

NORTHWEST ATLANTIC FISHERIES ORGANIZATION



Scientific Council Reports 2002

Dartmouth, Nova Scotia
Canada

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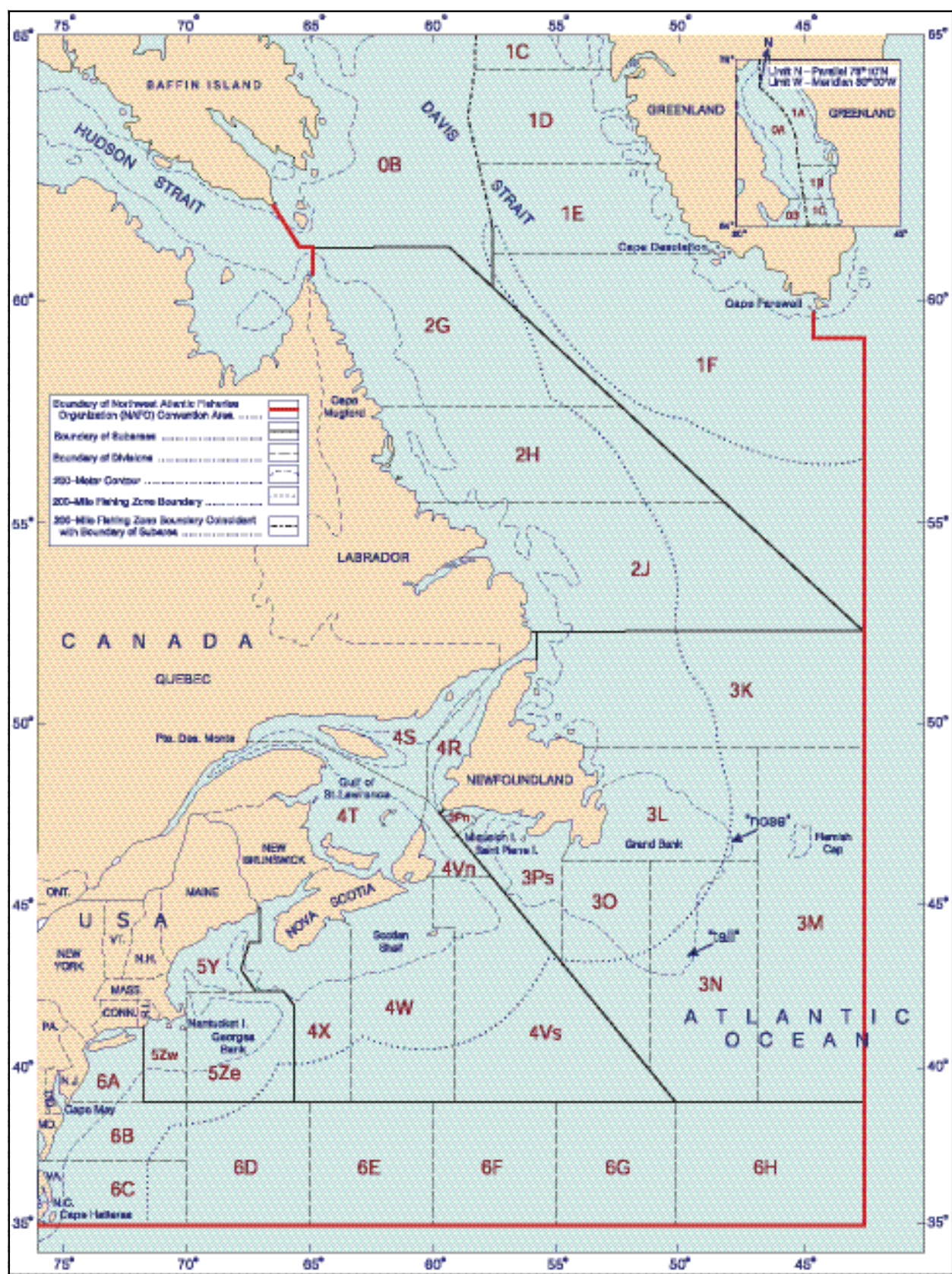
January 2003

PREFACE

This twenty-fourth issue of *NAFO Scientific Council Reports* containing reports of Scientific Council Meetings held in 2002 is compiled in four sections: **Part A** – Report of the Scientific Council Meeting during 6-20 June 2002, which addressed most of the annual requests for scientific advice on fisheries management, **Part B** – Report of the Scientific Council Annual Meeting during 16-20 September 2002, which includes the Report of the Symposium on "Elasmobranch Fisheries" held during 11-13 September 2002, **Part C** – Report of the Scientific Council Meeting during 6-13 November 2002, which addressed the requests for scientific advice on northern shrimp in Division 3M, Divisions 3LNO, Subareas 0 and 1 and Denmark Strait and off East Greenland, and **Part D** contains the Agendas, Lists of Research and Summary Documents, List of Representatives, Advisers/Experts and Observers, and List of Recommendations relevant to Part A, B and C.

January 2003

Tissa Amaratunga
Assistant Executive Secretary



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PART A

Scientific Council Meeting, 6-20 June 2002

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Participants at Scientific Council Meeting, 6-20 June 2002:

Back Row (left to right): D. W. Kulka, D. E. Stansbury, C. Darby, V. N. Shibanov, D. Power, R. Alpoim, W. R. Bowering, K. V. Gorchinsky, S. E. Lisovsky, B. P. Healey, D. Maddock Parsons, C. S. Simonsen, H. Murua, O. Jorgansen, A. Vazquez, P. Durán-Muñoz, L. Hendrickson, E. G. Dawe, J.-C. Mahé, D. Cross, W. B. Brodie, M. Stein

Front Row (left to right): R. K. Mayo, V. A. Rikhter, A. Avila de Melo, D. B. Atkinson, A. Nicolajsen, K. Dwyer, T. Ichii, F. Gonzalez, E. A. Colbourne, M. J. Morgan, S. J. Correia, K. F. Drinkwater, T. Amaratunga

Missing from picture: A. Aglen, D. C. A. Auby, C. L. Kerr, B. L. Marshall, G. M. Moulton, A. Okhanov, D. C. Orr, K. Patterson, F. M. Serchuk, M. A. Treble



The Chairs, Scientific Council Meeting, 6-20 June 2002 (left to right): R. K. Mayo, Chair Scientific Council, M. J. Morgan, Chair STACREC, M. Stein, Chair STACPUB, D. E. Stansbury, Chair STACFIS, E. B. Colbourne, Chair STACFEN.



STACFIS in session during the 6-20 June 2002 Meeting.

REPORT OF SCIENTIFIC COUNCIL MEETING

6-20 June 2002

Chair: R. K. Mayo

Rapporteur: T. Amaratunga

I. PLENARY SESSIONS

The Scientific Council met at the Alderney Landing, 2 Ochterloney Street, Dartmouth, Nova Scotia, Canada, during 6-20 June 2002, 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), Japan, Norway (as of 11 June), Russian Federation and United States of America. The Assistant Executive Secretary was in attendance.

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 6 June 2002.

The Chair welcomed everyone to Dartmouth and to this venue for the June Meeting. The Assistant Executive Secretary was appointed rapporteur.

The Assistant Executive Secretary informed the Council that prior to the meeting, authorization had been received for proxy votes from Estonia, Latvia and Norway to record their abstentions during any voting procedures. The Council noted it had no request from observers to attend this meeting.

In the review of the Provisional Agenda, the Chair noted tasks at hand resulting from requests for advice from the Fisheries Commission and the Coastal States as well as considerations concerning many working groups. In particular considerations of pelagic *Sebastes mentella* (redfish), reports from the Working Group on Reproductive Potential and the NAFO/ICES Working Group on harp and hooded seals were noted. While noting that Standing Committees may include some changes to their individual agendas, the Council **adopted** the agenda as presented (see Agenda, Attachment V).

The Chair informed the Council that the meeting of the Working Group on the Precautionary Approach, scheduled for 20-21 June 2002 at the Ramada Hotel, Dartmouth, overlaps this meeting of the Scientific Council on 20 June and may affect both meetings with respect to participation. The Council was also informed of the meeting of *Ad hoc* Working Group on Oceanic Redfish, scheduled for 24-26 June 2002 at the Ramada Hotel, Dartmouth, for which the Council will do preparatory work.

Having reviewed the work plan for each Agenda item, the opening session was adjourned at 1145 hours.

The Council through 6-20 June 2002 addressed various outstanding agenda items as needed. The concluding session was called to order at 0830 hours on 20 June 2002.

The Council first reviewed and **adopted** the reports of the Standing Committees.

The Council then considered and **adopted** the Report of the Scientific Council of this meeting of 6-20 June 2002, noting changes as discussed during the reviews would be made by the Chairman and Assistant Executive Secretary.

The meeting was adjourned at 1000 hours on 20 June 2002.

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, 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-XVI.

II. REVIEW OF SCIENTIFIC COUNCIL RECOMMENDATIONS IN 2001

The Council noted recommendations made in 2001 pertaining to the work of the Standing Committees were addressed directly by the Standing Committees, while recommendations pertaining specifically to the Council's work will be considered under each relevant topic of its Agenda.

III. FISHERIES ENVIRONMENT

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

The **recommendations** endorsed by the Council are as follows:

1. *the proceedings of the mini-Symposium on "Hydrographic Variability in NAFO Waters for the Decade 1991-2000 in Relation to Past Decades" be published in a special issue of the Journal of the Northwest Atlantic Fisheries Science.*
2. *further studies be conducted attempting to link climate and fisheries and to bring forward such studies for review at STACFEN.*
3. *the STACFEN Chair, or designate, be included in the presentation of scientific advice from the Scientific Council to the Fisheries Commission at its September 2002 meeting, and further that such presentations be made every 5 years or more frequently if significantly large changes in the environment are observed.*
4. *an annual climate status report beginning in 2003 to describe environmental conditions during the previous year be produced, that this be compiled prior to the annual June Meeting and posted prominently on the NAFO website.*

IV. PUBLICATIONS

The Council **adopted** the Report of the Standing Committee on Publications (STACPUB) as presented by the Chair, M. 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 provide a copy of the mailing list to each delegation's representatives. Representatives are requested to review the list and provide a list of names that are no longer involved with NAFO and that should be removed from the list.*
2. *the Secretariat maintain the restricted website area for specific Scientific Council business, and that the restricted website name be changed on an annual basis in order to maintain restricted access.*
3. *STACFEN's annual climate status summary report on essential climatic conditions in the NAFO Convention Area be published on the website.*
4. *"Informational bulletins" of interest to NAFO Contracting Parties, such as location of mooring of ocean current meters in the Flemish Pass, should also be published on the website.*

5. *Secretariat asks the host country to fund a social event during the Elasmobranch Symposium.*

V. RESEARCH COORDINATION

The Council **adopted** the Report of the Standing Committee on Research Coordination (STACREC) as presented by the Chair, M. J. Morgan. The full report of STACREC is at Appendix II.

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

1. *the Assistant Executive Secretary attend the CWP 20th Session to be held in the Seychelles during 21-24 January 2003.*
2. *the Rules of Procedure of the Scientific Council be modified to include participation at CWP sessions in the functions of the Vice-Chair who is also the Chair of STACREC and that the Scientific Council Chair address the budgetary aspect of this to the Executive Secretary with respect to the attendance at the 20th CWP Session and subsequent sessions.*
3. *STACFIS Tables and the Scientific Council Summary Sheets should include both the catch data used by STACFIS in the stock assessments and the officially reported STATLANT 21A data.*
4. *the Conservation and Enforcement Measures Part VI, Program for Observers and Satellite Tracking, be amended to formally incorporate the Scientific Council protocols as specified in NAFO SCS Doc. 00/23 and as adopted by the Fisheries Commission in September 2000. Specifically, that Section 3.d of the Conservation and Enforcement Measures Part VI, Program for Observers and Satellite Tracking be amended to be consistent with the requirements of SCS Doc. 00/23 in that set-by-set information shall be available to any Contracting Party that requests it.*
5. *the development of a training and operation manual for the collection of scientific data in the Observer Program and Satellite Tracking continue, and that the Scientific Council be represented at the September 2002 STACTIC Meeting to further pursue this issue.*
6. *the Observer Program Access database developed by Canada be adapted by the NAFO Secretariat to capture data collected under the NAFO Program for Observers and Satellite Tracking, with highest priority given to inclusion of current data and secondary priority given to capturing the historic data.*
7. *the Secretariat conduct a trial converting 2002 fishery data from the Observer Program to the Access electronic database with a view to establishing a budget for further conversion of observer data.*
8. *in future years the Secretariat compile the reports of research activities as a working document for the June Meeting, and that it then be presented to STACREC as a SCS document at its September Meeting.*
9. *Contracting Parties report the catches of wolffish by species, and the STATLANT questionnaires be modified to distinguish between the spotted wolffish (*Anarhichas minor*), Northern wolffish (*A. denticulatus*) and the striped or Northern wolffish (*A. lupus*) and that the Secretariat inform Contracting Parties of this request (including all necessary information) as soon as possible.*

VI. FISHERIES SCIENCE

The Council **adopted** the Report of the Standing Committee on Fisheries Science (STACFIS) as presented by the Chair, D. E. Stansbury. 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

For stocks within or partly within the Regulatory Area, the Fisheries Commission requested scientific advice.

a) Request for Advice on TACs and Other Management Measures for Year 2003

The Scientific Council at its meeting of September 2001 agreed to consider certain stocks on a multi-year rotational basis. While this schedule was agreed to by the Fisheries Commission during the 29 January-01 February 2002 Meeting, the Fisheries Commission additionally forwarded requests for advice on certain stocks. This section presents those stocks for which the Scientific Council provided scientific advice for the year 2003.

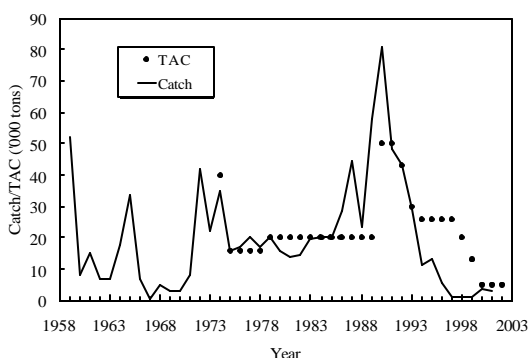
Redfish (*Sebastes spp.*) in Division 3M

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

Fishery and Catches: The redfish fishery in Division 3M increased from 20 000 tons in 1985 to 81 000 tons in 1990, falling continuously since then until 1998-1999, when a minimum catch around 1 100 tons was recorded mostly as by-catch in the Greenland halibut fishery. This decline was related to the simultaneous quick decline of the stock biomass and fishing effort. There was an overall increase of the redfish catches to 3 800 tons in 2000. In 2001 provisional catch was at a somewhat lower level of 3 200 tons with the directed fishery primarily prosecuted by EU (Portugal) and Russia. Starting in 1993 and further development of a shrimp fishery on Flemish Cap led to high levels of redfish by-catch in 1993-94. Since 1995 this by-catch in weight fell to apparent low levels but in 2001 redfish by-catch reached 738 tons, the highest level observed since 1994. Translated to numbers this represents an increase from the recent by-catch level of 3.4 million redfish (1999-2000) to 25.8 million in 2001, representing 74% of the total 2001 catch numbers.

Year	Catch ('000 tons)		TAC ('000 tons)	
	STACFIS	21A	Recommended	Agreed
1999	0.9	1.1	10	13
2000	3.8	3.8 ¹	3-5	5
2001	3.2	3.2 ¹	3-5	3-5
2002			3-5	3-5

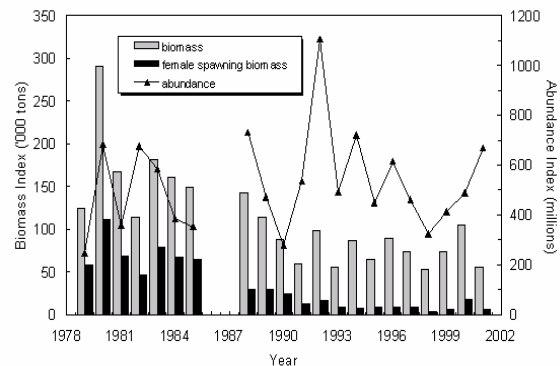
¹ Provisional.



Data: Catch-at-age data were available from 1989-2001 including by-catch information from the shrimp fishery. Catch rate data for 1959-93 were available from the NAFO database.

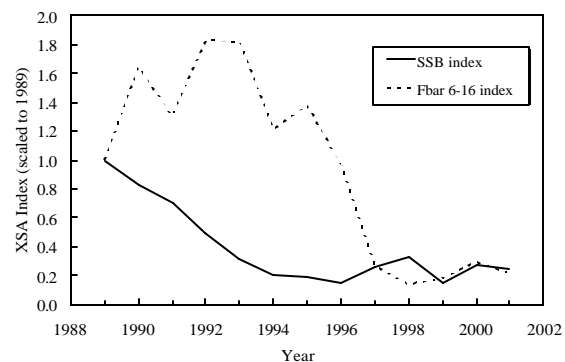
There are three survey series providing bottom biomass indices as well as length and age data for the Flemish Cap redfish stocks; Russia (1983-93, 1995-96 and 2001), EU (1988-2001) and Canada (1979-85 and 1996). The Russian survey was complemented with an acoustic estimate of the redfish pelagic component for the 1988-1992 period.

Assessment: Survey bottom biomass and female spawning biomass were calculated from 1979 to 1985 Canadian and 1988 to 2001 EU surveys.

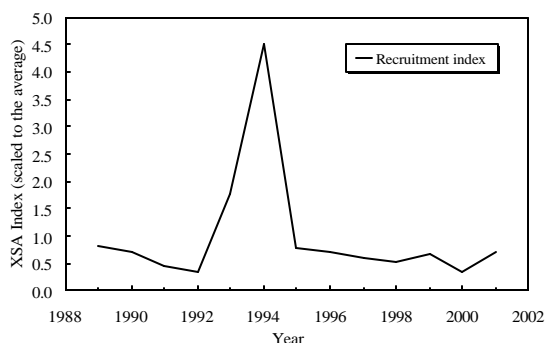


A virtual population analysis (XSA) and a surplus production analysis (ASPIC) were carried out for 1989-2001, providing indicators of stock biomass, female spawning biomass and fishing mortality trends.

Fishing Mortality: Fishing mortality was at very high levels until 1995 and then has dropped to relatively low levels since 1997.



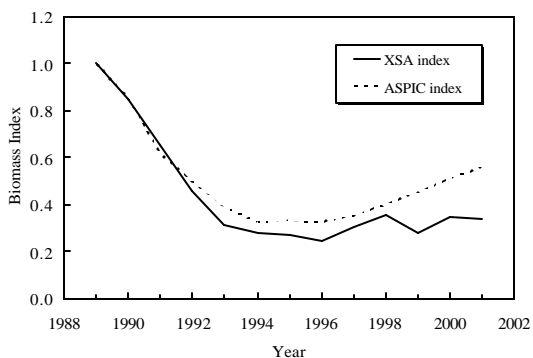
Recruitment: There has been no pulse of recruitment since 1990. However the recruit/SSB has increased through the nineties, compensating for the SSB decline.



Special Comments: At present stock growth in biomass and in abundance is dependent upon the appearance and survival of cohorts past their early life stage so they recruit to the SSB and commercial fishery. As such it is important to keep catch and fishing mortality at a low level by drastically reducing by-catch of very small redfish.

Sources of Information: SCR Doc. 02/9, 12, 54; SCS Doc. 02/04 (Part 2), 6, 7.

Biomass: The Div. 3M beaked redfish stock experienced a steep decline from the second half of the 1980s until 1996. Since 1997 fishing mortality has been well below the assumed natural mortality of 0.1, allowing for survival and growth of the population. Despite recent fluctuations, biomass and female spawning biomass appear to have increased marginally since 1997 but are still well below the SSB that produced the 1990 year-class.



State of the Stock: Scientific Council concluded that while the decline in stock biomass appears to have halted, it is still unclear as to whether there has been any actual increase. The total stock and spawning stock are currently at a low level compared to the earlier period in the time series. At the low fishing mortalities of the most recent years, with growth of the relatively strong 1990 year-class, spawning biomass should gradually increase.

Recommendation: The Council was unable to advise on a specific TAC for year 2003; however, in order to maintain relatively low fishing mortalities so as to promote stock recovery, Scientific Council recommends that catch for Div. 3M redfish in year 2003 be in the range of 3 000-5 000 tons.

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

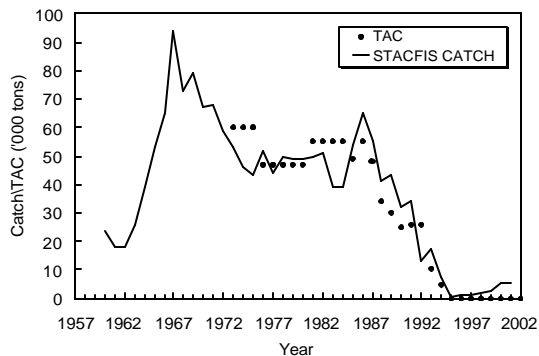
American Plaice (Hippoglossoides platessoides) in Divisions 3L, 3N and 3O

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

Fishery and Catches: In most years the majority of the catch has been taken by offshore otter trawlers. There was no directed fishing in 1994 and there has been a moratorium from 1995 to 2002. Even under moratorium catches have increased substantially in recent years.

Year	Catch ('000 tons)		TAC ('000 tons)	
	STACFIS	21A	Recommended	Agreed
1999	2.6	2.4	ndf	ndf
2000	5.2	2.7 ¹	ndf	ndf
2001	5.7	2.8 ¹	ndf	ndf
2002			ndf	ndf

¹ Provisional
ndf No directed fishing.

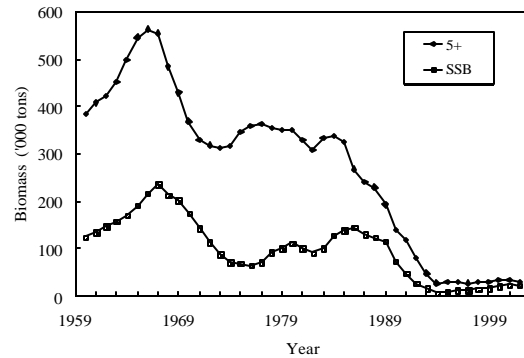


Data: Biomass and abundance data were available from several surveys. Age sampling from Canadian by-catch as well as length sampling from by-catch from Russia, EU-Spain and EU-Portugal was available.

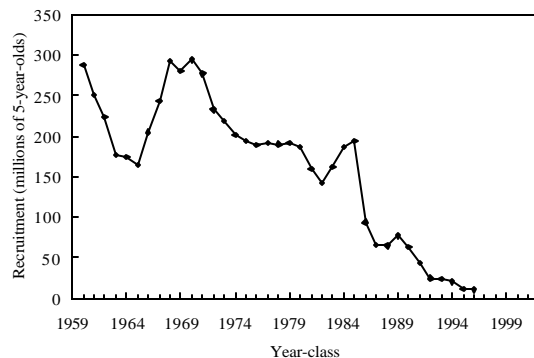
Assessment: An analytical assessment using the ADAPtive framework tuned to the Canadian spring and autumn surveys was used. Natural mortality was assumed to be 0.2 for all ages except from 1989 to 1996 it was assumed to be 0.53.

Biomass: Biomass is very low compared to historic levels.

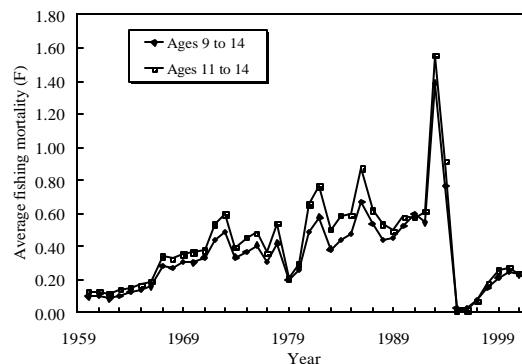
Spawning stock biomass: SSB declined to a very low level in 1994 and 1995. It has increased since then but still remains very low at just over 20 000 tons.



Recruitment: There has been no good recruitment to the exploitable biomass since the mid-1980s.



Fishing mortality: In the last 3 years average fishing mortality on ages 9 to 14 has been above 0.2. Estimates of fishing mortality in 2000 changed little in the present assessment from those estimated in the 2001 assessment and the precision of these estimates is considered to be high.



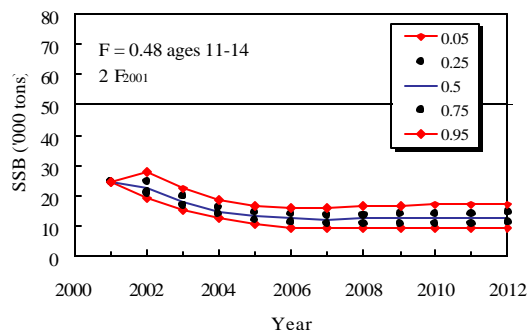
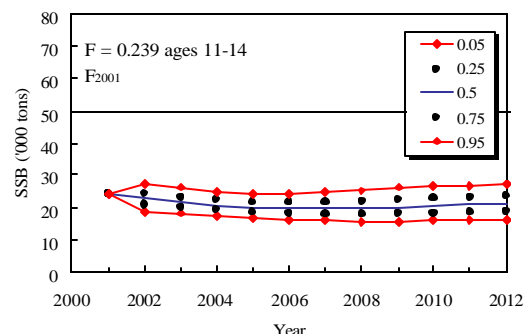
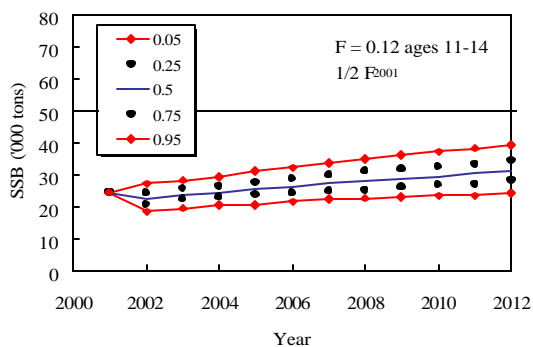
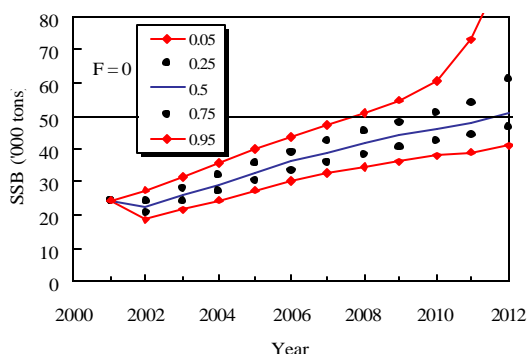
State of the Stock: The stock remains low compared to historic levels.

Recommendation: Scientific Council reiterates its recommendation of no directed fishing on American plaice in Div. 3LNO in 2003. By-catches be kept to the lowest possible level.

Reference Points: No good recruitment has been estimated for this stock at SSB below 50 000 tons and this could serve as a preliminary B_{lim} .

Medium term considerations: Simulations were carried out to compare population trajectories under different levels of by-catch fishing mortality. These simulations take into account the precision of the stock size estimates currently available.

These results show that at or above current levels of catch and fishing mortality, stock size is likely to decline. If fishing mortality decreases to half of current levels, then the stock is estimated to increase only slightly over the medium term.



Special Comments: Scientific Council is concerned that catches of American plaice have increased substantially since 1995 such that fishing mortality is close to $F_{0.1}$ although the stock is currently under moratorium and at a very low SSB. Most of this increase is reported to be due to by-catches in the unregulated skate fishery in the NAFO Regulatory Area, the Greenland halibut fishery, and the yellowtail flounder fishery. Any catches will impede the recovery of this stock. Catches at or above the current level will cause further decline.

Although recruitment at age 5 has been poor since the mid-1980s, Scientific Council noted that there are signs of possible stronger year-classes for 1999 and 2000 based on Canadian and EU survey data.

Scientific Council examined the results of the EU and Canadian surveys in the NRA compared to the Canadian survey results for the entire stock area (Div. 3LNO). These data show a larger increase in recent years in the NRA of Div. 3NO than indicated by the trends over the entire stock area. This could account for any increases in commercial catch rates in the NRA but these increases would not reflect the development of the stock in total. In addition, the resource in Div. 3NO is not considered to be as depressed compared to historical levels compared to the situation in Div. 3L. Based on examination of available information, Scientific Council concluded there is currently no basis for splitting the Div. 3LNO American plaice stock into subcomponents.

Sources of Information: SCR Doc. 02/1, 2, 36, 44, 65, 70, 80; SCS Doc. 02/4, 6, 7.

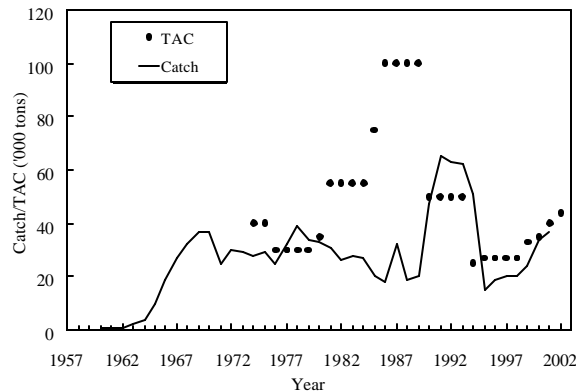
Greenland Halibut (*Reinhardtius hippoglossoides*) in Subarea 2 and Divisions 3KLMNO

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: 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 has been increasing since 1998 and in 2001 was estimated to be 38 000 tons, the highest since 1994.

Year	Catch ('000 tons)		TAC ('000 tons)	
	STACFIS	21A	Recommended	Agreed
1999	24	24	~30	33
2000	34	32 ¹	~30	35
2001	38	29 ¹	40	40
2002	-	-	40	44

¹ Provisional.

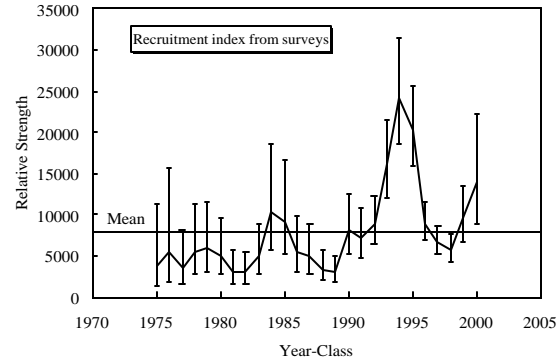


Data: CPUE data were available from international otter trawl fisheries throughout the stock area and the Portuguese otter trawl fishery in the NAFO Regulatory Area of Div. 3LMN. Abundance and biomass indices were available from research vessel surveys of Canada in Div. 2J+3KLMNO (1978-2001), EU in Div. 3M (1988-2001) and EU-Spain in Div. 3NO (1995-2001). International commercial catch-at-age data were available from 1975-2001.

Assessment: An analytical assessment using Extended Survivors Analysis (XSA) was attempted to investigate population numbers in 2002 but the recent trends were considered unreliable in that the analysis overestimated the abundance of the 1993, 1994 and 1995 year-classes.

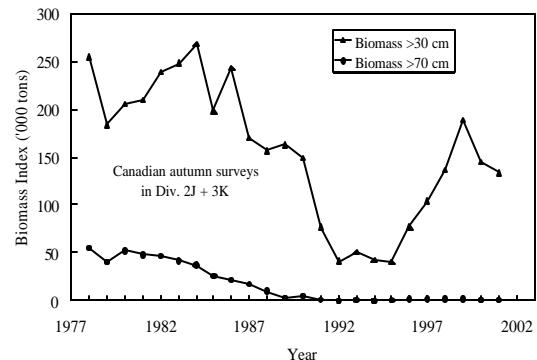
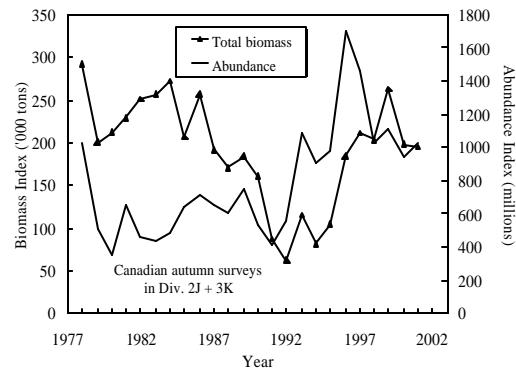
Fishing Mortality: While the absolute estimate of fishing mortality implied from the analysis was uncertain, it indicated that the fishing mortality for 2001 was relatively low in comparison to the early-1990s.

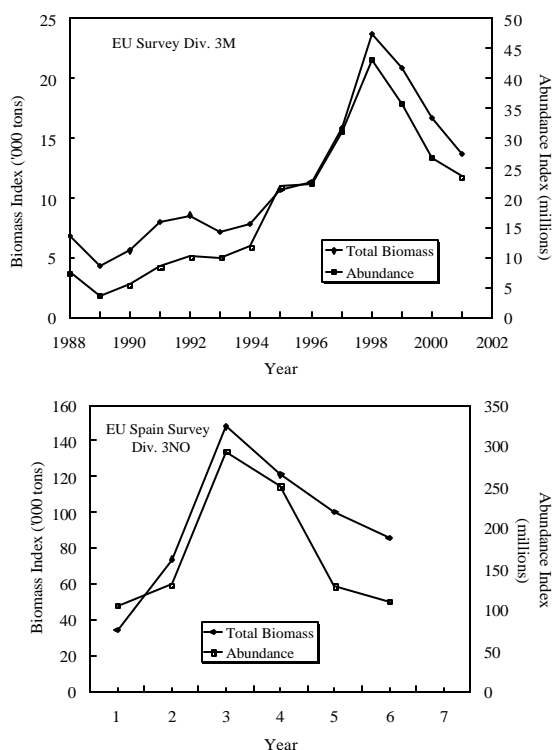
Recruitment: The level of recent recruitments is uncertain because expected strong year-classes did not recruit to the fishery according to the predictions made previously.



Biomass: As the dynamics of the population remain uncertain, it is not possible to determine an estimate of absolute biomass.

Most survey indices of biomass increased from 1996 to 1999 but declined since then.





Indices of fishable biomass since 1995 (30 cm is the minimum landing size) increased until 1999 as good year-classes recruited to the fishable stock but declined since then. The biomass index of fish greater than 70 cm (approximately length at 50% maturity) remains at a very low level.

State of the Stock: The stock appeared to be recovering from about 1996-99 due to good recruitment and relatively low fishing mortality but the biomass of fish over 70 cm remained low. Most stock size indicators from commercial CPUE and research vessel surveys suggest that presently the stock is either relatively stable or declining. If the TAC of 44 000 tons for 2002 is fully realized the stock will likely decline.

Recommendation: Although there remains a high level of uncertainty associated with the estimates of the strong 1993-95 year-classes, of these three, only the 1995 year-class is expected to contribute significantly to the catch in 2003. The major contribution is expected to come from the 1996 and 1997 year-classes, which are about average. In addition, the exploitation of immature fish and the low abundance of adult fish (>70 cm), is indicative of a situation of significant biological risk, although this risk cannot be quantified at present. Given the current uncertainty as to the contribution of the above-average year-classes to the fishable stock, Scientific Council recommends that the catch for 2003 should not increase above the average

level of 2000 and 2001 (36 000 tons) until the fishable biomass has increased.

The Council again recommends that measures be considered to reduce, as much as possible, the exploitation of juvenile Greenland halibut in all fisheries.

Reference Points: Assessment results are not considered sufficiently reliable to allow estimation of formal reference points in quantitative terms. Until such reference points can be provided, Scientific Council advises that:

Fishing mortality: should be maintained, with high probability, below the average level estimated for the period 1991 to 1994.

This approach is advised in order to maintain a low risk that the stock will enter regions of unknown dynamics, which are considered to have unacceptable levels of risk.

The recommendation about catch level made by Scientific Council is made to provide consistency with this approach.

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.

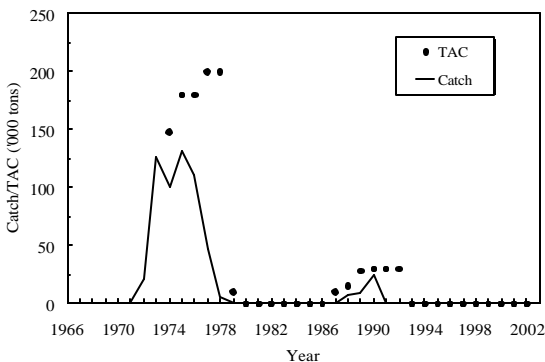
During previous assessments, Scientific Council has noted that fishing effort should be distributed in a similar fashion to biomass distribution in order to ensure sustainability of all spawning components.

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. 02/4, 6, 12, 21, 24, 27, 31, 39; SCS Doc. 02/4, 6, 7.

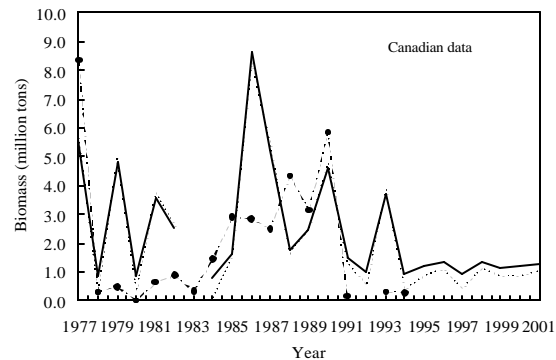
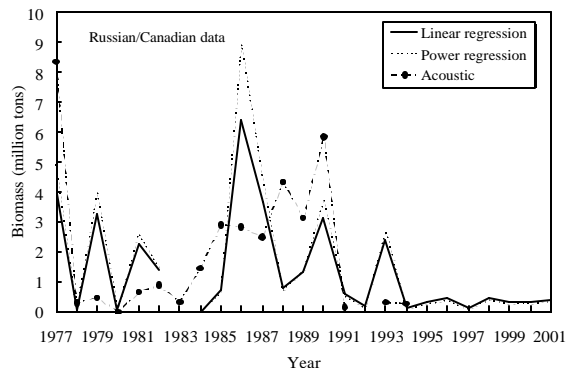
Capelin (Mallotus villosus) in Divisions 3N and 3O

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



Data: Capelin catches from Canadian bottom trawl surveys conducted in 1977-2001, as well as historical data sets from Russian and Canadian trawl acoustic surveys directed to capelin.

Assessment: The only indicator of stock dynamics presently available may be capelin biomass indices obtained during Canadian stratified-random bottom trawl surveys. Trawlable biomass of capelin in Div. 3LNO and 3NO for 1977-2001 was converted into absolute values on the basis of the relationship between trawl and acoustic estimates of capelin stock in Div. 3LNO in spring 1977-1994. Assuming the existence of a correlation between biomass estimates derived by the acoustic and the trawl methods, it was concluded that in 1990-1995, both the calculated and the trawlable biomass of capelin in Div. 3LNO fluctuated within a wide range. Since 1995, capelin biomass has remained at a low level compare to late-1980s.



Recommendation: Scientific Council recommends no directed fishery on capelin in Div. 3NO in 2003.

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

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

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

It is not clear how precise the capelin indices from the bottom trawl surveys reflect the real stock distribution and stock status.

b) Request for Advice on TAC and Other Management Measures for the Years 2003 and 2004

The Scientific Council and the Fisheries Commission during the meeting of 28 January-1 February 2002 agreed to consider certain stocks on an alternating year basis. This section presents those stocks for which the Scientific Council provided scientific advice for the years 2003 and 2004.

Cod (Gadus morhua) in Division 3M

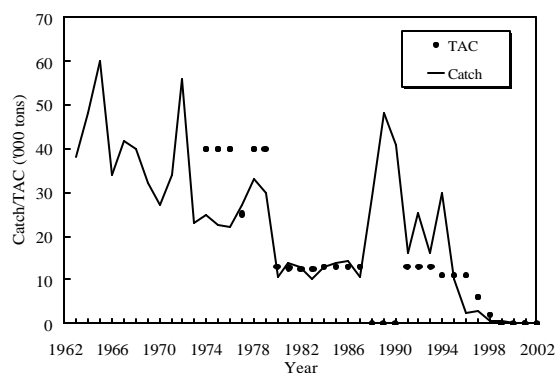
Background: The cod stock on Flemish Cap is considered to be a discrete population.

Fishery and Catches: Catches exceeded the TAC from 1988 to 1994, but were below the TAC from 1995 to 1998. Large numbers of small fish were caught by the trawl fishery in most recent years. By-catches were estimated to be low in the shrimp fishery since 1993. The fisheries since 1996 were very small compared with previous years. In 1999 the fishery was closed. Virtually all of the catch in 1999 was taken by vessels from non-Contracting Parties.

Year	Catch ('000 tons)		TAC ('000 tons)	
	STACFIS	21A	Recommended	Agreed
1999	0.4	0.0	ndf	ndf
2000	0.1	0.0 ¹	ndf	ndf
2001	0.0	0.1 ¹	ndf	ndf
2002			ndf	ndf

¹ Provisional.

ndf No directed fishing.

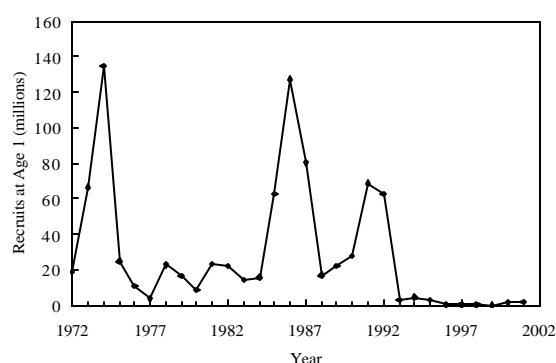


Data: Length and age composition of the 2000 and 2001 by-catches were available for Portuguese trawlers. Data were also available from the EU bottom-trawl and the Russian trawl surveys, both covering the whole distribution area of the stock.

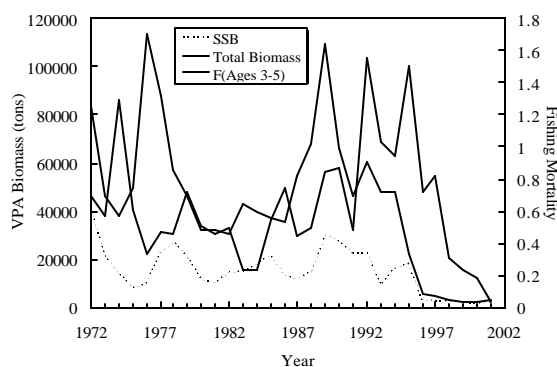
Assessment: An analytical assessment was presented. However, the analysis is strongly dependent on survey results at the current low levels of the commercial fishery.

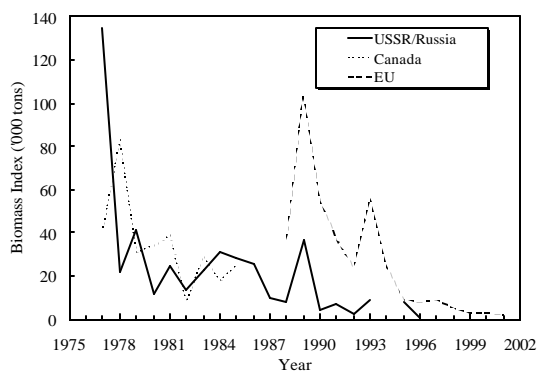
Fishing Mortality: The low fishing mortality since 1998 is consistent with the implementation of a moratorium on directed fishing in recent years.

Recruitment: The 1992 and subsequent year-classes appear to be weak.



Biomass: The stock biomass and spawning stock biomass at the beginning of 2002 remain at a very low level and is mainly composed of fish age 7 and older. Younger fish are scarce due to the lower recruitment after 1992. The biomass is expected to remain low in the near future due to the poor recruitment.





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 2003 and 2004. 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 assessment will be held in 2004.

Sources of Information: SCR Doc. 02/12, 58; SCS Doc. 02/4, 6.

American Plaice (*Hippoglossoides platessoides*) in Division 3M

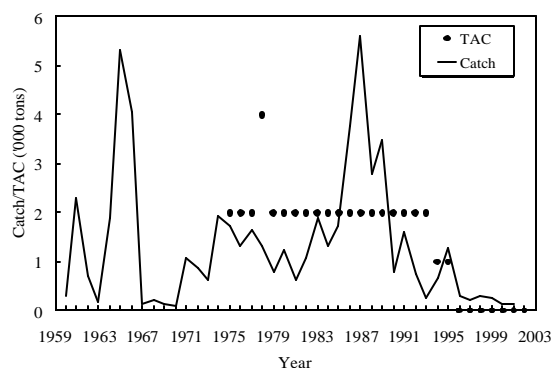
Background: The stock occurs mainly at depths shallower than 600 m on Flemish Cap.

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

Year	Catch ('000 tons)		TAC ('000 tons)	
	STACFIS	21A	Recommended	Agreed
1999	0.3	0.2	ndf	ndf
2000	0.1	0.3 ¹	ndf	ndf
2001	0.1	0.2 ¹	ndf	ndf
2002			ndf	ndf

¹ Provisional.

ndf No directed fishing.

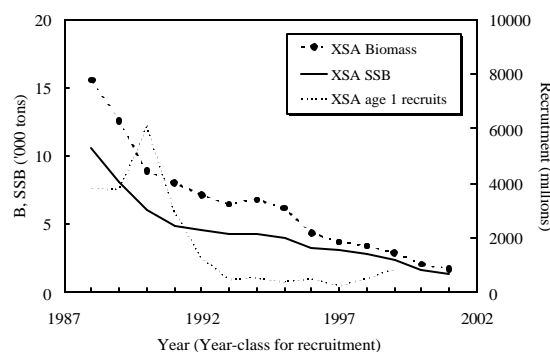


Data: Length compositions were available from the 1988 to 2001 fisheries. Abundance and biomass from surveys were available from USSR/Russia (1972-2001), EU (1988-2001) and Canada (1978-1996). Age-length keys were available from EU (1988-2001).

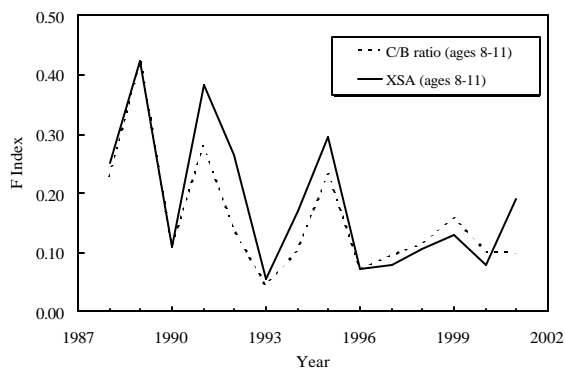
Assessment: An analytical assessment (XSA) was presented.

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

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



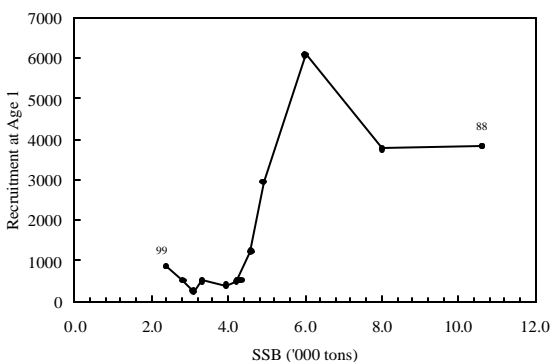
Fishing Mortality: The ratio of catch biomass to EU survey biomass (F index) and XSA fishing mortality declined from the mid-1980s to the mid-1990s, and fluctuated between 0.1 and 0.2 since 1996. F in 2001 estimated by XSA is at the level of the assumed natural mortality.



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

Recommendation: There should be no directed fishery on American plaice in Div. 3M in years 2003 and 2004. By-catch should be kept at the lowest possible level.

Reference Points: From the 12 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 $F_{0.1} = 0.156$ and $F_{\max} = 0.319$.

Special Comments: 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.

The next Scientific Council assessment of this stock will be in 2004.

Sources of Information: SCR Doc. 02/12, 59, 62; SCS Doc. 02/4, 6.

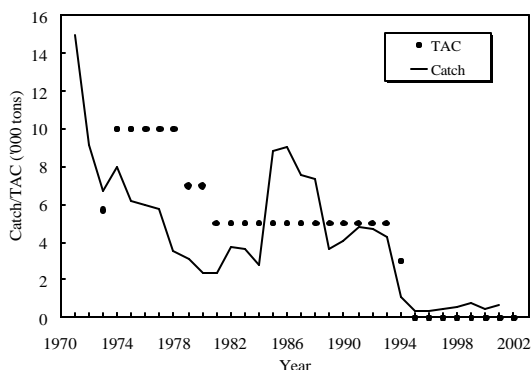
Witch Flounder (*Glyptocephalus cynoglossus*) in Divisions 3N and 3O

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 since 1995 ranged between 300-800 tons including unreported catches.

Year	Catch ('000 tons)		TAC ('000 tons)	
	STACFIS	21A	Recommended	Agreed
1999	0.8	0.9	ndf	ndf
2000	0.5	0.7 ¹	ndf	ndf
2001	0.7	0.4 ¹	ndf	ndf
2002	-	-	ndf	ndf

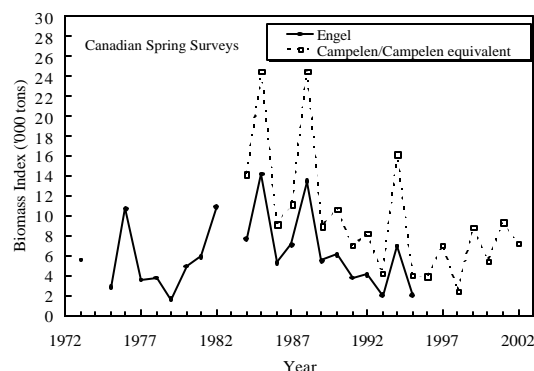
¹ Provisional.
ndf No directed fishing.



Data: Abundance and biomass data were available from Canadian spring surveys during 1984-2002 and autumn surveys during 1990-2001.

Assessment: No analytical assessment was possible with current data.

Biomass: The Canadian spring survey biomass index trended downwards from the mid-1980s until 1998, which has the lowest observed value. Some increase in the index has occurred since then.



Recruitment: No information.

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

Recommendation: No directed fishing on witch flounder in the years 2003 and 2004 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: Scientific Council is not in a position to propose reference points at this time.

Special Comments: No ageing data were available since 1993 and none are anticipated in the near future.

The next Scientific Council assessment of this stock will be in 2004.

Sources of Information: SCR Doc. 02/53; SCS Doc. 02/6, 7.

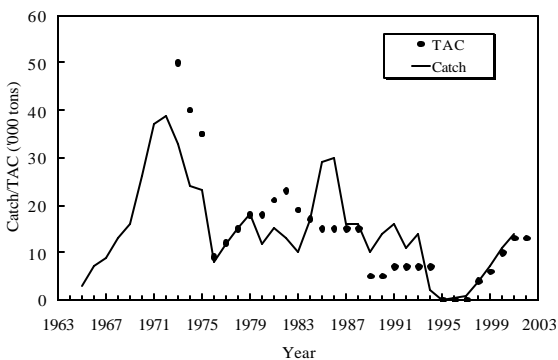
Yellowtail Flounder (*Limanda ferruginea*) in Divisions 3L, 3N and 3O

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 14, 100 tons in 2001. TACs have been exceeded each year from 1985 to 1993, and 1998-2001.

Year	Catch ('000 tons)		TAC ('000 tons)	
	STACFIS	21A	Recommended	Agreed
1999	7	7	6	6
2000	11	11 ¹	10	10
2001	14	13 ¹	13	13
2002				13

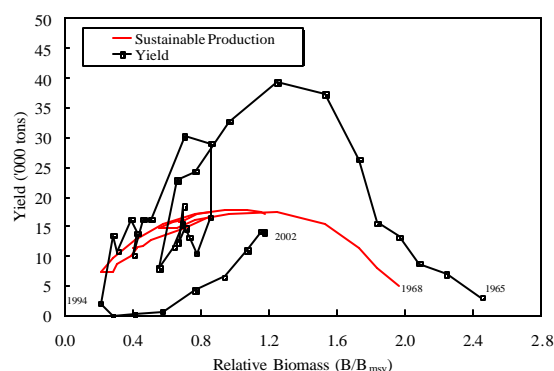
¹ Provisional.



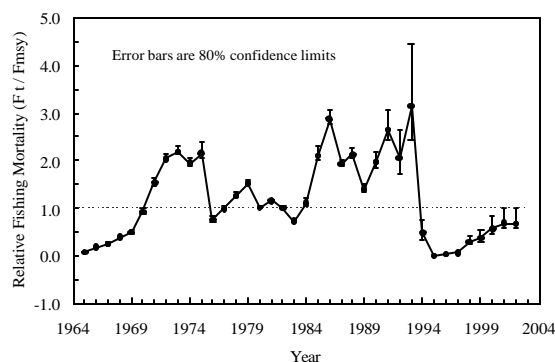
Data: CPUE from Canadian trawlers were available from 1965 to 2001. For 2001, length frequency data from the Canadian fishery, and from by-catches of Russian, Portuguese and Spanish trawlers were available. Abundance and biomass indices were available from: annual Canadian spring (1971-82; 1984-2001) and autumn (1990-2001) bottom trawl surveys; annual USSR/Russian spring surveys (1972-91); co-operative Canadian Dept. Fisheries and Oceans/Canadian fishing industry surveys (1996-2001); and Spanish surveys in the NAFO Regulatory Area of Div. 3NO (1995-2001).

Assessment: An analytical assessment using a stock production model was presented to estimate stock status in 2002. Since the moratorium (1994-97), the

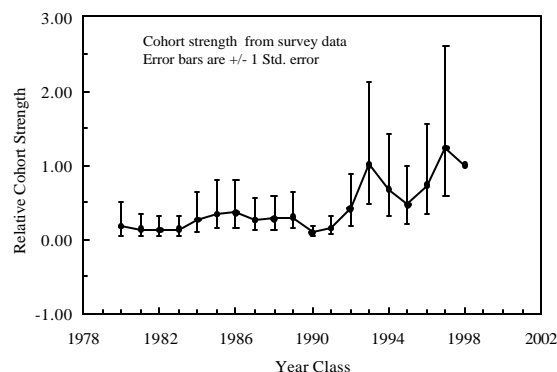
estimated yield has been below sustainable production levels.



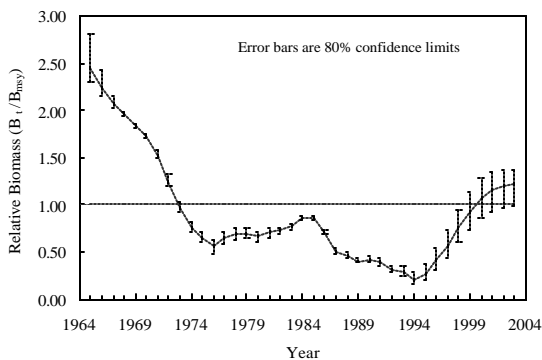
Fishing Mortality: Has been below F_{msy} since 1994 and is projected to be 68% of F_{msy} in 2002 with an assumed catch of 14 300 tons (TAC + 10% over-run).



Recruitment: Has improved in the 1990s and cohorts since 1992 are the highest in the series.



Biomass: Biomass estimates in 2001 in the Spanish and both Canadian surveys were the highest in all series. Relative biomass from the production model has been increasing since 1994, is estimated to be above the level of B_{msy} in 2002, and projected to be above B_{msy} in 2003.



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

Recommendation: The total catches should not exceed 14 500 tons in 2003 and 2004. This corresponds to catch projections based on $F = 2/3 F_{msy}$ and an assumed catch of 14 300 tons in the year 2002. Scientific Council noted that catches have been about 10% higher than TACs during 1998-2001. In providing its advice, Scientific Council notes that the advice applies to all removals (directed plus by-catch). Scientific Council recommends that measures be put in place to ensure that total catches do not exceed the recommended levels.

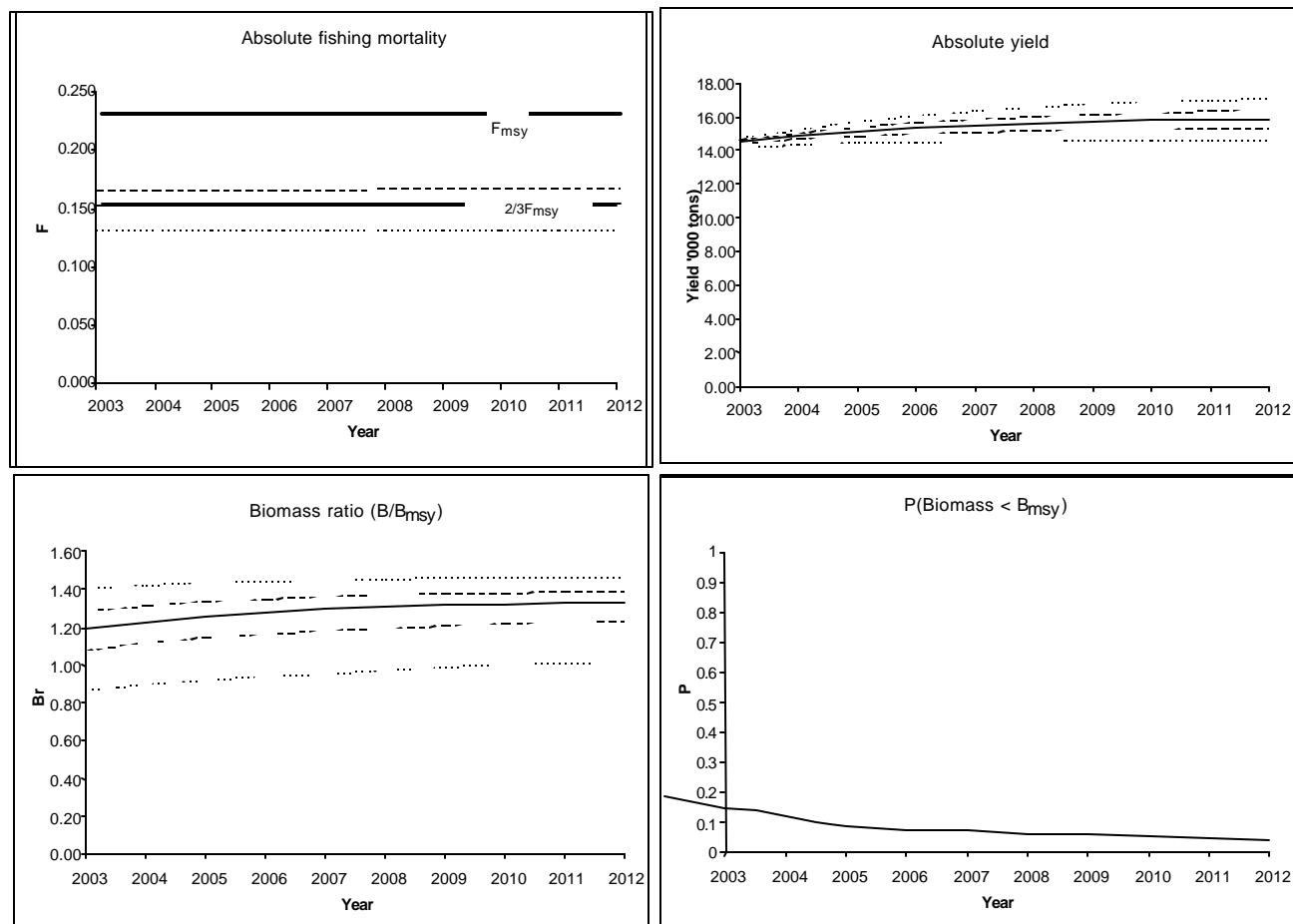
Reference Points: Scientific Council considered $2/3 F_{msy}$ to be a fishing mortality target.

Scientific Council notes it is not in a position to propose age-based reference points for this stock at this time and recommends that priority be given to restore the Council's ability to do age-structured analyses on this stock.

Medium Term Considerations: Projections were made to estimate yield for each year from 2003 to 2012 while constraining F at $2/3 F_{msy}$. The results suggest that yield will gradually increase to a maximum of almost 17 000 tons in the year 2012. The probability of biomass falling below B_{msy} decreases to less than 5% by 2012.

Sources of Information: SCR Doc. 02/3, 5, 43, 44, 65, 71, 73; SCS Doc. 02/4, 6, 7.

Medium term projections for yellowtail flounder at a constant fishing mortality of $2/3 F_{msy}$. The figures show the 5th, 25th, 50th, 75th and 95th percentiles of fishing mortality, yield and biomass / B_{msy} . The probability of biomass being less than B_{msy} is also given. The results are derived from an ASPIC bootstrap run (500 iterations) with a catch constraint of 14 300 tons in 2002.



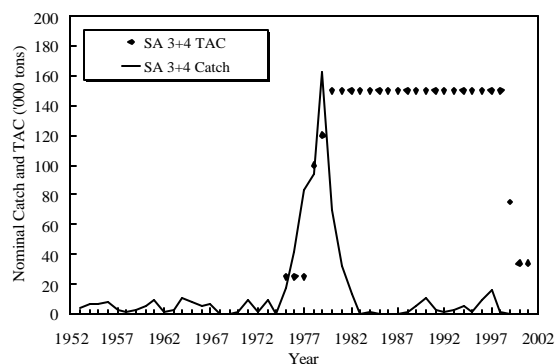
Northern Shortfin Squid (*Illex illecebrosus*) in Subareas 3 and 4

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 81 000 tons during 1976-1981, and peaking at 162 000 tons in 1979. Catches in Subareas 3+4 declined to 100 tons in 1986, ranged between 600 and 11 000 tons during 1987-1995, then increased to 15 800 tons in 1997. After 1997, catches declined sharply, from 1 100 tons in 1998 to 60 tons in 2001. 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 2000-2002.

