varied from 29 to 33% and constituted on average 31%. Investigations proved the statistical reliability of differences by materials, in which scales were used taken from under the pectoral fin. It turned out, that results of age reading by scales from this part are sufficiently underestimated. Comparison between spinal and tail parts and otoliths showed that these differences are big, but statistically unreliable.

e) **Results of the Spanish Experimental Fishing in NAFO Subarea 1** (SCR Doc. 04/23). An experimental fishing was carried out with a commercial Spanish vessel from October to December of the year 2003 in the Subarea 1. The main objective of the experimental fishing was to search for cephalopods species concentrations inside the territorial waters of Greenland. During the experimental fishing a scientific observer stayed on board to collect effort data, catches and yields by haul and Division, strata and gear. The observer carried out length distributions samplings of the following species: *Pandalus borealis*, *Sebastes* spp., *Hippoglossoides platessoides*, *Gadus morhua* and *Macrourus berglax*. Biological samplings of *Reinhardtius hippoglossoides*, *Hippoglossoides platessoides*, *Gadus morhua* and *Gadus ogac* were also carried out. Greenland halibut was the main species caught and the cephalopods, target species, have not been found in enough concentrations for their commercial exploitation in the experimental fishing. The gear used was a bottom trawl with a mesh size of 40 mm in the codend. Two types of bottom trawl net were used, one type with a vertical opening of 3 m (BT) and the other one with a high-opening of 7 m (BT-GOV).

f) **The Use of Indices of Reproductive Potential in the Setting of Reference Points and Stock Projections** (SCR Doc. 04/39). Estimates of reproductive potential for cod in Div. 3NO were produced by sequentially incorporating estimates of proportion mature at age, sex ratio at age and potential egg production. The estimates of reproductive potential produced by each method were broadly similar but there were important differences. This leads to differing perceptions of the stock productivity as measured by relative recruitment rate of a stock and in the spawner stock produced per recruit. An example was illustrated of how these different estimates of reproductive potential can be used in the determination of biological limit reference points and in projections of stock size.

g) **Length-weight Relationships of the Portuguese Commercial Catches in NAFO, 1998-2003** (SCR Doc. 04/40). On behalf of the Portuguese scientific program, biological sampling was carried out over the period 1998-2003 on board of several stern trawlers fishing in Div. 3L, 3M, 3N and 3O all the year round. The 2003 Greenland halibut data were used to compare two methods of computation the length/weight (LW) relationship. The first calculation was done using all observations without averaging the weights of each length group. The second method used the mean weight at each length class. In both methods the LW relationships were calculated from the regression of the log transformed length/weight observations. The second method was chosen to calculate LW relationships for other commercial species since it gave expected weights closer to the observed ones in upper limit of the length distributions, were fewer observations are available. Sampling length/weight data were assembled for several species and stocks, for each one LW relationships were derived.

h) **Results from Bottom Trawl Survey on Flemish Cap of July 2003** (SCR Doc. 04/21). A stratified random bottom trawl survey on Flemish Cap was carried out from 2 June to 27 July 2003 following the same procedures as in previous years. However the survey was carried out by the R/V *Vizconde de Eza*, which will continue for this survey in the future. For this reason during the first ten days of the survey a comparative fishing trial for calibration was conducted between the former vessel R/V *Cornide de Saavedra* and the new one. Taking into account that the calibration will continue during the next year's survey, the indexes in the series from 1988 to 2002 were not changed to the new scale by now. Still, the 2003 current indices from the R/V *Vizconde de Eza* were transformed to the R/V *Cornide de Saavedra* scale, to make them comparable to the results obtained in previous years. Abundance-at-age indices was presented for cod, American plaice, redfish and Greenland halibut.

8. Other Matters

a) Tagging Activities

STACREC reviewed the list of tagging activities carried out in 2003 (SCS Doc. 04/11) compiled by the Secretariat, and requested National Representatives to update the list during the meeting in order that the finalized document can be issued soon after this meeting.

b) Comparative Fishing Between Canada and EU-Spain

It was reported that an inconclusive comparative fishing trial was carried out for two days in 2003. No report was provided. The comparative trial will be continued when an opportunity is available.

c) Conversion of Spanish Survey Length Distributions

In 2003 STACREC had recommended that the summed abundance and biomass on conversion of the length frequencies be presented for American place, cod, Greenland halibut and yellowtail flounder in the Div. 3NO surveys conducted by EU-Spain, and these be compared to the estimates from the method used to convert the CPUE. This analysis has been carried out and presented in the following: for American plaice in SCR Doc. 04/09, for yellowtail flounder in SCR Doc. 04/10, for cod in SCR Doc. 04/12, for Greenland halibut in SCR Doc. 04/11 and for skates in SCR Doc. 04/24. The conclusion of the analysis has been that the transformation of the series carried out by the Robson method for mean catches, abundance and biomass and the transformations of the lengths distributions by the Warren method are adopted.

d) Research Activities

Research activities were discussed under Section 4b(i) above.

e) Other Business

STACREC noted that there were reports of a new gear category (twin trawls for Greenland halibut in northern Atlantic waters) in use in the area. Currently no FAO Gear Code was available for such a gear. The Secretariat was requested to determine if this was an identifiable gear type and, if appropriate, to request FAO to assign it an appropriate unique gear code.

The Chair thanked the participants for their valuable contributions to the Committee. Special thanks were extended to the rapporteur and to the Deputy Executive Secretary and 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 2004 STACREC Meeting.

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

Chair: Hilario Murua Rapporteurs: Various

I. OPENING

The Committee met at the Alderney Landing, 2 Ochterloney Street, Dartmouth, Nova Scotia, Canada, during 3–17 June 2004, 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 Faroe Islands and Greenland), European Union (France, Germany, Portugal, Spain and United Kingdom), Russian Federation and United States of America. Various scientists assisted in the preparation of the reports considered by the Committee. The Deputy Executive Secretary, Tissa Amaratunga, was in attendance.

The Chair, Hilario Murua (EU-Spain), opened the meeting by welcoming participants. The agenda was reviewed and a plan of work developed for the meeting. The provisional agenda was **adopted**.

II. GENERAL REVIEW

1. **Review of Recommendations in 2003**

STACFIS agreed that relevant stock-by-stock recommendations from previous years should be reviewed before the assessments were undertaken.

Recommendations in June 2003

i) With respect to catch statistic reports available for assessments; STACFIS had recommended that *the NAFO Secretariat write Contracting Parties to remind them that all catches should be apportioned as to species and area where caught*

STATUS**:** The Secretariat had informed Contracting Parties through general circulation letters.

ii) **Considering Greenland Halibut (*Reinhardtius hippoglossoides*) in Subarea 0 and Division 1A Offshore and Divisions 1B-1F;**

STACFIS had recommended that *the investigations of the by-catch of Greenland halibut in the shrimp fishery in Subareas 0 and 1 should be continued and the results should be made available before the assessment in 2004*, and also STACFIS had recommended that *the CPUE series from Div. 0B should be updated.*

STATUS: No progress has been made in both recommendations.

STACFIS had recommended that *a survey be carried out in the northern part of the Baffin Bay (north of the areas which were surveyed in 2001) in order to investigate the distribution of Greenland halibut in the area.*

STATUS**:** STACFIS was informed that in 2004 Canada will conduct a bottom trawl survey in the western part of the Baffin Bay including areas in the northern part of the Bay not previously surveyed. Greenland will conduct a survey (74ºN–77ºN) north of the area surveyed in 2001 with the same vessel as used in 2001 and in the Canadian 2004 survey.

iii) **Considering Greenland Halibut (*Reinhardtius hippoglossoides*) in Division 1A Inshore**;

It was noted that in 2001 an annual gill net survey with small mesh net was started in the Disko Bay in order to estimate relative year-class strength of pre recruits to the fishery. STACFIS had recommended that *results from the gill net survey for Greenland halibut Div. 1A be presented for review in June 2004.*

STATUS**:** No progress has been made

Voluntary logbooks were introduced in 1999 but have only covered a small proportion of the landings due to poor return rates. STACFIS had recommended that *authorities consider means to ensure a higher return rate of inshore logbooks from the Greenland halibut commercial fishery in Div. 1A.*

STATUS**:** No progress has been made

STACFIS had recommended that *investigations of by-catch of juvenile Greenland halibut in the commercial shrimp fishery in Subareas 0+1 be continued.*

STATUS**:** No progress has been made

STACFIS had recommended that *the discard rate of* '*small Greenland halibut*' *in Div. 1A be investigated.*

STATUS**:** No progress has been made

iv) **Considering Demersal Redfish (*Sebastes* spp.) in Subarea 1**;

STACFIS had recommended that *the quantity of redfish discarded in the shrimp fishery in Subarea 1 be quantified.*

STATUS: STACFIS was informed it has not been possible to get any information on discard on redfish from the shrimp fishery.

STACFIC had recommended that *determination of maturity of redfish caught during surveys in Subarea 1 be carried out.*

STATUS**:** STACFIS noted **o**nly few mature redfish are caught in Greenland survey. The study will continue in 2004.

v) **Considering Other Finfish in Subarea 1**;

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

STATUS: STACFIS again noted it has not been possible to get any information on discard other finfish from the shrimp fishery.

vi) **Considering Redfish (*Sebastes mentella* and *Sebastes fasciatus*) in Division 3M**;

STACFIS had recommended that *information on the distribution on shrimp and small redfish (<12 cm) in Div. 3M be compiled for review during the June 2004 Meeting of Scientific Council.*

STATUS: Implemented.

STACFIS had recommended that *an update of the Div. 3M redfish by-catch information from the shrimp fishery be compiled on an annual basis, including the estimated weights and numbers of redfish caught annually as well as tables showing their size distribution.*

STATUS: STACFIS noted that this information has been updated for 2003 with redfish by-catch data of the Canadian shrimp fishery on Flemish Cap

vii) **Considering American Plaice (*Hippoglossoides platessoides*) in Division 3M;**

STACFIS had recommended that *for American plaice in Div. 3M current initiatives aiming at reconciling age determinations from different age readers be continued.*

STATUS: Some effort have been spent in order to revisit the otoliths from the former years under the present accepted criteria, but, due to the size of the otoliths collections from several years and to the deterioration of some sets due to the enhancing methods used before, this work is difficult to achieve.

viii) **Considering Cod (*Gadus morhua*) in Divisions 3N and 3O**;

In view of the difficulty in determining if the current low productivity will persist in the immediate future, STACFIS had recommended that *for cod in Div. 3NO the Scientific Council review in detail the biological reference points in the context of the PA framework when the SSB has reached half the current estimate of* B_{lim}.

STATUS: STACFIS noted that based on last assessment done in 2003, SSB remains well below half the current estimate of B_{lim} (where B_{lim} = 60 000 tons).

ix) **Consider Redfish (*Sebastes mentella* and *Sebastes fasciatus*) in Divisions 3L and 3N**;

STACFIS had recommended that *(1) redfish data in Div. 3LN and Div. 3O be analyzed further to determine if a relationship exists between Div. 3LN and Div. 3O that may help in the interpretation of the indices of abundance; and (2) data be examined to evaluate the appropriateness of Div. 3LN and Div. 3O as management units for redfish*.

STATUS: A paper was presented to the STACFIS discussing this issue. STACFIS concluded that the issue of the relationship of redfish in Div. 3L, 3N and 3O remains complicated and unclear. A genetic study is currently being conducted within Canada that may provide useful results for the determination of the most appropriate management unit(s) in Div. 3L, 3N and 3O. It is anticipated that the results of this study will be made available to the Scientific Council meeting in June 2005.

x) **Considering Capelin (*Mallotus villosus*) in Divisions 3N and 3O**;

STACFIS had recommended 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: STACFIS was informed this was not implemented.

xi) **Considering Redfish (*Sebastes mentella* and *Sebastes fasciatus*) in Division 3O**;

STACFIS had again recommended that *(1) redfish data in Div. 3LN and Div. 3O be analyzed further to determine if a relationship exists between Div. 3LN and Div. 3O that may help in the interpretation of the indices of abundance; and (2) data be examined to evaluate the appropriateness of Div. 3LN and Div. 3O as management units for redfish.*

STATUS: A paper was presented to the STACFIS discussing this issue. STACFIS concluded that the issue of the relationship of redfish in Div. 3L, 3N and 3O remains complicated and unclear. A genetic study is currently being conducted within Canada that may provide useful results for the determination of the most appropriate management unit(s) in Div. 3L, 3N and 3O. It is anticipated that the results of this study will be made available to the Scientific Council Meeting in June 2005.

xii) **Considering Roughhead Grenadier (*Macrourus berglax*) in Subareas 2 and 3**

STACFIS had recommended that *further investigations into yield-per-recruit analysis by sex be carried out for roughhead grenadier in SA 2 and 3.*

STATUS: Not implemented. STACFIS was informed it will be studied during the full assessment scheduled for 2005.

xiii) **Considering Greenland Halibut (*Reinhardtius hippoglossoides*) in Subarea 2 and Divisions 3KLMNO**

STACFIS had recommended that *in future assessments of Greenland halibut in Subarea 2 + Div. 3KLMNO the details of the calculation of the catch at age in the final year be provided for review.*

STATUS: This was implemented and generally described to STACFIS during this 2004 assessment.

2. **General Review of Catches and Fishing Activity**

As in previous years STACFIS conducted a general review of catches in the NAFO Regulatory Area of Subareas 2 and 3 in 2003. In addition to the catches reported (available to date) in STATLANT 21A reports and national research reports, and in order to derive the most appropriate estimates of catches for the various stocks in Subareas 2 and 3, data from various sources were considered, namely the Canadian Surveillance data for EU-Spain and EU-Portugal catches, scientific estimates of catches and the NAFO Observer Program for EU-Spain catch (in effect since 1995, with total coverage of all ships in NAFO areas operating under the flags of Contracting Parties).

Having no scientific basis to judge them, STACFIS was not in position to decide between any of the catch estimates as best estimate catches. Consequently, a range of catches from the above-mentioned sources were considered for several stocks and, as a compromise, the average values were used in the assessments.

STACFIS agreed to continue documenting the preliminary tabulations of catch data from SATLANT 21A reports and the catches determined by STACFIS, giving a catch range for this year's assessments, in the introductory catch table for each stock.

III. STACFIS WORKING PROCEDURES

Environmental Review. For the STACFIS report, STACFIS considered presenting an environmental review at the beginning of each section addressing each major geographic region. It was agreed that the Chair of STACFEN would provide this review for each geographic area which would enable a quick comparison between fishery and environmental trends.

STACFIS agreed that a new subject heading titled "changes from the last assessment" would be included for each assessment in the STACFIS report. STACFIS agreed this text would help to keep track of the changes made from one year to the next, especially in the methods used and in the results. It would enable a quick revision of the consistency of the assessment between consecutive years.

Structure of STACFIS Report. STACFIS agreed the present STACFIS report, as in recent years, will be based on four geographic regions. The region-based structure of the report is planned to enable a quick comparison of the status and trends of biomass and exploitation of resources inhabiting the same or adjacent regions.

IV. STOCK ASSESSMENTS

A. STOCKS OFF GREENLAND AND IN DAVIS STRAIT

Environmental Overview

Temperatures and salinities data in the inshore region of southwest Greenland reflect inflow of Polar Water carried by the East Greenland Current. Water of Atlantic origin with temperatures >3ºC and salinities >34.5 is normally found at the surface offshore off the shelf break in this area. Historical data from Fyllas Bank revealed several cold "polar events" during 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 layers. Temperature and salinity observations at greater depths (400–800 m) show the presence of Irminger Water with temperatures of about 4.5ºC and salinities of >34.95 at Cape Farewell and north as far as Fylla Bank, while modified Irminger Water with salinities between 34.88 to 34.95 can be traced up to about 67ºN. The data indicate that Irminger Water was not found during all years at this site, but was present during the 1960s, the second half of the 1980s, the early-1990s, during 1999, 2000 and 2003. Oceanographic data from Fyllas Bank revealed considerable warming in the upper 200 m of the water column during summer and autumn of 2003. The time series of mid-June temperatures on top of Fylla Bank was about 1ºC above average and up to 2ºC above average by autumn. The temperature of the Polar Water was higher than normal and the front between Polar Water and Irminger Water was weak, indicating a reduced inflow of Polar Water to the West Greenland area in 2003. In June pure Irminger Water was observed from Cape Farewell to the Fylla Bank section, and Modified Irminger Water could be traced as far north as the Maniitsoq (Sukkertoppen) section. The inflow of Irminger Water seems to be much higher than the previous two years, which most likely can be a consequence of reduced inflow of Polar Water. In general, during 2003 in this area warm-saline conditions dominated from summer to autumn. Polar inflows were weak and Irminger Current waters reached north of Fylla Bank.

1. Greenland Halibut (*Reinhardtius hippoglossoides)* in Subarea 0 and Division 1A Offshore and Divisions 1B-1F (SCR Doc. 97/21, 04/18, 19, 23, 44, 45; SCS Doc. 04/3, 9, 10, 14)

a) Introduction

The annual catches in Subarea 0 and Div. 1A offshore and Div. 1B–1F were below 2 600 tons from 1984 to 1988. From 1989 to 1990 catches increased from 2 200 tons to 10 500 tons, remained at that level in 1991 and then increased to 18 100 tons in 1992. During 1993–2000 catches fluctuated between 8 300 and 11 400 tons. The catches increased gradually from 13 400 tons in 2001 to 20 000 tons in 2003 (Fig. 1.1).

In Subarea 0 catches peaked in 1992 at 12 400 tons, declined to 4 300 tons in 1994 then stayed at that level until 2000 when they increased to 5 500 tons. Catches increased further to 7 600 tons in 2001, primarily due to an increase in effort in Div. 0A. Catches remained at that level in 2002 (7 800 tons) but increased again in 2003 to 10 400 tons. The increase between 2002 and 2003 was mainly due to increased catches in Div. 0B. Catches in Div. 0A increased from a level around 300 tons in the late-1990s and 2000 to 2 600 tons in 2001, and increased further to 3 800 tons in 2002 and 4 300 tons in 2003.

Catches in Div. 1A offshore and Div. 1B–1F fluctuated between 900 and 2 400 tons during the period 1987–92. After that catches have fluctuated between 3 900 and 5 900 tons. Catches increased from 5 500 tons in 2001 to 7 400 tons in 2002, and further to 9 600 in 2003, primarily due to increased effort in Div. 1A. Prior to 2001 catches offshore in Div. 1AB have been low but they increased gradually from 150 tons in 2000 to 4 000 tons in 2003.

Recent catches and TACs ('000 tons) are as follows:

	1995[1]	1996	1997	1998	1999	2000	2001	2002	2003	2004
Recommended TAC	25	11	11	11	11	11	15[2]	15[2]	19[3]	19[3]
SA 0	3	5	4	4	5	5	8	8	10	
SA 1 excluding Div. 1A inshore	5	4	5	5	5	5	6	7	10	
Total STATLANT 21A	8	9	9	9	17[4]	7[5]	13[5]	12[5]	14[5,6]	
Total STACFIS	8	9	9	9	10	11	13	15	20	

1 In the period 1991-95 the TAC included Div. 1A inshore.
2 Including a TAC of 4 000 tons allocated specifically to Div. 0A and 1A.
3 Including a TAC of 8 000 tons allocated specifically to Div. 0A and 1AB.
4 Including 7 603 tons reported by error from Subarea 1.
5 Provisional.
6 Including 1366 tons reported by error from Subarea 0.

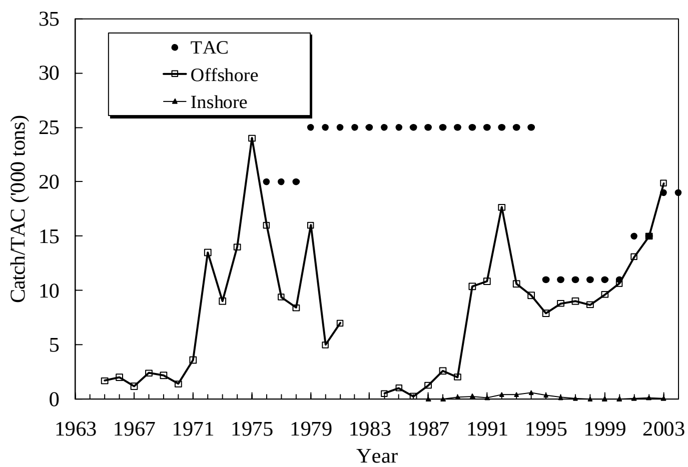


Fig. 1.1. Greenland halibut in Subareas 0+1 (excluding Div. 1A inshore): catches and TACs.

The fishery in Subarea 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. During 1998–2003 Canada was the only country fishing in Div. 0B. In 2003, 641 tons were taken by longlines, 1 168 tons by gill net and 4 024 tons by trawlers.

Besides Canadian trawlers, trawlers from a number of different countries chartered by Canada participated in the fishery in Div. 0A in 2001–2003. Catches (4 278 tons) in Div. 0A in 2003 were distributed equally among single trawl, twin trawl and longlines.

A longline fishery in Cumberland Sound started in 1987. The catches gradually increased to 400 tons in 1992 where they remained until 1994. Catches decreased to 285 tons in 1995. During 1996–2001 catches were below 100 tons. The decrease in catches in recent years has been due to decrease in effort as a result of poor ice conditions. Catches Cumberland Sound amounted to 106 tons in 2002 and increased to 244 tons in 2003.

The fishery in Div. 1A offshore + Div. 1B–1F. Traditionally the fishery in SA 1 has been taken place in Div. 1D and to a minor extent Div. 1C. Catches have mainly been taken by trawlers from Japan, Greenland, Norway, Russia, Faeroe Islands and EU (mainly Germany). These countries, except Japan, were also engaged in the fishery in the area in 2003 together with two gill netters from Greenland. The gillnet fishery was started by Greenland in 2000. An offshore longline fishery in Div. 1CD was started in 1994 but there has been no longline fishery since 2002.

During the years there have been a number of research fisheries offshore in Div. 1A but the catches have always been less than 200 tons annually. The catches increased gradually during 2000–2003 to 4 000 tons in 2003. In 2003 most of the catches were taken by trawlers but gill netters also participated in the fishery. The main part of the fishery in SA1 takes place during autumn and winter at depths between 1 000 and 1 500 m.

b) **Input Data**

i) **Commercial fishery data**

Information on length distribution was available from the trawl fishery in Div. 0AB and longline fishery in Div.0A (SCR Doc. 04/44). The length distributions were almost identical in Div. 0A and 0B and resembled the length frequency seen in Div. 0A in 2002 with a mode at 47 cm. The mode in the longline fishery in Div. 0A shifted from 47 cm in 2002 to 50 cm in 2003.

Information on length distribution of catches from Div. 1A and Div. 1D was available from trawlers from Russia (SCS Doc. 04/3). Further, length distributions were available from the Greenland gill netter fishery in Div. 1A and 1C, respectively (SCR Doc. 04/45). The length distributions in the Russian trawl fishery had modes at 44 and 50 cm in Div. 1A and Div. 1D, respectively, compared to modes at 42 and 48 cm in 2002. The length distributions in Div. 1A and Div. 1C had broad modes at 67-72 cm and 72-78 cm, respectively.

Age distributions were available from the Russian trawl fishery in Div. 1A and 1D. Age 6 fish dominated the catches in Div. 1A, while age 7 dominated the trawl catches in Div. 1D as seen in previous years.

Unstandardized catch-rates from the trawl fishery in Div. 0A showed a gradual increase between 2001 and 2003 for both single and twin trawls, respectively (SCR Doc. 04/44). This increase in catch rates probably does not reflect an increase in the stock but rather that the fishery has moved northward to areas not previously fished, combined with increased experience with fishery. The catch rate in the Greenland trawl fishery in Div. 1A was stable between 2001 and 2002 but showed a decrease in 2003 (SCS Doc. 04/14).

Standardized annual catch rates were calculated for the trawl fishery in Div. 1CD for 1988-2003 based on available logbooks and the EU-Germany fishery in Div. 1D (SCS Doc. 04/10; SCR Doc. 04/45). The catch rates increased slightly between 2002 and 2003 and were stable during the period 1990-2002 (Fig. 1.2).

Combined standardized annual catch rates were calculated for the trawl fishery in SA 0 for 1990-2000 and from Div. 1CD for 1988-2000 based on available logbooks and the EU-Germany fishery in Div. 1D (SCR Doc. 01/48, SCS Doc. 01/13). The combined catch rates showed a decrease from 1988-89 (one large vessel with high catch rates) to 1990, but have remained stable since (Fig. 1.2). The catch rates series has not been updated in the recent years due to lack of data from SA0.

Due to the frequency of fleet changes in the fishery both in SA 0 and Div. 1CD, the indices of CPUE should be treated with caution.

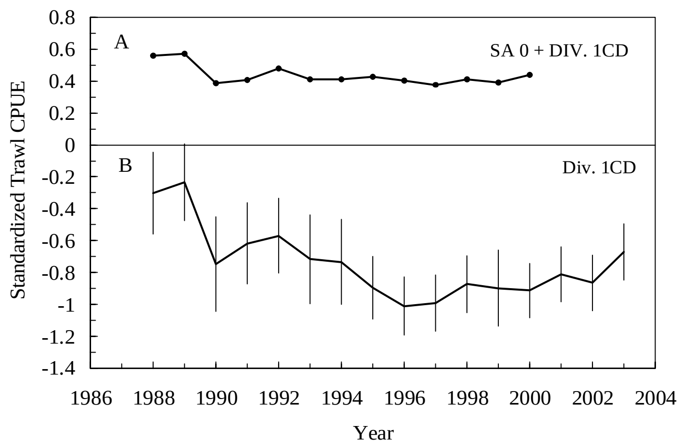


Fig. 1.2. Greenland halibut in Subareas 0+1 (excluding Div. 1A inshore): A: Combined standardized trawl CPUE from SA0 and Div. 1CD. B: Standardized trawl CPUE from Div. 1CD with ± S.E.

ii) **Research survey data**

Deep-sea surveys. During the period 1987–95 bottom-trawl surveys were conducted in Subarea 1 jointly by Japan and Greenland (the survey area was re-stratified and the biomass estimates were recalculated in 1997 (SCR Doc. 97/21)). 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 was estimated to be 69 000 tons in 2003, which is slightly less compared to 72 000 tons in 2002, but still above average for the time series (56 000–78 000 tons) (Fig. 1.3) (SCR Doc. 04/19).

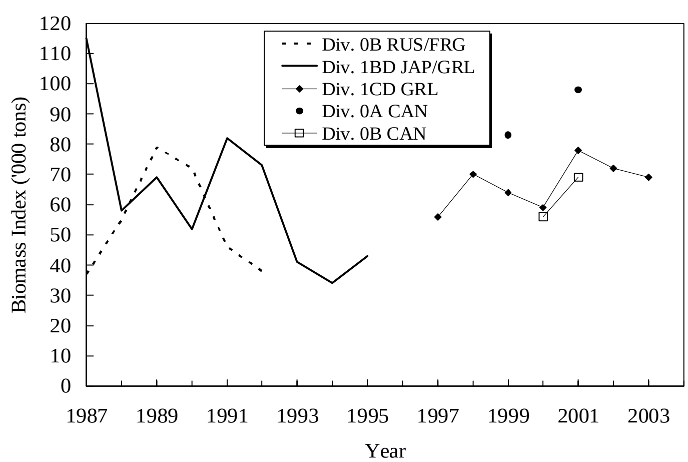


Fig. 1.3. Greenland halibut in Subareas 0+1 (excluding Div. 1A inshore): biomass estimates from surveys.

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 on a relatively high level in recent years and the estimate for 2003 (16 100 tons) was the highest in the time series which dates back to 1992. The number of one-year-old fish in the total survey area including Disko Bay increased gradually from

1996 to a peak of 450 million in 2001. The estimate was 196 million one-year-old specimens in 2002, which is above the recruitment of the 1989–1994 year-classes but below the recruitment levels since then, except the 1996 and 1997 year-classes. The number of one-year-olds increased in 2003 to 316 million (SCR Doc. 04/45) (Fig. 1.4).

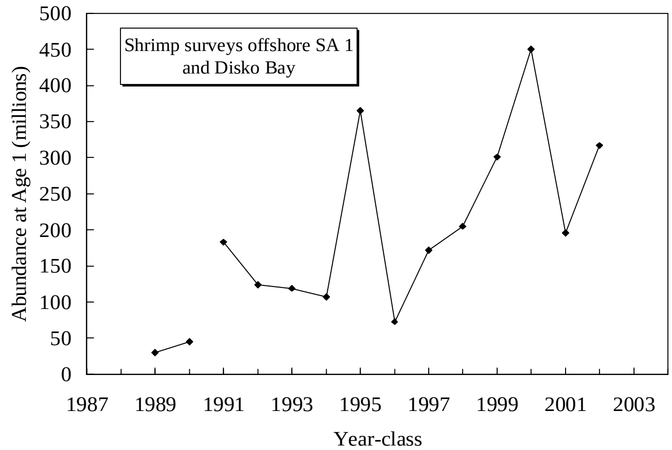


Fig. 1.4. Greenland halibut in Subareas 0+1: recruitment index at age 1 in Subarea 1 derived from the Greenland shrimp trawl surveys. Note that the survey coverage was not complete in 1989 and 1990.

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. (SCR Doc. 03/54). The XSA was not updated this year due to lack of catch-at-age data, primarily from SA0.

d) **Assessment Results**

Div. 0A + Div. 1A (offshore) + Div. 1B

Div. 0A was surveyed in 1999 and 2001 and Div. 1AB was surveyed in 2001. Based on these surveys a separate TAC on 4 000 tons was set for Div. 0A + Div. 1A for 2001 and 2002 and the TAC was increased to 8 000 tons for 2003 and 2004 for Div. 0A + Div. 1AB. Further, the Greenland Shrimp Survey has covered, among others, Div. 1B and part of Div. 1A (to 72°30N) annually since 1992.

The biomass, which is mainly found in Div. 1AB, estimated in Greenland Shrimp Survey has been stable in recent years and in 2003 was the highest observed in the time series.

The length distribution in the trawl fishery in Div. 0A was stable between 2002 and 2003, while fish generally were larger in the longline fishery in 2003 compared to 2002. The mode in the trawl fishery in Div. 1A changed from 42 cm in 2002 to 44 cm in 2003.

Unstandardized trawl CPUE indices showed an increase between 2001 and 2003 in Div. 0A but decreased in Div. 1A between 2002 and 2003.

Div. 0B + 1C-1F

The survey biomass index in Div. 1CD was estimated as 69 000 tons in 2003, which is above average for the seven year time series (56 000-78 000 tons).

Although the survey series from 1987-95 is not directly comparable with the series from 1997-2003, the decline in the stock observed in Subarea 1 until 1994 has stopped and the stock seems to be back at the level of the late-1980s and early-1990s.

The mode in the trawl fishery in Div. 1D shifted from 48 cm in 2002 to 50 cm in 2003.

A combined standardized trawl CPUE index from SA 0 and Div. 1CD was stable during 1990–2000 and a standardized trawl CPUE index from Div. 1CD has been stable during 1990-2003.

SA 0 + Div. 1A (offshore) + Div. 1B-1F

Estimation of trawlable one-year-olds in the Greenland Shrimp survey has been steadily increasing since 1996 and the 2000 year-class was the largest in the time series. The 2002 year-class is considered to be an above average. It was noted, that the 1995 year-classes was estimated to be a very strong year-class at age one but it has not shown up in the fishery as a particularly strong year-class.

e) **Precautionary Reference Points**

There was no new information available to allow determination of precautionary reference points.

f) **Research Recommendation**

STACFIS **recommended** that *the investigations of the by-catch of Greenland halibut in the shrimp fishery in Subareas 0 and 1 should be continued and the results should be made available before the assessment in 2005.*

STACFIS **recommended** that *the CPUE series and catch-at-age for Greenland halibut from Div. 0B should be updated.*

2. **Greenland Halibut (*Reinhardtius hippoglossoides*) in Division 1A Inshore** (SCR Doc. 99/25, 04/18, 51; SCS Doc. 04/14)

a) **Introduction**

The main fishing grounds for Greenland halibut in Div. 1A are located inshore. The inshore landings in Div. 1A were around 7 000 tons in the late-1980s then increased until 1998 when the landings were almost 25 000 tons. Since 1999 landings have declined and were 16 900 tons in 2001 but increased again to 20 000 tons in 2002, and remained at the same level in 2003 (Fig. 2.1).

Recruitment to the inshore stock is dependent on immigration from the offshore nursery grounds and the spawning stock in Davis Strait. Only sporadic spawning seems to occur in the fjords, hence the stock is not considered self-sustainable. Based on tagging data the fish remain in the fjords, and do not appear to contribute back to the offshore spawning stock. This connection between the offshore and inshore stocks implies that reproductive failure in the offshore spawning stock for any reason will have severe implications on the recruitment to the inshore stocks.

Landings ('000 tons) in Div. 1A inshore are as follows:

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Recommended TAC							7.9	7.9	7.9	na
Disko Bay[1]	7.4	7.8	8.6	10.7	10.6	7.6	7.1	11.7	11.6	
Recommended TAC							6.0	6.0	6.0	na
Uummannaq	7.2	4.6	6.3	6.9	8.4	7.6	6.6	5.4	5.0	
Recommended TAC							4.3	4.3	4.3	na
Upernavik	3.3	4.8	4.9	7.0	5.3	3.8	3.2	3.0	3.9	
Unknown[2]	-	-	-	-	-	-	2.2			
STATLANT 21A	17.0	17.3	20.8	19.7	24.3	21.1[3,4]	17.1[3,4]	19.9[3]	21.5[3]	
STACFIS	17.9	17.3	19.8	24.6	24.3	21.0	16.9	20.1	20.5	

na no advice.
[1] Formerly named Ilulissat.
[2] Landings from unknown areas within Div. 1A.
[3] Provisional. Landings data from 2000 are likely to be underestimated by 2 000 tons.
[4] Includes catches from the offshore area.

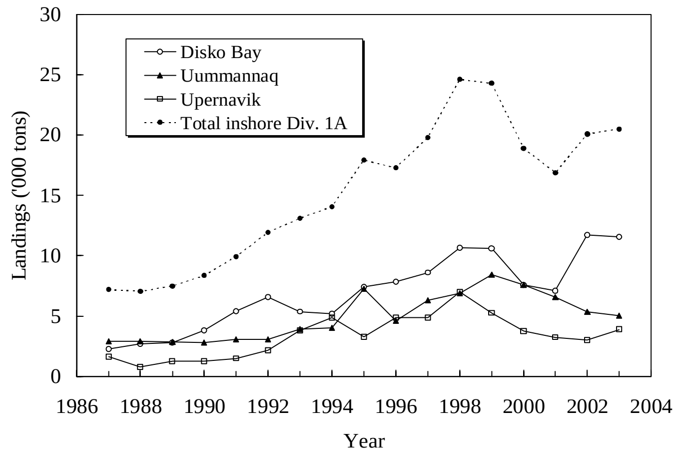


Fig. 2.1. Greenland halibut in Div. 1A inshore: landings by area.

This fishery takes place in the inner parts of the ice fjords at depths between 500 to 800 m. Longlines are set from small boats, or in winter through the ice. Since the mid-1980s gillnets were used in the fishery, but a combination of lower price of gillnet caught fish and local bans on this gear caused this fishery to decrease during the last decade. A total ban on gillnets has been in force since 2000, although dispensation is presently given to a gillnet fishery at Ilulissat in Disko Bay. Dispensations were also given to a gillnet fishery in the outer parts of the fjords in Uummannaq and Upernavik in 2002. In 2003 the areas of dispensation from gillnet ban were increased, and authority to lay down local rules have been given to the Uummannaq and Upernavik municipalities. The minimum mesh size allowed is 110 mm (half meshes).

There are no regulations on landings, but from 1998 a fishery licence has been required to land Greenland halibut. The total number of licenses is about 1 100 which involves about 200 large vessels and an unknown number of smaller boats.

The inshore fishery in Div. 1A is mainly located in three areas: Disko Bay (69°30'N-70°N), Uummannaq (70°30'N-72°N) and Upernavik (72°30'N-75°N), which are separately dealt with in the following:

Disko Bay. The Greenland halibut fishery is conducted in, and in front of an ice fjord in the immediate vicinity of Ilulissat town, and in an ice fjord Torssukattaq, north of Ilulissat.

The landings in Disko Bay increased from about 2 300 tons in 1987 to a high level of about 10 500 tons in 1998. Thereafter landings declined to 7 000 tons in 2001. In 2002 landings increased to record high 11 700 tons, and in 2003 landings were 11 600 tons.

Uummannaq. The area consists of a large system of ice fjords where the fishery is conducted. The main fishing ground is in the southwestern part of the fjord system. During earlier times Qarajaqs Ice fjord was the main fishing area but during the last decade the fishery spread further north to include Sermilik and Itiviup ice fjords.

Landings increased from a level of 2 000 tons before 1987 to a record high in 1999 of 8 425 tons. The landings declined to 5 400 tons in 2002 and further to 5 000 tons in 2003.

Upernavik. The northernmost area consists of a large number of ice fjords. The main fishing grounds are Upernavik and Giesecke ice fjords (up to 73°45'N). New fishing grounds around Kullorsuaq in the northern part of the area have been exploited recently.

The landings in the Upernavik area increased steadily from about 1 000 tons in the late-1980s to about 4 000 tons in 1995 and reached the highest on record in 1998 at 7 000 tons (Fig. 2.1). Landings gradually decreased since then to 3 000 tons in 2002. In 2003 landings increased again to 3 900 tons.

b) **Input Data**

i) **Commercial fishery data**

Landings data available at the time of the assessment were preliminary, however, they were considered reliable. Length distributions were available from longlines and gill nets from the summer and winter fisheries in Disko Bay and Uummannaq.

Length measurements (Fig. 2.2) of the commercial longline landings from 1993 to 2004 in Disko Bay and Uummannaq, and from 1993 to 2002 in Upernavik indicated that the fisheries take place on smaller sub-components of the stock, as size distribution differs substantially between summer and winter.

Mean length in Disko Bay has been relatively stable in the summer fishery since 1993. Trend in the winter fishery was increasing overall until 2001, except for winter 2000 when weather conditions prevented the traditional fishery. Mean length in the winter fishery decreased from 2002 to 2004, but is still at the average level for the period 1993-2001. In Uummannaq, a decreasing trend in mean length was observed until 1999 for the summer fishery, but this has stabilized since then. In the winter fishery mean length was relatively stable up to 2001. In the winter of 2002 mean length increased sharply but decreased again in 2003 and remained at the same level in 2004.

In Upernavik, the mean length has varied but an overall negative trend was observed until 1999, especially in the winter fishery where the reduction was statistically significant. From 1999-2002 the mean length has been stable around 62 cm in both the winter and summer fisheries. No data has been obtained from the commercial longline fishery since 2002 in Upernavik.

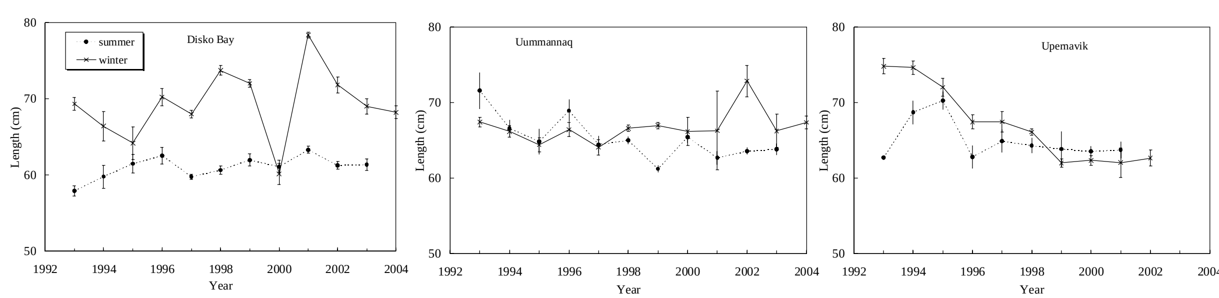


Fig. 2.2. Greenland halibut in Div. 1A inshore: mean length of Greenland halibut in commercial longline catches from Ilulissat, Uummannaq and Upernavik with 95% CI.

In recent years the age composition has changed towards younger age groups especially in Upernavik. In Disko Bay and Uummannaq age composition in the catches has stabilized at 50 to 75% fish being 10 years and younger.

Logbooks are not mandatory. However, in 1999 logbooks were introduced on a voluntary basis. Available logbooks constitute an insignificant part of the fishery (<1%), and data are thus too scarce to be used in the assessment. Earlier attempts to estimate fishing effort showed a significant correlation between effort (expressed as fishing days) and landings.

ii) **Research survey data**

In 1993 a longline survey program for Greenland halibut was initiated for the inshore areas, Disko Bay, Uummannaq and Upernavik. The surveys have been conducted annually covering two of the three areas in rotation, with approximately 30 fixed stations in each area. In 2003 only the Uummannaq area was covered. Standardised CPUE for Uummannaq has been decreasing from 1999 to 2003 (Fig. 2.3).

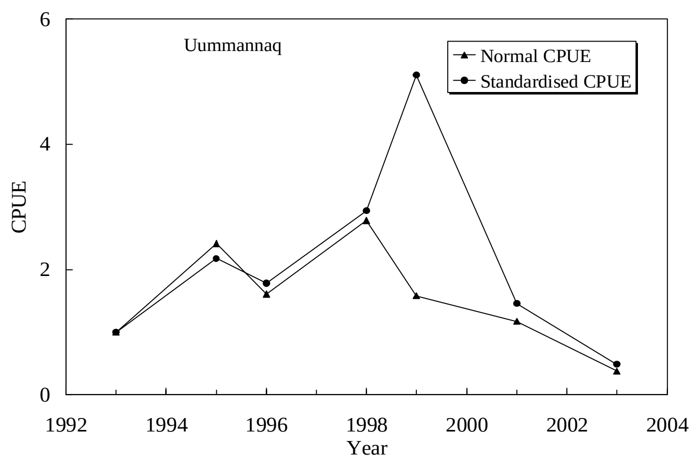


Fig. 2.3. Greenland halibut in Div. 1A inshore: normal and standardised CPUE from longline surveys in Uummannaq 1993-2003

Since 2001 gillnet surveys have been carried out in Disko Bay. CPUE from the gillnet surveys have decreased from 2001 to 2002, and have remained at the same level in 2003 (Fig. 2.4). However the area covered by the gillnet surveys was larger in 2002 and 2003 compared to that in 2001.

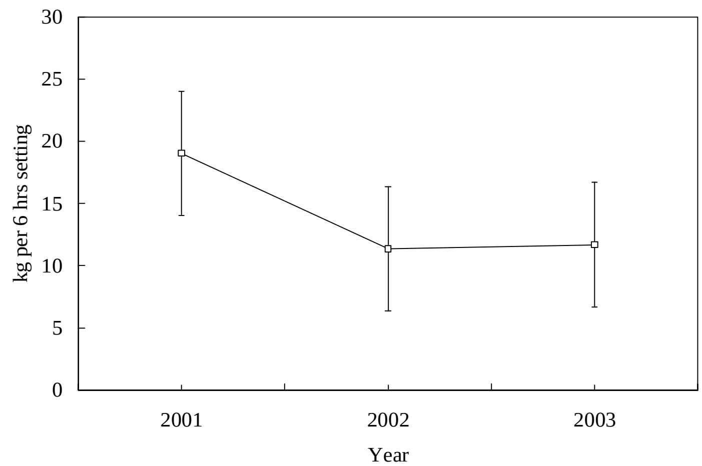


Fig. 2.4 Greenland halibut in Div. 1A inshore: CPUE from gillnet survey Disko Bay 2001-2003

Since 1988 annual trawl surveys have been conducted with a shrimp trawl off West Greenland between 59°N and 72°30'N from the 3-mile offshore line to the 600 m depth contour line. Since 1991 the area inshore of the 3-mile line in Disko Bay has been included. Standardized recruitment indices based on the survey were presented as catch-in-numbers per age per hour, for both the offshore and inshore nursery areas (Fig. 2.5). The index was recalculated in 2003 using hauls from depths >300 m only. The recalculations resulted in an increase in the values, but the overall trends in the series did not change. The number of one-year-old of the 2002 year-class offshore was above average, while it was the second largest in the time series in Disko Bay.

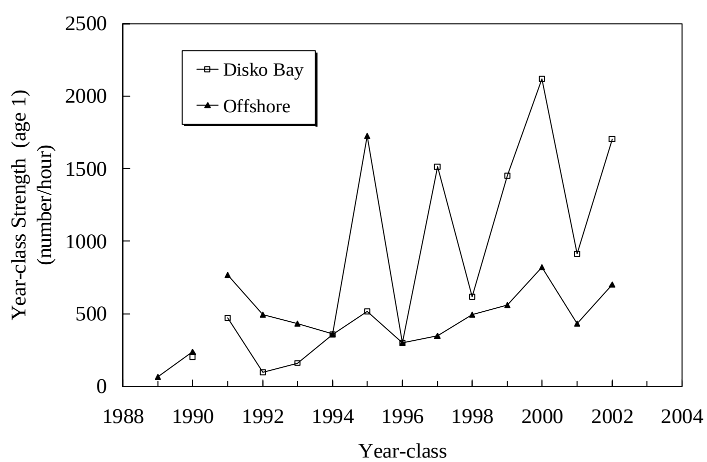


Fig. 2.5 Greenland halibut in Div. 1A and 1B: recruitment at age 1 on nursery grounds.

iii) **Biological studies**

A review of the tagging experiments at West Greenland in the period 1986-98 was given in the 1999 assessment (SCR Doc. 99/25). Tagging of inshore Greenland halibut in Div. 1A has continued since 1999. There have been few tag-returns since then thus no new analysis has been carried out.

c) **Assessment Results**

General comment. Landing data, biological data (mean length and age) from the fishery and information from longline and gillnet surveys were available. The lack of information on fishing effort makes it difficult to evaluate trends in landings relative to stock biomass or fishing effort.

Exploitation of younger age groups has increased considerably for all areas in the past 10-15 years.

Disko Bay. Indices of abundance have been relatively stable since 1993. A new gillnet survey (2001-2003) shows stable catch rates over the last two years. Mean length in commercial catches shows an overall stability over the entire time series. Recruitment indices from Disko Bay and offshore areas suggest high 1995 and onward year-classes, which might benefit the fishery in future years.

Uummannaq. Abundance indices indicate an increase in abundance until 1999, but have since 2001 decreased significantly. Survey results indicate a decrease in abundance since 2001, and during the same period landings declined. However, mean lengths from both the surveys and the fishery are relatively stable over the entire period, indicating that the decrease in catch rates is for all lengths groups.

Upernavik. Since no surveys and sampling from landings has been conducted in Upernavik area recently, there is no basis to evaluate the state of Greenland halibut stocks in that area.

Information from the fishing industry and fishermen about the fishery in 2002 and 2003 suggests that: the increase in landings in Disko Bay in recent years is a result of a rise in effort. Gillnet vessels from Uummannaq participate in the fishery in Torssukattaq in Disko Bay and thus shifted effort from Uummannaq to Disko Bay. In Upernavik 2002 several 25-35 ft vessels were lost in a fire, and 4 of the larger vessels, normally fishing Greenland halibut, shifted to a new fishery for snow-crab. Effort was thus reduced in Upernavik in 2002, the increase in landings 2003 suggests however that effort has increased during last year.

d) **Reference Points**

Precautionary reference points could not be given.

e) **Research Recommendations**

It was noted that in 2001 an annual gill net survey with small mesh net was started in the Disko Bay in order to estimate relative year-class strength of pre recruits to the fishery. STACFIS **recommended** that *a study should be conducted to calibrate the gill net survey to the longline survey in order to allow use of the whole time series for Greenland halibut in Disko Bay.*

Voluntary logbooks were introduced in 1999 but have only covered a small proportion of the landings due to poor return rates. STACFIS **recommended** that *authorities consider means to ensure a higher return rate of inshore logbooks from the Greenland halibut commercial fishery in Div. 1A.*

STACFIS **recommended** that *investigations of by-catch of juvenile Greenland halibut in the commercial shrimp fishery in Subareas 0+1 be continued.*

STACFIS **recommended** that *the discard rate of 'small Greenland halibut' in Div. 1A be investigated.*

3. **Roundnose Grenadier (*Coryphaenoides rupestris*) in Subareas 0 and 1** (SCR Doc. 04/19; SCS Doc. 04/10, 14)

a) **Interim Monitoring Report**

A total catch of 46 tons, taken as by-catch in the fishery for Greenland halibut, was reported from 2003 compared to 34 tons in 2002 (Fig. 3.1).

Recent catches and TACs ('000 tons) are as follows:

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Recommended TAC	8.0	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf
STATLANT 21A	0.31[2]	0.12[3]	0.15[4]	0.03[5]	0.04	0.09[1]	0.06[1]	0.01[1]	0.01[1]	
STACFIS	0.31[2]	0.12[3]	0.15[4]	0.03[5]	0.04	0.09	0.06	0.03	0.05	

[1] Provisional.
[2-5] Includes roughhead grenadier from Div. 1A misreported as roundnose grenadier: 24[2] tons, 30[3] tons, 28[4] tons, 3[5] tons.

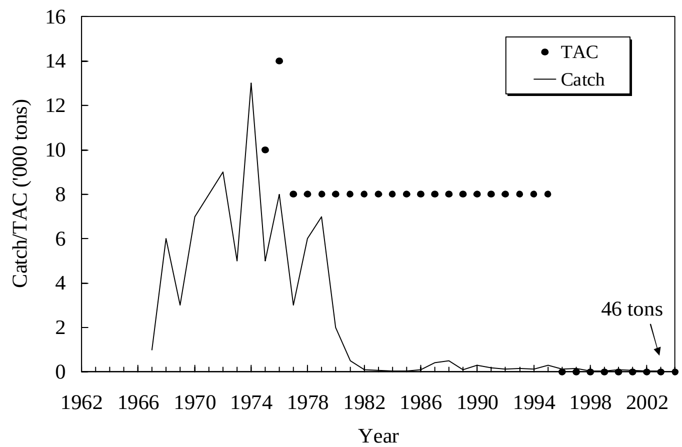


Fig. 3.1. Roundnose grenadier in Subareas 0+1: catches and TACs

In the survey by Greenland in 2003, the biomass in Div. 1CD was estimated at 774 tons, which is the second lowest on record (Fig. 3.2).

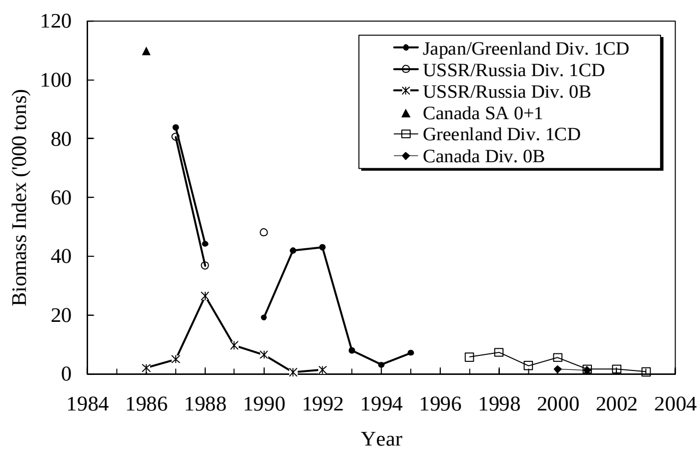


Fig. 3.2. Roundnose grenadier in Subareas 0+1: biomass estimates from USSR/Russian, Japan/Greenland, Greenland and Canadian surveys in Div. 0B and Div. 1CD.

The stock of roundnose grenadier is still at a very low level observed since 1993.

Exploitation level is considered to be low in recent years.

4. **Demersal Redfish (*Sebastes* spp.) in Subarea 1** (SCR Doc. 04/18, 19, 23, 28, SCS Doc. 04/10, 14)

a) **Interim Monitoring Report**

There are two redfish species of commercial importance in Subarea 1, golden redfish (*Sebastes marinus* L.) and deep-sea redfish (*Sebastes mentella* Travin). 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 Subarea 1 have been less than 1 000 tons since 1987 (Fig. 4.1). Redfish is mainly taken as by-catch by the offshore shrimp trawlers; reported by-catches in 2002 and 2003 were 422 tons and 312 tons, respectively, however, this must be considered an underestimation. Smaller vessels take inshore a minor amount mainly of golden redfish, and in 2002 and 2003 landing was reported to 65 tons and 166 tons, respectively.

Recent catches (‘000 tons) and TACs are as follows:

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
TAC	19	19	19	19	19	19	19	19	19	8	8
STATLANT 21A	1	0.9	0.9	1	0.9	0.8	0.6[1]	0.3[1]	0.5[1]	0.5[1]	
STACFIS	1	0.9	0.9	1	0.9	0.8	0.6	0.3	0.5	0.5	

[1] Provisional.

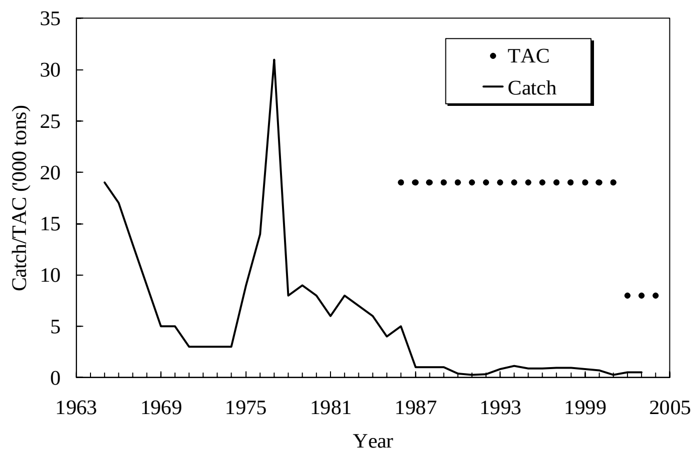


Fig. 4.1. Redfish in Subarea 1: catches and recommended TAC.

In view of dramatic declines in survey biomass indices of golden redfish (Fig. 4.2), deep-sea redfish (≥17 cm) (Fig. 4.3) and in abundance indices of juvenile redfish (Fig. 4.4) to extremely low levels, along with significant reduction in fish sizes, STACFIS concluded that the stocks of golden and deep-sea redfish in Subarea 1 remain severely depleted and there are no signs of any recovery in the short term.

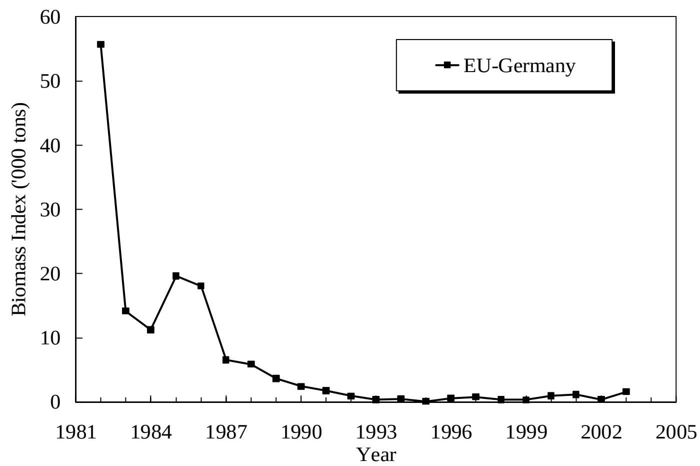


Fig. 4.2. Golden redfish in Subarea 1: survey biomass index.

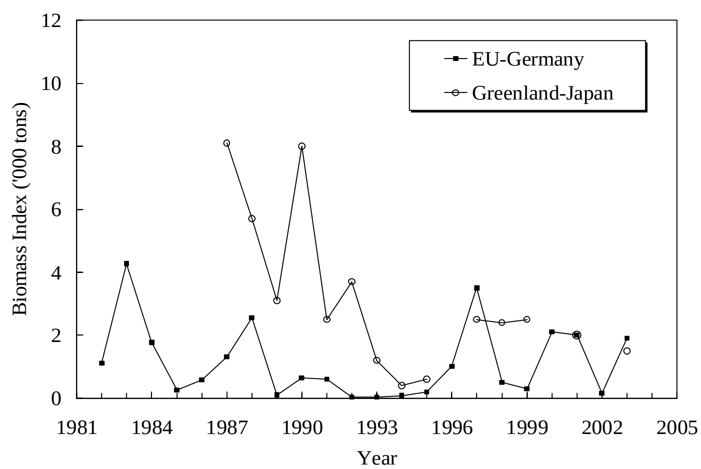


Fig. 4.3. Deep-sea redfish in Subarea 1: survey biomass index.

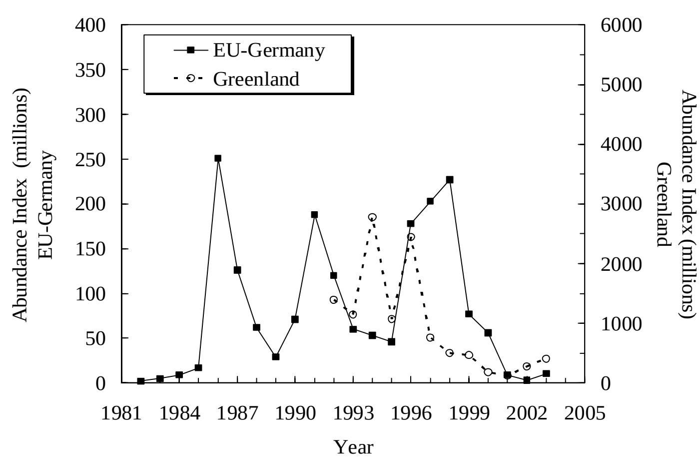


Fig. 4.4. Juvenile redfish (<17 cm) (deep-sea redfish and golden redfish combined) in Subarea 1: survey abundance indices. The Greenland survey data include the entire length range, but very few fish were >16 cm.

b) **Research Recommendations**

STACFIS **recommended** that *the quantity of redfish discarded in the shrimp fishery in Subarea 1 be quantified.*

STACFIC **recommended** that *determination of maturity of redfish caught during surveys in Subareas 1 be carried out.*

5. **Other Finfish in Subarea 1** (SCR Doc. 04/18, 19, 28; SCS Doc. 04/14)

a) **Interim Monitoring Report**

The resources of other finfish in Subarea 1 are mainly Greenland cod (*Gadus ogac*), American plaice (*Hippoglossoides platessoides*), Atlantic wolffish (*Anarhichas lupus*), spotted wolffish (*A. minor*) thorny skate (*Raja radiata*) (Fig. 5.1), lumpsucker (*Cyclopterus lumpus*), Atlantic halibut (*Hippoglossus hippoglossus*) and sharks.

Nominal reported catches (tons) are as follows:

Species	1994	1995	1996	1997	1998	1999	2000[1]	2001[1]	2002[1]	2003[1]
Greenland cod	1 854	2 526	2 117	1 729	1 717	1 899	931	1 152	939	1 288
Wolffish	100	51	47	68	30	33	59	75	118	393
Atlantic halibut	38	23	34	22	22	45	9	1	1	0
Lumpfish	607	447	425	1 158	2 143	3 058	1 211	3 216	5 872	8 832
Sharks	34	46	135	nd	nd	nd	nd	nd	nd	0
Non-specified finfish	643	618	609	1 269	588	nd	769	589	584	475
Sum	3 276	3 711	3 367	4 246	4 500	5 035	2 979	5 033	7 437	10 988

[1] Provisional/estimated.
nd No data.

Despite gradually increasing recruitment since the 1980s, no increase in Atlantic wolffish SSB has been observed. Recruitment of American plaice remains below average. Thorny skates have exhibited declines since the 1980s and the biomass indices remained at very low levels in 2003. For Spotted wolffish, biomass indices in Greenland survey has recently shown an increasing trend, however, at the same time indices from EU-Germany surveys showed a decreasing trend.

Based on the above STACFIS has concluded that the status of these stocks remains severely depleted.

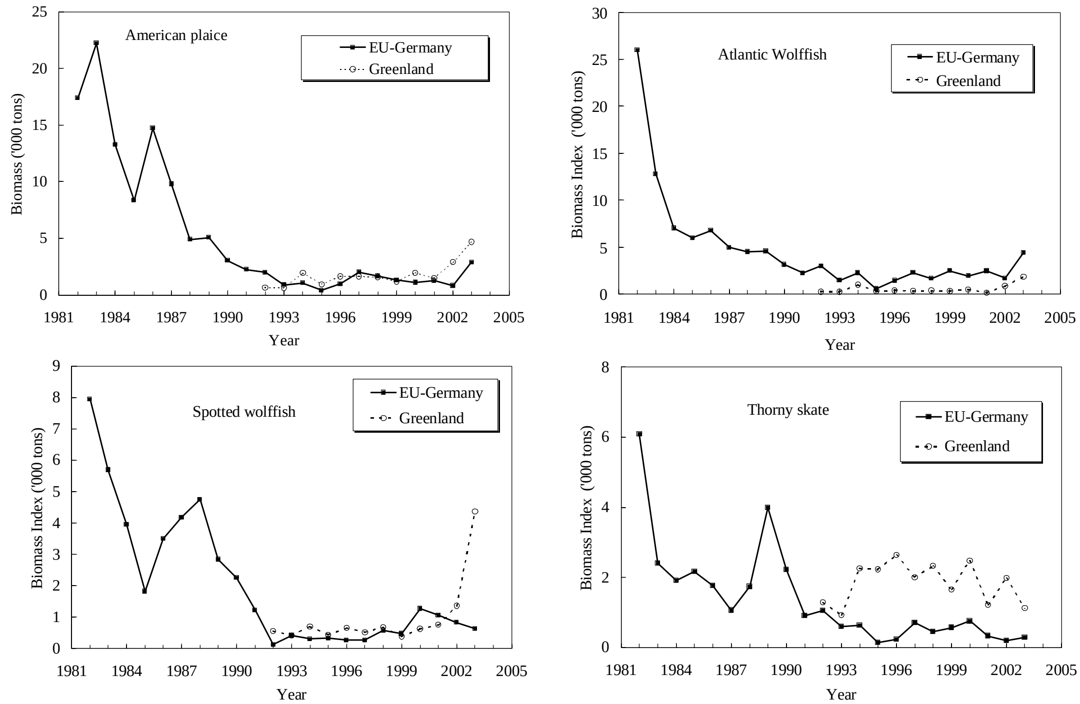


Fig. 5.1. Finfish in Subarea 1: survey biomass indices of various finfish species.

Taking the poor stock status of American plaice, Atlantic wolffish, spotted wolffish and thorny skate into account, even low by-catch in the shrimp fishery might be sufficient to retard the recovery potential of these stocks. The continued failures of the recruits to rebuild the spawning stocks indicate high mortality rates in excess of the sustainable level. The probability of stock recovery would be enhanced by minimizing the by-catch of finfish in Subarea 1 to the lowest possible level.

b) **Research Recommendations**

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

B. STOCKS ON THE FLEMISH CAP

Environmental Overview

The water mass characteristics of the Flemish Cap area are a mixture of Labrador Current Slope Water and North Atlantic Current Water, this water mass is generally warmer and saltier than the sub-polar shelf waters with a temperature range of 3º to 4ºC and salinities in the range of 34 to 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 to the east, north of the Cap, which then flows southward. To the south, the Gulf Stream flows to the northeast merging with the Labrador Current to form the North Atlantic Current which 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. Recent trends in temperature on the Flemish Cap indicate cold periods during the 1970s, mid-1980s and the late-1980s to the mid-1990s. By 1995 temperatures moderated and were above normal at most depths from 1997 to

2002. Annual surface temperatures during 2003 were about normal, while values at deeper levels were similar to those of 2002, generally above normal. It should be noted that the annual estimates for 2003 were based on only three observations. During the summer of 2003, temperatures directly over the Cap were highly variable, while adjacent areas showed significant positive anomalies. Near bottom temperatures over the Cap were generally around 3.5ºC, which was slightly below normal in some areas particularly on the western side of the Cap. The time series of salinity anomalies show fresher-than-normal conditions from 1970 to 1975. Negative salinity anomalies also occurred during the mid-1980s and mid-1990s, however, the amplitude was much smaller than the great salinity anomaly of the early-1970s. The trend in salinity values during the latter half of the 1990s ranged from slightly above normal at the surface to near-normal at deeper depths. Annual salinity anomalies in 2003 continued the increase noted in 2002 over all depths reaching >0.5 above normal at the surface. Both the measured currents and the geostrophic estimates from the CTD measurements confirm the existence of the general anticyclonic circulation around the Flemish Cap during the summer of 2003.

6. Cod (*Gadus morhua*) in Division 3M (SCR Doc. 04/21, 53; SCS Doc. 04/3)

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 by-catch in the directed redfish fishery by Portuguese trawlers. Small amounts of cod were taken as by-catch in the shrimp fishery by Canada and Norway. The by-catch of cod in the past Russian pelagic fishery for redfish was also low. The fishery has been under moratorium since 1999.

ii) Nominal catches

From 1963 to 1979, the mean reported catch was 32 000 tons, with high variations between years. Reported catches declined after 1980, when a TAC of 13 000 tons 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 tons, 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 by-catch of the redfish fishery.

Recent TACs and catches ('000 tons) are as follow:

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Recommended TAC	0	11	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf
STATLANT 21A	3.2	2.3	1.5	0.5	0.0	0.0[1]	0.1[1]	0.0[1]	0.0[1]	
STACFIS	10.4	2.6	2.9	0.7	0.4	0.1	0.0	0.0	0.0	

[1] Provisional.
ndf No directed fishery.

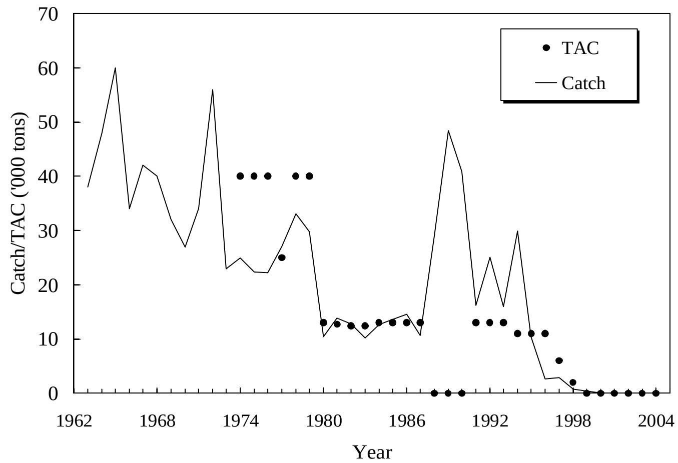


Fig. 6.1. Cod in Div. 3M: catches and TACs, catch figures include estimates of misreported catches since 1988.

b) **Input Data**

i) **Commercial fishery data**

Length and age compositions of the 2002 and 2003 commercial catches were not available. That information is available for the1973 to 2001 period.

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 tons in 1978 and a minimum of 8 000 tons 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 tons in 1989; a minimum 2 500 tons in 1992, and a decline from 8 300 tons in 1995 to 700 tons in 1996. The estimates in 2001 and 2002 were 800 and 700 tons, respectively.

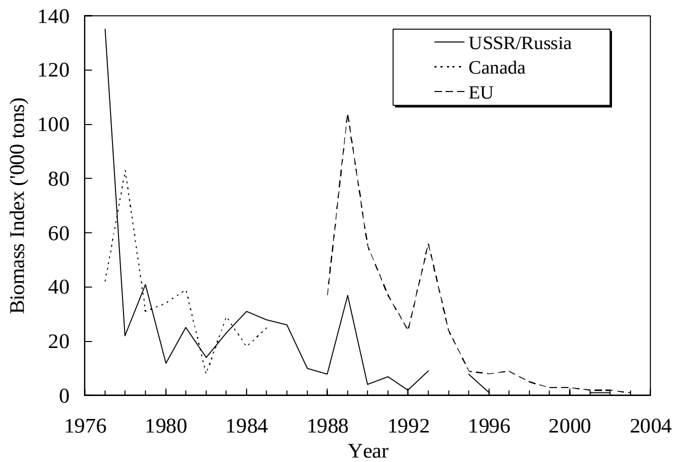


Fig. 6.2. Cod in Div. 3M: total biomass estimates from surveys.

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 tons. Biomass estimates for cod, American plaice and redfish in the Canadian survey and the EU survey in 1996 were similar.