Year	Catch ('000 tons)		TAC ('000 tons)	
	STACFIS	21A	Recommended	Agreed
1999	0.3	0.3	19-34	75
2000	0.4	0.3 ¹	19-34	34
2001	<0.1	<0.1 ¹	19-34	34
2002			19-34	34

¹ Provisional.

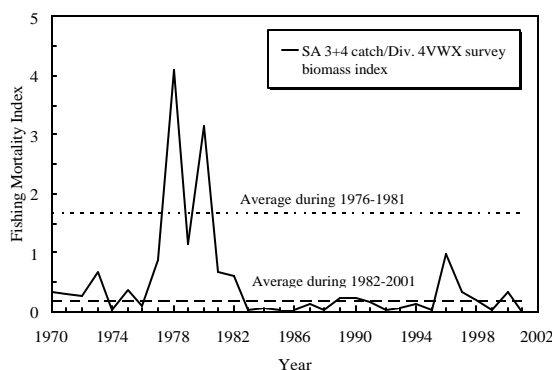


Data: Relative biomass and abundance indices were available from annual Canadian bottom trawl surveys conducted in Subarea 4 in July on the Scotian Shelf (Div. 4VWX, 1970-2001) and in September in the southern Gulf of St. Lawrence (Div. 4T, 1971-2001). The July survey indices are assumed to reflect relative stock size at the beginning of the fishing season. During 2001, mean mantle lengths of squid caught

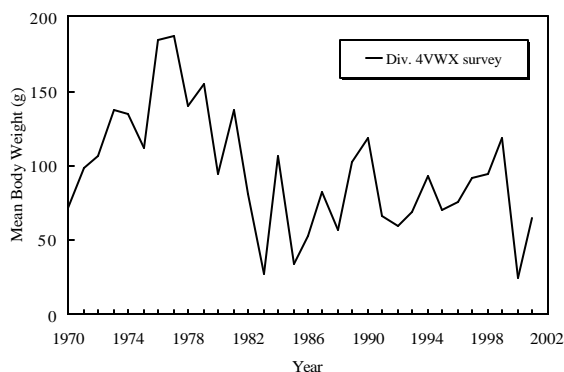
during September were available from one of the Subarea 3 inshore jig fishery sites.

Assessment: Absolute biomass and recruitment estimates for *Illex* in SA 3+4 were not available.

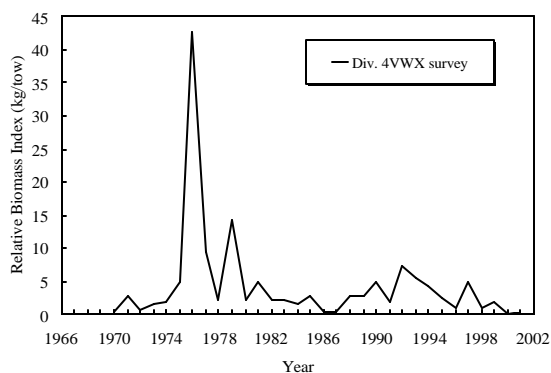
Fishing Mortality: Fishing mortality indices were highest during 1978-1980 and averaged 1.67 during the period of highest catch (1976-1981). During 1982-2001, fishing mortality indices were much lower and averaged 0.18.



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 increased slightly during 2001. Mean mantle lengths of squid caught in the Subarea 3 inshore jig fishery, during September, were also larger than the small size observed in 2000.



Biomass: Survey biomass indices 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 in 2001, were at the second lowest level since 1970.



State of the Stock: Based on survey biomass indices and mean body weights, in Div. 4VWX, the Northern shortfin squid resource in Subareas 3+4 remained at a low level in 2001.

Recommendation: The Scientific Council is unable to advise on a specific level of catch for 2003 or 2004. However, 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 2003 and 2004, 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: Scientific Council is not in a position to propose reference points at this time.

Special Comments: It is important to note that northern shortfin squid in Subareas 36 (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 2002 assessment advice applies to the period 2003-2004. The next assessment of this stock will occur in 2004.

Sources of Information: SCR Doc. 98/59, 75, 01/57, 02/40, 56; SCS Doc. 01/11, 02/4, 8, 13.

- v) The Fisheries Commission requested: *For squid (Illex) in Subareas 3 and 4, the Scientific Council is encouraged to further analyze available data toward developing possible indicators that could be used under an in-season management regime.*

The Council responded:

In 2002, the Scientific Council reviewed a series of pre-fishery abundance and biomass indices from the Canadian spring bottom trawl survey in Div. 3LNO and Subdiv. 3Ps and concluded that these indices did not adequately characterize trends in *Illex illecebrosus* biomass. A comparative analysis of *Illex* and *Loligo pealeii* abundance in relation to environmental variables (SCR Doc. 02/40) was also reviewed, which indicated that correlations exist between some environmental variables and *Illex* abundance indices. However, further research is required before a reliable pre-season indicator of *Illex* abundance is available.

c) **Special Requests for Management Advice**

i) **Formulation of advice under the Precautionary Approach**

The Council noted that this matter was considered on a stock-by-stock basis, and addressed and reported where relevant with those stocks.

ii) **Relationship of witch flounder in Divisions 2J and 3KL to Division 3M**

The Fisheries Commission, with the concurrence of the Coastal State, requested: *the Scientific Council comment on the possible relationship of witch flounder in Div. 2J+3KL to that reported as caught in Div. 3M based on examination of all survey and biological data available.*

Based upon survey distribution data examined, the Scientific Council concluded that:

1. Witch flounder in Div. 3M in depths less than 730 m do not appear to be strongly linked with witch flounder in Div. 2J and 3KL.
2. Witch flounder in the deep waters of Flemish Pass (>730 m) are likely to be closely associated with witch flounder along the slope of the Grand Bank in Div. 3L.
3. Almost no witch flounder were observed in the northwestern part of Div. 3M in depths greater than 550 m.

iii) **Distribution of shrimp in Division 3M**

The Fisheries Commission requested: *for shrimp in Div. 3M, including the area in footnote 1 of Part I, G of the Conservation and Enforcement Measures (the Div. 3L 'box'), Scientific Council is requested, in advance of the annual NAFO Meeting in September 2002, to provide information on the monthly distribution of shrimp by size as taken in the commercial fishery and to comment on these distributions in relation to the closed area of Div. 3M as defined by coordinates in footnote 2 of Part I, G of the Conservation and Enforcement Measures and the consequences to the stock of the following scenarios: a) closure of the area during June 1 through December 31, and b) no closure at any time.*

The Council responded:

As the analysis presented to the Scientific Council was incomplete, it was agreed to defer the matter to the Scientific Council meeting in September 2002 when the Council expects clarification on the methodology. In addition, analysis of the implications of the closure on future yield from this stock will be provided.

- iv) **Pelagic *Sebastes mentella* in NAFO Subareas 1-3 and Adjacent ICES Area** (Annex 1, Item 8) (SCR Doc. 02/10, 19; SCS Doc. 02/18)

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

The Council responded as follows:

At its September 2001 Meeting, Scientific Council reviewed the most recent information available on the distribution of pelagic *S. mentella* based on the July 2001 international acoustic survey (SCR Doc. 01/161). The Scientific Council's conclusions on this subject can be found in *NAFO Sci. Coun. Rep.*, 2001, pages 211-212.

Scientific Council noted that the issue of possible relationships between pelagic *S. mentella* and demersal *S. mentella* in the NAFO area has not been considered by the ICES Working Group.

Scientific Council concludes that the recent report of the ICES North-Western Working Group presents the best available summary of knowledge about the distribution of pelagic *S. mentella* and its affinity to the shelf stocks in the relevant ICES area. Possible relationships between pelagic *S. mentella* and shelf *S. mentella* (demersal) have not been studied in the NAFO area, and no data adequate to address this question exist. No national funds have been committed to this research area at present. Additional funding for specific research studies would be needed in order to address this topic.

Further to this subject, Scientific Council noted the following recommendations from Scientific Council from its June 2001 Meeting:

"annually, in advance of the meeting of the North-Western Working Group (next meeting tentatively scheduled for April 2002), Scientific Council members who will be participating identify themselves to the NAFO Secretariat who will work with the Chair of Scientific Council and designate formal representation of NAFO to the Working Group. The designated person(s) shall then report back on the ICES North-Western Working Group deliberations to the subsequent meeting of Scientific Council.

and

"the Chair of Scientific Council will interact with the Chair of the ACFM of ICES as required so that information on approved analyses and recommendations pertaining to the North-Western Working Group is shared and conveyed to NAFO Scientific Council for consideration as necessary."

Scientific Council was provided a report on the deliberations of the ICES North-Western Working Group (NWWG) meeting that took place from 28 April to 8 May 2002 in Copenhagen as it pertains to stock structure, distribution and state of pelagic *S. mentella* in ICES Sub-areas V, XII and XIV and the NAFO Convention Area. New information was presented on the general issue of stock structure within this whole area. The genetic structure of the pelagic and demersal stocks of deep-sea redfish (*S. mentella*) in the North Atlantic remains poorly known, but further research is currently being carried out. However, Scientific Council agreed with the NWWG that, based on the data available, all information suggests that the fishery for pelagic *S. mentella* in the NAFO Convention Area (eastern part of Div. 1F, 2H and 2J) is based on the same stock as fished in western part of ICES Sub-area XII.

Scientific Council also noted the following as it pertains to the state of the pelagic *S. mentella* resource in ICES Sub-areas V, XII and XIV and the NAFO Convention area:

In the 2001 trawl-acoustic survey, as well as in that of 1999, the stock shallower than 500 m was observed more southwesterly and deeper than it has been during former acoustic surveys in the last decade. During the same period, a gradual increase in temperature in the observation area has been observed. This may have influenced the distribution pattern of the redfish in June-July as the highest concentrations were found in the colder, i.e. southwestern part of the survey area. In June/July 2001, about half of the total acoustically estimated stock biomass was found in the NAFO Convention Area shallower than 500 m omitting the Canadian EEZ. Scientific Council noted that the surveys in 1999 and 2001 extended further to the south and west into the NAFO Convention Area and this may in past account for the perception of greater distribution to the west.

Since 1994, acoustic estimates of stock biomass show a drastic decreasing trend. The estimate was only 0.7 million tons in 2001, compared with 2.2 and 1.6 and 0.6 million tons in 1994, 1996 and 1999, respectively. This represents a reduction of about 1.5 million tons in the period. During the same period, the total catch has been about 800 000 tons. Therefore, the catch alone cannot explain the changes in the stock estimate. During the same period, the fishery has also developed towards greater depth and towards bigger fish, and in recent years, the majority of the catch has been caught at depths deeper than 500 m. Based on these results, the NWWG concluded that acoustic estimates cannot be considered accurate measures of relative changes in stock size of the upper layer fish, as availability may have changed during the surveyed period. Information suggests that fish inhabiting the upper layer may have migrated out of the surveyed area, both horizontally and vertically (deeper). Scientific Council agreed with this evaluation.

In addition to the acoustic measurements, an attempt was made to estimate the redfish in and below the deep scattering layer. This was done by correlating catches and acoustic values at depths between 100 and 450 m. The obtained correlation was used to convert the trawl data at greater depths to acoustic values and subsequently to an abundance and biomass estimate. Standardized trawl hauls were carried out at different depth intervals, evenly distributed over the survey area. Data for the correlation calculations between trawl catches and the acoustic results were obtained during trawling only. In addition, scrutinized acoustic values were only taken from exactly the same position and depth range as covered by the trawl. Using this method, a total of approximately 1 075 000 tons were estimated to be at depths between 0 and 500 m. and about 1 056 000 tons below 500 m. In June/July 2001, one third of the biomass obtained with the trawl method of about 2 million tons was found in the NAFO Convention Area outside the Canadian EEZ. The NWWG considered that the low correlation between catch and the acoustic values used for abundance estimation and the assumption that catchability of the trawl is the same, regardless of the trawling depth, make the method questionable. Estimates based on these calculations both above and below 500 m depth, must be considered as a very rough measure with high uncertainty as the applicability of the method can only be verified after replicate measurements. The NWWG considered that the estimated abundance derived from the trawl data should be treated with great caution and they cannot be combined with the acoustic results. Scientific Council agreed with this evaluation.

The trend in unstandardized CPUE from different fleets in depths shallower than 500 m indicates a steep downward trend since 1995, and the trend in acoustic estimates from the surveys (described above) track these changes. In recent years, there is no clear signal in CPUE, but it should be noted that CPUE decreased between 2000 to 2001 for most indices, both shallower and deeper than 500 m. The results of a standardized CPUE analysis, derived from a GLM CPUE model incorporating data from Germany (1995-2001), Iceland (1995-2001), Greenland (1999-2001) and Norway (1995-2001) were available. The model takes into account year, month, vessel and area (ICES statistical square). The model shows that the index did decrease until 1997 and increased thereafter until 2000 and decreased by about 15% in 2001. Given the technical, seasonal, geographical and depth changes of the fishing activities, the NWWG considered that the relevance of the unstandardized national CPUE series as indicator of stock abundance remains difficult to assess. However, from the standardized CPUE series, the NWWG stated that it can be concluded that the pelagic redfish CPUE remained stable since 1995 for all fishing areas as well as separated above and below 500 m depth. The models do not indicate significant stock reductions since 1995. Scientific Council considered that

CPUE (standardized or not) in hours fished for redfish can be misleading and may be optimistic. Scientific Council does not consider this a reliable indicator of stock status since redfish exhibit schooling behavior and relatively good catch rates may still be possible while the area of the distribution of the resource is declining or number of schools is diminishing.

The decline in the acoustic survey time series estimates has been the basis for the advice in past assessments. The assessment of the current state of the stock and basis of the advice is based on trends in standardized CPUE indices and a trawl biomass estimator that is based on an approach that is highly uncertain. The NWWG concluded that taking into account the uncertainty in stock indicators, it is not known if the exploitation rate generated by recent catches is above or below the 5% exploitation rate.

In summary, Scientific Council concluded that a stronger statement should be made about the uncertainty in the stock status of pelagic *S. mentella* resource in ICES Sub-areas V, XII and XIV and the NAFO Convention Area, particularly for the considerations that the standardized CPUE series do not indicate significant stock reductions since 1995.

v) **Distribution of shrimp in Divisions 3LNO**

Fisheries Commission requested that: *Scientific Council provide information on the geographical distribution of this resource including the relative and seasonal distribution inside and outside the NAFO Regulatory Area by both Division and age group. With reference to the proposed closed area in the region of the South East Shoal in Div. 3N as referenced in FC Working Paper 02/01, Scientific Council is further requested to provide information on the abundance and distribution of shrimp in the area proposed for closure.*

The Council responded:

Canadian bottom trawl surveys indicate shrimp are widely distributed along the edge of the Grand Banks. However, the preponderance of shrimp is in NAFO Div. 3L. The biomass index increased from 5 921 tons in autumn of 1995 to 59 914 tons during autumn of 1998, remained stable until spring of 2000, at which time it increased to 121 815 tons but then decreased to 103 451 tons the following spring.

Relative seasonal distribution, inside and outside the NAFO Regulatory Area

Over the study period, more than 90% of the biomass was found within Div. 3L, mostly within depths from 185 to 550 m. Over the six autumn surveys, the biomass within the NRA portion of Div. 3L ranged between 11 and 24% of the total Div. 3L biomass. During spring, shrimp in the NRA of Div. 3L contribute between 18-30% of the total Div. 3L biomass.

Divisions 3N and 3O accounted for less than 10 and 1% of the total Div. 3LNO biomass, respectively. Over 90% of the Div. 3N biomass was found in the Div. 3N NRA. However, Div. 3O shrimp catches were highly variable; therefore, between 5 and 85% of the Div. 3O biomass was found in the Div. 3O NRA.

The NRA accounted for between 12 and 31% of the total Div. 3LNO shrimp biomass.

Figures 1 and 2 indicate the geographic distributions of catches of small (male) and large (female) shrimp during a period of near normal temperatures (1995-1997), and during a relatively warm period (1998-2000). During the period of normal temperatures, shrimp appeared to be segregated by depth with the smaller individuals occurring in shallower water. Females are not commonly found in shallower waters, but during warm periods the shrimp appear mixed.

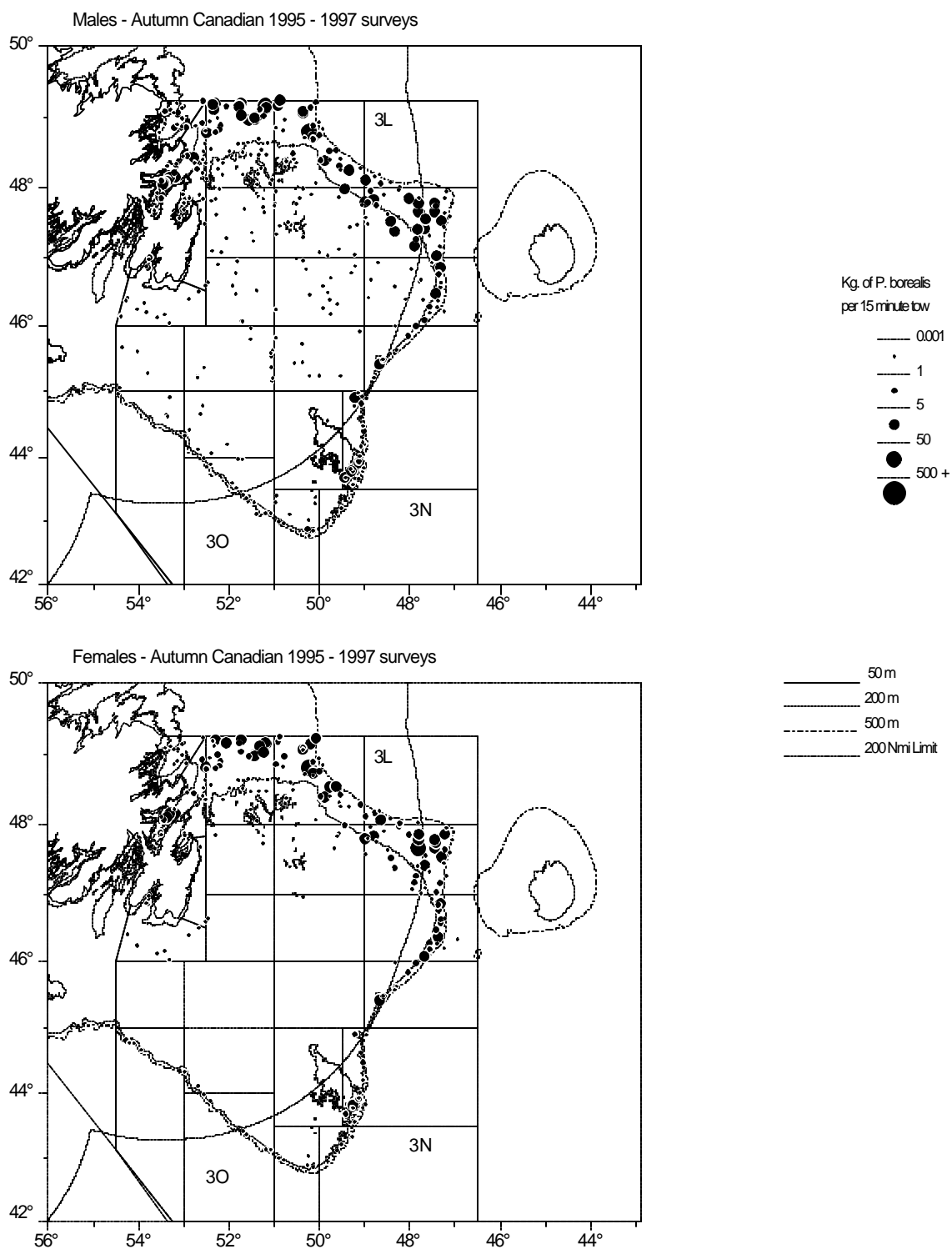


Fig. 1. Catches of male and female *P. borealis* obtained by autumn Canadian bottom trawl surveys into NAFO Div. 3LNO over 1995-1997.

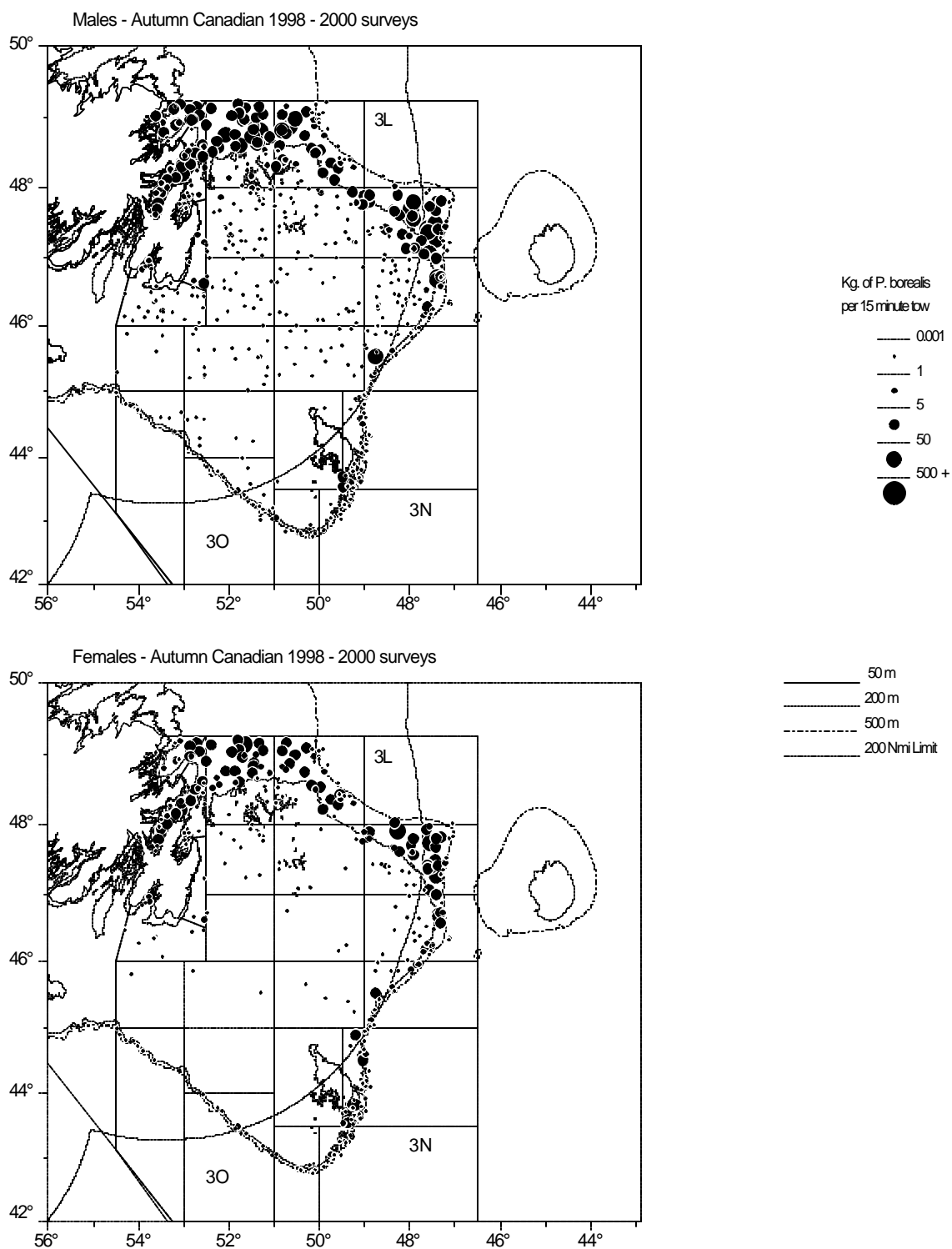


Fig. 2. Catches of male and female *P. borealis* obtained by autumn Canadian bottom trawl surveys in NAFO Div. 3LNO over 1999-2000.

Distribution by age group

Northern shrimp carapace length distributions in the NRA portion of Div. 3L were similar to those in the Canadian EEZ of Div. 3L (Fig. 3). The following table can be used to identify age classes along these length frequencies:

Age (years)	Carapace length
0	<8.5 mm
1	8.5-12.0 mm
2	12.5-17 mm
3	17.5-20.0 mm
4	20.5-22.5 mm
5	23.0-24.5 mm
6	25.0-27.0 mm
7+	>27.0 mm

Males with a modal length of 18.0 mm carapace length, believed to have been the 1997 year-class (age 3) dominated abundances within the autumn 2000 survey data. The 1998 year-class was evident near 15 mm while the 1999 year-class had a mode between 9 and 11.5 mm. There is a higher abundance of young males in the Canadian EEZ of Div. 3L area compared to the NRA, because as discussed above, the younger animals tend to be distributed in shallower waters. The largest males (>19 mm) and smallest females (<22 mm) are thought to belong to the 1996 year-class. The weaker 1996 year-class appears to be followed by relatively strong 1997 and 1998 year-classes. The broad female distribution suggests that it consists of several year-classes.

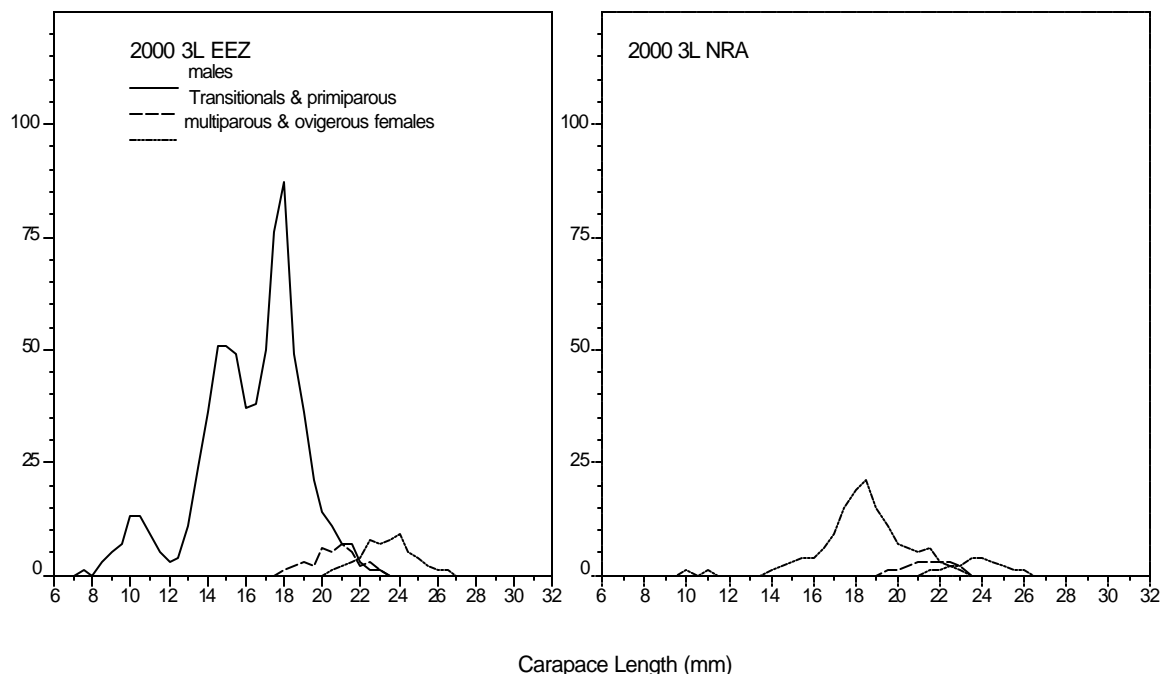


Fig. 3. *P. borealis* length frequencies illustrating similarities between shrimp within Div. 3L and those in the NRA.

Geographic distribution in relation to the proposed closed area

Northern shrimp have rarely been found in the proposed area as defined in the FC Working Paper 02/10 (Fig. 4).

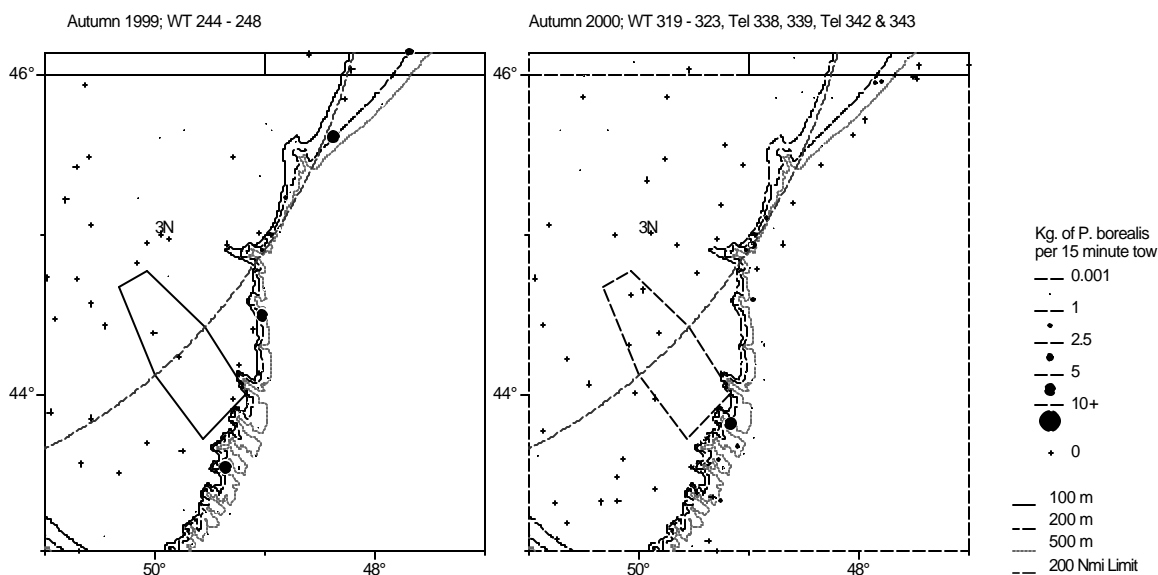


Fig. 4. Catches of Northern shrimp within the area defined within FC Working Paper 02/10 collected during autumn 1999 and 2000 Canadian research surveys.

d) Monitoring of Stocks for Which Multi-year Advice was Provided in 2001

The Scientific Council in 2001 provided 2-year advice (for 2002 and 2003) for three stocks (cod in Div. 3NO; redfish in Div. 3LN; and witch flounder in Div. 2J and 3KL). The Scientific Council reviewed the status of these three stocks at this meeting of June 2002, and found no significant change in status for any of the stocks. Therefore, the Scientific Council has not provided updated/revised advice for 2003 for these stocks. The next Scientific Council assessment of these stocks will be in 2003.

2. Coastal States

a) Request by Canada for Advice

The Scientific Council was requested by the Coastal State Canada to provide advice on stock status for Greenland halibut in Subareas 0-3, cod in Div. 2J+3KL, by-catch of yellowtail flounder in Div. 3LNO, by-catch of American plaice in Div. 3LNO and redfish in Div. 3O. This section provides the Scientific Council responses where possible.

i) Greenland halibut distribution in Subareas 0-3

The Scientific Council noted there was no information available at this meeting to respond to comment on overall SA 0-3.

For Greenland halibut in Subareas 0+1 Canada requested the Scientific Council to:

- a) *provide an assessment of the status of the Greenland halibut stock component in Division 0A+1A;*

See Scientific Council Summary Sheet for Greenland halibut in Subareas 0+1.

- b) *advise on an appropriate TAC level for 2003 for Greenland halibut in the offshore area of Division 0A+1A and any other management measures the Scientific Council deems appropriate to ensure the sustainability of the resource;*
- c) *comment on the relationship between Greenland halibut in the offshore area of Divisions 0A+1A and the remainder of SA 0+1 as well as the potential impact of any fishery in Divisions 0A+1A on the stock development throughout SA 0+1.*

The Council responded:

The continuous distribution of the catches in the offshore surveys in Div. 0A-B and Div. 1A-D indicate that Greenland halibut in the area likely constitute a single stock. This has also been suggested by a few other studies but the basis for the hypothesis has not been fully evaluated.

The offshore surveys in 2001 showed that fish were generally smaller in the northern areas, compared to the southern areas indicating that Div. 0A and 1AB could act as recruitment area for Div 0B and 1CD.

The inshore fishery in the Uummannaq and Upernavik area is probably dependent on recruitment from the offshore area. A fishery in Div.0A and 1A (and Div. 1B) is likely to have an impact on the inshore fishery in Div. 1A and the offshore fishery in Div. 0B and 1CD, but the impact cannot be quantified.

- d) *outline the elements of a scientific program necessary to provide detailed response to above and the timeframe if such a program were implemented.*

The Council responded:

A tagging program conducted in Div. 0A and 1A with longlines is likely to provide information on migration and hence the relation between Greenland halibut in this area and Div 0B and 1CD and the inshore areas in Div. 1A. The program could run for two-three years or as an intensive one-year effort. It is likely to take several years after the program has been terminated before sufficient tags have been returned to allow for any meaningful analysis.

Genetic studies, studies of parasite infection rates and morphometry have been used in stock delimitation investigations for Greenland halibut in the past. However, small-scale stock components are difficult to define using these methods.

ii) **Cod in Divisions 2J and 3KL**

Canada requested: *for the cod stock in Divisions 2J+3KL, the Scientific Council is requested to report on recent trends in the total and spawning biomass based on the most recent stock status update.*

The Council responded (also see SCS Doc. 02/3):

The total and spawning biomass indices are both extremely low relative to historic levels.

The biomass index from the autumn survey in 2001 remained extremely low at only 2% of the average in the 1980s. Since 1999, the biomass index has remained more or less constant at a level that is less than 20% of that which was measured in the year in which the moratorium was declared. Furthermore, the biomass index from the spring bottom-trawl survey in Div. 3L is also currently much lower than the historical average. The biomass index increased from 1998 to 1999, then declined in 2000 and 2001. The Div. 3L biomass index in 2001 is less than 1% of the average in the 1980s.

A spawner index from the survey numbers using weights and proportion mature was not computed for the stock status update in 2002. However, the sentinel and commercial indices, as well as the tagging index, can serve as a proxy of mature biomass given the age ranges involved (commercial size fish). The sentinel and commercial indices were among the lowest observed in the time series for all areas. Based upon the tagging data, there is concern that a number of experiments resulted in exploitation rates that were calculated to be greater than 10% with one as high as 30% in 2001.

The only known overwintering aggregation of any significance throughout the entire stock area is found in Smith Sound, Trinity Bay. Acoustic studies have estimated this aggregation around 20 000 tons. Fish from this aggregation migrate seasonally out of the sound in the spring, mainly northward in Div. 3L and into southern Div. 3K, supporting most of the commercial fishery which has taken place in the autumn over the last three years.

For the stock status update, age specific mortality estimates were calculated for the autumn Div. 2J+3KL bottom-trawl survey for ages 1-14. The current levels of mortality rates are similar to or higher than those observed during periods when there was a substantial fishery.

The new information considered in the stock status update substantially increases the concerns noted in the 2001 assessment regarding the sustainability of current levels of fishing.

iii) **Redfish in Division 3O** (SCR Doc. 01/67, 02/79; SCS Doc. 02/4, 6, 7)

Canada submitted requests on the redfish stock in Div. 3O, and the Council responded with respect to each as follows:

The Scientific Council noted that there are two species of redfish that are fished in Div. 3O, *Sebastes fasciatus* and *S. mentella*. These species overlap in distribution and are very similar in appearance, which requires special techniques to separate in the catch. It is therefore unlikely that these will ever be properly separated in the fishery statistics and are not separated out in most research surveys. It is noted this pertains to the following:

- a) *Information on the fishing mortality on redfish in Div. 3O in recent years, as well as information on by-catches of other groundfish in the Div. 3O redfish fishery.*

The Scientific Council noted it is not possible to estimate fishing mortality for this stock. There is insufficient historical catch sampling for some fleets and no data for others to conduct analytical assessments. The Scientific Council noted that there is some doubt about the magnitude of actual catches reported from Div. 3O as it is not regulated by TAC in the Regulatory Area. Accepting this caveat and the observation that Canadian spring and autumn survey estimates of Div. 3O redfish are relatively stable in the last few years, the increase in catches in Div. 3O in recent years, particularly in 2001 at 20 000 tons, suggests that fishing mortality may have increased in 2001.

With regard to by-catches of other groundfish in the Div 3O redfish fishery, it was noted that based on the NAFO STATLANT 21B data for 1998-2000, Atlantic cod, American plaice, Greenland halibut, witch flounder, and yellowtail flounder constitute the major by-catch species in the directed redfish fishery in Div. 3O. The percentage of by-catch, calculated as the sum of by-catch for all species as a percentage of redfish catch, suggests that there are differences by fleet and by year, which ranged between 2% to 20% from 1998-2000. There were large differences between by-catch

within the Canadian EEZ (at less than 3% each year) and by-catch within the NRA (between 12% to 20% annually depending on the fleet).

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

The Scientific Council noted the only information available on abundance indices was from the Canadian spring and autumn research surveys. The Scientific Council does not consider the Canadian research survey indices as indicative of year-to-year changes in the resource. With regard to distribution of the stock in relation to groundfish resources, redfish reside on the slopes of the shelf primarily from 100-750 m in an area that encompasses about 6 400 square nautical miles of the 20 000 square nautical miles of the total bank and shelf area of Div. 3O to 1 500 m. Based on the Canadian survey data pooled from 1999-2001 separately for spring and autumn, a comparison was made of the relative distribution of redfish with stocks currently under moratorium (Div. 3NO Atlantic cod, Div. 3LNO American plaice and Div. 3NO witch flounder). For cod and American plaice, the greatest overlap occurs in depths between 100 m to 200 m. For witch flounder, redfish overlap with its distribution with the exception of the area >750 m. There are also differences in the amount of overlap for all species between spring and autumn with greater overlap generally occurring in the spring with Atlantic cod and witch flounder and in the autumn with American plaice.

- c) Information on the distribution of redfish in Division 3O, as well as a description of the relative distribution inside and outside the NAFO Regulatory Area.*

The Scientific Council noted the overall distribution has been described in the previous section. The relative distribution inside and outside the NRA was determined based on Canadian survey data. As noted earlier, redfish reside primarily in the 100 m to 750 m depth zone. The area of redfish habitat in the NRA is about 496 square nautical miles compared to 5 515 square nautical miles inside the Canadian EEZ. This represents about 8.25% of the area. Based on spring survey data, the proportion of the redfish survey biomass in the NRA ranged from 1.4% to 37.9% with an average of about 12%. Based on the autumn surveys, the proportion ranges from 3.4% to 16.4% with an average of about 9%.

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

The Council noted there is insufficient information to determine biological reference points for this resource because it is not possible to determine the current level or historic levels of fishing mortality or stock biomass. Research survey results are highly variable and, while considered useful for determining longer term stock trends, are not considered a reliable indicator of actual abundance and are therefore of limited value in providing information for establishing reference points.

Given that the fishery in the NRA is currently unregulated, an initial conservation measure should be to bring the stock under a quota management regime that is applicable throughout the stock area.

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

The Scientific Council noted there is insufficient information on which to base predictions of annual yield potential for this resource. Stock dynamics and recruitment patterns are also poorly understood. Catches have averaged about 13 000 tons since 1960 and over the longer term, catches at this level do not appear to have been detrimental.

- 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.*

The Scientific Council noted information from Canadian spring and autumn surveys that the area of overlap between redfish and juveniles of groundfish stocks which are under moratorium (Div. 3NO Atlantic cod, Div. 3LNO American plaice and Div. 3NO witch flounder) diminished as depth increases beyond 100 m. The research survey data pooled from 1999-2001 indicated that redfish were caught in only a few of the sets in depths less than 100 m where most of the juveniles of cod (≤ 40 cm) and American plaice (≤ 30 cm) and witch flounder (≤ 25 cm) reside. The densities of juveniles of these species are relatively low beyond 200 m. Therefore, fishing at depths greater than 200 m for redfish should minimize the impact on juveniles of these species. The Scientific Council noted the following information with regard to depth fished while directing for redfish by the primary fleets in 2001:

Canada:	65 m-450 m
EU/Spain:	200 m-600 m
EU/Portugal:	68 m-553 m
Russia:	300 m-600 m

- 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).*

The Scientific Council noted currently, there are spring and autumn surveys that are conducted by Canada in Div. 3O that sufficiently cover the redfish habitat. Estimates of abundance and biomass have been highly variable from these surveys and part of the reason may be due to vertical and horizontal migrations of redfish in the area. There is also uncertainty regarding the integrity of Div. 3O as a separate management unit. Recent technological advances in the tagging of deepwater fish at depth may be one possible avenue of research that help address the problems of the resource surveys and provide another method of estimating stock size as well as assisting in better understanding of stock structure. The Scientific Council noted there has been much discussion in recent years about the relationship between Div. 3O and Div. 3LN with regard to stock structure and that a recommendation was made (*NAFO Sci. Coun. Rep.*, 2001, p. 138) that *studies be carried out to further clarify stock structure of redfish*. The Scientific Council also noted that the utilization of the NAFO Observer Program set-by-set data would have been beneficial in addressing this request on Div. 3O redfish and could be an important source of data to aid in monitoring of this resource.

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

The Council noted commercial sampling from the most current catches (2001) was available from Canada, EU/Portugal, EU/Spain and Russia. These data indicate that fish between 21-25 cm dominate the size composition of the 2001 catches. Based on recent size at maturity data, the female portion of these catches will largely be immature (size at 50% maturity is approximately 27.5 cm). The Scientific Council noted that size at maturity was based on data that did not separate *S. mentella* and *S. fasciatus* and that it is possible that there were different maturity rates between these species. However, it is not expected that these differences would be large.

b) Request by Denmark (Greenland) for Advice

The Scientific Council was requested by Denmark (Greenland) to provide advice for various stocks.

i) Multi-year advice for Roundnose grenadier in Subareas 0 and 1 for 2003-2005

The Council consideration on this stock is reported below:

Roundnose Grenadier (*Coryphaenoides rupestris*) in Subareas 0 and 1

Background: The roundnose grenadier stock in Davis Strait is probably connected to other stocks in the North Atlantic. The stock component found in Subareas 0+1 is at the margin of the distribution area. Canadian and Russian surveys that covered both Subareas 0 and 1 showed that most of the biomass generally was found in Subarea 1.

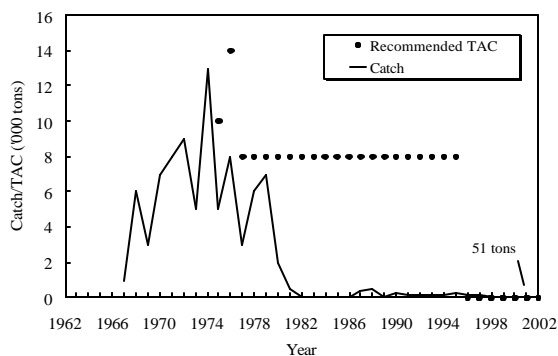
Fishery and Catches: Recommended TACs were at 8 000 tons in the period 1977-95. The advice since 1996 has been that the catches should be restricted to by-catches in fisheries targeting other species. There has been no directed fishery for this stock since 1978. An unknown proportion of the reported catches are roughhead grenadier (*Macrourus beglax*).

Year	Catch ('000 tons)		TAC ('000 tons)	
	STACFIS	21A	Recommended	Agreed
1999	0.04	0.04	ndf	3.4
2000	0.10	0.08 ¹	ndf	3.4
2001	0.05	0.04 ¹	ndf	3.4
2002			ndf	4.2

¹ Provisional.

² Set by Greenland for Subarea 1.

ndf No directed fishing, catches restricted to by-catch in other fisheries.

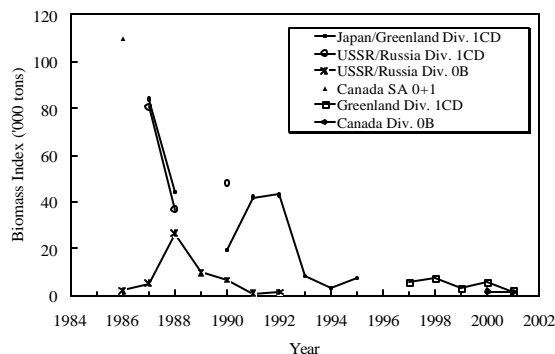


Data: Biomass estimates of roundnose grenadier from surveys in Div. 0B during the period 1986-92, from Div. 1CD during the period 1987-95, from Div. 1CD in 1997-2001 and Div. 0B in 2000-2001 were available.

Assessment: No analytical assessment could be performed.

Fishing Mortality: Exploitation level is considered to be low in recent years.

Biomass: There are no recent estimates of biomass of roundnose grenadier for the entire stock area. In 2001 the biomass of roundnose grenadier was estimated at 1 600 tons for Div. 1CD, the lowest ever observed. Surveys in Div 0B in 2000 and 2001 also showed a very low biomass; 1 700 and 1 300 tons, respectively. In Div. 1CD the biomass of roughhead grenadier was estimated at 4 600 tons, the same level as seen in previous years.



State of the Stock: The stock of roundnose grenadier is still at the very low level observed since 1993.

Reference points. No reference points available.

Recommendation: There should be no directed fishing for roundnose grenadier in Subareas 0 and 1 in 2003-2005. Catches should be restricted to by-catches in fisheries targeting other species.

Special Comments: The biomass of the stock component in Subareas 0+1 has been at a very low level since 1993 and the stock is composed of small individuals.

The next Scientific Council assessment of this stock will be in 2005.

Sources of Information: SCR Doc. 02/30, 47; SCS Doc. 02/4, 9, 16.

ii) **Monitoring of demersal redfish and other finfish in Subarea 1**

In the Scientific Council report of 2001 scientific advice on management of redfish (*Sebastes* spp.) and other finfish in Subarea 1 was given for 2002 and 2003. 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 2001 Meeting Scientific Council provided 2-year advice for 2002 and 2003 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 2002 Meeting and found no significant changes in the status of these stocks. Therefore, Scientific Council has not provided updated/revised advice for 2003. The next Scientific Council assessment of these stocks will be in 2003.

iii) **Greenland halibut in Division 1A inshore**

Denmark/Greenland requested the Scientific Council for advice on allocation of TACs distributed in areas of Iluisset, Uummannag and Upernavik in Subarea 1 inshore. The Scientific Council's advice for 2003 is provided in this section.

Greenland Halibut (Reinhardtius hippoglossoides) in Division 1A inshore

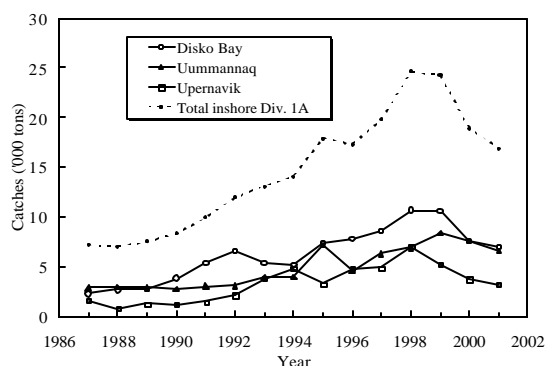
Background: The inshore stock is dependent on the spawning stock in Davis Strait and immigration of recruits from the offshore nursery grounds in Div. 1A and 1B. Only sporadic spawning seems to occur in the fjords, hence the stock is not considered self-sustainable. The fish remain in the fjords, and 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 catches in all areas have increased from 8 000 tons in the late-1980s increasing to more than 20 000 tons until 2000. In 2001 catches decreased to 16 900 tons.

	Year	Catch ('000 tons)	TAC ('000 tons)
		STACFIS	Recommended
Disko Bay	1999	10.6	7.9
	2000	7.6 ^{1, 2}	7.9
	2001	7.0 ¹	7.9
	2002		7.9
Uummannaq	1999	8.4	6.0
	2000	7.6 ^{1, 2}	6.0
	2001	6.6 ¹	6.0
	2002		6.0
Upernavik	1999	5.3	4.3
	2000	3.8 ^{1, 2}	4.3
	2001	3.2 ¹	4.3
	2002		4.3

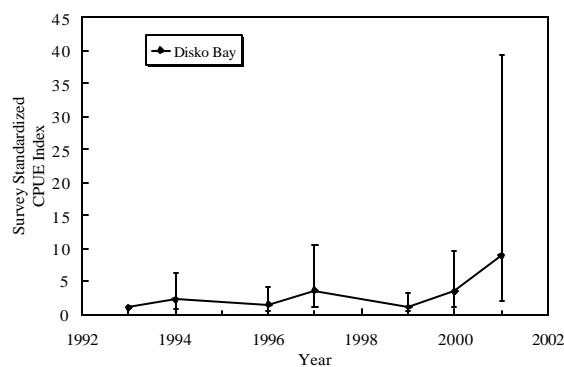
¹ Provisional.

² The total catches are likely to have been underestimated by about 2 000 tons in Div. 1A inshore total.

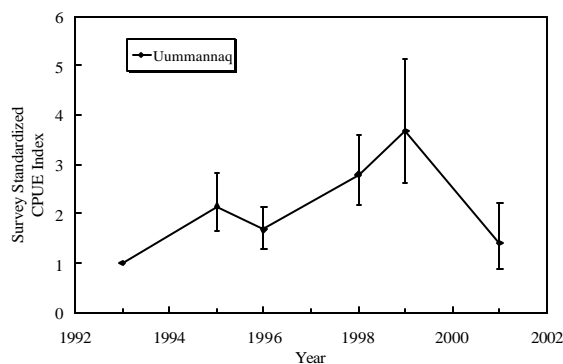


Data: Catch-at-age data were available for years 1988-2001 at Disko Bay, and for most years in this period at Uummannaq and Upernavik. Data on length frequency in commercial catches were available. A recruitment index for age 1 was available from trawl survey. Catch rates and length frequency were available from inshore longline surveys.

Assessment: *Disko Bay:* Survey results from 1993 onwards do not indicate any major changes in abundance, except for the year 2001, when the abundance-index was remarkably higher, although estimated with uncertainty. Length composition in the survey data indicated above average recruiting year-classes entering the fishery in 2000 and 2001. In the commercial fishery the mean length in the summer fishery has been relatively stable while an increase has been observed in the winter fishery.

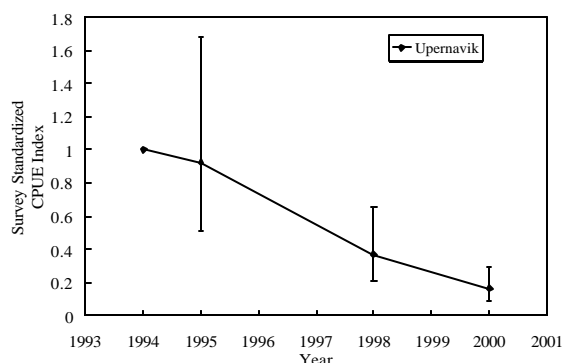


Uummannaq: Survey results from 1993 to 1999 indicate an increase in abundance until 1999. In 2001 survey abundance index decreased statistically significantly to a level observed in the mid-1990s. Catch composition in the commercial fishery has changed significantly since the 1980s towards a higher exploitation of younger age groups, but has recently stabilized.



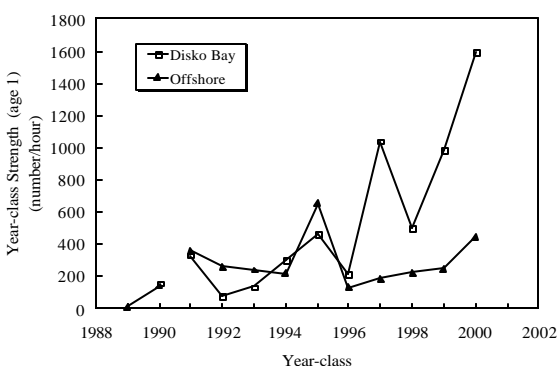
Upernavik: Survey results from 1993 onwards indicate a steady and significant decline in abundance. Mean length in both commercial and survey catches have

decreased, most significantly in the winter fishery. In the traditional fishing grounds at Upernavik up to 73°45'N younger and fewer age groups are caught. New fishing grounds in the northern part of the district have been exploited only recently. Little information exists from these areas.



Fishing mortality: Estimates of *F* suggest a continued increase in Disko Bay and Upernavik throughout the time series. In Uummannaq *F* appear to be more stable. However, *F* estimates are based on ages 10-14 which are not well represented in the catches and thus may not reflect recent fishing patterns.

Recruitment: Both offshore and in Disko Bay the numbers of one-year-olds from the 2000 year-class were above average. In Disko Bay it was the highest on record in the time-series. There is uncertainty 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 sensitive to incoming year-classes.

Disko Bay: Indices of abundance have been relatively stable since 1993. Age structure has also been stable although it consists of relatively few and younger age groups compared to before 1990.

Uummannaq: Abundance indices from 1993 to 1999 indicate an increase in abundance until 1999. In 2001 abundance index decreased significantly to a level observed in the mid-1990s. Since the mid-1990s age structure has moved towards younger and fewer age groups but has stabilized in recent years.

Upernavik: Abundance indices from 1993 onwards indicate a steady and significant decline. Since the mid-1990s age structure has moved towards younger and fewer age groups in the traditional fishing areas around Upernavik and up to 73°45'N (Giesecke Ice fjord). In the northern parts of the district, where new fishing grounds are exploited, data are insufficient to determine the status of the resource.

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

Assessments indicate that there has been no appreciable change in stock status in Disko Bay or Uummannaq. Scientific Council therefore reiterates its 2002 TAC advice for 2003 for each of the two areas to be: Disko Bay 7 900 tons and Uummannaq 6 000 tons.

For Upernavik Scientific Council advises that the 2003 TAC should be no more than 2 400 tons which is 25% below the 2001 catch. The justification for this reduction is a continued decline in survey indices since 1994 concurrent with a decrease in catches since 1998.

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

Special Comments: The TAC values for Disko Bay and Uummannaq were proposed in the 1998 Scientific Council report to prevent escalating effort and are based on the average catches for 1995-97.

The abrupt decline in landings in the most recent years raises concern. The lack of information on fishing effort makes it difficult to fully evaluate whether it is a result of declining stock biomass or 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. 02/55, 38, 48; SCS Doc. 02/16.

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

The Scientific Council was requested by the Coastal States Canada and Denmark (Greenland) to: *provide advice for certain stocks*. This section presents the Scientific Council advice for the year 2003.

Scientific Council noted the request usually makes reference to Greenland halibut in Subareas 0 and 1. The Council noted that the specific stock area to be addressed under this request is Greenland halibut in Subarea 0, Div. 1A offshore and Div. 1B-1F. The Council considerations are as given below.

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

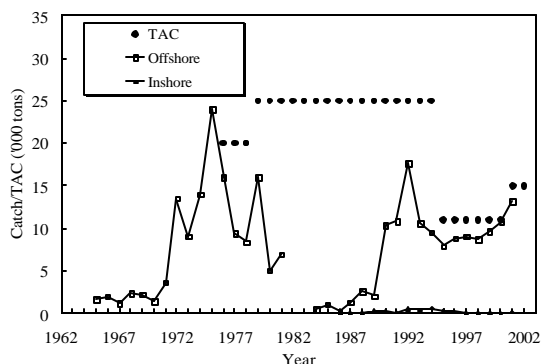
Background: The Greenland halibut stock in Subarea 0 + Div. 1A offshore and Div. 1B-1F is part of a common stock distributed in Davis Strait and south to Subarea 3.

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 have remained at about 10 000 tons annually since. Catches increased to 13 000 tons in 2001, primarily due to increased effort in Div. 0A.

Year	Catch ('000 tons)		TAC ('000 tons)	
	STACFIS	21A	Recommended	Agreed
1999	10	17	11	11
2000	11	5 ¹	11	11
2001	13	8 ¹	15 ²	15
2002			15 ²	

¹ Provisional.

² Including 4 000 tons allocated specifically to Div. 0A and 1A.

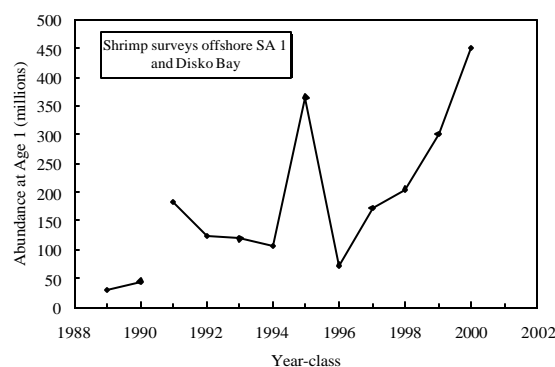


Data: Catch-at-age data were available for assessment from SA 0 and Div. 1CD. Standardized and unstandardized catch rates were available from Div. 0A and 1CD. Biomass estimates were available from surveys in Div. 0A, 0B, 1AB and 1CD. Recruitment data were available from surveys in Div. 1A-1F from 1989-2001.

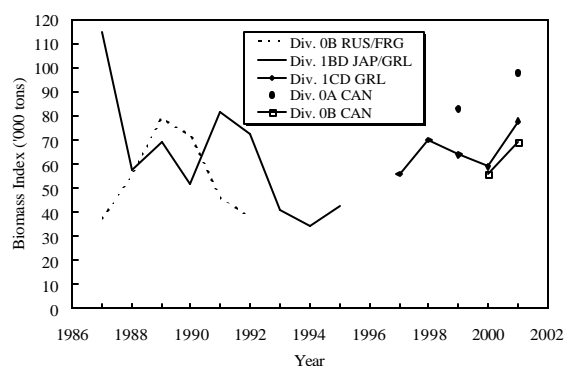
Assessment: No analytical assessment could be performed. Combined standardized catch rates for SA 0 + Div. 1CD during 1990-2000 and standardized catch rates from Div. 1CD during 1990-2001 have been stable.

Fishing Mortality: Level not known.

Recruitment: Recruitment of the 2000 year-class at age one was the largest in the time series.



Biomass: A new survey in 2001 estimated the biomass in Div. 1A and 1B at 50 000 and 12 000 tons, respectively. The biomass in Div. 0A, 0B and 1CD in 2001 was estimated at 98 000, 69 000 and 78 000 tons, respectively. The latter three survey estimates are all somewhat higher than previous estimate.



State of the Stock: The age composition in the catches has been stable in recent years. Although the survey series from Div. 1B-1D in 1987-95 is not directly comparable with the series from 1997-2001, the decline in the stock observed in these Divisions until 1994 has stopped. It now appears that the stock component in the traditional off shore fishing area is at the level of the late-1980s and early-1990s. Recent survey estimates from Div. 0B (2000-2001) have been of similar magnitude. Although biomass estimates from Div. 0A and Div. 1A are relatively high, the values cannot be put into any historical context.

Recommendation: Considering the relative stability in biomass indices and CPUE rates, the TAC for year 2003 should not exceed 11 000 tons for Div. 0B and 1B-1F.

At its 2000 meeting the Scientific Council advised a modest catch of 4 000 tons for Div. 0A + 1A based on a survey biomass estimate of 83 000 tons in Div. 0A. This was believed to generate a low F. The survey estimate for 2001 for Div. 0A + 1A combined is about double the previous value for Div. 0A alone. The Scientific Council therefore advises a catch in 2003 of 8 000 tons for Div. 0A + 1A. It is believed that this catch will generate a relatively low F.

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

Sources of Information: SCR Doc. 02/30, 46, 47, 48, 50, 60, 67, 68; SCS Doc. 02/4, 9, 10, 16.

Distribution of biomass of Greenland halibut between Subareas 0 and 1

In its 1993 report, the Scientific Council noted that the offshore component of Greenland halibut was distributed equally between Subareas 0 and 1. Denmark on behalf of Greenland requested the Scientific Council: *to update the information on the distribution of Greenland halibut and provide advice on allocation of TACs to Subarea 0 and Subarea 1 offshore.*

The Council responded:

Based on results from survey in Div. 0B and Div. 1CD in 2000 conducted by Canada and Greenland the biomass was estimated at 56 000 tons and 59 000 tons, respectively.

In 2001 Canada conducted two surveys covering Div. 0A and 0B from which the biomass was estimated at 98 000 tons and 69 000 tons, respectively. The total biomass in SA 0 was hence estimated at 167 000 tons.

Greenland also conducted two surveys in 2001 covering Div. 1AB and 1CD, respectively. The biomass in Div. 1A was estimated at 50 000 tons and 12 000 ton in Div. 1B, which is adjacent to the southern part of Div. 0B. The biomass in Div. 1CD was estimated at 78 000 tons. The total biomass in Div. 1A-1D is hence estimated at 140 000 tons.

The surveys were conducted one after the other with same vessel and gear allowing comparison between the two Subareas.

Based on the surveys in 1987, 1988, and 1990 (*NAFO Sci. Coun. Rep.*, 1993 p. 98), the surveys in Div. 0B and Div. 1CD in 2000 and the surveys in 2001, the biomass seems to be distributed approximately 50:50 between the two Subareas 0 and 1.

VIII. FUTURE SCIENTIFIC COUNCIL MEETINGS 2002 AND 2003

1. Scientific Council Meeting and Special Session, September 2002

The Council reconfirmed that the Annual Meeting will be held during 16-20 September 2002 in Santiago de Compostela, Spain. The Scientific Council Special Session, the Symposium on "Elasmobranch Fisheries: Managing for Sustainable Use and Biodiversity Conservation" will be held during 11-13 September 2002 at the same venue.

2. Scientific Council Meeting, November 2002

The Council reconfirmed its meeting on Northern shrimp will be held during 6-13 November 2002, in Nuuk, Greenland.

3. Scientific Council Meeting, June 2003

The Council reconfirmed the Scientific Council Meeting will be held during 29 May-12 June 2003, at Alderney Landing, 2 Ochterloney Street, Dartmouth, Nova Scotia, Canada.

4. Scientific Council Meeting and Special Session, September 2003

The Council noted that the Annual Meeting will be held during 15-19 September 2003 and the Scientific Council Special Session is scheduled for 10-12 September 2003. The venue has not been determined.