Stratified-random bottom trawl surveys were conducted by the EU from 1988 to 2003. This survey also showed a decline in trawlable biomass from a peak of 104 000 tons in 1989 to 24 000 tons in 1992, an increase to 56 000 tons in 1993, a decrease to a 8 800-9 000 tons level in the 1995 to 1997 period, and a further decrease to a level around 2 500 tons in the 1999-2002 period. The level observed in 2003 is still lower. The survey indicates poor recruitment of the 1992 to 1994 year-classes. Recruitment indices for the 1995 and subsequent year-classes were even lower at all observed ages. The abundance at age 1 in the 2003 survey has been the highest observed after 1995, however that level is still very low and it is not a signal for stock improvement.

The peak stock biomass in 1989 indicated by both EU and Russian surveys were produced by the relatively abundant 1985 and 1986 year-classes at ages 4 and 3 years, respectively. The biomass level observed in 2001-2002 by the EU survey is 22 times below the observed mean in the 1988-1993 period. The equivalent figure for the Russian survey is 15 times. The biomass level further decreased according to the EU survey in 2003.

c) **Estimation of Parameters**

Last sequential population analysis (XSA) was carried out for ages 1 to 8+ and years 1973 to 2001. Catch-at-age data were not available for 2002 and 2003, and it impedes further analyses. Catch-at-age data for most recent years had become imprecise because of the low catch, scarce sampling, and the use of the EU survey age-length keys.

The indices of abundance from the 2003 EU survey were used to estimate absolute figures for the SSB and to judge its current level in relation to the 14 000 tons accepted as a preliminary B_{lim} for this stock. This transformation in the scale of the figures, from survey indices to absolute SSB values, involves catchability-at-age parameters, which were calculated based on previous XSA analysis using 1973 to 1999 data, because the catches were the highest during that period and, consequently, provided the best fit. This method will be useful as a criterion to reopen the fishery, because it provides the SSB estimate and the probability for such value being above or below B_{lim}.

d) **Assessment Results**

Estimates of the current spawning stock biomass indicate that its level is well below B_{lim}. Besides that, the recruitments observed in most recent years have been very poor, and there is no sign that any abundant recruitment has taken place. The stock continues to be collapsed.

e) **Reference Points**

A SSB of 14 000 tons has been identified as a preliminary B_{lim} for this stock.

7. **Redfish (*Sebastes mentella* and *Sebastes fasciatus*) in Divisions 3M** (SCR Doc. 04/21, 31; SCS Doc. 04/3, 5, 9)

a) **Interim Monitoring Report**

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. STACFIS evaluates the status of the Div. 3M beaked redfish stock, regarded as a management unit composed of populations of two very similar species.

The redfish fishery in Div. 3M increased from 20 000 tons in 1985 to 80 000 tons in 1990, falling continuously since then till 1998/99, when a minimum catch of around 1 000 tons was recorded (Fig. 7.1). Catch increased to a somewhat higher level during 2000-2002 but in 2003 declined again and did not reach 2 000 tons.

From 1995 onwards redfish by-catch in weight in Div. 3M shrimp fishery fell to low levels but since 2001 has been increasing again, reaching 1 006 tons in 2003. Translated to numbers this represents an increase from an annual by-catch level of 3.4 millions of redfish, recorded in 1999-2000, to 21.9 millions in 2001-2003.

Recent TACs, catches and by-catch ('000 tons) are as follows:

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Recommended TAC	20	20	20	20	10	5	5	5	5	5
STATLANT 21A	6.7	1.1	0.4	1.0	0.8	3.8[1]	3.2[1]	3.0[1]	0.9[1]	
STACFIS Catch	13.5	5.8	1.3	1.0	1.1	3.7	3. 2	2.9	1.9	
By-catch	0.37	0.55	0.16	0.19	0.10	0.10[2]	0.74[2]	0.77[2]	1.00[2]	
Total catch[3]	13.9	6.4	1.5	1.2	1.2	3.8	3.9	3.7	2.9	

1 Provisional.
2 In shrimp fishery (D. Kulka and J. Firth, pers. comm., 2000-2004).
3 Total STACFIS + by-catch.

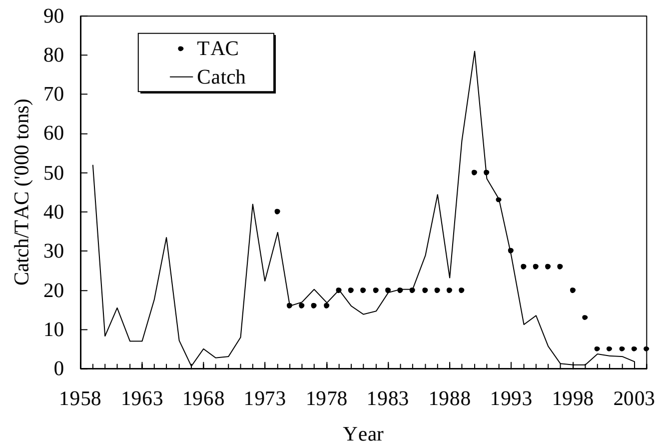


Fig. 7.1. Redfish in Div. 3M: catches and TACs.

The EU bottom trawl survey on the Flemish Cap has been conducted annually in June-July since 1988, down to the 731m-depth contour. In June 2003 a new Spanish research vessel, the RV *Vizconde de Eza*, replaced the RV *Cornide de Saavedra* that has carried out the whole EU survey series, with the exception of the years of 1989 and 1990. The first part of the calibration between the old and new RVs of the Flemish Cap EU survey has been carried out in July 2003, with both vessels fishing on Flemish Cap with the same Lofoten gear used throughout the series, and will be completed next July 2004. At this stage the 2003 survey results are from the new research vessel.

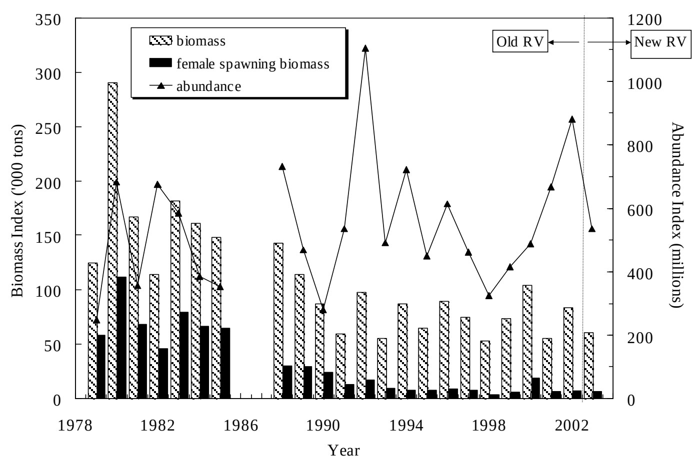


Fig. 7.2. Redfish in Div. 3M: survey biomass, female spawning biomass and abundance from Canadian (1979-85) and EU (1988-2003) surveys. Note: vertical line at year 2003 indicates when new research vessel came into operation.

Despite the observed declines in the EU survey indices (Fig. 7.2), 2003 data on the length structure of the commercial catch and survey abundance at length suggests stability in the Div. 3M beaked redfish exploitable and spawning stock.

b) **Research Recommendations**

STACFIS **recommended** that *an update of the Div. 3M redfish by-catch 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.*

8. American Plaice (*Hippoglossoides platessoides*) in Division 3M (SCR Doc. 04/21, 50; SCS Doc. 04/5, 9)

a) Introduction

On the Flemish Cap the stock of American plaice mainly occurs at depths shallower than 600 m. Catches of Contracting Parties, in the recent years, are mainly by-catches in trawl fisheries directed to other species in this Division.

Nominal catches increased during the mid-1960s, reaching a peak of about 5 341 tons in 1965, followed by a sharp decline to values less than 1 100 tons until 1973. Since 1974, when catches of this stock became regulated, catches ranged from 600 tons (1981) to 5 600 tons (1987). After that catches declined to 275 tons in 1993, caused partly by a reduction in directed effort by the Spanish fleet in 1992. Catch for 2003 was estimated to be 131 tons.

From 1979 to 1993 a TAC of 2 000 tons was in effect for this stock. A reduction to 1 000 tons was agreed for 1994 and 1995 and a moratorium was agreed to thereafter (Fig. 8.1).

Recent catches and TACs ('000 tons) are as follows:

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Recommended TAC	1	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf
STATLANT 21A	0.2	0.1	0.1	0.2	0.2	0.3[1]	0.2[1]	0.2[1]	0.1[1]	
STACFIS	1.3	0.3	0.2	0.3	0.3	0.1	0.1	0.1	0.1	

[1] Provisional.
ndf No directed fishing.

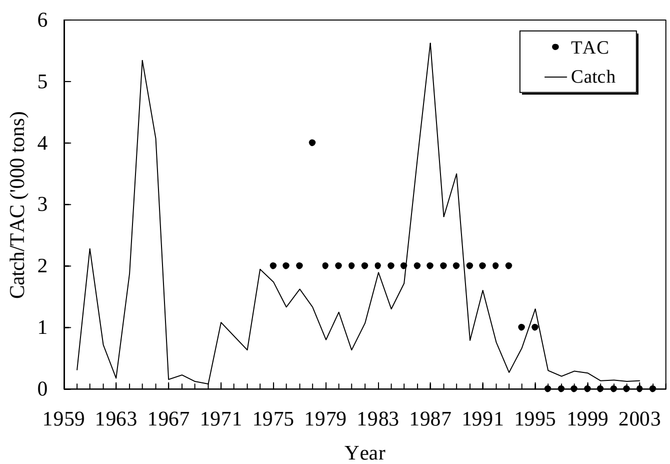


Fig. 8.1. American plaice in Div. 3M: STACFIS catches and agreed TACs.

b) **Input Data**

i) **Commercial fishery data**

EU-Portugal and EU-Spain provided length composition data for the 2003 trawl catches. EU-Portugal length composition was used to estimate the length and age compositions for the total catch (131 tons). The 1991 year-class (age 12 in 2003) was the most abundant one.

Mean weights-at-age in the catch showed a decreasing trend from 1998 to 2003 for ages older than 8, being slightly below the average in 2003.

ii) **Research survey data**

The series of research surveys conducted by the EU since 1988 was continued in July 2003. The USSR/Russian survey series started in 1972 ending in 1993. From 1972 to 1982 the survey series was post-stratified because surveys were conducted using fixed-station design. Since 1983 USSR/Russia adopted the stratified random survey method. A new Russian survey was carried out in 2001 and 2002. Canada conducted research vessel surveys from 1978 to 1985, and a single survey was conducted in 1996.

A continuous decreasing trend in abundance and biomass indices was observed from the beginning of the EU survey series. The 2000 abundance and biomass were the lowest of the series and remained at very low levels in 2003. Though with a higher variability, USSR/Russian survey series also showed a decreasing trend during the 1986-93 period. Abundance and biomass from the Russian survey in 2001 were the lowest of the series. Canadian survey biomass and abundance between 1978 and 1985 were around 6 700 tons and 10 million fish. Both indices from the Canadian survey in 1996 were at the same level of the ones from the EU survey (Fig. 8.2 and 8.3).

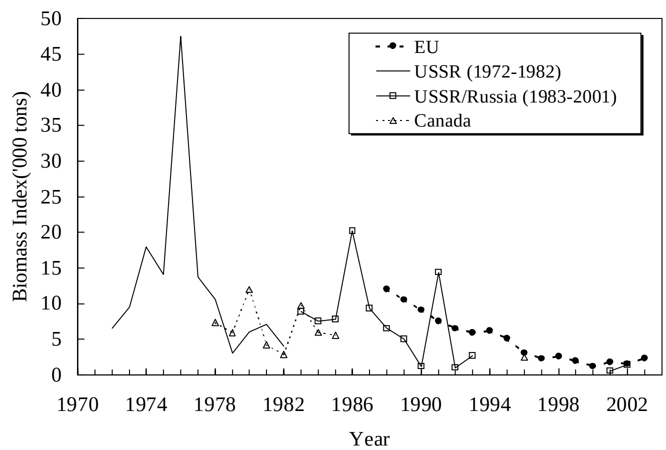


Fig. 8.2. American plaice in Div. 3M: trends in biomass index in the surveys.

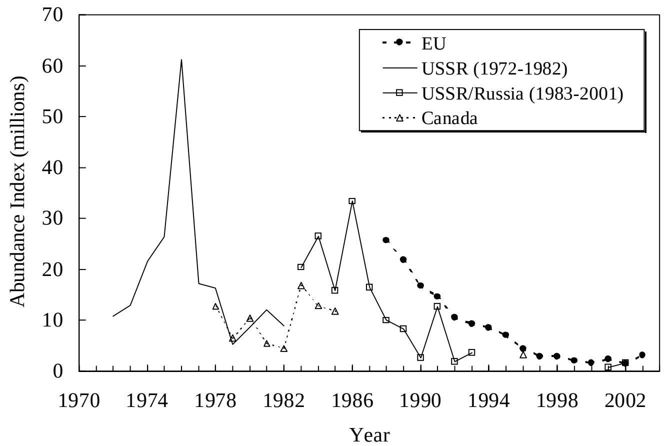


Fig. 8.3. American plaice in Div. 3M: trends in abundance index in the surveys.

Ages 9 to 14 were dominant in the 2003 EU survey. Since 1991 year-class all the year-classes at recruitment (age 3) were very poor as shown by EU survey indices.

In the EU surveys, spawning stock biomass (50% of age 5 and 100% of age 6 plus) has been declining since 1988. A minimum was recorded in 2000.

c) **Estimation of Parameters**

A proxy to fishing mortality is given by the catch and EU survey biomass ratio for ages fully recruited to the fishery (ages 8-11).

A partial recruitment vector for American plaice in Div. 3M was revised assuming flat topped partial recruitment and adjusting a relative mean index-at-age to a general logistic curve. This index was derived by determining the ratio between the 1989-2003 age composition of the catch and American plaice EU survey abundance. Both data sets were standardized to numbers-per-thousand prior to analysis.

An XSA for the most recent period of 1988-2003 was run, using the EU survey data for tuning. Natural mortality was set at 0.2. The month with peak spawning for American plaice in Div. 3M is May and this month was considered for the estimate of the proportion of F and M before spawning. This XSA was accepted by STACFIS.

d) **Assessment Results**

A proxy to fishing mortality (C/B) and XSA fishing mortality declined from the mid-1980s to the mid-1990s (Fig. 8.4), and fluctuated between 0.05 and 0.2 since 1996. F in 2003 estimated by XSA is at the level of the assumed natural mortality.

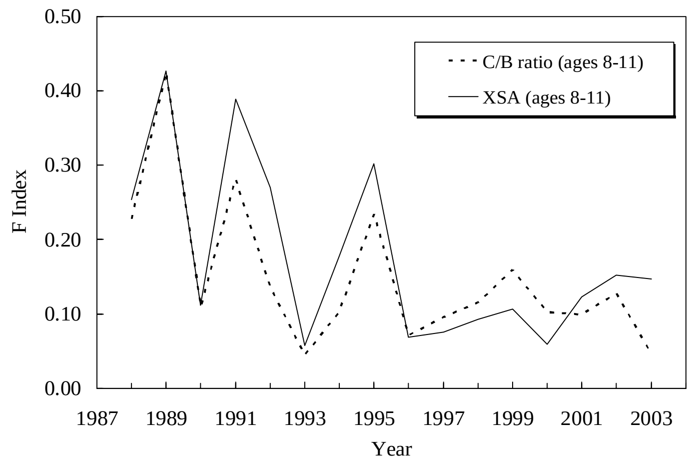


Fig. 8.4. American plaice in Div. 3M: fishing mortality trends: catch/biomass index from EU survey (ages 8-11) and XSA (ages 8-11).

EU survey data and XSA both indicate no sign of recruitment since 1991 with only weak year-classes expected to recruit to the SSB for at least the next five years. Stock biomass and the SSB are at a very low level and there is no sign of recovery, due to consistent year-to-year recruitment failure since the beginning of the 1990s. Although catches have declined to low levels, F is at the level of M, and this is a matter of concern for a stock in a very poor condition and under moratorium (Fig. 8.5).

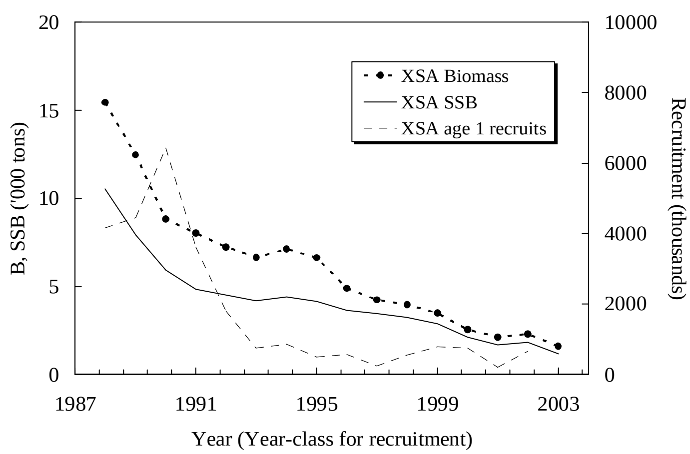


Fig. 8.5. American plaice in Div. 3M: biomass, spawning stock biomass (SSB) and corresponding recruitment from XSA

e) **Reference Points**

Based on the 15 points available from the XSA to examine a stock/recruitment relationship, very poor recruitment occurs at SSB below 5 000 tons (Fig. 8.6).

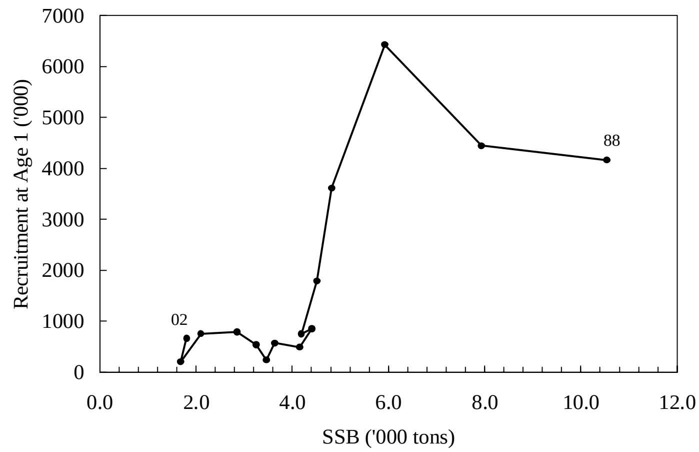


Fig. 8.6. American plaice in Div. 3M: SSB-Recruitment scatter plot.

The following set of parameters was used for the yield-per-recruit analysis: M = 0.2; exploitation pattern described above; a knife edge maturity of 50% at age 5 and 100% at age 6 plus; and an average mean weights-at-age in the catch and in the stock for the period 1988-2003. This analysis gave a $F_{0.1}$ = 0.163 and a F_{max} = 0.355.

C. STOCKS ON THE GRAND BANK

Environmental Overview

The water mass characteristics on the Grand Banks are typical cold-intermediate-layer (CIL) waters which extend to the bottom in northern areas with average bottom temperatures generally <0ºC during spring through to autumn. The winter formed CIL water mass is a reliable index of ocean climate conditions in this area. Bottom temperatures increased to 1º to 4ºC in southern regions and along the slopes of the banks below 200-m depth. 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. In most areas of the Newfoundland Shelf, 2003 was a year of extremes, with very cold spring conditions that moderated by mid-summer and warmed to above normal conditions throughout the remainder of the year. The CIL was below-normal (implying warm conditions) across the Grand Bank for the 6^{th} consecutive year. Time series of bottom temperatures for Div. 3LNO region shows large inter-annual variations and a downward trend that started in 1984 that continued until the early-1990s. The highest temperature in the 25-year record occurred in 1983 when the average temperature was 3.2ºC and the lowest temperature of 0.25ºC occurred in 1990. Recently, temperatures have increased over the lows of the early-1990s with the average bottom temperature during the spring of 1999 and 2000 reaching 2ºC. During the 2001 to 2003, the spatially average spring bottom temperature decreased over the 2000 value to about 1ºC in 2003, the 11^{th} coldest in the 28 year record. On the other hand autumn bottom temperatures in this region, while having decreased by about 1ºC over 1999 values, have remained relatively constant, slightly warmer than normal.

9. Cod (*Gadus morhua*) in Divisions 3N and 3O (SCR Doc. 04/12; SCS Doc. 04/5, 8, 9)

a) Interim Monitoring Report

The cod stock in Div. 3NO has been under moratorium to directed fishing both inside and outside the Regulatory Area since February 1994. Catches have increased steadily since the implementation of the moratorium (Fig 9.1). The total catch of cod for 2003 in Div. 3NO from all fisheries was estimated to be within the range of 4 280 tons and 5 459 tons.

During the last assessment of this stock in 2003, based on an accepted VPA model, total biomass and spawning biomass were estimated to be 6 100 tons and 4 500 tons, respectively. Recent recruitment was also estimated to be extremely low. The fishing mortality averaged over 2000 to 2002 for ages 4 to 6 was 0.32. Deterministic projections conducted in 2003 at F = 0 suggested minimal stock increases in the five year period to 2008.

The spring and autumn Canadian research vessel surveys conducted in 2003 indicated no signs of stock rebuilding in Div. 3N and 3O (Fig. 9.2). This is also reflected in the EU-Spain survey which is restricted to the NRA (Fig. 9.3). Based on recent surveys and increasing catches, it is believed that fishing mortality has not decreased and it is likely has increased substantially in 2003.

Recent TACs and catches ('000 tons) are as follows:

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Recommended TAC	nf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf
STATLANT 21A	0.1	0.1	0.4	0.5	0.9	0.5[1]	0.9[1]	1.2[1]	1.0[1]	
STACFIS	0.2	0.2	0.4	0.5	0.5	1.1	1.3	2.2	4.3-5.5[2]	

[1] Provisional.
[2] In 2003, STACFIS could not precisely estimate the catch.
nf No fishing.
ndf No directed fishery and by-catches of cod in fisheries targeting other species should be kept at the lowest possible level.

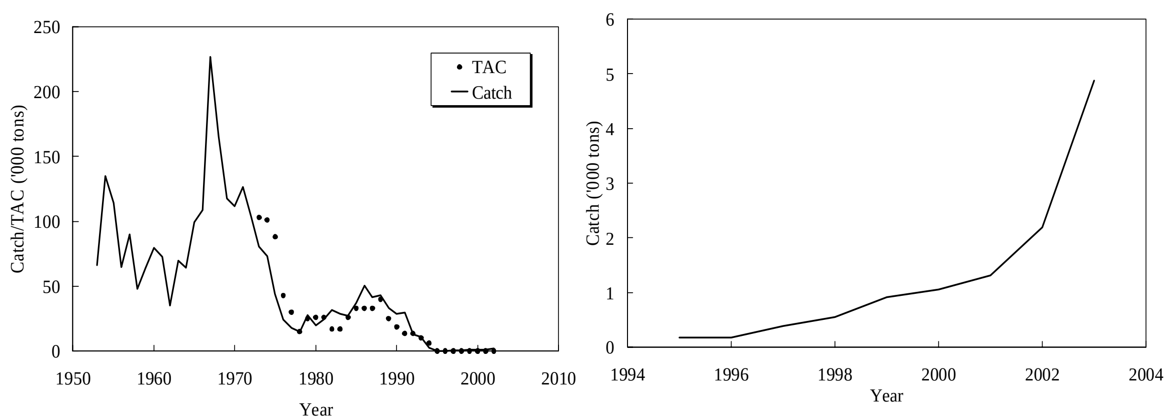


Fig 9.1. Cod in Div. 3NO: total catch and TACs. Panel at right highlights catches during the moratorium on fishing.

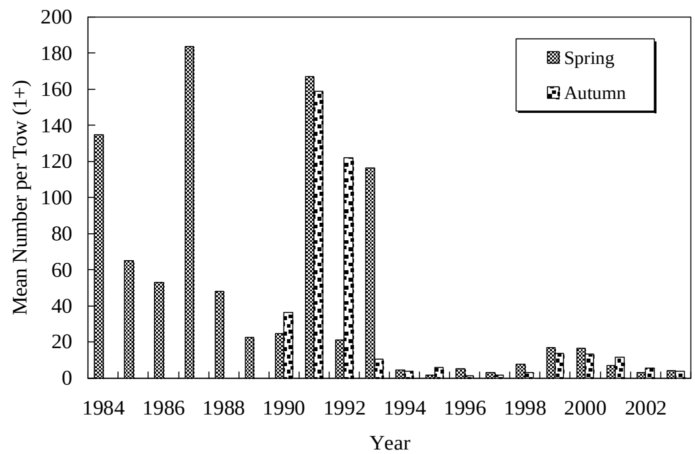


Fig. 9.2. Cod in Div. 3NO: mean number per tow from Canadian spring and autumn research surveys.

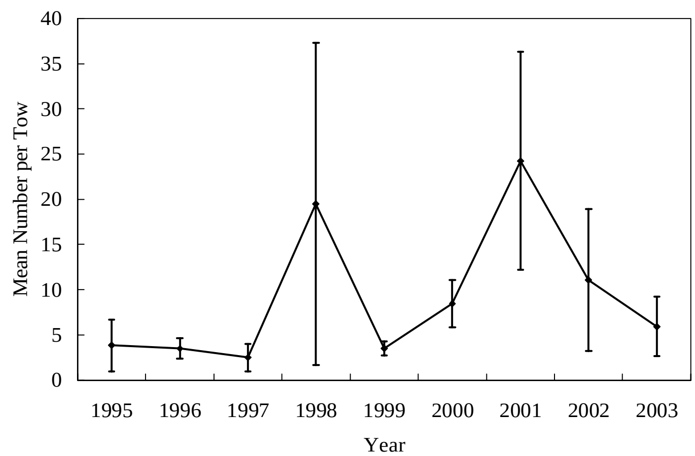


Fig. 9.3. Cod in Div. 3NO: mean number per tow ± 1 standard deviation from EU-Spain survey in NRA.

10. **Redfish (*Sebastes mentella* and *Sebastes fasciatus*) in Divisions 3L and 3N** (SCR 04/08; SCS Doc. 04/3, 5, 9)

a) **Interim Monitoring Report**

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 fasciatu*s). 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.

A total catch of 1 330 tons was estimated for 2003 compared to 1 200 tons in 2002 (Fig. 10.1). The catches were taken as by-catch in the Greenland halibut fisheries for various fleets. By-catch of redfish, taken in the Div. 3L shrimp fishery, was estimated to be about 6 tons in 2003.

Recent nominal catches and TACs ('000 tons) for redfish are as follows:

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Recommended TAC	14	11	11	ndf	ndf	ndf	ndf	ndf	ndf	ndf
STATLANT 21A	2.0	0.5	0.6	0.9	1.8	1.5[1]	0.8[1]	1.0[1]	0.7[1]	
STACFIS	2	0.5	0.6	0.9		1.7	1.4	1.2	1.3	

[1] Provisional.
ndf no directed fishing.

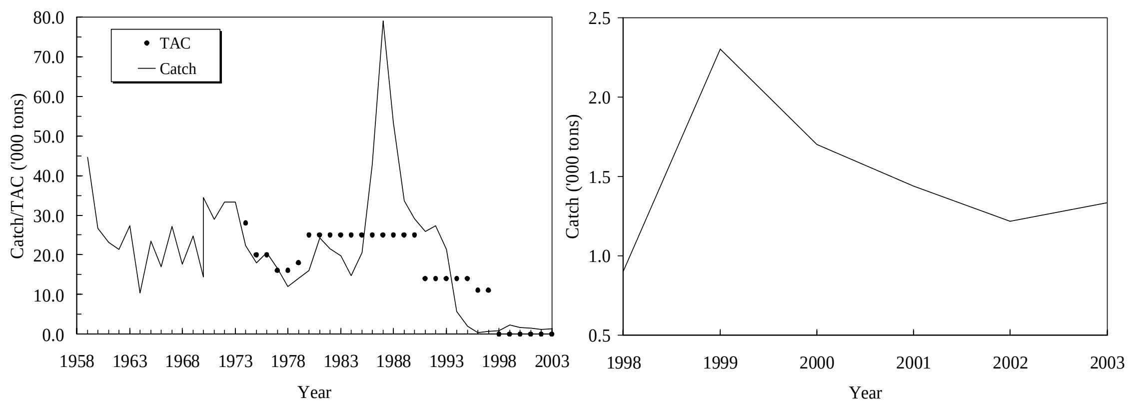


Fig. 10.1. Redfish in Div. 3LN: total catches and TACs. Panel at right highlights catches during the moratorium on directed fishing.

Spring and autumn surveys were conducted by Canada in Div. 3L and 3N during 2003. The survey estimates (Fig. 10.2) did not alter the perception of STACFIS that the stock biomass remains at a low level and recruitment has been poor (Fig. 10.3) for the past 13 years. Relative exploitation in Div. 3L and 3N (Fig. 10.4), based on ratios of catch to spring survey biomass estimates, has been very low since 1995.

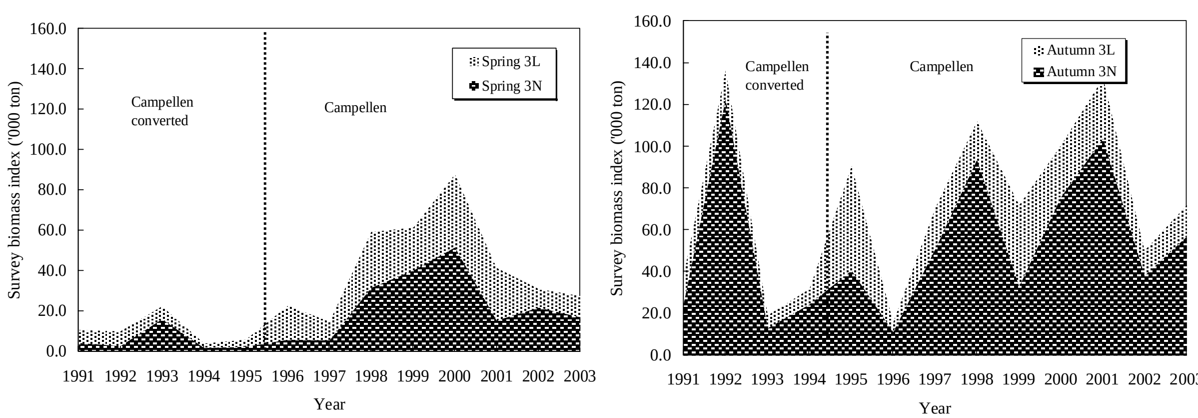


Fig. 10.2. Redfish in Div. 3LN: survey biomass indices from Canadian spring and autumn surveys in Campelen equivalent units for surveys prior to autumn 1995.

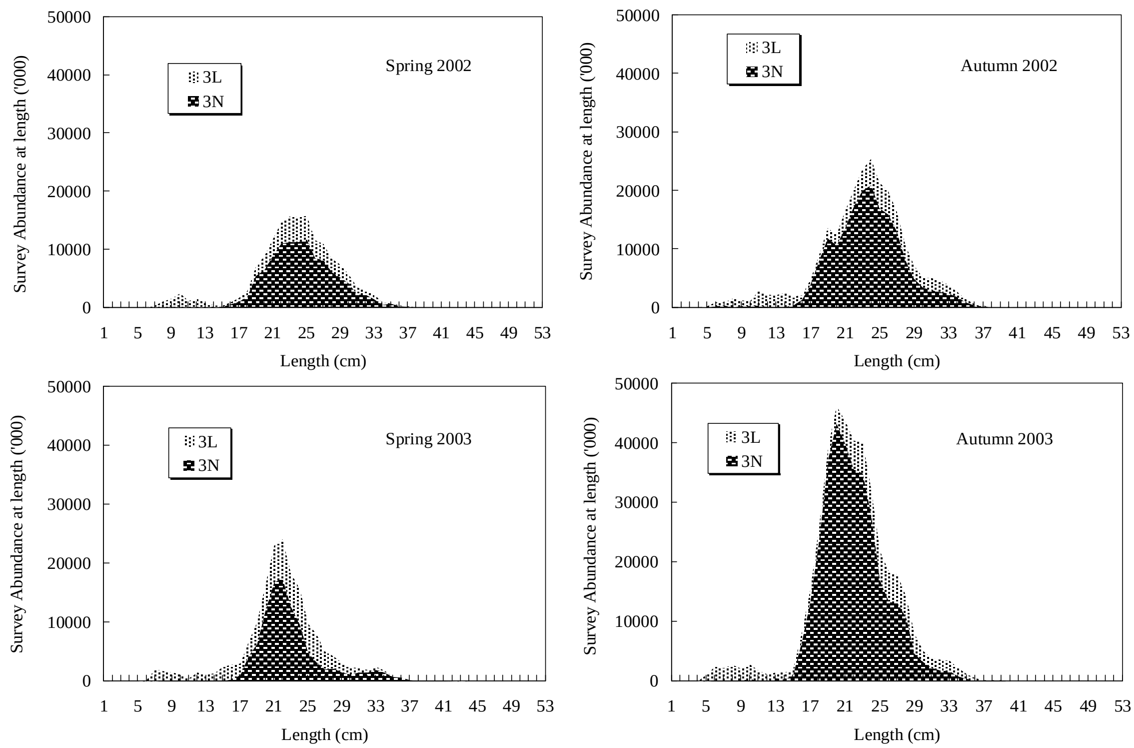


Fig. 10.3 Redfish in Div. 3LN: size distribution (abundance at length) from Canadian surveys in 2001.

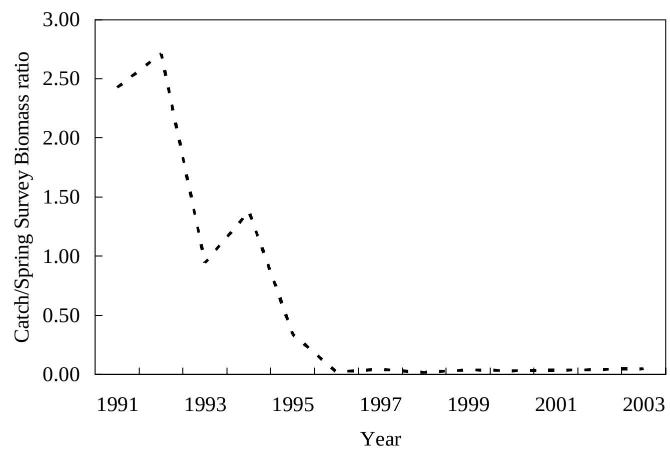


Fig. 10.4. Redfish in Div. 3LN: catch/spring survey biomass (Canadian survey) ratios for Div. 3L and 3N.

b) **Research Recommendations**

A paper was presented to STACFIS discussing this issue (SCR 04/08). STACFIS concluded that the issue of the relationship of redfish in Divisions 3L, 3N and 3O remains complicated and unclear. STACFIS noted that although recent studies on this issue have suggested a closer connection between Div. 3N and Div. 3O, in the absence of more definitive information, managing these as separate stocks is still appropriate.

A genetic study is currently being conducted within Canada that may provide useful results for the determination of the most appropriate management unit(s) in Divisions 3L, 3N and 3O. It is anticipated that the results of this study will be made available to the Scientific Council meeting in June 2005. Accordingly, STACFIS **recommended** that *(1) redfish data in Div. 3LN and Div. 3O be analyzed further to determine if a relationship exists between Div. 3LN and Div. 3O that may help in the interpretation of the indices of abundance; and (2) data be examined to evaluate the appropriateness of Div. 3LN and Div. 3O as management units for redfish*.

STACFIS also **recommended** that *an update of the Div. 3L redfish by-catch information from the shrimp fishery be compiled on an annual basis, including the estimated weights and numbers of redfish caught annually as well as tables showing their size distribution.*

11. American Plaice (*Hippoglossoides platessoides*) in Divisions 3L, 3N and 3O (SCR Doc. 04/9, 13, 47; SCS Doc. 04/3, 5, 8, 9)

a) Interim Monitoring Report

This fishery was under moratorium in 2003. Total catch in 2003 was estimated to range from 6 855-10 599 tons (mean 8 727 tons) (Fig. 11.1). This was mainly taken in the Regulatory Area and as by-catch in the Canadian yellowtail flounder fishery.

Recent nominal catches and TACs ('000 tons) are as follows:

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Recommended TAC	nf	nf	nf	nf	nf	ndf	ndf	ndf	ndf	ndf
STATLANT 21A	0.5	0.9	1.4	1.6	2.4	2.7[1]	2.8[1]	3.1[1]	2.9[1]	
STACFIS	0.6	0.9	1.4	1.6	2.6	5.2	5.7	4.8	6.9-10.6[2]	

[1] Provisional.
[2] In 2003, STACFIS could not precisely estimate the catch.
nf No fishing.
ndf No directed fishing.

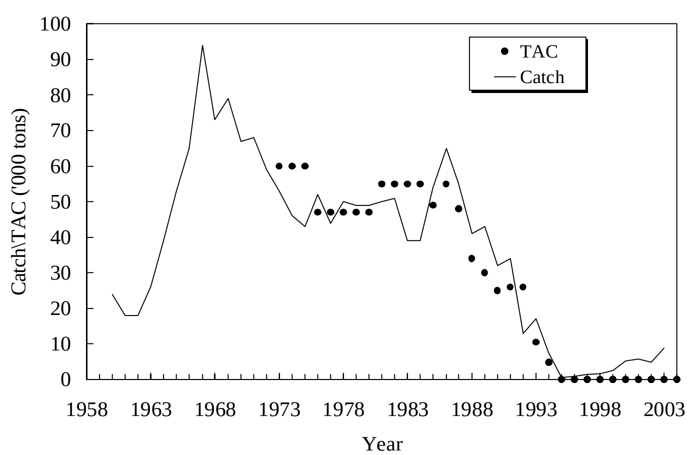


Fig. 11.1. American plaice in Div. 3LNO: catches and TACs.

b) **Input Data**

i) **Research survey data**

Canadian stratified-random bottom trawl surveys. Spring and autumn Canadian research vessel surveys conducted in 2003 indicate that biomass is still at a low level (Fig. 11.2 and 11.3). The spring survey biomass index in 2003 was 22% of the average level in the mid-1980s while the autumn survey biomass index was 30% of the average level of 1990 and 1991. Biomass in the spring survey has been fluctuating but stable since 1999 and the autumn survey since 2000.

Abundance (mean number per tow) from the spring survey fluctuated since 1996 with a slight increase over that period. The spring survey abundance index in 2003 was 24% of the average level in the mid-1980s. The autumn survey abundance index in 2003 was 38% of the average level of 1990 and 1991.

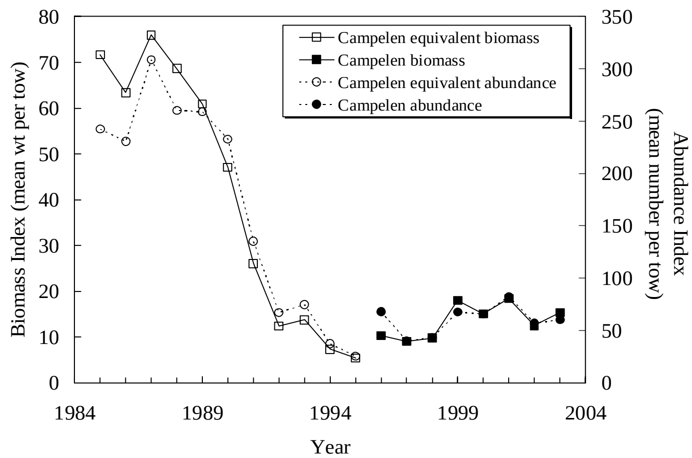


Fig. 11.2. American plaice in Div. 3LNO: biomass and abundance indices from Canadian spring surveys.

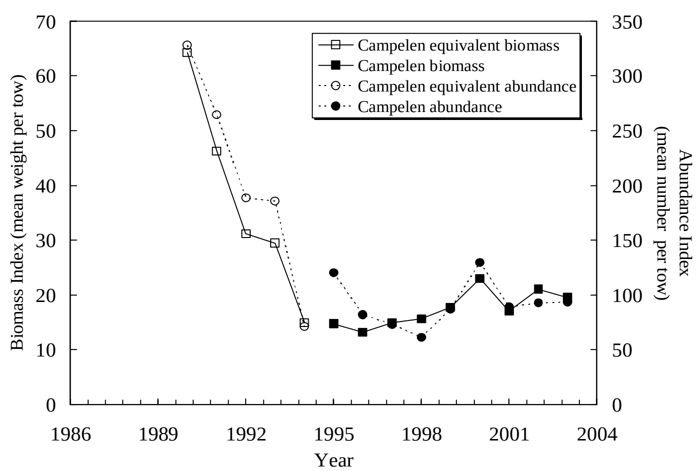


Fig. 11.3. American plaice in Div. 3LNO: biomass and abundance indices from autumn surveys.

Survey by EU-Spain. Surveys have been conducted annually from 1995 to 2003 by EU-Spain in the Regulatory Area in Div. 3NO to a maximum depth of 1 462 m (since 1998). Both the biomass and abundance indices from this survey peaked in 2000 and fluctuated since then, decreasing slightly (Fig. 11.4).

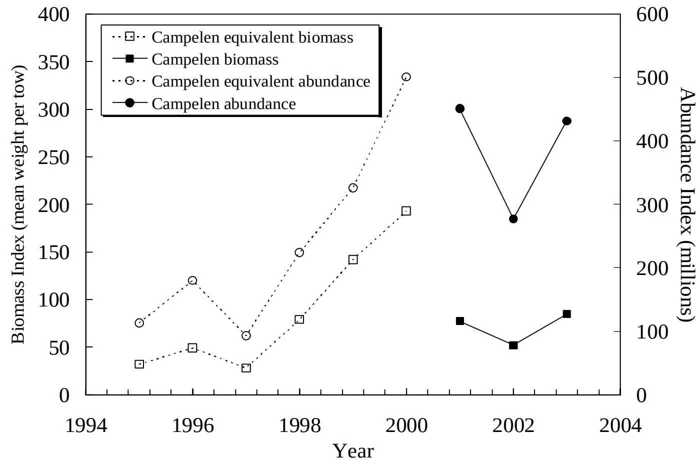


Fig. 11.4. American plaice in Div. 3LNO: biomass and abundance indices from the survey by EU-Spain.

c) **Assessment Results**

Based on overall indices for the current year, there is nothing to indicate a change in the status of the stock.

12. **Yellowtail Flounder (*Limanda ferruginea*) in Divisions 3L, 3N and 3O** (SCR Doc. 04/10, 13, 36, 41, 49, 54; SCS Doc. 04/3, 5, 8, 9)

a) **Introduction**

Since the fishery re-opened in 1998, catches increased from 4 400 tons to 14 100 tons in 2001 (Fig 12.1). Catches in 2002 declined to about 10 800 tons, due mainly to decreased catches by Canada and EU-Spain. Catches in 2003 increased to about 13 800 tons, similar to the level in 2001.

Recent catches and TACs ('000 tons) are as follows:

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Recommended TAC	ndf	ndf	ndf	4	6	10	13	13	14.5	14.5
STATLANT 21A	0.1	0.2	0.7	4.4	7.0	10.6[1]	12.8[1]	10.4[1]	13.0[1]	
STACFIS	0.1	0.3	0.8	4	7	11	14.1	10.8	13.5-14.1[2]	

[1] Provisional.
[2] In 2003, STACFIS could not precisely estimate the catch.
ndf No directed fishing.

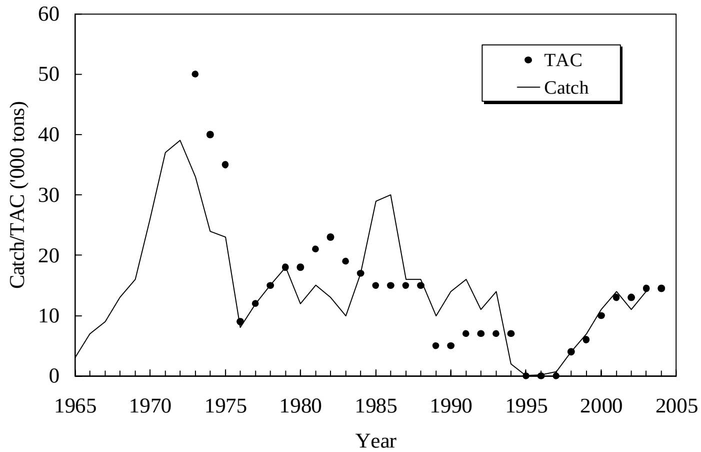


Fig. 12.1. Yellowtail flounder in Div. 3LNO: catches and TACs.

b) **Input Data**

i) **Commercial fishery data** (SCR Doc. 04/41; SCS Doc. 04/3, 5, 9)

There were catch and effort data from the Canadian commercial fishery in 2002-03, which were included in a multiplicative model to analyze the CPUE series from 1965 to 2003. The index showed a steady decline from 1965 to 1976 and then rose to a relatively stable level from 1980-85 before declining to its lowest level during the 1991-93 time period. STACFIS again noted that the 1998-2003 CPUE values are not directly comparable to CPUE indices from previous years because of changes in the 1998-2003 fishing patterns. The 1998-2003 catch rates are related to the Canadian fleet's fishing pattern, which because of the 5% by-catch rule, resulted in concentrating effort mainly in areas where yellowtail flounder was abundant and catches of American plaice and cod were expected to be low. In 2001, by-catch rates of American plaice increased, and remained at this level in 2002-03. Excluder grates have been used by the Canadian fleet in recent years in an attempt to control by-catch levels, particularly cod. Catches of juvenile yellowtail flounder were reduced by the use of large mesh sizes (145 mm) in the codend. Mean size of yellowtail flounder in the Canadian fishery was 38 cm in 2003, and has shown little variation during 2000-2003.

There was sampling of yellowtail flounder from by-catches by EU-Portugal in the Regulatory Area of Div. 3N. The modal length in the Portuguese by-catches was 34-35 cm, slightly below the modal length in the Canadian catch.

ii) **Research survey data**

Canadian stratified-random spring surveys (SCR Doc. 04/36). In 2003, most of the trawlable biomass of this stock continued to be found in Div. 3N. The index of trawlable biomass in 2003 increased from the 2002 value to about the same level estimated in 1999 and 2001, and was the highest in the 20-year series (Fig. 12.2).

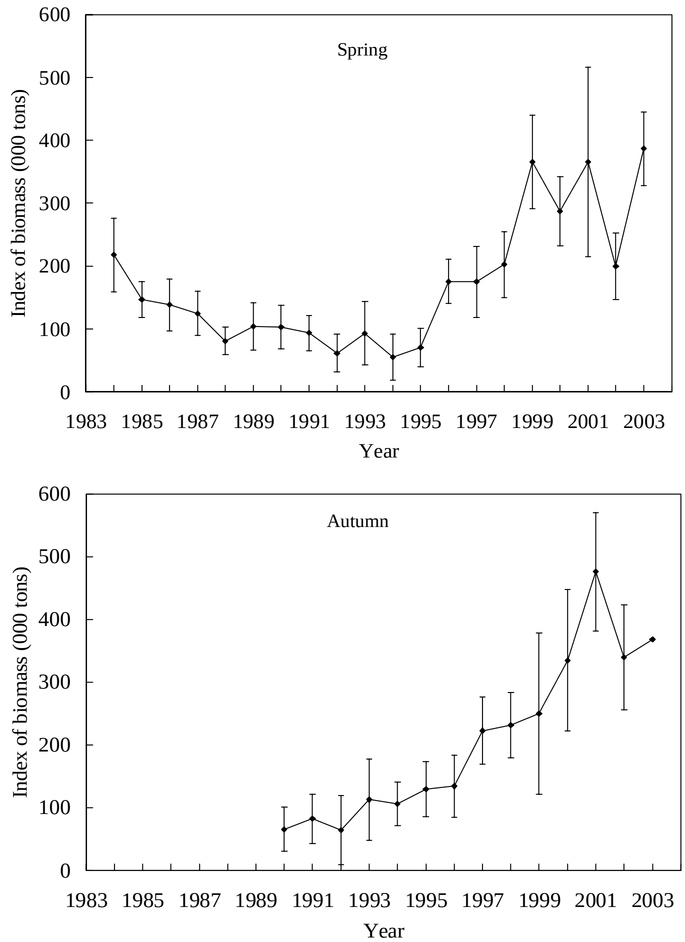


Fig. 12.2. Yellowtail flounder in Div. 3LNO: indices of biomass with approx 95% confidence intervals, from Canadian spring and autumn surveys.

Canadian stratified-random autumn surveys (SCR Doc. 04/36). Most of the biomass from the autumn survey in 2003 was also 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 the peak value in 2001, biomass increased slightly in 2003, and was the second highest in the 14-year time series.

Cooperative DFO/fishing industry seasonal surveys (SCR Doc. 04/13). Cooperative surveys between Canadian Department of Fisheries and Oceans (DFO) and the Canadian fishing industry in Div. 3NO have been carried out from 1996-2003 using a commercial fishing gear without a codend liner. These surveys use a grid design with fixed stations, and the survey area was expanded in 2000. The CPUE for the original grid and the expanded grid both show an increasing trend, with the 2003 survey values being the highest in the series. These surveys also pointed out the limited area available for conducting a directed fishery for yellowtail flounder within the 5% by-catch restriction for American plaice.

Spanish stratified-random spring surveys in the Regulatory Area of Div. 3NO. (SCR Doc. 04/10) 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 1 300 m. In 2003, after extensive comparative fishing between the old vessel, C/V *Playa de*

Menduiňa and old *Pedreira* trawl with the new vessel, C/V *Vizconde de Eza*, using a Campelen 1800 shrimp trawl as the new survey trawl, all data were converted to Campelen.

The biomass of yellowtail flounder increased sharply up to 1999, and has declined from 2001 to 2003 (Fig. 12.3). The 1995-2002 results are in general agreement with the Canadian spring series for all of Div. 3LNO. In 2003 the Spanish survey shows a slight decline, while both Canadian series show an increase. This survey shows the progression of the mode in the length frequencies from the mid-1990s to 2003, with the mode in 2003 occurring at 32-34 cm.

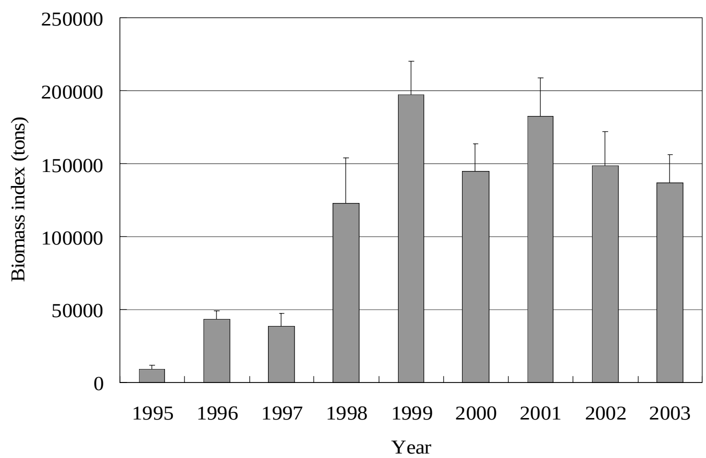


Fig. 12.3. Yellowtail flounder in Div. 3LNO: index of biomass from the Spanish spring surveys in the Regulatory Area of Div. 3NO. Data are in Campelen equivalents, and show 1 SD.

Stock distribution (SCR Doc. 04/36). In all surveys, yellowtail flounder were most abundant in strata on the Southeast Shoal and immediately to the west in Div. 3N, most of which straddle the Canadian 200 mile limit. Yellowtail flounder appear to be more abundant in the Regulatory Area of Div. 3N in the 1999-2003 surveys than in previous years, and the northward distribution of the stock has again extended in Div. 3L, similar to mid-1980s when overall stock size was also relatively large. The proportion of biomass north of 45ºN confirms that the range of the stock has been extending northward since 1995, with one obvious exception in the spring of 2002 when the proportion of biomass is close to that of the early-1990s. The preliminary analysis of the amount of fish found in deepwater showed that small catches of yellowtail flounder are more prevalent in waters deeper than 92 m during the spring surveys than during the autumn surveys. However, the vast majority of the stock was still found to be shallower than 92 m in both seasons. This reduction in the frequency of small catches in deep water from spring to autumn could indicate seasonal movements but there is no annual pattern to the data.

iii) **Biological studies** (SCR Doc. 04/49, 54)

Validation studies have shown that the current method used for ageing older yellowtail flounder is not accurate, and that re-ageing of some of the historical collection of research and commercial otoliths using thin-sectioned otoliths will be required. A study using re-aged otoliths from spring and autumn Canadian surveys of 1998 was carried out to determine minimum sample size needed for re-ageing. The analysis indicated that sample sizes of about 60% of the archived otoliths would be required for re-ageing, excluding fish less than 25 cm, which the study showed did not need to be re-aged. For the 1998 samples, this was about 40% of the total number of otoliths in each survey. The analysis also indicated that spring and autumn samples should not be combined. Re-aged samples from another year should be examined to ensure consistent results. STACFIS noted that this work is essential in order to enable development of a VPA for the Div. 3LNO yellowtail flounder stock, and that significant resources will be required to repeat the exercise and continue re-ageing the archived otoliths. STACFIS was encouraged by the considerable progress thus far, and noted that this work should remain a priority.

Maturity at size was estimated for each sex separately, using Canadian spring research vessel data from 1984-2003. L_{50} declined in males, by about 7 cm from around 30 cm in the mid-1980s to 23 cm in 1999 (Fig. 12.4). The last 4 years have seen an increase with the L_{50} for males averaging 25 cm. Female L_{50} has been fairly stable with at most a 1 cm decline from 34 to 33 cm and the estimate for 2003 is the only one in the time series that is less than 32 cm. In general for males, years prior to 1992 were significantly different from 2003. After this there are also years that are significantly different from the final year but there is no pattern. For females, all years except 1994 are significantly different from 2003.

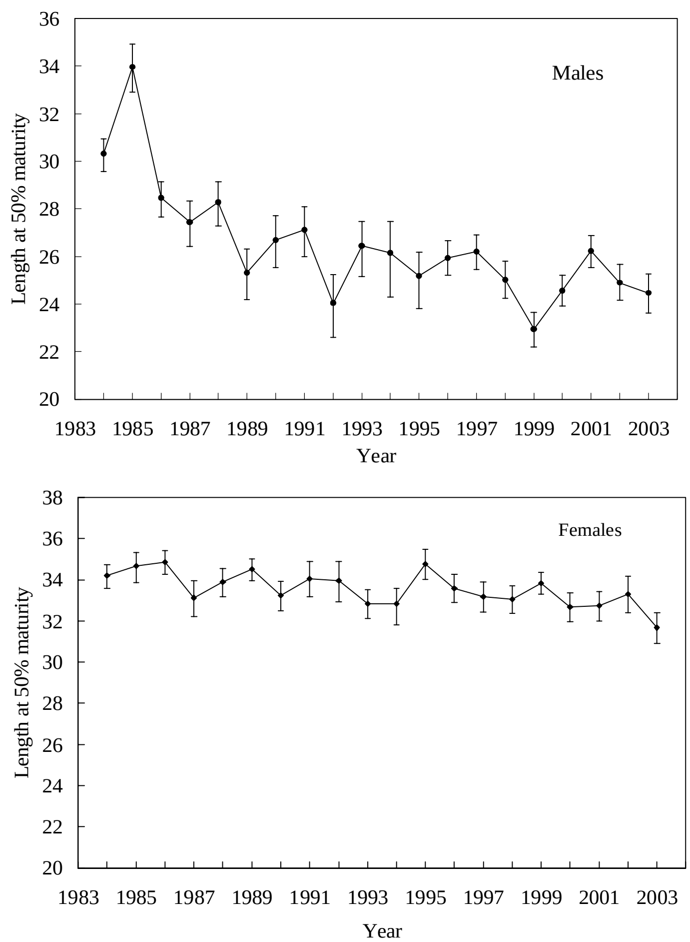


Fig. 12.4. Yellowtail flounder in Div. 3LNO: length at 50% maturity.

A length-based female SSB index was derived from the 1984-2003 Canadian spring survey data, annual maturity ogives and annual mean weights-at-length. Female SSB declined from 1984 to 1992 (Fig. 12.5), but since 1995 it has increased substantially. There was a large increase in the index in 1999 consistent with the large increase in the overall survey abundance index for that year. Estimates for 1999-2001, and 2003 were fairly similar and much higher than previous years. In general, the female SSB index mirrors the trend in the total survey biomass index.

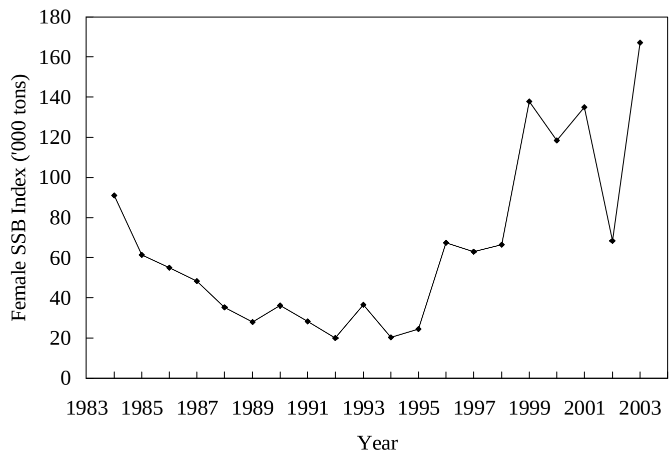


Fig. 12.5. Yellowtail flounder in Div. 3LNO: female spawning stock biomass index estimated from 1984 to 2003 annual spring surveys.

The model for relative year-class strength was not updated in 2004 due to the lack of current ageing data. In 2002, STACFIS noted that "cohort strength reached a minimum in 1990 but has increased since. Based on this analysis, cohorts since 1992 are not significantly different from that of 1998, and are the highest in the series". Analyses of length composition data also indicated that there were good year-classes produced during the early to mid-1990s. These good year-classes were responsible for the increase in biomass during and after the moratorium.

c) **Estimation of Parameters** (SCR Doc. 04/54)

Several formulations of a surplus production analysis (ASPIC) were presented. STACFIS accepted the same formulation used in 2002, updated with current data. This model includes the catch data (1965-2003), Russian spring surveys (1972-91), Canadian spring surveys (1971-82), Canadian spring (1984-2003) and autumn (1990-2003) surveys and the Spanish spring (1995-2003) surveys. All surveys were given equal weight in the analysis. Catch projections assumed that the TAC of 14 500 tons will be taken in the 2004 fishery.

Because of differences in catchability among the various indices, relative indices of biomass and fishing mortality rate were used instead of absolute values. As this stock was assessed with a production model, fishing mortality refers to catch/biomass ratio.

d) **Assessment Results**

The surplus production model results are consistent with the assessment in 2002, and indicate that stock size increased rapidly after the mid-1990s and has now begun to level off. Bias-corrected estimates from the model suggests that a maximum sustainable yield (MSY) of 17 350 tons can be produced by total stock biomass of 79 000 tons (B_{msy}) at a fishing mortality rate of 0.22 (F_{msy}). The analysis showed that relative population size (B_t/B_{msy}) was below 1.0 from 1973 to 1999. Biomass (B_t) has been estimated to be above B_{msy} since then, and the ratio is 1.29 at the beginning of 2005 (Fig. 12.6).

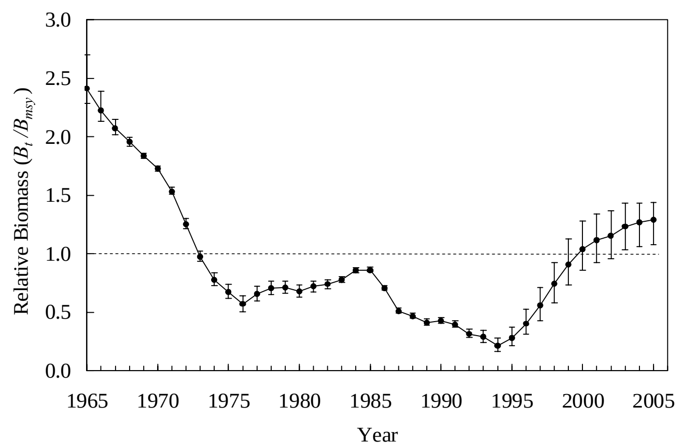


Fig. 12.6. Yellowtail flounder in Div. 3LNO: bias corrected relative biomass trends with 80% confidence intervals.

Relative fishing mortality rate (F_t/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. 12.7). After 1993, F_t has remained below F_{msy}. In 2004, F is projected to be 65% of F_{msy} if the TAC of 14 500 tons is caught.

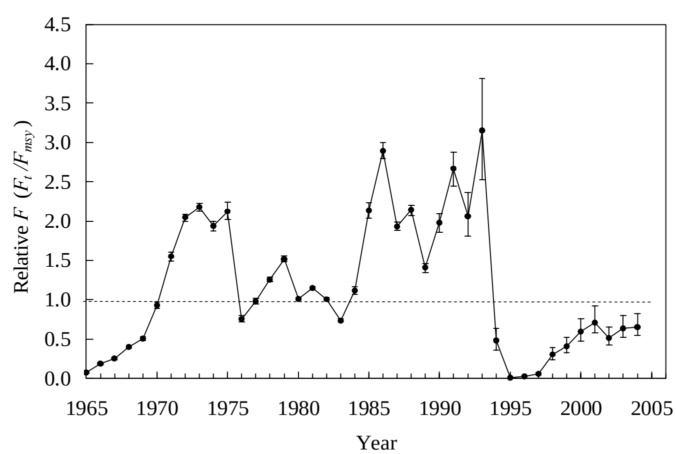


Fig. 12.7. Yellowtail flounder in Div. 3LNO: bias corrected relative fishing mortality trends with 80% confidence intervals.

Since 1994, when the moratorium (1994-97) was put in place, the estimated catch has been below surplus production levels (Fig. 12.8).

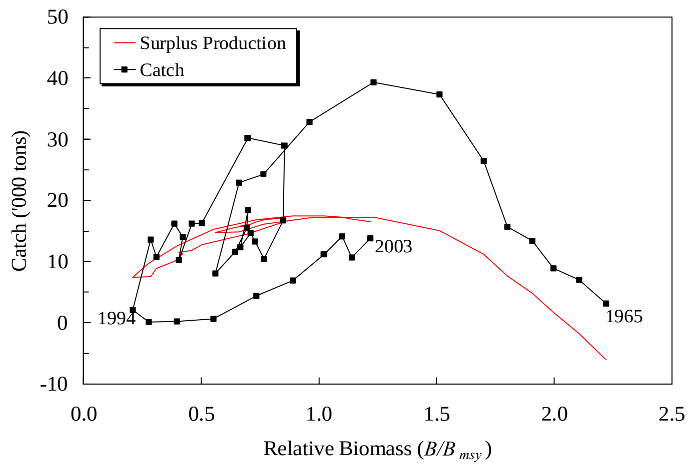


Fig. 12.8. Yellowtail flounder in Div. 3LNO: catch trajectory.

The model was bootstrapped to derive estimates of catch projections for 2005 and 2006 assuming a range of *F* multipliers. Percentiles of fishing mortality, catch and biomass for a series of *F* multipliers were estimated (Table 12.1). STACFIS noted that all analyses assumed that the catch in 2004 would equal the TAC of 14 500 tons. However, the TACs have not been taken in 2002 and 2003. Catch projections (in tons) at various levels of *F* are shown below.

Projected F	Catch in 2005	Catch in 2006
F_{2004}	14 700	14 000
2/3 F_{msy}	15 000	15 200
75% F_{msy}	16 700	16 700
85% F_{msy}	18 800	18 400
F_{msy}	21 800	20 800

Table 12.1. Management options for 2005-2006. *F* multipliers are applied to F_{2004}.

		2005 *F/Fmsy* percentiles						2006 *F/Fmsy* percentiles				
	***F* multiplier**	**5**	**25**	**50**	**75**	**95**	***F* multiplier**	**5**	**25**	**50**	**75**	**95**
	0.5	0.062	0.068	0.071	0.075	0.088	0.5	0.062	0.068	0.071	0.075	0.088
	0.75	0.094	0.102	0.107	0.113	0.132	0.75	0.094	0.102	0.107	0.113	0.132
	0.9	0.112	0.122	0.128	0.135	0.159	0.9	0.112	0.122	0.128	0.135	0.159
	1	0.125	0.136	0.142	0.150	0.176	1	0.125	0.136	0.142	0.150	0.176
2/3 *Fmsy*	1.020	0.127	0.139	0.145	0.153	0.180	1.020	0.127	0.139	0.145	0.153	0.180
75% *Fmsy*	1.147	0.143	0.156	0.163	0.172	0.202	1.147	0.143	0.156	0.163	0.172	0.202
85% *Fmsy*	1.300	0.162	0.177	0.185	0.195	0.229	1.300	0.162	0.177	0.185	0.195	0.229
Fmsy	1.530	0.191	0.208	0.218	0.230	0.270	1.530	0.191	0.208	0.218	0.230	0.270

		2005 Catch percentiles						2006 Catch percentiles				
	***F* multiplier**	**5**	**25**	**50**	**75**	**95**	***F* multiplier**	**5**	**25**	**50**	**75**	**95**
	0.5	7.477	7.559	7.617	7.681	7.791	0.5	7.841	8.009	8.135	8.287	8.555
	0.75	11.052	11.164	11.239	11.319	11.460	0.75	11.323	11.541	11.699	11.864	12.165
	0.9	13.145	13.272	13.355	13.445	13.599	0.9	13.280	13.515	13.674	13.844	14.158
	1	14.517	14.655	14.743	14.834	14.991	1	14.530	14.771	14.931	15.101	15.395
2/3 *Fmsy*	1.020	14.789	14.930	15.018	15.109	15.268	1.020	14.774	15.017	15.177	15.341	15.638
75% *Fmsy*	1.147	16.507	16.656	16.748	16.842	16.995	1.147	16.294	16.537	16.693	16.847	17.113
85% *Fmsy*	1.300	18.540	18.698	18.793	18.887	19.046	1.300	18.035	18.274	18.413	18.550	18.829
Fmsy	1.530	21.523	21.693	21.787	21.873	22.037	1.530	20.440	20.679	20.798	20.904	21.206

		2006 Biomass / *Bmsy* percentiles						2007 Biomass / *Bmsy* percentiles				
	***F* multiplier**	**5**	**25**	**50**	**75**	**95**	***F* multiplier**	**5**	**25**	**50**	**75**	**95**
	0.5	1.103	1.270	1.364	1.451	1.549	0.5	1.182	1.361	1.448	1.524	1.611
	0.75	1.063	1.227	1.320	1.410	1.507	0.75	1.111	1.281	1.371	1.450	1.539
	0.9	1.037	1.204	1.296	1.385	1.482	0.9	1.069	1.237	1.325	1.406	1.496
	1	1.020	1.189	1.280	1.369	1.464	1	1.041	1.208	1.296	1.379	1.467
2/3 *Fmsy*	1.020	1.016	1.186	1.277	1.366	1.461	1.020	1.036	1.203	1.290	1.373	1.462
75% *Fmsy*	1.147	0.995	1.166	1.257	1.346	1.440	1.147	1.000	1.169	1.255	1.338	1.428
85% *Fmsy*	1.300	0.973	1.145	1.233	1.321	1.415	1.300	0.956	1.128	1.214	1.297	1.385
Fmsy	1.530	0.939	1.112	1.200	1.285	1.379	1.530	0.897	1.068	1.154	1.239	1.327

Management option table for 2005 and 2006.

The percentiles of catch in 2005-6, and biomass ratio in 2006-7 are based on *F* in 2005-6 calculated as the product of the *F* multiplier and *F* in 2004.

The results are derived from an ASPIC bootstrap run (500 iterations) with a catch constraint of 14 500 tons in 2004.

Medium-term projections were carried out by extending the ASPIC bootstrap projections forward to the year 2014 under an assumption of constant fishing mortality at 2/3 F_{msy}, 0.75 F_{msy} and 0.85 F_{msy}. The projections are conditional on the estimated values of r, the intrinsic rate of population growth and K, the carrying capacity. STACFIS noted that all analyses assumed that the catch in 2004 would equal the TAC of 14 500 tons. However, the TACs have not been taken in 2002 and 2003. At 2/3 F_{msy}, catch and stock size continue to increase slightly (Table 12.2), and probability that biomass in 2005 is below B_{msy} is about 6%, declining to less than 3% after 2008. Catch and biomass both decrease slightly in the projections at 0.75 and 0.85 F_{msy} (Tables 12.3 and 12.4). At 0.75 F_{msy}, the probability of biomass being below B_{msy} is stable around 5-6% throughout the projection years. At 0.85 F_{msy}, the probability that biomass is below B_{msy} increases from 6% in 2005 to around 13% from after 2011 (Fig. 12.10). Also, at 0.85 F_{msy}, the 95th percentile of the bootstrapped *F* is above F_{msy}.