5. **Scientific Council Meeting, November 2003**

The Council tentatively noted that its meeting on Northern shrimp will be held during 5-12 November 2003, subject to review at the November 2002 Meeting.

Further discussion with the Chair of the ICES ACFM is required if the proposed cooperation on joint assessment meetings of shrimp stocks between Scientific Council and the ICES Working Groups is to be developed.

IX. ARRANGEMENTS FOR SPECIAL SESSIONS

1. **Progress Report on Special Session in 2002: the Symposium on "Elasmobranch Fisheries"**

The Symposium "Elasmobranch Fisheries: Managing for Sustainable Use and Biodiversity Conservation" will be held during 11-13 September 2002, at Galicia Congress and Exhibition Centre, Santiago de Compostela, Spain, in conjunction with the 24th NAFO Annual Meeting. The organizer (D. Kulka) on behalf of the co-convenors (M. Pawson, J. Musick, and T. Walker) updated Scientific Council on progress in the organization of the Symposium. The co-convenors reported that a total of 99 papers originating from 20 countries (4 Invited, 61 Oral and 34 Posters) have been accepted. A program comprising of 4 sessions was prepared:

- Life history and demographic analysis (sub-sessions on Life History and Demographic analysis).
- Stock identity (sub-sessions on distribution using various methods, abundance (fishery independent), abundance (fishery dependent), genetic, tagging).
- Stock assessment (sub-sessions on age-structure and modeling, biomass dynamics/catch-effort trend analysis, fishery description/monitoring and various methods).
- Harvest strategies and biodiversity maintenance (sub-sessions on harvest strategy evaluation through modeling, gear selectivity, finning issue, by-catch (discards) evaluation, By-catch management/fishery description and Ecosystem structure and function).

Proposed invited speakers are Sarah Fowler, Jack Musick, Andre Punt and Mike Pawson.

2. **Topic for Special Session in 2003**

Proposed Workshop on Mapping and Geostatistical Methods for Fisheries Stock Assessment. Geographic visualization and spatial analysis of fish and environmental data are essential components of fisheries research. Papers incorporating these techniques are increasingly common in the work of Scientific Council; this proliferation is aided by the availability of GIS software. Such application tools provide mapping functions, but in addition many also have modeling and geostatistical functionality.

It was noted many scientists are not versed in GIS, and therefore, lack the knowledge to validate conclusions made in the interpretation of such analyses. A proposal to hold a geostatistical methods workshop, as a Special Session of the Scientific Council Meeting of September 2003, was presented by L. Hendrickson and D. Kulka. The proposed approach is a hands-on workshop entitled "Mapping and Geostatistical Methods for Fisheries Stock Assessment" that will educate Scientific Council members in the visualization and analysis of spatial data using various mapping and geostatistical applications commonly found in GIS applications. The purpose is to show fisheries scientists, using practical demonstrations relevant to NAFO issues, how spatial techniques can be applied to survey and environmental data to solve fisheries problems.

The Workshop will show how the raw data (set attributes) can be effectively Visualized (mapping techniques), progressing through Point to Surface Transformation (i.e. methods such as Contouring, Voronoi, Potential Mapping, Kriging that produce the surfaces required to facilitate spatial modeling) to Overlay Modeling and Geostatistics. Where appropriate, underlying theory and procedures of geostatistics will be elaborated.

The Council agreed the subject and the proposed time for the Workshop were appropriate.

The Council agreed to review the possible structure of the Workshop by correspondence during the summer and a formal proposal be developed during the September 2002 Meeting.

3. **Topic for Special Session in 2004**

The Council broadly considered the proposal to review the scientific and environmental information on the Flemish Cap in a Special Session setting in September 2004. The Council agreed to review this proposal during its September 2002 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 is comprised of 18 members representing 8 countries (Canada, Denmark, Iceland, Norway, Russia, Spain, United Kingdom, and USA). Terms of Reference are: (1) Explore and review availability of information and existing data on reproductive potential by areas and species, (2) Explore possibilities to develop standard internationally co-ordinated research protocols to estimate egg and larval production, (3) Explore and evaluate alternative methods to estimate reproductive potential annually as part of routine monitoring and sampling schemes, and (4) Review possibilities to develop methods and applications to estimate reproductive potential for assessment and management. Two meetings have been held to date, one in San Sebastian, Spain (October 2000) and one in St. Petersburg, Russia (October 2001).

Two publications are planned as products of the Working Group's activities. A large volume of the *NAFO Scientific Council Studies* will be 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 over 50 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, and plans are being made to have these data tables listed on the NAFO website.

A special volume of the *Journal of Northwest Atlantic Fishery Science* will be published that will contain 9 peer reviewed articles authored by the members of the Working Group. This volume is intended to provide state-of-the-art techniques and methods used to estimate reproductive potential of fish stocks. In addition, it reviews and synthesizes published results in this field of fishery science and provides case studies of various approaches that may be used to integrate knowledge of stock reproductive potential into improving scientific advice for fishery resource management. Tentative titles of the nine articles are: (i) Available data and information applicable to the estimation of stock reproductive potential of Northwest Atlantic fish stocks, (ii) Reproductive strategies of marine fish and their classification in the North Atlantic, (iii) Procedures to estimate fecundity of wild collected marine fish in relation to fish reproductive strategy, (iv) Experimental methods to monitor egg production and egg quality in marine fish species, (v) Estimation of male reproductive success of marine fishes, (vi) Utility of using captive fish studies in the estimation of fish reproductive potential of wild stocks, (vii) Correlation between reproductive characteristics and environmental and biological indices as alternative methods of estimating reproductive potential, (viii) Incorporating reproductive potential into fisheries management for stocks spanning an information gradient, and (ix) Alternative predictors of recruitment for Georges Bank cod and haddock stocks.

It is anticipated that these *Journal* and *Studies* publications will be available in late-2002 or early-2003. For further background information one may refer to the Report of the Working Group on Reproductive Potential, *NAFO Scientific Council Reports*, 2001, which is available on the NAFO website.

The Chair introduced the possibility of a third meeting of the Working Group, either in autumn 2002 or in the subsequent year, but noted that some discussion and guidance is required from the Scientific Council. Members

have indicated that they would like to continue to meet as a Working Group beyond the completion of the original set of Terms of References (ToR). It was tentatively suggested that a 2003 meeting, perhaps in Woods Hole or Boston, USA, could plan and undertake any new activities.

The Scientific Council agreed that a broad expertise in fish reproductive biology exists among members, and that this should be retained. Scientific Council reviewed the progress to date and congratulated the working group on their accomplishments. Future activities of the Working Group would include two components: (i) continuing to improve data quality and availability on fish reproductive potential of a wide variety of stocks and species, and (ii) integrate this information in fisheries management advice. The latter would encompass issues such as measures of stock reproductive potential (instead of spawning stock biomass), stock conservation measures, recruitment prediction, and fishery management reference points. Some broadening of the Working Group membership will presumably be required, particularly with regard to population modeling. Members of the Scientific Council are encouraged to correspond with members of the Working Group to suggest future members with population modeling expertise.

The Working Group proposed that any continued initiatives would also require contact with the Chairs and activities of any related ICES Study Group, for example the proposed Study Group on Growth, Maturity and Condition in Stock Projections, which is tentatively scheduled to hold their first meeting in December 2002 and will concentrate on ICES stocks. Also existing is the ICES Working Group on Recruitment Processes.

The Scientific Council agreed to the following ToR for the extension of the Working Group:

- ToR 1: Complete inventory of available data in standardized format on reproductive potential for fish stocks of the North Atlantic and Baltic Sea.*
- ToR 2: Explore the use of correlation analysis to estimate the reproductive potential of fish stocks having limited data availability.*
- ToR 3: Model the inter-annual and inter-stock variability in size-dependent fecundity for stocks having multi-year estimates.*
- ToR 4: Explore how the current use of biological reference points and medium-term stock projections can be adapted to include new information on reproductive potential.*
- ToR 5: Explore the consequences of fishery-induced changes in the timing and location of spawning to reproductive success.*
- ToR 6: 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.*
- ToR 7: Explore the effects of the environment on Stock Reproductive Potential and how these relate to ToRs 2, 3, and 4.*

The Working Group noted there would be some relationship to ICES Working and Study Groups, and observed the following interactions:

There will be minimal overlap with the ICES Working Group on Recruitment Processes. This ICES Working Group concentrates to a large degree on pelagic egg and larval stages and currently there is no shared membership with the NAFO Working Group on Reproductive Potential. However, a major emphasis of their activities is to improve recruitment prediction, and thus their activities have to a greater degree considered the influence of parent stock structure on recruitment processes.

There will be moderate overlap with the proposed ICES Study Group on SGGROMAT (Study Group on Growth, Maturity and Condition in Stock Projections), and some overlap in membership exists. T. Marshall (Norway) is co-Chair, and N. Yaragina (Russia), J. Tomkiewicz (Denmark), J. Morgan (Canada) and F.

Saborido-Rey (Spain) would sit on this proposed Study Group and the NAFO Working Group on Reproductive Potential.

It should be noted that the predecessor to SGGROMAT was the ICES Study Group SGPRISM (Study Group on Incorporation of Process Information into Stock-Recruitment Models). This operated concurrently with the NAFO Working Group on Reproductive Potential, and the two groups benefited from each other's existence.

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

The Chair of the Scientific Council presented a status report on the activities of the joint NAFO-ICES Working Group on Harp and Hooded Seals. The working group met intersessionally during 2001, and a report was presented to Scientific Council in September 2001. At that time, it was expected that the working group would hold a 3-day workshop entitled "Harvest Modeling of Pinniped Populations" in February 2002. Due to logistical issues, the workshop did not take place as scheduled, and is now scheduled for February 2003 under a revised title. Thus, a "Workshop to Develop Improved Methods for Providing Harp and Hooded Seal Harvest Advice" will be held at the Northeast Fisheries Science Center in Woods Hole, MA, USA, on 11-13 February 2003.

During recent meetings, the Working Group discussed the need for a workshop to examine methods of modeling pinniped populations, with specific focus on North Atlantic harp and hooded seals. The Working Group has so far been unable to assess existing pinniped population models and decide upon a standardized series of models. At the proposed workshop, a variety of population models are to be presented and their performance evaluated under different scenarios concerning the availability of data and the degree of uncertainty expected. The Working Group notes that, as more information becomes available on the various harp and hooded seal stocks, there will be an increased need to standardize a suite of population models that can most effectively accommodate the range and type of data collected. Topics of the workshop will include, but not necessarily be limited to:

- A review of existing Working Group models.
- Comparison of other modeling regimes (e.g. the International Whaling Commission's Revised Management Procedure and the US Marine Mammal Protection Act) to the current Working Group approach.
- Approaches to the incorporation of density dependence into pinniped models.
- Use of simulation to test the assumptions implicit in model parameters.
- Comparison of age-aggregated *versus* disaggregated models, especially under scenarios where the age structure of the catch is highly skewed.
- Consider the applicability of biological reference points.

Scientific Council noted that the Workshop Conveners intend to draw upon a wide range of experts in the field of population modeling and pinniped biology. As such, the Working Group Chair requested that NAFO provide funds to assist some scientists with travel costs associated with the workshop. After considerable discussion, Scientific Council agreed that such funds could not be provided, but looked forward to learning about progress on this proposed Workshop.

XI. REVIEW OF SCIENTIFIC COUNCIL WORKING PROCEDURES/PROTOCOL

1. Implementation of Precautionary Approach

a) Report of the 2002 ICES PA Workshop

Scientific Council was presented with a summary of the ICES Study Group on the Development of the Precautionary Approach that met in Lisbon, Portugal in March 2002. Scientific Council noted the developments in the PA taking place within ICES and will consider them in the continued development of the NAFO Precautionary Approach advice.

Subsequent to the ICES PA Workshop, the ICES Advisory Committee on Fishery Management meeting in May 2002 has set out a provisional timetable for the revision of the ICES Precautionary Approach reference points. As part of the revision process ICES has scheduled a further meeting of the Study Group on the Development of the Precautionary Approach that will meet in December 2002 to develop technical guidelines. NAFO has been invited to send an observer to that meeting. Scientific Council agreed that a representative should be appointed to attend the meeting and agreed to communicate among the Executive Committee members to decide on who would represent the Scientific Council at the December 2002 ICES Study Group Meeting.

b) Further Development of PA Methodology

Scientific Council discussed options for advancing further development of PA methodology. Several approaches were suggested including developing multi-species concepts, re-opening criteria, and additional measures to reduce exploitation on stocks, which are currently fished and those under moratorium.

Scientific Council agreed that a separate meeting devoted specifically toward advancing the PA methodology will be required. Although no specific time frame was identified, it is suggested that a Workshop be held in 2003. Topics to be addressed globally and for each stock must first be identified. Scientific Council **recommended** that *in preparation for a Precautionary Approach Workshop in 2003, each Designated Expert is requested to identify data requirements and specific approaches for their stock and present the information for further discussion at the September 2002 Scientific Council Meeting.* It was further **recommended** that *\$5 000 be requested to fund travel costs for 2 invited experts to participate in a 2003 Workshop.*

2. NAFO Scientific Council Observership at ICES ACFM Meetings

The Council was informed that no Council member was able to attend the ICES ACFM Meeting of October 2001. It was noted however that attendees at that meeting reported back to Scientific Council on aspects of the ICES Meetings.

Noting, particularly, that the meeting time schedules of ICES and NAFO often make it difficult for Council members to attend, it was agreed that the Council would not attempt to find a nominee at this time.

3. Website and Technology Issues

Council noted there were discussions on this subject in different Standing Committees and reported accordingly in those reports.

4. Facilitating Workload of Scientific Council During Annual Meeting in September

Scientific Council discussed the difficulty in providing timely advice to Fisheries Commission on Div. 3M shrimp and Div. 3LNO shrimp. The timing of the assessment and development of advice is especially problematic for Div. 3LNO shrimp in that the survey upon which the stock status is based occurs during the November Scientific Council meeting, and the results are not available for the current assessment. The advice is presented to the Fisheries Commission at the subsequent annual meeting to implement measures for the following year. Thus, when the fishery commences, two additional surveys had been conducted making the basis of the assessment two years out of date.

Several options were offered to alleviate the delay between the assessment and the provision of advice. It was suggested that the assessment of shrimp in Div. 3LNO could be conducted at the June or September Scientific Council meetings. Scientific Council agreed to review this item in September 2002 and at the November 2002 Scientific Council meeting on assessment of shrimp stocks.

XII. OTHER MATTERS

1. Report of CWP Intersessional Meeting, Rome, Italy, 21-22 March 2002

In accordance with the Scientific Council recommendation of June 2001, the Assistant Executive Secretary attended the Inter-sessional Meeting of the Coordinating Working Party (CWP) on Fishery Statistics held at FAO on 21 and 22 March 2002. The meeting discussed issues arising from the 19th Session of the CWP, in particular its recommendations for actions by CWP members and the CWP Secretariat and prepared a provisional agenda for CWP-20.

The meeting was opened by CWP Vice-Chair D. Cross and was attended by representatives of CWP members (NAFO, ICES, ICAAT, EU/EUROSTAT, IOTC, CECAF). A full report of the meeting is given in SCS Doc. 02/11.

Discussions took place on a draft partnership agreement providing for international cooperation in the development and implementation of the Fisheries Resources Monitoring System (FIRMS), which will be part of the Fisheries Global Information System (FIGIS) being developed at FAO. This draft agreement was based on discussions held with some CWP members. It provides the basis for a working agreement between FAO and any Regional Fishery Body. Further discussions on this matter will continue through 2002 and perhaps during the 20th CWP Session. The proposed agreement when ready would be brought to Scientific Council by the Assistant Executive Secretary for review.

Proposed International Plan of Action (IPOA) on Status and Trends Reporting: The meeting reviewed the general nature and intent of the proposed IPOA to be discussed at the Technical Consultation on the issue to be held at FAO from 25th to 28th March 2002. The meeting noted the concordance of the aims and content of the IPOA with work for which the CWP is mandated, and recognized the importance of the opportunity for CWP to be represented at the Technical Consultation.

Review of recommendations of CWP-19. The Chair noted that there were generally two sets of recommendations: those for which some inter-sessional activities have taken place and could be reported on; and those that should be noted and decisions made on possible action prior to CWP-20 (see SCS Doc. 02/11 for detailed discussions).

CWP-20 Provisional Agenda: based on discussions held at this Inter-sessional Meeting and comments on previous agenda items at CWP-19, a provisional agenda for CWP-20 to be held in Seychelles from 21 to 24 January 2003 was prepared. It was noted that there would be a preliminary session on 20 January 2003 to address the statistical issues associated with socio-economic indicators.

The Council **endorsed** the STACREC recommendation that the Assistant Executive Secretary attend the CWP-20 Session.

The Council noted the Scientific Council Rules of Procedures will be modified to ensure the Council Vice-Chair, who is the STACREC Chair, will also attend CWP sessions in the future.

2. Report of FAO Technical Consultation on Status and Trends, Rome, Italy, 25-28 March 2002

In accordance with the request of the Scientific Council (letter from the Chair dated 6 February 2002), the Assistant Executive Secretary attended this meeting during 25-28 March 2002, which took place immediately after the CWP Intersessional Meeting held during 21-22 March 2002 at FAO, Rome, Italy.

The Technical Consultation on Improving Information on the Status and Trends of Capture Fisheries was attended by 38 Members of FAO and by observers from one non-Member Nation of FAO. Observers from 13 FAO intergovernmental organization and international non-governmental organizations also attended the Consultation.

The Assistant Executive Secretary presented the following general remarks regarding the meeting (the Final Report of the Meeting will be issued by FAO (in 1-2 months) and be available through the standard FAO circulation to Member States).

The Council noted the Twenty-fourth session of COFI (Committee on Fisheries, FAO) held in February 2001 considered a proposal for improving reporting on the status and trends of fisheries. COFI had unanimously recognized that information on the status and trends of fisheries is fundamental to the mandate of FAO. Many COFI members supported development of an International Plan of Action (IPOA).

The Consultation revised the draft IPOA for Improving Status and Trends of Capture Fisheries to reflect the choice of a Strategy as the instrument to promote this initiative.

3. **Participation in FAO Committee on Fisheries (COFI)**

The Council observed that the FAO Technical Consultation on Status and Trends had requested the FAO Secretariat to present this report and the draft FAO Status and Trends Strategy to the Twenty-fifth Session of the Committee on Fisheries (COFI), to be held at FAO, Rome during 24-28 February 2003.

The Council also noted the Regional Fisheries Bodies (RFB) Meeting is now scheduled for immediately after this COFI Meeting. Recognizing that the Assistant Executive Secretary, in accordance with the Scientific Council recommendation in June 2000, had attended and was rapporteur of the last RFB meeting in February 2001, the Council **recommended** that *the Assistant Executive Secretary attend the Twenty-fifth Session of the Committee on Fisheries (COFI) to be held in Rome, Italy during 24-28 February 2003, and the meeting of the Regional Fishery Bodies to be held immediately after the COFI Meeting.*

4. **Report on NAFO Intersessional Meetings**

Scientific Council reviewed the Report of the STACTIC Intersessional Meeting, May 2002 with emphasis on the section entitled Use of Observer Information for Scientific Purposes. The STACTIC discussion focussed on a paper entitled Harmonized NAFO Observer Program Data System Proposal (SCS Doc. 00/23). While Scientific Council is pleased that Contracting Parties agreed on the value of an automated system with common data elements, Scientific Council remains frustrated with the lack of progress by the Fisheries Commission to ensure that the protocols contained in SCS Doc. 00/23, and adopted by the Fisheries Commission in 2000, are implemented by Contracting Parties.

SCS Doc. 00/23 provides a detailed description of the data requirements of Scientific Council from the Observer Program. Consequently Scientific Council will not consider any changes to the protocols described in this document. The data collected by the Observer Program are of extreme importance to Scientific Council in addressing requests from the Fisheries Commission and Coastal States, as well as in the completion of stock assessments. Many of the recent requests to Scientific Council have required analyses of set-by-set information on catch and set location. Without these data Scientific Council will not be in a position to address many of the requests of this nature that have been received in recent years.

Scientific Council endorsed the STACREC recommendations and further **recommended** that *Fisheries Commission and General Council take the necessary steps to ensure that Contracting Parties adhere to the protocols for collecting data for scientific purposes as adopted by the Fisheries Commission, and that provisions be made to allow the Secretariat to develop a database to facilitate access and analysis of these data by Scientific Council.*

5. **Meeting Highlights for NAFO Website**

The Council noted the meeting highlights of this June 2002 Meeting were summarized by each Standing Committee. These highlights will be placed on the NAFO website in the public domain soon after this June 2002 Meeting.

The Council also noted that a special site on the NAFO website presenting the Ocean Climate status report was proposed for June 2003. However, the Council was pleased that a preliminary site was created on the website during this June 2002 Meeting, and further work on it will continue intersessionally.

6. Other Business

a) NAFO Observer Program Data

Scientific Council has commented on various occasions in the past, regarding the value of information gathered by NAFO observers on vessels of NAFO Contracting Parties. During the current meeting, their value was seen in the context of determining the best possible estimates of catch in 2001 of the various stocks under review. Scientific Council considers that there are additional data available from this source that are also of significant value in formulating advice to Fisheries Commission. Specific information regarding fishing locations, including depths, and fishing effort would have assisted Scientific Council during its deliberations for a number of stocks including witch flounder (Div. 2J+3KL *versus* Div. 3M), redfish in Div. 3O and Div. 3LNO American plaice. In addition, these data would support the requirements described under "Multi-species Fisheries Considerations" described below.

Scientific Council noted that some information regarding catches was made available during the meeting but that even this basic information was lacking from a number of Contracting Parties.

Scientific Council once again emphasizes the importance of the observer data to the work of the Council in support of the mandate of the Fisheries Commission and encourages Fisheries Commission to make progress in making these data available, in electronic format, to Scientific Council.

b) Multi-species Fisheries Considerations

Scientific Council presently provides assessment advice and forecasts on a single-stock basis. However, some groups of species and stocks are unavoidably caught together in mixed-species fisheries, and it is often difficult to discriminate between targeted fisheries and unavoidable by-catches.

When stocks recover to levels at which directed fisheries may take place with acceptable risk levels, opening such fisheries may very likely result in high levels of incidental catches that prejudice the recovery of other stocks. While data reporting, assessments and advice continue to be pursued in a strictly single-species context, it will not be possible to evaluate the magnitude of such problems, nor to design appropriate mitigating measures for which the benefits and effects can be evaluated without appropriate data.

Scientific Council sees a need therefore to begin work on fleet-based approaches to data collection, with preparation for advisory methods that take account of the mixed nature of the fisheries. To this end, Scientific Council **recommended** that *the issue of fleet-based approaches to data collection and collation be included as an agenda item for discussion by Scientific Council during the September 2002 Meeting, and that during the summer, representatives of Contracting Parties should consider what analyses may be required and prepare any documentation considered appropriate to aid in the September discussions.*

XIII. ADOPTION OF COMMITTEE REPORTS

The Council, during the course of the meeting reviewed some of the Standing Committee recommendations. Having considered and endorsed each recommendation and also the text of the reports, the Council during the concluding session on 20 June 2002 **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 Chairman and the Assistant Executive Secretary.

XIV. SCIENTIFIC COUNCIL RECOMMENDATIONS TO GENERAL COUNCIL AND FISHERIES COMMISSION

The Council Chair undertook the task of addressing the recommendations from this meeting report and to submit relevant ones, as needed to the General Council and Fisheries Commission.

XV. ADOPTION OF SCIENTIFIC COUNCIL REPORT

At its concluding session on 20 June 2002, the Council considered the Draft Report of the meeting, and **adopted** the report with the understanding that the Chair and the Assistant Executive Secretary will incorporate later the text insertions related to plenary sessions of 6-20 June 2002 and other modifications as discussed at plenary.

XVI. ADJOURNMENT

There being no other business, the Chair thanked the members of the Scientific Council for their diligent work and cooperative spirit, noting especially the contributions by the Committee Chairs and the Designated Experts. After expressing special thanks to the NAFO Secretariat for their continued support and dedication, the Chair wished all members safe travels. The meeting was adjourned at 1000 hours on 20 June 2002.

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

Chair: E. B. Colbourne

Rapporteur: K. F. Drinkwater

The Committee met at Alderney Landing, 2 Ochterloney Street, Dartmouth, Nova Scotia, Canada, on 7 and 8 June 2002, to conduct a mini-symposium on environmental conditions during the decade of the 1990 and 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), Japan, Russian Federation and United States of America.

1. Opening

The Chair welcomed the members to the annual June meeting of STACFEN. The Committee discussed the work plan and noted the following documents would be reviewed: SCR Doc. 02/ 7, 17, 25, 28, 34, 40, 41, 49; SCS Doc. 02/4, 15, 9, 10 19. K. F. Drinkwater (Canada) was appointed rapporteur.

2. Chair's Introduction and Intersessional Report

The primary work of the Chair between sessions was involved in preparing and organising the mini-symposium and for this June 2002 STACFEN meeting. In addition, the Chair presented a STACFEN environmental review (SCR Doc. 01/182) of oceanographic conditions in NAFO Div. 3M and 3LNO in support of the November 2001 meeting of Scientific Council on assessment of Northern shrimp. This was the 9th such review presented to Scientific Council in support of the assessment of shrimp in Div. 3M.

3. Review of Recommendations in 2001

No recommendations were made during the 2001 meeting.

4. Mini-Symposium on Hydrographic Variability in NAFO Waters, 1991-2000

In reviewing the achievements of the ICES Hydrobiological Symposium held in Edinburgh in August of 2001, it was felt by the Scientific Council representatives E. B. Colbourne, M. Stein and K F. Drinkwater that, although there was some information available for the Northwest Atlantic region, the Symposium did not adequately cover the NAFO Convention Area in detail. During the September 2001 Scientific Council meeting in Cuba, plans were approved to conduct an overview of climate conditions in NAFO waters during the June 2002 meeting of STACFEN.

It was noted that historically, ICNAF and NAFO have conducted several symposia on decadal reviews of environmental conditions in the Northwest Atlantic and their influence on fish stocks. The first was held at Rome, Italy, in 1964, which addressed the decade of 1950-59 (*ICNAF Special Publication*, No. 6, 1965). The second symposium in Dartmouth, Canada, during May 1971 focused upon the decade of 1960-69 (*ICNAF Special Publication*, No. 8, 1972). A Symposium on environmental conditions in the Newfoundland Grand Bank Area in 1972 and their effects on Fishery Trends was held in Copenhagen, Denmark, in May 1973 (*ICNAF Special Publication*, No. 10, 1975) while the decade of 1970-1979 was reviewed at Dartmouth, Canada, in September 1981 (*NAFO Scientific Council Studies*, No. 5, 1982). A fourth symposium was held at NAFO headquarters in Dartmouth during September 1994 on the impact of anomalous oceanographic conditions at the beginning of the 1990s in the Northwest Atlantic on the distribution and behaviour of marine life and included reviews of the 1980s and early-1990s (*NAFO Scientific Council Studies*, No. 24, 1996).

In accordance with the agreement of Scientific Council during the September 2001 meeting, a mini-Symposium, entitled *Hydrographic variability in NAFO waters for the decade 1991-2000 in relation to past decades*, was held at Alderney Landing, 2 Ochterloney Street, Dartmouth, Nova Scotia, Canada, on 7 June 2002. There were 40 registrants representing Canada, Denmark (in respect of Faroe Islands and Greenland), France, Germany, Portugal, Spain, United Kingdom, Japan, Russian Federation and United States of America. A total of 8 oral presentations were given reviewing meteorological, sea-ice and oceanographic variability in all

NAFO Subareas from SA 1 off West Greenland to SA 6 off the northeast coast of the United States. They ranked the past decade in relation to long-term climate change and several also considered the effects of the climate variations on the fisheries.

STACFEN invited D. B. Atkinson (Canada) to open the mini-Symposium. He presented a brief overview of past Symposia conducted by ICNAF and NAFO and gave a brief introduction on recent changes in both the fishery within NAFO waters and ocean climate trends. E. B. Colbourne, chair of STACFEN then gave an outline of the agenda and justification for the mini-symposium. It was noted that E. Buch of Denmark and J. Gil of Spain could not attend, but their papers would be presented, respectively, by C. Simonsen from the Greenland Institute of Natural Resources and E. B. Colbourne from DFO Canada.

Summary of the Proceedings

The mini-Symposium considered detailed climate conditions and their effects on the fishery within NAFO Subareas 0/1, 2, 3, 4, 5 and 6 during the decade of 1991-2000. In general the past decade was one of extremes, both in terms of ocean climate variability and fish production in the Northwest Atlantic. A brief review of the presentations for each Subarea follows.

A Review of the Atmospheric and Sea-ice Conditions in the Northwest Atlantic during the Decade 1991-2000, by K. F. Drinkwater (SCR Doc. 02/63)

The atmospheric and sea ice conditions in the decade 1991-2000 were described. The North Atlantic Oscillation (NAO) index in the 1990s was the highest in the past 11 decades and there has been a general increase from the minimum of the 1960s. This was accompanied by increasing southwesterly winds. Mean decadal air temperatures were above their long-term means throughout the NAFO area except at West Greenland and have been increasing since the 1960s. Sea-ice conditions off the Labrador and northern Newfoundland coast, in the Gulf of St. Lawrence and the Scotian Shelf indicate the least amount of ice was during the decade of the 1960s. From Labrador to the Gulf there was little difference in ice severity between the 1970s, 1980s and 1990s, however, on the Scotian Shelf, ice area was less during the 1990s compared to the previous two decades. The decadal mean of the number of icebergs drifting along the Labrador and Newfoundland Shelves was at a maximum during the 1990s. There has been large variability within the decade, however. The early years of the 1990s were characterized by high NAO indices, strong northwesterly winds, cold temperatures from the Labrador Sea to the Gulf of Maine and extensive ice cover. In 1996, the NAO index experienced its largest annual decline in the over 100-year record. During the remaining years of the 1990s decade, the NAO rose achieving values that even exceeded those of the early years of the 1990s. Also an eastward shift in the pressure fields occurred during the late-1990s. During this time there were weaker northwesterly winds, warmer temperatures in the Labrador Sea to the Gulf of Maine, and a reduction in sea-ice coverage.

Climatic Overview NAFO Subarea 1 – 1991-2000, by M. Stein (SCR Doc. 02/8)

Based on air temperatures, sea-ice cover and sea surface temperatures, as well as on autumn subsurface oceanographic time series data, the climatic conditions off West Greenland were described for the 1990s, including a comparison with previous decades. The 1990s was a decade of extremes: The NAO index flipped from its most positive value in winter 1995 to its most negative value in the winter thereafter and reached a high level again during the last winter of the decade. Air temperatures followed these extremes in the first part of the 1990s when cold air temperatures at West Greenland paralleled a high NAO-index. The northward extension of warm Irminger Water along the West Greenland banks and slopes showed extreme situations varying from 1992 when no Irminger mode water was found to 1999 when the northernmost extension of this warm water was observed. Cold polar water masses were most prevalent in 1992 and 1993 whereas warm waters such as the Irminger component of the West Greenland Current system dominated the second half of the 1990s. Sea-ice cover at the two southern-most sites off West Greenland, Nuuk and Prins Christian Sound, show high concentrations of ice in the first half of the 1990s. From 1998 onwards there was little sea-ice cover in the vicinity of these stations. The northern two locations, Upernavik and Egedesminde, reveal sea-ice presence throughout the decade, however, there is a significant decrease in coverage during the second half of the 1990s. Winter duration at West Greenland meteorological observation sites seems to differ from north to south. In the north, winters extended into March during all decades, while observations from southern sites show longer

winters only from the 1960s onwards. Before that period, winters were shorter at Nuuk and the southern tip of Greenland. It is suggested that the warmer-than-normal winter conditions during the first half of the 20th century favoured spawning of cod and led to increasing cod (*Gadus morhua*) populations off West Greenland.

Ecosystem Variability and Regime Shift in West Greenland Waters, by E. Buch (SCR Doc. 02/16)

A review of the past 50 years climate conditions off West Greenland revealed large variability in the atmospheric, oceanographic and sea-ice conditions, as well as in the fish stocks. A positive relationship was found between water temperature and the recruitment of Atlantic cod and redfish, whereas the recruitment of shrimp and halibut increased in response to lower temperatures. Observed warming during the second half of the 1990s indicate that changes in the fish stocks may be expected. Relationships between the past variations in fisheries resources, hydrographic conditions, and the large-scale climate conditions, expressed by the NAO, were analyzed and presented.

Oceanographic Conditions in the Labrador Sea in the 1990s and in the Context of Interdecadal Variability, by I. Yashayaev, A. Clarke and R. Hendry (SCR Doc. 02/51)

The Labrador Sea is a key location in terms of the circulation and climate change in the North Atlantic. It has the freshest and coldest conditions relative to the zonal means of temperature and salinity and serves as the source of the major intermediate water mass of the North Atlantic, referred to as the Labrador Sea Water (LSW). The water masses, which descend from the Nordic Seas into the North Atlantic across the Greenland Scotland Ridge, fill the deep and abyssal layers of the North Atlantic below LSW. They carry the signals from their sources and also respond to significant climatic variations in the Labrador Sea. In the 1990s, the Labrador Sea experienced the largest full-depth change ever observed in the modern instrumental oceanographic record becoming 0.6°C colder and 0.05 fresher (relative to the late-1960s), which is an equivalent of mixing an extra 6 to 7 m of fresh water into the water column. Hydrographic and profiling float data are used to identify seasonal cycles and long-term variations in the upper layer of the Labrador Sea. The magnitude of seasonal variation in temperature in the central region of the Labrador Sea is between 6°C (10 m) and 1.5°C (100 m). The seasonal change in fresh water content is 0.55 m, which is an order of magnitude less than the reported accumulation of fresh water between the 1960s and 1970s. A long-term cooling of the upper 300 m of the central Labrador Sea was observed between 1930s and 1980s by about 1°C. Between 1984 and 1999 the Labrador Sea became warmer, with a period of weaker cooling between 1988 and 1994. Between 1999 and 2001 the upper layer cooled by about 0.3°C. In the early-1970s and 1980s the upper 300 m layer experienced freshening, lowering salinity by 0.2. However, the cold anomaly of the early-1990s was not accompanied by lower salinity and this resulted in the highest recorded density of the upper layer and the deepest convection ever observed in the Labrador Sea (in 1993-1994 it reached 2 300 m depth).

Geostrophic Circulation and Heat Flux across the Flemish Cap (1988-2000), by J. Gil and R. Sánchez (SCR Doc. 02/37)

Historical data, together with CTD data from bottom trawl surveys performed in the Flemish Cap, were used to estimate geostrophic circulation over the bank and the heat flux across 47°N. The recurrence of anticyclonic circulation around Flemish Cap during the July surveys suggests topographic forcing plays an important role in the gyre dynamics. A coherent cold flow skirts around the northeastern flank of the Cap with enhanced southerly geostrophic velocities of $\sim 0.07 \text{ ms}^{-1}$ on the eastern slope. Part of this flow continues around the southern and southwestern flanks of the Cap with a mean speed of $\sim 0.03 \text{ ms}^{-1}$ forming an anticyclonic gyre over Flemish Cap. The gyre contains warmer and less saline waters than water surrounding the Cap. The most significant source of variability in the water masses over Flemish Cap was linked to the variability of the advective flows, namely the offshore branch of the Labrador Current and oscillations of the North Atlantic Current's north wall. The series of geostrophic heat flux anomaly was estimated to be balanced to within order 2.3 TW, with the long-term trend of the heat flux series suggesting a net shift from positive (poleward) in the late-1980s to slightly negative (equatorward) in the second half of the 1990s. The latter was attributed to enhanced Labrador Current during 1995-2000, which was also observed to strengthen the anticyclonic gyre over the Flemish Cap.

Decadal Changes in the Ocean Climate in Newfoundland Waters from the 1950s to the 1990s, by E. B. Colbourne (SCR Doc. 02/33)

A review of decadal changes in the ocean climate in NAFO waters adjacent to Newfoundland and Labrador were presented based on standard station and section data, as well as data from fishery resource assessment surveys. Both the annual trends and decadal means were examined for the decades of the 1950s to the 1990s. The analysis indicated that the 1950s and particularly the 1960s were the warmest decades during the latter half of the 20th century and the 1990s represent the 3rd consecutive decade with below normal temperatures on the Newfoundland Shelf. The decadal mean salinity indicated that the magnitude of negative salinity anomaly on the inner Newfoundland Shelf during the 1990s was comparable to that experienced during the 'Great Salinity Anomaly' of the early-1970s. In addition, the decade of the 1990s experienced some of the most extreme variations since measurements began during the mid-1940s. Ocean temperatures ranged from record low values during 1991 to record highs during 1999 in many areas, particularly on the Grand Bank of Newfoundland. The potential impact of these changes in ocean climate during the past several decades on marine production in Newfoundland waters was discussed.

Hydrographic Variability on the Scotian Shelf During the 1990s, by K. F. Drinkwater, B. Petrie and P.C. Smith (SCR Doc. 02/42)

Temperature, salinity and nutrient conditions of the waters on the Scotian Shelf during the 1990s were described and compared to the long-term variability. Three major features are highlighted. First was the presence of cold subsurface waters throughout much of the decade in the northwest and nearshore regions of the Shelf. These cold conditions, initially established in the mid-1980s, were also observed off southern Newfoundland and in the Gulf of St. Lawrence. The temperature trends on the Scotian Shelf are believed to have resulted from downstream advection with some contribution from *in situ* cooling. Second was the arrival in 1997-98 of cold Labrador Slope water along the shelf break, which subsequently flooded onto the Scotian Shelf. This produced the coldest near-bottom conditions on the central and southwestern shelf in the past 30 years but was of short duration, lasting only for approximately a year. Major changes in the dissolved oxygen and nutrient concentrations accompanied the Labrador Slope water intrusion; oxygen levels increased while nutrients decreased. These changes were consistent with a longer-term event in the mid-1960s. Finally, the changes in the near-surface waters were described. Of particular importance was the increase in near-surface vertical stratification due primarily to the presence of low salinity waters at the surface. The impact of these ocean climate changes on the Shelf fisheries was also briefly discussed.

Oceanographic Variability in NAFO Subareas 5 and 6 during the 1990s, by D. G. Mountain (SCR Doc. 02/45)

Oceanographic conditions on the northeast shelf of the United States from Cape Hatteras northward through the Gulf of Maine were described for the 1990s and compared to conditions during an earlier reference period (1977-1987). The two major inflows to the region appeared to reverse their contributions from one-third Scotian Shelf water and two-thirds Slope Water during the late-1970s to two-thirds Scotian Shelf water and one-third Slope Water during the 1990s. As a result, the salinity in the surface layers of the Gulf of Maine decreased during the 1990s. The salinity decrease also was evident in the shelf water within the Middle Atlantic Bight (MAB). The average shelf water temperature anomalies for the 1990s exhibited a seasonal and spatial pattern with high (>2 K) in the southern parts of the Bight decreasing northward to negative values in the surface layers of the Gulf of Maine during winter. The reverse was found in summer with positive anomalies in the Gulf of Maine decreasing to negative values in the southern MAB. The mean volume of shelf water in the MAB increased by about 1 000 km³ in the 1990s compared with the earlier reference period. The cause of this increase is not known. The interannual variability in the volume of the shelf water in the MAB appears to be closely related to changes in the magnitude of inflows to the Gulf of Maine system. The deep layer of the western Gulf of Maine was about 1 K warmer in the 1990s than in the earlier decade. This apparent warming is believed due to a reduction in wintertime convection in the western Gulf of Maine resulting from the low surface layer salinities. In 1998, Labrador Slope Water entered the Gulf of Maine through the Northeast Channel for the first time since the 1960s. This water was colder and fresher than the Slope Water usually entering the Gulf. The westward extension of Labrador Slope Water was observed along the Scotian Shelf and is believed to have been caused by the large drop in the NAO in 1996.

The Scientific Council Chair extended his congratulations on behalf of the Council for a very informative and well-run mini-Symposium.

To document the information from the meeting, STACFEN **recommended** that *the proceedings of the mini-Symposium on "Hydrographic Variability in NAFO Waters for the Decade 1991-2000 in Relation to Past Decades"* be published in a special issue of the *Journal of the Northwest Atlantic Fisheries Science*.

5. Review of Environmental Conditions

a) Marine Environmental Data Service (MEDS) Report for 2001 (SCR Doc. 02/28)

The inventory of oceanographic data obtained by MEDS during 2001 was presented along with information on several new initiatives.

i) Hydrographic Data Collected in 2001

Data from 8 203 oceanographic stations collected in the NAFO area sent in delayed mode to MEDS in 2001 have been archived, of which 4 929 were CTDs, 2 199 were BTs and 1 075 were bottles. An additional 474 stations were received directly by MEDS but are not yet archived and a total of 98 stations were collected but not yet received by MEDS. A total of 4 991 stations were received through IGOSS (Integrated Global Ocean Service System) and have been archived of which 1 135 were BTs and 3 836 were TESAC messages.

ii) Historical Hydrographic Data Holdings

Data from 17 999 oceanographic stations collected prior to 2001 were obtained during the year and processed during 2001, of which 9 392 were CTDs, 2 669 were BTs and 5 938 were bottles.

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 over 28 130 stations in the Northwest Atlantic being received during 2001, up significantly over the 5 590 stations during 2000.

iv) Drift-buoy Data

A total of 118 drift-buoy tracks within NAFO waters were received by MEDS during 2001 representing over 200 buoy months. The total number of buoys decreased by 23 over 2000.

v) Wave Data

In 2001, 92 747 wave spectra were processed, mostly from the permanent network of moored wave buoys in the area. This represents almost a 19% decrease compared to 2000. A total of 15 wave buoy stations were operational in the NAFO area during 2001.

vi) Tide and Water Level Data

MEDS processes and archives operational tidal and water level data obtained from the Canadian Hydrographic Service (CHS). The data are derived from the CHS active permanent water level network. A total of 46 stations were processed during 2001, a decrease of 1 station from 2000.

vii) Recent Activities

MEDS reported on three other initiatives during 2001:

1. Since 1998, MEDS has been acquiring and archiving data from the profiling buoys, known as PALACE floats. 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 2 000 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 role is to carry out the processing of the data received from Canadian floats, to distribute the data on the GTS, to contribute 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 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.
2. The IODE Steering Group for Underway Sea Surface Salinity Data Archiving Pilot Project was established during IODE-XVI. The objective of the project is to organize surface salinity data that are currently collected and to work with data collectors to improve data collection to meet the benchmarks of spatial and temporal sampling and data accuracy set out by the Ocean Observations Panel for Climate (OOPC). The first meeting of interested participants took place in Brest in November 2001 (see <http://ioc.unesco.org/iode>). Catherine Maillard of IFREMER and Bob Keeley of MEDS co-chaired the meeting. Representatives from Canada, France, Greece, ICES countries, Japan, Russia, UK, USA attended the meeting. The goals of the project are to: (a) improve data acquisition systems and provide feedback to data collectors (b) build comprehensive archives for surface salinity data, which will include data collected by any instrumentation at any time, (c) refine and standardize quality control procedures and (d) provide data and information to users in a timely way. A second meeting is to be held in Ottawa 16-17 September 2002.
3. The DFO Atlantic Zone Monitoring Program activities include regular sampling of 6 fixed stations, 13 standard sections, and several research cruises 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 web site: 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. Climate indices have also been added to show long-term trends of physical variables. Water level data for 9 gauges beginning in 1895 and running to present were also available. Biological data are stored in a nationally distributed database (BIOCHEM) that is presently being developed at BIO. Graphical representations of biological data (phytoplankton) however are currently being displayed on the web site. The Sir Alister Hardy Foundation for Ocean Science (SAHFOS) is an international charity that operates the Continuous Plankton Recorder (CPR) survey. The CPR data for the AZMP area are presently made available from the MEDS web site.

b) Review of Environmental Studies in 2001

i) Results of physical oceanographic studies

General Meteorological and Sea-Ice Conditions

A review of meteorological, sea-ice and sea surface temperature conditions in the Northwest Atlantic during 2001 was presented (SCR Doc. 02/49). Annual mean air temperatures throughout most of the northwest Atlantic were warmer-than-normal. They generally increased relative to 2000 but were below the record setting temperatures of 1999. The North Atlantic Oscillation (NAO) index was below normal and fell compared to its 2000 value. It was similar to the values of 1996-1998 and

well below the levels seen in the cold period of the early-1990s. The Labrador Sea experienced predominantly more easterly winds than usual throughout most of the year. Sea-ice on the southern Labrador and Newfoundland Shelves generally appeared late and left early, resulting in a shorter duration of ice than usual and less ice coverage. The number of icebergs reaching the Grand Banks in 2001 was only 89, almost a 10-fold decrease from 2000. Less ice than usual reached the Scotian Shelf. The lower amount of sea-ice is consistent with higher sea-surface temperatures throughout the region in 2001.

Subareas 0 and 1

During the German groundfish survey off Greenland (12 October to 22 November 2001), oceanographic measurements were performed at 59 fishing stations by means of CTD/Rosette (SCS Doc. 02/9). Additionally, temperature and salinity at stations along 3 NAFO standard oceanographic sections off West Greenland (Cape Desolation, Frederikshaab Bank, Fyllas Bank) were measured and together with information on air temperature anomalies, water mass properties and ice distribution were used to describe climatic trends.

Results of the 2001 summer cruise to the standard sections along the west coast of Greenland were presented together with CTD data gathered during trawl surveys (SCS Doc. 02/16; SCR Doc. 02/17). The 2001 cruise was carried out according to the agreement between the Greenland Institute of Natural Resources and Danish Meteorological Institute during the period 6-11 June 2001. The time series of mid-June temperatures and salinities on top of Fylla Bank revealed 2001 to be a year close to average conditions. Pure Irminger Water was observed only at the Cape Farewell Section, while Modified Irminger Water could be traced from Cape Farewell to Holsteinsborg. The cold and low salinity conditions observed off southwest Greenland reflect the inflow of Polar Water carried to the area by the East Greenland Current. Water of Atlantic origin ($T > 3^{\circ}\text{C}$; $S > 34.5$) is found at the surface only at the outermost stations on the Cape Farewell Section. The 2001 temperature value (1.74°C) is slightly above the average value of 1.67°C for the whole 50-year period, which correlates well with the slightly negative value of NAO. The 2001 conditions therefore most likely reflect a return to normal conditions. The 2001 mean salinity value (33.40) on top of Fylla Bank was slightly higher than in 2000, and equal to the average value for the entire period.

Changes in the ocean climate in the waters off West Greenland generally follow those of the air temperatures. In 2001, however, the mean temperature on top of Fylla Bank in the middle of June was well below the values of the previous 3 years. These 3 years did however show anomalously high values due to an eastward displacement of the NAO Pattern. Temperature and salinity observations at greater depth showed that pure Irminger Water ($T \sim 4.5^{\circ}\text{C}$, $S > 34.95$) was clearly present at the Cape Farewell section, but has not advected beyond this point. Modified Irminger Water ($34.88 < S < 34.95$) was present in great quantities at all sections up to the Holsteinsborg section, however most clearly at the southernmost sections. Northwest Atlantic Mode Water ($3.5^{\circ}\text{C} < T < 4.5^{\circ}\text{C}$; $34.5 < S < 34.88$) was observed at all sections from Cape Farewell to Nugssuaq.

Subareas 2 and 3

Hydrographic conditions on Flemish Cap in July 2001 are described from a survey with 94 CTD stations (SCR Doc. 02/25). The near surface water around the Cap is Labrador Current Water. Since the mid-1990s temperatures have been increasing until 1999. In 2001, the superficial waters (< 100 m) are warmer ($+1$ K) and saltier ($+0.5$) than the mean of 25 past years. In water depths over 200 m, a well-developed layer with temperatures around 3.5°C and salinity 34.85 was observed all around the Cap. The annual anomalies in the thermohaline properties in 2001 with respect to historical means are small and less than previous years. The fresh and cold water from the Labrador Current at intermediate depths that comes from the north, heated in the surface layer by the atmosphere. The main influence on the thermohaline properties of upper Flemish Cap waters. Below 150 m the temperature and the salinity increase by mixing with the nearby warmer and saltier North Atlantic water, flowing northwards. As in previous years, in the summer 2001, surface water on the Cap in the center of anticyclonic gyre was warmer and fresher than the surrounding waters. The lowest

temperatures occur between 70 and 120 m, coinciding with the incoming Labrador Current (typically $>4^{\circ}\text{C}$). From 120 m to the bottom, all around the Cap, temperatures increase to 4°C due to a mixture between Labrador Slope Water and North Atlantic water.

A description of environmental information collected in the Newfoundland Region during 2001 was presented (SCS Doc. 02/10). This included physical, chemical and biological data collected as part of the Atlantic Zonal Monitoring Program, 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 Region conducted three annual physical/biological oceanographic surveys during 2001 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 the autumn. The main objectives were to establish the seasonal temporal and spatial distribution and abundance of plant pigments, nutrients, microzooplankton and mesozooplankton in relation to the physical environment. Physical, biological and chemical variables being monitored include temperature, salinity, dissolved oxygen, ocean currents as well as measures of primary and secondary production and biomass, species composition of phytoplankton and zooplankton and nutrients.

The cycle of nutrient depletion in the upper 50 m of the water column at Station 27 was delayed in 2001 relative to the previous year (SCS Doc. 02/10). The depletion of nutrients in the surface mixed layer appeared to be more substantial in 2001 than in the previous year, with silicate concentration approximately 2-3 μM lower in 2001. However, the deeper mixed layer in 2000 led to an overall greater decrease in the total nutrient pool in that year relative to 2001. A potentially more important difference between the two years occurred in the deep nutrient pool (50-150 m) where overall levels in 2001 were 1.5-2 times lower than in 2000. Along each of the major transects, deep nutrient pools appeared to be at comparable levels to those observed in previous years. The onset of the spring phytoplankton bloom was also delayed by approximately 30 days and the duration of the period of high phytoplankton biomass in the upper 50 m of the water column was also reduced by approximately 50% relative to the previous year. A notable point about the composition of phytoplankton throughout the region indicates a significant 2-fold decrease in the density of small flagellates. Although these organisms do not make up a substantial portion of the total biomass of phytoplankton, in which diatoms are more important, flagellates play an important role in the microbial food web. Their decrease may be indicative of changes in this portion of the pelagic ecosystem during 2001. Overall zooplankton densities at Station 27 in 2001 were lower than in the previous year but similar to observations in 1999. The relative importance of *Calanus finmarchicus* was greater in 2001 than in the two previous years, largely as a result of the influx of a cohort of young copepodite stages (CI-CV) from the autumn of 2000 into the winter of 2001. Densities of *Calanus finmarchicus* on the Newfoundland Shelf during the spring survey were similar to observations in previous years but there were substantially fewer copepodites found on the southern Grand Banks during this period. During summer survey, densities of *Calanus finmarchicus* were substantially higher on the Labrador Shelf than in 2000, while concentrations in the Newfoundland Shelf and Grand Banks were generally similar to observations in 2000.

Oceanographic observations in NAFO Subareas 2 and 3 during 2001 were presented referenced to their long-term (1971-2000) means (SCR Doc. 02/41). The annual water column averaged temperature at Station 27 during 2001 warmed slightly compared to 2000, remaining above the long-term mean. Surface temperatures were above normal for 9 of the 12 months with anomalies reaching a maximum of near 1.6°C in October. Bottom temperatures at Station 27 were above normal (by $\sim 0.5^{\circ}\text{C}$) during 12 months of the year. Water column averaged summer salinities at Station 27 decreased to below normal values over the near-normal conditions of 2000. The cross-sectional area of $<0^{\circ}\text{C}$ (Cold Intermediate Layer or CIL) water on the Newfoundland and Labrador Shelves during the summer of 2001 decreased over 2000 values, except on the Grand Bank where there was a slight increase. Off Bonaville the CIL area decreased to the lowest value observed since 1978. Bottom temperatures on the Grand Banks during the spring of 2001 were generally above normal (up to 0.5 K) over most areas, except the southeast shoal of the Grand Bank where temperatures were slightly below normal. During the autumn bottom temperatures were above normal on the northern Grand Bank (Div. 3L) and in Div. 2J and 3K.

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 summary, during 2000 and 2001 ocean temperatures were cooler than the 1999 values, but remained above normal over most areas continuing the warm trend established in 1996. Salinities during 2001 were generally fresher-than-normal in the inshore regions continuing the trend observed during most of the 1990s.

During a survey in Div. 3M, 39 oceanographic stations at 130-1 016 m depth were occupied (SCS Doc. 02/4). Data on the vertical distribution of water along the 47°N section show that in 100-150 m depth range, temperatures ranged from 3.0°-3.5°C, while surface values reached 5.0°-5.5°C. Temperature in the near-bottom layer ranged from 3.3° to 3.8°C. Salinity varied from 34.4 near the surface to 34.5 near the bottom to 150 m depth. Below 150 m, salinity varied from 34.5 to 34.8. Data on the horizontal distribution of temperature and salinity from the surface to 300 m depth show the intrusion of warm water of the North Atlantic Current to the western and southern slopes of the bank. The highest temperatures of these waters varied from 7°C in the 200-300 m depth range to 12°C near the surface. Maximum salinities varied from 34.9 to 35.3. The rest of the bank was occupied by mixed water with temperature and salinity of 3.0°-6.0°C and 33.0-34.4, respectively, near the surface and 3.3°-3.7°C and 34.7-34.8 near the bottom. Thermohaline frontal zone, which separates North Atlantic water from mixed water of the Flemish Cap, can be traced down to 300 m depth in the southern part of the investigated area. Collation of temperature data with long-term mean indicated that on the northern, western and southern slopes of the Flemish Cap and Flemish Pass down to 200-300 m depth, temperatures were warmer-than-normal with the maximum (up to 2.4 K) in the surface layer. In greater depths, temperatures showed only slight deviations from the long term mean. On the eastern slope and in the center of the Flemish Cap Bank, temperatures were colder-than-normal by 0.2-0.4 K.

Subarea 4

In 2001, monitoring of SST and water mass boundary dynamics at the surface in the area of Labrador and Gulf Stream current systems continued (SCS Doc. 02/4). The trends in SST fluctuations and hydrological fronts shift in the Northwest Atlantic in 2000 and 2001 revealed continuation of the higher temperatures in the Labrador Sea, on the Labrador Shelf, on Flemish Cap and on the northern Grand Bank. Since 1999, SSTs decreased to near or below normal temperatures, i.e. on the Scotian Shelf, in the Slope Water and in Gulf Stream waters. The basic reason of this decrease is the strengthening of Labrador water outflow and weakening of warm Slope water advection in the areas of New England and Scotian Shelves, evidenced by the shift of these water masses boundaries southwards after 1999. It is hypothesized that this has resulted in deterioration of silver hake spawning conditions on the Scotian Shelf in 2000 and 2001. Updating of retrospective series of water mass boundary location indices in 1962-81 was continued using Canadian SST maps.

The updating included replacement of frontal indices based upon a typical isotherm to those based upon SST gradients. New mean monthly indices, long-term average and standard deviation were estimated.

Surface temperatures on the Scotian Shelf and in the Gulf of Maine and adjacent offshore areas during 2001 varied from higher-than-normal in the Gulf of Maine and over the central and northeastern portions of the Scotian Shelf (SCR Doc. 02/69). In contrast, the southwestern shelf and along the coast of Nova Scotia, sea surface temperature anomalies were negative. Subsurface temperatures were colder in the northeastern portions of the Scotian Shelf, declining to below normal values and reversing the warming trend of the past decade. Near-bottom waters in the deep basins both on the Shelf and in the Gulf of Maine indicate a continuance of the warm conditions re-established in 1999 after the cold-water event of 1998. However, mid-depth temperatures over Emerald Basin were much colder-than-normal, ~1 K from 50 to 150 m. Near-bottom temperatures throughout the Scotian Shelf were generally below normal in 2001. There was some evidence to suggest the return of Cold Slope Water along the Scotian Shelf. While the vertical stratification in the upper water column (between surface and 50 m) over the Scotian Shelf generally weakened in 2001 relative to 2000, it remained higher than normal. The Shelf/Slope front and the Gulf Stream moved seaward of their positions during 2001 relative to its position in 2000. This resulted in the Shelf/Slope front being seaward of its normal position while the Gulf Stream remained shoreward of its normal position.

Subareas 5 and 6

The United States Research Report listed several ongoing oceanographic, plankton and benthic studies (SCS Doc. 02/15). During 2001 more than 1 900 CTD (conductivity, temperature, depth) profiles were made on NEFSC cruises. These data have been processed and made available via an anonymous FTP site. A report on the oceanographic conditions in 2001 is in review and expected to be released by mid-2002. The Georges Bank GLOBEC program has begun a synthesis phase in which results from the various components of the program will be integrated to provide a greater understanding of how environmental variability influences the Banks ecosystem, particularly the plankton populations. A number of studies are underway focusing on both the zooplankton populations and the early life stages of the cod and haddock stocks on Georges Bank. The synthesis effort is scheduled to continue for four years. Laboratory studies have been completed evaluating the growth, metabolism, and growth efficiency of larval and juvenile cod and haddock at different temperatures.

ii) Results from Interdisciplinary Studies

An unusually high abundance of long-finned squid (*Loligo pealeii*) in Newfoundland waters was observed in 2000 (SCR Doc. 02/40). Prevalence of maturing females and mature males within samples, together with the collection of a single viable egg mop, provide the first evidence of spawning of this species at the northern limit of its geographic range of distribution. Trends in size and abundance of short-finned squid (*Illex illecebrosus*) suggest that this northward expansion of the long-finned squid population may be related to relief of competition. Trends in local water temperature at Newfoundland suggest that this phenomenon may also be related to environmental variation. Using time series analysis, with biological and environmental input variables, to each of long-finned and short-finned squid, the hypothesis is tested that these two species share, to a large extent, a common niche on the Northeast USA Shelf and that opposing responses to ecosystem variation regulate their relative abundance. The resultant models indicate that north-south shifts in the location of the Shelf/Slope Front (SSF) are closely related to direct oceanographic processes that affect both squid species. While these two species exhibit opposing responses to variation in the oceanographic regime, direct mechanisms that regulate year-class strength remain unknown. It is quite possible that mechanisms differ between the two species, with local variables directly affecting long-finned squid and broad-scale factors affecting short-finned squid. The expansion of the long-finned squid population in 2000 was associated with an unusual eastward displacement of an intense NAO that may have resulted in unfavourable oceanic conditions for short-finned squid but favourable environmental conditions for long-finned squid on the continental shelf as far north as southern Newfoundland.

c) Overview of Environmental Conditions in 2001

STACFEN agreed that this year and in subsequent years, the environmental conditions for the NAFO Convention Area will be reported on an individual Subarea basis rather than in the large summary document that has been presented over the past 2 decades (see also agenda item 9).

6. Long-term Environmental Indicators

a) Review of Environmental Indicators

An important role of STACFEN, in addition to providing climate summaries, is to determine the response of fish and invertebrate stocks and the fishery to the changes in the environment, as well as to provide advice on how relationships between climate and marine production may be used to help improve the assessment process. It was felt that a greater emphasis should be placed on these latter two activities within STACFEN in future.

b) **Formulation of Recommendations Based on Environmental Conditions**

STACFEN **recommended** that *further studies be conducted attempting to link climate and fisheries and to bring forward such studies for review at STACFEN.*

STACFEN felt that the Fisheries Commission should be informed of the results from the mini-Symposium on “*Hydrographic Variability in NAFO Waters for the Decade 1991-2000 in Relation to Past Decades*” especially in view of the significant environment changes that occurred in recent years compared to the earlier years of the 1990s. The last presentation to the Fisheries Commission by STACFEN on environmental matters was five years ago. It was further suggested that presentations by STACFEN should continue on a regular 5-year basis, and more frequently if significant climate events occur.

STACFEN **recommended** that *the STACFEN Chair, or designate, be included in the presentation of scientific advice from the Scientific Council to the Fisheries Commission at its September 2002 meeting, and further that such presentations be made every 5 years or more frequently if significantly large changes in the environment are observed.*

7. **Environmental Indices (Implementation in the Assessment Process)**

A review and short description of environmental-stock relationships for some species of marine and anadromous fish and invertebrates in Newfoundland waters was presented. Oceanographic observations are routinely collected and compiled by fisheries laboratories in NAFO Contracting Parties in the Northwest Atlantic, either by directed oceanographic surveys or as part of stock assessment surveys. Many studies have suggested that variations in the physical ocean environment influence the production of marine organisms, therefore the integration or incorporation of environmental information in the fishery resource assessment process is a pressing issue. The recent extreme variations, particularly in the thermal habitat of many marine species, are thought to influence the abundance, distribution and catchability of marine organisms and hence the management of the fishing industry. Several working groups are currently addressing this issue, including one under the Fisheries Oceanography Committee (FOC) of the Canadian Department of Fisheries and Oceans. To date however, environmental information is still used only in a qualitative way in the regional assessment process (RAP) in Atlantic Canada, although quantitative applications have been used in forecasting the pre-fishery abundance of salmon in the Northwest Atlantic. Generally, the effort to date has been restricted to general environmental overviews, which are sometimes aimed at the habitat of the species being assessed. At best, this effort usually results in a brief description of environmental conditions to be included in the stock status reports. However at some recent invertebrate assessments, environmental-stock relationships have been presented and discussed in more detail and some preliminary attempts at predictive modeling were attempted. The result of this effort was used as an indicator that helped form the basis of the outlook for the stock using the so-called 'traffic-light' approach.

One of the first steps towards the integration of environmental information into stock assessments is to establish associations or correlations between environmental signals and trends in production indices of various fish and invertebrate stocks and to explore the predictive powers of models using environmental signals. This should eventually lead to the inclusion of both physical and biological information in process-orientated effects, which would account for variations in primary and secondary production in ecosystem. The results indicate that in many cases environmental indices and indices of various aspects of fish and invertebrate survival and production show similar trends that coincide in the physical and biological environment. Given that the environmental influence is often on the egg and larval stages and recruitment to the fishery occurs one to several years later, this lag allows some future predictive capability. Some examples of forecasting trends in invertebrate production using environmental indices look promising.

8. **Review of Recent Trans-Atlantic Environmental Conditions**

a) **Review of Hydrographic and Larval Studies**

A Workshop on Transport on Cod Larvae was held at Hillerød, Denmark on 14-17 April 2002 initiated by the ICES/GLOBEC Working Group on Cod and Climate Change. They were examining the role of

transport in the recruitment process and broke into four groups, based upon geography. These were the Baltic, the Northeast Atlantic including the North Sea and the Barents Sea, Iceland-Greenland and the Northwest Atlantic. M. Stein reported on the findings from the Iceland-Greenland group. Earlier studies have shown that the source of high recruitment and abundance of Atlantic cod in West Greenland is derived from Iceland. These fish grow and feed in West Greenland and, at least at times, appear to return to Iceland. Data from 1970-1998 presented at the workshop revealed juvenile cod between Iceland and Greenland, primarily along the 500 m isobath. The distribution of the cod was consistent with the current patterns as measured by drift buoys. There was also a strong relationship between pelagic juveniles and 0-group cod between Iceland and Greenland, as well as the abundance of Greenland recruits from the 1970s to the 1990s. In the 1950s and 1960s, there is evidence of large numbers of cod larvae to the west of West Greenland in the Labrador Sea. The group had four main recommendations: (1) increased modeling of the region, (2) increase knowledge of the subsurface currents, (3) the development of transport indices and (4) analysis of the distribution of juvenile cod (0- and 1-group) from the German database to define nursery areas in relation to water temperature and depth.

b) **Establishing of a Special Study Group**

At the 2001 STACFEN meeting, discussions were held on the possible involvement in proposed trans-Atlantic field studies and active retrieval of data collected during the multinational NORWESTLANT Program in the 1960s. No decisions were made on these issues and it was decided that they should be reconsidered at the 2002 meeting.

At the 2002 STACFEN meeting, it was agreed that field studies were outside the activities of STACFEN and the Committee decided it could not become involved in any trans-Atlantic field studies. Funding will be required to retrieve the NORWESTLANT data and it was felt that STACFEN should not undertake the data retrieval but encourage interested scientists from within NAFO to consider such an endeavour.

9. **The Production of a NAFO Annual Ocean Climate Status Summary**

STACFEN considered a proposal to produce an annual climate status summary report for the NAFO area. This will be modelled on the ICES annual climate status summary for the ICES area and would include an overview that summarizes overall and general climate changes for the previous year and a regional overview that provided climate indices from each of the Subareas. This report would essentially replace the traditional much larger environmental overview paper normally presented at the end of the reviews of environmental conditions. M. Stein agreed to produce the first report with information for the Subareas sought from the following scientists: Subareas 0-1, West Greenland (M. Stein and E. Buch); Subareas 2 and 3 (E. Colbourne), Subareas 4 and 5 (K. Drinkwater), Subareas 5 and 6 (D. Mountain). STACFEN felt such a summary report would be very useful, especially if it were posted on the NAFO website and made available prior to the June assessment meetings. A demonstration of proposed web pages for the ocean climate status summary was given to STACFEN members on June 13, 2002.

STACFEN therefore **recommended** that *an annual climate status report beginning in 2003 to describe environmental conditions during the previous year be produced, that this be compiled prior to the annual June meeting and posted prominently on the NAFO website.*

10. **Cooperative Research Programs**

a) **Russian/German Data Evaluation**

M. Stein presented the Eighth Report on the Joint Russian/German Project "Assessment of short-time climatic variations in the Labrador Sea" (SCR Doc. 02/7). A workshop was held on 22-26 April 2002 in Hamburg, Germany. The major task was to prepare a manuscript for publication in the primary literature on their findings into the relationship between physical variables (air temperatures, winds and SSTs) and cod recruitment off West Greenland and Iceland. The manuscript should be complete within the next few months. The project is expected to continue under Russian/German funding and the next workshop is planned for September 2002 in Murmansk.

b) Other Research Programs

There were no other research programs considered by the Committee.

11. National Representatives

The Committee was informed that the national representatives responsible for hydrographic data remain 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), A. J. Paciorkowski (Poland), J. Pissarra (Portugal), F. Troyanovsky (Russia), L. J. Rickards (United Kingdom), and K. J. Schnebele (USA).

12. Other Matters

The Committee was informed of current meters being moored by the Bedford Institute of Oceanography in Flemish Pass beginning in June 2002 with a planned deployment for upwards of 3-4 years. One mooring will be on the slope of the Grand Banks and another in the deep section of the Pass. Their purpose is to gain information on the variability in the strength and position of the Labrador Current. It was also recommended that Contracting Parties at STACFEN inform their labs of this deployment if carrying out assessment surveys 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.

13. Acknowledgements

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

APPENDIX II. REPORT OF STANDING COMMITTEE ON PUBLICATION (STACPUB)

Chair: M. Stein

Rapporteur: S. J. Correia

The Committee met at the Alderney Landing, 2 Ochterloney Street, Dartmouth, Nova Scotia, Canada, on 10 June 2002, 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), Japan, Russian Federation and United States of America. The Assistant Executive Secretary was in attendance.

1. Opening

The Chair opened the meeting by welcoming the participants. The agenda as presented in the Provisional Agenda was adopted. S. J. Correia (USA) was appointed rapporteur.

2. Review of Recommendations in 2001

a) Recommendations in June

- i) STACPUB had recommended that *each member of the Secretariat be given an individual e-mail address.*

The Scientific Council Chair reported that he had correspondence with the Executive Secretary. The Executive Secretary indicated that business of the Secretariat is efficiently conducted under the current structure and that he did not see the need to add individual e-mail address beyond the five individual e-mail addresses now available. STACPUB reiterates the **recommendation** that each member of the Secretariat be given individual e-mail address. STACPUB notes that this recommendation is currently met by other international bodies. STACPUB has difficulties understanding the Secretariat's rationale given state of development of electronic communications and widespread usage of e-mails.

- ii) STACPUB had recommended that *in future, the Secretariat should routinely submit a report in June on the website usage to STACPUB.*

STACPUB discussed this recommendation with the next one below.

- iii) STACPUB had recommended that *an additional agenda item for future meetings should be introduced to include website use summaries and statistics.*

The Secretariat provided monthly reports on website usage. The Chair presented statistics on website usage for January-April 2002. The site is continuously used and activity peaks prior to meetings. STACPUB concluded that the NAFO website is used as a source of information

- iv) STACPUB had again recommended that *a Working Group with representatives from General Council, Fisheries Commission and Scientific Council should be established in order to ensure that all relevant material becomes available on the NAFO website.*

No action has been taken on this recommendation

- v) STACPUB had recommended that *the collections of papers being prepared by the Working Group on Reproductive Potential be edited by the Working Group Chairman, E. A. Trippel (Canada).*

A special Volume of the *Journal of Northwest Atlantic Fishery Science* containing 9 peer-reviewed articles by members of the Working Group on Reproductive Potential is being prepared. It is anticipated that this publication will be available in late-2002 or early-2003.

- vi) STACPUB had recommended that *the list of tables designed for the inventory of data on reproductive potential for marine fish stocks be compiled into a single issue of the NAFO Scientific Council Studies in 2002 once it has been reviewed by Scientific Council.*

The Volume of the *NAFO Scientific Studies* from the Working Group on Reproductive Potential, containing short summaries and citation sources on stock structure and reproductive potential data for over 50 fish stocks (all NAFO stocks and several ICES stocks) is in preparation. It is anticipated that this publication will be available in late-2002 or early-2003.

- vii) STACPUB had recommended that *the co-conveners of Symposia be responsible for nominating qualified editors, maintaining the scientific standard of the Journal, and that once the edited papers were received from the editors further editorial problems, if any, with such Symposia submissions will be addressed by STACPUB, while the NAFO Secretariat will only edit for technical aspects.*

This policy has been implemented for the Deep-Sea Fisheries Symposium.

b) **Recommendations in September**

STACPUB noted that appointed STACPUB membership was no longer required and accordingly the Scientific Council Rules of Procedures were modified by deleting Rule 5.1.c.(ii).

3. **Review of Scientific Publications**

a) **Publications**

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

STACPUB was informed that:

Volume 29 containing 5 papers and 1 notice (99 pages), was published with a publication date of December 2001 and placed on the NAFO website www.nafo.ca.

Volume 30. There are presently 5 papers in Secretariat files for this issue. The status of each is given in Table 1.

A Special Volume containing papers from the Symposium on "Deep-sea Fisheries". A total of 47 papers have been received at the Secretariat and sent to co-conveners for review. To-date 10 reviews have been sent back to authors for revision and 9 including an Abstract have been received at the Secretariat for final technical edit, 1 has been rejected, 1 withdrawn and 26 are still in referee stages of the review process. This issue is targeted for publication by late-2002.

A Special Volume containing 9 peer-reviewed articles by members of the Working Group on Reproductive Potential is being prepared. This volume is intended to provide state-of-the-art techniques and methods used to estimate reproductive potential of fish stocks. In addition, it reviews and synthesizes published results and provides case studies of various approaches that may be used to integrate knowledge of stock reproductive potential into improving scientific advice for fishery resource management. It is anticipated that this publication will be available in late-2002 or early-2003.

ii) **NAFO Scientific Council Studies**

STACPUB was informed that:

Studies Number 34 containing 3 miscellaneous papers and 1 notice (91 pages), was published with a publication data of October 2001 and placed on the NAFO website www.nafo.ca.

Studies Number 35 containing a complete narrative of the proceedings and 9 papers presented at the 2000 Workshop on Assessment Methods held during 13-15 September 2000 in Boston, USA, is in final stage of preparation and targeted to be published by mid-summer.

Studies Number 36, the report of "The Canada-United States yellowtail flounder age reading workshop, 28-30 November 2000, St. John's, Newfoundland", is targeted to be published by late-autumn.

The volume of the **Studies** from the Working Group on Reproductive Potential, 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 over 50 fish stocks (all of the NAFO stocks and several ICES stocks) is being prepared. It is anticipated that this publication will be available in late-2002 or early-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 1960-2001. Information is the most up-to-date information available at the Secretariat and is updated as new information become available.

In accordance with the Scientific Council recommendation of June 2001, the *NAFO Statistical Bulletins*, Vol. 45-49 for the years 1995 to 1999 were published without the USA data with publication dates of October 2001 for 1995, November 2001 for 1996, 1997 and 1998, and January 2002 for 1999. It is noted these were published without the complete USA data but the Secretariat was able to include some total catches from STATLANT 21A data in some of the tables.

Deadline for submission of STATLANT 21B reports 2000 was 30 June of each subsequent year. Data are still outstanding from Canada (Central and Arctic), Greenland, Norway and USA.

iv) **NAFO Scientific Council Reports**

STACPUB was informed that:

The volume (339 pages) containing reports of the 2001 meetings of the Scientific Council in June, September and November was published and distributed in January 2002. The *NAFO Scientific Council Reports* (Redbook) was published on the NAFO website on schedule along with both hardcopy and CD printed issues.

v) **Index and Lists of Titles**

STACPUB was informed that:

The provisional index and lists of titles of 191 research documents (SCR Doc.) and 28 summary documents (SCS Doc.) which were presented at the Scientific Council Meetings during 2001 were compiled and presented in SCS Doc. 02/5 (43 pages) for the June 2002 Meeting.

vi) **Others**

There were no other publications considered.

b) **Review of Mailing Lists and Continuation of Printed Copies**

The Chair read a letter recommending the Secretariat should accelerate the switch to electronic copies to reduce mailing costs. A request was sent to all Contracting Parties to list which publications they want and

in what form. Several parties request hard copies of individual publications. Work continues on reviewing mailing list and removing names that should not receive publications. STACPUB **recommended** that *the Secretariat provide a copy of the mailing list to each delegation's representatives. Representatives are requested to review the list and provide a list of names that are no longer involved with NAFO and that should be removed from the list.*

4. **Production Costs and Revenues for Scientific Council Publications**

Production costs for all publications are calculated as part of the Annual budget. There is no relevant "revenue", as NAFO is a non-profit organization and publications do not generate revenues. Income, generated by publications, is only for recovery of the costs of producing publications.

5. **Electronic Communications, Including NAFO Website**

a) **Public Access Areas of Website**

The entire website is for public access. However, there is a "restricted" site ("/SCS"), which only Scientific Council mailing list people are informed of. STACPUB notes that access to the current restrictive website is not adequately restrictive and parties other than Scientific Council may now access the restrictive site. STACPUB **recommended** that *the Secretariat maintain the restricted website area for specific Scientific Council business, and that the restricted website name be changed on an annual basis in order to maintain restricted access.*

b) **Password Protected Areas of Website for Scientific Council**

STACPUB noted that at present there is no need for Password Protected areas of Website for Scientific Council.

6. **Promotion and Distribution of Scientific Publications**

a) **Invitational Papers**

A special Volume of the Journal of Northwest Atlantic Fishery Science containing 9 peer-reviewed articles by members of the Working Group on Reproductive Potential is being prepared. It is anticipated that this publication will be available in late 2002 or early-2003.

b) **NAFO Website**

STACPUB **recommended** that *STACFEN's annual climate status summary report on essential climatic conditions in the NAFO Convention Area be published on the website.* STACPUB also **recommended** that *"Informational bulletins" of interest to NAFO Contracting Parties, such as location of mooring of ocean current meters in the Flemish Pass, should also be published on the website.*

c) **Scientific Citation Index(SCI)**

The Assistant Executive Secretary reported that the SCI authorities have not accepted the Journal of Northwest Atlantic Fishery Science for inclusion in the Scientific Citation Index.

d) **CD-ROM Version of Reports, Documents**

All journal issues are now on CD. The Secretariat is in the process of scanning back issues of Scientific Council Studies with the expectation that the entire series will be available on CD.

e) **New Initiatives for Publications.**

STACPUB has no new initiatives at this time.

7. Editorial Matters Regarding Scientific Publications

a) Review of Editorial Board

STACPUB noted that there are no changes to Editorial Board

b) Progress Report of Publication of 2000 Workshop Workbook

Outstanding papers for the 2000 Workshop Workbook were received and galley reviews are underway.

c) Progress Report of Publication of Symposium Proceedings

A total of 47 papers from the Symposium on "Deep-sea Fisheries" have been received at the Secretariat and sent to co-conveners for review. To-date 10 reviews have been sent back to authors for revision and 9 including an Abstract have been received at the Secretariat for final technical edit, 1 has been rejected, 1 withdrawn and 26 are still in referee stages of the review process. This issue is targeted for publication by late-2002.

STACPUB reiterated that responsibility maintaining quality standards for papers published in the Journal remains with the Editorial Board. However, a concern was raised that some approved papers to Symposia proceedings may be at lower standard than contributions to the Journal. An *Ad hoc* Working Group consisting of Editorial Board members present at this STACPUB meeting, Assistant Executive Secretary and the Scientific Council Chairs was formed to address this issue.

The *Ad hoc* Working Group consisting of Editorial Board members D. B. Atkinson, K. F. Drinkwater, F. Serchuk, the Scientific Council Chairs and the Assistant Executive Secretary, met on 12 June 2002. The group concluded that prior to a Symposium, STACPUB Chair, the Assistant Executive Secretary and members of the Editorial Board (if present at the Symposium) meet with the appointed Special Editors for the Symposium to explain their responsibilities with respect to maintaining the publication standards of the *Journal of Northwest Atlantic Fisheries Science*.

8. Papers for Possible Publication

a) Review of Proposals Resulting from 2001 Meetings

i) Papers nominated by STACPUB

In accordance with the Scientific Council recommendation of September 1999, the final issue of *NAFO Scientific Council Studies* using the STACPUB method of selecting scientific papers from the SCR Documents issued at Scientific Council Meetings ended in June 1999. All papers selected by that process have been assigned to Studies Numbers 33 and 34.

Consequent disposition of STACPUB nominated papers is as follows:

At its meetings since 1980, STACPUB has nominated a total of 737 research documents. This includes 46 documents nominated at the Symposium on "Deep-sea Fisheries" in September 2001. Since 1980, a total of 624 papers have been published in the Journal (312) and Studies (312).

In addition, 4 papers from outside of the STACPUB nomination process were submitted for the Journal since June 2001.

ii) Up-date since June 2001

A total of 22 papers were published or are in their final stage of galley preparation (9 in the Journal and 13 in Studies) since June 2001.

b) **Review of Contributions to the June 2002 Meeting**

All papers are available on web prior to the June Meeting. This item is no longer needed as a regular item on the STACPUB agenda.

9. **Funding of Future NAFO Symposia**

According to STACFAD budget funds for Symposia are to be used for invited speakers, co-conveners and incidental technical aspects of the symposium. STACPUB noted that social events are important for Symposia to further scientific exchange at an informal level. STACPUB **recommended** that *Secretariat ask the host country to fund a social event during the Elasmobranch symposium.*

10. **Other Matters**

a) **Highlights of Scientific Council Meeting**

Highlights from Scientific Council Meeting should be published on the website soon after the end of the NAFO June Scientific Council Meeting.

b) **Other Business**

There being no other business, 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: M. J. Morgan

Rapporteur: D. Cross

The Committee met at the Alderney Landing, 2 Ochterloney Street, Dartmouth, Nova Scotia, Canada, during 6-20 June 2002, 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), Japan, Norway, Russian Federation and United States of America. The Assistant Executive Secretary was in attendance.

1. Opening

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

2. Review of Recommendations in 2001

a) From the June 2001 Meeting

STACREC noted the recommendations would be addressed under the relevant Agenda items and reported appropriately below.

3. Fishery Statistics

a) Progress Report on Secretariat Activities in 2001/2002

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

The Assistant Executive Secretary outlined the status of the STATLANT data submissions for recent years. The following table shows the dates when STATLANT 21A and 21B submissions were received at the Secretariat through June 2002.

Publication of statistical information. STATLANT 21A data were used for the compilation of SCS Doc. 02/13 on "Historical Nominal Catches for Selected Stocks". In accordance with the recommendation of the Scientific Council to update reported catches, this document was expanded to include all stocks assessed by the Scientific Council. Data was updated to include data for 2001.

The STATLANT 21B data constitute the final catch and effort data for the compilation of the annual publication of *Statistical Bulletin*.

In accordance with the Scientific Council recommendation of 2001, *Statistical Bulletins* for the year 1995 to 1999 were completed in the same manner as the Bulletin for 1994 without complete data for the USA. The *Statistical Bulletin* Tables 1, 2 and 3 were compiled in the usual manner, and for USA, incomplete data were available to incorporate total catch by species (giving total catch by species with no breakdown by Division), however, Tables 4 and 5 excluded USA STATLANT 21B data which were not available.

Table 1. Dates of receipt of STATLANT 21A and 21B reports for 1999-2001 at the Secretariat up to June 2002.

Country/ Component	STATLANT 21A (deadline, 15 May)			STATLANT 21B (deadline, 30 June)		
	1999	2000	2001	1999	2000	2001
BGR*	-	-		-		
CAN-CA**	04 Jul 00	-	17 May 02	04 Jul 00	-	
CAN-M	12 May 00	17 May 01	15 May 02	12 Feb 00	14 Feb 02	
CAN-N	18 May 00	15 May 01	15 May 02	10 Dec 01	05 Mar 02	
CAN-Q	09 Jun 00	22 May 01	09 Apr 02	30 Apr 01	09 Apr 02	
CUB	01 Jun 00	31 May 01		01 Jun 00	31 May 01	
EST	03 May 00	08 May 01	30 Apr 02	03 May 00	27 Jun 01	
E/DNK	17 May 00	No fishing	14 May 02	29 Jun 00	No fishing	
E/FRA-M	No fishing	No fishing	No fishing	No fishing	No fishing	No fishing
E/DEU	04 May 00	10 May 01	No fishing	05 Jul 00	31 Aug 01	No fishing
E/NLD	No fishing	No fishing	No fishing	No fishing	No fishing	No fishing
E/PRT	16 May 00	14 May 01	15 May 02	23 Nov 01	04 Apr 02	
E/ESP	29 May 00	31 May 01	22 May 02	19 Sep 00	04 Apr 02	
E/GBR	No fishing	No fishing	No fishing	No fishing	No fishing	No fishing
FRO	07 Jun 01	07 Jun 01		07 Jun 01	07 Jun 01	
GRL	18 Aug 00	-		11 Dec 01		
ISL	26 May 00	04 Jan 02	23 May 02	02 Aug 00	14 Jan 02	23 May 02
JPN	11 Apr 00	11 Apr 01	21 May 02	11 Apr 00	11 Apr 01	21 May 02
KOR	-	-		-		
LVA	12 May 00	22 May 01	27 May 02	12 May 00	22 May 01	27 May 02
LTU	28 May 01	16 May 01		28 May 01	18 Apr 02	
NOR	09 May 00	28 May 01	13 Jun 02	21 Nov 01		
POL	21 Jun 00	15 Apr 02	24 May 02	06 Jul 00	15 Apr 02	
ROM*	-	-		-		
RUS	04 May 00	06 Jun 01	07 Jun 02	05 Jun 00	10 Sep 01	
USA	-	-		-		
FRA-SP	04 May 00	26 Jan 01	17 Apr 02	11 May 00	16 May 01	

* Note Bulgaria and Romania have not reported in recent years.

** Canada Central and Arctic 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 2000-2001. (N.B. Bulgaria and Romania have not reported in recent years and USA data from 1994- present are not available).

STATLANT 21A		STATLANT 21B	
2000	2001	2000	2001
Canada (Central & Arctic)	Cuba	Greenland	Canada (Maritimes)
Greenland	Faroe Islands	Korea	Canada (Newfoundland)
Korea	Greenland	Norway	Canada (Quebec)
	Korea		Canada (Central & Arctic)
	Lithuania		Cuba
			Estonia
			EU/Denmark
			EU/Netherlands
			EU/Portugal
			EU/Spain
			Faroe Islands
			Greenland
			Korea
			Lithuania
			Norway
			Poland
			Russia

ii) **Interagency data harmonization**

STACREC noted the Secretariat continued to review the need to harmonize NAFO data with other international publications of NAFO area data (e.g. by FAO). No new harmonization exercises were needed since June 2001.

b) **CWP Sessions 2002/2003**

i) **Report on the CWP Intersessional Meeting, Rome, 21-22 March 2002**

STACREC noted that in accordance with the Scientific Council recommendation of 2001 the Assistant Executive Secretary attended the CWP Intersessional Meeting held in Rome on 21-22 March 2002. The complete report of that meeting is presented in SCS Doc. 02/11.

ii) **CWP 20th Session, January 2003**

The NAFO Secretariat announced that the CWP 20th Session is scheduled to be held at the Headquarters of the Indian Ocean Tuna Commission (IOTC) in the Seychelles during 21-24 January 2003. STACREC drew attention to the draft agenda included in SCS Doc. 02/11 and requested members to provide any suggested changes or additional agenda items to the Assistant Executive Secretary to communicate to the CWP Secretary.

Continuing the usual practice, STACREC **recommended** that *the Assistant Executive Secretary attend the CWP 20th Session to be held in the Seychelles during 21-24 January 2003.*

STACREC further noted that both the STACREC Chair and the Assistant Executive Secretary make valuable contributions to the CWP sessions. The Assistant Executive Secretary brings continuity and an international focus while the STACREC Chair brings a focus on the needs of the Scientific Council. STACREC recognises that significant costs can be associated with attending the CWP sessions. These costs for the STACREC Chair should be covered by the standard NAFO budget. STACREC therefore **recommended** that *the Rules of Procedure of the Scientific Council be modified to include participation at CWP sessions in the functions of the Vice-Chair who is also the Chair of STACREC and that the Scientific Council Chair address the budgetary aspect of this to the Executive Secretary with respect to the attendance at the 20th CWP Session and subsequent sessions.*

STACREC noted that the Scientific Council invites the participation of representatives of any Contracting Party (at national expense) at the CWP 20th Session, and requested interested parties to contact the NAFO Secretariat.

c) **Reporting of Catch Statistics in Scientific Council Summary Sheets**

STACREC noted that some clarification was required between the officially reported STATLANT catch statistics and the data used in Scientific Council stock assessments and **recommended** that *STACFIS tables and the Scientific Council Summary Sheets should include both the catch data used by STACFIS in the stock assessments and the officially reported STATLANT 21A data.*

STACREC noted the usefulness of comparisons between catches used by STACFIS for assessment purposes and those officially report in STATLANT 21A. It was agreed that the Secretariat would produce such a comparison (example SCS Doc. 01/5) periodically, ideally every 3 years.

4. **Research Activities**

a) **Biological sampling**

i) **Report on activities in 2001/2002**

STACREC noted and reviewed the listings of Biological Sampling Data prepared by the NAFO Secretariat. These listings (SCS Doc. 02/8) include biological sampling data for 2001 reported to the Secretariat prior to the present meeting.

ii) **Report by National Representatives on commercial sampling conducted**

Canada: Data on catch rates and length composition were obtained from trawl, longline, gillnet, trap, seine and dredge catches for cod (Div. 3K, 3L, 3N, 3NO, 3O, 4R, 4S, Subdiv. 3Ps, 3Pn), Pollock (Subdiv. 3Ps), white hake (Div. 3O, Subdiv. 3Ps), redfish (Div. 3O, 4R, 4W, Subdiv. 3Ps, 4Vn, 4Vs), Greenland halibut (Div. 0A, 0B, 2J, 3K, 3KL, 3L, 4R, 4S, 4T, Subdiv. 3Ps), American plaice (Div. 3K, 3L, 3N, 3NO, 3O, Subdiv. 3Ps), yellowtail flounder (Div. 3L, 3N, 3O), witch flounder (Div. 2J, 3K, 3L, Subdiv. 3Ps), winter flounder (Div. 3L, Subdiv. 3Ps), Atlantic halibut (Div. 4R, 4S, 4T), lumpfish (Subdiv. 3Ps), Atlantic herring, Div. 4R, 4S), Atlantic mackerel (Div. 4R, 4S, 4W, 4X, Subdiv. 4Vn), capelin (Div. 4R), surf clam (Div. 4S, 4T), clams (NS) (Div. 4S, 4T), sea scallop (Div. 4S, 4T), whelks (Div. 4S, 4T), Atlantic rock crab (Div. 4S, 4T), queen crab (Div. 4S, 4T), American lobster (Div. 4S, 4T), pink (pandalid) shrimps (Div. 2J, 3K, 3L, 3N, 3O, 4R, 4S, 4T), and sea urchins (Div. 4T). Details on commercial samplings from the 2001 fisheries were reported in SCS Doc. 02/8.

EU-Spain: Data on length and age composition of the trawl and pair trawl catches were obtained for Greenland halibut (Div. 3LMNO) and roughhead grenadier (Div. 3LMN). Data on length composition of the pair trawl catches were obtained for redfish (Div. 3LM). Data on length composition of the trawl catches were obtained for witch flounder (Div. 3LMNO), American plaice (Div. 3LNO), yellowtail flounder (Div. 3N), cod (Div. 3NO), skate (Div. 3LMN) and redfish (Div. 3LMNO). Information can be found in SCS Doc. 02/7.

EU-Portugal (NAFO SCS Doc 02/6): Data on catch rates and length composition was obtained from trawl catches for Greenland halibut (Div. 3LMNO). Data on length and age composition of the catch were obtained for cod (Div. 3M), redfish (Div. 3M) and American plaice (Div. 3M). Data on length composition of the catch were obtained for cod (Div. 3LNO), redfish (Div. 3LNO), American plaice (Div. 3LNO), yellowtail flounder (Div. 3NO), roughhead grenadier (Div. 3LMN), witch flounder (Div. 3LMNO) and red hake (Div. 3NO).

Greenland. CPUE based on logbook data were available from the fishery for Greenland halibut. Length and age composition were available from the inshore fishery for Greenland halibut.

Russia. Data on catch rates, length and age composition were taken from longline and trawl catches of Greenland halibut in Div. 1D. Data on catch rates and length, age composition from pelagic trawl catches of redfish in Div. 1F, 2J were available either. Data on catch rates, length, age composition, maturity were obtained from trawl catches of Greenland halibut (Div. 3LMNO), redfish (Div. 3LMNO), roughhead grenadier (Div. 3LMO), American plaice (Div. 3LMNO), witch flounder (Div. 3LMNO), yellowtail flounder (Div. 3LMNO), cod (Div. 3LMNO), red hake (Div. 3LM), white hake (Div. 3O), thorny skate (Div. 3LMNO), black dogfish (Div. 3L).

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

Available data from commercial fisheries relevant for stock assessment on a stock-by-stock basis were prepared from inputs from Designated Experts

Table 3. Available data from the commercial fisheries related to stock assessment (2001). (+ is data available).

Stock	Country ¹	Biological Sampling						
		Catch	CPUE	Sex	Length	Age	Individual Wt.	Maturity
2J3KL Cod	CAN	+	+	+	+	+	+	+
	EU/PRT	+			+			
	RUS	+			+	+		
3M Cod	RUS	+			+			

Table 3. Continued.

Stock	Biological Sampling							
	Country ¹	Catch	CPUE	Sex	Length	Age	Individual Wt.	Maturity
3NO Cod	CAN	+	+	+	+	+	+	+
	EU/PRT	+			+			
	EU/ESP	+			+			
	RUS	+			+	+		
SA 1 Redfish	GRL	No						
Div. 3M Redfish	EU/PRT	+	+	+	+	+		
	EU/ESP	+			+			
	RUS	+		+	+	+	+	+
	EST	+						
	LAT	+						
	POL	+						
	JPN	+						
3LN Redfish	CAN(N)	+		+	+			
	EST	+						
	JPN	+						
	EU/PRT	+			+	+		
	EU/ESP	+	+		+	+		
	RUS	+			+	+		
3M American plaice	EU/PRT	+		+	+	+		
	EU/ESP	+						
	RUS	+		+	+			
	JPN	+						
3LNO American Plaice	CAN	+		+	+	+		
	EU/ESP	+		+	+			
	EU/PRT	+		+	+			
	LTU	+						
	POL	+						
	EST	+						
	JPA	+						
3NO Witch flounder	CAN	+						
	EU/ESP	+		+	+			
	EU-PRT	+		+	+			
	RUS	+						
3LNO Yellow-tail flounder	CAN	+	+	+	+			
	RUS	+			+			
	EU/SP	+			+			
	EU/POR	+			+			
SA 0 + 1B-F Greenland halibut	CAN	+	+	+	+	+		
	EU/GER	+	+					
	GRL	+	+					
	RUS	+	+	+	+	+		
SA 1A inshore Greenland halibut	GRL	+	+	+	+	+	+	+

Table 3. Continued.

Stock	Country ¹	Biological Sampling						
		Catch	CPUE	Sex	Length	Age	Individual Wt.	Maturity
SA 2+3 Green-land halibut	CAN	+	+	+	+	+	+	
	EU/ESP	+		+	+	+		
	EU/PRT	+	+	+	+			
	RUS	+		+	+	+		
	JPN	+						
	EST	+						
	LTU	+						
	LVA	+						
	POL	+						
	ICL	+						
SA 0+1 Roundnose Grenadier	GRL	+						
	RUS	+						
	EU/GER	+						
SA 2+3 Roundnose grenadier	Not reviewed in 2002							
SA 2+3 Roughhead Grenadier	EU/ESP	+		+	+	+	+	+
	EU/PRT	+	+		+			
	RUS	+		+				
3NO Capelin	No data available							
SA 3+4 Squid	CAN	+			+			
SA 1 Other Finfish	GRL				No data available			
	RUS	+		+	+			
3LN Shrimp	to be provided at the November 2002 Meeting of the Scientific Council							
3M Shrimp	to be provided at the November 2002 Meeting of the Scientific Council.							
SA 0+1 Shrimp	to be provided at the November 2002 Meeting of the Scientific Council.							
Denmark Strait Shrimp	to be provided at the November 2002 Meeting of the Scientific Council.							

¹ Country abbreviations as found in *Statistical Bulletin*; 'OTHER' and 'NCP' refer to estimates of non-Contracting Parties who did not report catches to NAFO.

b) Biological surveys

i) Review of survey activities in 2001 (by National Representatives and Designated Experts)

An inventory of biological surveys conducted in 2001 as submitted by National Representatives and Designated Experts was prepared by the Secretariat.

Table 4. Inventory of biological surveys conducted in the NAFO Area in 2001

Subarea	Division	Country ¹	Month	Type of survey	No. of sets
Stratified-random Surveys					
0	0A	CAN-CA	9	Groundfish Assessment	48
0	0B	CAN-CA	10	Groundfish Assessment	36
1	1A	GRL	5-6	Snow crab inshore	40 (12)
1	1B	GRL	5-6	Snow crab inshore	56(12)
1	A-F	GRL	7-9	Shrimp and groundfish trawl	234
1	C-D	GRL	9-10	Greenland halibut deep-sea trawl	42
1	A-B	GRL	9-10	Greenland halibut deep-sea trawl	79
2+3	HJKLMNO	CAN-N	10-12	Multispecies survey	764
3	LM	RUS	3,4,7,12	Trawl selectivity	131
3	LNO	CAN-N	5-6	Multispecies Survey	311
3	NO	EU-ESP	5	Groundfish	225 (92)
3	M	EU-ESP/PRT	7	Groundfish	120
3	M	FAR	6	Northern shrimp trawl survey	61
3	M	RUS	5-6	Multi-species trawl survey	90
3	Ps	CAN-N	4-5	Multi-species trawl survey	174
3+4	PnRST	CAN-Q	8	Summer multidisciplinary survey in the Estuary & Gulf of St. Lawrence	242
4	X	USA	4	Spring bottom trawl	17
4	X	USA	4	Ecosystems monitoring	8
4	X	USA	7	Harbor porpoise aerial survey	-
4	X	USA	7	Harbor porpoise aerial survey	-
5	Y,Z	USA	7	Harbor porpoise aerial survey aerial photogrammetry survey	-
4	X	USA	10	Autumn bottom trawl	16
4	X	USA	10	Ecosystems monitoring	9
5	YZ	USA	2	Winter bottom trawl	80
5	YZ	USA	2	Ecosystems monitoring	30
5	YZ	USA	3,4	Spring bottom trawl	169
5	YZ	USA	4	Ecosystems monitoring	56
5	YZ	USA	7	Harbor porpoise aerial survey	-
5	YZ	USA	7,8	Northern shrimp	57
5	YZ	USA	9,10	Autumn bottom trawl	164
5	YZ	USA	10	Ecosystems monitoring	65
5	Z	USA	7,8	Sea scallops	320
6	ABC	USA	1,2	Winter bottom trawl	95
6	ABC	USA	2	Ecosystems monitoring	43
6	ABC	USA	2,3	Spring bottom trawl	139
6	ABC	USA	3	Ecosystems monitoring	43
6	ABC	USA	6,7	Sea scallops	233
6	ABC	USA	9	Autumn bottom trawl	105
6	ABC	USA	9	Ecosystems monitoring	44
Other Surveys					
1	A	GRL	7-8	Longline and gillnet, inshore Greenland halibut	14
1	D-E	GRL	8,9	Snow crab, off shore	40(12)
1	D-F	GRL	6-7	Gillnets, inshore juvenile cod	6
3	K	CAN-N	9	White Bay/Notre Dame Bay snow crab trawl/trap survey	-
3	KL	CAN-N	5	Capelin Distribution & Abundance	-
3	KLNO	CAN-N	11	Physical/Biological Oceanography	-
3	L	CAN-N	1	Cod habitat and acoustics	-
3	L	CAN-N	1	Overwintering acoustic survey	-
3	L	CAN-N	5-6	Avalon snow crab trawl/trap survey	-
3	L	CAN-N	5-6	Inshore cod acoustics survey	-
3	L	CAN-N	5	Sediment/Zooplankton	-
3	L	CAN-N	7-8	Bonavista Bay snow crab trawl/trap survey	-

Table 4. Continued.

Subarea	Division	Country ¹	Month	Type of survey	No. of sets
Other Surveys					
3	L	CAN-N	7	Fish/Seabird Interactions	-
3	L	CAN-N	7	Predator/Prey Interactions	-
3	L	CAN-N	9-10	Conception Bay snow crab trawl/trap survey	-
3	LMNO	CAN-N	4	Physical & Biological Oceanography	-
3	Ps	CAN-N	11	Cod Tagging/tagging mortality	-
3	Ps	CAN-N	4	Cod Tagging	-
3	Ps	CAN-N	4	Inshore cod tagging	-
3	Ps	CAN-N	4	Cod Acoustic Survey	-
3	Ps	CAN-N	4	Inshore pre-spawning cod trawl/acoustics survey	-
3	Ps	CAN-N	6	Inshore cod tagging	-
4	R	CAN-N	5	Scallops	-
4	S	CAN-Q	5-10	Evaluation of the shelly potential at the Mingan river mouth	103
4	S	CAN-Q	5-6	Growth and natural mortality of the Iceland scallop off the Middle North Shore	50
4	S	CAN-Q	5	Population dynamics of snow crab in Sainte-Marguerite bay	54
4	S	CAN-Q	7	Sampling of juvenile cods	-
4	S	CAN-Q	8	Evaluation of the shelly potential of the clams off Magdalen Islands	98
4	ST	CAN-Q	9	Zooplankton biomass assessment in the Estuary & Gulf of St. Lawrence	46
4	ST	CAN-Q	4	Sampling of egg-bearing female shrimps in the Estuary & the Gulf of St. Lawrence	-
4	ST	CAN-Q	6	Northern shrimp recruitment	70
4	ST	CAN-Q	7-8	Snow crab res. survey in the Estuary & northeastern Gulf of St. Lawrence	-
4	T	CAN-Q	2	Sampling of young grey seals	-
4	T	CAN-Q	3	Harp & hooded seal monitoring	-
4	T	CAN-Q	4	Evaluation of the growth of the Northern shrimp	17
4	T	CAN-Q	4-5	Fecundity study of the copepod <i>Temora longicornis</i>	-
4	T	CAN-Q	5	Inter-annual variations of the larvae production by redfish females	18
4	T	CAN-Q	5-10	Sampling of clams & urchins	-
4	T	CAN-Q	6	Diving sampling of benthic organisms	-
4	T	CAN-Q	6	Monitoring of the planktonic comm..unities (zoo & phyto) & the marine environment in the Laurentian Channel off Rimouski	65
4	T	CAN-Q	6-7	Sampling of alive cods	-
4	T	CAN-Q	8	Distribution, abundance & biology of scallop off Magdalen Islands	38
4	T	CAN-Q	8	Diving sampling of benthic organisms.	-
4	T	CAN-Q	8	Evaluation of the growth of the Northern shrimp	18
4	T	CAN-Q	8	Sampling of juvenile snow crabs	-
4	T	CAN-Q	8-9	Development of an abundance index for the rock crab off Magdalen Islands.	-
4	T	CAN-Q	9	Abundance assessment of the lobster off Magdalen Islands	74
4	T	CAN-Q	9	Abundance assessment of the lobster off Magdalen Islands	-
4	T	CAN-Q	9	Sampling of alive cods	-
4	T	CAN-Q	9-10	Assessment of the common whelk stock status on the North shore of the St.Lawrence Estuary	50
4	T	CAN-Q	10	Evaluation of the growth of the Northern shrimp	18
4	T	CAN-Q	10	Nutritional condition of the snow crab	8
4	VsWX	CAN-M	1	Pollock Hydroacoustics	-
4	X	USA	11	Ecosystems monitoring	7
4	X	USA	2	CMER-GLOBEC Plankton Study	-
4	X	USA	3-7	North Atlantic right whale aerial surveys	-
4	X	USA	6	Ecosystems monitoring	13

Table 4. Continued.

Subarea	Division	Country ¹	Month	Type of survey	No. of sets
Other Surveys					
4	X	USA	7-8	North Atlantic right whale Bay of Fundy vessel surveys	-
4	X	USA	7,8	Northern right whale	-
4	X	USA	8	Ecosystems monitoring	11
4	X	USA	8	North Atlantic right whale Bay of Fundy	-
4	X	USA	8	North Atlantic right whale Bay of Fundy aerial photogrammetry survey	-
5	YZ	USA	11	Ecosystems monitoring	13
5	YZ	USA	3	North Atlantic right whale aerial surveys	-
5	YZ	USA	5,6	Ecosystems monitoring	48
5	Y	USA	7,8	Northern right whale	-
5	YZ	USA	8	Ecosystems monitoring	47
5	YZ	USA	9,10	Atl. Herring Hydroacoustic survey	-
5	Z	USA	11	Benthic Habitat	-
5	Z	USA	11,12	Deepwater Systematics	-
5	Z	USA	3,4	Trawl survey calibration	150
5	Z	USA	6	Benthic Habitat	-
6	A	USA	3,4	Trawl survey calibration	33
6	ABC	USA	10,11	Ecosystems monitoring	41
6	ABC	USA	5	Ecosystems monitoring	41

¹ Country abbreviations as per *Statistical Bulletin*.

ii) Surveys planned for 2002 and early-2003

An inventory of biological surveys planned for 2002 and early-2003 as submitted by National Representatives and Designated Experts was prepared by the Secretariat.

Table 5. Biological surveys planned for the NAFO Area in 2002 and early-2003.

Area/Div.	Country ¹	Type of Survey	Dates
Stratified-random Surveys			
1A	GRL	Snow crab inshore	6 May
1A-F	GRL	Shrimp and groundfish trawl	Jul-Sep
1B	GRL	Snow crab inshore	6 May
1B	EU-FRG	Groundfish	Oct
1C	EU-FRG	Groundfish	Nov
1C-D	GRL	Greenland halibut deep-sea trawl	Sep-Oct
1D	EU-FRG	Groundfish	Nov
1E	EU-FRG	Groundfish	Nov
1F	EU-FRG	Groundfish	Oct
2J+3KLMNO	CAN-N	Multi-species trawl survey	5 Oct-9 Dec
3LNO	CAN-N	Multi-species trawl survey	8 May-23 Jun
3M	EU-ESP/PRT	Groundfish	July
3M	FAR	Northern shrimp trawl survey	Jun
3M	RUS	Multi-species trawl survey	Jun
3NO	EU-ESP	Groundfish	May
3OP+4V	CAN-N	Redfish survey	29 Jul-16 Aug
3Ps	CAN-N	Multi-species trawl survey	5 Apr-3 May
3Pn+4RST	Can-Q	Summer multidisciplinary survey in the Estuary and Gulf of St. Lawrence	3 Aug-2 Sep
4X+5YZ	USA	Harbor porpoise aerial survey	26 Jul- 16 Aug
4X+5YZ	USA	Ecosystems monitoring	22 Jan- 1 Feb

Table 5. Continued

Area/Div.	Country ¹	Type of Survey	Dates
Stratified-random Surveys			
4X+5YZ	USA	North Atlantic right whale aerial survey	15 Mar-15 Jul
4X+5YZ+6ABC	USA	Spring bottom trawl	4 Mar- 26 Apr
4X+5YZ+6ABC	USA	Ecosystems monitoring	21 May -7 Jun
4X+5YZ+6ABC	USA	Ecosystems monitoring	13-30 Aug
4X+5YZ+6ABC	USA	Autumn bottom trawl	3 Sep-26 Oct
4X+5YZ+6ABC	USA	Spring bottom trawl	3 Mar-25 Apr , 2003
4X+5YZ+6ABC	USA	Ecosystems monitoring	28 Oct- 15 Nov
5YZ	USA	Northern shrimp	22 Jul-3 Aug
5Z+6ABC	USA	Winter bottom trawl	4 Feb-2 Mar
5Z+6ABC	USA	Surf clam/ocean quahog	3 Jun-12 Jul
5Z+6ABC	USA	Sea scallop survey	15 Jul-16 Aug
5Z+6ABC	USA	Winter bottom trawl	3 Feb-1 Mar, 2003
6BC	USA	Apex predators	7 Apr-23 May, 2003
Other Surveys			
1A	GRL	Longline and gillnet, inshore Greenland halibut	Jul-Aug
1B-F	GRL	Gillnets, inshore juvenile cod	Jun-Jul
1D-E	GRL	Snow crab, off shore	Aug-Sep
3KL	CAN-N	Capelin acoustic/trawl survey	6-25 May
3KL	CAN-N	Cod Acoustics	10-23 Jun
3KL	CAN-N	Capelin Larvae	16-30 Sep
3KL	CAN-N	Capelin Larvae	16-25 Nov
3KLNO	CAN-N	Oceanography	1-28 Jul
3KLNO	CAN-N	Oceanography	12-26 Nov
3L	CAN-N	Avalon snow crab trawl/trap survey	22 May-8 Jun
3L	CAN-N	Bonavista Bay snow crab trap/trawl survey	29 Jul- 10 Aug
3L	CAN-N	Conception Bay snow crab trap/trawl survey	31 Aug- 15 Sep
3L	CAN-N	Conception Bay snow crab trap/trawl survey	1-11 Oct
3L	CAN-N	Cod Population Dynamics	26 Nov-14 Dec
3L	CAN-N	Cod Population Dynamics	8-26 Jan
3L	CAN-N	Bonavista Bay cod habitat and acoustics	8-17 Jan
3LMNO	CAN-N	Physical and biological oceanographic survey	20 Apr-5 May
3LMNO	CAN-N	Bio-physical Survey: Egg Production survey	26 May - 9 Jun
3LMNO	RUS	Trawl Selectivity	Apr, May, Jul, Dec
3Ps	CAN-N	Cod tagging	1-9 Apr
3Ps	CAN-N	Inshore cod tagging	25 Apr- 10 May
3Ps	CAN-N	Inshore cod tagging	10-24 Jun
3Pn,Ps+4RST	CAN-Q	Cod stock mixing survey (3Pn, 4RS and 3Ps)	14-24 Jan
3Pn,Ps+4RST	CAN-Q	Cod stock mixing survey (3Pn, 4RS and 3Ps)	4-15 Mar
3Pn+4R	CAN-Q	Cod spawning survey (3Pn, 4R)	29 Apr-29 May
4R	CAN-N	Scallops	24 Jun-3 Jul
4R	CAN-Q	Newfoundland West Coast herring acoustic survey	Oct-Nov
4R	CAN-Q	Newfoundland West Coast herring trawling survey	Oct-Nov
4RST	CAN-Q	Sampling of egg-bearing female shrimps in the Estuary and the Gulf of St. Lawrence	5-15 May
4S	CAN-Q	Population dynamics of snow crab in Sainte-Marguerite bay	20 Apr-13 May
4S	CAN-Q	Survival and growth of the Iceland scallop in Minganie	20-25 May
4S	CAN-Q	Scallop assessment - Mingan Archipelago.	23 May -4 Jun
4S	CAN-Q	Population dynamics of snow crab	18-28 Jun
4ST	CAN-Q	Recruitment of the Northern shrimp	5-17 Jun
4T	CAN-Q	Validation of the data gathered during the winter sportfishing in the Saguenay Fjord	1-13 Apr
4T	CAN-Q	Evaluation of the growth of the Northern shrimp	15-20 Apr

Table 5. Continued

Area/Div.	Country ¹	Type of Survey	Dates
Other Surveys			
4T	CAN-Q	Abundance and distribution of the Greenland halibut in the St. Lawrence Estuary	15-22 May
4T	CAN-Q	Development of an egg production index for the rock crab	1-15 May
4T	CAN-Q	Sampling of alive cods.	29 Jun-10 Jul
4T	CAN-Q	Snow crab research survey in the St. Lawrence Estuary	11 Jul-6 Aug
4T	CAN-Q	Evaluation of the Northern shrimp growth	7-13 Aug
4T	CAN-Q	Mackerel egg sampling survey	14-29 Jun 4T
	CAN-Q	Characterization of the scallop stocking sites in Magdalen Islands	25 Aug-3 Sep
4T	CAN-Q	Lobster assessment - Magdalen Islands	4-15 Sep
4T	CAN-Q	Scallop assessment - Chaleur Bay	18-30 Sep
4T	CAN-Q	Sampling of alive snow crabs	21-30 Oct
4T	CAN-Q	Prerecruitment of the Northern shrimp	31 Oct-8 Nov
4WX+5YZ	USA	Scotian Shelf humpback whale photo-ID surveys	5-28 Aug
4X	USA	North Atlantic right whale aerial photogrammetry survey	18 Aug -7 Sep
4X+5YZ	USA	Atlantic herring hydroacoustic	3 Sep-11 Oct
4X+5YZ	USA	Ecosystems monitoring	22-30 Jan, 2003
4X+5YZ	USA	North Atlantic right whale Gulf of Maine vessel surveys	29 Apr-17 May
4X+5Z	USA	Trawl survey calibration	1-26 Apr
4X+5Z	USA	Trawl survey calibration	15-25 Oct
5Z	USA	Gear testing	14-18 Jan
5Z	USA	Clam Dredge Calibration	20-31 May
5Z	USA	Benthic habitat	14-25 Oct
5Z+6ABC	USA	Sm. pelagics hydroacoustic	20 Feb-8 Mar
5Z+6ABC	USA	Sperm whale feeding habits & deepwater systematics	15 Jul-2 Aug
5Z+6ABC	USA	Benthic habitat	19-30 Aug
5Z+6ABC	USA	Sm. pelagics hydroacoustic	13-31 Jan, 2003
6BC	USA	Mid-Atlantic humpback Whale photo-ID surveys	12-29 Mar

¹ Country abbreviations as per *Statistical Bulletin*.

iii) Northwest Atlantic Survey Database

The virtual data centre developed by the Bedford Institute of Oceanography (BIO) was presented to STACREC at the June 2001 meeting and STACREC discussed the rationale for the development of a comprehensive North Atlantic Trawl Survey database. At that time representatives were asked to provide information on progress in their home institutes to STACREC in June 2002. STACREC noted that formal arrangements have developed between the BIO and the Northeast Fisheries Science Center, Woods Hole, Massachusetts (USA). A letter of intent has been submitted by these institutes to implement international standard network services for Canadian and USA research trawl databases.

BIO will initiate development of procedures to create metadata and datasets according to ANSI/NISO Z39.50 standards. Initially, BIO will develop and serve distribution and abundance data for 99 species presently displayed on the ECNASAP website, and ultimately, it is planned that data for over 400 species will be included.

Initiatives are also under development at the Northwest Atlantic Fisheries Centre, St. John's, Newfoundland (Canada) to eventually allow incorporation of survey data from the Grand Banks and

Labrador Shelf into the virtual data centre. Participants were asked again to check with their institutes on interest in this database to inform STACREC of any developments.

5. NAFO Observer Protocol

In 1996 a Pilot Observer Program was implemented with a requirement for 100% coverage on vessels fishing in the NAFO Regulatory Area. In 1999, STACTIC requested Scientific Council (STACREC) to define scientific requirements for the Pilot Observer Program in a harmonized format. An *ad hoc* Working Group of Scientific Council on Observer Data Harmonization worked inter-sessionally to prepare draft collection forms and associated documentation. The result, a series of 4 forms based on a harmonization of existing formats was presented to STACTIC in September 1999 (STACTIC WP 99/12). These forms were designed to capture the basic information as required for assessing removals from stocks in the regulatory area.

STACTIC subsequently requested that Scientific Council produce a data description (codes, variable definitions) for the forms presented to STACTIC in September 1999. As a result Scientific Council produced SCS Doc. 00/23. This document outlines the data required by Scientific Council from the observer program, along with protocols for collecting and recording this data. During the 22nd Annual Meeting, September 2000, STACTIC accepted SCS Doc. 00/23. During that same meeting, based on a recommendation by STACTIC, the Fisheries Commission adopted the Scientific Council protocols contained in SCS Doc. 00/23 specifying a harmonized data system and this decision is recorded in the Meeting Proceedings of the Fisheries Commission for 2000 (Part I, Item 3.24, page 284). Pursuant to this decision, the Secretariat contacted Contracting Parties, requesting them to ensure that data collected by observers on board vessels fishing in the NAFO Regulatory Area are recorded in accordance with the recommended forms and formats developed by the Scientific Council. Despite this clear direction from the Fisheries Commission and the Secretariat, the contents of SCS Doc. 00/23 have not yet been fully implemented.

SCS Doc. 00/23 provides a detailed description of the data requirements of Scientific Council from the Observer Program. Consequently STACREC does not foresee any changes to the protocols described in this document. The data collected by the Observer Program are of extreme importance to Scientific Council in addressing requests from the Fisheries Commission and Coastal States, as well as in the completion of stock assessments. Many of the recent requests to Scientific Council have required the analyses of set-by-set information on catch and set position. Without these data Scientific Council cannot adequately address many of the requests that it regularly receives.

STACREC was extremely disappointed in the lack of progress on this issue. STACREC notes that the steps needed to fully implement SCS Doc. 00/23 and make the data available to Scientific Council in a useable format are clear.

STACREC **recommended** that *the Conservation and Enforcement Measures Part VI, Program for Observers and Satellite Tracking, be amended to formally incorporate the Scientific Council protocols as specified in NAFO SCS Doc. 00/23 and as adopted by the Fisheries Commission in September 2000. Specifically, that Section 3.d of the Conservation and Enforcement Measures Part VI, Program for Observers and Satellite Tracking be amended to be consistent with the requirements of SCS Doc.00/23 in that set-by-set information shall be available to any Contracting Party that requests it.*

STACREC **recommended** that *the development of a training and operation manual for the collection of scientific data in the Program for Observers and Satellite Tracking continue, and that the Scientific Council be represented at the September 2002 STACTIC meeting to further pursue this issue.*

STACREC recognizes that the development of harmonized data collection forms and protocols, while important, is only the first step. For this information to be usable, it must be available in the form of a properly structured relational database including input, storage and output elements to accommodate the data elements, and the resources to support such a system be made available on an ongoing basis. The database should be structured with the appropriate links and should provide timely access of the information to users. It was noted that without the data available in such an electronic format that it will not be possible for Scientific Council to respond to any requests requiring the analyses of Observer data.

Noting that a suitable observer database structure has been designed by Canada, STACREC **recommended** that *the Observer Program Access database developed by Canada be adapted by the NAFO Secretariat to capture data collected under the NAFO Program for Observers and Satellite Tracking, with highest priority given to inclusion of current data and secondary priority given to capturing the historic data.* STACREC further **recommended** that *the Secretariat conduct a trial converting 2002 fishery data from the Observer Program to the Access electronic database with a view to establishing a budget for further conversion of observer data.*

6. Review of SCR and SCS Documents

STACREC reviewed 13 SCR and SCS documents as summarised below.

- a) A comparative analysis of recruitment dynamics of nine commercial populations and water temperature in the Northwest Atlantic (NAFO Subareas 2-4) has been carried out (SCR Doc. 02/01). The research shows that recruitment abundance of cod in Div. 2J+3KL, 3NO, 4VsW, American plaice in Div. 3LNO, haddock in Div. 4TVW, Pollock in Div. 4VWX+5Zc and silver hake in Div. 4VWX decreased during strong cooling while that of Greenland halibut in Div. 2J+3KLMNO and yellowtail flounder in Div. 3LNO increased. The data obtained led to the view that the reason for the reliable correlation between recruitment dynamics of stock units under consideration was their identical (or opposite) reaction to interannual fluctuations of water temperature. An attempt was made to forecast trends of fishable and spawning biomass dynamics of respective populations during the first decade of the 21st Century.
- b) In 2002 the new R/V *Vizconde de Eza* (using Campelen 1800 gear) replaced the C/V *Playa de Mendiña* (using Pedreira gear) in the Div. 3NO Spanish spring bottom trawl survey carried out since 1995 (SCR Doc. 02/5). Thus, in May 2001 comparative fishing was conducted between the two vessels in order to transform the series of the indices previously obtained by the old vessel. The main conclusion of this comparative fishing was that the Campelen is, in general, less efficient than the Pedreira except when it applies to short lengths. Pedreira catches were in the order of four times greater than for Campelen catches, in line with the results of the comparative experiments performed between the C/V *Playa de Mendiña* and the R/V *Wilfred Templeman* in 2000-2001. The transformed series had a similar trend to the original series for the two species analysed, although an important decrease was noted in the catches in the new series. In forthcoming years, it is expected to use converted times series so the survey historical abundance values will decrease. Conversely, an increase in recruitment is anticipated because the Campelen catches a great number of short lengths. This may accentuate the increase in recruitment already detected by the Pedreira, particularly in the case of American plaice.
- c) The results of recent Russian investigations and the fishery for thorny skate were presented (SCR Doc. 02/11). The international catch of this species has increased in recent years due to the activities of the commercial fleets of EU-Spain, EU-Portugal, Russia and Canada. The Russian directed fishery for thorny skate was carried out mainly in Div. 3NO at a depth of 40-80 m. Catches consisted of fish 25-92 cm long with mature individuals of 32-60 cm predominating.
- d) Data on by-catches of snow crab *Chionocetes opilio* taken during the Russian bottom trawl fishery directed to skates and redfish in 2001 were presented (SCR Doc. 02/14). Snow crabs were observed on the southern slope of Grand Bank at depth range of 46-560 m. All crabs taken were males with 62-138 mm carapace width, 85% had the size of more than 110 mm. The traumatism of snow crabs reached 49% in Div. 3N and 42% in Div. 3O.
- e) The information on roughhead grenadier population structure recorded during the last 11 EU surveys (1991-2001) on Flemish Cap was presented (SCR Doc. 02/18). Total biomass of roughhead grenadier estimated by the swept area method increased from 1989 to 1993. Since then the biomass has decreased steadily up to 2000, in 2001 total biomass increased reaching the second highest level of 2 473 tons in the period studied. Age and length composition of the catches showed clear differences between the two sexes. The importance of males in the catch declined in larger fish, disappearing from the catch in the largest length classes. There were sexual differences in growth: mean length at age was similar for males and females for ages under 9 years but males grew slower from this length onwards. In addition, sex-ratios, length-weight relationship, and mortality estimates from catch curves are presented.

- f) Comparative otolith-based age readings of pelagic redfish (*Sebastes mentella*) from the Irminger Sea were presented (SCR Doc. 02/26) for an otolith exchange program between institutes in Germany, Iceland and Norway. 213 otoliths were thin-sectioned and read independently in the participating labs. Age reading results were compared between readers in terms of bias and precision, using a set of statistical tests and graphical methods. Significant bias was observed between readers, mainly caused by deviations between age scores in the higher ages (>20 years). Precision estimates, considering the high longevity of *S. mentella*, were relatively good compared to age readings of other long-lived species. In contrast, the age dependent percent agreement was poor (<20%) for a tolerance level of ± 0 years, particularly for the age range 21-40 years, which represents the major fraction of the fished stock. A tolerance level of ± 5 years, however, led to around 90% agreement for the age ranges up to 20 years. The fit of age reading scores with the von-Bertalanffy growth curve was relatively good, showing good correspondence between readers. A comparison of growth parameters with age-length relationships reported for demersal *S. mentella* in shelf areas in the Northeast Arctic, around Greenland and on the Flemish Cap showed that pelagic *S. mentella* generally exhibits slower growth. In the age range up to 10 years, however, relatively large fast-growing juveniles seemed to be present, probably having recruited from the higher productive shelf areas off East Greenland and Iceland. The observed problems in bias and precision of age readings should to be improved by continuing with similar *Sebastes* otolith exchange programs and setting up a further age reading workshop to harmonise the interpretation of growth structures.
- g) Russian results on the study of bottom trawl bags 130, 145 and 150 mm selectivity in relation to Greenland halibut in NAFO Regulatory Area were presented (SCR Doc. 02/29). The analysis of available data has shown that increasing the mesh size from 130 to 150 mm in trawls in Div. 3LMNO will not give the essential long-time financial profits, and the existing length composition of Greenland halibut if fished out will lead to the cessation of fishing by trawls due economic considerations. The minimum landing size of Greenland halibut can be increased to 34 cm. Such an increase in the minimum landing size would reduce fishing pressure of juvenile fish.
- h) The Northwest Atlantic Fisheries Centre conducts annual bottom trawl surveys with the *CCGS Wilfred Templeman* and the *CCGS Teleost* using the Campelen 1800 shrimp trawl. Standardization protocol has been adopted to minimize the uncertainty in estimates of abundance that could be associated with variations in trawl construction and fishing practices. Trawl performance data are recorded for all fishing sets during the surveys using SCANMAR acoustic trawl instrumentation. An analysis of the performance of the Campelen 1800 during the 2001 annual autumn survey of Div. 2J+3KLMNO and spring survey of Subdiv. 3Ps and Div. 3LNO was undertaken (SCR Doc. 02/32). There was a statistical difference in survey gear performance between research vessels and between surveys conducted with the same research vessel in different years. Some of this difference may be explained by differences in mean depth fished and bottom type. Other differences in fishing power between research vessels can be explained by comparing the physical characteristics of the three research vessels i.e. displacement, horsepower and deck layout.
- i) A preliminary analysis of otolith shape of pelagic redfish (*Sebastes mentella*) in the Irminger Sea, comparing NAFO and NEAFC Convention areas and depth layers (shallower and deeper than 500 m) was presented (SCR Doc. 02/35). Elliptical Fourier Analysis (EFA) was applied to describe digitized otolith outlines. The resulting Fourier descriptors were used as the basis for discriminant analysis to investigate separation success between area/depth groups. In general, differences in univariate measurements (otolith length, breadth and weight) and otolith shapes between area/depth groups were marginal and subject to high variation. Discriminant analysis indicated poor separation between area/depth groups. Differences in average shapes between the area/depth groups were relatively low. Based on this morphometric study, the existence of separate stocks of *S. mentella* in the Irminger Sea seems to be unlikely, neither on a vertical (depth) nor horizontal scale (NAFO/NEAFC areas).
- j) Information of most of fish species on Flemish Cap was presented (SCR Doc. 02/72) based on the results of the EU surveys in July from 1988 to 2001. It includes: annual abundance and biomass estimates, bathymetric distribution, length distribution, age composition (when available), and length-weight relationship.