Table 12.2. Medium-term projections for yellowtail flounder. The 5, 25, 50, 75 and 95th percentiles of fishing mortality, biomass, yield and B/B_{msy} are shown, for projected F of 2/3 F_{msy}. The results are derived from an ASPIC bootstrap run (500 iterations) with a catch constraint of 14 500 tons (TAC) in 2004.

F	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
5	0.127	0.127	0.127	0.127	0.127	0.127	0.127	0.127	0.127	0.127
25	0.139	0.139	0.139	0.139	0.139	0.139	0.139	0.139	0.139	0.139
50	0.145	0.145	0.145	0.145	0.145	0.145	0.145	0.145	0.145	0.145
75	0.153	0.153	0.153	0.153	0.153	0.153	0.153	0.153	0.153	0.153
95	0.180	0.180	0.180	0.180	0.180	0.180	0.180	0.180	0.180	0.180
Fmsy	0.217	0.217	0.217	0.217	0.217	0.217	0.217	0.217	0.217	0.217
2/3*Fmsy*	0.145	0.145	0.145	0.145	0.145	0.145	0.145	0.145	0.145	0.145

B	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
5	83.64	85.87	87.40	88.85	90.07	91.06	91.71	92.24	92.68	93.04
25	97.64	99.19	100.26	101.11	101.88	102.46	102.80	103.11	103.38	103.48
50	102.62	103.59	104.43	104.98	105.34	105.65	105.88	106.12	106.30	106.40
75	107.20	107.44	107.93	108.34	108.69	109.06	109.27	109.48	109.60	109.70
95	113.98	115.62	116.38	118.07	118.55	120.03	121.62	122.34	122.93	123.37

Y	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
5	14.79	14.77	14.76	14.76	14.75	14.75	14.75	14.74	14.74	14.74
25	14.93	15.02	15.08	15.13	15.16	15.19	15.21	15.22	15.23	15.24
50	15.02	15.18	15.30	15.39	15.46	15.52	15.56	15.59	15.62	15.64
75	15.11	15.34	15.53	15.67	15.78	15.86	15.94	15.99	16.03	16.06
95	15.27	15.64	15.93	16.18	16.37	16.52	16.65	16.74	16.81	16.86

Br	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
5	0.99	1.02	1.04	1.05	1.06	1.07	1.08	1.09	1.09	1.10
25	1.16	1.19	1.20	1.22	1.23	1.24	1.24	1.25	1.25	1.26
50	1.26	1.28	1.29	1.30	1.31	1.32	1.32	1.32	1.33	1.33
75	1.35	1.37	1.37	1.38	1.38	1.39	1.39	1.39	1.39	1.39
95	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46

Table 12.3. Medium-term projections for yellowtail flounder. The 5, 25, 50, 75 and 95th percentiles of fishing mortality, biomass, yield, and biomass/B_{msy}, are shown, for projected F of 0.75 F_{msy}. The results are derived from an ASPIC bootstrap run (500 iterations) with a catch constraint of 14 500 tons (TAC) in 2004.

F	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
5	0.143	0.143	0.143	0.143	0.143	0.143	0.143	0.143	0.143	0.143
25	0.156	0.156	0.156	0.156	0.156	0.156	0.156	0.156	0.156	0.156
50	0.163	0.163	0.163	0.163	0.163	0.163	0.163	0.163	0.163	0.163
75	0.172	0.172	0.172	0.172	0.172	0.172	0.172	0.172	0.172	0.172
95	0.202	0.202	0.202	0.202	0.202	0.202	0.202	0.202	0.202	0.202
Fmsy	0.217	0.217	0.217	0.217	0.217	0.217	0.217	0.217	0.217	0.217
75%*Fmsy*	0.163	0.163	0.163	0.163	0.163	0.163	0.163	0.163	0.163	0.163

B	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
5	83.64	84.16	84.31	84.58	84.90	85.12	85.37	85.52	85.57	85.62
25	97.64	97.58	97.38	97.26	97.21	97.20	97.15	97.19	97.22	97.19
50	102.62	102.00	101.64	101.29	101.02	100.84	100.75	100.68	100.63	100.62
75	107.20	105.83	105.14	104.71	104.31	104.04	103.83	103.70	103.59	103.50
95	113.98	115.62	116.38	116.49	115.60	116.02	116.60	117.05	117.06	116.92

Y	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
5	16.51	16.29	16.15	16.04	15.97	15.91	15.86	15.83	15.81	15.79
25	16.66	16.54	16.45	16.39	16.34	16.30	16.27	16.25	16.23	16.21
50	16.75	16.69	16.65	16.62	16.59	16.57	16.55	16.54	16.53	16.52
75	16.84	16.85	16.85	16.86	16.86	16.86	16.87	16.87	16.87	16.87
95	17.00	17.11	17.21	17.28	17.34	17.38	17.42	17.45	17.48	17.50

Br	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
5	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
25	1.16	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17
50	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.25	1.25	1.25
75	1.35	1.35	1.34	1.33	1.33	1.33	1.33	1.32	1.32	1.32
95	1.46	1.44	1.43	1.42	1.41	1.40	1.40	1.40	1.40	1.40

Table 12.4. Medium-term projections for yellowtail flounder. The 5, 25, 50, 75 and 95th percentiles of fishing mortality, biomass, yield and biomass/B_{msy}, are shown, for projected F of 0.85 F_{msy}. The results are derived from an ASPIC bootstrap run (500 iterations) with a catch constraint of 14 500 tons (TAC) in 2004.

F	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
5	0.162	0.162	0.162	0.162	0.162	0.162	0.162	0.162	0.162	0.162
25	0.177	0.177	0.177	0.177	0.177	0.177	0.177	0.177	0.177	0.177
50	0.185	0.185	0.185	0.185	0.185	0.185	0.185	0.185	0.185	0.185
75	0.195	0.195	0.195	0.195	0.195	0.195	0.195	0.195	0.195	0.195
95	0.229	0.229	0.229	0.229	0.229	0.229	0.229	0.229	0.229	0.229
Fmsy	0.217	0.217	0.217	0.217	0.217	0.217	0.217	0.217	0.217	0.217
85%*Fmsy*	0.184	0.184	0.184	0.184	0.184	0.184	0.184	0.184	0.184	0.184

B	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
5	83.64	82.14	80.71	79.66	79.02	78.36	77.85	77.34	76.91	76.57
25	97.64	95.65	93.98	92.81	91.90	91.19	90.70	90.21	89.93	89.72
50	102.62	100.08	98.26	96.96	95.92	95.15	94.63	94.23	93.95	93.68
75	107.20	104.01	101.82	100.34	99.23	98.45	97.91	97.35	97.01	96.73
95	113.98	115.62	116.38	114.60	112.21	111.26	110.48	109.97	109.69	109.41

Y	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
5	18.54	18.03	17.68	17.41	17.22	17.07	16.96	16.88	16.81	16.74
25	18.70	18.27	17.95	17.72	17.53	17.40	17.30	17.22	17.16	17.11
50	18.79	18.41	18.12	17.90	17.73	17.61	17.51	17.44	17.38	17.34
75	18.89	18.55	18.29	18.10	17.95	17.83	17.75	17.69	17.62	17.58
95	19.05	18.83	18.63	18.48	18.39	18.32	18.27	18.21	18.17	18.13

Br	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
5	0.99	0.97	0.96	0.94	0.93	0.92	0.92	0.91	0.90	0.90
25	1.16	1.14	1.13	1.11	1.10	1.09	1.09	1.08	1.08	1.08
50	1.26	1.23	1.21	1.20	1.19	1.18	1.18	1.17	1.17	1.16
75	1.35	1.32	1.30	1.28	1.27	1.26	1.25	1.25	1.24	1.24
95	1.46	1.41	1.39	1.36	1.35	1.34	1.33	1.33	1.32	1.32

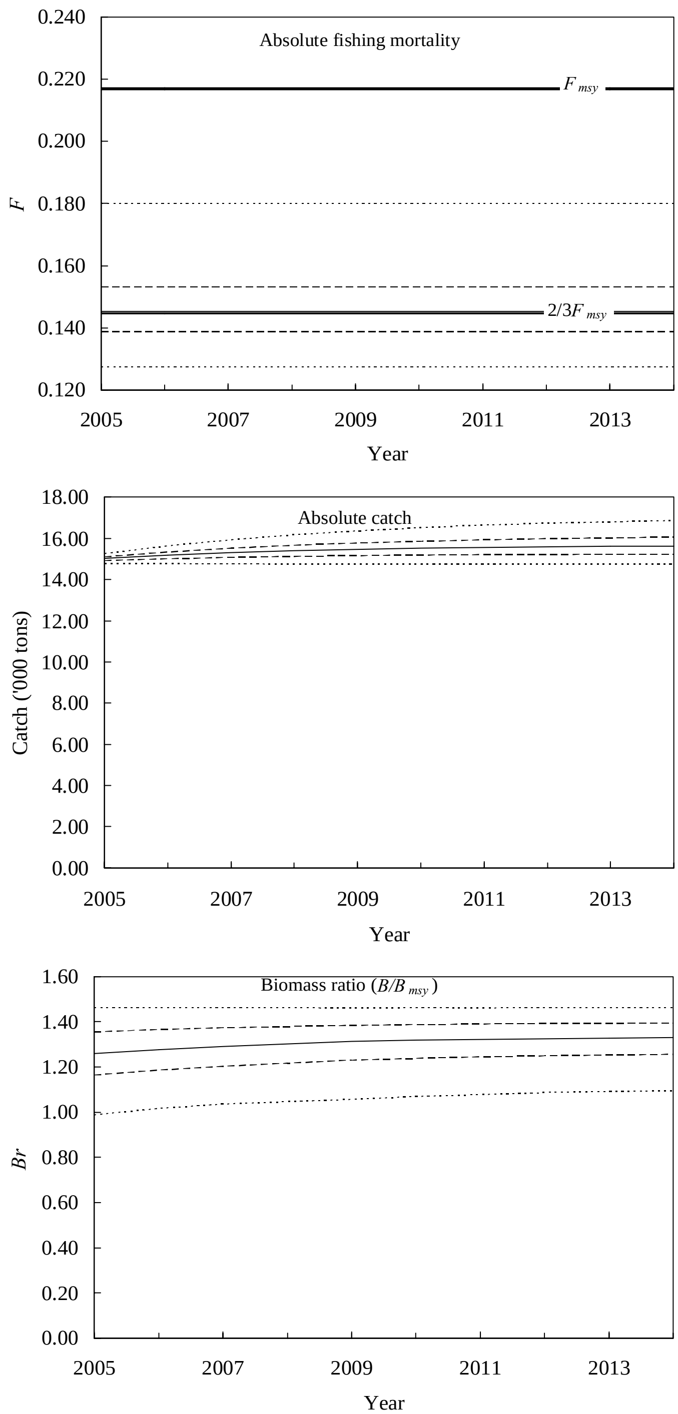


Fig. 12.9. Yellowtail flounder in Div. 3LNO: medium-term projections at a constant fishing mortality of 2/3 F_{msy}. The figures show the 5th, 25th, 50th, 75th and 95th percentiles of fishing mortality, catch, and biomass/B_{msy}. The results are derived from an ASPIC bootstrap run (500 iterations) with a catch constraint of 14 500 tons (TAC) in 2004.

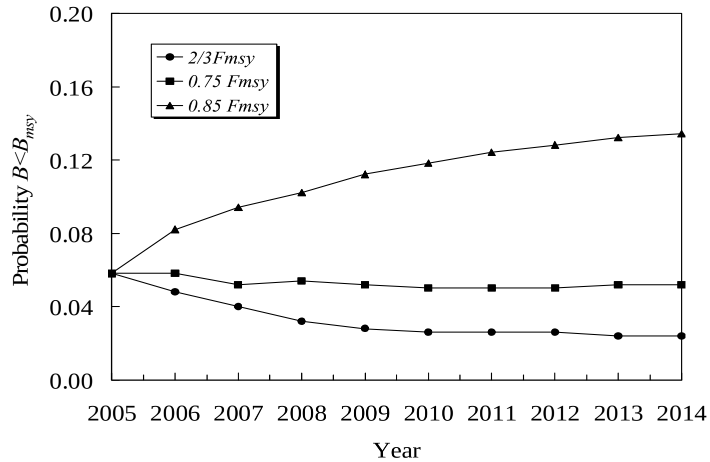


Fig. 12.10. Yellowtail flounder in Div. 3LNO: The probability of biomass being less than B_{msy} for medium term projections at fishing mortalities of 2/3 F_{msy}, 75% F_{msy}, and 85% F_{msy}. The results are derived from an ASPIC bootstrap run (500 iterations) with a catch constraint of 14 500 tons in 2004.

e) Reference Points

Precautionary approach. The stock production model outputs in the current assessment are similar to those reported in the 2002 assessment. The results indicate that the stock is presently above B_{msy} and below F_{msy}. The data were input into an updated model of a precautionary framework (Fig 12.11). At the NAFO SC Study Group meeting in Lorient in 2004 (SCS Doc. 04/12)**,** it was recommended that 30% B_{msy} be considered as a limit reference point (B_{lim}) for stocks where a production model is used. This reference point is indicated, along with F_{lim} (F_{msy}), in Fig. 12.11. Also indicated are B_{msy} and 2/3 F_{msy}. The current assessment results indicate that the stock was below B_{lim} from 1993 to 1995, then increased rapidly during and after the moratorium, exceeding B_{msy} from 2000 onward. At present, it is not possible to express the risk of the stock being below B_{lim} = 30% B_{msy}. However, the estimated probability of the current (beginning of 2005) stock size being below B_{msy} is so small (less than 6%), that the probability of being below B_{lim} must be negligible.

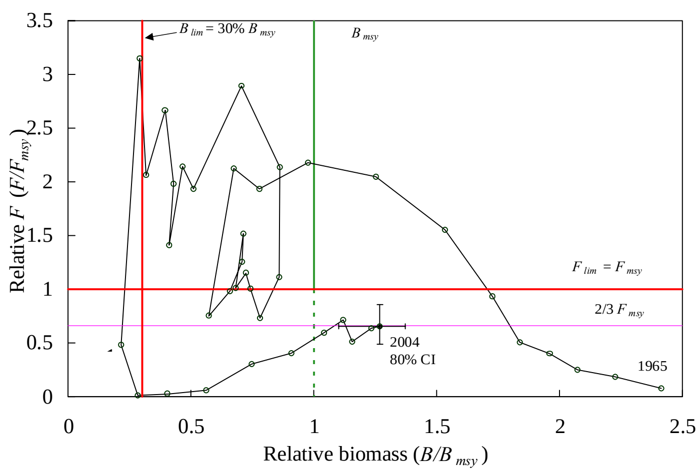


Fig. 12.11. Yellowtail flounder in Div. 3LNO: stock trajectory estimated in the surplus production analysis, under a precautionary approach framework.

13. Witch Flounder (*Glyptocephalus cynoglossus*) in Divisions 3N and 3O (SCR Doc. 04/43; SCS Doc. 04/3, 5, 8, 9)

a) Introduction

Reported catches in the period 1972-84 ranged from a low of about 2 400 tons in 1980 and 1981 to a high of about 9 200 tons in 1972 (Fig. 13.1). With increased by-catch from other fisheries, catches rose rapidly to 8 800 and 9 100 tons in 1985 and 1986, respectively. This increased effort was concentrated mainly in the Regulatory Area of Div. 3N.

Recent catches and TACs ('000 tons) are as follows:

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
TAC	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf
STATLANT 21A	0.3	0.3	0.5	0.6	0.9	0.7[1]	0.5[1]	0.7[1]	0.5[1]	
STACFIS	0.3	0.3	0.5	0.6	0.8	0.5	0.7	0.4	0.81-2.24[2]	

[1] Provisional.
[2] In 2003, STACFIS could not precisely estimate the catch.
ndf No directed fishery.

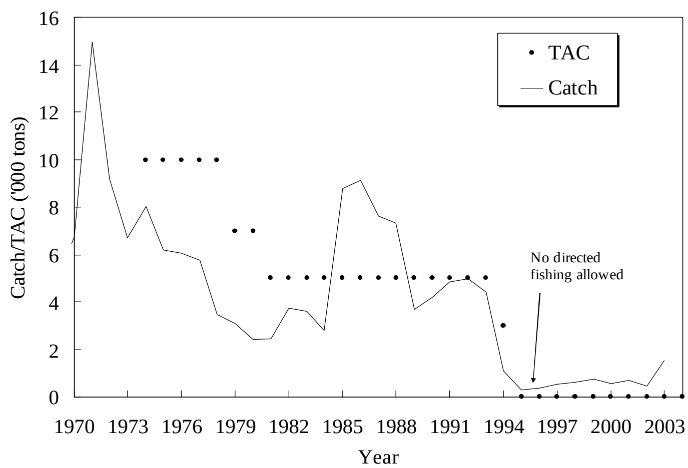


Fig. 13.1. Witch flounder in Div. 3N and 3O: catches and TAC

In 1987 and 1988, the total catch was about 7 500 tons, declining to between 3 700 and 4 900 tons from 1989 to 1992 with a catch of 4 400 tons estimated for 1993. The best estimates of catch for 1994-96 were 1 100, 300 and 300 tons, respectively, with the 1997-2002 catch estimates ranging from 400-800 tons. Catches by Canada ranged from 1 200 tons to 4 300 tons from 1985 to 1993 (about 2 650 tons in 1991 and 4 300 tons in 1992) and were mainly from Div. 3O. Only very small amounts of by-catch by Canada have been taken since then due to the moratorium. Catches by USSR/Russian vessels declined from between 1 000 and 2 000 tons in 1982-88 to less than 100 tons in 1989-90, and there has been little or no catch since then. Catch for 2003 was estimated to be between 809 and 2 239 tons.

b) Input Data

i) Research survey data

Mean weight (kg) per tow. For Div. 3N, mean weights (kg) per tow in the Canadian spring survey ranged from as high as 0.96 kg per tow in 1984 to a low of 0.07 kg per tow in 1996 and a marginal increase to 0.23 kg per tow in 2003 (Fig 18.2). Mean weights (kg) per tow in the fall survey in Div.

3N ranged from 1.22 kg per tow in 1992 to a low of 0.07 kg per tow in 1996. Estimates have been variable throughout the series, showing little or no trend, and in 2003 is 0.64 kg per tow. In Div. 3O, the spring survey estimates are variable, but show a decreasing trend from 9.67 kg per tow in 1985 to 0.83 kg per tow in 1998. Since then mean weights per tow have remained variable but have increased slightly and in 2003 the estimate is 6 kg per tow. Although the index in Div. 3NO appears higher in 2003 than in recent years, it is driven by one large set.

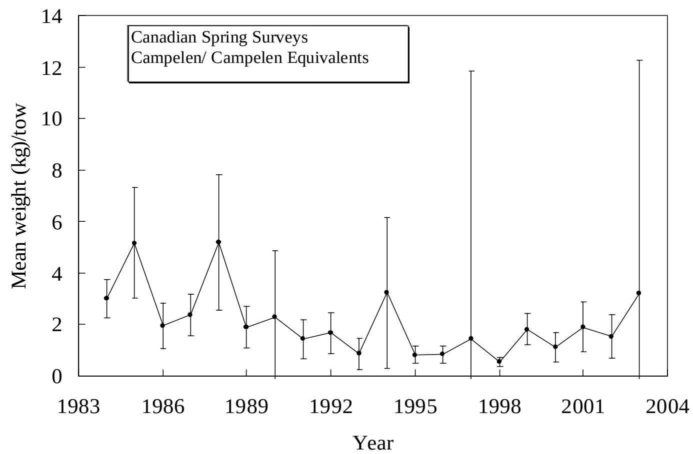


Fig. 13.2. Witch flounder in Div. 3NO: mean weights (kg) per tow from Canadian spring surveys (with 95% confidence limits).

Length Frequency data: Length frequency data were available from the Spanish and Portuguese commercial catch as well as from Canadian surveys. Sizes in commercial length frequencies ranged from 24 to 58 cm with the mode at 38 cm in the Portuguese samples. Only one sample from the Spanish catch was available and the lengths ranged from 27-41 cm with the modal length at 34 cm. The frequencies taken in the Canadian surveys ranged from 8-64 cm with modal length around 40 cm. Smaller fish were evident in the Canadian research vessel frequencies from 1995-2000 and in 2002, which may be contributing to the apparent improvement in the stock, but this peak was not evident in the 2001 or 2003 surveys.

c) **Assessment Results**

Based on the most recent data, STACFIS considers that the overall stock remains at a low level. Although the index in Div. 3NO appears higher in 2003 than in recent years, it is driven by one large set.

d) **Future Studies**

Problems related to age determination were presented as a key obstacle to the use of an analytical approach for witch flounder in Div. 3NO. STACFIS noted that both the time series of survey and commercial catch data may be sufficiently long enough to attempt stock production analyses.

STACFIS **recommended** that *the use of stock production models be attempted in the next assessment of Div. 3NO witch flounder.*

14. Capelin (*Mallotus villosus*) in Divisions 3N and 3O (SCR Doc. 04/17)

a) Interim Monitoring Report

The directed fishery was closed in 1992 and the closure has continued through 2004 (Fig. 14.1). No catch was reported from this stock in 2003.

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Recommended TAC	ndf	ndf	na	na	na	na	na	na	ndf	ndf
STACFIS[1]	0	0	0	0	0	0	0	0	0	0

[1] No catch reported or estimated for this stock.
ndf No directed fishing.
na No advice possible.

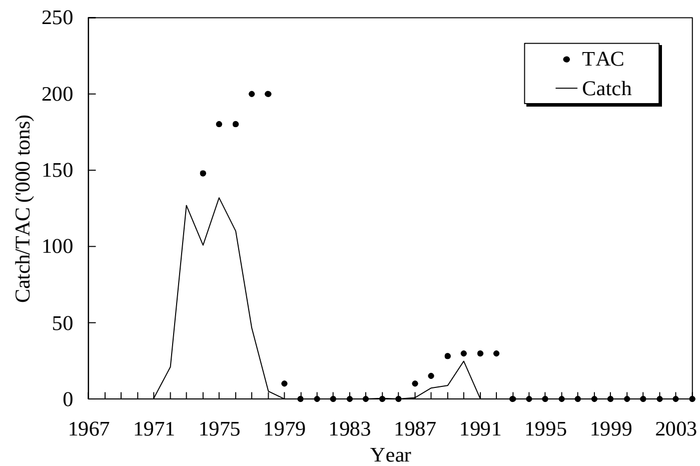


Fig. 14.1. Capelin in Div. 3N and 3O: catches and TACs.

Based on the results of the Canadian random-stratified bottom trawl surveys, the biomass of capelin has remained at a low level since 1994. The biomass estimated for 2003 was 510 tons (Fig. 14.2).

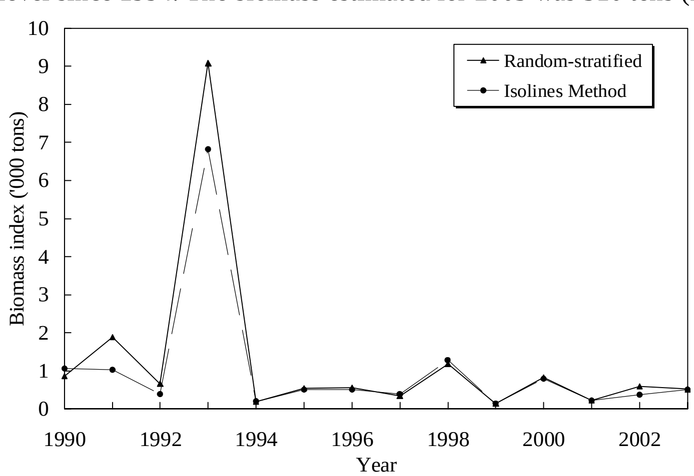


Fig. 14.2. Capelin in Div. 3NO: biomass estimates in 1990-2003.

There were no evident signs of capelin stock recovery in recent years.

b) **Research Recommendation**

STACFIS **recommended** that *initial investigations be carried out to evaluate the status of capelin in Div. 3NO utilizing trawl acoustic surveys to allow comparison with the historical time series.*

15. **Redfish *(Sebastes mentella* and *Sebastes fasciatus*) in Division 3O** (SCR Doc. 04/8; SCS Doc. 04/3, 5, 8, 9)

a) **Interim Monitoring Report**

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 fasciatu*s). 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. Redfish in Div. 3O are under TAC management within Canada's 200 mile limit and are currently not regulated by TAC within the NRA.

Catches ranged from 3 000 tons to 14 000 tons between 1995 and 2000, increased to 20 000 tons in 2001 then declined to 17 000 tons in 2002 (Fig. 15.1). The catch for 2003 is estimated to be within the range of 16 100 tons and 18 400 tons.

Recent catches and TACs ('000 tons) are as follows:

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
TAC (Canada Only)	10	10	10	10	10	10	10	10	10	10
STATLANT 21A	2.8	10	5	13	13	13[1]	22[1]	19[1]	15[1]	
STACFIS	3.2	10	5	14	13	10	20	17	16-18[2]	

[1] Provisional.
[2] In 2003, STACFIS could not precisely estimate the catch.

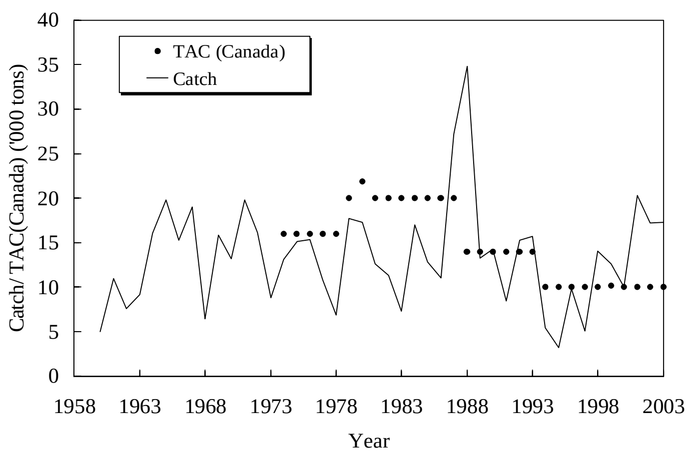


Fig. 15.1. Redfish in Div. 3O: catches and Canadian TACs.

In the 2003 assessment of this resource, STACFIS concluded it was not possible to determine current fishing mortality rate or absolute size of the stock. Accepting that the Canadian spring and autumn surveys may indicate general trends over the time period, the survey estimates did not increase in the last few years. Surveys conducted in 2003 continued to suggest there has been no increase (Fig. 15.2). Size distributions from surveys in 2003 also suggest weak incoming year-classes (Fig. 15.3). Ratios of catch to survey biomass estimates, averaged between the spring of year "n" and autumn of year "n-1", suggest that relative fishing mortality in 2003 was at the higher end of values that have been increasing since 1998. (Fig.15.4). In summary, there is no substantial change in Div. 3O redfish from last year.

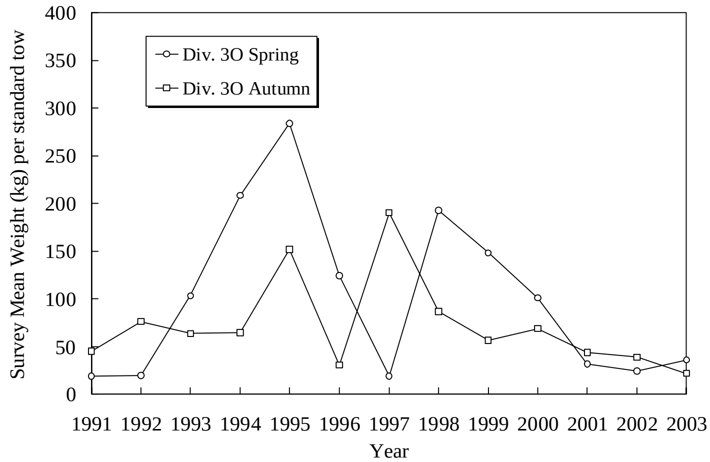


Fig. 15.2. Redfish in Div. 3O: survey biomass indices from Canadian surveys in Div. 3O in Campelen equivalent units for surveys prior to autumn 1995.

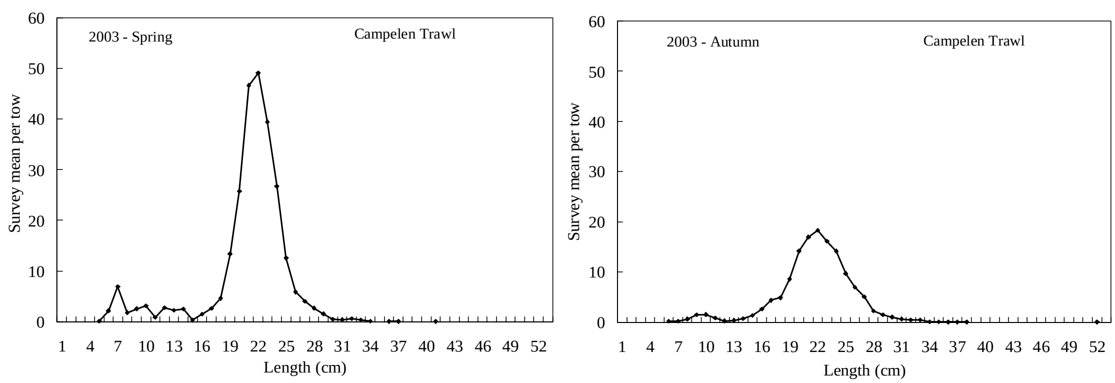


Fig. 15.3 Redfish in Div. 3O: size distribution (stratified mean per tow) from Canadian spring and autumn surveys for 2003.

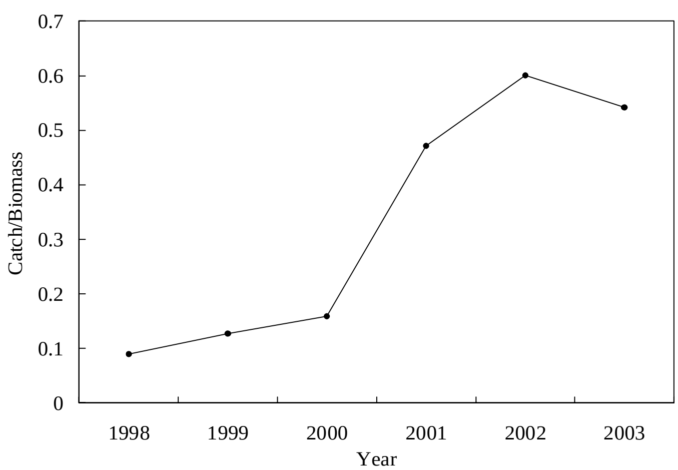


Fig. 15.4. Redfish in Div. 3O: catch/ratio of averaged autumn (n-1) and spring (n) survey biomass ratio for Div. 3O.

b) **Research Recommendations**

A paper was presented to the STACFIS discussing this issue (SCR 04/08). STACFIS concluded that the issue of the relationship of redfish in Div. 3L, 3N and 3O remains complicated and unclear. STACFIS noted that although recent studies on this issue have suggested a closer connection between Div. 3N and Div. 3O, in the absence of more definitive information, managing these as separate stocks is still appropriate.

A genetic study is currently being conducted within Canada that may provide useful results for the determination of the most appropriate management unit(s) in Div. 3L, 3N and 3O. It is anticipated that the results of this study will be made available to the Scientific Council meeting in June 2005. Accordingly, STACFIS **recommended** that *(1) redfish data in Div. 3LN and Div. 3O be analyzed further to determine if a relationship exists between Div. 3LN and Div. 3O that may help in the interpretation of the indices of abundance; and (2) data be examined to evaluate the appropriateness of Div. 3LN and Div. 3O as management units for redfish*.

16. **Thorny Skate (*Amblyraja radiata*) in Divisions 3L, 3N and 3O** (SCR Doc. 01/7, 02/11, 118, 121, 03/39, 57, 04/35; SCS Doc. 04/3, 5, 9, 12, 24)

a) **Introduction**

Commercial catches of skates comprise a mix of skate species. However, thorny skate dominates, comprising about 95% of the skates taken in the Canadian catches. EU-Spain reported that 96% of the skates taken in Div. 3NO comprised thorny skate. Thus, the skate fishery on the Grand Banks can be considered as a directed fishery for thorny skate.

Nominal catches increased in the mid-1980s with the commencement of a directed fishery for thorny skate. The main participants in this new fishery are EU-Spain, Canada, Russia and EU-Portugal. Prior to the mid-1980s, this species was commonly taken as a by-catch in other fisheries and continue to be taken as a by-catch, mainly in the Greenland halibut fishery and the Canadian mixed fishery for thorny skate, white hake and monkfish. Catches peaked at about 31 500 tons in 1991 (STATLANT 21A). During the period from 1985 to 1991, catches averaged 22 300 tons, lower during 1992-1995 (8 600 tons). There are substantial uncertainties in the catch levels prior to 1996. Catch levels after 1995 as estimated by STACFIS averaged 10 800 tons (Fig. 16.1). This species has not been regulated by quota, except within Canadian waters.

Recent catches ('000 tons) are as follows:

	1996	1997	1998	1999	2000	2001	2002	2003
STATLANT 21A	7.0	13.7	9.7	12.2	18.7[1]	10.0[1]	11.7[1]	12.1[1]
STACFIS	6.6	12.6	8.8	9.5	13.7	10.4	11.5	13.3-13.5[2]

[1] Provisional.
[2] In 2003, STACFIS could not precisely estimate the catch.

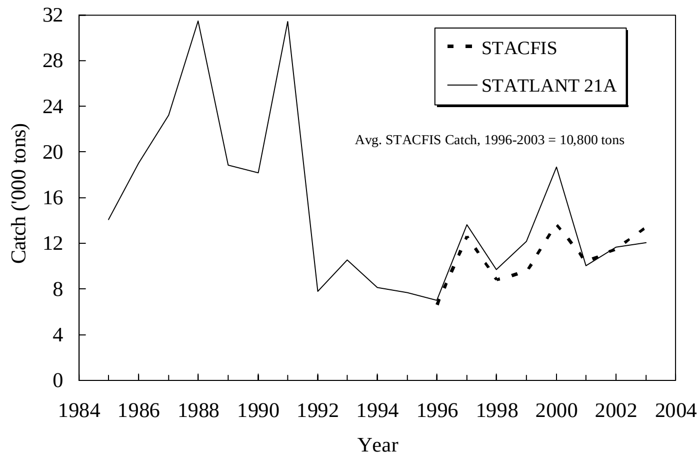


Fig. 16.1. Thorny skate in Div. 3LNO: total catches, 1985-2003.

b) **Input Data**

i) **Commercial fishery data**

Catch rates. Russia reported a catch rate of 21.3 tons per day in the directed 2003 otter trawl fishery in the NRA. EU-Spain reported CPUE for the skate fishery: 1998- 868 kg/hr, 2000 – 998 kg/hr, 2001 –892 kg/hr and 2002 – 898 kg/hr.