- k) Since 1995, a stratified-random spring bottom trawl survey in the NAFO Regulatory Area (NRA) of Div. 3NO has been carried out by EU-Spain. This area is also surveyed in Canadian DFO's annual spring and autumn surveys of the Grand Bank. Yellowtail flounder and American plaice biomass estimates were compared from Canadian spring surveys using *Campelen* gear and the original bottom trawl net used in the survey by EU-Spain, *Pedreira*, as well as converted *Campelen* values from the surveys conducted by EU-Spain (SCR Doc. 02/65). In all gear type comparisons, there were similar trends in the survey series, although only one of four correlations of biomass estimates between surveys was significant. It was noted that both surveys indicate a general increase in biomass of American plaice and yellowtail flounder. Differences in actual biomass levels are at least partially due to differences in the efficiency of the *Pedreira* and *Campelen* trawls.
- l) Abundance-at-age indices estimated from trawl surveys are one of the main parameters in fisheries assessment, nevertheless these indices were observed to be associated with high variability (SCR Doc. 02/76). The usefulness of bootstrap methods to the evaluation of variability on the three sampling levels was explored, isolating each source of variability and then resampling it separately. Data from the Flemish Cap cod were used in a case study.
- m) During the EU bottom trawl survey on Flemish Cap on July 1999-2001, a comparative trial between the survey gear (Lofoten) and a Campelen 1800 shrimp trawl was carried out (SCR Doc. 02/74). Results were interpreted based on the two main differences between both gears: the gear geometry, being the vertical opening of the Campelen gear the highest, and the cod-end mesh size, being the Campelen one the smallest.

7. Other Matters

a) Tagging Activities

STACREC reviewed the list of tagging activities carried out in 2001 (SCS Doc. 02/17) compiled by the Secretariat, and requested national representatives to update the list during the meeting. Also reviewed were outstanding data from 2000.

b) Conversion Factors

The EU(EUROSTAT) representative reported that FAO has made available on its website, the program developed by EUROSTAT for the consultation of the FAO database on conversion factors (<http://www.fao.org/fi/statist/fisoft/conv.asp>)

c) Comparative Fishing Between Canada and EU-Spain

Comparative fishing between Canada and EU-Spain continues with the most recent having been conducted in May 2002.

d) Research Activities

EU-Spain survey in Div. 3NO. In May 2001 a bottom trawl survey was conducted in Div. 3NO Regulatory Area. A total of 133 hauls using a *Pedreira* gear with a stratified design were performed to a depth of 1 450 m. 92 of them were made fishing in parallel with the R/V *Vizconde de Eza* using a *Campelen* gear, which was replaced this year by the C/V *Playa de Mendiña* which performed the bottom trawl. So, a comparative study was developed to transform the historical series of the C/V *Playa de Mendiña* (1995-2000) in the new series of the R/V *Vizconde de Eza*. The results of the comparative study are presented in SCR Doc. 02/5. In addition, 18 of the 92 hauls have been made in parallel with the Canadian R/V *Wilfred Templeman*, using also a *Campelen* gear. The results of the Spanish Div. 3NO bottom trawl survey for all the period studied (1995-2001), including abundance and biomass indices and length distributions of American plaice, yellowtail flounder and Greenland halibut are presented in SCR Doc. 02/2, 3 and 4, respectively.

EU-Spain and EU-Portugal survey in Div. 3M The EU bottom trawl survey on Flemish Cap (Div. 3M) was carried out in July 2001. A total of 120 valid hauls with the usual survey gear (Lofoten) were made up to 730 m depth. Additionally, 20 hauls were made with a Campelen gear for catchability comparisons. Survey results including abundance indices of the main commercial species and age distributions for cod, redfish, American plaice and Greenland halibut are presented in SCR Doc. 02/12, and for roughhead grenadier in SCR Doc. 02/18. Data on shrimp from this survey was presented in SCR Doc. 01/172 and SCR Doc. 01/189. The results regarding the hydrographic conditions during the survey are presented in SCR Doc. 02/25.

Russian survey in Div. 3M In the period from 10 May to 4 June 2001, the bottom trawl survey of demersal fish was carried out in Div. 3M by MG-1360 "Mozdok". The research covered the area of 15 800 sq. miles in 127-1 280 m depth range and was performed according to the NAFO stratification scheme. During the survey 39 oceanographic stations at 130-1 016 m depth were undertaken, 90 trawlings of half an hour's duration were performed. Trawlings were being performed using standard research bottom trawl (type 1625 A) with a small mesh size insertion in the codend ($a = 10-12$ mm). The results of the Russian bottom trawl survey concerning redfish and Greenland halibut are presented in SCR Doc. 02/9 and 02/27, respectively.

United States Research Report (SCS Doc. 02/15) presents information of the status of 19 finfish and groundfish stocks in Subareas 5 and 6. Many of the stocks show signs of increased abundance from the low levels observed in the early-1990s. Information about environmental and biological research projects underway at the Northeast Fisheries Science Center, Woods Hole, Mass., was also provided, including studies on life history/ecology of fishes, invertebrates and marine mammals, food web dynamics, age and growth, habitat relationships, and fisheries by-catch. Additionally, brief summaries were presented on three areas of population dynamics research in 2001: (1) Atlantic salmon research; (2) Cooperative research with the fishing industry; and (3) Stock assessment methods development.

STACREC considered the reports of research activities covered in Tables 3, 4 and 5 on the availability of data for stock assessments useful and should continue to be compiled. However it was felt that they should be submitted to a review process and STACREC **recommended** that *in future years the Secretariat compile the reports of research activities as a working document for the June meeting, and that it then be presented to STACREC as a SCS document at its September meeting.*

e) **Use of GRT vs. GT in Recording Effort Data**

STACREC noted that, although the GT is increasingly being used to record the tonnage of fishing vessels, and thus the comparability of current CPUE data from different fleets was less at risk, care had to be taken when comparing data over time. It was agreed that STACREC should continue to monitor the situation.

f) **Other Business**

STACREC noted that concern was being expressed as to the state of wolffish stocks in the Northwest Atlantic and that improved catch statistics were required to monitor the situation (SCR Doc. 02/64). Accordingly STACREC **recommended** that *Contracting Parties report the catches of wolffish by species, and the STATLANT questionnaires be modified to distinguish between the spotted wolffish (Anarhichas minor), Northern wolffish (A. denticulatus) and the striped or Atlantic wolffish (A. lupus) and that the Secretariat inform Contracting Parties of this request (including all necessary information) as soon as possible.*

The Chair thanked the participants for their valuable contributions to the Committee. Special thanks were extended to the rapporteur and to the Assistant 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 2002 STACREC Meeting.

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

Chair: D. E. Stansbury

Rapporteurs: Various

I. OPENING

The Committee met at the Alderney Landing, 2 Ochterloney Street, Dartmouth, Nova Scotia, Canada, during 6-20 June 2002, to consider and report on matters referred to it by the Scientific Council, particularly those pertaining to the provision of scientific advice on certain finfish and invertebrate stocks. Representatives attended from Canada, Denmark (in respect of Faroe Islands and Greenland), European Union (France, Germany, Portugal, Spain and United Kingdom), Japan, Norway (as of 11 June), Russian Federation and United States of America. Various scientists assisted in the preparation of the reports considered by the Committee.

The Chair, D. E. Stansbury (Canada), opened the meeting by welcoming participants. The agenda was reviewed and a plan of work developed for the meeting. The Chair noted that there were deletions to Agenda items, *viz* moving Fisheries Commission request (Annex 1 Item 3g and 9) for advice on shrimp in Div. 3M and Div. 3LNO to Scientific Council. The provisional agenda with these modifications was accordingly **adopted**.

II. GENERAL REVIEW

1. Review of Recommendations in 2001

STACFIS reviewed the recommendations from 2001 during considerations of each relevant stock.

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 Subarea 3 in 2001. Estimates of catches from various sources were considered along with catches reported (available to date) in STATLANT 21A forms and national research reports, in order to derive the most appropriate estimates of catches for the various stocks in Subarea 3.

Since 1995 there has been an Observer Program in effect, with total coverage of all ships in NAFO areas operating under the flags of Contracting Parties. In addition landings by EU ships in NAFO area were inspected at their landing sites in 2001. These provided other sources of catch data.

STACFIS agreed that the preliminary tabulations of catch data from SATLANT 21A reports and the catches determined by STACFIS for this year's assessments will be documented in the introductory catch table for each stock.

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

III. STOCK ASSESSMENTS

A. STOCKS OFF GREENLAND AND IN DAVIS STRAIT

1. Greenland Halibut (*Reinhardtius hippoglossoides*) in Subarea 0 and Division 1A Offshore and Divisions 1B-1F (SCR Doc. 02/30, 46, 47, 48, 50, 60, 67, 68; SCS Doc. 02/ 4, 9, 10, 16)

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 amounted to 10 700 tons in 2000 and increased to 13 400 tons in 2001 (Fig. 1.1).

In Subarea 0 catches peaked in 1992 at 12 400 tons, declined to 4 300 tons in 1994 and 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 in Div. 1A offshore and Div. 1B-1F have 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 were 5 300 tons in 2000 and increase to 5 600 in 2001. Catches from offshore in Div. 1AB have been low but increased from 150 tons in 2000 to 650 tons in 2001.

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

	1993	1994	1995 ¹	1996	1997	1998	1999	2000	2001	2002
Recommended TAC ¹	25	25	25	11	11	11	11	11	15 ²	15 ²
SA 0	7	4	3	5	4	4	5	5	8	
SA 1 excluding Div. 1A inshore	4	6	5	4	5	5	13 ³	5	6	
Total STATLANT 21A	11	10	8	9	9	9	17	5 ⁴	8 ⁴	
Total STACFIS	11	10	8	9	9	9	10	11	13	

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 7 603 tons reported by error.

⁴ Provisional.

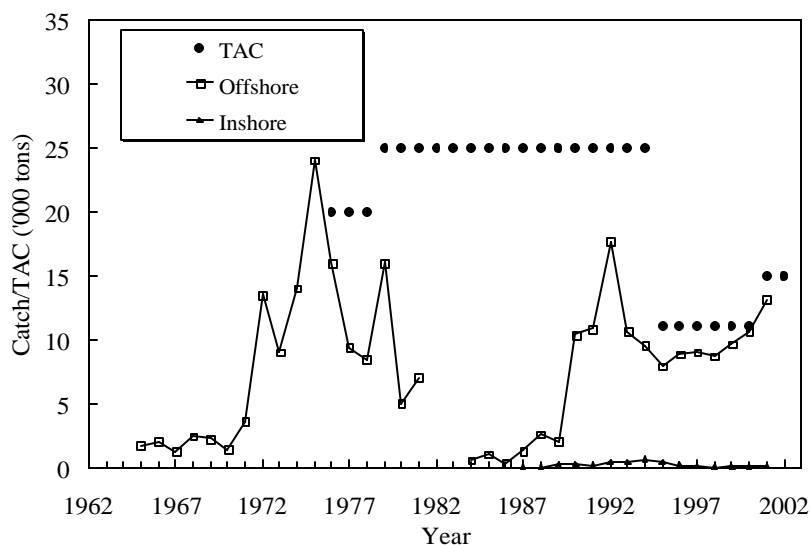


Fig. 1.1. Greenland halibut in Subareas 0+1 (excluding Div. 1A inshore): catches and TACs.

The fishery offshore 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. In 1997 only Faroe Islands and Canada conducted a fishery in the area. During 1998-2000 Canada was the only country fishing in the area. Besides Canadian trawlers, trawlers from four different countries chartered by Canada participated in the trawl fishery in Div. 0A in 2001. Catches have been around 300 tons in Div. 0A since 1996 but increased to 2 625 tons in 2001. In Div. 0B catches amounted to 5 022 tons in 2001. Trawlers took 1 970 tons, longliners 787 tons, gillnetters 2 138 tons while 127 tons were taken on longlines in Cumberland Sound. Almost all the fishery takes place in the second half of the year.

The 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 1996-2000 catches have been below 100 tons. The decrease in catches in recent years has been due to decrease in effort as a result of poor ice conditions.

The fishery in Div. 1A offshore + Div. 1B-1F. Almost all catches are taken offshore mainly by trawlers from Japan, Greenland, Norway, Russia, Faroe Islands and EU (mainly Germany). 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 in Div. 1A increased to 666 tons in 2001. An offshore longline fishery in Div. 1CD was started in 1994 and a gillnet fishery was started by Greenland in 2000. In 2001 trawlers from Greenland, Norway, Russia, Faroe Islands and EU-Germany took 4 562 tons, 768 tons was taken by gillnet and 318 tons by longline. Almost all the fishery takes place during autumn and winter in Div. 1D 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. 0A. Only 48.2% of the fish caught were > 45 cm (SCR Doc. 02/46).

Catch-at-age and weight-at-age data were available from the trawl fishery (single-trawl and twin trawl combined) and fixed gear fishery (gillnet and longline combined) in Div. 0B (SCR Doc. 02/50).

Information on the catch-at-age and weight-at-age from commercial catches in the Russian trawl fishery in Div. 1D (SCS Doc. 02/4), together with length distributions from the Norwegian trawl fishery was available for 2001. Further, length compositions were available from the Russian longline fishery in Div. 1D (SCS Doc. 02/4). These were combined with age data from the Greenland deep-sea survey.

Age 7 fish dominated the trawl catches while ages 10 and 7, respectively, dominated gillnet and longline catches (SCR Doc. 02/67).

An unstandardized catch-rate series from the trawl fishery in Div. 0A covering 1996-2001 showed an increase between 2000 and 2001 and is in 2001 at an average level (SCR Doc. 02/46).

Standardized annual catch rates were calculated for the trawl fishery in Div. 1CD for 1988-2001 based on available logbooks and the EU-Germany fishery in Div. 1D (SCR Doc. 02/67, SCS Doc. 02/9). The catch rates have been stable during the period 1990-2001.

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).

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

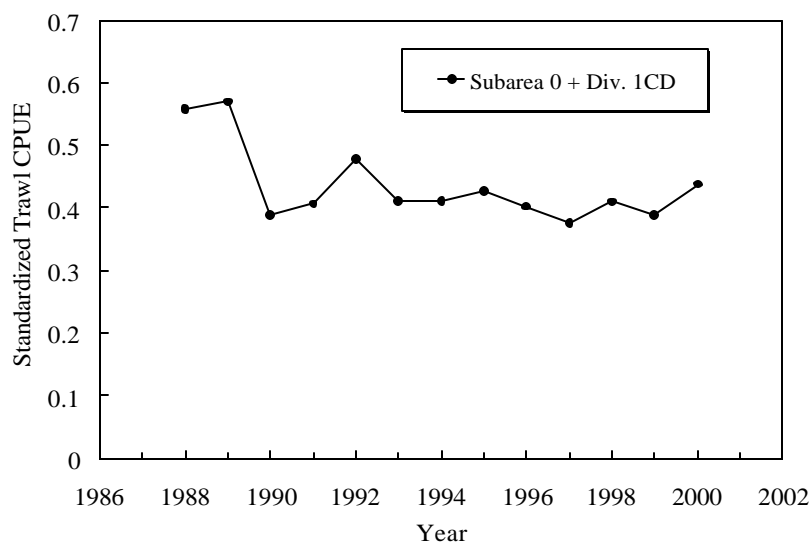


Fig. 1.2. Greenland halibut in Subareas 0+1 (excluding Div. 1A inshore): combined standardized trawl CPUE from SA 0 and Div. 1CD.

ii) Research survey data

Deep-sea surveys. During the period 1987-95 bottom-trawl surveys have been conducted in Subarea 1 jointly by Japan and Greenland. (The survey area was restratified 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 78 000 tons in 2001, which is above the estimates from 1997-2000 (56 000- 70 000) (Fig. 1.3). In 2001 the survey also covered Div. 1AB at depths down to 1500 m, where the trawlable biomass was estimated to be 63 000 tons (SCR Doc. 02/30).

In September-October 2001 a joint Canada/Greenland survey was carried out in Div. 0AB using the same vessel and gear as the survey in Div. 1AD. The survey was conducted as a stratified-random bottom trawl survey covering depths between 400 and 1 500 m. The trawlable biomass in Div. 0A was estimated to be 98 000 tons which is an increase from 83 000 tons estimated from a similar survey in 1999. The trawlable biomass in Div. 0B was estimated to be 69 000 tons, which is an increase from 56 000 tons in 2000 (SCR Doc. 02/47).

The length distributions in the Greenlandic and the Canadian deep-sea surveys are shown in Fig. 1.4.

Biomass estimates ('000 tons) from USSR (Russia)/GDR(FRG) surveys, Japan/Greenland and Greenland and Canadian surveys for the years 1987-2001 in Subareas 0 and 1 are as follows:

Year	Canada		USSR(Russia)/GDR(FRG)		Japan/Greenland		Greenland		Total
	0A	0B	0B	1BCD	1BCD	1ABCD ¹	1AB	1CD	0AB+1ABCD ²
1987	-	-	37	56	115 ³	116 ³	-	-	153
1988	-	-	55	47	58	63	-	-	118
1989	-	-	79	-	69	-	-	-	-
1990	-	-	72	88	52	55	-	-	127
1991	-	-	46	-	82	86	-	-	132
1992	-	-	38	-	73	77	-	-	115
1993	-	-	-	-	41	-	-	-	-
1994	-	-	-	-	34	-	-	-	-
1995	-	-	-	-	43	44	-	-	-
1996	-	-	-	-	-	-	-	-	-
1997	-	-	-	-	-	-	-	56	-
1998	-	-	-	-	-	-	-	70	-
1999	83	-	-	-	-	-	-	64	-
2000	-	56	-	-	-	-	-	59	-
2001	98	69	-	-	-	-	63	78	307

¹ Div. 1A south of 70°N.

² USSR(Russia)/GDR(FRG) Survey Div. 0B + Japan/Greenland Survey Div. 1ABCD.

³ In 1987 the biomass at depths >1 000 m (42%) was estimated by an ANOVA.

- No survey.

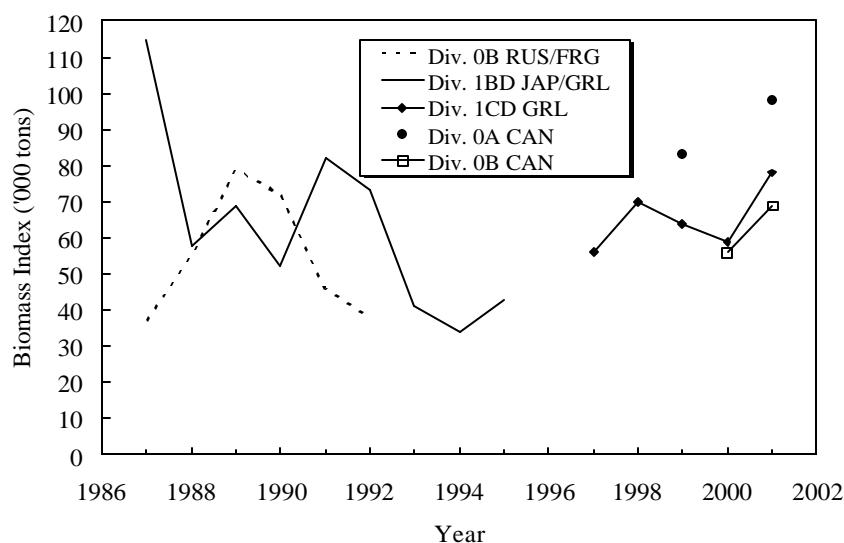


Fig. 1.3. Greenland halibut in Subareas 0+1 (excluding Div. 1A inshore): biomass estimates from surveys.

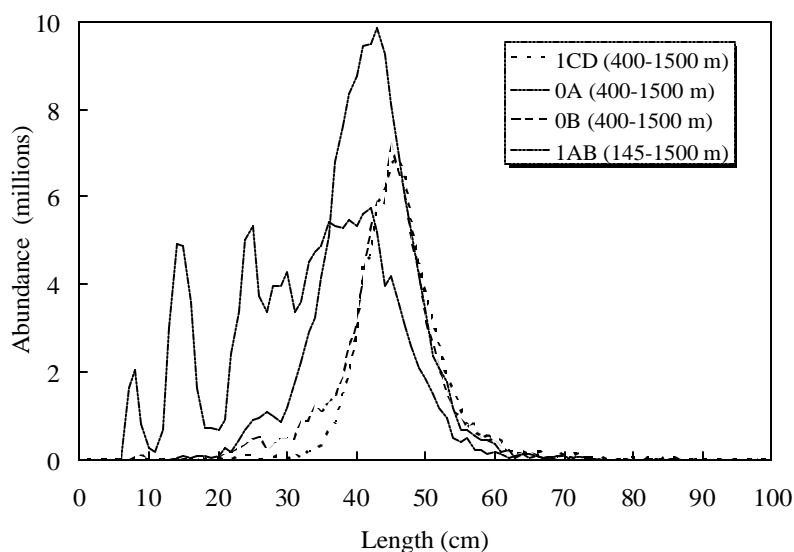


Fig. 1.4. Greenland halibut in Subareas 0+1: length composition from Div. 0A, Div. 0B and Div. 1CD (400-1500 m), and Div. 1AB (145-1500 m) in 2001.

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 Greenland halibut catches in 2001 consisted mainly of one-year-old fish. The number of one-year-old fish in the total survey area including Disko Bay has been increasing gradually since 1996 and was estimated at 450 million in 2001, which is the largest on record. The high index is caused by a combination of the second best recruitment observed in the offshore area and the best recruitment in the time series seen in the Disko Bay. (SCR Doc. 02/48)(Fig. 1.5).

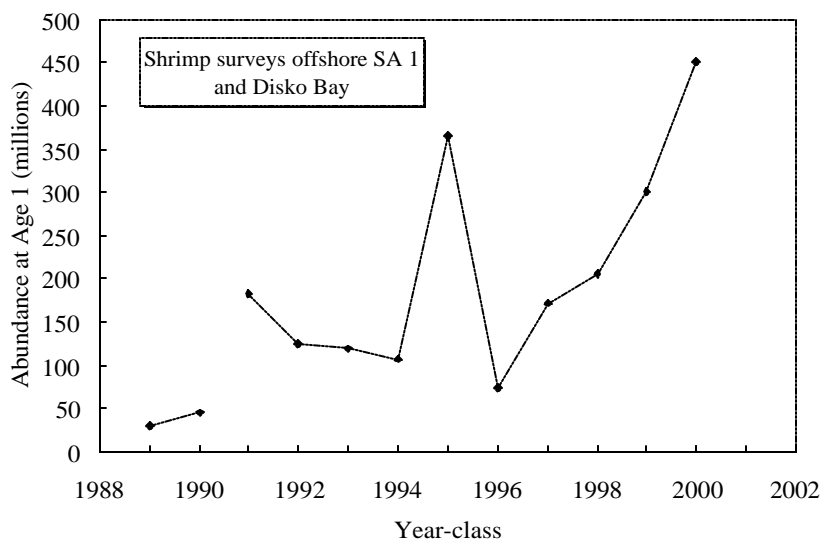


Fig. 1.5. Greenland halibut in Subareas 0+1: recruitment index at age 1 in Subarea 1 derived from the Greenland shrimp trawl surveys. Note that the survey coverage was not complete in 1989 and 1990.

c) **Estimation of Parameters**

An Extended Survivors Analysis (XSA) stock assessment model was fitted to the stock data from SA 0+1. The model was calibrated with trawl survey data (ages 5-15) from Div. 1CD for the years 1997-2001. The analysis was considered to be provisional due to problems with the catch-at-age data and the short time series, but the outcome is considered to reflect the dynamics of the stock. The rate of exploitation seems to have been relative stable in recent years (SCR Doc. 02/68).

d) **Assessment Results**

A survey in Div. 1A and 1B in 2001 estimate the biomass to be 50 000 tons and 12 000 tons, respectively.

The survey biomass index in Div. 1CD was estimated as 78 000 tons in 2001, which is the highest in the five year time series (56 000-70 000 tons).

Although the survey series from 1987-95 is not directly comparable with the series from 1997-2001, 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.

A survey in Div. 0AB showed an increase in biomass. In Div. 0A from 83 000 tons in 1999 to 98 000 tons in 2001 and from 56 000 tons in 2000 to 69 000 tons in 2001 in Div. 0B.

The total biomass in Div. 0AB and Div. 1A-1D was hence estimated at 307 000 tons and the biomass was evenly distributed among the two Subareas. Fish were generally smaller in the northern areas, especially shallow waters in Div. 1AB were dominated by fish <30 cm. The even distribution of the catches in the surveys indicate that Greenland halibut in the area likely constitute a single stock.

Estimation of trawlable one-year-olds have been steadily increasing since 1996 and the 2000 year-class is the largest in the time series. It was noted, however, that the 1995 year-classes also was estimated to be a very strong year-class at age one but it has not shown up in the fishery as a particular strong year-class.

A combined standardized trawl CPUE index from SA 0 and Div. 1CD has been stable during 1990-2000 and a standardized trawl CPUE index from Div. 1CD has been stable during 1990-2001.

It was noted that 48% of the fish were <45 cm in the commercial trawl fishery in Div. 0A in 2001 compared to appropriately 20% in the Russian and 12% in the Norwegian trawl fishery in Div. 1D and 22% in the trawl fishery in Div. 0B.

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 2003.*

2. Greenland Halibut (*Reinhardtius hippoglossoides*) in Division 1A Inshore (SCR Doc. 02/55, 38, 48; SCS Doc. 02/16)

a) Introduction

The main fishing grounds for Greenland halibut in Div. 1A are located inshore. The inshore catches in Div. 1A were around 7 000 tons in the late-1980s and have increased until 1998 when the catch was almost 25 000 tons. Since 2000 catches have declined and were 16 900 tons in 2001 (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.

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

	1993	1994	1995	1996	1997	1998	1999	2000 ¹	2001 ¹	2002
Recommended TAC							7.9	7.9	7.9	7.9
Disko Bay ²	5.4	5.2	7.4	7.8	8.6	10.7	10.6	7.6	7.0	
Recommended TAC							6.0	6.0	6.0	6.0
Uummannaq	3.9	4.0	7.2	4.6	6.3	6.9	8.4	7.6	6.6	
Recommended TAC							4.3	4.3	4.3	4.3
Upernavik	3.8	4.8	3.3	4.8	4.9	7.0	5.3	3.8	3.2	
Unknown ³	0.1	-	-	-	-	-	-	2.2		
STATLANT 21A	13.2	14.1	17.0	17.3	20.8	19.7	24.3	-	-	
STACFIS	13.1	14.0	17.9	17.3	19.8	24.6	24.3	21.1	16.9	

¹ Provisional. Catch data from 2000 are likely to be underestimated by 2 000 tons.

² Formerly named Ilulissat.

³ Catches from unknown areas within Div. 1A.

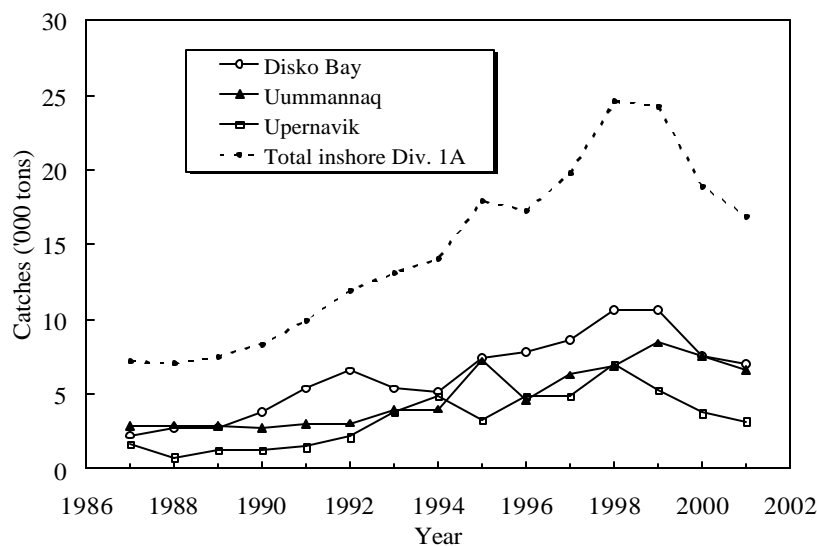


Fig. 2.1. Greenland halibut in Div. 1A: catches by area.

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 from 2000, although dispensation presently is given to a gillnet fishery at Ilulissat in Disko Bay. Dispensations has also been given to a gillnet fishery in the outer parts of the fjords in Uummannaq and Upernavik in 2002. The minimum mesh size allowed is kept at 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 around 1 200.

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 dealt with separately 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 catches in Disko Bay increased from about 2 300 tons in 1987 to an historic high level of about 10 500 tons in 1998. Since then, landings have declined and were 7 100 tons in 2001.

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 Icefjord was the main fishing area but during the last decade the fishery spread further north to include Sermilik and Itivdup Ice fjords.

Catches increased from a level of 2 000 tons before 1987 to a record high in 1999 of 8 425 tons. The landings in 2000 declined to 7 600 tons and further to 6 600 tons in 2001.

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 recently been exploited.

The catches in the Upernavik area increased steadily from about 1 000 tons in the late-1980s to about 3 000 to 4 000 tons in 1993 to 1995 and reached the highest on record in 1998 with 7 000 tons (Fig. 2.1). Catch gradually decreased since then and was in 2001 only 3 200 tons.

b) Input Data

i) Commercial fishery data

Landing data available at the time of the assessment were preliminary, however, considered reliable. Catch-at-age data for each of the three inshore areas were available from the fishery covering area, gear and, in most cases, season. Where otolith sampling was missing or inadequate, age-length keys were applied from adjacent years or areas.

The age composition has changed towards fewer and younger age groups especially in Upernavik. In Disko Bay and Uummannaq age composition has stabilized in recent years.

Length measurements of the commercial longline landings from 1993 to 2001 in Disko Bay, Uummannaq and Upernavik indicated that the fishery takes 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 while the trend in the winter fishery was increasing overall except for winter 2000 when weather conditions prevented the traditional fishery. In Uummannaq, a decreasing trend in mean length was observed until 1999 for the summer fishery, but has stabilized since then. In the winter fishery mean length

has been relatively stable up to 2001. In the winter of 2002 mean length increased sharply. 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. Since 2000 the mean length has been stable around 62 cm.

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

Before 1993 various longline exploratory fisheries were conducted with research vessels. Owing to different design and gear these surveys were not quite comparable. In 1993 a longline survey program for Greenland halibut was initiated for the inshore areas, Disko Bay, Uummannaq and Upernavik. The surveys are conducted annually covering two of the three areas in rotation, with approximately 30 fixed stations in each area. In July-August 2001 the research longline vessel *Adolf Jensen* covered the fjord areas of Uummannaq and Disko Bay. The CPUE time-series from the survey was re-analysed and standardized in 2002 (Fig. 2.2) (SCR Doc. 02/55).

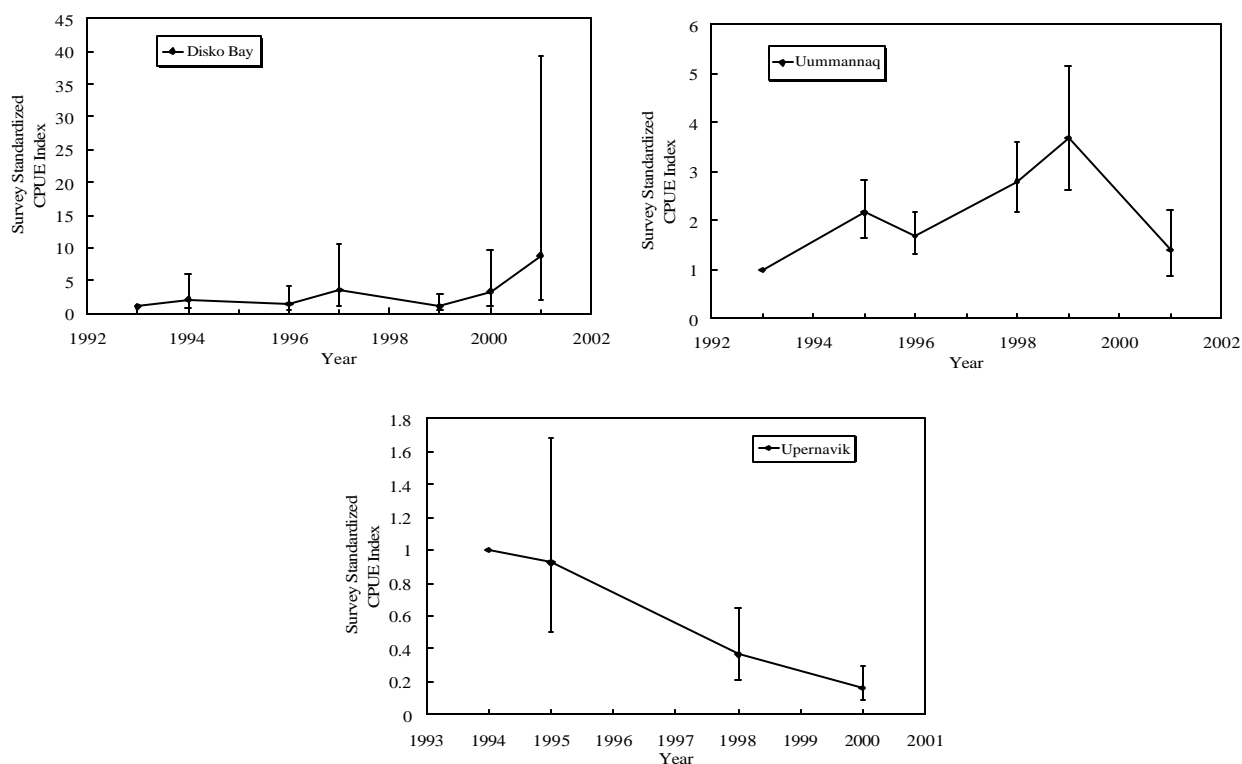


Fig. 2.2 Greenland halibut in Div. 1A: standardized and relativized CPUE index from longline surveys conducted in Div. 1A inshore areas.

In Disko Bay the CPUE index fluctuated throughout the time series without any trend until 2001, when it increased sharply but the increase was not statistically significant. In Uummannaq CPUE increased until 1999 but decreased in 2001. In Upernavik the CPUE index has decreased throughout the time series. The decreases in both were statistically significant (Fig. 2.2).

Mean length (cm) from catches taken in Div. 1A inshore longline surveys.

Area	1993	1994	1995	1996	1997	1998	1999	2000	2001
Disko Bay	55.9	56.5	-	53.6	57.0	-	56.7	54.3	56.1
Uummannaq	57.5	-	57.8	59.5	-	61.2	61.5	-	59.7
Upernavik	-	64.6	60.8	-	-	57.1	-	58.4	-

In the standardized surveys from 1993 to 2001 the mean length in Disko Bay has been stable with a mode around 60 cm. Surveys in both 2000 and 2001 found higher abundance of smaller fish (<50 cm) indicating year-classes above average have been recruiting to the fishery these years. In Uummannaq a small increase in mean length has been observed with a shift in length mode from around 55 to 65 cm. In Upernavik the mean length decreased since mid-1990s especially with larger fish being less abundant. The survey in 2000 did however indicate a small increase in mean length. There is no indication of year-classes above average recruiting to the fishery in the near future in either Uummannaq or Upernavik.

Since 1988 annual trawl surveys were 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 in 2001 were presented as catch-in-numbers per age per hour, for both the offshore and inshore nursery areas (Fig. 2.3). Both offshore and in Disko Bay the numbers of one-year-olds from the 2000 year-class were above average. In Disko Bay it was the highest on record.

A linkage between the recruitment at age 1-3 and the subsequent recruitment to the inshore fishery at age 7 to 10 was investigated in Disko Bay. No strong correlation between year-class strength recorded by the shrimp trawl survey and incoming year-classes in the commercial fishery several years later was evident. However, the overlapping time-series was short and no firm conclusions can be made at present.

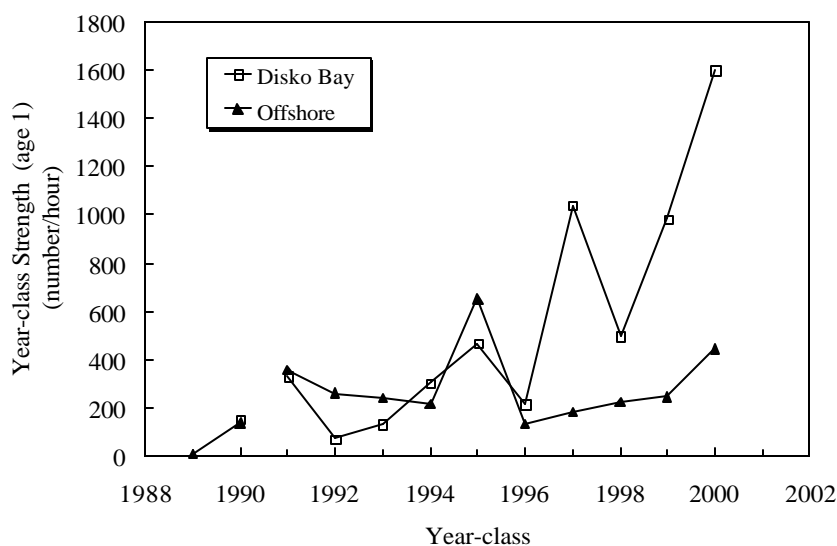


Fig. 2.3. Greenland halibut in Div. 1A: recruitment at age 1 on nursery grounds.

iii) **Biological studies**

A review of the tagging experiments in West Greenland in the period 1986-98 was given in the 1999 assessment (SCR Doc. 99/25). It was concluded that Greenland halibut in the fjords were very stationary and did not migrate to the Davis Strait area or between the 3 inshore areas. 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.

A study on maturity and spawning of Greenland halibut in Disko Bay was presented (SCR Doc. 02/38). The study covered the period February to May. It was concluded that spawning does not take place in this period. The study is being continued so as to cover the rest of the year. Earlier studies concluded that little and only sporadic spawning takes place in the inshore area.

iv) **Others studies**

Methodological aspects of the Greenland halibut longline survey were reviewed in detail (SCR Doc. 00/29). On the basis on this review STACFIS believed that caution should be taken when analyzing trends in CPUE from the longline survey.

c) **Assessment Results**

Disko Bay. Survey results from 1993 onwards do not indicate any major changes in abundance, except for the year 2001, when the abundance-index was remarkably higher, although estimated with uncertainty. Length composition in the survey data indicated above average recruiting year-classes entering the fishery in 2000 and 2001.

In the commercial fishery the mean length in the summer fishery has been relatively stable while an increase has been observed in the winter fishery.

Uummannaq. Survey results from 1993 to 1999 indicate an increase in abundance until 1999. In 2001 survey abundance index decreased statistically significantly to a level observed in the mid-1990s. Catch composition in the commercial fishery has changed significantly since the 1980s towards a higher exploitation of younger age groups, but has recently stabilized.

Upernavik. Survey results from 1993 onwards indicate a steady and significant decline in abundance. Mean length compositions in both commercial and survey catches have decreased, most significantly in the winter fishery. In the traditional fishing grounds at Upernavik up to 73°45'N younger and fewer age groups are caught. New fishing grounds in the northern part of the district have been exploited only recently. Little information exists from these areas

The abrupt decline in landings in the most recent years raises concern. The lack of information on fishing effort makes it difficult to fully evaluate whether it is a result of declining stock biomass or fishing effort. Estimates of F suggest increasing fishing mortality in some areas (Disko Bay and Upernavik) and stability in others (Uummannaq), but this is based on ages 10-14 which are not well represented in the catches and thus may not reflect recent fishing patterns. Nevertheless, in recent years an extensive reorganization in the fishing industry has been taking place and this is likely to have resulted in a reduction in fishing effort as landing feasibility was reduced. However, indices from both survey and commercial fishery do indicate, especially in Upernavik and to some degree in Uummannaq, a stock decline.

d) **Reference Points**

Precautionary reference points could not be given.

e) Research Recommendations

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

STACFIS **recommended** that *studies of the longline survey in Div. 1A be continued to investigate if the observed variation in CPUE is caused by natural behaviour of the Greenland halibut or if it is due to survey design.*

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. 02/30, 47; SCS Doc. 02/4, 9, 16)

a) Introduction

A total catch of 51 tons was reported for 2001 compared to 97 tons for 2000.

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

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Recommended TAC	8.0	8.0	8.0	ndf	ndf	ndf	ndf	ndf	ndf	ndf
STATLANT 21A	0.16	0.12 ²	0.31 ³	0.12 ⁴	0.15 ⁵	0.03 ⁶	0.04	0.08 ¹	0.04 ¹	
STACFIS	0.16	0.12 ²	0.31 ³	0.12 ⁴	0.15 ⁵	0.03 ⁶	0.04	0.10	0.05	

¹ Provisional.

²⁻⁶ Includes roughhead grenadier from Div. 1A misreported as roundnose grenadier: 14² tons, 24³ tons, 30⁴ tons, 28⁵ tons, 3⁶ tons.

ndf No directed fishing.

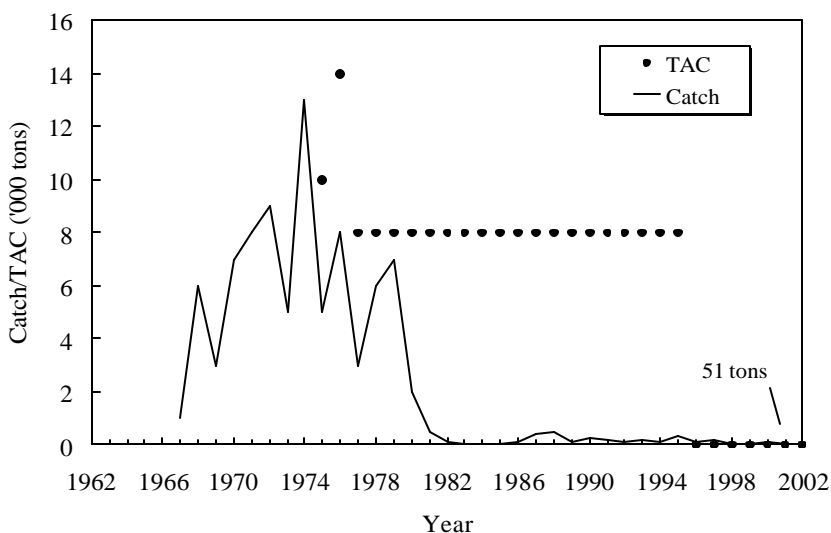


Fig. 3.1. Roundnose grenadier in Subareas 0+1: catches and recommended TACs.

b) **Input Data**i) **Commercial fishery data**

There has been no directed fishery for roundnose grenadier in Subareas 0+1 since 1978. Roundnose grenadier is taken as by-catch in the Greenland halibut fishery. No update of the catch/effort analysis which was presented previously (*NAFO Sci. Coun. Rep.*, 1985, p. 72) was possible.

ii) **Research survey data**

In the period 1987-1995 Japan in cooperation with Greenland conducted bottom trawl research surveys in Subarea 1 covering depths down to 1 500 m. (The survey area was restratified and the biomasses recalculated in 1997). USSR/Russia in the period 1986-1992 conducted surveys covering Div. 0B and Div. 1CD at depths down to 1 250 m until 1988 and down to 1 500 from then on. The surveys took place in October-November. During 1997-2000 Greenland conducted surveys in September/October covering Div. 1CD at depths between 400 and 1 500 m. In 2001 the survey took place in October/November and also covered Div. 1AB. The biomass of roundnose grenadier in this area was, however, very low. Canada conducted surveys in Div. 0A in 1999, in Div. 0B in 2000 and in Div. 0AB in 2001 at depths down to 1 500 m. Roundnose grenadier was not observed in Div. 0A.

Table 1. Trawlable biomass ('000 tons) estimated from various surveys in SA 0+1.

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
USSR/Russia																
0B		2.0	5.0	26.5	9.7	6.5	0.6	1.4	-	-	-	-	-	-	-	-
1CD		-	80.6	36.8	-	48.1	-	-	-	-	-	-	-	-	-	-
Japan/Greenland																
1CD		-	83.8 ¹	44.2 ²	8.1 ³	19.2 ⁴	41.9 ⁴	43.1	8.0 ⁴	3.1 ⁴	7.2 ⁴	-	-	-	-	-
Greenland																
1CD		-	-	-	-	-	-	-	-	-	-	5.7	7.3	2.8	5.6	1.6
Canada																
SA 0+1	111.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Canada																
0B		-	-	-	-	-	-	-	-	-	-	-	-	-	1.7	1.3

¹ June/July. Biomass at depth >1 000 m estimated by an ANOVA (47%).

² September/October.

³ April/May.

⁴ August/September.

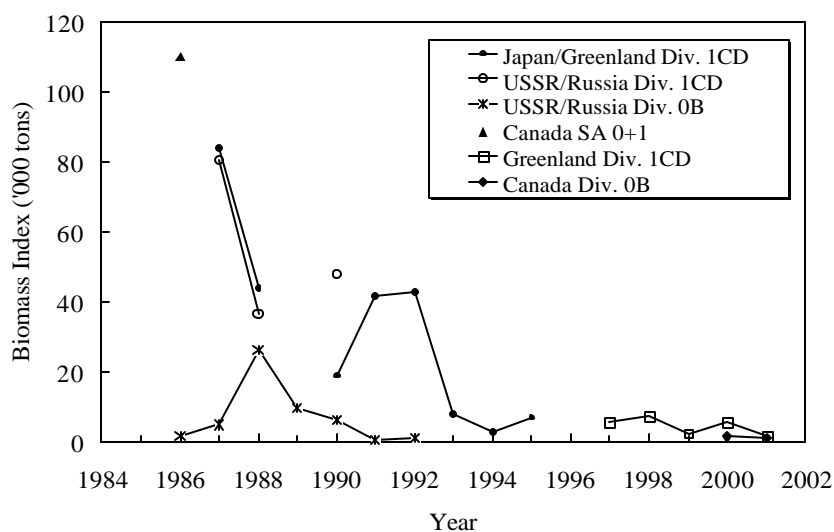


Fig. 3.2. Roundnose grenadier in Subareas 0+1: biomass estimates from USSR/Russian, Japan/Greenland and Greenland surveys in Div. 0B and Div. 1CD.

c) Precautionary Approach

The biomass was estimated at 111 000 tons in SA 0+1 in 1986 by a Canadian survey. Almost all the biomass (90%) was located in SA 1. The fishery has been at a very low level since the late-1970s and the stock could in 1986 be considered as virgin. If B_{lim} is set at 20% of B_{virgin} the biomass has been well below B_{lim} in recent years.

d) Assessment Results

From the Greenland survey in 2001 the biomass in Div. 1CD was estimated at 1 557 tons and hence the biomass has remained at the very low level observed since 1993. Almost all the biomass was found at depths >1 000 m in Div. 1D. The fish were generally small, between 5 and 10 cm pre-anal fin length. The Canadian surveys in Div. 0B in 2000 and 2001 also showed very low biomasses, 1660 and 1 256 tons, respectively.

4. Demersal Redfish (*Sebastes* spp.) in Subarea 1 (SCR Doc. 02/23, 30, 48)

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. Redfish is mainly taken as by-catch by the offshore shrimp trawlers; reported by-catches in 2000 were 880 tons (no data available for 2001), however, this must be considered an underestimate. Smaller vessels take a minor amount inshore, but no catches were reported for 2001.

Recent catches and TACs ('000 tons) are as follows (Fig. 4.1):

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Recommended TAC	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf
STATLANT 21A	0.8	1	0.9	0.9	1	0.9	0.8	nd	nd	
STACFIS	0.8	1	0.9	0.9	1	0.9	0.8	0.9	nd	

ndf No directed fishing.

nd No data.

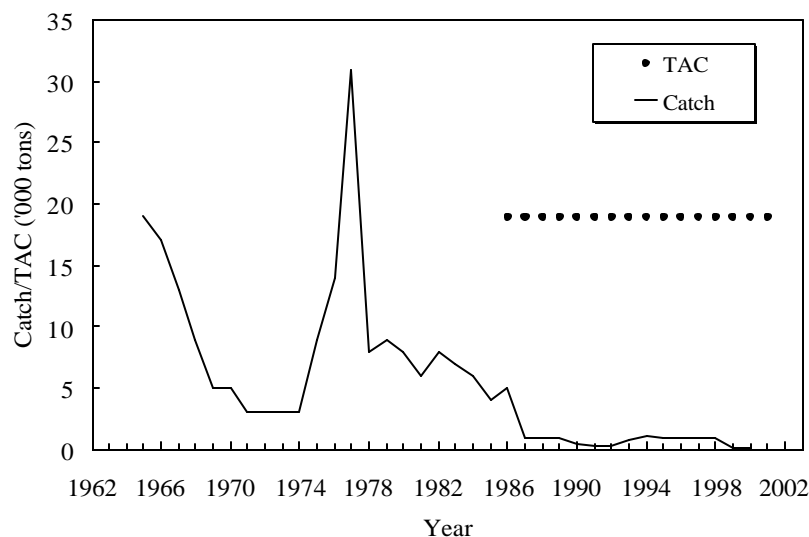


Fig. 4.1. Redfish in Subarea 1: catches and recommended TAC.

In view of dramatic declines in survey biomass indices of golden redfish (Fig. 4.2), deep-sea redfish (≥ 17 cm) (Fig. 4.3) and abundance indices of juvenile redfish (Fig. 4.4) to extremely low levels, along with significant reduction in fish sizes, it is concluded that the stocks of golden and deep-sea redfish in Subarea 1 remain severely depleted and there are no signs of any short term recovery.

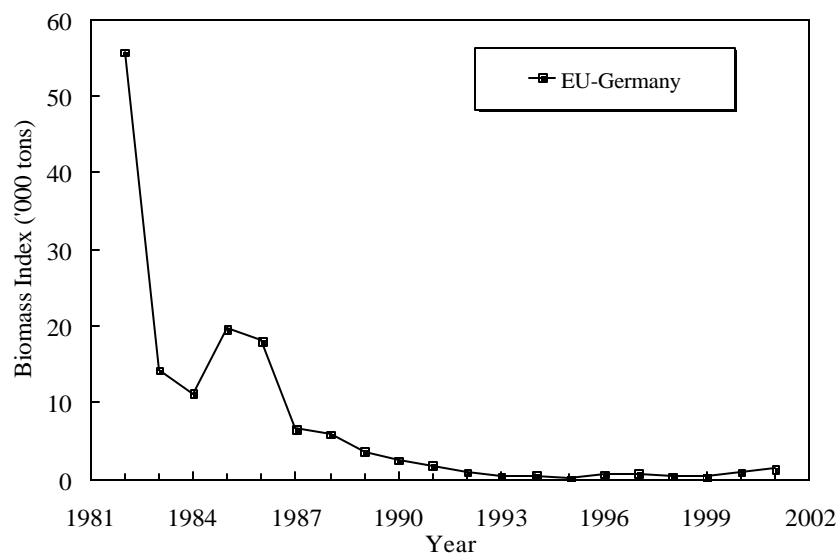


Fig. 4.2. Golden redfish in Subarea 1: survey biomass index

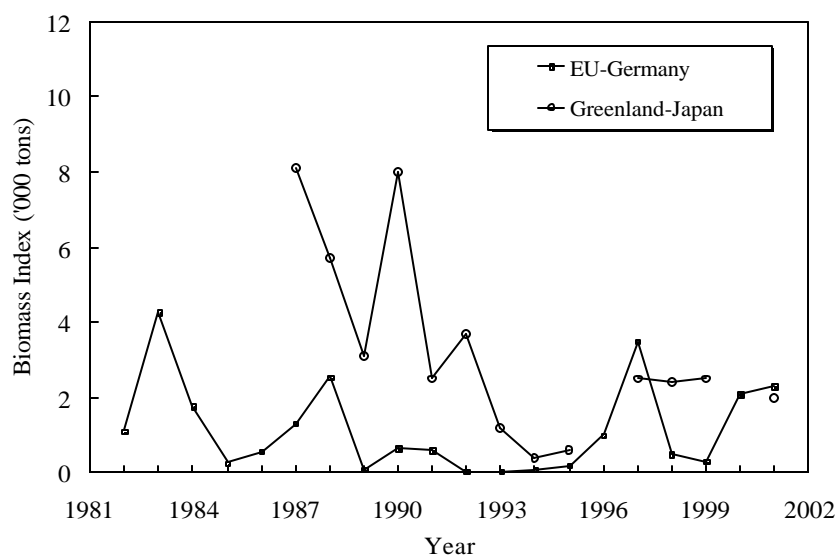


Fig. 4.3. Deep-sea redfish in Subarea 1: survey biomass index

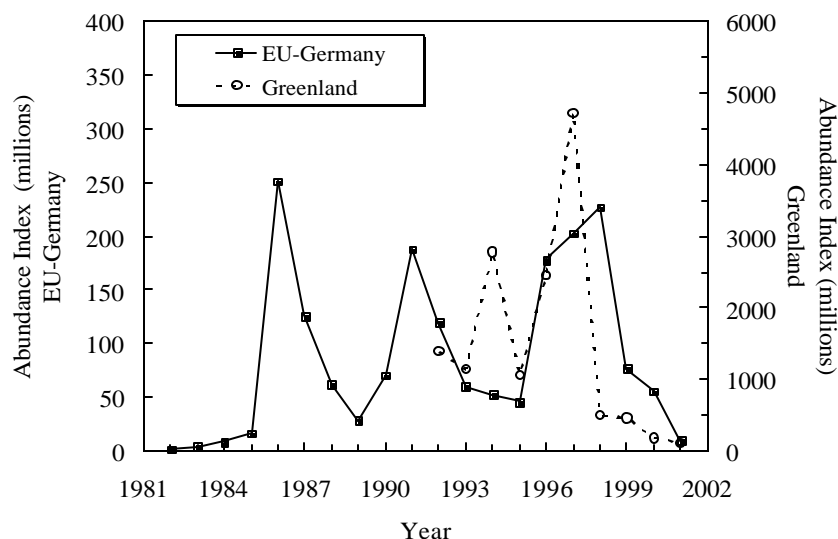


Fig. 4.4. Juvenile redfish (<17 cm) (deep-sea redfish and golden redfish combined) in Subarea 1: survey abundance indices. The Greenland survey data include the entire length range, but very few fish >16 cm.

b) Research Recommendations

STACFIS **recommended** that *studies on maturation and reproduction of demersal redfish in Subarea 1 should be carried out.*

5. Other Finfish in Subarea 1 (SCR Doc. 02/22, 48; SCS Doc. 02/16)

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*) and thorny skate (*Raja radiata*) (Fig. 5.1); lumpsucker (*Cyclopterus lumpus*); Atlantic halibut (*Hippoglossus hippoglossus*) and sharks.

STATLANT 21A is the only data source for these stocks, catches (tons) are as follows:

Species	1993	1994	1995	1996	1997	1998	1999	2000 ¹	2001 ²
Greenland cod	1 896	1 854	2 526	2 117	1 729	1 717	1 899	nd	824
Wolffishes	157	100	51	47	68	30	26	37	nd
Atlantic halibut	43	38	23	34	22	22	45	9	nd
Lumpsucker	246	607	447	425	1 158	2 143	3 057	3 000	-
Sharks	10	34	46	135	-	-	-	-	nd
Non-specified finfish	411	643	618	609	1 269	588	nd	770	nd
Total	2 763	3 276	3 711	3 367	4 246	4 500	5 027	3 816	-

¹ Provisional.

² Estimate.

nd No data.

Despite gradually increasing recruitment since the 1980s, no increase in Atlantic wolffish SSB has been observed. The increase in recruitment of American plaice in 1997 and 1998 did not result in any increase in SSB. Both spotted wolffish and thorny skates have exhibited declines since the 1980s and are at or near record low levels. Based on the above, STACFIS has concluded that these stocks remain severely depleted.

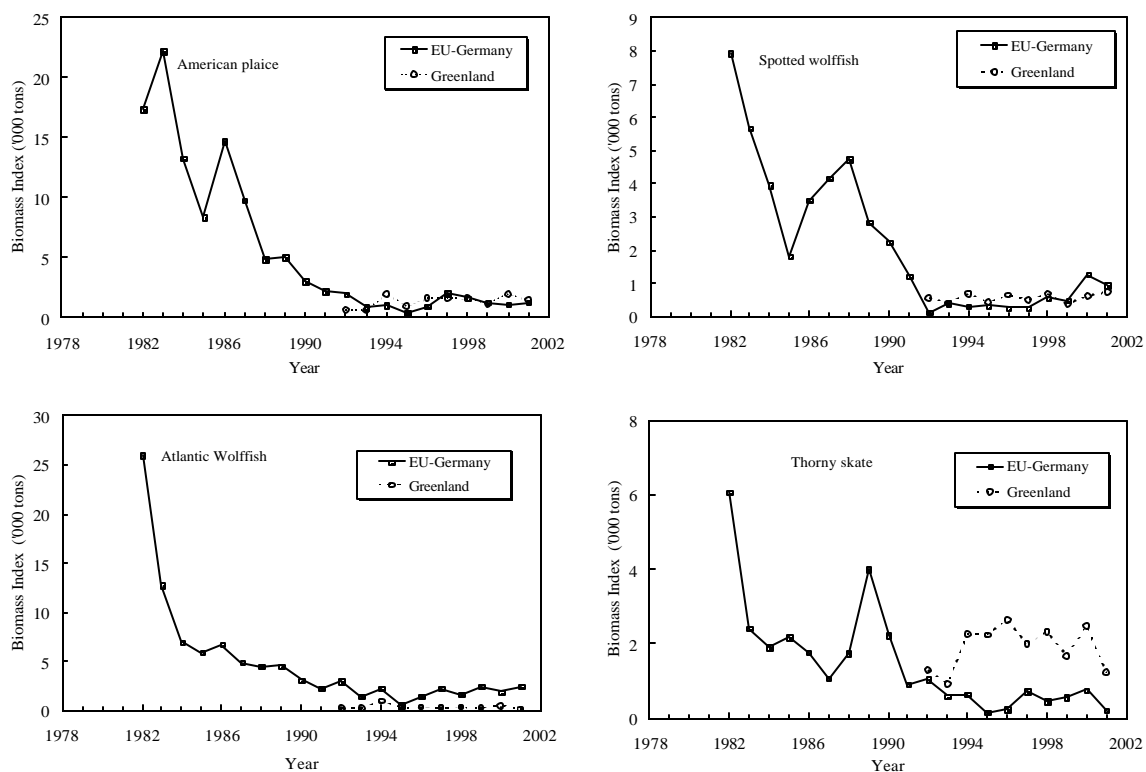


Fig. 5.1. Finfish in Subarea 1: survey biomass indices of various finfish species.

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 for Subarea 1, the length disaggregated abundance and biomass data for American plaice, Atlantic wolffish, spotted wolffish and thorny skate, derived from the Greenland shrimp/groundfish survey, should be split by recruits and SSB, respectively.

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

B. STOCKS ON THE FLEMISH CAP

6. Cod (*Gadus morhua*) in Division 3M (SCR Doc. 02/12, 58, SCS Doc. 02/4, 6)

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, based on observer data from these fleets in 1993-95, and were reported null in the Icelandic fishery in 1995 and 1996. The by-catch of cod in the past Russian pelagic fishery for redfish was also low. The fleet currently operating in Div. 3M includes vessels from non-Contracting Parties, most of them stern-trawlers. 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 from non-Contracting Parties based on Canadian Surveillance reports. Those fleets were not observed in 2000 and 2001, and catches were reduced to 55 and 37 tons respectively, mainly obtained as by-catch of the redfish fishery.

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

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Recommended TAC	0	0	0	11	ndf	ndf	ndf	ndf	ndf	ndf
STATLANT 21A	8.3	6.9	3.2	2.3	1.5	0.5	0.0	0.0 ¹	0.1 ¹	
STACFIS	16.0	29.9	10.4	2.6	2.9	0.7	0.4	0.1	0.0	

¹ Provisional.

ndf No directed fishery.

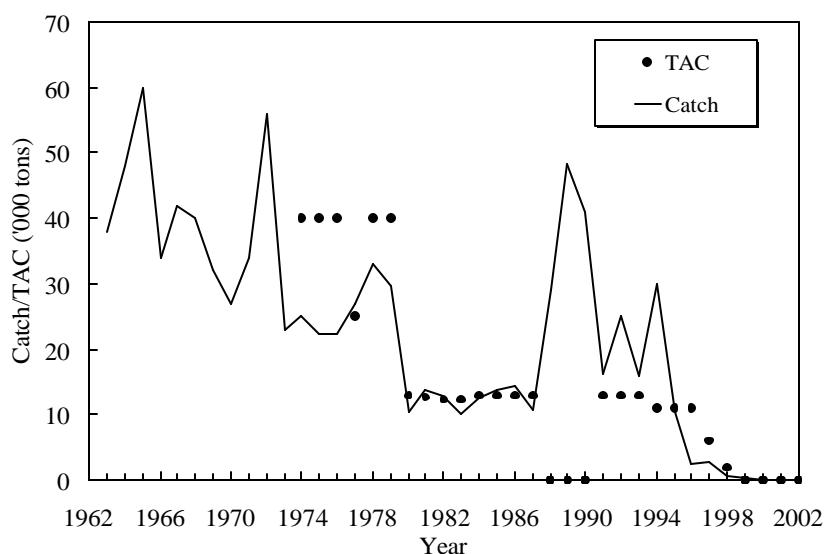


Fig. 6.1. Cod in Div. 3M: catches and TACs. Catch figures include estimates of misreported catches since 1988.

b) Input Data

i) Commercial fishery data

Length and age compositions of 2000 and 2001 catches were available from Portuguese trawlers. Length frequencies were transformed to catch at age numbers with the age-length key from the EU survey, and the resulting frequencies at age were considered representative of the catch, even when the samples were very small, based on the similarity of length frequencies in the catch samples and those observed in the EU survey.

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 and 2001, with the exception of 1994 (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 estimate in 2001 was 800 tons.

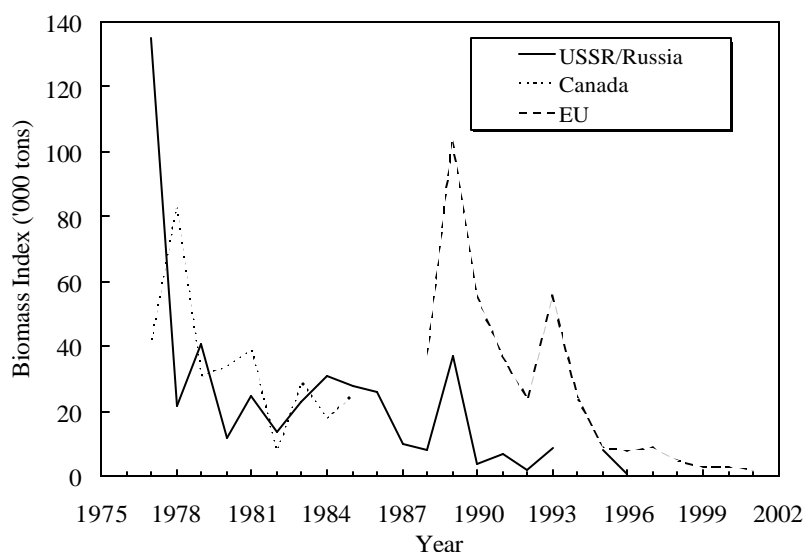


Fig. 6.2. Cod in Div. 3M: total biomass estimates from surveys.

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. There was a reasonably good fit between the biomass estimates for cod, American plaice and redfish in the Canadian survey and EU survey in 1996.

Stratified-random bottom trawl surveys were conducted by the EU from 1988 to 2001. 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 last decrease to a level around 2 500 tons in the 1999-2001 period. Surveys indicate poor recruitment of the 1992 to 1994 year-classes. Recruitment indices were even lower for the 1995 and subsequent year-classes at all observed ages.

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 by the EU survey is 21 times below the observed mean in the 1988-1993 period; the same figure for the Russian survey is 14 times.

c) Estimation of Parameters

A sequential population analysis (XSA) was carried out for ages 1 to 8+ and years 1973 to 2001. Catch-at-age data became imprecise in the last three years. This was because the catch was very low; the sampling was particularly scarce and, additionally, dependent of the EU survey age-length keys. Maturity ogives were updated for the years 1972 to 1985 after Canadian survey results were reviewed; values for 1998 were extended up to 2001. Natural mortality was set at 0.2. The analysis was tuned with the results of the EU survey for ages 1 to 8+ and from 1988 to 2001.

The analysis showed a reasonably good fit in ages 1 to 7. However, the analysis is strongly dependent on survey results due to the low level of commercial catches. The very scarce information that commercial fishing produces cannot substantially modify the views of the surveys results used for tuning. This is a general feature of the VPA, which needs a consistent set of commercial data. Consequently the surveys remain as the main source of information at the current low level catch, and their views on the level of the recruitment of last years are the clearest indication of the stock status.

Retrospective analysis indicates that this XSA has the tendency to underestimate fishing mortality and, consequently, overestimate biomass. Also the current total biomass estimated by the analysis is considered optimistic in comparison with survey results.

VPA results are as follows showing recruits at age 1('000), biomass, SSB and landings (tons), and F_{bar} , and biomass indices from EU and Russian surveys.

Year	Recruits	Biomass	SSB	Landings	F 3- 5	EU-survey	Russian survey
1972	18861	83839	40474	57503	0.689	-	-
1973	66655	46551	21415	22900	0.569	-	-
1974	134636	37829	14414	24938	1.289	-	-
1975	24746	49619	8240	22375	0.606	-	-
1976	11146	113363	9973	22266	0.334	-	-
1977	3579	87518	22761	27019	0.465	-	-
1978	22791	56861	27387	33131	0.453	-	-
1979	16216	46618	20822	29710	0.725	-	-
1980	8547	31999	11521	10468	0.511	-	-
1981	23235	32181	10317	13873	0.453	-	-
1982	22417	30641	14856	12753	0.490	-	-
1983	13949	42831	15005	10215	0.236	-	23070
1984	15862	39513	18187	12702	0.229	-	31210
1985	62916	37393	21954	13675	0.550	-	28070
1986	127455	35649	13376	14518	0.747	-	26060
1987	80414	54666	12032	10632	0.445	-	10150
1988	16888	67889	15443	28899	0.495	3713	7720
1989	22063	109225	30358	48373	0.844	103644	36520
1990	27622	66568	27396	40827	0.871	55360	3920
1991	68798	46102	22620	16229	0.477	36597	6740
1992	62715	60307	22698	25089	1.554	24295	2490
1993	3225	48218	9423	15958	1.025	55642	8990
1994	4462	47810	16490	29916	0.939	24062	-
1995	2768	21881	18309	10372	1.500	8815	8260
1996	141	5503	3150	2601	0.717	8196	730
1997	164	4517	2792	2933	0.821	9063	-
1998	222	3081	2857	705	0.304	4532	-
1999	28	2132	1983	353	0.237	2596	-
2000	1332	2182	1921	55	0.185	2782	-
2001	1689	3088	2400	37	0.033	2451	784

d) Assessment Results

Estimated fishing mortality was very high throughout the age range of the exploited population from 1989 to 1997. From 1994 to 1997 the exploited population has been mainly restricted to the survivors of the 1991 and 1990 cohorts, and fishing mortalities of these cohorts remained at a relatively high level. The low fishing mortality since 1998 is consistent with the implementation of a moratorium on fishing and catch in recent years (Fig. 6.3).

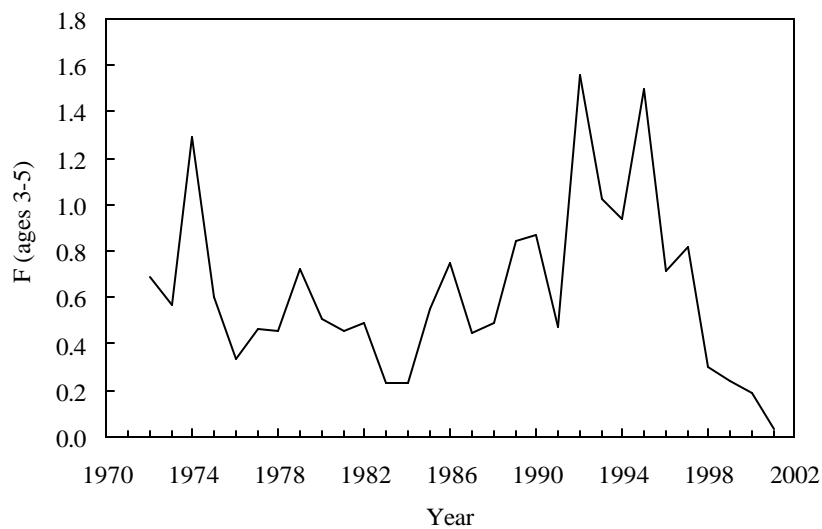


Fig 6.3. Cod in Div. 3M: results from Sequential Population Analysis (F)

Estimated total biomass remained above 30 000 tons prior to 1995 when it declined to 22 000 tons. Since then, biomass has remained below 6 000 tons. Total biomass in 2001 was 3 100 tons. The XSA results also confirm the relative abundance of the 1985, 1990 and 1991 year-classes and the weakness of those from 1992 onwards.

The stock biomass and spawning stock biomass at the beginning of 2002 remains at a very low level (Fig. 6.4) and is mainly composed of fish age 7 and older. Younger fish are scarce due to the low recruitment since 1993 (Fig. 6.5). The abundance of the intermediate ages where a healthy fishery should be based is very low.

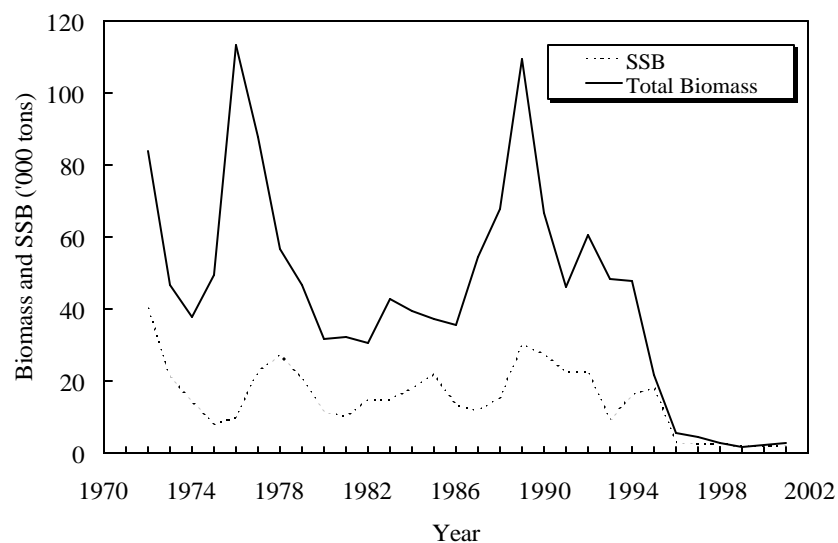


Fig 6.4. Cod in Div. 3M: results from Sequential Population Analysis.

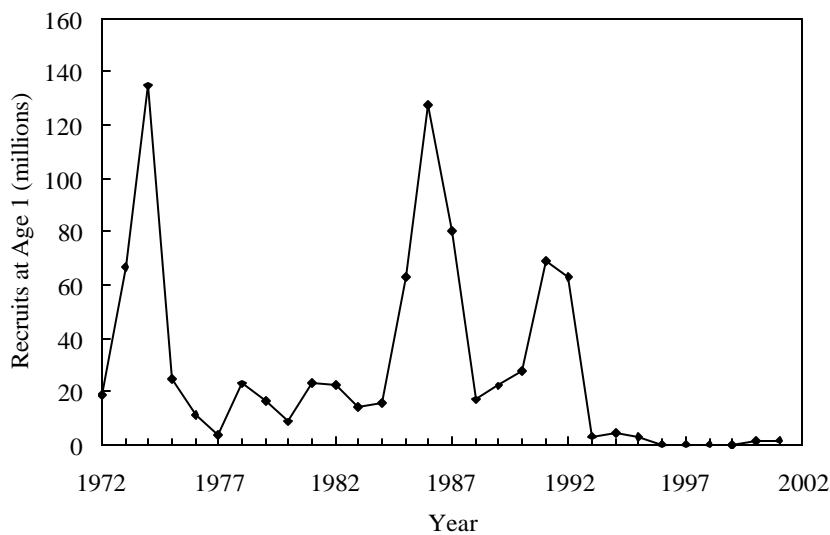


Fig 6.5. Cod in Div. 3M: results from Sequential Population Analysis (Recruits at age 1).

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 Division 3M** (SCR Doc. 02/9, 12, 54; SCS Doc. 02/4 (Part 2), 6, 7.

a) **Introduction**

There are three species of redfish that are commercially fished on Flemish Cap; deep-sea redfish (*Sebastes mentella*), golden redfish (*Sebastes marinus*) and Acadian redfish (*Sebastes fasciatus*). The term beaked redfish is used for *S. mentella* and *S. fasciatus* combined. Because of difficulties with identification and separation, all three species are reported together under 'redfish' in the commercial fishery. All stocks have both pelagic and demersal concentrations as well as a long recruitment process to the bottom, extending to lengths up to 30-32 cm. All redfish species are long lived with slow and very similar growth. Female sexual maturity is reached at a median length of 26.5 cm for Acadian redfish, 30.1 cm for deep-sea redfish and 33.8 cm for golden redfish.

i) **Description of the fishery**

The redfish fishery on Division 3M increased from 20 000 tons in 1985 to 81 000 tons in 1990, falling continuously since then until 1998-99, when a minimum catch around 1000 tons was recorded mostly as by-catch of the Greenland halibut fishery. There was an overall increase of the redfish catches to 3 800 tons in 2000. In 2001 the provisional catch was at a somewhat lower level of 3 200 tons.

The drop of the Div. 3M redfish catches from 1990 until 1999 is related both to the decline of the stock biomass and the abrupt decline of fishing effort deployed in this fishery by the fleets responsible for the high level of catches of the late-1980s and early-1990s (former USSR, former GDR and Korean crewed non-Contracting Party vessels). However in 1999 Russian vessels again were fishing on Flemish Cap and their nominal catch increased from 168 tons to 1 808 tons in 2000. The EU catches increased from 505 tons in 1999 to 1 349 tons in 2000 due to an increase in the

catches of EU-Portugal from 96 tons to 916 tons. In 2001, the directed fishery was primarily prosecuted by EU (Portugal) and Russia with 1 600 tons and 1 300 tons caught, respectively.

Beginning in 1993, and further development of a shrimp fishery on Flemish Cap, led to high levels of redfish by-catch in 1993-1994. Since 1995 the by-catch in weight fell to apparent low levels but in 2001 redfish by-catch reached 738 tons, the highest level observed since 1994. Translated to numbers this represents an increase from the recent by-catch level of 3.4 million redfish (1999-2000) to 25.8 million in 2001, representing 74% of the total 2001 catch numbers.

Recent TACs catches and by-catch ('000 tons) are as follows (Fig. 7.1):

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Recommended TAC	20	20	20	20	20	20	10	5	5	5
STATLANT 21A	21.6	9.9	6.7	1.1	0.4	1.0	0.9	3.8 ¹	3.2 ¹	
STACFIS ²	29.0	11.3	13.5	5.8	1.3	1.0	1.1	3.8	3.2	
By-catch ³	11.97	5.90	0.37	0.55	0.16	0.19	0.10	0.10	0.75	
Total catch ⁴	41.0	17.2	13.9	6.4	1.5	1.2	1.2	3.9	4.0	

¹ Provisional.

² Includes estimates of non-reported catches from various sources.

³ In shrimp fishery (Kulka, D., *pers. comm.* 2000-2002).

⁴ Total STACFIS + by-catch.

The Div. 3M redfish stocks have been exploited in the past both by pelagic and bottom trawls. The majority of the bottom commercial catches were composed of beaked redfish. The species composition of the pelagic redfish catches, which dominated the fishery in the early-1990s, remains unknown. However, based on bottom survey results, on average *S. mentella* and *S. fasciatus* together represent most of the abundance and biomass of Div. 3M redfish. It is assumed therefore that the pelagic catches in the commercial fishery were also dominated by beaked redfish.

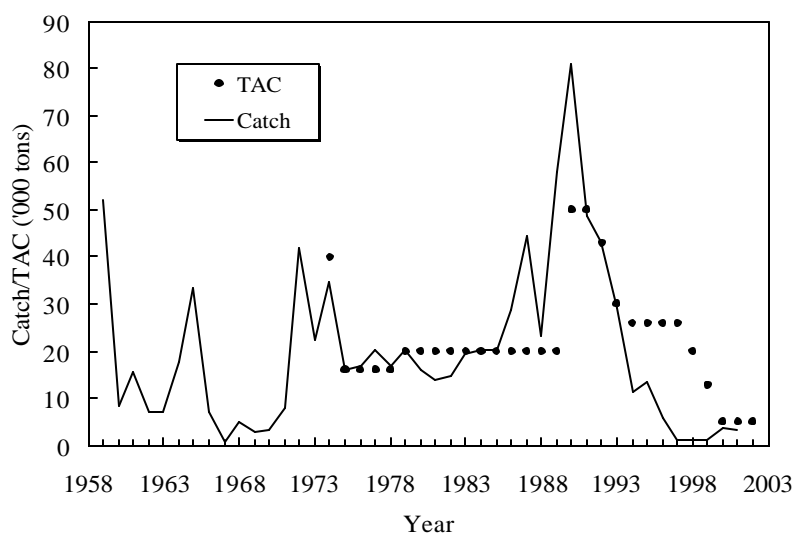


Fig. 7.1. Redfish in Div. 3M: catches and TACs.

b) Input Data

The present assessment evaluates the status of the Div. 3M beaked redfish stock, regarded as a management unit composed of populations of two very similar species. The reasons for this approach were the dominance of this group in the Div. 3M redfish commercial catches and respective CPUE series, corresponding also to the bulk of all redfish bottom biomass survey indices available for the Flemish Cap. Any recovery of the Div. 3M redfish fishery from its present minimum will be basically supported by the *S. mentella* plus *S. fasciatus* biomass.

i) Commercial fishery and by-catch data

Sampling data. Most of the commercial sampling data available for the Div. 3M redfish stocks since 1989 are from the Portuguese fisheries. Length sampling data from Russia (1989-1991, 1995, 1998-2001) and from Japan (1996 and 1998) were used to estimate the length composition of the commercial catches for those fleets and time periods. The 1989-2001 length composition of the Portuguese trawl catch was applied to the rest of the commercial catches. These length compositions have been combined with the Div. 3M beaked redfish length-weight relationship from 1989-2001 EU surveys, to estimate the catch in numbers-at-length of the Div. 3M redfish commercial catch for the same period.

Redfish by-catch in numbers at length for the Div. 3M shrimp fishery were available for 1993-2001 based on data collected on board of Canadian and Norwegian vessels. These numbers-at-length were recalculated in order to fit by-catch in weight with the annual length weight relationships derived from EU survey data.

The commercial and by-catch length frequencies were then summed to establish the total removals at length. These were converted to removals at age using the *S. mentella* age-length keys from the 1990-2001 EU surveys. The 1990 year-class continued to dominate catches in 2001. Annual length weight relationships derived from EU survey data were used for determination of mean weights-at-age.

CPUE data. A STATLANT 21B CPUE series incorporating catch and effort data for most of the components of the fishery (1959-1993) was used in a surplus production analysis carried out in this assessment.

ii) Research survey data

Survey bottom biomass and survey female spawning biomass of Div. 3M beaked (*S. mentella* plus *S. fasciatus*) redfish were calculated based on the abundance at length from Canadian and EU bottom trawl surveys for the periods 1979-1985 and 1988-2001 respectively, and based on the Div. 3M beaked redfish length weight relationship from 1989-2001 EU survey data. Female spawning biomass was calculated applying length maturity ogives derived from data collected during the 1992-1994 and 1999 surveys.

Age compositions for Div. 3M beaked redfish EU survey stock and mature female stock in 1989-2000 were obtained using the *S. mentella* age length keys from the 1990-2000 EU surveys with both sexes combined. Mean weights-at-age were determined using the EU survey annual length weight relationships.

Survey results. Biomass indices (swept area method) from EU surveys are presented in the following table ('000 tons):

Year	Beaked redfish	<i>S. mentella</i>	<i>S. fasciatus</i>	Juveniles
1988	143.0	-	-	-
1989	113.7	-	-	-
1990	87.6	-	-	14.7
1991	59.3	50.1	5.7	3.5
1992	97.6	71.8	5.3	20.5
1993	55.0	25.1	4.4	25.6
1994	87.0	35.7	7.8	43.5
1995	64.6	59.3	5.0	0.2
1996	89.2	77.9	11.0	0.3
1997	74.3	56.1	17.5	0.7
1998	52.8	45.4	6.4	1.0
1999	73.4	65.3	8.0	0.2
2000	102.3	89.4	12.9	1.8
2001	55.3	38.6	11.5	5.1

Total survey biomass, spawning biomass and abundance. During the earlier period (1979-1985), covered by the Canadian surveys, both total survey biomass and female spawning biomass of beaked redfish were stable (Fig. 7.2). The more recent period of 1988-2001, covered by EU surveys, started with a continuous decline of bottom biomass until 1991 followed by a period of biomass fluctuation with no apparent trend from 1992 until 1996. A further decline occurred in 1997 and 1998, when the second lowest biomass was recorded (Fig.7.2). Survey bottom biomass increased in 1999 and 2000 to 104 000 tons, the highest observed since 1989. However in 2001 biomass declined again to 55 000 tons. This decline was also reflected in the spawning biomass index, reduced to 7 000 tons after being at 18 000 tons just the year before. It is difficult to associate the drastic year-to-year changes with actual changes in stock status.

From the Canadian survey series female spawning biomass of beaked redfish (SSB) was stable and represented on average more than 40% of the survey bottom biomass. Survey spawning biomass declined through the first years of EU survey series, oscillating within 9% and 12% for most of the following years between 1994 and 2001.

Beaked redfish abundance increased continuously from 1998 onwards despite the fluctuations in biomass and spawning biomass. The most recent increase in stock abundance, from 2000 to 2001, was the result of increases in the pre-recruited age groups (1-4). The 2000 year-class is the most abundant year-class at age 1 of the EU survey series.

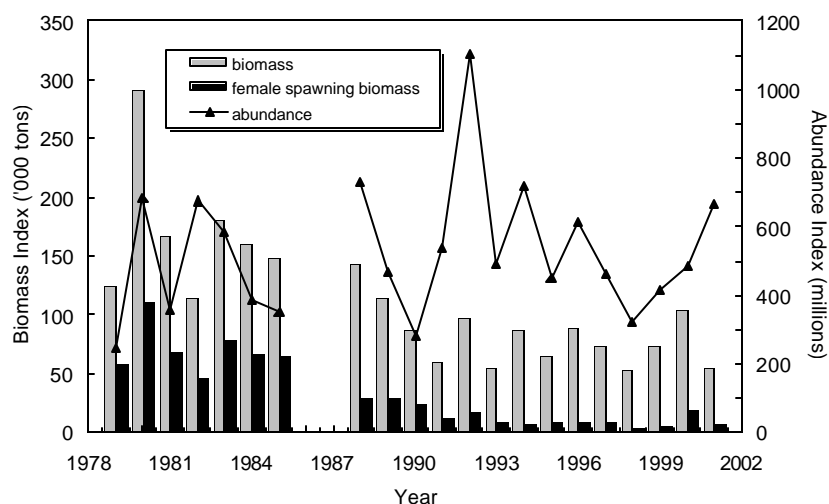


Fig. 7.2. Beaked redfish in Div. 3M: survey biomass, female spawning biomass and abundance from Canadian (1979-1985) and EU (1988-2001) surveys.

c) Estimation of Parameters

The expected proportion of mature females found at each age for Div. 3M beaked redfish was calculated using the mean proportion of mature females found in survey stock abundance-at-age and fitting a general logistic curve fit to the observed data. This female "maturity ogive" was incorporated in the yield-per-recruit analysis.

A partial recruitment vector for Div. 3M beaked redfish 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 1989-2000 age composition of the total catch, including redfish by-catch in the shrimp fishery, and beaked redfish survey abundance. Both data sets were standardized to numbers-per-thousand prior to analysis.

An Extended Survival Analysis (XSA) (Shepherd, 1999)¹ for the most recent period of 1989-2001 was run. Natural mortality was assumed constant at 0.1. The input catch-at-age was as described above as was the female maturity ogive used. The month of peak spawning (larval extrusion) for Div. 3M *S. mentella*, February, was used for the estimate of the proportion of fishing mortality and natural mortality before spawning. The first age group considered was age 4 and a plus group was set at age 19. EU survey abundance at age was used for calibration.

A logistic surplus production model which does not use the equilibrium assumption (ASPIC) was applied using the 1959-2001 STACFIS catch estimates with the standardized STATLANT commercial catch and effort data (1959-1993) and the age 4+ EU bottom biomass (1988-2000). The selection of these series was made because of their higher correlation, compared with the negative or very low correlation between any other combination of the CPUE and survey series available for Div. 3M redfish. A starting estimate for the intrinsic rate of biomass increase was derived from $R_{0.1}$ determined by the yield-per-recruit analysis. Catchability (q) of the EU survey was fixed based on mean age 4 + survey bottom biomass/XSA stock biomass ratio for the 1992-2001 period.

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.*, **56**(5): 584-591.

ASPIC was first run to fit for estimates of parameters, together with effort and survey patterns of unweighted residuals as well as the biomass and fishing mortality trends expressed as ratios to B_{msy} and F_{msy} . Effort and survey residuals were finally run through bootstrap analysis in order to derive bias corrected estimates and probability distribution of the parameters.

d) Assessment Results

The XSA and ASPIC results were used for illustrative purposes only to indicate trends in the resource over time.

Both VPA and ASPIC analysis indicate that the Div. 3M beaked redfish stock experienced a steep decline from the second half of the 1980s until 1996 (Fig. 7.3). Fishing mortality was relatively high from 1988-1994 (Fig. 7.4), due to increasing commercial catches since the mid-1980s that peaked in 1989 and 1993. From 1995 onwards fishing mortality declined and since 1997 has been well below the assumed natural mortality of 0.1, allowing the survival and growth of the population. Despite recent fluctuations, biomass and female spawning biomass appear to have increased marginally since 1997, but are still well below the SSB that produced the 1990 year-class (Fig. 7.5). At the same time abundance has not increased (Fig. 7.3).

Based on XSA, there has been no pulse of recruitment since 1990. However the recruit/SSB has increased through the 1990s (Fig. 7.6), compensating for the SSB decline.

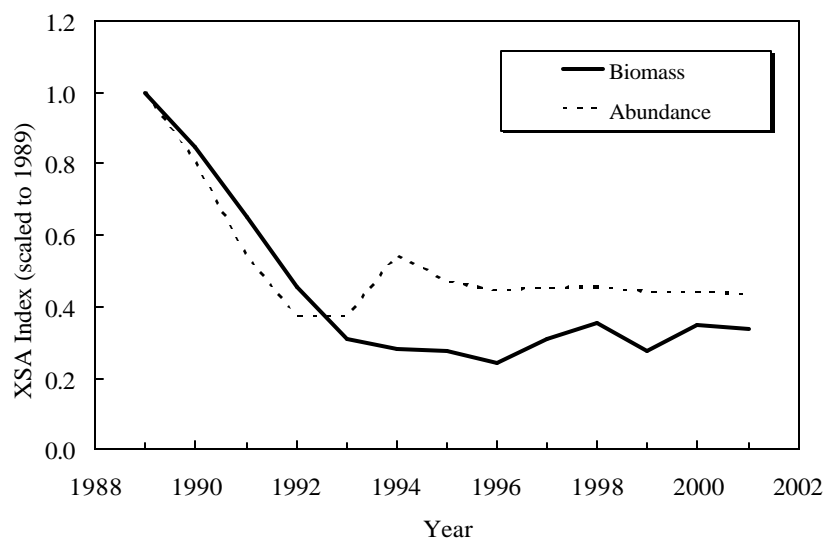


Fig. 7.3. Beaked redfish in Div. 3M: 4 plus biomass *versus* 4 plus abundance trends from XSA.

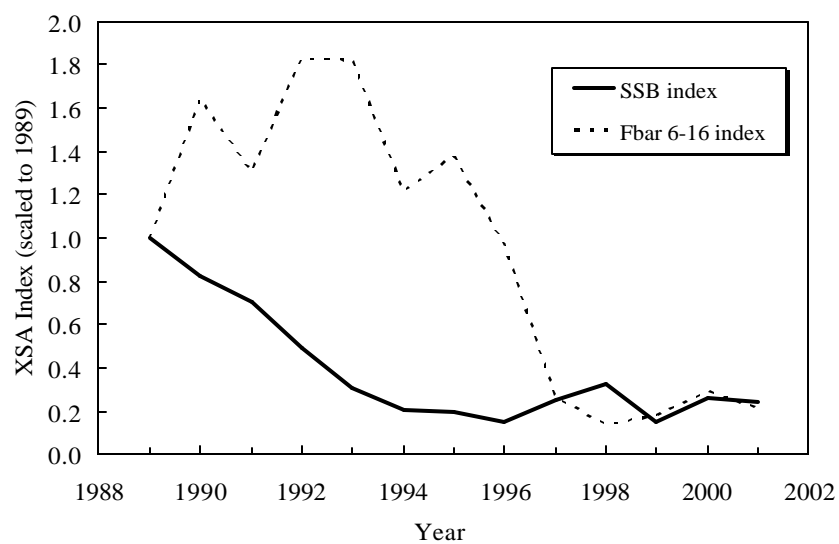


Fig. 7.4. Beaked redfish in Div. 3M: female spawning biomass and fishing mortality trends from XSA.

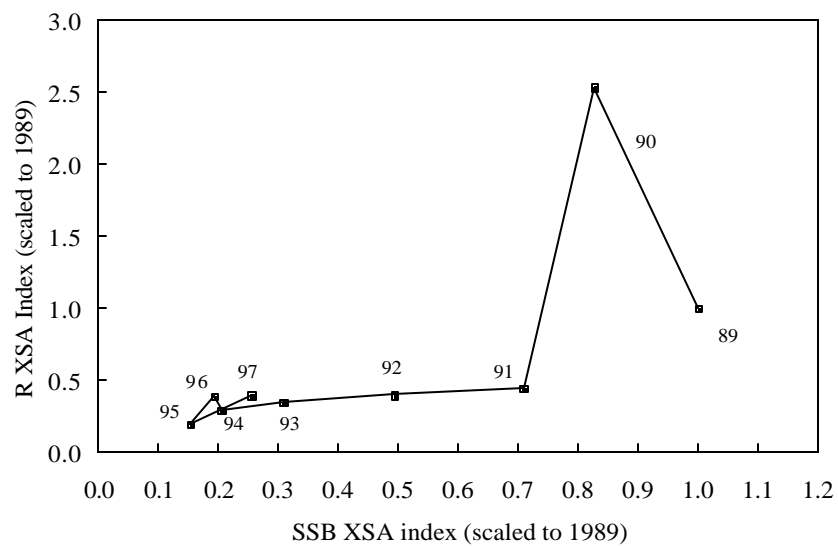


Fig. 7.5 Beaked redfish in Div. 3M: relative recruitment from XSA (year-classes indicated)

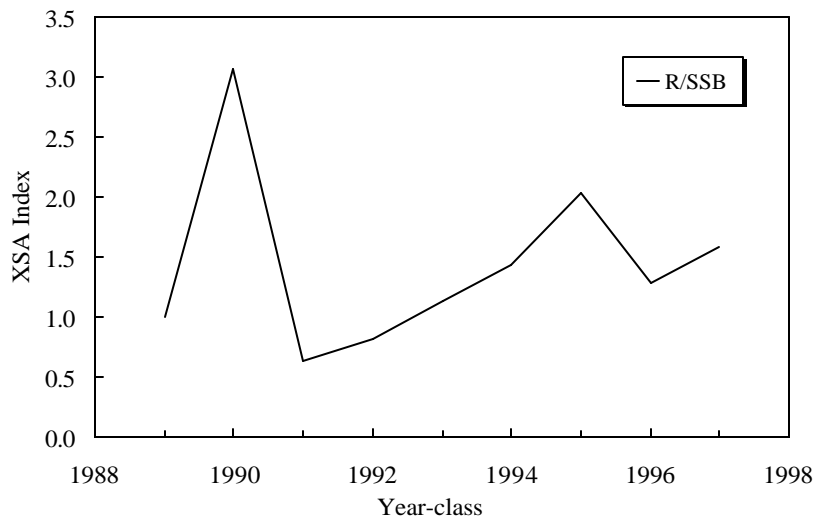


Fig. 7.6 Beaked redfish in Div. 3M: recruitment per thousand tons of SSB trend from XSA (recruits at age 4 four years later than SSB).

The ASPIC results, as regards biomass and fishing mortality trends are comparable to those from the XSA model, but with biomass declining to a lesser extent and increasing at faster rate through the second half of the 1988-2000 period (Fig. 7.7).

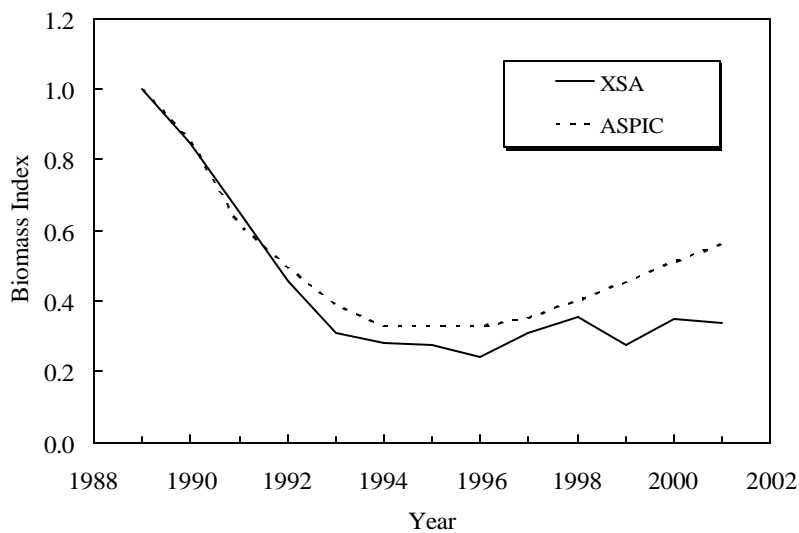


Fig. 7.7. Beaked redfish in Div. 3M: XSA and ASPIC total biomass trends.

STACFIS concluded that while the decline in stock biomass appears to have halted, it is still unclear as to whether there has been any actual increase. The total stock and spawning stock are currently at a low level compared to the earlier period in the time series. At the low fishing mortalities of the most recent years, with growth of the relatively strong 1990 year-class spawning biomass should gradually increase.

At present stock growth in biomass and in abundance is dependent upon the appearance and survival of cohorts past their early life stage so they recruit to the SSB and commercial fishery. As such it is important to keep catch and fishing mortality at a low level by drastically reducing by-catch of very small redfish.

STACFIS noted that measures should be taken to reduce significantly the actual proportion of very small redfish (<12 cm) in the by-catch of the Div. 3M shrimp fishery. In order to assist in developing possible approaches to achieve this, STACFIS **recommended** that *information on the distribution on shrimp and small redfish (<12 cm) be compiled for review during the June 2003 meeting of Scientific Council.*

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.*

e) Reference Points

No updated information on biological reference points was available.

8. American Plaice (*Hippoglossoides platessoides*) in Division 3M (SCR Doc. 02/12, 59, 62; SCS Doc. 02/4, 6)

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 2001 was estimated to be 149 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:

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Recommended TAC	2	1	1	ndf	ndf	ndf	ndf	ndf	ndf	ndf
STATLANT 21A	0.7	0.3	0.2	0.1	0.1	0.2	0.2	0.3 ¹	0.2 ¹	
STACFIS	0.3	0.7	1.3	0.3	0.2	0.3	0.3	0.1	0.1	

¹ Provisional.

ndf No directed fishing.

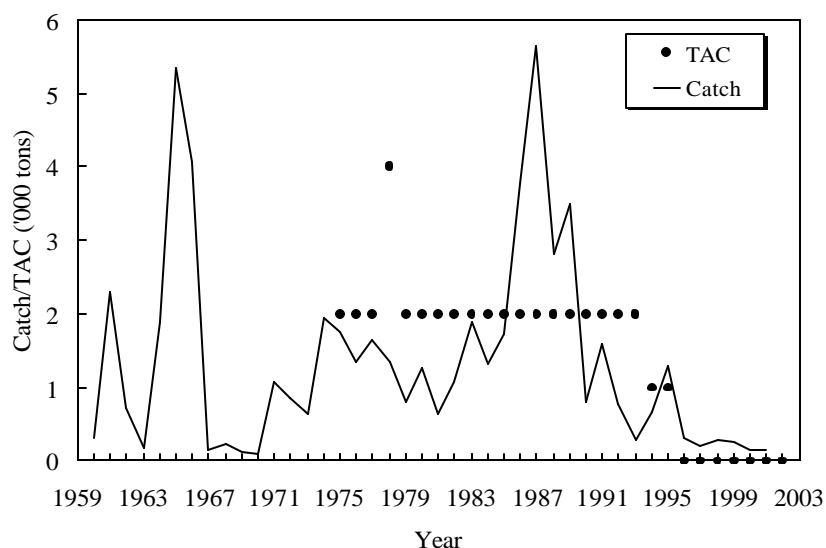


Fig. 8.1. American plaice in Div. 3M: STACFIS catches and agreed TACs.

b) Input Data

i) Commercial fishery data

EU-Portugal and Russia provided length composition data for the 2001 trawl catches. EU-Portugal length composition was used to estimate the length and age compositions for the total catch (149 tons). The 1991 year-class (age 10 in 2001) was the most abundant one.

Mean weights-at-age in the catch showed a decreasing trend from 1998 to 2001 for ages older than 8, being slightly below the average in 2001.

ii) Research survey data

The series of research surveys conducted by the EU since 1988 was continued in July 2001. 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 series started in 2001. Canada conducted research vessel surveys from 1978-85, 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. 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).

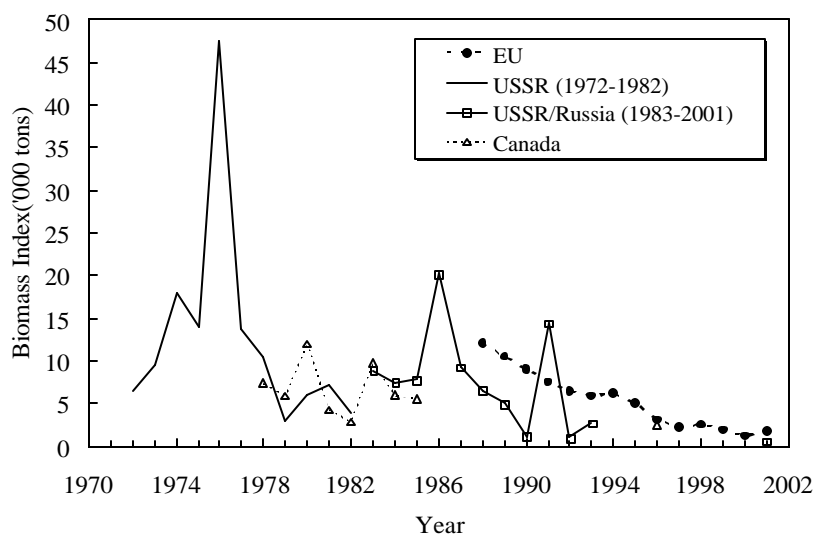


Fig. 8.2. American plaice in Div. 3M: trends in biomass index in the surveys.

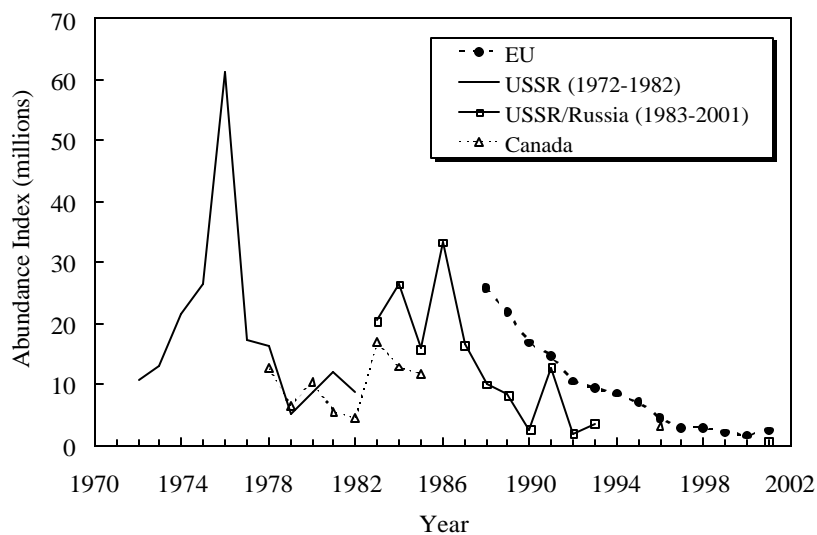


Fig. 8.3. American plaice in Div. 3M: trends in abundance index in the surveys.

Ages 9 to 12 were dominant in the 2001 EU survey. Since 1991 all the year-classes at recruitment (age 3) were very poor as shown by EU survey indices.

The EU survey 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 Div. 3M American plaice 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 1989-2001 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 1988-2001 was run, using the EU survey data for tuning. Natural mortality was set at 0.2. The month with peak spawning for Div. 3M American plaice 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. An ICA assessment model was also performed for comparison, and gave similar results to the XSA.

d) Assessment Results

Both index and XSA fishing mortality declined from the mid-1980s to the mid-1990s (Fig. 8.4), and fluctuated between 0.1 and 0.2 since 1996. F in 2001 estimated by XSA is at the level of the assumed natural mortality.

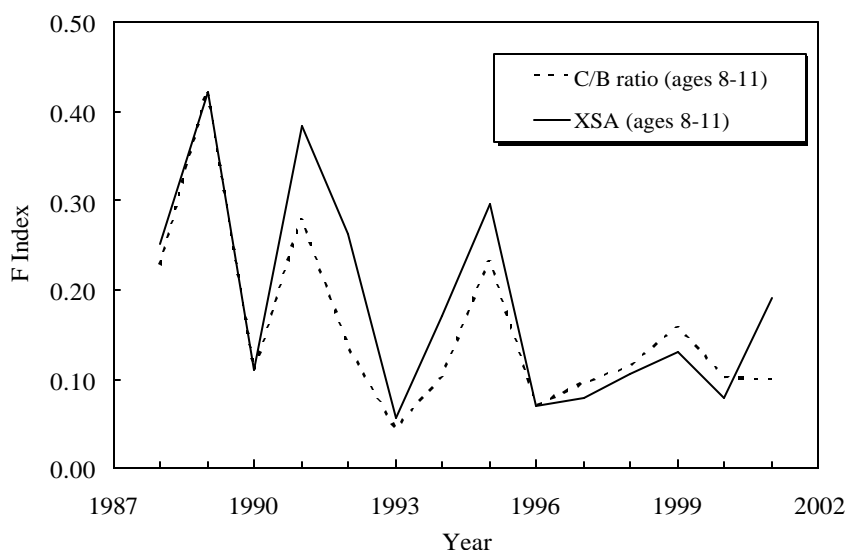


Fig. 8.4. American plaice in Div. 3M: fishing mortality trends: catch/biomass EU survey (ages 8-11) and XSA (ages 8-11).

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).

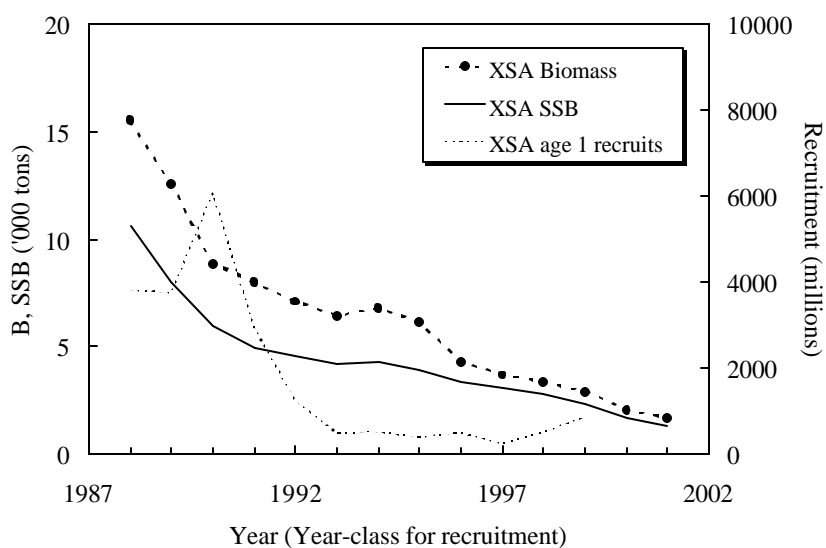


Fig. 8.5. American plaice in Div. 3M: biomass, spawning stock biomass (SSB) and corresponding recruitment from XSA

e) Reference Points

Based on the 12 points available from the XSA to examine a stock/recruitment relationship, very poor recruitment occurs at SSB below 5 000 tons (Fig. 8.6).

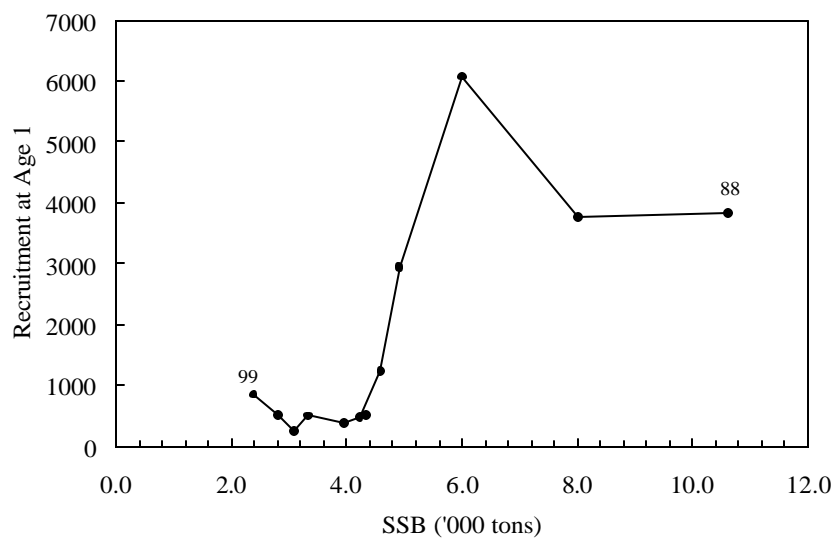


Fig. 8.6. American plaice in Div. 3M: SSB-Recruitment scatter plot.

The yield-per-recruit analysis adopted the following set of parameters: $M = 0.2$; exploitation pattern described above; a knife edge maturity of 50% at age 5 and 100% at age 6 plus and 1988-2001 average mean weights at age in the catch and in the stock for the period 1988-2001. This analysis gave a $F_{0.1} = 0.156$ and a $F_{max} = 0.319$.

f) Future Studies

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

C. STOCKS ON THE GRAND BANK

9. Cod (*Gadus morhua*) in Divisions 3N and 3O (SCR Doc. 02/1, 57, 72; SCS Doc. 02/4, 6, 7, 10, 13)

a) Interim Monitoring Report

The cod stock in Div. 3NO has been under moratorium to all directed fishing both inside and outside the Regulatory Area since February 1994. During the last assessment of this stock, in 2001, it was concluded that recruitment and spawning stock are extremely low. In 2001 the total by-catch of cod in Div. 3NO was 1 309 tons. Since the moratorium was instituted, catches have increased by a factor of over 7 (Fig. 9.1). The spring and autumn Canadian research vessel surveys conducted in 2001 indicated no signs of stock rebuilding in Div. 3N and 3O (Fig. 9.2 and 9.3). Both the abundance and biomass indices have decreased since 2000. The stock size is still much below B_{im} (Fig 9.4). In the last assessment of this stock, the average fishing mortality over ages 4-6 in 1999-2000 was estimated as 0.29. Based on recent surveys and increasing catches, it is believed that fishing mortality has not decreased and may have increased.

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

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Recommended TAC	10.2	6	nf	ndf	ndf	ndf	ndf	ndf	ndf	ndf
STATLANT 21A	10.0	1.9	0.1	0.1	0.4	0.5	0.9	0.5 ¹	0.9 ¹	
STACFIS	10.6	2.7	0.2	0.2	0.4	0.5	0.5	1.1	1.3	

¹ Provisional.

nf No fishing.

ndf No directed fishing.

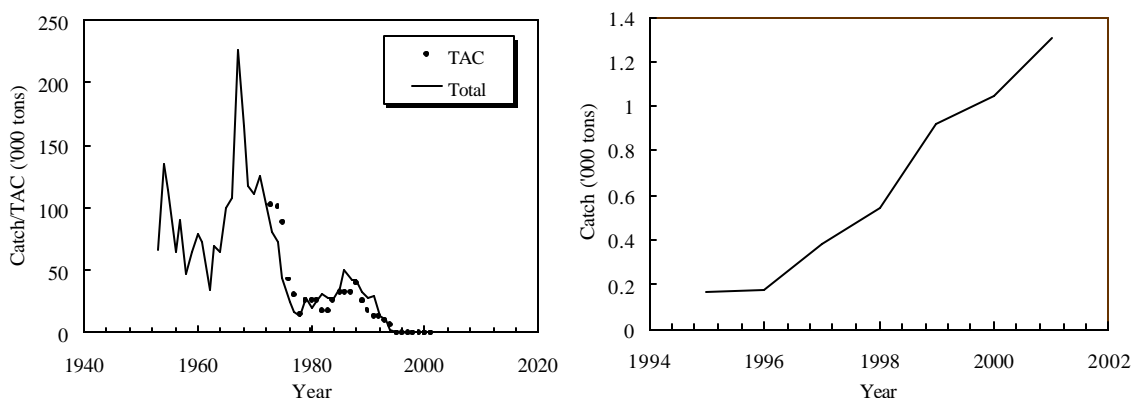


Fig 9.1. Cod in Div. 3NO: total catch and TACs . Panel at right highlights catches during the moratorium on directed fishing.

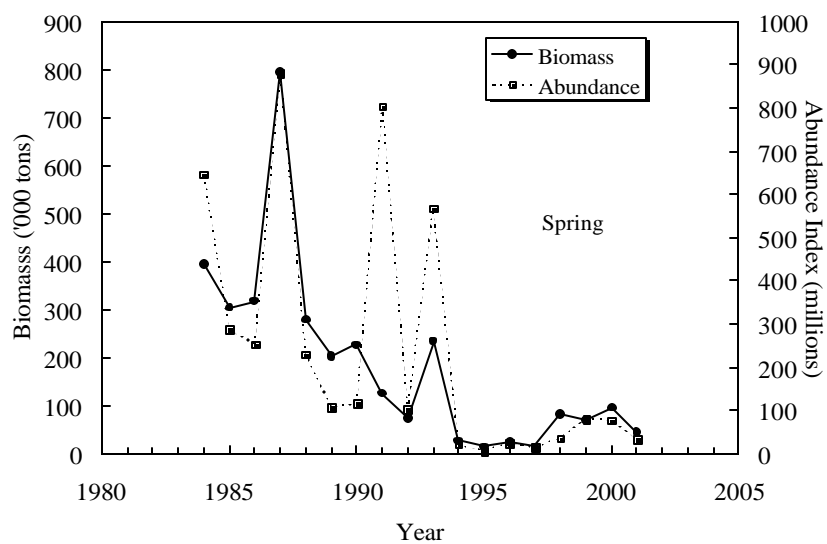


Fig 9.2. Cod in Div. 3NO: abundance and biomass indices from Canadian spring surveys.

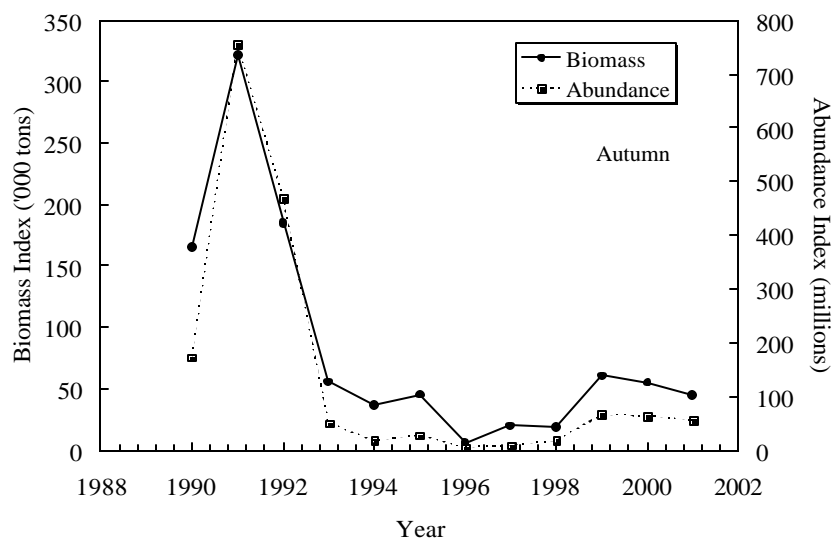


Fig 9.3. Cod in Div. 3NO: abundance and biomass indices from Canadian autumn surveys.

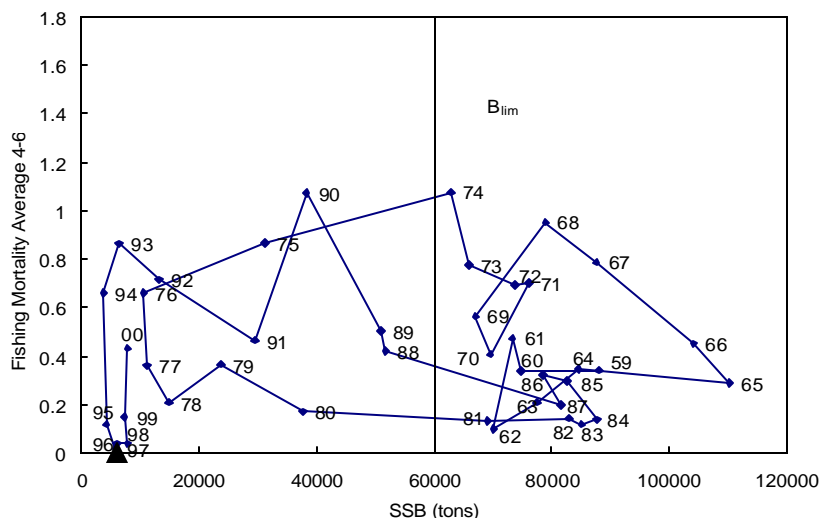


Fig. 9.4. Cod in Div. 3NO: Spawner stock scatter. The 2001 autumn survey (Q adjusted) estimate of spawning stock biomass is indicated by the triangle.

10. **Redfish (*Sebastes mentella* and *Sebastes fasciatus*) in Divisions 3L and 3N** (SCR Doc. 02/13, SCS Doc. 02/4, 6, 7, 10)

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 fasciatus*). The external characteristics are very similar, making them difficult to distinguish, and as a consequence they are reported collectively as "redfish" in the commercial fishery statistics.

A total catch of 1 440 tons was estimated for 2001 compared to 1 700 tons in 2000 (Fig. 10.1). The catches were taken as by-catch in the Greenland halibut fisheries for various fleets. By-catch of redfish, taken by the Canadian fleet in the Div. 3L shrimp fishery, was estimated to be less than 3 tons during each of 2000 and 2001.

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

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Recommended TAC	14	14	14	11	11	ndf	ndf	ndf	ndf	ndf
STATLANT 21A	15	2.7	2.0	0.5	0.6	0.9	1.8	1.5 ¹	0.8 ¹	
STACFIS	21 ²	6 ²	2	0.5	0.6	0.9	2.3	1.7	1.4	

¹ Provisional.

² STACFIS could not precisely estimate the catch. Values are midpoint of range of estimates.

ndf no directed fishing.

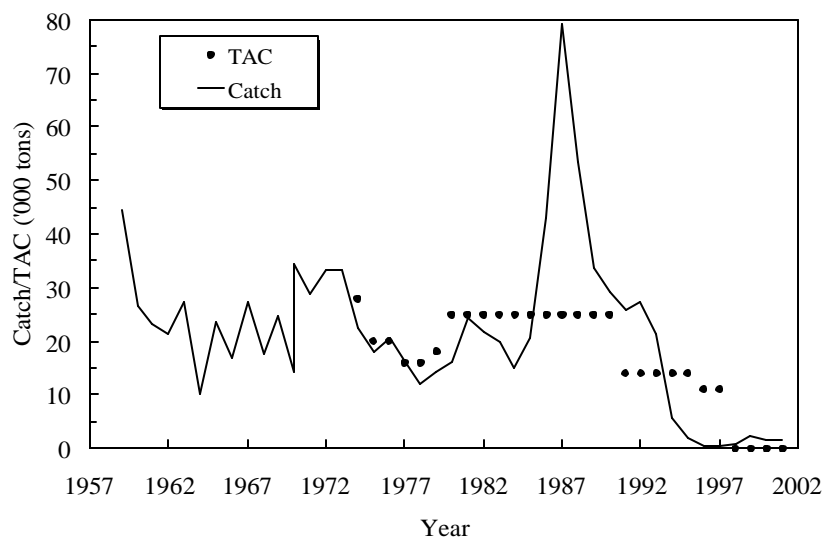


Fig. 10.1. Redfish in Div. 3LN: catches and TACs.

Spring and autumn surveys were conducted in Div. 3L and Div. 3N during 2001. The spring 2002 survey data were also available but considered preliminary. The survey estimates (Fig. 10.2) did not alter the perception of STACFIS that the stock biomass remains at a very low level and recruitment has been poor (Fig. 10.3) for the past 15 years. Relative exploitation in Div. 3L and Div. 3N (Fig. 10.4), based on ratios of catch to survey biomass estimates averaged over the year, has been low since 1995.

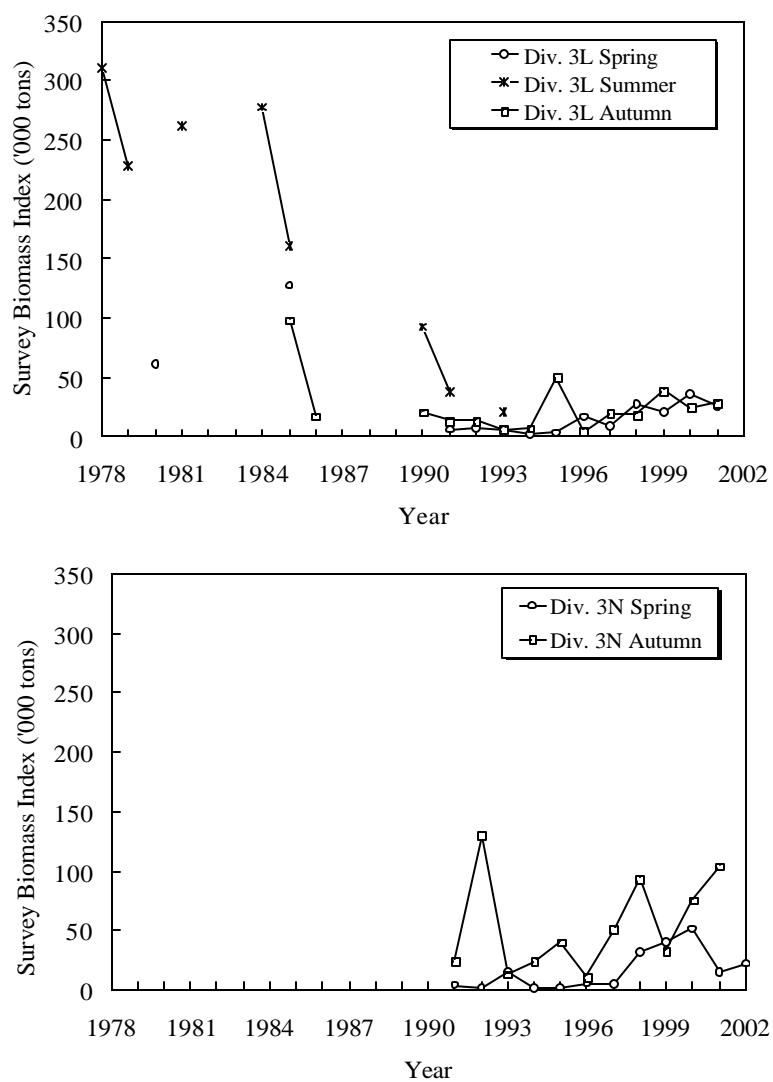


Fig. 10.2. Redfish in Div. 3LN: survey biomass indices from Canadian surveys in Div. 3L and Div. 3N in Campelen equivalent units for surveys prior to autumn 1995.

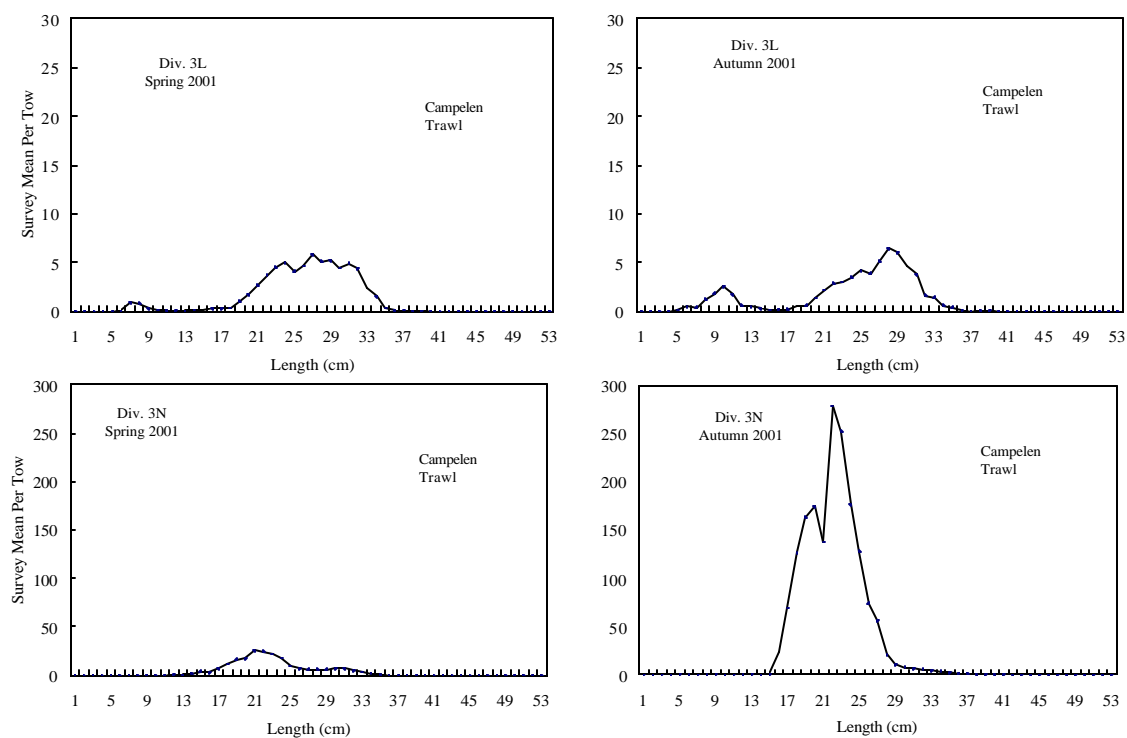


Fig. 10.3 Redfish in Div. 3LN: Size distribution (stratified mean per tow) from Canadian surveys in Div. 3L and Div. 3N for 2001.