Catch-at-age. Thorny skate are not aged. Length frequencies were available for EU-Spain (1996-2003), EU-Portugal (2002-2003), Canada (1994-2003) and Russia (1998-2003).

ii) **Research survey data**

Canadian spring surveys. Stratified-random research vessel surveys have been conducted in spring 1974-2003 by Canada in Div. 3L, 3N and 3O using the Engel bottom trawl prior to 1996 and employing the Campelen 1800 trawl since. Maximum depth surveyed was 366 m before 1991 and ~750 m since. The two survey series, using different trawl gears are not directly comparable.

The Canadian spring survey biomass fluctuated without trend prior to the mid-1980s then declined rapidly until the early-1990s. During the Campelen series, 1996 to 2003, the biomass has been stable or has increased slightly (Fig.16.2). The pattern of abundance from the spring survey was similar.

Canadian autumn surveys. Additional stratified-random surveys have been conducted by Canada during autumn since 1990 in Div. 3LNO using the Engel bottom trawl prior to 1995 and employing the Campelen 1800 trawl since to depths of ~1 450 m. As for the spring series, the two survey series, using different trawl gears, are not directly comparable.

Survey biomass and abundance, similar to the spring estimates declined rapidly during the early-1990s. The biomass in the Campelen series has been stable or increased slightly (Fig. 16.2). The autumn estimates of both biomass and abundance were on average higher than the spring estimates. This is expected since the thorny skate are found at depths exceeding the maximum depths surveyed in the spring (~750 m) and are more deeply distributed during the winter/spring.

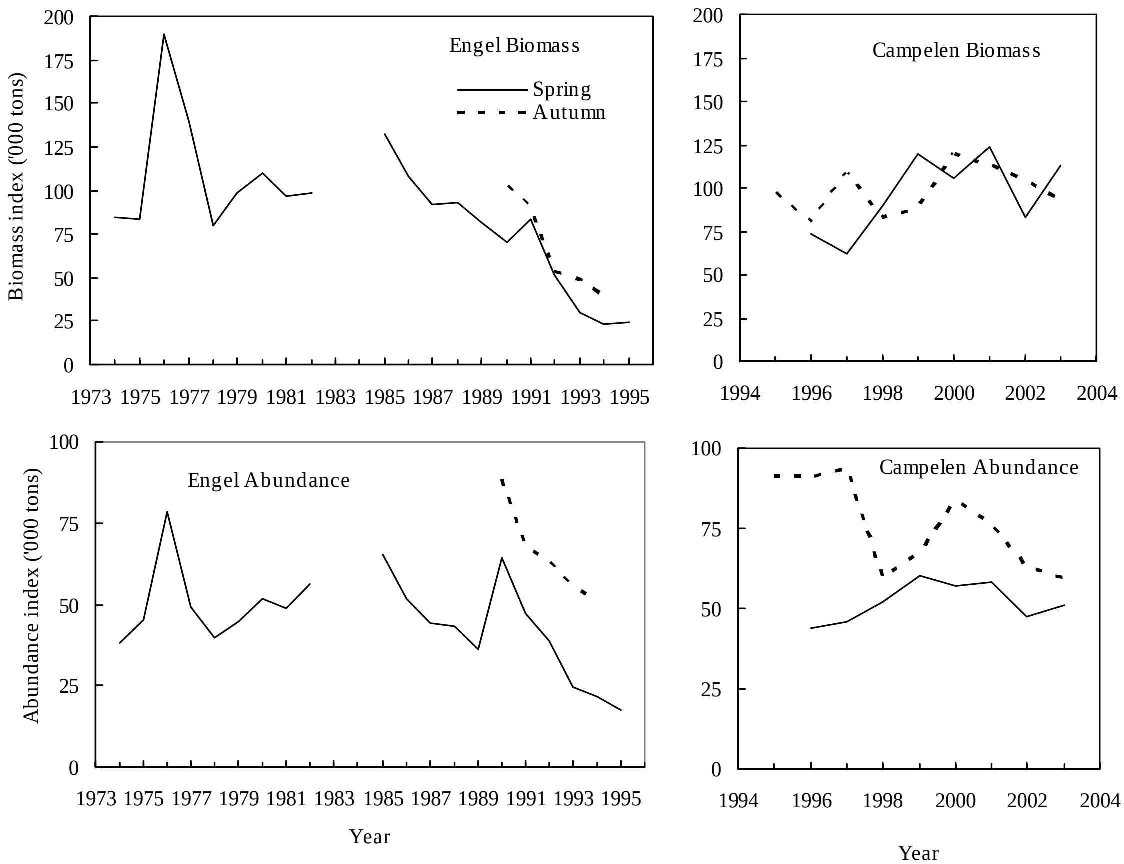


Fig. 16.2. Thorny skate in Div. 3LNO: estimates of biomass and abundance from Canadian spring and autumn surveys. Engel and Campelen trawl series are plotted separately.

Spanish surveys. Spanish survey biomass indices in Div. 3NO were available for the period 1997-2003. The Spanish survey was conducted in the NRA portion of Div. 3NO while the Canadian survey covered the entire extent of Div. 3NO. The biomass trajectory from the Spanish survey was very similar to that of the Canadian spring survey (Fig. 16.3).

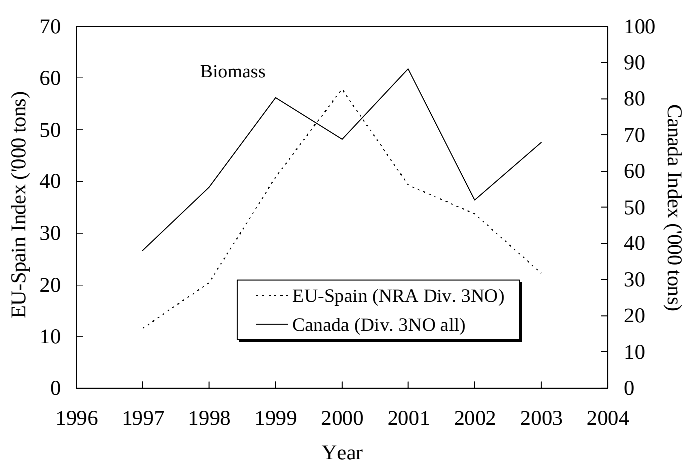


Fig. 16.3. Thorny skate in Div. 3NO: estimates of biomass from Spanish surveys compared to Canadian spring surveys.

iii) **Biological studies**

Life History and Distribution. Thorny skate have a length at 50% maturity of about 50 cm, low fecundity and long reproductive cycles. These characteristics result in low intrinsic rates of increase and are thought to lead to low resilience to fishing mortality. Investigations relating to these life history characteristics are ongoing and will be reported when completed.

Information on changes in the distribution of thorny skate can be found in the *NAFO Sci. Coun. Rep. 2002/2003,* pg. 174-179. New analyses showed that while the biomass has remained relatively constant since the mid-1990s, the density of skate continued to increase within the area on the southwest Grand Bank where >80% of the biomass has concentrated in recent years. As well, the *NAFO Sci. Coun. Rep. 2002/2003* indicated that on average 26.4% and 22.5% of the biomass of thorny skate was found in the NRA in autumn and spring respectively, mainly in Div. 3N.

c) **Assessment Results**

Although Scientific Council accepted the conversion factor of survey data from the Engel series to Campelen equivalent in 2003, further discussion by STACFIS identified a number of concerns and as such, further studies were recommended. Nevertheless, at the level of recent catches (avg. 10 800 tons in 1996-2003), biomass of thorny skate has remained relatively stable.

d) **Reference Points**

Reference points are not available for thorny skate at this time.

e) **Recommendations**

STACFIS **recommended** that *investigations into length-cohort analyses of commercial catches, standardization of the two research survey series (Engel and Campelen) and non-equilibrium production modeling be carried out for thorny skate in Div. 3LNO.*

D. WIDELY DISTRIBUTED STOCKS

Environmental Overview

The water mass characteristics of Newfoundland and Labrador Shelf are typical of sub-polar waters with a sub-surface temperature range of -1º to 2ºC and salinities of 32 to 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 3º to 4ºC and salinities in the range of 34 to 34.75. On average bottom temperatures remain <0ºC over most of the northern Grand Banks but increase to 1º to 4ºC in southern regions and along the slopes of the banks below 200-m. North of the Grand Bank, bottom temperatures are generally warmer (1º to 3ºC) except for the shallow inshore regions where they are mainly <0ºC. In the deeper waters of the Flemish Pass and across the Flemish Cap bottom temperatures generally range from 3º to 4ºC. 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 climate conditions. In general, shelf water masses undergo seasonal modification in its 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 be covered by relatively cold waters (1° to 4°C) whereas the basins in the central and southwestern regions have bottom temperatures that typically are 8°-10°C. On the Newfoundland and Labrador Shelf, 2003 was a year of extremes, with very cold spring conditions that moderated by mid-summer and warmed to above normal conditions throughout the remainder of the year. The CIL was below-normal (implying warm conditions) of eastern Newfoundland for the 9th consecutive year. Further south, on the Scotian Shelf, water temperatures decreased substantially over 2003 with below normal values in most areas, except for the deep basins. Shelf waters during 2003 throughout the entire region from Labrador to the Scotian Shelf were generally saltier than normal, similar to 2002 conditions. This has resulted in a decrease in shelf stratification over a road area which may have important implication for marine production in the region.

17. **Roughhead Grenadier (*Macrourus berglax*) in Subareas 2 and 3** (SCR Doc. 04/14; SCS Doc. 04/3**,** 5, 8, 9)

a) **Interim Monitoring Report**

It has been recognized that a substantial part of the recent grenadier catches in Subarea 3, previously reported as roundnose grenadier, correspond to roughhead grenadier. The misreporting has not yet been resolved in the official statistics before 1996, but the species have been reported correctly since 1997. STACFIS estimates that catches have been in the range of 3 792-4 177 tons in 2003.

Roughhead grenadier is taken as by-catch in the Greenland halibut fishery, mainly in Div. 3LMN of NAFO Regulatory Area (Fig. 17.1).

The revised catches ('000 tons) since 1995 are as follow:

	1995	1996	1997	1998	1999	2000	2001	2002	2003
STATLANT 21A	1.5	4.1	4.7	7.2	7.1	2.7[1]	1.6[1]	1.9[1]	1.5[1]
STACFIS	3.9	4.1	4.7	7.2	7.2	4.8	3.2	3.7	3.8-4.2[2]

[1] Provisional.
[2] In 2003, STACFIS could not precisely estimate the catch.

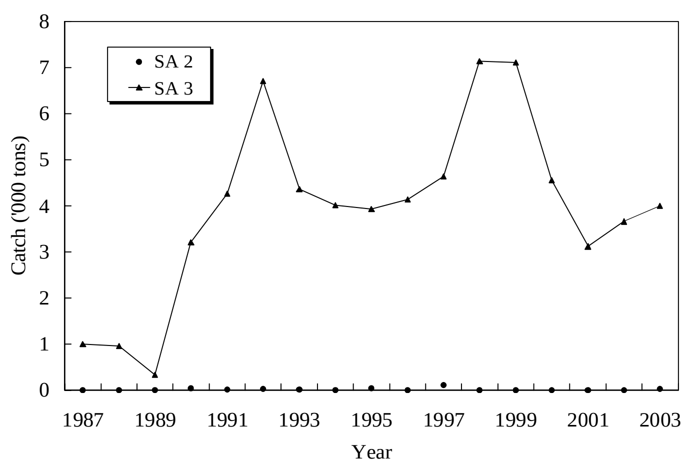


Fig. 17.1. Roughhead grenadier in Subareas 2+3: catches in Subarea 2 and Div. 3LMNO.

The biomass indices from the Canadian autumn, Canadian spring, Canadian deep-water and EU bottom trawl on Flemish Cap (with ± 2 SE) survey series are presented in Fig. 17.2.

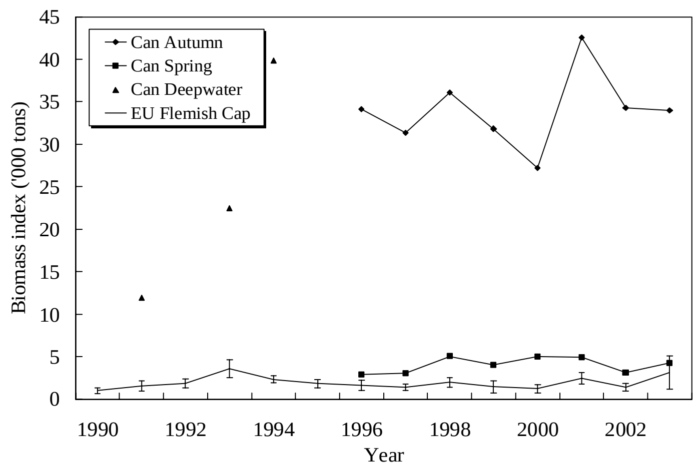


Fig. 17.2. Roughhead grenadier in Subareas 2+3: biomass indices from surveys.

The state of the stock is not known.

The catch/biomass (C/B) index in 2003 obtained using the Canadian autumn survey data was 0.12 (C/B_{2002} = 0.11).

The available time series of catches at age is too short to analyse trends in the SSB, however, it was noted that a low percentage of the catches in abundance were above the female age at maturity (15 years). Information is scarce to assess an appropriate exploitation level.

STACFIS is not in the position to provide references points at this time.

18. **Witch Flounder (*Glyptocephalus cynoglossus*) in Divisions 2J, 3K and 3L** (SCR Doc. 04/48; SCS Doc. 04/3, 5, 8, 9)

a) **Interim monitoring report**

The fishery for witch flounder in this area began in the early-1960s and increased steadily from about 1 000 tons in 1963 to a peak of over 24 000 tons in 1973 (Fig. 18.1). Catches declined rapidly to 2 800 tons by 1980 and subsequently fluctuated between 3 000 and 4 500 tons to 1991. The catch in 1992 declined to about 2 700 tons, the lowest since 1964; and further declined to around 400 tons 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 only 12 tons were reported for 1994, a catch of 491 tons was indicated for EU-Spain in the Spanish Research Report (SCS Doc. 95/15) for the Regulatory Area of Div. 3L. 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 tons, 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 tons, respectively, most of which was reported from the Regulatory Area of Div. 3L. From 1999 to 2002 catches were estimated to be between 300 and 800 tons, and in 2003 catch was estimated at about 780 tons.

Recent catches and TACs ('000 tons) are as follows:

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
TAC	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf
STATLANT 21A	0.8	1.4	0.9	0.4	0.4	0.5[1]	0.6[1]	0.7[1]	0.5[1]	
STACFIS		0.7	1.4	0.8	1.1	0.3	0.7	0.8	0.4	0.8

[1] Provisional.
ndf no directed fishing.

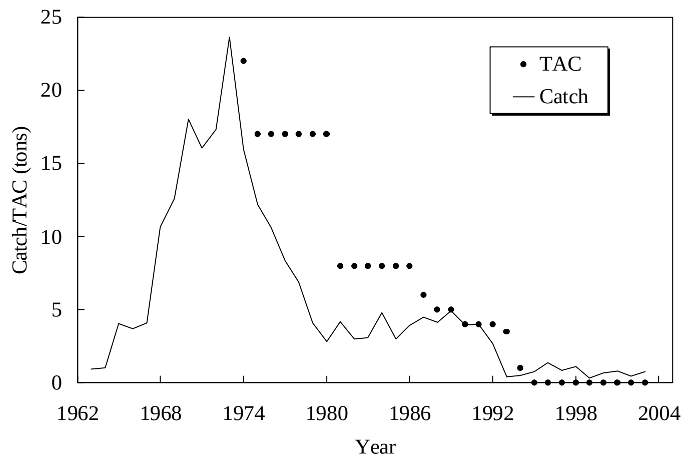


Fig. 18.1. Witch flounder in Div. 2J, 3K and 3L: catches and TAC.

b) **Input Data**

ii) **Research survey data**

Mean weight (kg) per tow. For Div. 2J, mean weights (kg) per tow ranged from as high as 1.82 kg per tow in 1986 to a low of 0.05 kg per tow in 2003 (Fig 18.2). In Div. 3K, during 1979-85, there was a period of relative stability where most survey sets averaged 7-13 kg. Since that time estimates have declined considerably to less than 0.09 kg per tow in 1995. Values increased slightly after 1995 ranging from 0.17 to 0.28 kg per tow between 1996-2001, but declined in 2002 to 0.09 kg per tow, the lowest value in the series and remained low at 0.13 kg per tow in 2003. For Div. 3L, mean weights per tow varied generally between 2.5 and 1.31 kg per tow from 1983 to 1990 but declined rapidly since then to a low of 0.08 kg per tow in 1995. Values have remained low since then.

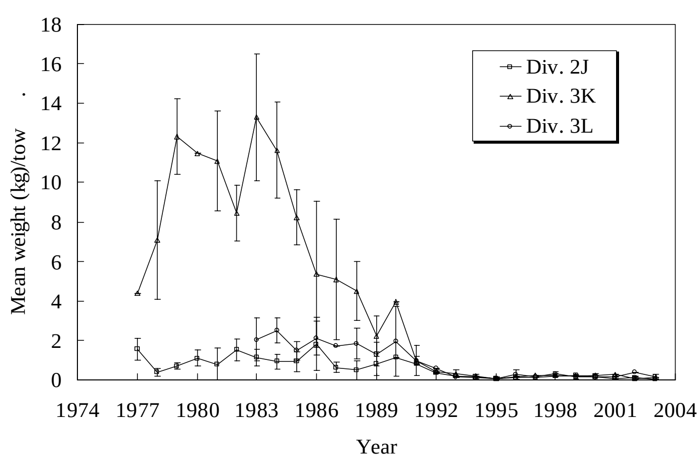


Fig. 18.2. Witch flounder in Div. 2J, 3K and 3L: mean weights (kg) per tow from Canadian autumn surveys.

Distribution. Survey distribution data from the late-1970s and early-1980s indicated that witch flounder were widely distributed throughout the shelf area in deeper channels around the fishing banks primarily in Div. 3K. By the mid-1980s, however, they were rapidly declining and by the early-1990s had virtually disappeared from the area entirely with the exception of some very small catches along the slope and in the southern area. They now appear to be located only along the deep continental slope area, especially in Div. 3L both inside and outside the Canadian 200-mile fishery zone (Fig. 18.3).

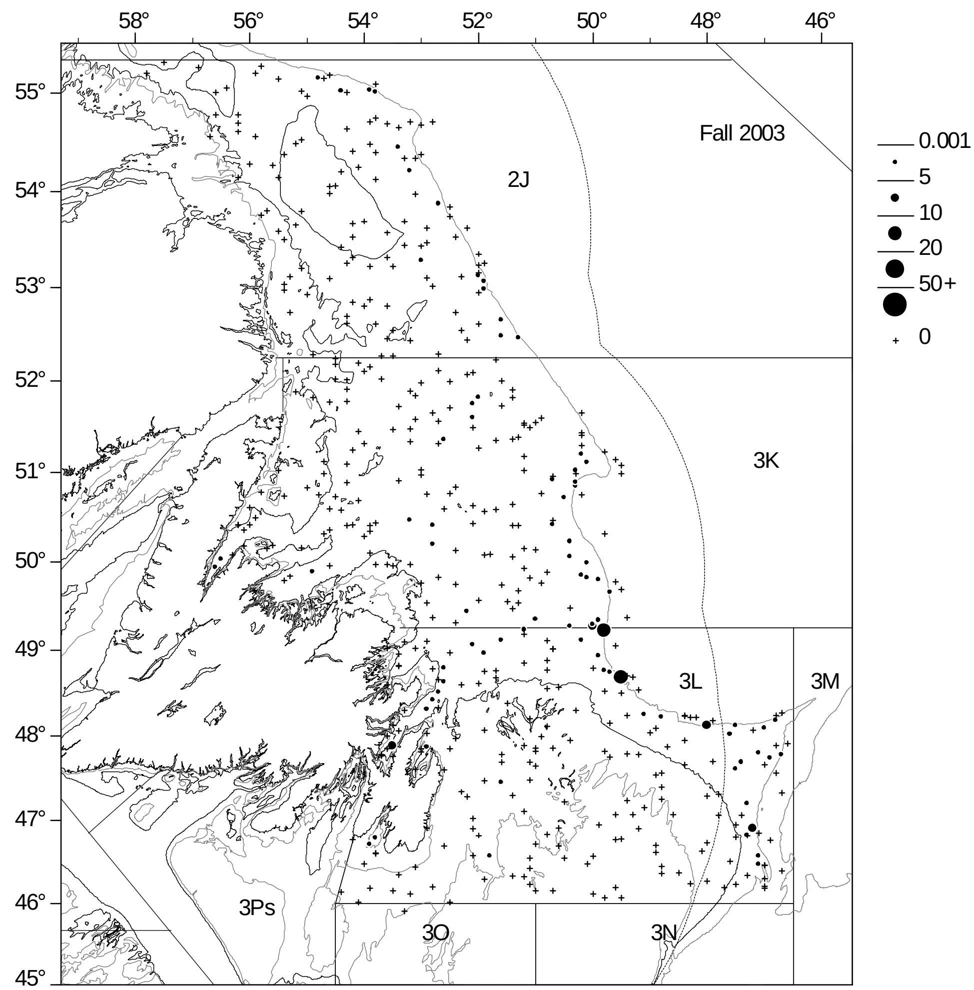


Fig. 18.3. Witch flounder in Div. 2J, 3K and 3L: weight (kg) per set from Canadian surveys during autumn 2003.

c) Assessment Results

Based on the most recent data, STACFIS considers that the overall stock remains at a very low level.

19. **Greenland Halibut (*Reinhardtius hippoglossoides*) in Subarea 2 and Divisions 3KLMNO** (SCR Doc. 04/11, 16, 21, 33, 37, 46, 48, 55; SCS Doc. 04/3, 5, 8, 9)

a) **Introduction**

Catches increased from low levels in the early-1960s to over 36 000 tons in 1969, and ranged from less than 20 000 tons to 39 000 tons until 1990 (Fig. 19.1). In 1990, an extensive fishery developed in the deep water (down to at least 1 500 m) in the NAFO Regulatory Area (NRA), around the boundary of Div. 3L and 3M and by 1991 extended into Div. 3N. The total catch estimated by STACFIS for 1990-94 was in the range of 47 000 to 63 000 tons annually, although estimates in some years were as high as 75 000 tons. Beginning in 1995, TACs for the resource were established by the Fisheries Commission, and the catch declined to just over 15 000 tons in 1995, a reduction of about 75% compared to the average annual catch of the previous 5 years. The catch from 1996-98 was around 20 000 tons per year. Subsequently catches increased and by 2001 had reached 38 000 tons before declining to 34 000 tons in 2002. The total catch for 2003 was believed to be within the range of 32 000 tons to 38 500 tons; for assessment purposes, STACFIS used a catch of 35 000 tons.

Prior to the 1990s Canada was the main participant in the fishery followed by USSR/Russia, Denmark (Faeroe Islands), Poland and EU-Germany (GDR before 1989) fishing primarily in Subarea 2 and Division 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 Divisions 3LM and to a lesser degree in Divisions 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. At its 2003 annual meeting the Fisheries Commission implemented a fifteen year rebuilding plan for this stock. It established TACs of 20 000, 19 000, 18 500 and 16 000 tons, respectively for the years 2004 to 2007, and that subsequent TAC levels shall not be set at levels beyond 15% less or greater than the TAC of the preceding year until the Fisheries Commission rebuilding target of 140 000 tons of age 5+ biomass has been achieved.

Recent catches and TACs ('000 tons) are as follows:

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
TAC	27	27	27	27	33	35	40	44	42	20[3]
STATLANT 21A	16	19	20	20	23	32[1]	29[1]	29[1]	27[1]	
STACFIS	15	19	20	20	24	34	38	34	32-38[2]	

[1] Provisional.
[2] In 2003, STACFIS could not precisely estimate the catch.
[3] Fisheries Commission rebuilding plan (FC 03/13).

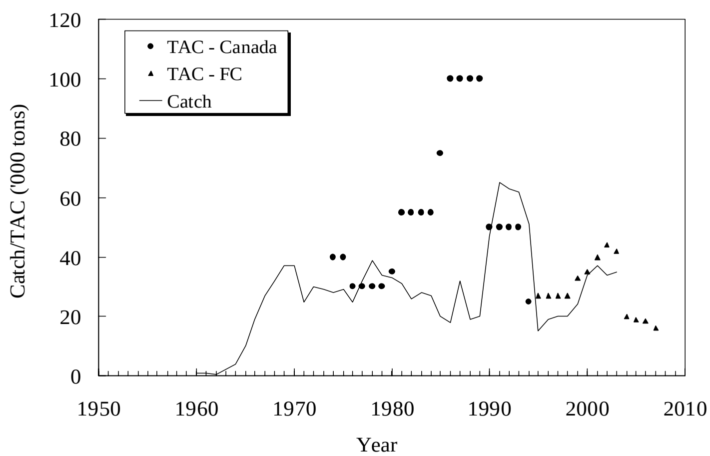


Fig. 19.1. Greenland halibut in Subarea 2 + Div. 3KLMNO: catches and TACs.

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 (Fig. 19.2), using both hours fished and days fished indicated a declining trend since about the mid-1980s, stabilizing at a low level during the mid-1990s. The standardized catch rate increased from 1997-2001 then declined in 2002-2003 to the low levels of the mid-1990s (SCR Doc. 04/37).

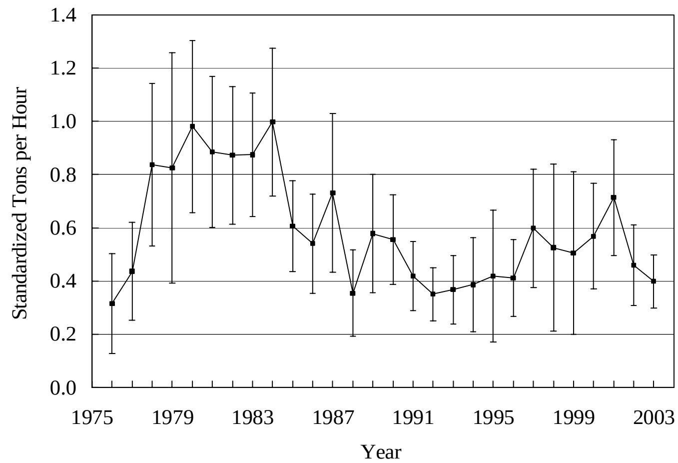


Fig. 19.2 Greenland halibut in Subarea 2 + Div. 3KLMNO: standardized CPUE (± 2 S.E.) based on hours fished from the Canadian fishery in Div. 2HJ+3KL.

Catch-rates of Portuguese otter trawlers fishing in the NRA of Div. 3LMN from 1988-2002 (Fig. 19.3) declined sharply from 1988 to 1991, and remained around this low level until 1994 (SCS Doc. 04/5). CPUE gradually increased until 1999-2000 when it was almost double the low values in 1991-94, but still below the CPUE in 1988-90. The CPUE declined in 2001 and has remained at about the same level since that time.

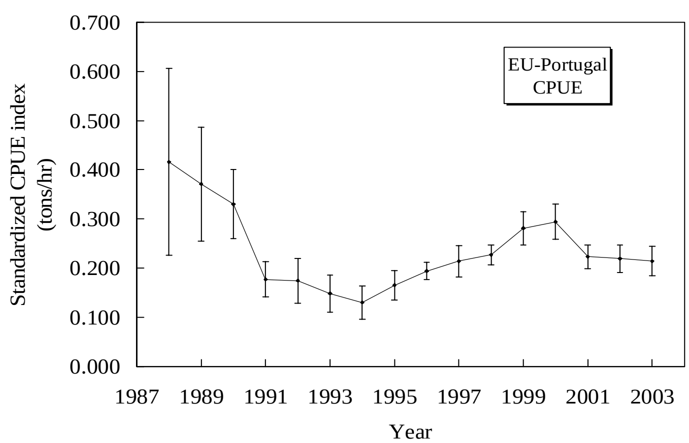


Fig. 19.3 Greenland halibut in Subarea 2 + Div. 3KLMNO: standardized CPUE (± 2 S.E.) from the EU-Portugal trawlers with scientific observers in Div. 3LMN.

Relative catch-rates of Spanish otter trawlers fishing in the NRA of Div. 3LMNO from 1991-2003 (Fig. 19.4) are estimated from national scientific observer data. The CPUE are quite variable with no clear trend (SCR Doc. 04/16). The CPUE index has been decreasing since 2000, and the 2003 result is below average.

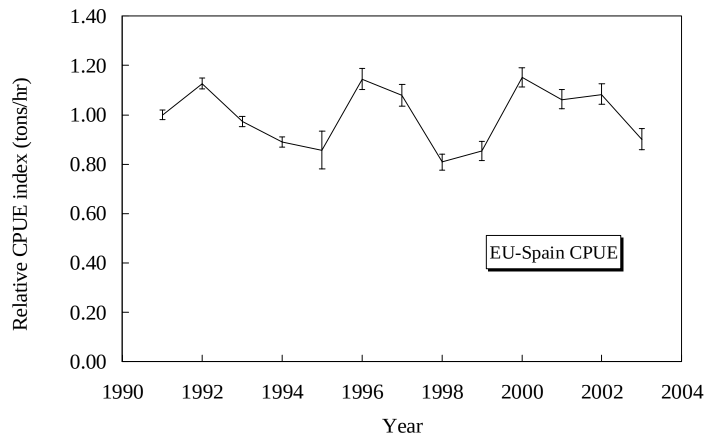


Fig. 19.4 Greenland halibut in Subarea 2 + Div. 3KLMNO: standardized CPUE (± 2 S.E.) from the EU-Spain trawlers with scientific observers in Div. 3LMNO.

Quality of CPUE Indices. No information was available to STACFIS on the spatial distribution of fishing effort. It is possible that by concentration of effort, commercial catch rates may remain stable as the stock declines. Therefore, STACFIS concluded that trends in commercial catch per unit effort should not be used as indices of the trends in the stock.

A standardized catch rate series for hours fished and days fished was available for all fleets based on STATLANT 21B data. STACFIS noted that there were deficiencies in the catches in the database for some fleets and concluded that a standardized CPUE of all fleets based on the STATLANT 21B could result in a biased index for this stock. STACFIS concluded STATLANT 21B catch data cannot currently be used for the calculation of CPUE indices.

Catch-at-age and mean weights-at-age. The methods used for constructing the catch-at-age and mean weights-at-age (kg) from 1975-2000 fisheries are described in detail in SCR Doc. 00/24.

The catch-at-age data from the Canadian fisheries since 2000 are documented in SCR Doc. 02/39, 03/36, 04/33. Length samples for the 2003 fishery were provided by EU-Spain (SCS Doc. 04/9), EU-Portugal (SCS Doc. 04/5), Russia (SCS Doc. 04/03) and Canada (SCR Doc. 04/33). Ageing information was provided by EU-Spain (SCS Doc. 04/9), Russia (SCS Doc. 04/3), and Canada (SCR Doc. 04/33). Due to aging inconsistencies (SCR Doc. 02/141), a Canadian age-length key was used to calculate catch-at-age for all catches in 2003 as in previous assessments.

Ages 6-8 dominated the catch throughout the entire time period; with ages 12+ contributing less than 15% on average to the annual catch biomass. Mean weights-at-age exhibit variable patterns in the earliest period likely due to poor sampling. Mean weights-at-age for age groups 5-9 during the recent period were relatively stable. For older fish they were variable and show a declining trend since 1998 (SCR Doc. 04/55).

ii) **Research survey data**

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.

Canadian stratified-random autumn surveys in Div. 2J and 3K (SCR Doc. 04/48). In Div. 2J the biomass index (Fig. 19.5; mean weight (kg) per tow) was relatively stable from 1978-84 before declining to an all time low in 1992. It increased only marginally until 1995 after which it began to increase more rapidly. By 1999 the index had reached the highest level since 1986 but subsequently declined again and by 2003 was well below the levels observed in the late-1990s. In Div. 3K there was a rather long period of apparent stability from 1978-89. The index declined to the lowest observed level in 1992; after 1994 the index increased rapidly and steadily until 1999, near the highest in the time series. The index has been declining since then and by 2002 was much less than the values of the late-1990s. The index declined by nearly 50% between 2001 and 2002, where it remained in 2003.

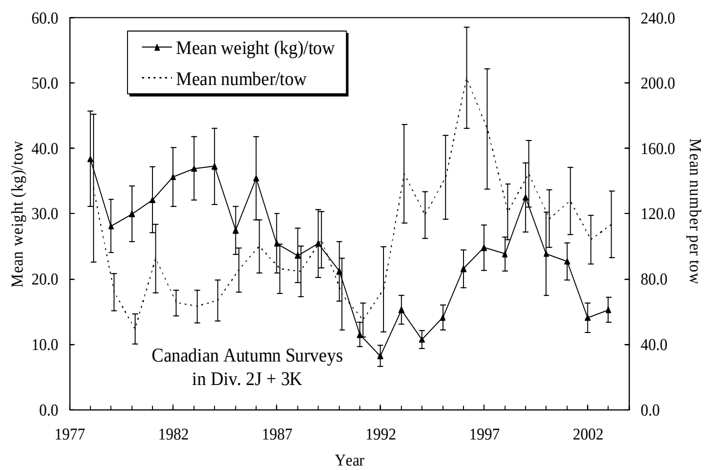


Fig. 19.5. Greenland halibut in Subarea 2 + Div. 3KLMNO: biomass and abundance indices (mean weight-per-tow with 95% CI) from Canadian autumn surveys in Div. 2J and 3K.