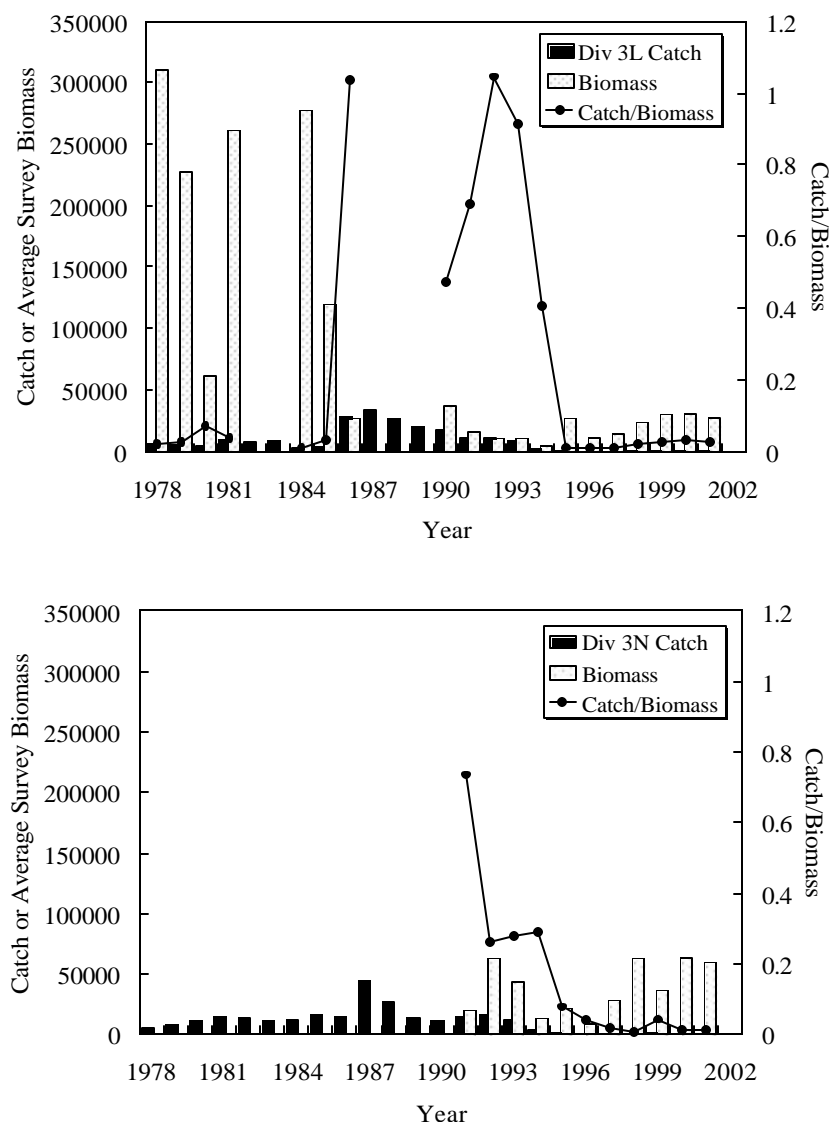


Fig. 10.4. Redfish in Div. 3LN: Redfish in Div. 3LN: Catch/Biomass ratios for Div. 3L and Div. 3N

b) Current and Future Studies

STACFIS noted that results from a study of redfish species distribution and population genetic structure, which is pertinent to the Committee's long standing recommendation on the appropriateness of Div. 3LN and Div. 3O as management units, had been published recently in a primary journal (Roques *et al.*, 2001)¹. The study suggests that hybrids of *Sebastes mentella* and *S. fasciatus* exist, but are restricted to an area of common overlap that includes Div. 4RST (Gulf of St. Lawrence) and Div. 3P and 4V (Laurentian Channel). The study also suggests that for *S. mentella*, no genetic difference could be detected among samples from Div. 3LNO and those from Subarea 2 and Div. 3K.

¹ Roques S, J. M. Sévigny, and L. Bernatchez. 2001. Evidence of broadscale introgressive hybridization between two redfish (genus *Sebastes*) in the North-west Atlantic: a rare marine example. *Mol. Ecol.*, **10**: 149-165.

A study of parasite fauna available during the current meeting (SCR Doc. 02/13) suggests the existence of seven isolated poorly intermingling groupings that exist along the coast of Canada. The study also suggests that Div. 3N and Div. 3O are the areas of closest similarity.

STACFIS acknowledged that while these studies suggest alternative management units may be more appropriate than those that currently exist, there was no consensus as to which methodology yielded results that better reflected the most appropriate management units. However, both studies suggest that managing Div. 3O as a separate management unit may not be appropriate.

STACFIS **recommended** that *further studies be carried out to further clarify stock structure of redfish stock of interest to NAFO.*

11. **American Plaice (*Hippoglossoides platessoides*) in Divisions 3L, 3N and 3O** (SCR Doc. 02/1, 2, 36, 44, 65, 70, 80; SCS Doc. 02/4, 6, 7)

a) **Introduction**

This fishery was under moratorium in 2001. Total catch in 2001 was 5 739 tons, mainly taken in the Regulatory Area (Fig. 11.1), and as by-catch in the Canadian yellowtail flounder fishery. There has been an increase in catch each year since 1995. Canadian catch in 2001 was about 1 620 tons, and catches by EU-Portugal and EU-Spain were 959 and 2 627 tons, respectively.

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

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Recommended TAC	10.5	4.8 ¹	nf	nf	nf	nf	nf	ndf	ndf	ndf
STATLANT 21A	7.9	0.6	0.5	0.9	1.4	1.6	2.4	2.7 ²	2.8 ²	
STACFIS	17 ³	7	0.6	0.9	1.4	1.6	2.6	5.2	5.7	

¹ No directed fishing.

² Provisional.

³ Catch may be as high as 19 400 tons.

nf No fishing.

ndf No directed fishing.

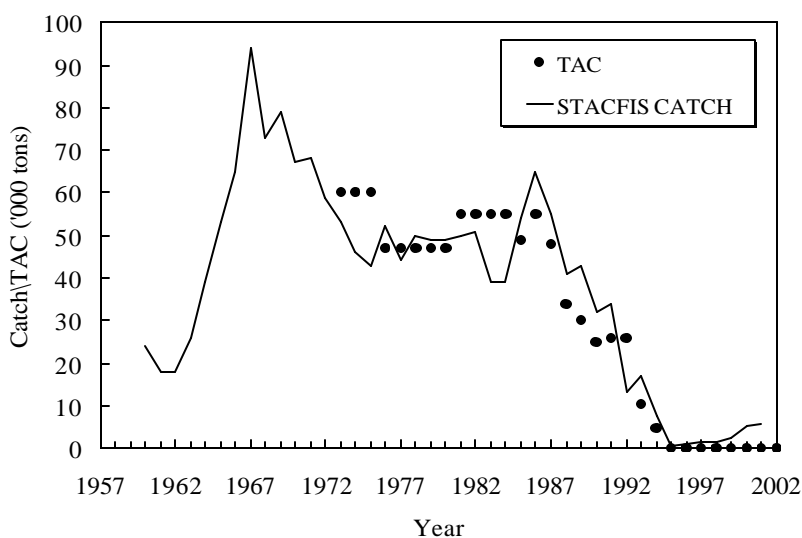


Fig. 11.1. American plaice in Div. 3LNO: catches and TACs.

b) **Input Data**i) **Commercial fishery data**

Catch and effort. There were no recent catch and effort data available.

Catch-at-age. There was age sampling of the 2001 by-catches in the Canadian fishery and length sampling of by-catch in the Portuguese, Spanish and Russian fisheries. Catch-at-age in the Canadian by-catch was mainly age 7 to 11 with a peak at age 10. For the Spanish by-catch the peak in Div. 3L was 32-40 cm while in Div. 3N it was 34-49 cm. In Div. 3O there were two peaks, one at 20-26 cm and the other at 34-42 cm but the Div. 3O length frequencies were based on only one sample (SCS Doc. 02/7). For the Portuguese trawler fleet most of the by-catch in Div. 3L was 34-42 cm, in Div. 3N 32-46 cm, and in Div. 3O 32-36 cm (SCS Doc. 02/6). In the Russian by-catch the bulk of the catch was made up of fish 32-38 cm in length in Div. 3L, 32-36 cm in Div. 3N and 36-46 cm in Div. 3O (SCS Doc. 02/4). Total catch-at-age for 2001 was produced by applying Canadian survey age-length keys to length frequencies collected each year by EU-Spain, EU-Portugal and Russia and adding it to the catch-at-age calculated for Canada. This total was adjusted to include catch for which there were no sampling data. Overall, ages 7 to 11 dominated the 2001 catch.

ii) **Research survey data**

Canadian stratified-random bottom trawl surveys. Data from **spring surveys** in Div. 3L, 3N and 3O were available from 1985 to 2001. Surveys prior to 1991 generally had a maximum depth of 366 m. From 1991 to 2001, the depth range has been extended to at least 731 m in each survey.

In the spring survey in 2001 the biomass estimates for 3L, 3N and 3O were 28 000, 92 000 and 70 000 tons, respectively. The value for Div. 3N represents a very large increase over the estimate for 2000. From 1996 to 1998 the estimate for Div. 3N biomass was approximately half of the estimate for Div. 3O while from 1999 to 2001 the estimates in the two Divisions are similar. Biomass in Div. 3LNO combined has increased somewhat since 1996 but is only 26% (Campelen equivalents) of that of the mid 1980s (SCR Doc. 02/70; Fig. 11.2).

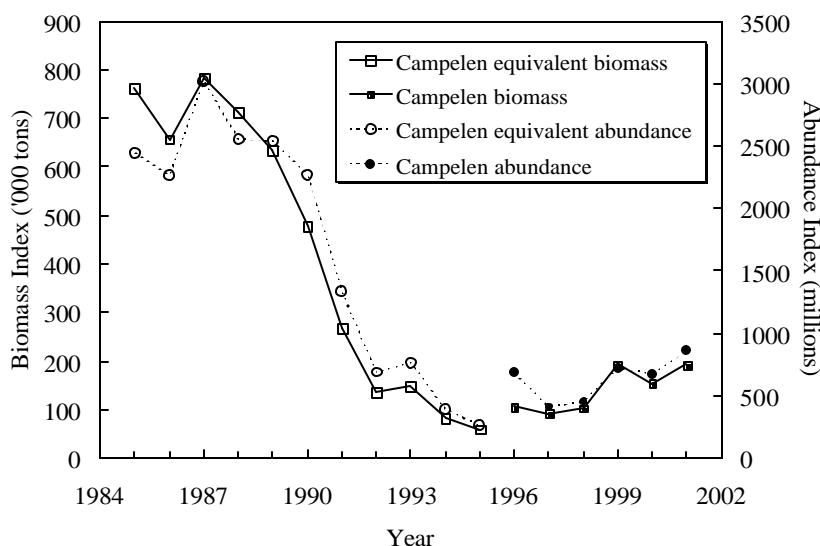


Fig. 11.2. American plaice in Div. 3LNO: biomass and abundance indices from Canadian spring surveys.

The total abundance has fluctuated since 1996 with perhaps a slight increasing trend. Abundance of the oldest ages (12+) has increased since 1996 while the younger ages (0-5) declined from 1996 to 1997 but increased to 1996 levels in 2000. Since 1998, 20-30% of the population was made up of fish age 9+ while this was less than 8% in 1996 and 1997. Ages 1 and 2 in 1999 to 2001 are the highest in the time series but these ages are probably 'under converted' in the 1985 to 1995 data.

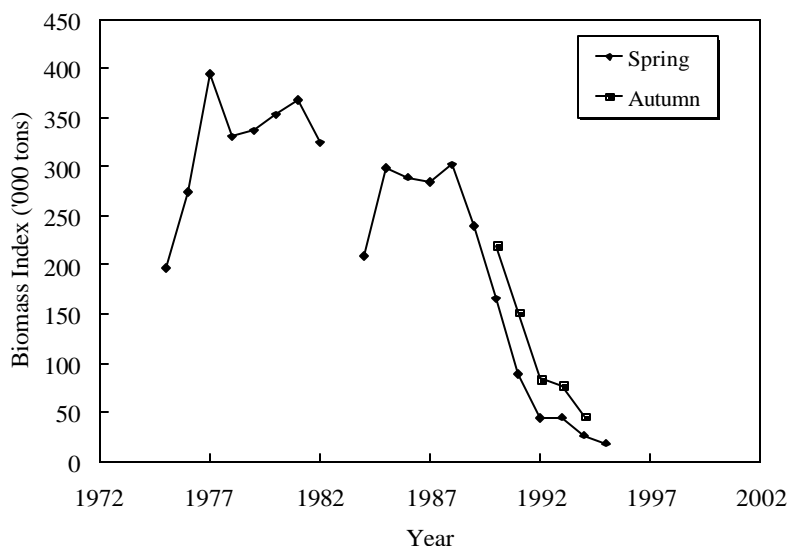


Fig 11.3. American plaice in Div. 3LNO: biomass index from Canadian spring surveys using the Engel groundfish trawl.

Canadian spring and autumn surveys conducted prior to autumn 1995 were conducted using an Engel bottom trawl. There is no conversion of the data series prior to 1985. However, the index from the spring survey using the Engel indicates that the biomass level in the mid 1980s was slightly lower than that in the late-1970s (Fig. 11.3).

From Canadian **autumn surveys** biomass estimates in 2001 were 50 000, 93 000 and 54 000 tons for Div. 3L, 3N and 3O respectively. Except for a decline in 2000, biomass in Div. 3L in the autumn survey has been fairly stable. During 1995 to 1997, Div. 3N constituted on average 40% of the Div. 3NO total while from 1999 to 2001 it comprised 64% of the Div. 3NO total. The overall biomass for Div. 3LNO has shown a slight increasing trend since 1995 (Fig. 11.4). The biomass index remains well below that of 1990 with the average of the 2000 and 2001 indices representing only 36% of that of 1990.

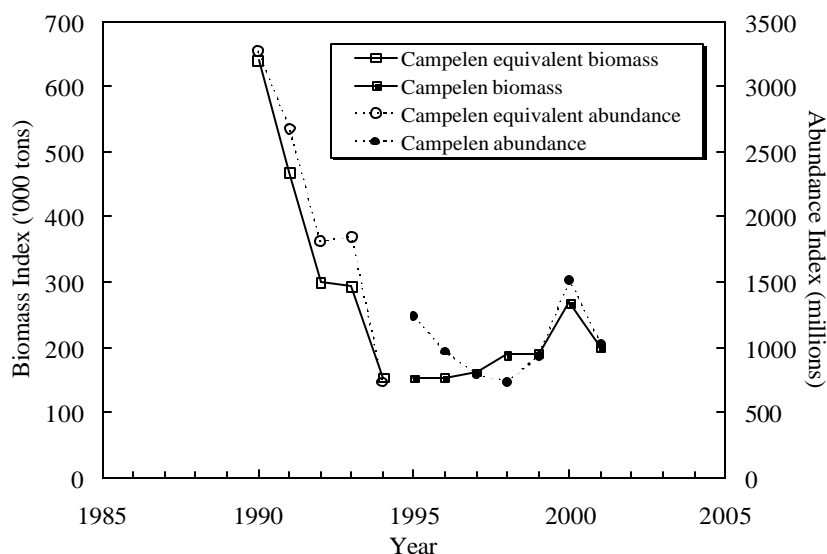


Fig. 11.4. American plaice in Div. 3LNO: biomass and abundance indices from autumn surveys.

Abundance in Div. 3L has declined in each year since 1995, while abundance has been increasing in Div. 3N since 1996. Ageing was not available for 2001. Similar to the spring survey older ages have made up a higher proportion of the abundance in the last few years. In 1998-2000, 13-15% of the population was made up of fish ages 9+ compared to less than 5% in 1996 and 1997. Also similar to the spring survey the abundance at ages 1 and 2 in 1999 and 2000 are the highest in the time series.

Survey by EU-Spain. Surveys have been conducted annually from 1995 to 2001 by EU-Spain in the Regulatory Area in Div. 3NO to a maximum depth of 1 462 m (since 1998). Surveys since 1996 are comparable in coverage. Biomass and abundance declined between 1996 and 1997. Estimates of abundance from the surveys have been increasing since 1998. The estimates of biomass increased from 1997 to 2000. The estimate in 2001 was 387 000 tons, similar to the 1999 estimate (Fig. 11.5). In 2001, there were 2 modes in the length distribution of both males and females (SCR Doc. 02/2). For males these modes were at 20-22 cm and 32-36 cm and for females they were at 20-22 cm and 38-36 cm. These modes at the smaller sizes may indicate incoming recruitment. STACFIS noted that the entire time series of survey data was presented in a single document as had been recommended in 2001.

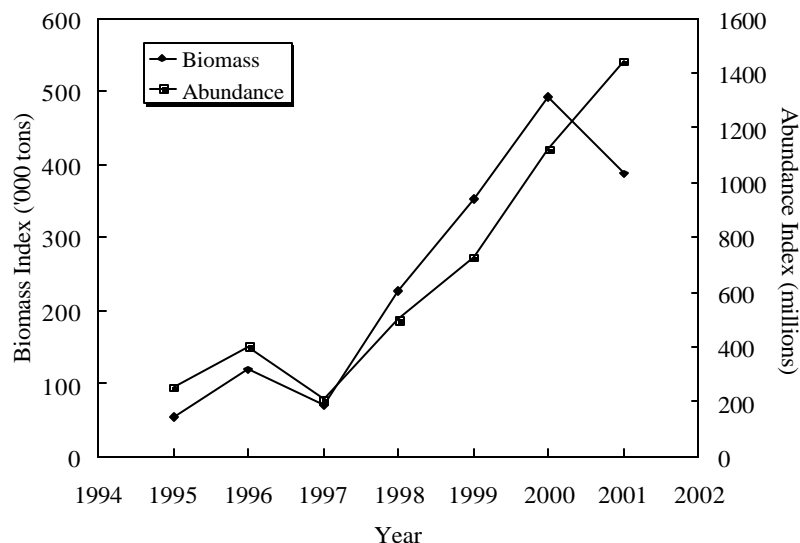


Fig. 11.5 American plaice in Div. 3LNO: biomass and abundance indices from the survey by EU-Spain.

Joint DFO-Industry surveys. Since 1996 grid surveys directed at yellowtail flounder have been conducted in Div. 3LNO. Information is also collected on American plaice. Data collected from common grids in July (the most frequent time of the survey) showed no trend over the 6 years (SCR Doc. 02/44). The grid was expanded in 2000. Catch rates of American plaice in the expanded grid in 2001 were similar to 2000.

iii) Biological studies

Maturity. Age (A_{50}) and length (L_{50}) at 50% maturity were produced from spring RV data. For males, A_{50} declined and then showed an increase in both the estimates, although the most recent two cohorts have shown a decline. For females, estimates of A_{50} have been declining since the beginning of the time series. The A_{50} for males in recent cohorts is about 4 years compared to 6 years at the beginning of the time series. For females the A_{50} for recent cohorts is about 7.5 to 8.0 years compared to 11 years for cohorts at the beginning of the time series. L_{50} has declined for both sexes but recovered in recent cohorts. The current L_{50} for males of about 20 cm is similar to the earliest cohorts estimated. The L_{50} of most recent cohorts for females is in the range of 34-35 cm, lower than the 38 cm of the earliest cohorts.

Size-at-age. Mean weights-at-age were calculated for male and female American plaice for Div. 3LNO using spring survey data from 1990 to 2001 and mean lengths-at-age using data from 1985-2001. Means were calculated accounting for the length stratified sampling design. In both mean length and mean weight at age there is some indication of a decline from 1996 or 1997 to 2001 in the older ages and an increase at the younger ages.

Recruitment studies. A multiplicative model incorporating data from Canadian spring and autumn surveys was used to estimate the relative year-class strength produced by the spawning stock. Predicted year class strength generally declines over time; the estimates indicate no substantial recruitment since 1989. However, the model estimate of the 1997 year-class strength shows marginal improvement over the six previous cohorts (Fig. 11.6).

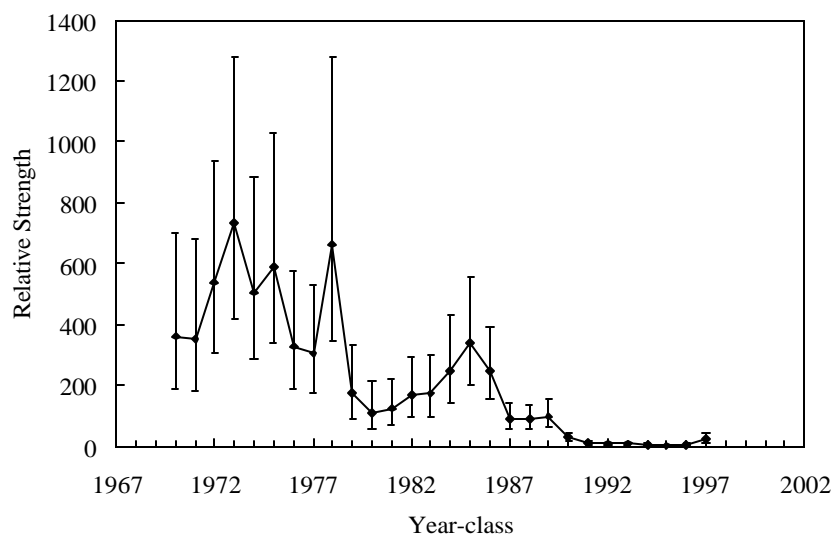


Fig. 11.6 American plaice in Div. 3LNO: estimates of relative cohort strength from Canadian surveys

Correlations between year-class strength in several species were examined (SCR Doc. 02/1). For Div. 3LNO American plaice, poor year-classes seemed to coincide with periods of below average temperature.

Mortality from surveys. Estimates of total mortality (Z) from the Campelen or equivalent, spring and autumn survey data were calculated for ages 1 to 16. Both surveys indicate an increase in mortality up to the mid-1990s. Since that time, mortality has declined. The estimates of total mortality from the spring and autumn surveys indicate that mortality was very high after the moratorium on fishing was introduced. The average Z for ages 5 to 10 in 1995 and 1996 was approximately 0.6. The estimates of total mortality were very high from 1989 through 1996 but decreased substantially after that period.

Stock structure. In 2001, STACFIS noted that historically the largest biomass, based on survey data, was in Div. 3L. Based on comparisons of survey data with the results of SPA, it is also clear that the overall historical perspective of the resource, including SSB and recruitment, is most reflective of changes in Div. 3L. Noting that the current status of the resource is largely driven by the status of that portion of the resource in Div. 3L, STACFIS noted the 2001 **recommendation** that *studies be initiated to examine the relationship between American plaice in each of Div. 3L, 3N and 3O. These studies should include examination of historical fishery and biological data disaggregated by Division, any tagging information and genetic analyses.* To address this recommendation, the basis of the stock definition for Div. 3LNO American plaice, along with some of the relevant material on the assessment history, fishery, distribution, spawning and maturity, growth, tagging and stock identification were reviewed (SCR Doc. 02/36). There is currently no basis for splitting the Div. 3LNO American plaice stock into sub-components. Further insights into any possible substructure of this stock would require a comprehensive research program involving such studies as tagging, including satellite tags, genetics and extensive analyses of biological data.

Comparison of Canadian spring and EU-Spain surveys. Results from the Canadian spring and EU-Spain RV surveys were compared (SCR Doc. 02/65). Overall, surveys by Canada and EU-Spain in the NAFO Regulatory Area in Div. 3NO appear to show similar trends. However, this represents only about 11% of the total stock area for Div. 3LNO American plaice. Data from the Canadian spring survey show that biomass of American plaice in the NRA in Div. 3NO has increased more rapidly than the biomass in the remainder of the survey area in Div. 3LNO. The relationship between the biomass estimates in these 2 areas is not significant (Fig. 11.7).

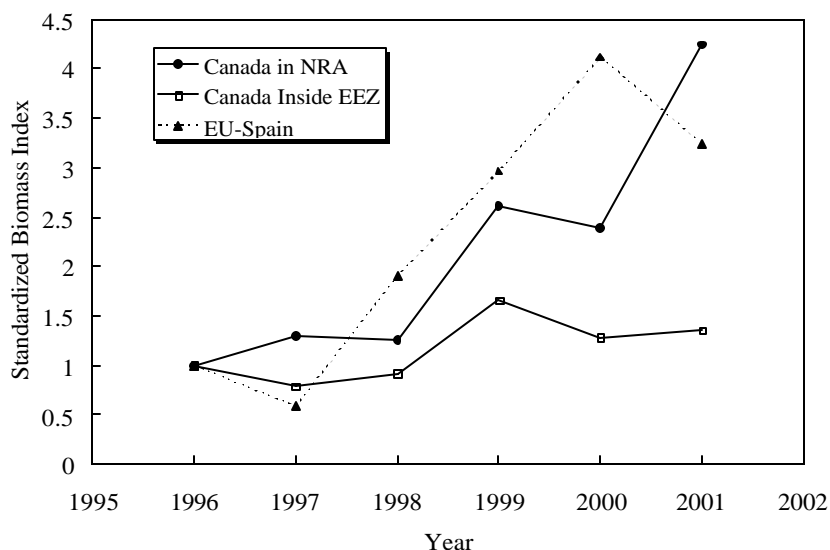


Fig. 11.7. American plaice in Div. 3LNO: Standardized biomass indices from Canadian spring and EU-Spain surveys.

c) Estimation of Parameters

Several formulations of virtual population analyses (VPA) were presented using catch-at-age and survey information up to 2001. Both the ADAPTive framework (SCR Doc. 02/70) and XSA (SCR Doc. 02/80) were explored.

Length frequencies of American plaice collected during the surveys by EU-Spain in the Regulatory Area of Div. 3NO were converted to numbers-at-age using age length keys from Canadian spring surveys in Div. 3N. The results of models containing survey indices from Canadian spring and autumn surveys and from the surveys by EU-Spain were examined.

There were strong patterns in the residuals for the index from the EU-Spain surveys when these were included in the VPA. If self-weighting of the indices was used in XSA very little weight was given to the EU-Spain survey. This survey covers only a small portion of the stock area for Div. 3LNO American plaice. STACFIS concluded that the best formulation of the model included both the Canadian spring and autumn surveys but that the survey by EU-Spain should be excluded from the analyses. The accepted formulation included a plus group at age 15 in the catch-at-age and the ratio of F on the plus group to F on the last true age was set at 1.0. M was assumed to be 0.2 on all ages except 0.53 on all ages from 1989 to 1996.

d) Assessment Results

The ratio of catch to biomass from Canadian spring RV surveys was examined. The Campelen ratios were highest in the 1991-94 period (similar to 1986), and the most recent values (1995-2001) were much lower, reflecting a period of reduced catches. However, catch/biomass ratios increased substantially in 2000, and were at a similar level in 2001, indicating an increase in fishing mortality, consistent with increased catches (Fig. 11.8).

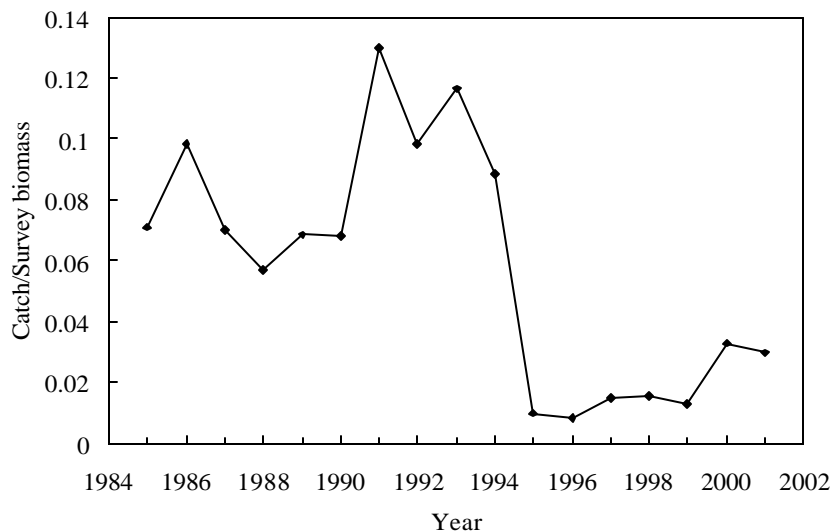


Fig. 11.8. American plaice in Div. 3LNO: catch to survey biomass ratios.

The VPA analyses showed that population abundance and biomass declined fairly steadily from the mid-1970s to 1995. Biomass and abundance have been relatively stable over the last number of years (Fig 11.9). Average F on ages 9 to 14 and ages 11 to 14 showed an increasing trend from about 1965 to 1985. There was a large peak in F in 1993, which may be an artifact. F since 1995 has been generally lower than in the earlier period but has been increasing steadily and in 1999 to 2001 average F on ages 9-14 was above 0.2. In 2001, the average F on ages 11-14 was 0.24 (Fig. 11.10). This is near the $F_{0.1}$ for this stock.

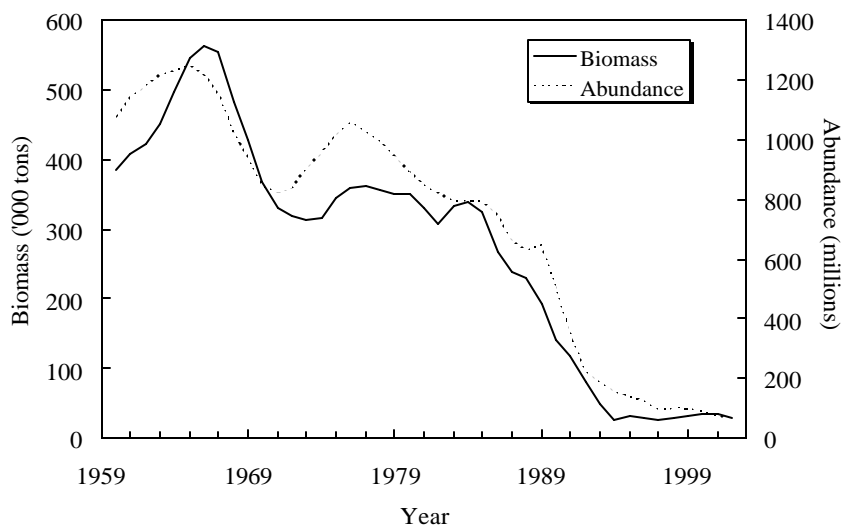


Fig. 11.9. American plaice in Div. 3LNO: Population abundance and biomass from VPA

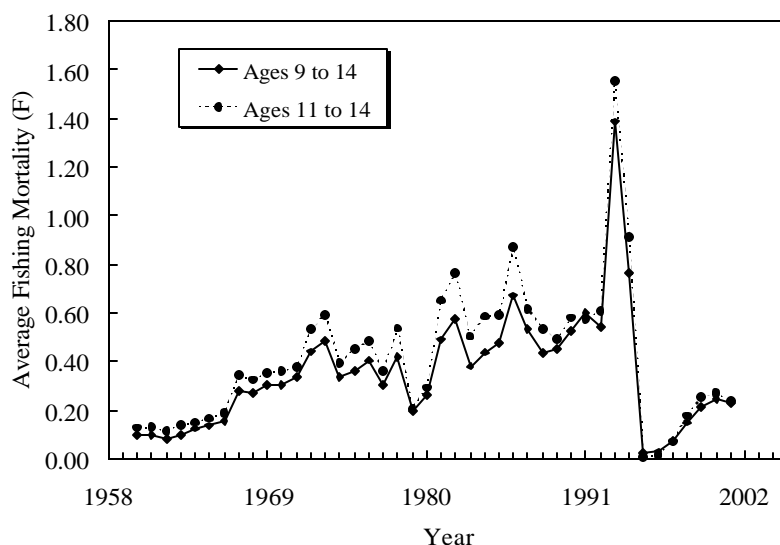


Fig. 11.10. American plaice in Div. 3LNO: Average fishing mortality from VPA.

There was little difference in the estimates of F in the 2002 assessment as compared to the 2001 assessment. A comparison of F estimates follows:

	Average ages 9 to 14		Average ages 11 to 14	
	F_{2000}	F_{2001}	F_{2000}	F_{2001}
2001 assessment	0.24		0.25	
2002 assessment	0.25	0.23	0.27	0.24

Spawning stock biomass has shown 2 peaks, one in the mid-1960s and another in the early- to mid-1980s. Since then it declined to a very low level (less than 10 000 tons) in 1994 and 1995 (Fig. 11.11). It has increased since then but still remains at a very low level at just over 20 000 tons. This is only 10% of the level in the mid-1960s and 16% of the level in the mid-1980s. Recruitment has been steadily declining since the 1986 year-class and there have been no good recruitment since then (Fig. 11.11). No good recruitment has been seen below an SSB of 50 000 tons.

Biomass: The biomass is very low compared to historic levels.

Spawning stock biomass: SSB declined to very low levels in 1994 and 1995. It has increased since then but remains very low at just over 20 000 tons.

Recruitment: There has been no good recruitment since the mid-1980s.

Fishing mortality: In the last 3 years average fishing mortality on ages 9 to 14 is above 0.2.

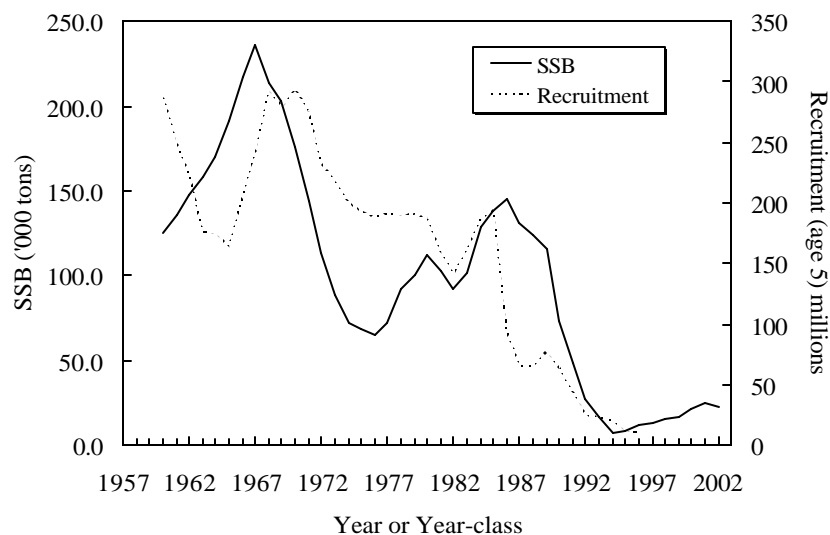


Fig. 11.11. American plaice in Div. 3LNO: Spawning stock biomass and recruitment from VPA.

e) **Reference Points**

An examination of the stock recruit scatter shows that there has been only good recruitment observed above 155 000 tons and no good recruitment observed at SSB below 50 000 tons (Fig. 11.12). This 50 000 ton level could serve as a preliminary B_{lim} for this stock. There is also an indication that since the mid-1980s recruitment has been depressed at SSB above this level, which may indicate that the stock has been in a period of low productivity.

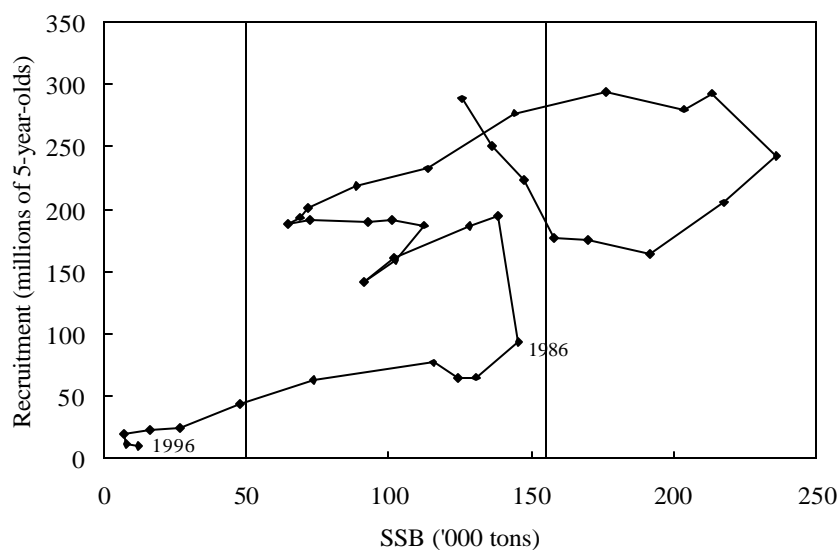


Fig. 11.12. American plaice in Div. 3LNO: spawning stock biomass recruitment relationship from VPA.

f) **Medium Term Considerations**

Simulations were carried out to examine the trajectory of the stock under 4 scenarios of fishing mortality: $F = 0$, $F = 0.5 \times F_{2001}$, $F = F_{2001}$, and $F = 2 \times F_{2001}$. For these simulations the results of the VPA and the covariance of these population estimates were used. The following assumptions were made:

Age	Estimate of 2002 population numbers (⁰⁰⁰)	CV on population estimate	Weight-at-age mid-year (avg. 1999-2001)	Weight-at-age beginning of year (avg. 1999-2001)	Maturity-at-age (avg. 1999-2001)	PR relative to ages 11-14 (avg. 1999-2001)
5			0.199	0.176	0.007	0.020
6	8310	0.553	0.287	0.232	0.049	0.091
7	7639	0.331	0.350	0.306	0.226	0.245
8	9856	0.276	0.416	0.370	0.543	0.395
9	8320	0.253	0.498	0.439	0.817	0.606
10	6445	0.247	0.640	0.564	0.943	0.775
11	6013	0.242	0.798	0.722	0.982	1
12	4105	0.258	1.025	0.906	0.999	1
13	2287	0.260	1.255	1.144	0.999	1
14	927	0.263	1.527	1.375	1	1
15	612	0.207	1.948	1.785	1	1

Simulations were carried out over a 10-year period. Recruitment was resampled from three sections of the estimated stock recruit scatter, depending on SSB. The three sections were 50 000 tons of SSB and below (only low recruitment), greater than 50 000 tons to 155 000 tons (low and high recruitment), and greater than 155 000 tons (only high recruitment). The simulations contained a plus group at age 15. At $F = F_{2001}$ or $F = 2 \times F_{2001}$ the population is estimated to decline over the 10-year period. At $F = 0.5 \times F_{2001}$ the population is estimated to grow very slowly. At $F = 0$ the population is estimated to grow more quickly and could reach B_{lim} before the end of the 10 year time period (Fig. 11.13). Yield is estimated to increase slightly over the 10-year time period under the scenario of $F = 0.5 \times F_{2001}$, but to decline over the time period at $F = F_{2001}$ or $F = 2 \times F_{2001}$.

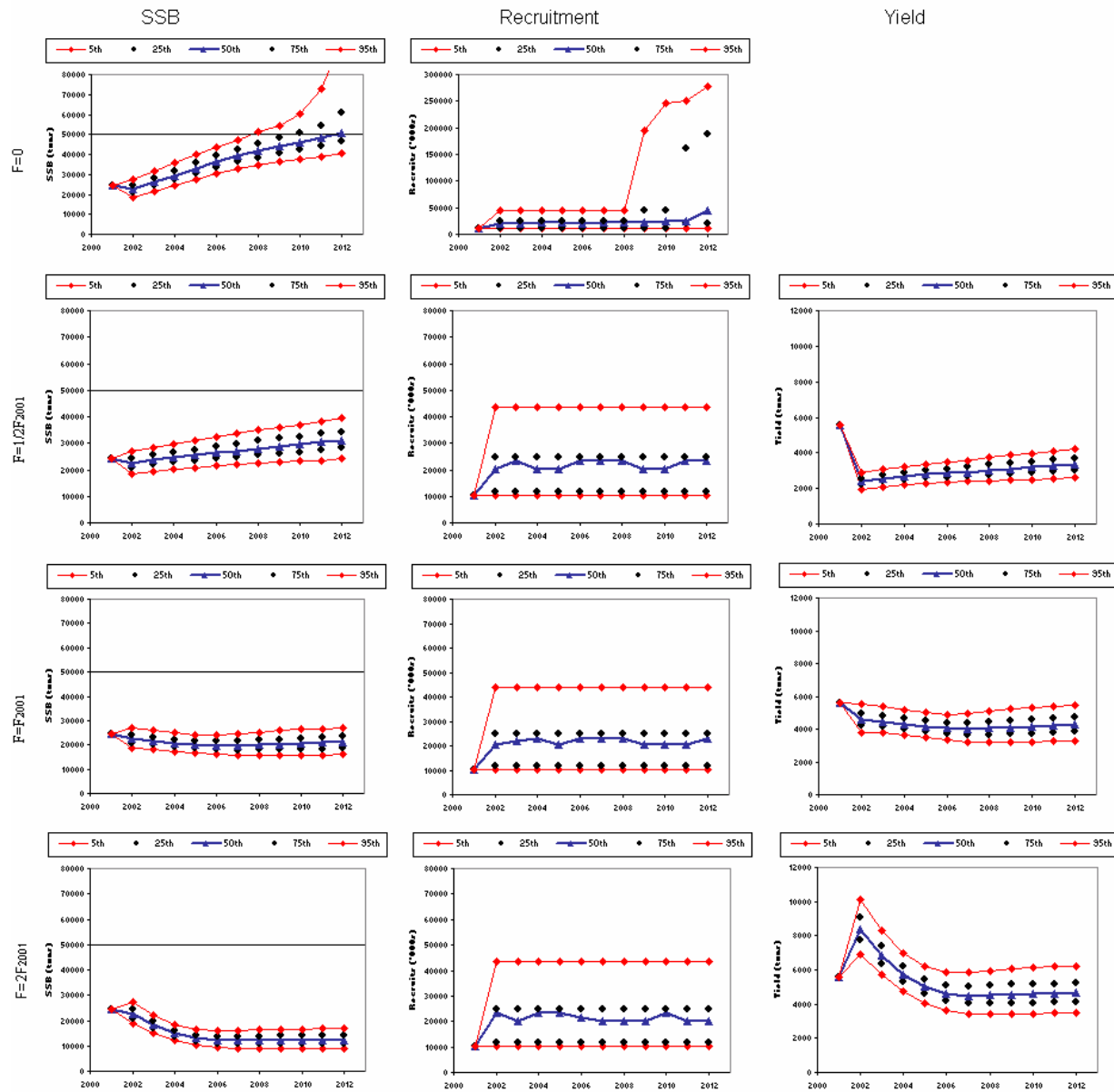


Fig. 11.13. American plaice in Div. 3LNO: median spawning stock biomass and yield from projections along with various percentiles

12. Yellowtail Flounder (*Limanda ferruginea*) in Divisions 3L, 3N and 3O (SCR Doc. 02/3, 5, 43, 44, 65, 71, 73; SCS Doc. 02/4, 6, 7)

a) Introduction (SCR Doc. 02/7)

During the moratorium (1994-97), catches decreased from around 2 000 tons in 1994 to about 280 tons in 1996 and increased to 800 tons in 1997, as by-catch in other fisheries (Fig. 12.1). Since the fishery re-opened in 1998, catches have increased from 4 400 tons to 14 100 tons in 2001. Catches exceeded the TACs during 1985 to 1993 and again from 1998-2001. During the latter period, catches exceeded the annual TACs by about 10%. As noted in previous reports of Scientific Council, catch statistics for this stock prior to the moratorium are not adequate, with as much as 25-50% of the catch in some years coming from surveillance estimates, including a categorization of unspecified flounder catches.

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

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Recommended TAC	7	7 ¹	ndf	ndf	ndf	4	6	10	13	13
STATLANT 21A	6.9	0.2	0.1	0.2	0.7	4.4	7.0	10.6 ²	12.8 ²	
STACFIS	14 ³	2 ³	0.1 ³	0.3	0.8	4	7	11	14.1	

¹ No directed fishing.

² Provisional.

³ Includes estimates of misreported catches.

ndf No directed fishing.

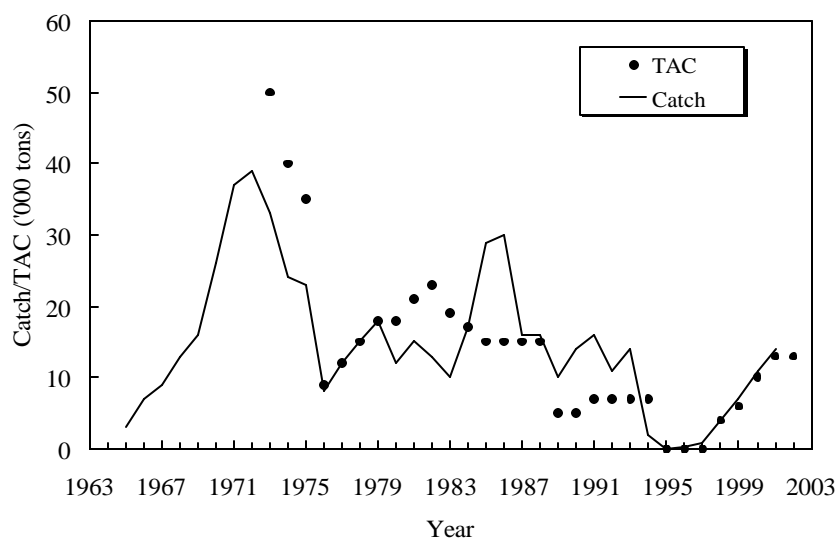


Fig. 12.1. Yellowtail flounder in Div. 3LNO: catches and TACs.

b) Input Data

i) Commercial fishery data (SCR Doc. 02/73; SCS Doc. 02/4, 6, 7)

There were catch and effort data from the Canadian commercial fishery in 2001, which were included in a multiplicative model to analyze the CPUE series from 1965 to 2001. 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. The 1998-2001 CPUE values are not directly comparable to CPUE indices from previous years because of changes in the 1998-2001

fishing patterns. The 1998-2001 catch rates are related to the fleet's fishing pattern, which because of the 5% by-catch rule, resulted in concentrating effort in the area where yellowtail flounder was abundant and the catches of American plaice and cod were expected to be low. In 2001, by-catch rates of cod and American plaice increased. Excluder grates were used to control by-catch levels, particularly cod. Catches of juvenile yellowtail were reduced by the use of large mesh sizes (145 mm) in the codend. Modal size of yellowtail flounder in the Canadian fishery was 38 cm.

There was sampling of yellowtail flounder from by-catches by EU-Spain, EU-Portugal and Russia in the Regulatory Area of Div. 3NO. The length frequency peaked at 36 cm in the Russian catches, and 34-35 cm in the Spanish catches. Length frequencies in the Portuguese by-catches peaked at 30-31 cm, although there was a slightly higher proportion of small yellowtail in by-catches in the large-mesh skate fishery.

ii) Research survey data

Sampling gear studies (SCR Doc. 02/5). Analysis of comparative fishing trials on the Grand Banks to derive conversion factors for the Spanish survey (convert Pedreira units to Campelen equivalents) were presented. The results showed that the Pedreira trawl caught more fish (about four times more) at most length groups, but the Campelen trawl caught more at the smaller sizes. Trends in the converted and unconverted data were similar for yellowtail. It was noted that comparative fishing between the Spanish survey vessel and the Canadian survey vessel, both using Campelen trawls, occurred in 2002. STACFIS **recommended** that *these comparative trials between Canada and EU-Spain be continued and that an analysis of the 2001 and 2002 comparative fishing trials results be presented in June 2003.*

Canadian stratified-random spring surveys (SCR Doc. 02/43). In 2001, most of the trawlable biomass of this stock continued to be found in Div. 3N. The index of trawlable biomass in 2001 increased from the 2000 value to about the same level estimated in 1999, and was the highest in the 19 year series (Fig. 12.2).

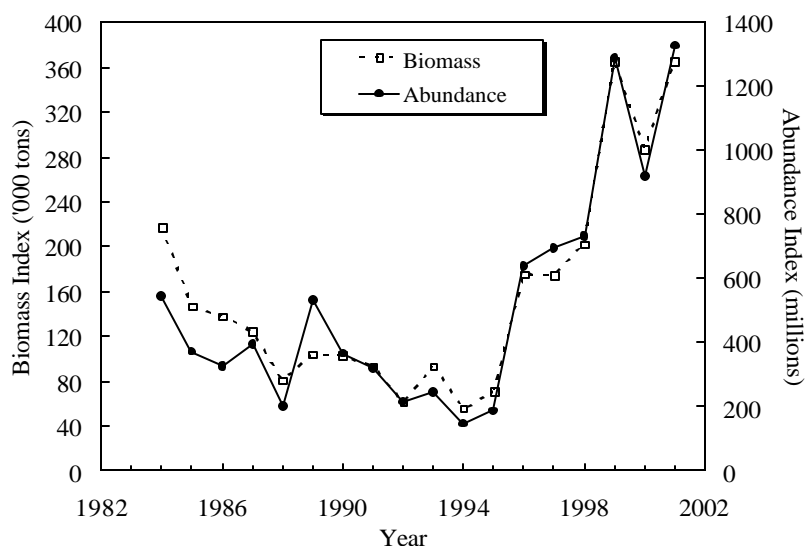


Fig. 12.2. Yellowtail flounder in Div. 3LNO: estimates of biomass and abundance from Canadian spring surveys.

Canadian stratified-random autumn surveys (SCR Doc. 02/43). Most of the biomass (78%) from the autumn survey in 2001 was also found in Div. 3N. The index of trawlable biomass for Div. 3LNO has increased steadily from 66 000 tons in 1990 to 475, 000 tons in 2001 (Fig. 12.3), and has risen by 34% and 42% in the last 2 years.

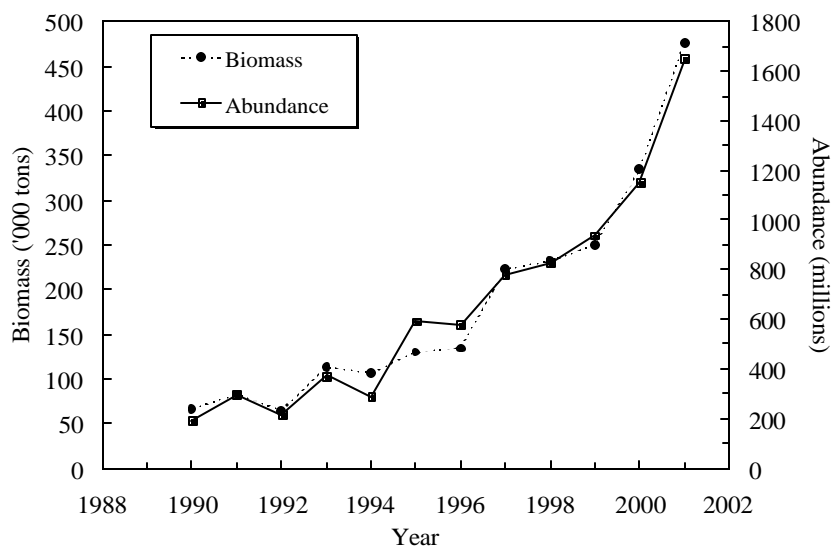


Fig. 12.3. Yellowtail flounder in Div. 3LNO: estimates of biomass and abundance from Canadian autumn surveys.

Cooperative DFO/fishing industry seasonal surveys (SCR Doc. 02/44). Cooperative surveys between Canadian Department of Fisheries and Oceans (DFO) and the Canadian fishing industry in Div. 3NO have been carried out since 1996 using a commercial fishing gear without a codend liner. These surveys use a grid design with fixed stations. The CPUE for the indexed grid blocks for July surveys from 1996-2001 has varied about a mean of 760 kg/h, with the 2001 survey value being about 7% higher than the mean. 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. 02/3) The abundance and biomass indices showed an increasing trend between 1995 and 1999, before declining in 2000 (Fig. 12.4). The 2001 values increased to the levels observed in 1999, e.g. the biomass index was about 600 000 tons. Comparison of the Spanish survey (Pedreira trawl) results with estimates from the portion of the Canadian spring surveys in the NRA in Div. 3NO for the years 1996-2001 showed a significant correlation in the biomass estimates of yellowtail flounder.

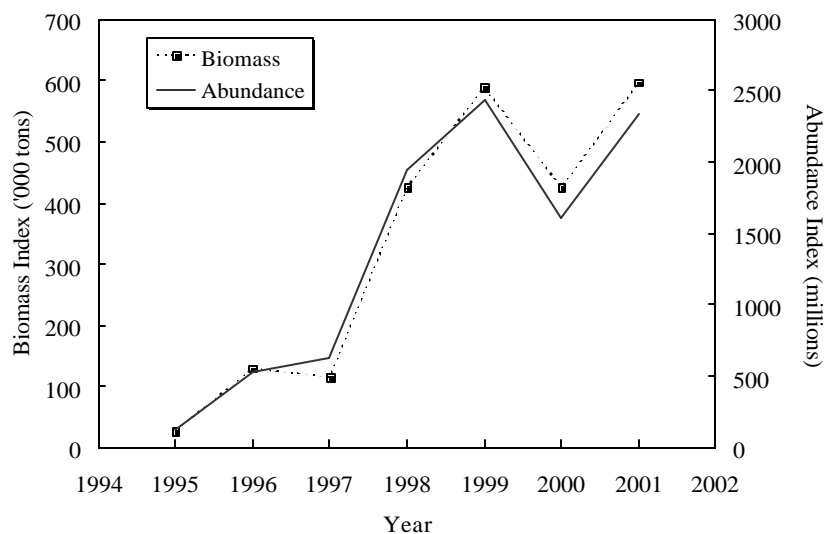


Fig. 12.4. Yellowtail flounder in Div. 3LNO: estimates of biomass from the Spanish spring surveys.

Stock distribution (SCR Doc. 02/43). Analysis of 1999 -2001 spring and autumn surveys confirmed that the stock was more widely distributed in all three Divisions, similar to that of the mid-1980s. In these surveys, the majority of the stock was concentrated in Div. 3NO, mainly on and to the west of the Southeast Shoal (as defined by the 55-metre depth contour), consistent with the distribution in other years. As well, expansion of the range back into Div. 3L has taken place.

iii) **Biological studies** (SCR Doc. 02/71).

Length at 50% maturity (L_{50}) was calculated for males and females separately, from samples collected during the 1984-2001 Canadian surveys in the Div. 3LNO. There was a 7 cm decrease in length at 50% maturity in males from the mid-1980s to 1999, with an increase of about 3 cm since then. Female length at 50% maturity has remained fairly stable at about 33-34 cm (Fig. 12.5).

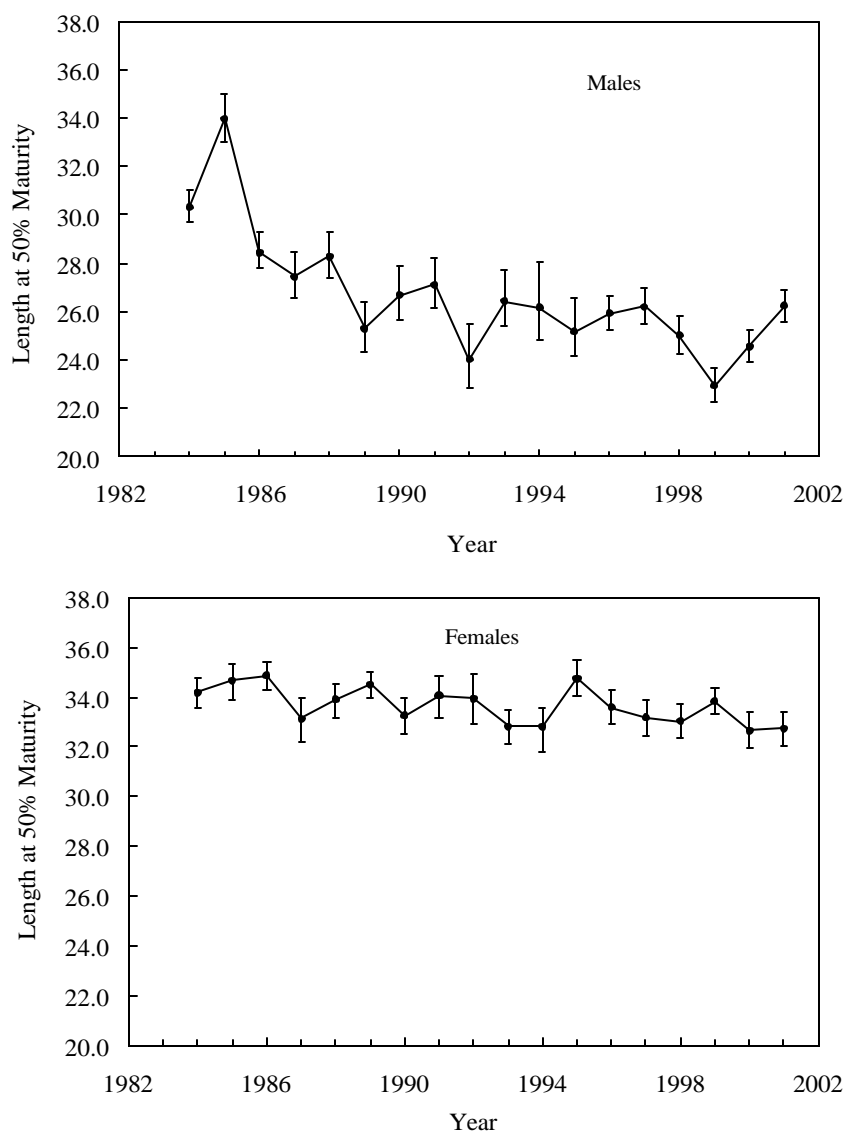


Fig. 12.5. Yellowtail flounder in Div. 3LNO: length at 50% maturity.

A length-based female SSB index was derived from the 1984-2001 Canadian spring survey data, annual maturity ogives and annual mean weights-at-length. The SSB index declined from 90 000 tons in 1984 to 24 000 tons in 1989, then varied without trend around an average value of 28 000 tons from 1990-95. The index increased in 1996 and appeared stable at an average level of 66 000 tons from 1996-98. In 1999, there was a large increase in the survey index to 138 000 tons, and it has remained around this level in 2000 and 2001 (Fig. 12.6).

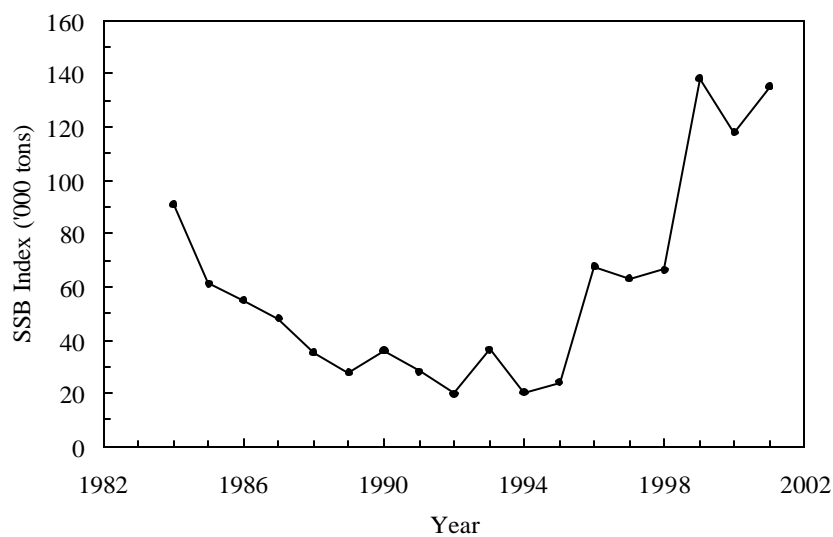


Fig. 12.6. Yellowtail flounder in Div. 3LNO: female spawning stock biomass index estimated from 1984 to 2001 annual spring surveys.

Relative year-class strength was estimated from a multiplicative model using information based on abundance of cohorts at ages 3 and 4 from the 1984-2001 spring and 1990-2001 autumn survey time series (Fig. 12.7). 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.

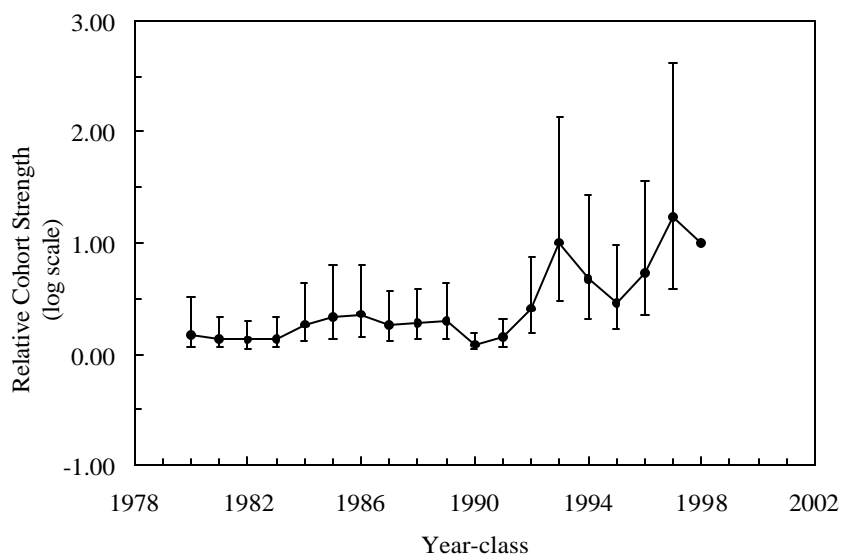


Fig. 12.7. Yellowtail flounder in Div. 3LNO: relative cohort strength with standard errors estimated from a multiplicative model using age 3 and 4 data from annual spring and autumn surveys.

c) Estimation of Parameters (SCR Doc. 02/71)

Several formulations of a surplus production analysis (ASPIC) were presented. STACFIS accepted the model that included the catch data (1965-2001), Russian spring surveys (1972-91), Canadian spring surveys (1971-82), Canadian spring (1984-2001) and autumn (1990-2001) surveys and the Spanish spring (1995-2001) surveys. All surveys were given equal weight in the analysis. Yield projections assumed that 14 300 tons (TAC of 13 000 tons + 10% over-run) will be taken in 2002 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 yield/biomass ratio.