Mean weight-per-tow in Div. 2J and 3K combined of fish greater than 30 cm (minimum size limit in commercial fishery) was lowest in 1992; remained the same until 1995 after which it increased steadily until 1999 when it approached levels of the late-1980s (SCR Doc. 04/48) (Fig. 19.6). The index has declined since then and by 2003 was about the same level as 1992-95. During the late-1970s and early-1980s large Greenland halibut (greater than 70 cm) contributed almost 20% to the estimated biomass. However, after 1984 this size category declined and by 1988 virtually no Greenland halibut in this size range contributed to the index (Fig. 19.6). Since then, the contribution to the stock from this size group has remained extremely low (SCR Doc. 04/48).

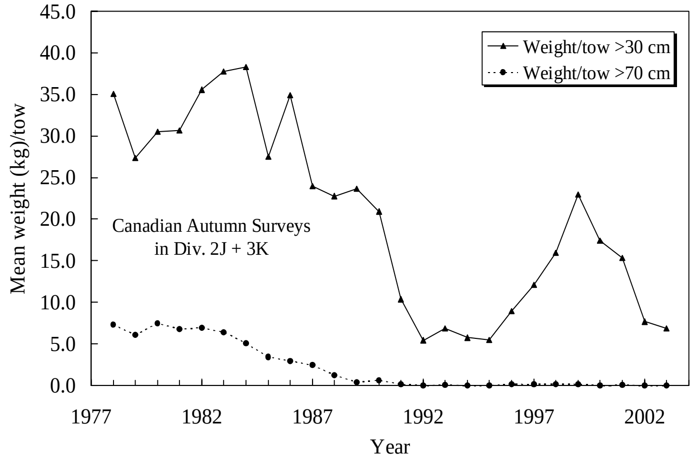


Fig. 19.6 Greenland halibut in Subarea 2 + Div. 3KLMNO: biomass indices (mean weight (kg)-per-tow) for fish >30 cm and >70 cm from Canadian autumn surveys in Div. 2J and 3K.

An examination of the age structure indicated that the ages 5+ biomass index (Fig. 19.7) declined by about 80% from the peak values of the mid-1980s to the lowest point observed in 1993 (SCR Doc. 04/48). The index increased steadily at these ages from 1993 and peaked in 1999. Since then it has declined once again and by 2003 was near the low levels observed in the mid-1990s. The index at ages 1-4 (Fig. 19.7) was variable without trend during the 1980s but increased substantially during the early-1990s. It generally remained above the long-term average since 1992 and reached a maximum in 1996 beyond which it declined but nevertheless remained relatively high.

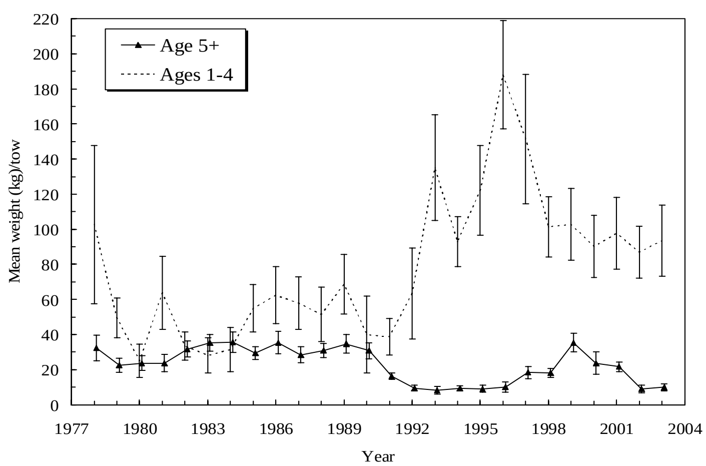


Fig. 19.7 Greenland halibut in Subarea 2 + Div. 3KLMNO: biomass indices (mean weight (kg)-per-tow with 95% CI) for ages 1-4 and ages 5+ from Canadian autumn surveys in Div. 2J and 3K.

STACFIS previously noted (*NAFO Sci. Coun Rep.,* 2002/2003, p. 306-327) an apparent redistribution of the resource in the early-1990s. Thus, the declining trend in the Canadian autumn surveys in Div. 2J and 3K from the mid-1980s to the early-1990s may be 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. Here they have been exploited by what has become the main component of the commercial fishery. Since the mid-1990s, survey indices both in the Regulatory

Area and in Div. 2J and 3K show similar trends suggesting that emigration does not appear to be a significant contributing factor to the overall trends in the indices since then. Given these observations, STACFIS concluded that it is inappropriate to use the Canadian autumn Div. 2J and 3K survey index prior to the mid-1990s as a calibration index in a VPA based assessment.

Canadian stratified-random surveys in Div. 3LNO and 3M (SCR Doc. 04/48). The biomass index (mean weight (kg)-per-tow) from the Canadian spring surveys in Div. 3LNO using the Campelen trawl increased from 1996 to 1998. Since 1998, the index has declined to low levels from 2001 to 2003 (Fig. 19.8). The Canadian autumn surveys in Div. 3L and 3N showed a similar trend (SCR 04/48); the autumn 2003 Div. 3N index is the lowest in the series. In Div. 3O, the index decreased in the past three years. However, autumn survey coverage in Div. 3N and 3O was highly variable from year to year. Canadian autumn surveys in Div. 3M indicated a decline from 1998 to 2002, which is the lowest value in the series (Fig. 19.9). The 2003 value increased to about the 2001 level.

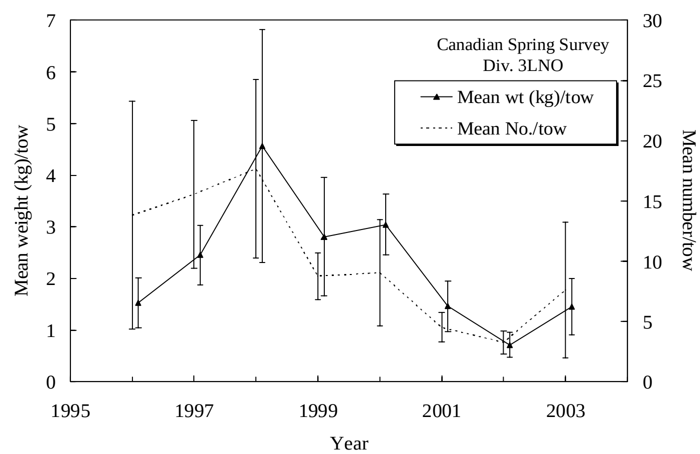


Fig. 19.8. Greenland halibut in Subarea 2 + Div. 3KLMNO: biomass and abundance indices (mean weight-per-tow with 95% CI) from Canadian spring surveys in Div. 3LNO.

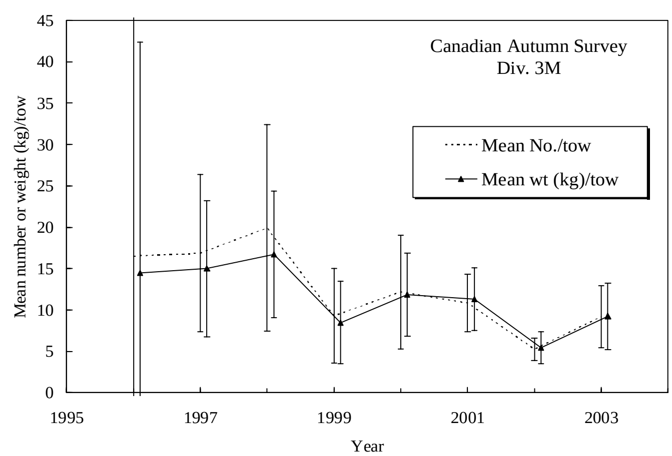


Fig. 19.9. Greenland halibut in Subarea 2 + Div. 3KLMNO: biomass and abundance indices (mean weight-per-tow with 95% CI) from Canadian autumn surveys in Div. 3M.

EU stratified-random surveys in Div. 3M (SCR Doc. 04/21). These surveys indicated that the Greenland halibut biomass index (mean weight (kg)-per-tow) in July on Flemish Cap in depths to 730 m increased from 1988 to the maximum value in 1998 (Fig. 19.9). The biomass index has consistently declined since 1998.

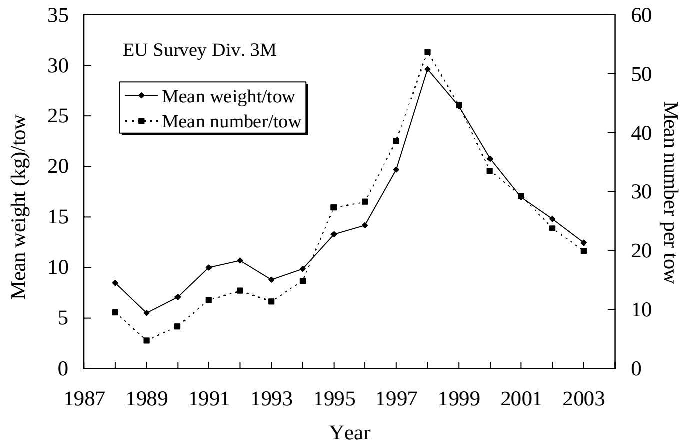


Fig. 19.10. Greenland halibut in Subarea 2 + Div. 3KLMNO: biomass and abundance indices mean weight-per-tow) from EU summer surveys in Div. 3M.

EU-Spain stratified-random surveys in Div. 3NO Regulatory Area (SCR Doc. 04/11). The biomass index (converted to Campelen trawl equivalents) increased from 1996 to 1998, but declined since then through 2002, the lowest in the time series (Fig. 19.11). The 2003 index increased relative to the 2002 value. Note that the 1998 value has been revised from that previously reported (*NAFO Sci. Coun Rep., 2002/2003*, p. 306-327) to correct data errors.

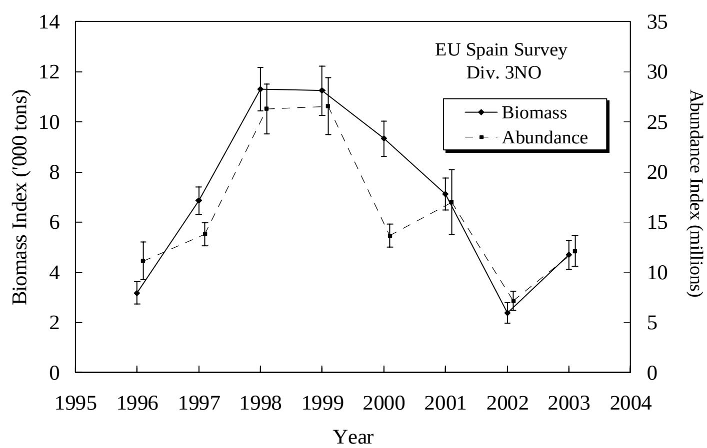


Fig. 19.11. Greenland halibut in Subarea 2 + Div. 3KLMNO: biomass and abundance indices (± 1 SE) from EU-Spain spring surveys in Div. 3NO.

Summary of research survey data trends. In the recent time period, indices from the majority of the surveys provide a consistent signal as to the dynamics of the stock biomass. They increase from 1996 to 1998, following which they have decreasing trends and are currently at levels comparable to 1996. The surveys provide coverage of the majority of the spatial distribution of the stock and the area from which the catches are taken. Few fish above 60 cm were caught in any of the surveys.

iii) **Recruitment indices**

A mixed log-linear model was applied to provide an index of year-class strength from several research vessel survey series (SCR Doc. 04/46). Five independent data series were used as follows: EU Div. 3M (1991-2003), Canadian autumn Div. 2J+3K (1978-2003), Canadian autumn Div. 3L (1995-2003), Canadian autumn Div. 3NO (1997-2003) and Canadian spring Div. 3LNO (1996-2003). All Canadian data were Campelen or equivalent values. In the previous assessment, stratified mean numbers-per-tow at age for ages 1-4 had been selected for the modelling exercise. While the results from this analysis were considered to reflect the general trend in development of year-class strength in the more recent period it was not believed to realistically indicate the historical trend in recruitment especially since the mid-1980s.

In the current assessment (SCR Doc. 04/46) survey estimates for ages 3-5 were used in the analysis. Estimates of these ages were considered to better indicate year-class strengths as they appeared in the fishery in subsequent years.

Model results showed that for year-classes prior to 1992 only the year-classes of the mid-1980s were above the long-term average (Fig. 19.12). The 1993-95 year-classes were estimated to be well above average (about twice the strength of those of the mid-1980s) despite wide confidence intervals. The subsequent year-classes (1996-2000) are all below the long term average.

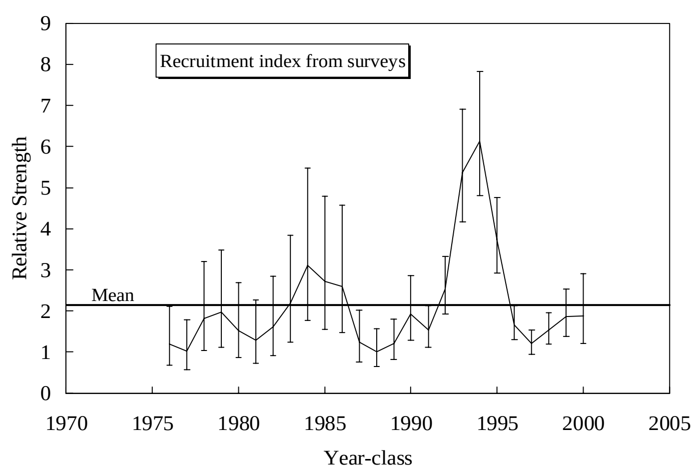


Fig. 19.12. Greenland halibut in Subarea 2 + Div. 3KLMNO: Recruitment index from five research vessel survey series.

c) **Estimation of Parameters**

At the June 2004 meeting STACFIS reviewed several alternate XSA (SCR 04/55; Shepherd 1999[1]; Darby and Flatman, 1994[2]) formulations. In addition to the XSA analyses, assessments of population status were

[1] 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.,* Vol. **56**(5), October 1999, pp. 584-591.

[2] DARBY, C. D., and S. FLATMAN. 1994. Virtual Population Analysis: Version 3.1 (Windows/Dos) user guide. *Info. Tech. Ser., MAFF Direct. Fish. Res., Lowestoft*, **1**: 85 p.

estimated using an alternate age-disaggregated method, ADAPT (Gavaris, MS 1988[3]) and also using an age-aggregated production approach, ASPIC (Prager, 1994[4]).

STACFIS reviewed the diagnostics from a fit of the 2003 XSA formulation to the 2004 catch-at-age and survey data sets. STACFIS concluded that the XSA formulation used in 2003 was still appropriate for fitting the model to the data and therefore retained the 2003 formulation. The XSA model specifications are as follows:

Catch data for 29 years, 1975 to 2003, ages 1 to 14+

Fleets	First year	Last year	First age	Last age
EU survey	1995	2003	1	12
Canadian autumn survey	1995	2003	1	13
Canadian spring survey	1996	2003	1	8

Natural Mortality is assumed 0.2 for all years, ages.
Tapered time weighting not applied
Catchability independent of stock size for all ages
Catchability independent of age for ages >=11
Terminal year survivor estimates shrunk towards the mean F of the final 5 years
Oldest age survivor estimates shrunk towards the mean F of ages 10-12
S.E. of the mean to which the estimates are shrunk = .500
Minimum standard error for population estimates from each cohort age = .500
Individual fleet weighting not applied.

d) **Assessment Results**

Biomass (Fig. 19.13): The fishable biomass (age 5+) declined to low levels in 1995-97 due to very high catches and high fishing mortality. It increased during 1998-2000 due to greatly reduced catches, much lower fishing mortality and improved recruitment. However, increasingly higher catches and fishing mortality since then accompanied by poorer recruitment has caused it to decline again, and the 2003 and 2004 estimates are the lowest in the series. Estimates of 2004 survivors from the XSA are used to compute 2004 biomass by assuming the 2004 stock weights are equal the 2001-2003 average. The 2004 5+ biomass is estimated to be 60 000 tons.

Fishing Mortality (Fig. 19.14): High catches in 1991-94 resulted in $F_{5\text{-}10}$ exceeding 0.50. $F_{5\text{-}10}$ then dropped to about 0.20 in 1995 with the substantial reduction in catch. $F_{5\text{-}10}$ has been increasing in recent years with increased catch, and the 2003 estimate is substantially higher; $F_{5\text{-}10}$ in 2003 is estimated to be 0.68.

Recruitment (Fig. 19.15): The above average 1993-95 year-classes have comprised most of the fishery in recent years although their overall contribution to the stock was less than previously expected. The most recent year-classes are estimated to be of about average strength. The result confirms the low abundance of the recruitment (1997-2000 year-classes) about to enter the exploitable biomass as estimated in the previous assessment (SCR Doc. 03/64).

STACFIS noted that the results of the current assessment are consistent with the analyses and projections accepted in the 2003 assessment (SCR Doc 03/64).

[3] GAVARIS, S. MS 1988. An adaptive framework for the estimation of population size. *CAFSAC Res. Doc*., No. 29, 12 p.

[4] PRAGER, M. H. 1994. A suite of extensions to a nonequilibrium surplus-production model. *Fish. Bull*., **92**: 374-389.

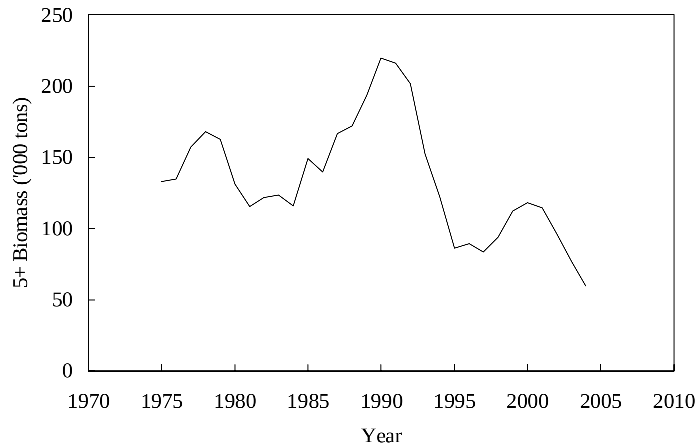


Fig. 19.13. Greenland halibut in Subarea 2 + Div. 3KLMNO: estimated 5+ biomass from XSA analysis.

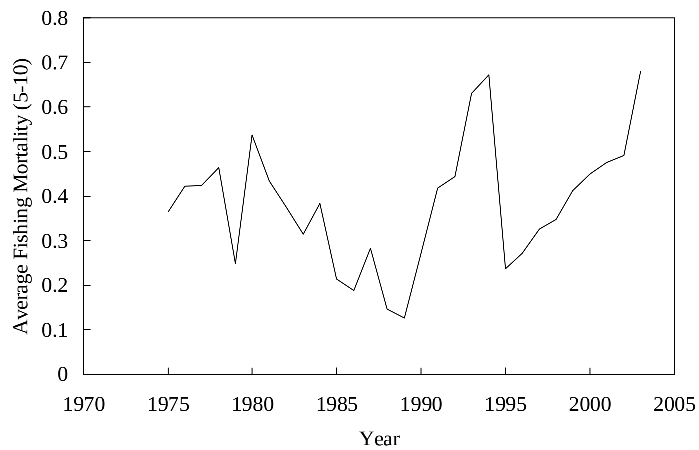


Fig. 19.14. Greenland halibut in Subarea 2 + Div. 3KLMNO: estimated fishing mortality (5-10) from XSA analysis.

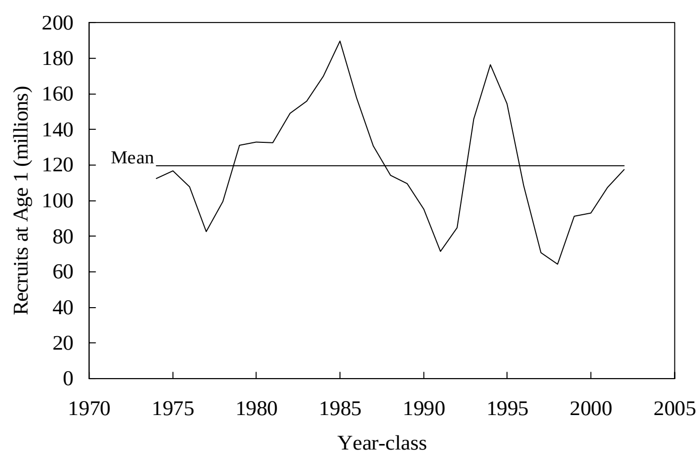


Fig. 19.15. Greenland halibut in Subarea 2 + Div. 3KLMNO: estimated recruitment at age 1 from XSA analysis.

e) **Retrospective analysis**

A retrospective analysis of the XSA was conducted. Fig. 19.16-19.18 present the age 1 recruitment, 5+ biomass and average fishing mortality at ages 5-10. The analysis indicates that aged based assessment models have difficulty in estimating of the abundance of the 1993-95 year-classes. The year-classes were initially estimated, using survey information at younger ages, to be the strongest in the time series. The year-classes have not contributed to the catch-at-age data or survey indices at older ages in the same proportions and their estimated abundance has been revised downwards with each subsequent assessment. The reasons for the change in relative abundance are unknown but could result from higher natural mortality or discarding, etc. The 2004 assessment has estimated the 1997-98 year-classes to be more abundant but they are still estimated to be amongst the lowest in the recorded time series. These year-classes are about to enter the exploitable biomass.

The influence of the downwards revision of the 1993-95 year-classes on the estimates of the 5+ biomass is seen in Fig. 19.17. The recent trend in biomass has been substantially revised downwards. The estimates from the last two assessments are more consistent. The fishing mortality retrospective pattern illustrates a consistent under-estimation; however, the increasing fishing mortality in recent years is consistent between the last two assessments.

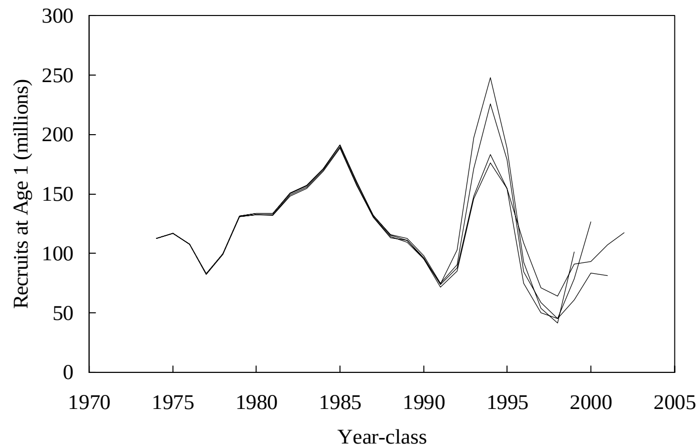


Fig. 19.16 Greenland halibut in Subarea 2 + Div. 3KLMNO: XSA retrospective analysis; age 1 recruitment.

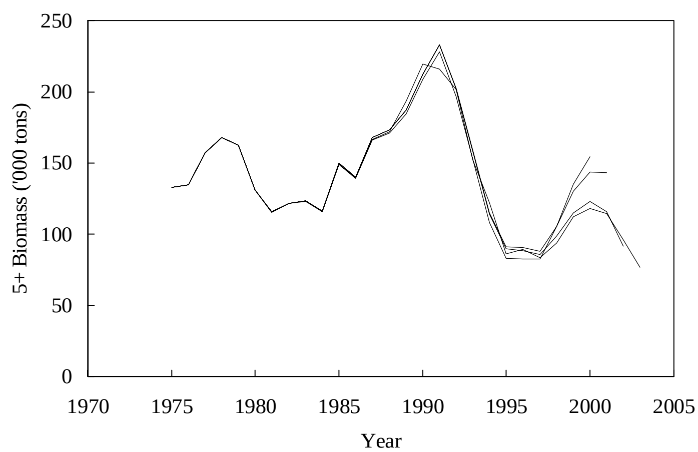


Fig. 19.17. Greenland halibut in Subarea 2 + Div. 3KLMNO: XSA retrospective analysis; 5+ biomass.

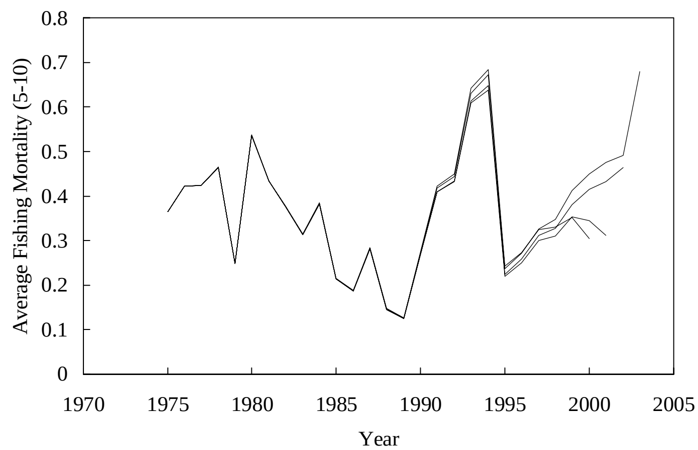


Fig. 19.18. Greenland halibut in Subarea 2 + Div. 3KLMNO: XSA retrospective analysis; average fishing mortality at ages 5-10.

f) **Sensitivity analysis of the XSA estimates**

A series of alternative model formulations were used to examine the robustness of the XSA estimated trends in the population dynamics of the stock.

i) ***Single fleet analyses***

XSA was fitted independently to each of the survey time series for which age based information was available. The fits to the EU survey and the Canadian autumn series used the 2003 age range and XSA formulation (*NAFO Sci. Coun Rep.,* 2002/2003, p. 306-327). The Canadian spring survey comprises ages 1-8, therefore XSA was fitted with an 11+ catch data age range.

Figures 19.19 and 19.20 present the XSA estimated 5+ biomass and Fig. 19.21 the average fishing mortality at ages 5-10. The figures illustrate the close agreement of the XSA estimate derived from models fitted to each of the survey series. The reduced age range fit to the Canadian spring survey produces higher average fishing mortality and lower biomass, but the same trends. This results from the shortening of the dome shaped exploitation pattern.

Fig. 19.19. Greenland halibut in Subarea 2 + Div. 3KLMNO: 5+ biomass trends estimated by XSA applied to the Canadian spring, autumn and EU survey data series. The bold line illustrates the fit to all series, the thin lines the autumn and EU surveys, and the thin line with boxes is the spring survey which only records ages 1-8.

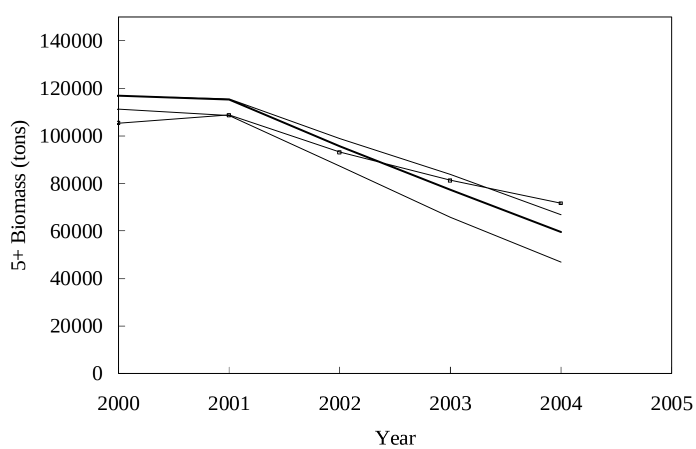


Fig. 19.20. Greenland halibut in Subarea 2 + Div. 3KLMNO: 5+ biomass trends in 2000-2004, as estimated by XSA applied to the Canadian spring, autumn and EU survey data series. The bold line illustrates the fit to all series, the thin lines the autumn and EU surveys, and the thin line with boxes is the spring survey which only records ages 1-8.

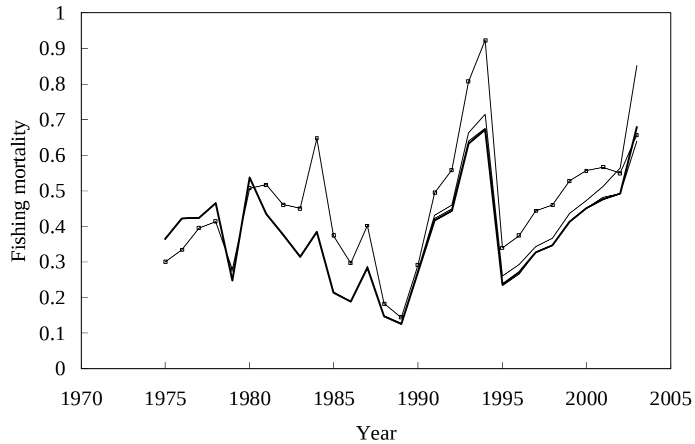


Fig. 19.21. Greenland halibut in Subarea 2 + Div. 3KLMNO: average fishing mortality as estimated by XSA applied to the Canadian spring, autumn and EU survey data series. The bold line illustrates the fit to all series, the thin lines the Autumn and EU surveys, and the thin line with boxes is the spring survey which only records ages 1-8.

ii) ***Canadian autumn survey data from 1978 to 1994***

Survey data collected prior to 1995 was excluded from the final model fit because of changes in survey catchability resulting from spatial changes in the stock distribution during the environmental variation that occurred during the late-1980s and early-1990s (*NAFO Sci. Coun. Rep*., *1993,* pp**.** 99-103). In order to examine the signal provided by the early survey information, the series was included within the XSA model fit as a separate index series. This allowed the early part of the time series to be fitted with catchability indices that were independent of the more recent survey information.

Canadian autumn survey log catchability residuals at ages 7-13 have strong trends during the period 1987-1994 (see Fig. 19.22, 19.23), consistent with the perception of changes in catchability discussed previously. The inclusion of the early years of the Canadian autumn survey series in the XSA model fit does not change the trends in the estimated stock metrics (Fig. 19.24).

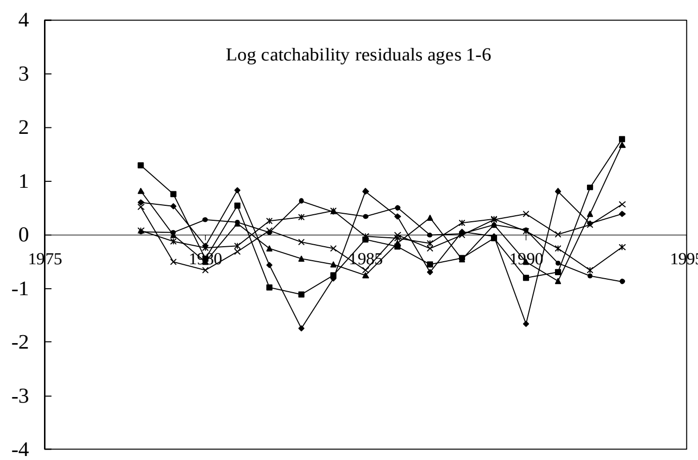


Fig. 19.22. Greenland halibut in Subarea 2 + Div. 3KLMNO: XSA log catchability residuals for the Canadian autumn survey for ages 1-6 during 1978-1994.

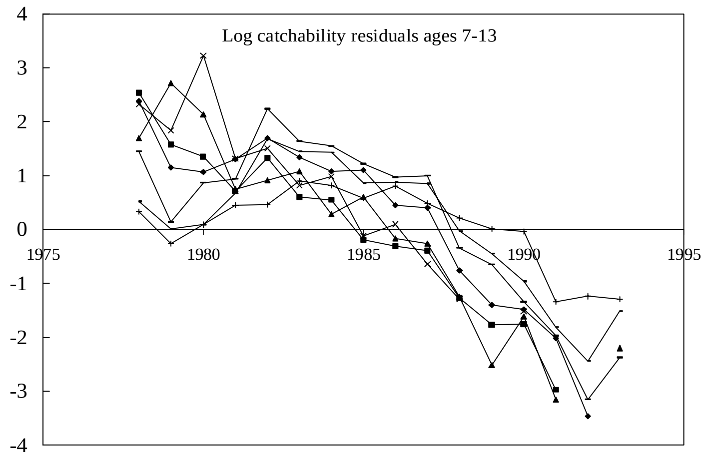


Fig. 19.23. Greenland halibut in Subarea 2 + Div. 3KLMNO: XSA log catchability residuals for the Canadian autumn survey for ages 7-13 during 1978-1994.

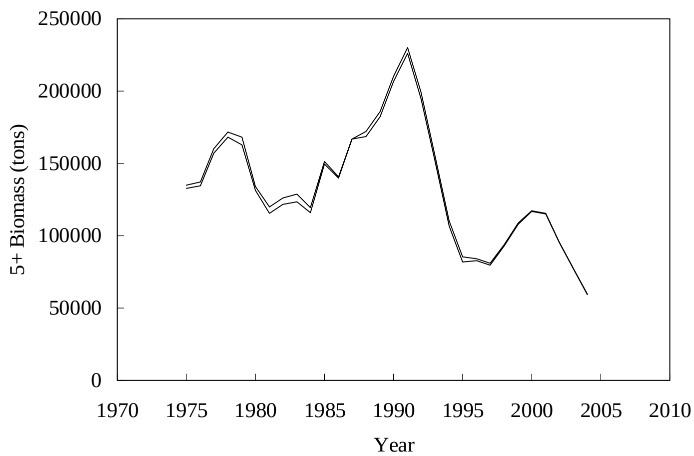


Fig. 19.24. Greenland halibut in Subarea 2 + Div. 3KLMNO: 5+ biomass trends, as estimated by XSA applied to the Canadian spring, autumn and EU survey data series. The two lines represent the inclusion, exclusion of the Canadian autumn 1978-1994 series.

iii) ***Assessment age range***

Several of the oldest age fleet estimates of catchability have relatively high standard errors. Although the reduced numbers of fish estimated at the oldest ages have little impact on the stock trends, the uncertainty may be influential on younger ages. The tuning data at the older ages cannot be removed from the assessment model without reducing the plus group as this result in a biased model fit. The stronger relative influence of shrinkage results in an underestimation of current fishing mortality and over estimation of biomass.

In order to examine the effect of removing those ages from the assessment, the plus group was reduced from 14+ to 12+ and 11+ and the XSA model refitted. The average fishing mortality range was reduced to age 5-9 in order to minimize the effect of plus group collation at ages close to the original maximum range in the average (age 10).

Figure 19.25 presents the estimates of 5+ biomass and Fig. 19.26 average fishing mortality at ages 5-9 for the XSA fitted with 11, 12 and 14+ groups. The results indicate that, although there is variability due to noise in the estimated fishing mortalities, the trends in the stock estimates are insensitive to the choice of plus group. In each case the stock is estimated to be declining to the lowest levels recorded and the fishing mortality is estimated to be at the highest levels recorded.

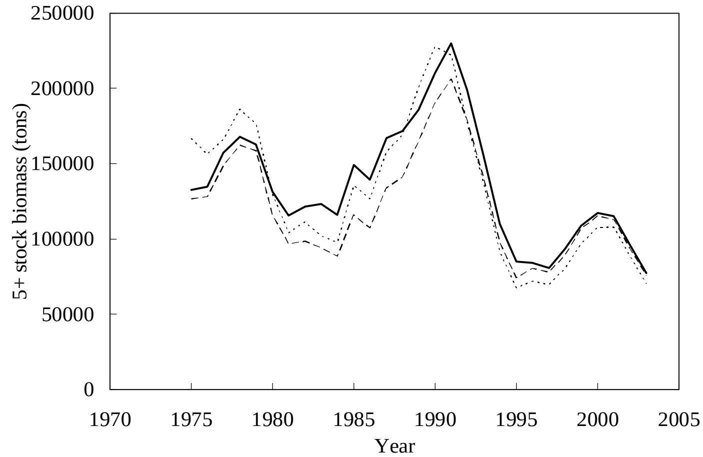


Fig. 19.25. Greenland halibut in Subarea 2 + Div. 3KLMNO: 5+ biomass, as estimated by XSA applied to the Canadian spring, autumn and EU survey data series. The solid line illustrates the fit to a 14+ group, large dashes 12+ and small dashes 11+.

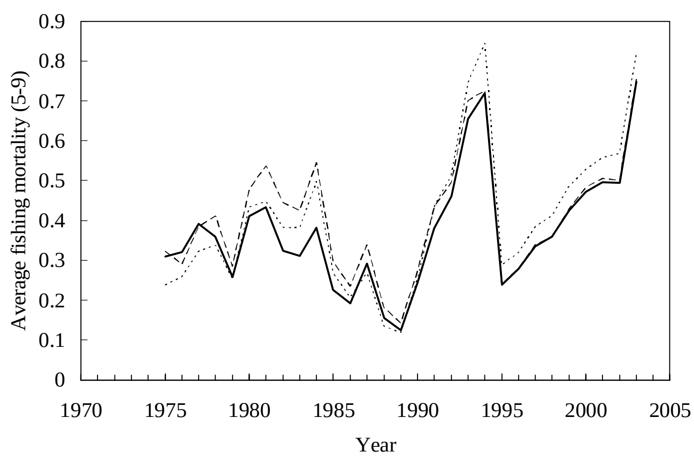


Fig. 19.26. Greenland halibut in Subarea 2 + Div. 3KLMNO: average fishing mortality (ages 5-9) as estimated by XSA applied to the Canadian spring, autumn and EU survey data series. The solid line illustrates the fit to a 14+ group, large dashes 12+ and small dashes 11+.

iv) ***2003 Total Catch***

As noted previously, STACFIS could not precisely estimate the 2003 catch. To examine the effect of varied 2003 catch levels, the accepted XSA formulation was used to re-run the assessment using 2003 catch estimates of 32 000 tons and 38 500 tons. This represents the range of catch estimates available for 2003. Figures of average fishing mortality, and 5 + biomass are presented (Fig. 19.28 and 19.29).

Results indicate that changing the 2003 total catch has no significant effect on estimates of fishing mortality and 5 + biomass.

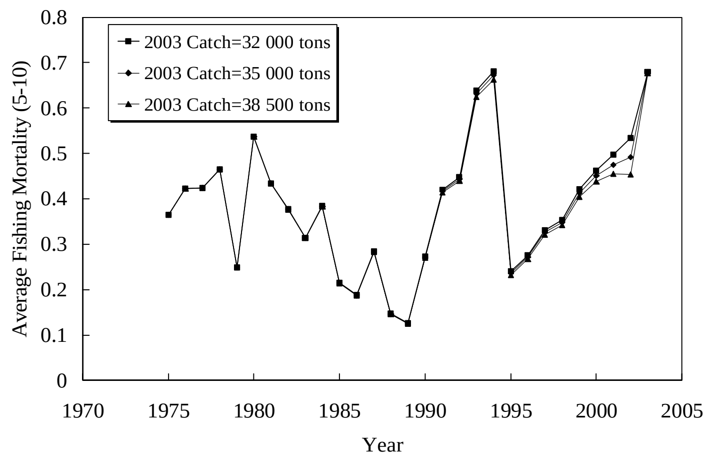


Fig. 19.27. Greenland halibut in Subarea 2 + Div. 3KLMNO: estimated average fishing mortality (ages 5-10) assuming three levels of 2003 catches.

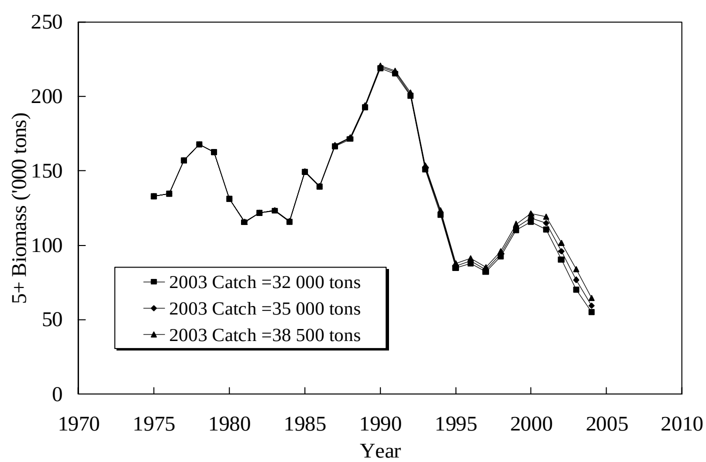


Fig. 19.28. Greenland halibut in Subarea 2 + Div. 3KLMNO: estimated biomass assuming three levels of 2003 catches.

Summary of the sensitivity analysis results. The sensitivity analyses have shown that the XSA estimated trends in the stock dynamics are robust to the data series used for the fitting of the model, the exclusion of the historic Canadian autumn survey data, the choice of plus group used for the analysis and the level of catches used for 2003. In recent years, the 5+ biomass is decreasing, and the average fishing mortality (5-10) is increasing in all analyses.

g) **Alternative Assessment Methods**

A comparison of the estimated biomass from the three methods explored is presented (Fig. 19.29): the STACFIS agreed XSA analysis, results from the ADAPT model, and the ASPIC production model. Each indicates a decline of the total biomass in the recent period. In recent years, the STACFIS agreed XSA is the most optimistic of the three estimation methods. The ASPIC model is calibrated with survey biomass, which is comprised mainly of fish aged 1-4. The ASPIC model therefore responds to changes in the biomass of younger ages, which occur earlier than the changes in the 5+ biomass (Fig. 19.29) as estimated by XSA and ADAPT. These are calibrated using numbers at age scaled by the appropriate catchability.

STACFIS noted that the results from the accepted assessment are consistent with the estimates from alternative assessment methods for Greenland Halibut in Subarea 2 and Div. 3KLMNO.

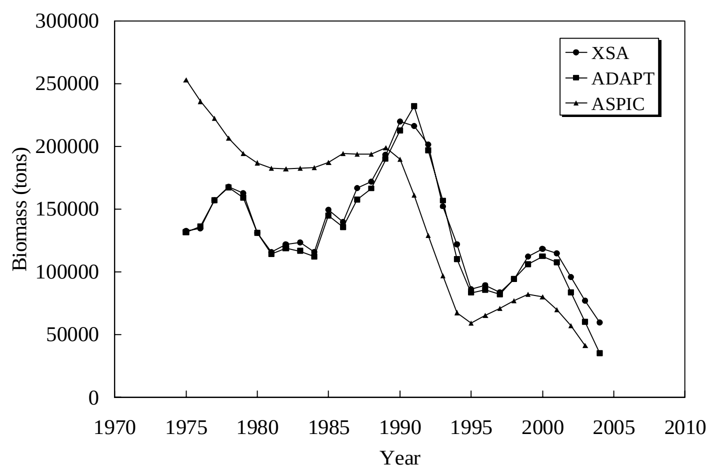


Fig. 19.29. Greenland halibut in Subarea 2 + Div. 3KLMNO: estimated biomass from ADAPT, ASPIC, and XSA models.

h) **Reference Points**

Precautionary approach reference points. Precautionary approach reference points have not been defined for this stock.

Biometric reference points. Based on average exploitation patterns and weight-at-age for the years 2001-2003, $F_{0.1}$ is estimated to be 0.15, F_{max} = 0.25.

i) **Projections under Fisheries Commission Recovery Plan**

The Fisheries Commission has implemented a 15-year rebuilding plan for this resource by instituting an exploitable biomass target (ages 5+) of 140 000 tons (FC Doc. 03/13). As an initial step, the Fisheries Commission established TACs of 20 000, 19 000, 18 500, and 16 000 tons for 2004-2007, respectively. In order to evaluate the population trends under the established TACs, deterministic and stochastic projections were conducted assuming an average exploitation pattern and weights-at-age for the period 2001-2003.

Attention is to be drawn on the fact that, as discussed by Patterson *et al*. (MS 2000)[5], current bootstrapping and stochastic projection methods generally underestimate uncertainty. The percentiles are therefore presented as relative measures of the risks associated with the current harvesting practices. They should not be taken as representing the actual probabilities of eventual outcomes.

The projection inputs are summarized in Table 19.1 with the variability in the projection parameters for the stochastic projections described by the coefficients of variation (column CV in the table). Numbers at age 2 and older at 1st of January 2004 and corresponding CVs are from the XSA output. Recruitment was bootstrapped in the 1975-2000 age 1 numbers from the XSA. Scaled selection pattern and corresponding CVs are derived from the 2001 to 2003 average from the XSA. Weights-at-age in the stock and in the catch and corresponding CVs are computed from the 2001-2003 average input data. Natural mortality was assumed to be 0.2 with a CV of 0.15 and a CV of 0.05 was assumed for the implementation of the management plan. The stochastic distribution was generated using the @Risk software. The distribution was assumed lognormal for the numbers at age and normal for the other input data.

The results of the stochastic projection (average fishing mortality, 5+ biomass and 10+ biomass) are plotted in Fig. 19.30, and projection results are in Table 19.2. The trend in ages 10+ biomass is presented to illustrate the short term development of older portion of the population and should not be considered to represent SSB which is not precisely known.

Under the current management plan, the population 5+ biomass is expected to remain stable in 2005 and slowly increase until 2008. However; the deterministic and stochastic projections both suggest that in 2008 the 5+ biomass only will have recovered to the level estimated in 2003, approximately 80 000 tons. The projections indicate there is very low probability that the target 5+ biomass will be reached by 2008. The 10+ biomass is expected to decrease as the strong 1993-95 year-classes are moving out of the exploitable biomass, and are replaced by subsequent year-classes which are much weaker.

---

[5] PATTERSON, K. R., R. M. COOK, C. D. DARBY, S. GAVARIS, B. MESNIL, A. E. PUNT, V. R. RESTREPO, D. W. SKAGEN, G. STEFÁNSSON, and M. SMITH. MS 2000. Validating three methods for making probability statements in fisheries forecasts. *ICES C.M. Doc*., No. V:06.

Table 19.1. Greenland halibut in Subarea 2 + Div. 3KLMNO: input data for stochastic projections.

Name	**Value**	**Uncertainty (CV)**	**Name**	**Value**	**Uncertainty (CV)**
Population at age in 2004			Selection pattern	(2001-2003)	
N1	Bootstrap (1975-2000)		sH1	0.000	0.00
N2	96136	0.29	sH2	0.000	0.00
N3	71971	0.22	sH3	0.000	0.00
N4	51008	0.18	sH4	0.033	0.24
N5	39879	0.15	sH5	0.171	0.56
N6	19254	0.16	sH6	0.688	0.39
N7	10126	0.15	sH7	1.948	0.10
N8	4757	0.15	sH8	1.598	0.14
N9	3907	0.16	sH9	0.841	0.08
N10	2066	0.20	sH10	0.752	0.31
N11	1148	0.20	sH11	0.914	0.31
N12	536	0.20	sH12	0.818	0.37
N13	267	0.22	sH13	0.699	0.17
N14+	312	0.25	sH14+	0.699	0.17
Weight in the catch	(2001-2003)		Weight in the stock	(2001-2003)	
WH1	0.000	0.00	WS1	0.000	0.00
WH2	0.000	0.00	WS2	0.000	0.00
WH3	0.000	0.00	WS3	0.000	0.00
WH4	0.249	0.01	WS4	0.000	0.00
WH5	0.378	0.03	WS5	0.378	0.03
WH6	0.564	0.01	WS6	0.564	0.01
WH7	0.831	0.01	WS7	0.831	0.01
WH8	1.187	0.01	WS8	1.187	0.01
WH9	1.735	0.04	WS9	1.735	0.04
WH10	2.270	0.04	WS10	2.270	0.04
WH11	2.849	0.05	WS11	2.849	0.05
WH12	3.566	0.04	WS12	3.566	0.04
WH13	4.456	0.03	WS13	4.456	0.03
WH14+	5.448	0.01	WS14+	5.448	0.01
TAC					
2004	20000	0.05			
2005	19000	0.05			
2006	18500	0.05			
2007	16000	0.05			
2008	16000	0.05			

Table 19.2. Greenland halibut in Subarea 2 + Div. 3KLMNO: results of Deterministic and Stochastic Projections assuming the catches follow the rebuilding plan TACs.

Deterministic	2004	2005	2006	2007	2008
Catch (tons)	20 000	19 000	18 500	16 000	
5+B (tons)	59 500	59 100	62 700	69 600	81 200

Stochastic (median values)	2004	2005	2006	2007	2008
F (5-10)	0.60	0.59	0.49	0.35	
5+B (tons)	59 300	58 700	61 900	68 800	81 300
10+B (tons)	12 600	12 200	9 400	7 200	6 700

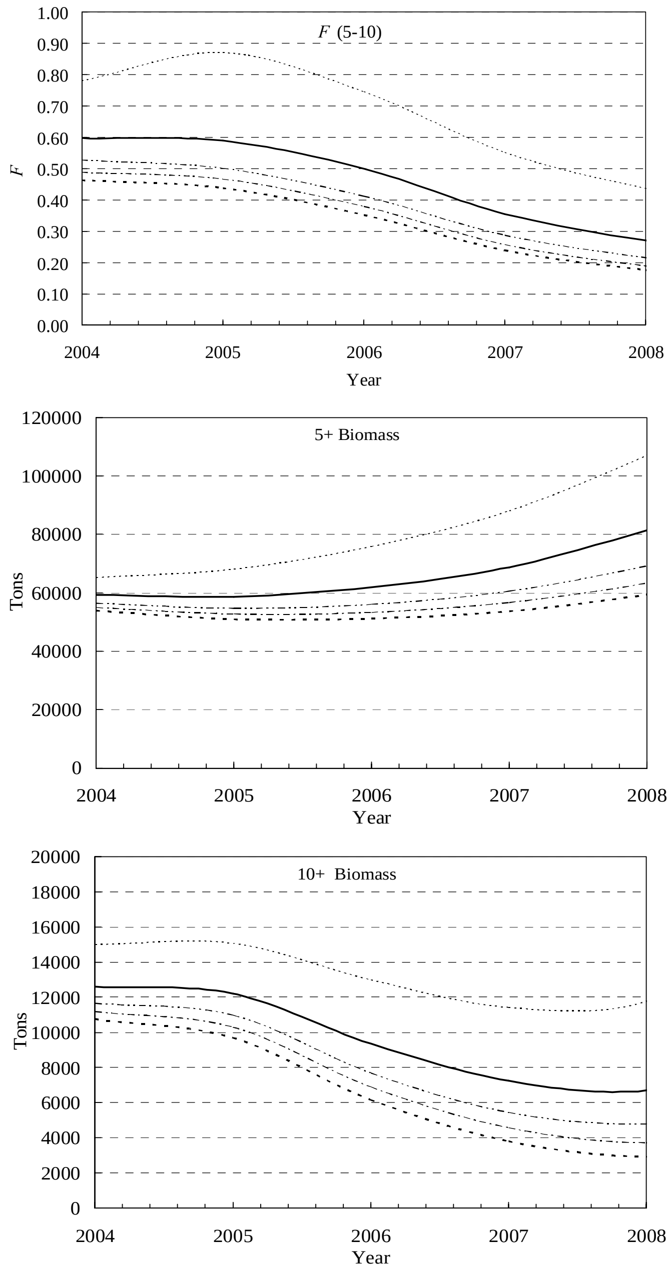


Fig. 19.30. Greenland halibut in Subarea 2 + Div. 3KLMNO: Projection estimates of average fishing mortality, 5+ biomass and 10+ biomass over 2004-2007 under Fisheries Commission Recovery Plan. (Lines show 5, 10, 20, 50 and 95 percentiles; 1 000 iterations, @Risk - Risk analysis Software, Bootstraped Recruitment (76-00). Uncertainties on all parameters taken into account.)

j) **Research Recommendation**

STACFIS **recommended** that *all available information on by-catch and discards of Greenland halibut in Subarea 2 and Divisions 3KLMNO be presented for consideration in future assessments.*

STACFIS **recommended** that *age-readers of Greenland halibut in Subarea 2 and Divisions 3KLMNO participate in a 2005 workshop to reach agreement upon common age reading practices and eliminate biases in age interpretation.*

STACFIS **recommended** that *age-disaggregated indices of Greenland halibut in Subarea 2 and Divisions 3KLMNO from the Spanish survey in Div. 3NO be presented for use in future assessments.*

20. **Northern Shortfin Squid (*Illex illecebrosus*) in Subareas 3 and 4** (SCR Doc. 98/59, 04/38, 52)

a) Introduction

i) Description of the Fisheries

Fisheries for northern shortfin squid consist of a Canadian inshore jig fishery in Subarea 3 and an international bottom trawl fishery for silver hake, squid and argentine in Subarea 4. A USA bottom trawl fishery occurs in Subareas 5+6. Historically, international bottom trawl and mid-water fleets participated in directed squid fisheries in Subareas 3, 4 and 5+6.

In Subareas 3+4, a TAC of 150 000 tons was in place during 1980-1998. It was set at 75 000 tons for 1999 and at 34 000 tons since then. Occasionally, very low catches from Subarea 2 occur; these have been included with Subarea 3 for convenience. Subareas 3+4 catches declined sharply from 162 100 tons in 1979 to 100 tons in 1986, then subsequently increased to 11 000 tons in 1990. During 1991-1995, catches in Subareas 3+4 ranged between about 1 000 tons and 6 000 tons, and in 1997, increased to 15 600 tons; the highest level since 1981. After 1998, catches were less than 1 200 tons and varied between 100 t in 2001 and 1 100 tons in 2003.

Since this annual species is considered to constitute a single stock throughout Subareas 2 to 6 (SCR Doc. 98/59), trends in Subareas 3+4 must be considered in relation to those in Subareas 5+6. Subarea 5+6 catches ranged between 2 000 tons and 24 900 tons during 1970-1997. During 1998-2002, catches in Subareas 5+6 declined from 23 600 tons to 2 800 tons and were 6 400 tons in 2003 (Fig. 20.1).

Recent nominal catches and TACs ('000 tons) are as follows:

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
TAC SA 3+4	150	150	150	150	75	34	34	34	34	34
STATLANT 21A SA 3+4	1.1	8.8	15.7	1.9	0.3	0.3[1]	<0.1[1]	0.2[1]	1.1[1]	
STATLANT 21A SA 5+6	14.0	17.0	13.6	23.6	7.4	9.0[1]	3.9[1]	2.7[1]	6.4[1]	
STACFIS SA 3+4	1.0	8.7	15.6	1.9	0.3	0.4	<0.1	0.2	1.1	
STACFIS SA 5+6	14.0	17.0	13.6	23.6	7.4	9.0	3.9	2.8	6.4	
STACFIS Total SA 3-6	15.0	25.7	29.2	25.5	7.7	9.4	4.0	3.0	7.5	

[1] Provisional.

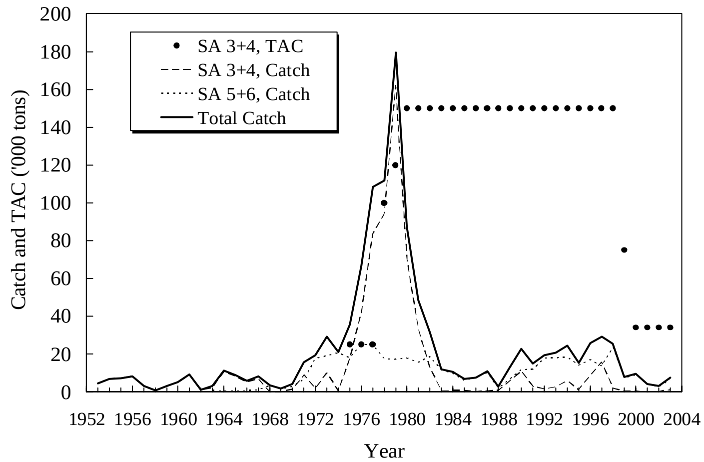


Fig. 20.1. Northern shortfin squid in Subareas 3+4: nominal catches and TACs in relation to catches from Subareas 5+6 and the total stock.

b) **Input Data**

i) **Commercial fishery data**

Nominal catches were available for Subareas 3+4, during 1953-2003, and for Subareas 5+6 during 1963-2003. Catches from Subareas 5+6, prior to 1976, may not be accurate because distant-water fleets did not report all squid catch by species. The accuracy of the Subareas 3+4 catches prior to the mid-1970s is unknown. During 1987-2003, Subarea 4 catches include squid caught during an international fishery for silver hake, squid and argentine, obtained by the Canadian Observer Program Database during a period of 100% fishery coverage, plus catches from the Canadian Zonal Interchange Format Database.

ii) **Research survey data**

Fishery-independent indices of relative abundance (stratified mean number per tow) and biomass (stratified mean kg per tow) were available from stratified, random bottom trawl surveys conducted by Canada on the Scotian Shelf (Div. 4VWX) during July of 1970-2003 and in the southern Gulf of St. Lawrence (Div. 4T) during September of 1971-2002. Different vessels were used in the Div. 4VWX survey during the periods of 1970-1981, 1982 and 1983-2003 but there are no conversion coefficients available with which to standardize squid catch rates. The Div. 4VWX survey occurs before or at the start of the fisheries, and the indices are assumed to represent relative biomass and abundance levels at the start of the fishing season. Indices were also available for bottom trawl surveys conducted by the USA in Subareas 5+6 during September-October of 1967-2003. Surveys in Div. 4T and Subareas 5+6 occur at or near the end of the fisheries and the indices are assumed to represent relative abundance and biomass levels at the end of the fishing season. Survey biomass indices (Fig. 20.2) were positively correlated between Subareas 4 and 5+6. These indices were also positively correlated with total catches from Subareas 3-6 (SCR Doc. 98/59).

Abundance and biomass indices for Subarea 3 were also derived from the Canadian survey in Div. 3LNO+Subdiv. 3Ps during April-June of 1995-2003 and the EU survey on the Flemish Cap (Div. 3M) during July of 1988-2002. However, indices from these two surveys do not appear to track the same trends as the July survey in Div. 4VWX. Indices were also derived from the Canadian survey in Div. 2J+3KLNO during September-December of 1995-2003. Although lower in magnitude, the Div. 2J+3KLNO indices appear to track the trends in the July survey in Div. 4VWX (Fig. 20.2).

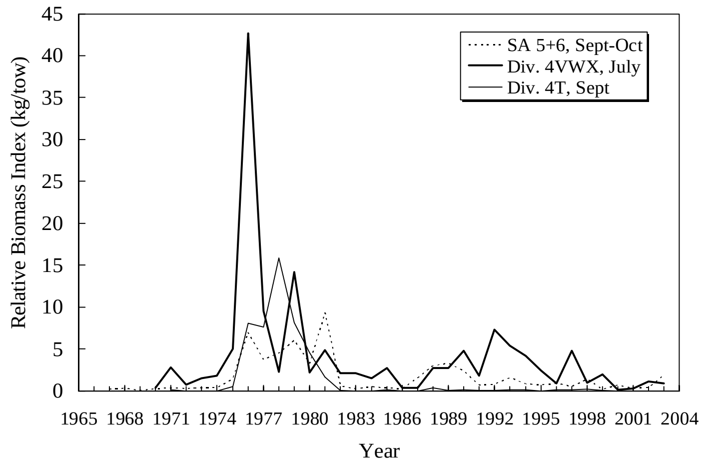


Fig. 20.2. Northern shortfin squid in Subareas 3+4: research survey biomass indices in Div. 4VWX during July, in Div. 4T during September, and in Subareas 5+6 during September-October.

iii) **Biological studies**

Annual mean body weights of squid from the July survey in Div. 4VWX declined sharply during 1982-1983, following a period of much higher mean weights during 1976-1981 (Fig. 20.3). Mean body weight increased gradually thereafter, and in 1999 (119 g), reached the highest value since 1981. Mean weight declined sharply to a record low in 2000 (25 g), then increased slightly in 2001 and has remained at about this level (70-85 g) since. Similar trends were evident in Subareas 5+6, with higher mean body weights during 1976-1981 than thereafter. During 2001-2003, mean weights of squid from both surveys were near the 1982-2002 average for the Div. 4VWX survey (75 g).

The range of mean mantle lengths of squid caught in the Newfoundland inshore jig fishery at New Bonaventure, during September of 2003, were much smaller (16.8-18.9 cm) and males less mature than those caught during 2002 (21.3-24.3 cm, SCR Doc. 04/52).

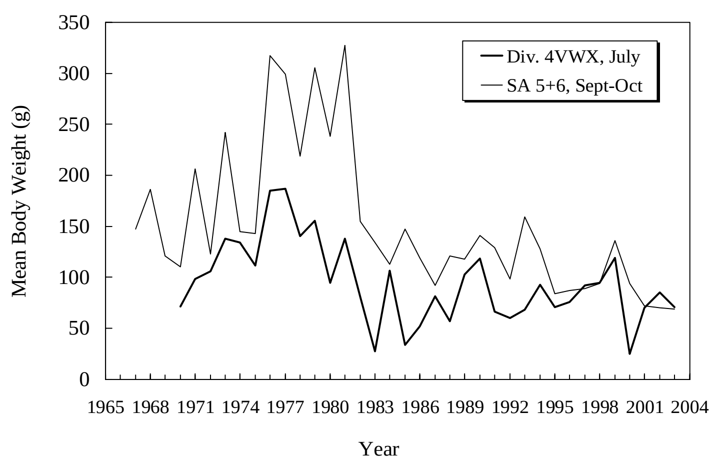


Fig. 20.3. Northern shortfin squid in Subareas 3+4: mean body weight of squid in the Div. 4VWX surveys during July and in the Subareas 5+6 surveys during September-October.

iv) **Fishing mortality indices**

Fishing mortality indices (Subareas 3+4 nominal catch/Div. 4VWX July survey biomass index) in Subareas 3+4 were highest during 1978-1980, within the 1976-1981 period of highest catch (Fig. 20.4), and were much lower during 1982-2002. During 2003, the fishing mortality index (0.07) was well below the 1982-2002 average (0.18).

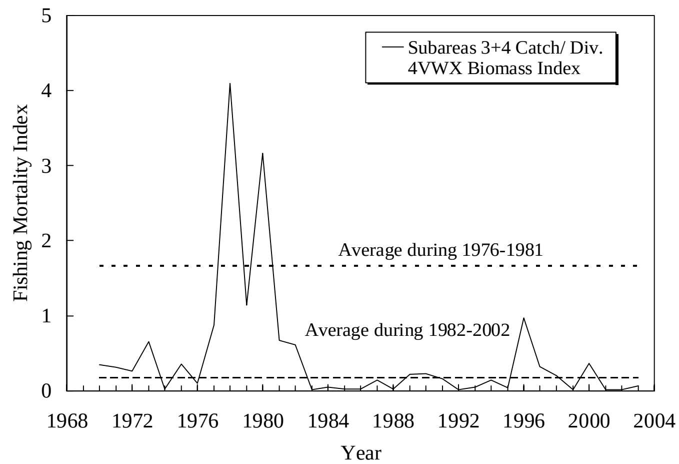


Fig. 20.4. Northern shortfin squid in Subareas 3+4: fishing mortality indices.

c) **Assessment Results**

Trends in fishery and research vessel survey data indicate that a period of high productivity occurred in Subareas 3+4 during 1976-1981, followed by a period of much lower productivity during 1982-2002. The high productivity period was associated with a larger mean body size than the more recent low productivity period.

After 1999, effort in the Subarea 4 silver hake, squid and argentine fishery, in which squid catches have been a major component, declined to very low levels. Squid catches in Subareas 3+4 reached the highest level since 1981 in 1997 (15 600 tons), then subsequently declined to less than 100 tons in 2001; the second lowest level since 1953. Catches increased in 2002 (258 tons) and 2003 (1 100 tons), but remained below the 1982-2002 average catch from Subareas 3+4 (3 600 tons).

During 1998-2002, the relative biomass index from the Div. 4VWX survey was below the 1982-2002 average for the low productivity period (2.4 kg/tow), and in 2003 (0.9 kg/tow), remained well below this average. In 2003, the Subareas 5+6 survey abundance index was the highest value in the survey time series. However, this was primarily attributable to the catch of a large number of squid at a single station, and unlike a previous period of high abundance (i.e. 1976-1981), the relative biomass index in 2003 was low, reflecting a much smaller mean body size of squid in 2003 than during 1976-1981. During 2001-2003, the mean body weight of squid caught in the Div. 4VWX survey was similar to the average size observed during the 1982-2002 low productivity period. The combination of a low biomass index and small mean size of squid in the July Div. 4VWX survey during 2003 suggest that the Subareas 3+4 stock component remained in a state of low productivity.

There is currently no basis for reliably predicting recruitment for this annual species.

d) **Reference Points**

There is no new information regarding reference points.

e) **Research Recommendation**

For northern shortfin squid in Subareas 3+4, STACFIS **recommended** that *distribution maps of squid abundance from the Canadian multi-species bottom trawl surveys in Div. 2J+3KLNO (September-October) and in Div. 3LNO+Subdiv. 3Ps (April-June) be produced, beginning with 1995, to determine the most appropriate subset of strata to use when deriving relative abundance and biomass indices from these surveys.*

V. OTHER MATTERS

1. Nomination of Designated Experts

STACFIS reviewed the list of Designated Experts for the stocks which would be assessed and for which management advice is requested by the Fisheries Commission and Coastal States. The final nomination of the Designated Experts will be conducted through the normal confirmation process between the various national institutes and Secretariat. The nominations to date by STACFIS for the 2005 assessment are:

- From the Instituto de Investigaciones Marinas, Eduardo Cabello, 6, 36208 Vigo, Spain [Phone: +34 9 86 23 1930 – Fax: +34 9 86 29 2762 –E-mail: avazquez@iim.csic.es]

for	Cod in Div. 3M	Antonio Vazquez

- From the Instituto Español de Oceanografia, Aptdo 1552, E-36280 Vigo (Pontevedra), Spain [Phone: +34 9 86 49 2111 – Fax: +34 9 86 49 2351 – E-mail: fernando.gonzalez@vi.ieo.es]

for	Roughhead grenadier in SA 2+3	Fernando Gonzalez-Costas
	Roundnose grenadier in SA 2+3	Fernando Gonzalez-Costas

- From the Instituto Nacional de Investigacao Agrária e das Pescas (INIAP/IPIMAR), Av. de Brasilia, 1449-006 Lisbon, Portugal [Phone: +351 21 302 7000 – Fax: +351 21 301 5948 – E-mail: listed below]

for	American plaice in Div. 3M	Ricardo Alpoim	ralpoim@ipimar.pt
	Redfish in Div. 3M	Antonio Avila de Melo	amelo@ipimar.pt
	Redfish in Div. 3LN	Antonio Avila de Melo	amelo@ipimar.pt

- From the Greenland Institute of Natural Resources, P. O. Box 570, DK-3900 Nuuk, Greenland [Phone: +299 32 1095 – Fax: +299 32 5957 – E-mail: listed below]

for	Northern shrimp in SA 0+1	Carsten. Hvingel	hvingel@natur.gl
	Redfish in SA1	Helle Siegstad	helle@natur.gl
	Other Finfish in SA1	Helle Siegstad	helle@natur.gl
	Greenland halibut in Div. 1A	Bjarne Lyberth	bjly@natur.gl
	Northern shrimp in SA 0+1	Carsten Hvingel	hvingel@natur.gl
	Northern shrimp in Denmark Strait	Carsten Hvingel	hvingel@natur.gl

- From the Danish Institute for Fisheries Research, Charlottenlund Slot, DK-2920, Charlottenlund, Denmark [Phone: +45 33 96 33 00 – Fax: +45 33 96 33 33 – E-mail: olj@dfu.min.dk]

for	Roundnose grenadier in SA 0+1	Ole Jørgensen
	Greenland halibut in SA 0+1	Ole Jørgensen

- From the Marine Research Institute, Skulagata 4, P. O. Box 1390, 121 - Reykjavik, Iceland
  [Phone: +354 552 0240 – Fax: +354 562 3790 – E-mail: unnur@hafro.is]

  for Shrimp in Div. 3M Unnur Skúladóttir

- From Knipovich Polar Research Institute of Marine Fisheries and Oceanography (PINRO), 6 Knipovich Street, Murmansk, 183763, Russia [Phone: +7 8152 47 2532 – Fax: +7 8152 47 3331 – E-mail: inter@pinro.ru]

  for Capelin in Div. 3NO Konstantin V. Gorchinsky

- From the National Marine Fisheries Service, NEFSC, 166 Water St., Woods Hole, MA 02543
  [Phone: +508-495-2285 – Fax: +508-495-2393 – E-mail: lisa.hendrickson@noaa.gov]

  for Squid in SA 3+4 Lisa Hendrickson

For the following stocks, the nomination of Designated Experts has been deferred to the Scientific Council Annual Meeting of September 2004, and the Secretariat was requested to contact the necessary national institutes well in advance of this:

for: Cod in Div. 3NO
Redfish 3O
American Plaice in Div. 3LNO
Witch flounder in Div. 3NO
Witch flounder in Div. 2J3KL
Yellowtail flounder in Div. 3LNO
Greenland halibut in SA 2+3KLMNO
Shrimp in Div. 3LNO
Thorny skate in Div. 3LNO
White hake in Div. 3NO

2. **Other Business**

There being no other business, the Chair thanked the participants for their valuable contributions, and in particular the Designated Experts and the Secretariat for their work and co-operation during the meeting.