STACFIS **recommended** that *further exploration of the ASPIC model with yellowtail flounder data be conducted for 2003, including sensitivity of the model to various indices and to convergence criteria.*

d) Assessment Results

The surplus production model results are generally consistent with the assessment in 2001, and indicate that stock size has increased. The model suggests that a maximum sustainable yield (MSY) of 17 600 tons can be produced by total stock biomass of 77 000 tons (B_{msy}) at a fishing mortality rate of 0.23 (F_{msy}). The analysis showed that relative population size (B_t/B_{msy}) was below the level at which MSY can be obtained from 1973 to 1999. Biomass (B_t) has been estimated to be above B_{msy} since then (Fig. 12.8).

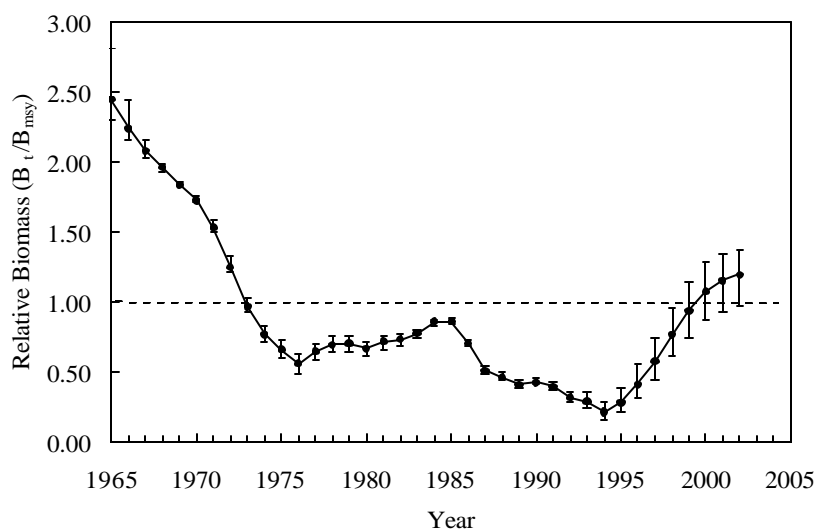


Fig. 12.8. Yellowtail flounder in Div. 3LNO: bias corrected relative biomass trends with 80% confidence intervals.

Relative fishing mortality rate (F_t/F_{msy}) was above F_{msy} , in particular from the mid-1980s to early-1990s when the catches exceeded or doubled the recommended TACs (Fig. 12.9). Since 1993, F_t has remained below F_{msy} . In 2002, F is projected to be 68% of F_{msy} if the TAC of 13 000 tons (+ 10% over-run) is taken in 2002.

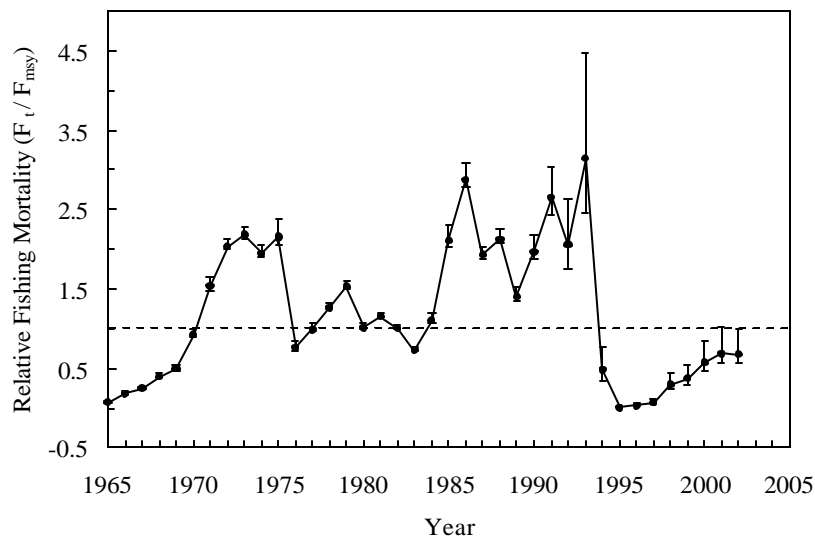


Fig. 12.9. Yellowtail flounder in Div. 3LNO: bias corrected relative fishing mortality trends with 80% confidence intervals.

Since 1994, when the moratorium (1994-97) was put in place the estimated yield has been below sustainable production levels (Fig. 12.10).

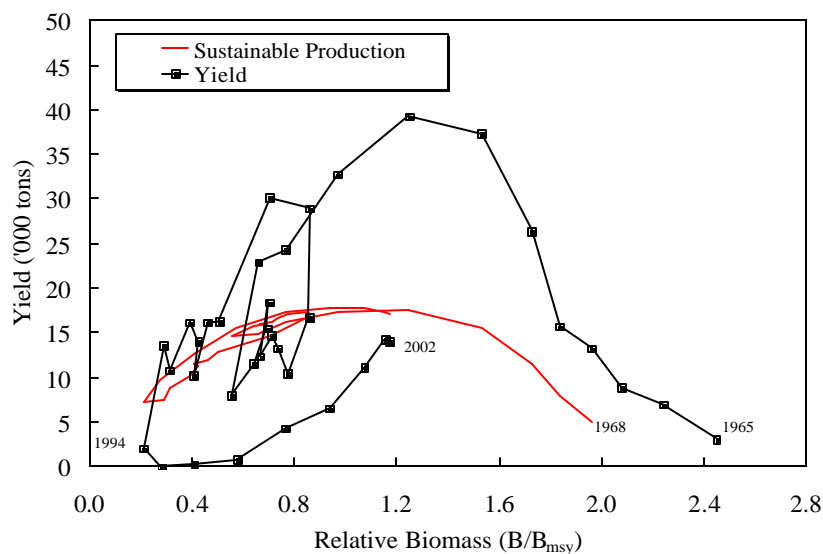


Fig. 12.10. Yellowtail flounder in Div. 3LNO: yield trajectory.

The model was bootstrapped to derive estimates of yield projections for 2003 and 2004 assuming a range of F multipliers. By constraining the catch in 2002 to 14 300 tons, percentiles of fishing mortality, yield and biomass for a series of multipliers were estimated (Table 12.1). A *status quo* F results in a yield of 14 700 tons in 2003 and 15 000 tons in 2004. Projections at $2/3 F_{msy}$ resulted in similar yields, 14 500 and 14 900 tons in 2003 and 2004.

Table 12.1. Management options for 2003-2004. F multipliers are applied to F_{2002} .

2003 F						2004 F					
F multiplier	5	Percentiles				F multiplier	5	Percentiles			
		25	50	75	95			25	50	75	95
1.0	0.134	0.145	0.155	0.168	0.193	1.0	0.134	0.145	0.155	0.168	0.193
0.9	0.120	0.130	0.139	0.151	0.174	0.9	0.120	0.130	0.139	0.151	0.174
0.8	0.107	0.116	0.124	0.134	0.154	0.8	0.107	0.116	0.124	0.134	0.154
0.6	0.080	0.087	0.093	0.101	0.116	0.6	0.080	0.087	0.093	0.101	0.116
0.4	0.054	0.058	0.062	0.067	0.077	0.4	0.054	0.058	0.062	0.067	0.077
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2/3 F_{msy}	0.132	0.143	0.153	0.166	0.191	2/3 F_{msy}	0.132	0.143	0.153	0.166	0.191
F_{msy}	0.198	0.215	0.229	0.248	0.286	F_{msy}	0.198	0.215	0.229	0.248	0.286
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2003 Yield						2004 Yield					
F multiplier	5	Percentiles				F multiplier	5	Percentiles			
		25	50	75	95			25	50	75	95
1.0	14.443	14.614	14.712	14.809	14.936	1.0	14.550	14.859	15.044	15.214	15.460
0.9	13.079	13.243	13.339	13.430	13.555	0.9	13.306	13.613	13.808	13.985	14.229
0.8	11.702	11.853	11.946	12.032	12.148	0.8	12.020	12.312	12.508	12.699	12.932
0.6	8.889	9.007	9.089	9.169	9.269	0.6	9.305	9.556	9.739	9.934	10.163
0.4	6.000	6.085	6.150	6.210	6.285	0.4	6.404	6.596	6.741	6.901	7.105
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2/3 F_{msy}	14.266	14.436	14.534	14.631	14.758	2/3 F_{msy}	14.391	14.701	14.887	15.057	15.301
F_{msy}	20.741	20.927	21.028	21.132	21.288	F_{msy}	19.782	20.121	20.275	20.422	20.696
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2003 B/ B_{msy}						2004 B / B_{msy}					
F multiplier	5	Percentiles				F multiplier	5	Percentiles			
		25	50	75	95			25	50	75	95
1.0	0.896	1.118	1.225	1.315	1.425	1.0	0.920	1.144	1.253	1.336	1.434
0.9	0.914	1.134	1.243	1.332	1.442	0.9	0.948	1.173	1.284	1.365	1.463
0.8	0.931	1.151	1.261	1.349	1.458	0.8	0.979	1.203	1.315	1.395	1.492
0.6	0.965	1.185	1.296	1.384	1.492	0.6	1.044	1.264	1.375	1.456	1.554
0.4	0.998	1.219	1.331	1.420	1.527	0.4	1.114	1.330	1.438	1.519	1.614
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2/3 F_{msy}	0.899	1.120	1.228	1.318	1.428	2/3 F_{msy}	0.924	1.148	1.257	1.340	1.438
F_{msy}	0.822	1.042	1.149	1.236	1.348	F_{msy}	0.787	1.008	1.118	1.200	1.305

Medium-term projections were carried out by extending the ASPIC bootstrap projections forward to the year 2012 under an assumption of constant fishing mortality at $2/3 F_{msy}$. The output shows that yield gradually increases, reaching a maximum of 16 900 tons in 2012. The results depicted in Fig. 12.11 show the percentiles of predicted absolute yield and biomass, and biomass relative to B_{msy} . The probability of biomass falling below B_{msy} declines from about 15% in 2003 to less than 5% after 2010. The projections are conditional on the estimated values of r , the intrinsic rate of population growth and K , the carrying capacity.

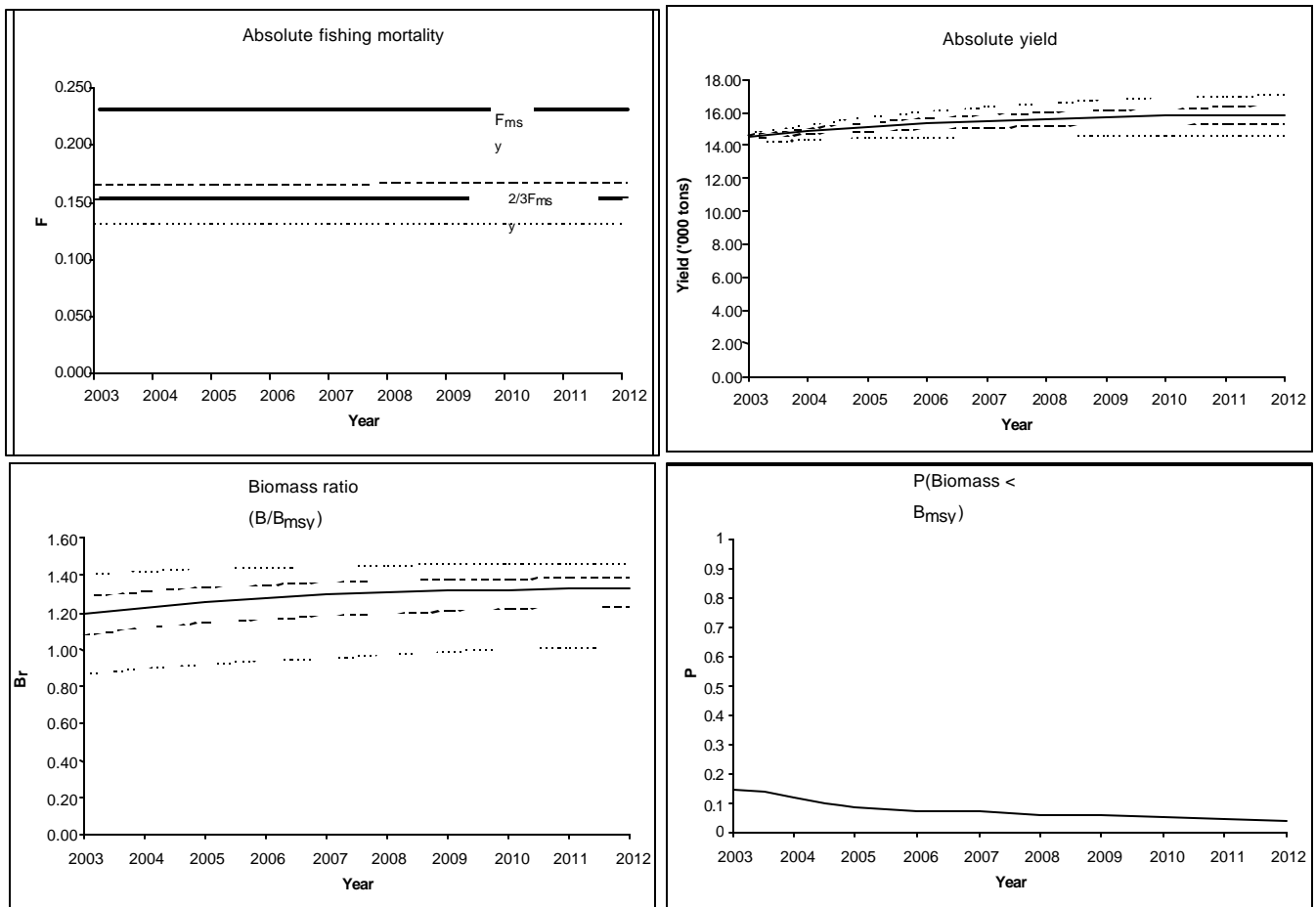


Fig. 12.11 Yellowtail flounder in Div. 3LNO: medium term projections at a constant fishing mortality of $2/3 F_{msy}$. The figures show the 5th, 25th, 50th, 75th and 95th percentiles of fishing mortality, yield, and biomass/ B_{msy} . The probability of biomass being less than B_{msy} is also given. The results are derived from an ASPIC bootstrap run (500 iterations) with a catch constraint of 14 300 tons in 2002.

e) Reference Points

Stock-recruitment relationships (SCR Doc. 02/71). There is no apparent stock recruitment relationship evident for this stock using a length based SSB derived from Canadian spring surveys (1984-2001) and cohort strength of ages 3 and 4 from Canadian spring (1989-2001) and autumn (1990-2001) surveys (Fig. 12.12).

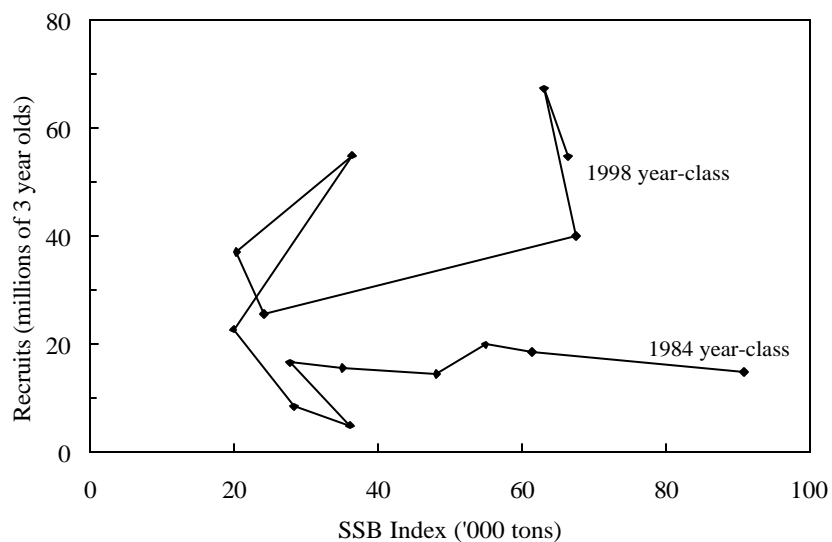


Fig. 12.12. Yellowtail flounder in Div. 3LNO: stock/recruitment plot.

Precautionary approach. The stock production model outputs in the current assessment are similar to those reported in the 2001 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 12.13).

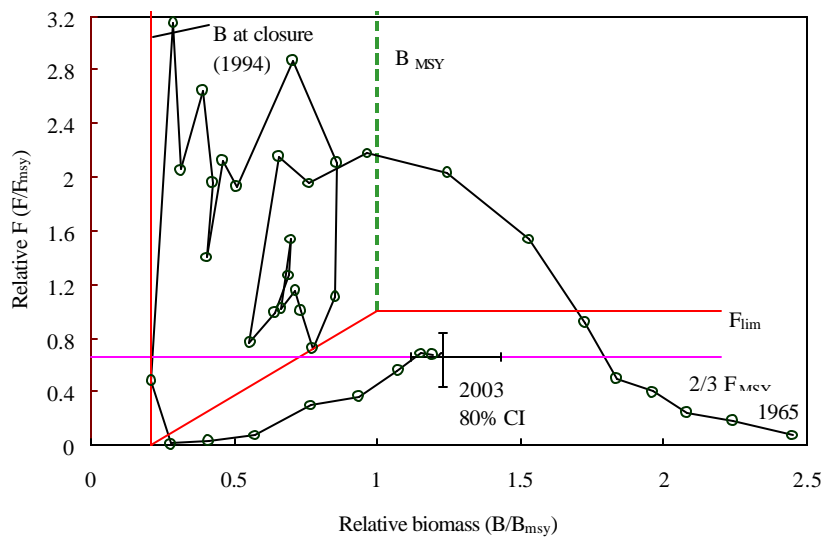


Fig. 12.13. Yellowtail flounder in Div. 3LNO: stock trajectory estimated in the surplus production analysis under precautionary approach framework.

13. Witch Flounder (*Glyptocephalus cynoglossus*) in Divisions 3N and 3O (SCR Doc. 02/53; SCS Doc. 02/6, 7)

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 effort, mainly by EU-Spain and EU-Portugal, 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:

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Recommended TAC	5	3 ¹	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf
STATLANT 21A	5	0.3	0.3	0.3	0.5	0.6	0.9	0.7 ²	0.4 ²	
STACFIS	4	1.1	0.3	0.3	0.5	0.6	0.8	0.5	0.7	

¹ No directed catch.

² Provisional.

ndf No directed fishing.

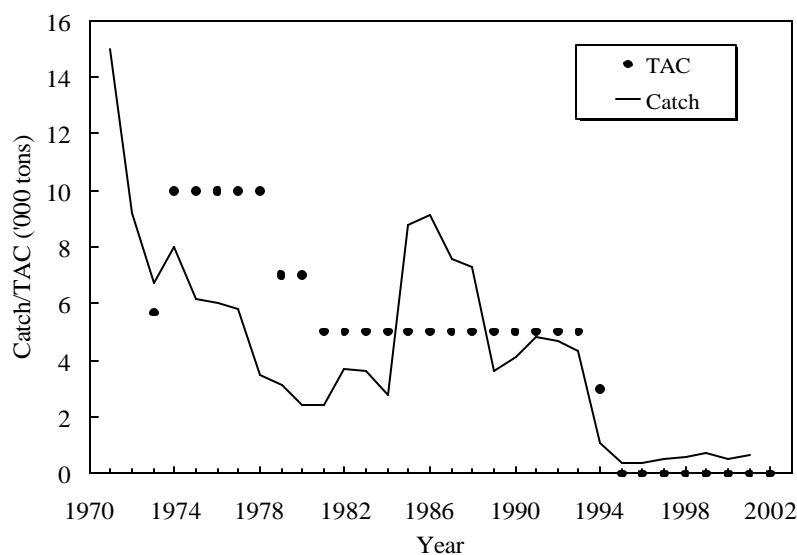


Fig. 13.1. Witch flounder in Div. 3NO: catches and TACs.

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 1997-2001 catch estimates ranging from 500-800 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 little or no catch since then.

b) Input Data

i) Commercial fishery data

Length frequency data from commercial catches of both EU-Portugal (SCS Doc. 02/6) and EU-Spain (SCS Doc. 02/7) indicate a range of lengths from about 34-42 cm and 24-60 cm, respectively.

ii) Research survey data

Biomass estimates. Biomass estimates from Canadian converted spring surveys (SCR Doc. 02/53) in Div. 3N have been at very low levels during 1984-2002 and in most years were less than 1 000 tons. For Div. 3O the estimates of biomass fluctuated annually, on average between 8 000 and 24 000 tons in the late-1980s. It was observed that despite the fact that survey coverage in Div. 3NO during 1991-2002 has been the most complete in the time series, including much deeper water, there was a declining trend since about 1984 with the 1998 value the lowest in the time series (Fig. 13.2). Although variable from year-to-year, recent surveys indicate some improvement in the stock. Canadian autumn surveys from 1990-2002 showed little or no trend during this period.

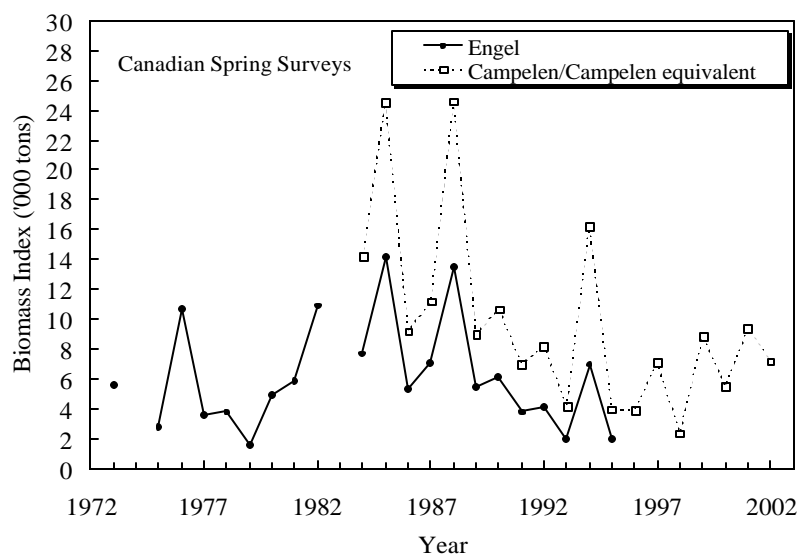


Fig. 13.2. Witch flounder in Div. 3NO: estimates of biomass.

c) Assessment Results

The most recent survey data indicate some slight improvement in the stock; however, STACFIS considers that the stock remains at a relatively low level.

14. Capelin (*Mallotus villosus*) in Divisions 3N and 3O (SCR Doc. 02/20)

a) Introduction

The directed fishery was closed in 1992 and the closure has continued through 2002 (Fig. 14.1).

No catches were reported for this stock since 1993:

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Recommended TAC	ndf	ndf	ndf	ndf	na	na	na	na	na	na
Catch ¹	+	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.

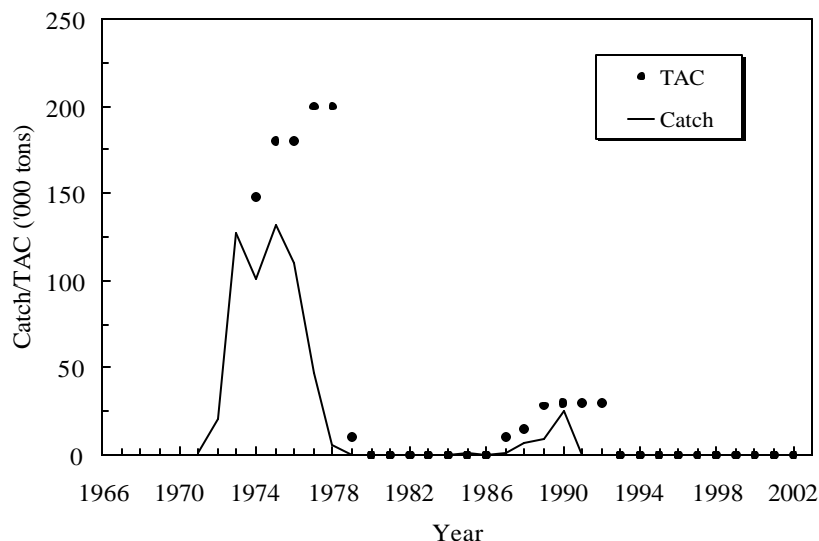


Fig. 14.1. Capelin in Div. 3N and 3O: catches and TACs.

b) Input Data

In accordance with previous recommendations of STACFIS (*NAFO Sci. Coun. Rep.*, 2000 and 2001) an attempt was made to use Canadian bottom trawl survey data on capelin in Div. 3NO for assessment purposes (SCR Doc. 02/20).

Trawl acoustic surveys of capelin on the Grand Bank previously conducted by Russia and Canada on a regular basis have not been undertaken since 1995. The only indicator of stock dynamics presently available may be capelin biomass indices obtained during Canadian stratified-random bottom trawl surveys. Trawlable biomass of capelin in Div. 3LNO and 3NO for 1977-2001 was converted into absolute values on the basis of the relationship between trawl (Lilly and Simpson, MS 2000¹) and acoustic (SCR Doc. 94/14) estimates of capelin stock in Div. 3LNO in spring 1977-1994. Data on by-catches of capelin reflect the availability (seasonal, diurnal, etc.) of its aggregations in the 5 m near-bottom layer for research trawls rather than actual capelin biomass in all layers. It is not clear how the data reflects the real stock distribution and stock status. The correlation between biomass estimates derived by the acoustic and the

¹ Lilly, G., and M. Simpson. MS 2000. Distribution and biomass of capelin, Arctic cod and sand lance on the Northeast Newfoundland Shelf and Grand Bank as deduced from bottom-trawl surveys. *CSAS Res. Doc.*, No. 91, 40 p.

trawl methods was relatively weak; with an R^2 of 0.36. Assuming the existence of linear or power relationship, it may be concluded that in 1990-1995, both the calculated and the trawlable biomass of capelin in Div. 3LNO fluctuated within a wide range, tending to decrease. Trawl biomass of capelin for the entire period was the highest in 1993 and the lowest in 1999. (Fig. 14.2 and 14.3).

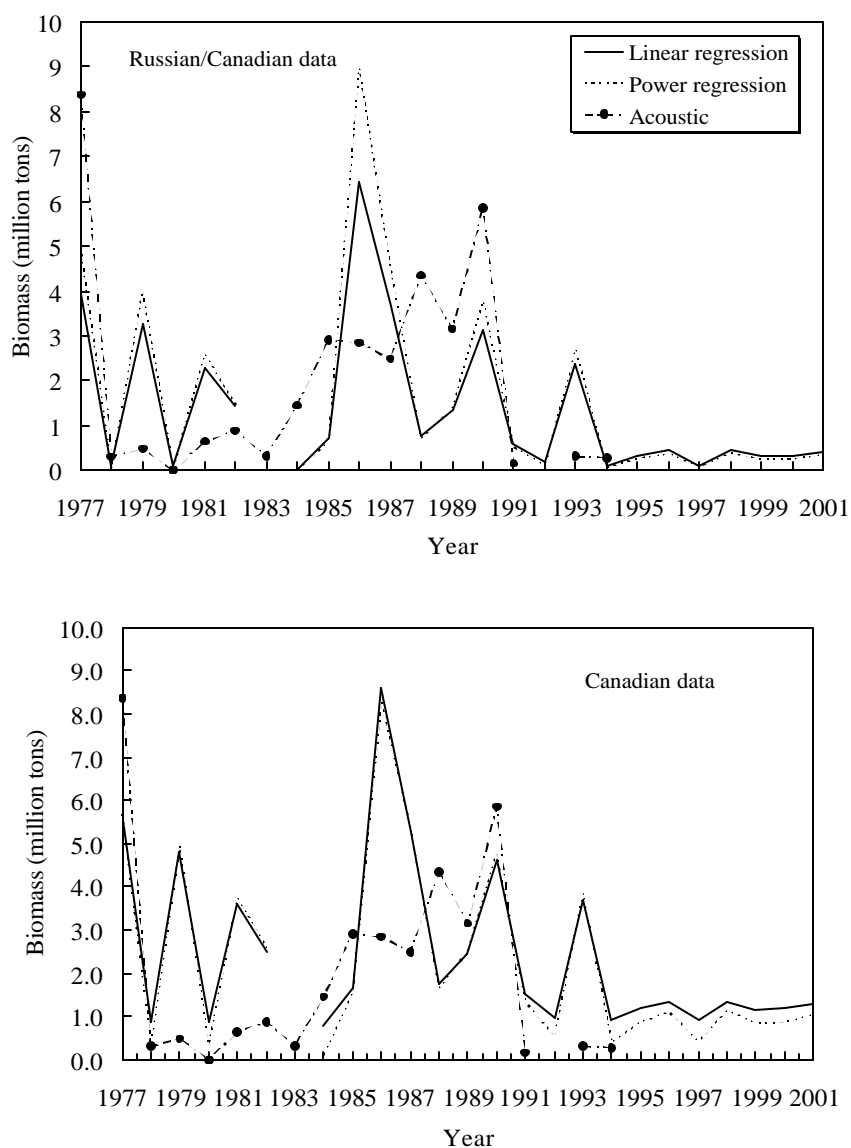


Fig. 14.2. Capelin in Div. 3LNO: biomass estimates in 1977-2001.

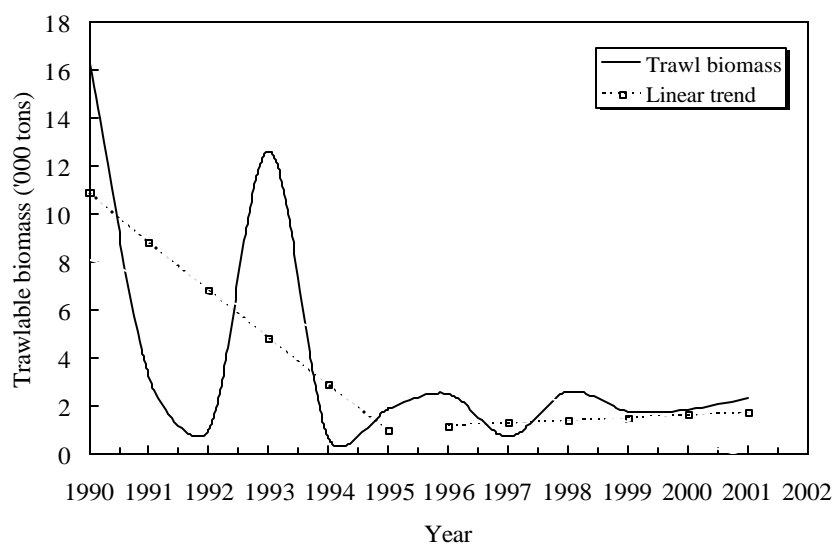


Fig. 14.3. Capelin in Div. 3LNO: trawlable biomass and linear trend in 1990-1995 (Engel) and 1996-2001 (Campelen).

c) **Assessment Results**

STACFIS considered that the stock is still at a low level relative to that of the late-1980s.

d) **Potential Reference Points**

It is not possible to determine biological reference points for capelin in Div. 3NO at this time.

e) **Research Recommendation**

STACFIS **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.*

D. WIDELY DISTRIBUTED STOCKS

15. Roughhead Grenadier (*Macrourus berglax*) in Subareas 2 and 3

- a) STACFIS did not conduct an assessment or prepare an interim monitoring report for this stock during this June 2002 Meeting.

16. Cod (*Gadus morhua*) in Divisions 2J, 3K and 3L (SCR Doc. 01/33, 02/01, 66; SCS Doc. 02/4, 6, 10)

a) Introduction

A full regional stock assessment of the Northern (Div. 2J+3KL) cod stock was not conducted in 2002. Alternatively, a stock status update was completed. A stock update has been defined to be the updating of the basic catch, tagging, and abundance index data, but not carrying out quantitative analyses of these data. Continued decline in the sentinel catch rate and the commercial catch rate, together with the concentration of commercial and recreational fishing effort in a small portion of the stock area is of considerable concern. Total exploitation rates calculated from tagging experiments in the stock area are variable, and while some are low, there is concern that a number of experiments resulted in exploitation rates that were calculated to be greater than 10% with one as high as 30% in 2001. The new information considered in the update substantially increased the concerns noted in the 2001 assessment regarding the sustainability of current levels of fishing.

Historical landings for this stock have changed dramatically over 1957-2002, peaking at 800 000 tons in 1968, with a median catch of less than 5 000 tons over the last ten years (Fig. 16.1). In 2001, a TAC of 5 600 tons was established for all removals. A mandatory log was introduced for the recreational fishery, providing an improved estimate of recreational removals (1 975 tons). Removals from the sentinel survey were 118 tons, and the commercial fishery landed 4 795 tons, for a 2001 total of 6 887 tons of Canadian landings.

Non-Canadian removals in 2001 are reported to have totaled 41 tons by EU -Portugal, and 27 tons by Russia in Div. 3L.

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

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
TAC	0 ¹	0 ¹	0 ¹	0 ¹	0 ¹	0 ¹	9 ²	7 ²	5.6 ²	
Total Catch	11	1.4	0.3	1.5	0.5	4.5	8.5	5.4 ³	6.9 ³	

¹ Moratorium on Canadian fishing became effective in July 1992, and ended in 1998.

² Inshore fixed gear only.

³ Provisional.

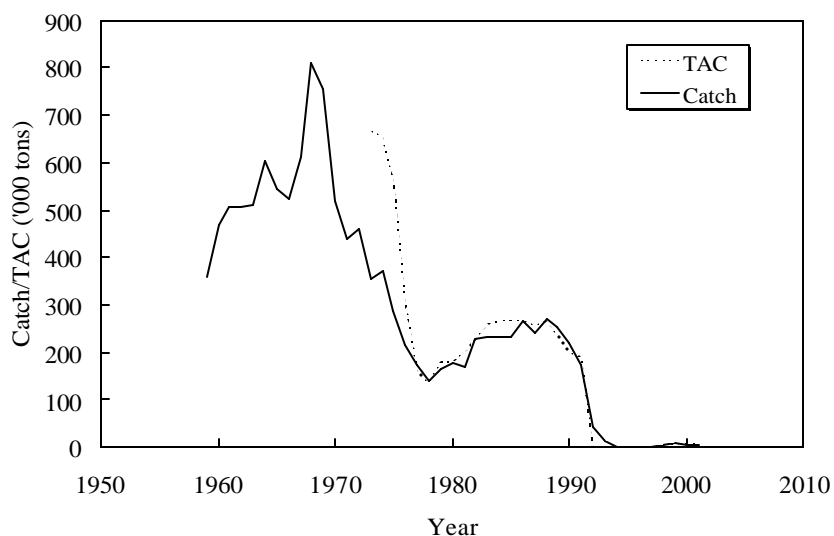


Fig. 16.1. Cod in Div. 2J+3KL: landings and TACs.

b) **Input Data**i) **Commercial fishery data**

Catch and effort. Median catch rates for the Canadian commercial index fishery (Fig. 16.2) were calculated from catch and effort data recorded in logbooks from 1998-2001. The spatial pattern for the predominant gear, gillnets, has been similar among years. With the exception of the Cape Bonavista, Newfoundland region, (commercial fishing sections 13 and 14), the medians for 2001 are at or near the lowest observed in the four years.

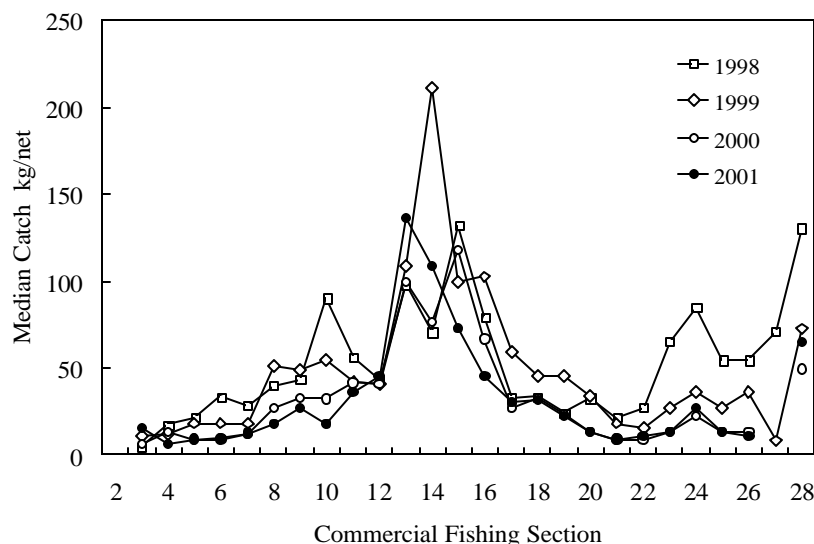


Fig. 16.2. Cod in Div. 2J+3KL: Median gillnet catch rates from the commercial fishery for the years 1998-2001 (refer to Fig. 1c in SCR Doc. 01/33 for definition of fishing sections).

Median catch rates in the Canadian sentinel gillnet fishery (Fig. 16.3) were computed for 1995-2001. The 2001 values are similar to those for 1995, the first year of the survey, and were generally lower than all other years throughout the sentinel fishery. The higher catches in 3Lq (St. Mary's Bay) are thought to be associated with migrating fish from neighbouring NAFO Subdiv. 3Ps.

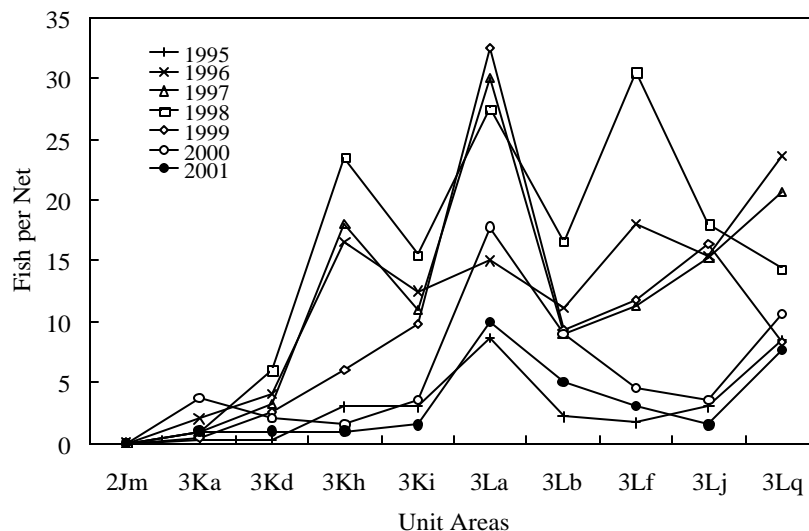


Fig. 16.3. Cod in Div. 2J+3KL: Median sentinel fishery gillnet catch rate for 1995-2001 by unit area (refer to Fig. 1b in SCR Doc. 01/33 for definition of unit areas).

Continued decline in the sentinel catch rate and the commercial catch rate, together with the concentration of commercial and recreational fishing effort in a small portion of the stock area (unit areas 3Ki, 3La, and 3Lb) is of considerable concern.

ii) Research survey data

The biomass index from the Canadian autumn bottom-trawl survey in 2001 remained extremely low at only 2% of the average in the 1980s (Fig. 16.4). Since 1999, the biomass index has remained more or less constant at a level that is less than 20% of that measured in the year in which the moratorium was declared.

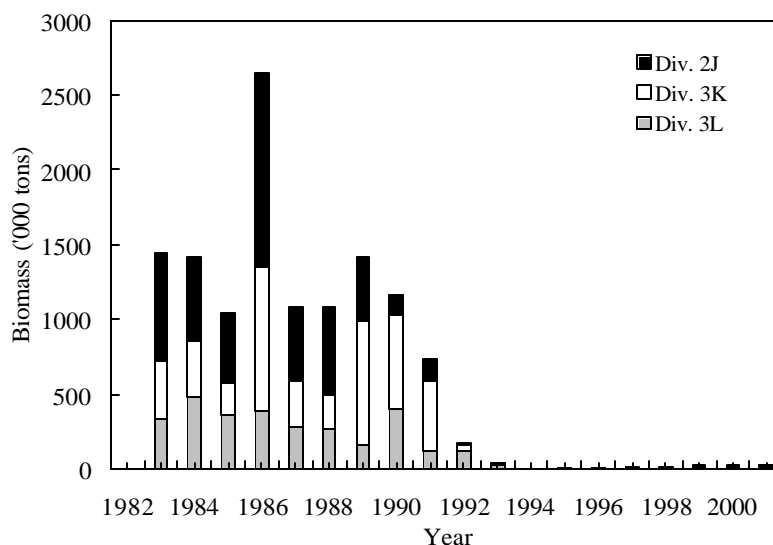


Fig. 16.4. Cod in Div. 2J+3KL: abundance and biomass indices from autumn surveys.

The biomass index from the 2001 Canadian spring bottom-trawl survey in Div. 3L was also much lower than the historical average. The biomass index increased from 1998 to 1999, then declined in 2000 and 2001. The biomass index in 2001 was less than 1% of the average in the 1980s.

Total exploitation rates calculated from tagging experiments in the stock area were variable, and while some were low, there is concern that a number of experiments resulted in exploitation rates that were calculated to be greater than 10% with one as high as 30% in 2001.

iii) Biological studies

Distribution and stock structure. Considerable uncertainty exists about the structure of the Div. 2J and 3KL stock. The available tagging, genetic, survey and biological data are consistent with two hypotheses: a) the inshore constitutes a separate inshore sub-population that is functionally separate from the offshore; and b) inshore and offshore fish together constitute a single functional population. Prior to the collapse of this stock, the major over-wintering aggregations were associated primarily with the offshore, including the Regulatory Area. The only aggregation known to exist at the present time over-winters in a deep-water inlet in northern Div. 3L, Smith Sound. Acoustic studies have estimated this aggregation around 20 000 tons. Fish from this aggregation migrate seasonally out of the sound in the spring, mainly northward in Div. 3L and into southern Div. 3K, supporting most of the commercial fishery which has taken place in the autumn over the last three years. Elsewhere densities are extremely low throughout the stock area, with the exception of the southern portion of Div. 3L where there is a seasonal migration of fish from Subdiv. 3Ps.

Survey estimates of total mortality. Age specific mortality estimates were calculated for the autumn Div. 2J+3KL bottom-trawl survey for ages 1-14. Mortality estimates for age 3 to age 4 are provided as an illustration (Fig. 16.5). For all ages, the current levels of mortality rates are similar to or higher than those observed during periods when there was a substantial fishery.

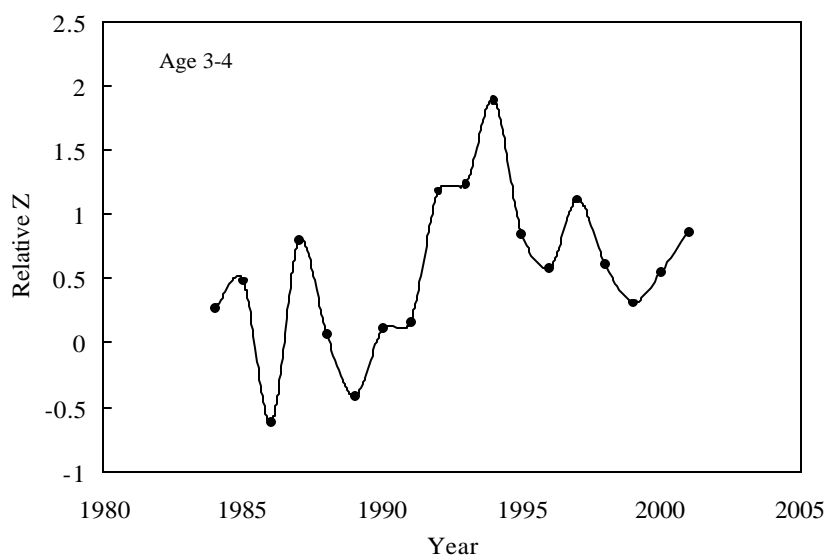


Fig. 16.5. Cod in Div. 2J+3KL: mortality rate (Z) for age 4 fish calculated from the Canadian autumn research vessel bottom-trawl data for 1984-2001.

The new information considered in this update of stock status substantially increases the concerns noted in the 2001 assessment regarding the sustainability of current levels of fishing.

17. Witch Flounder (*Glyptocephalus cynoglossus*) in Divisions 2J, 3K and 3L (SCR Doc. 02/52)

a) Interim Monitoring Report

Although the stock has been under moratorium since 1995 the annual by-catch of witch flounder has ranged between 800 to 1 400 tons during 1995-98 and 300 to 600 tons since then (Fig. 17.1).

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

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Recommended TAC	3.5	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf
STATLANT 21A	0.4	0.1	0.8	1.4	0.9	0.4	0.4	0.5 ¹	1 ¹	
STACFIS	0.4	0.5	0.7	1.4	0.8	1.1	0.3	0.6	0.6	

¹ Provisional.

ndf No directed fishing.

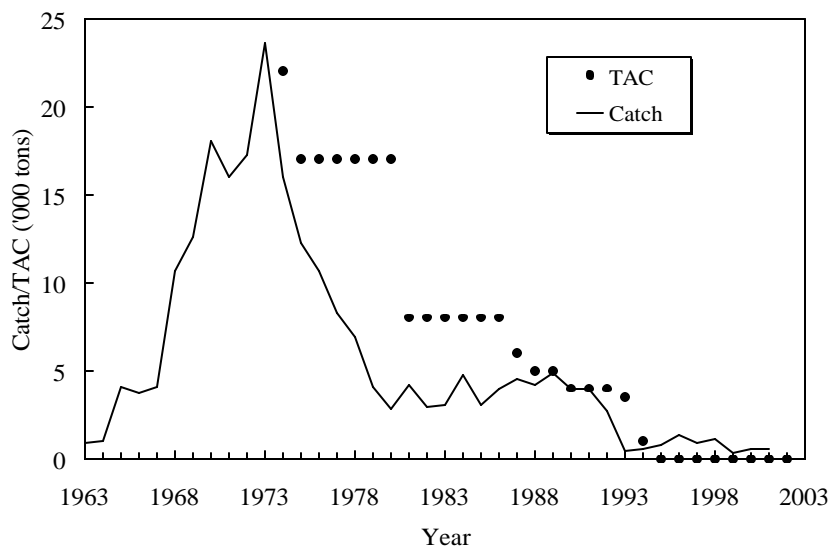


Fig. 17.1. Witch flounder in Div. 2J, 3K and 3L: catches and TAC

Survey biomass indices show that the stock declined very rapidly during the 1980s and by the early-1990s had reached an extremely low level (Fig. 17.2). No improvement in the stock has been observed since then including in the most recent 2001 autumn survey.

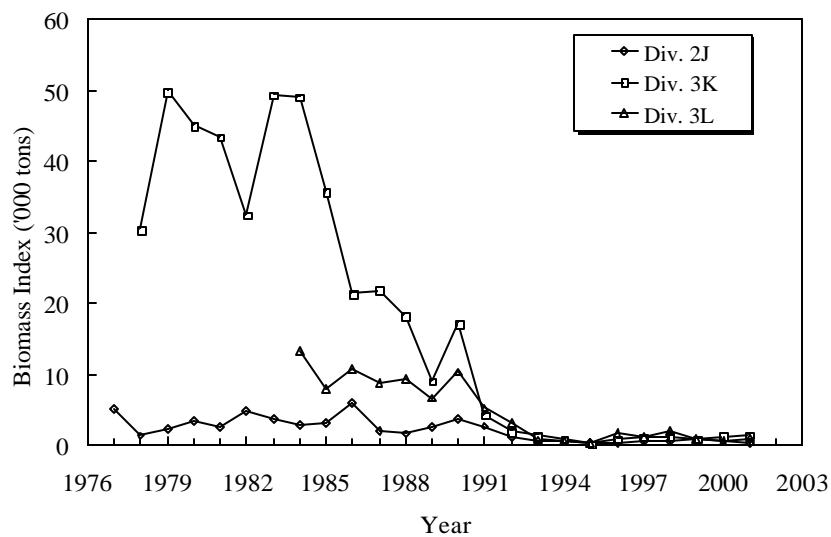


Fig. 17.2. Witch flounder in Div. 2J, 3K and 3L: biomass indices from Canadian autumn surveys.

18. **Greenland Halibut (*Reinhardtius hippoglossoides*) in Subarea 2 and Divisions 3KLMNO** (SCR Doc. 02/4, 6, 12, 24, 27, 21, 31, 39, 81; SCS Doc. 02/4, 6, 7)

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. 18.1). In 1990, an extensive fishery developed in the deep water (down to at least 1 500 m) in the Regulatory Area, 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. Catches have been increasing since then and by 2001 had reached 38 000 tons. The major participants in the fishery in the Regulatory Area in 2001 were EU-Spain (16 600 tons), EU-Portugal (4 400 tons), Russia (3 800 tons) and Japan (2 800 tons).

Canadian catches peaked in 1980 at just over 31 000 tons, while the largest non-Canadian catches before 1990 occurred in 1969-70. USSR/Russia, Denmark (Faroe Islands), Poland and EU-Germany (GDR before 1989) had taken catches from this stock in most years, but catches by the latter two countries have been negligible since 1991. Canadian catches ranged from 8 200 to 13 500 tons from 1985-91, then declined to between 2 300 and 6 200 tons per year from 1995 to 1999. Catches increased to 10 600 tons in 2000 but declined again to 8 000 tons in 2001. Most of the Canadian catch in recent years is taken by gillnets. By-catch of Greenland halibut in the Canadian Div. 3L shrimp fishery was estimated to be 5 and 7 tons for 2000 and 2001, respectively (SCR Doc. 02/06).

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

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
TAC ¹	50	25	27	27	27	27	33	35	40	44
STATLANT 21A	29	21	16	19	20	20	23	32 ²	29 ²	
STACFIS	42-62	51	15	19	20	20	24	34	38	

¹ Set autonomously by Canada 1985-94 and by the Fisheries Commission since 1995.

² Provisional.

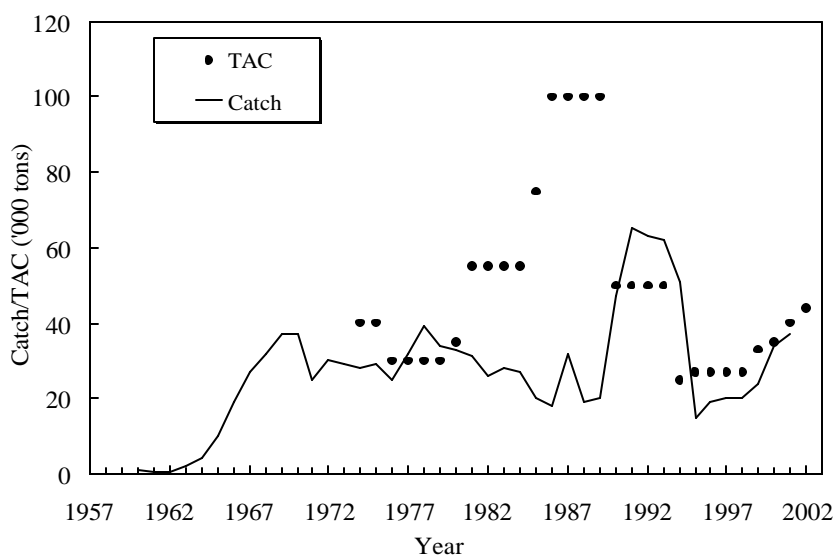


Fig. 18.1. Greenland halibut in Subarea 2 + Div. 3KLMNO: catches and TACs.

b) **Input Data**i) **Commercial fishery data**

Catch and effort. Analyses of otter trawl catch rates from many fleets (Fig. 18.2), but mostly from Canadian vessels, 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 in the hours fished analysis and 1998-2000 in the days fished analysis with a slight decline in the mean value for 2001(SCR Doc. 02/31).

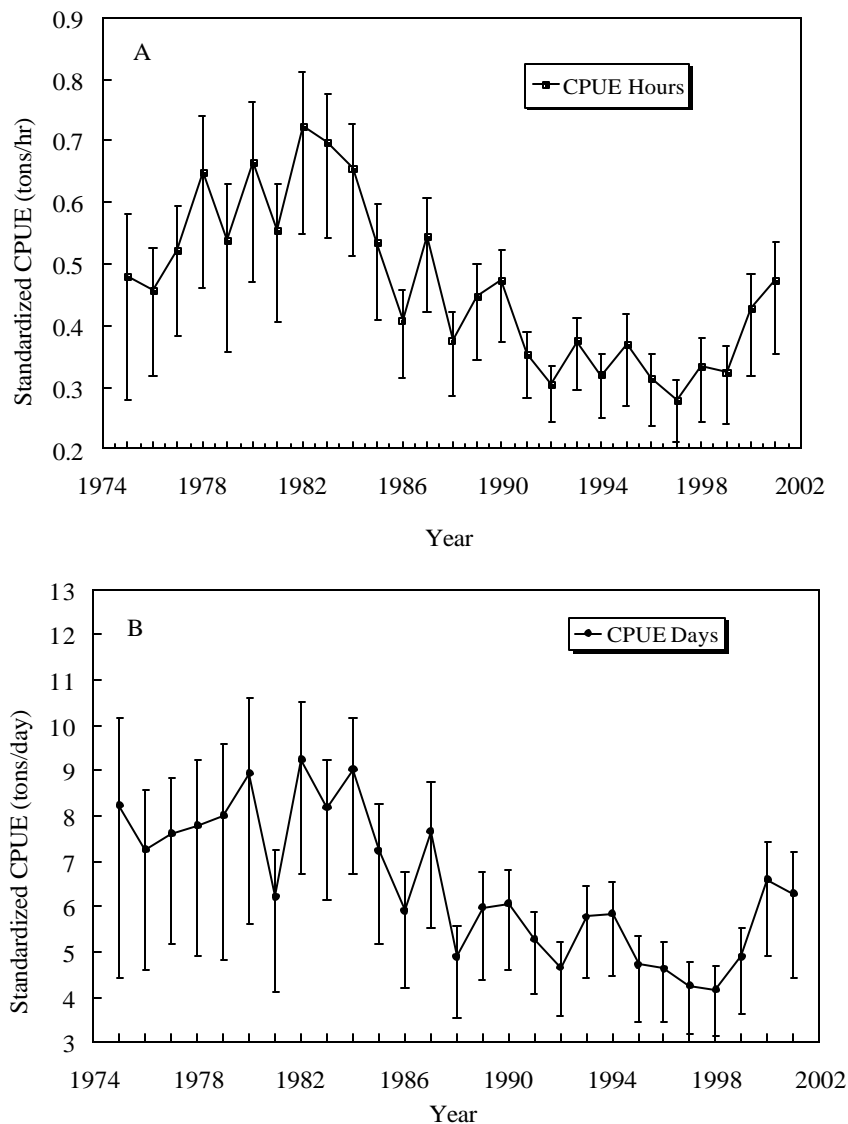


Fig. 18.2 Greenland halibut in Subarea 2 + Div. 3KLMNO: standardized CPUE based on A) hours fished and B) days fished from the international fishery.

Catch-rates of Portuguese otter trawlers fishing in the NAFO Regulatory Area (NRA) of Div. 3LMN from 1988-2001 (Fig. 18.3) declined sharply from 1989 to 1991, and remained around this low level until 1994 (SCS Doc. 02/06). CPUE gradually increased since then, 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. Directed effort on Greenland halibut was present in Div. 3L in all years from 1988-2001, in Div. 3N since 1990 but only since 1995 in Div. 3M.

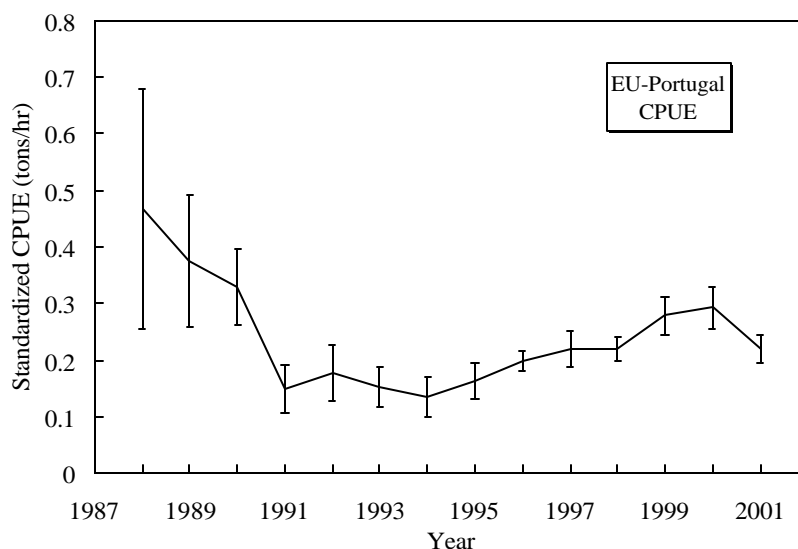


Fig. 18.3 Greenland halibut in Subarea 2 + Div. 3KLMNO: standardized CPUE from the EU-Portugal trawlers with scientific observers in Div. 3LMN.

Catch-at-age and mean weights-at-age. Catch-at-age and mean weights-(kg)-at-age from 1975-99 were used from the previous assessment as described in detail in SCR Doc. 00/24. The 2000 data were taken from the 2001 assessment.

At the current STACFIS meeting the Canadian catch-at-age data for 2001 were provided as calculated in the usual fashion (SCR Doc. 02/39). EU-Spain and Russia provided catch-at-age for their respective fisheries in the NRA in 2001. The EU-Spain age-length key was applied to length frequency data from EU-Portugal. The resultant age compositions were then adjusted to the agreed best estimates of total catch including countries fishing the NRA but providing no sampling data. The mean weights-at-age (kg) were computed by applying a standard length-weight relationship to the mean lengths-at-age (cm) from the adjusted age-length keys. This was the first year that non-Canadian age-length keys were used to determine a portion of the commercial catch-at-age.

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 (kg) show peculiar patterns in the earliest period likely due to poor sampling and lack of individual weights. Mean weights-at-age for age groups 59 during the recent period were relatively stable although in 2001 weights were somewhat higher in the younger ages and lower in the older ages of this range. For older fish they were rather variable but with a declining trend since 1998 (SCR Doc. 02/78).

ii) Research survey data

STACFIS reiterated that most research vessel survey series providing information on the abundance of Greenland halibut are deficient in various ways and to varying degrees. Lack of divisional and depth coverage creates problems in the comparability of results from different years. However, in the autumn of 1996-99 the Canadian survey included all Divisions in the geographical range of the Greenland halibut stock in Subarea 2 and Div. 3KLMNO. No surveys were conducted in Div. 2GH during 2000, however, Div. 2H was surveyed in 2001. Nevertheless, the extent of coverage varied from year-to-year in all Divisions except for Div. 2H, 2J and 3K (SCR Doc. 02/24).

Canadian stratified-random surveys in Div. 2J and 3K (SCR Doc. 02/24) (Fig. 18.4). These surveys are conducted in the autumn. Length-weight relationships were applied to estimate biomass-at-length for this survey series, from abundance-at-length estimates.

In Div. 2J the biomass index was relatively stable from 1978-84 at an average level of about 115 000 tons. It then began to decline to reach an all time low in 1992 at about 18 000 tons and only increased marginally until 1995 after which it began to increase more rapidly. By 1999 it had reached a level of around 87 000 tons, the highest since 1986 but it declined again in 2000 to 55 000 tons, the lowest value since 1995. The 2001 estimate increased to 65 000 tons. In Div. 3K there was a rather long period of apparent stability from 1978-89 at an average annual biomass index of 130 000 tons. It then declined to a low of 44 000 tons in 1992 with an average of 63 000 tons between 1991-94. After 1994 the biomass index increased rather rapidly and steadily until by 1999 when it reached an estimate of 176 000 tons, the highest in the time series. The index declined again in 2000 and 2001 to about 143 000 tons and 129 000 tons, respectively.

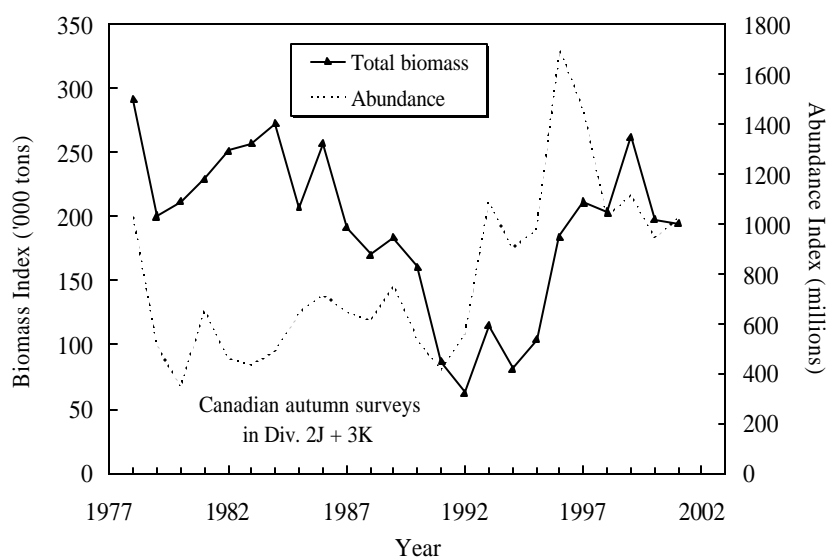


Fig. 18.4. Greenland halibut in Subarea 2 + Div. 3KLMNO: estimates of biomass and abundance from Canadian autumn surveys in Div. 2J and 3K.

Biomass of fish greater than 30 cm (minimum size limit) was lowest in 1992; remained the same until 1995 after which it increased steadily until 1999 when it approached historic highs (SCR Doc. 02/24). While the index declined in 2000 and 2001 it still remained at a relatively high level. During the late-1970s and early-1980s Greenland halibut greater than 70 cm (approximate length at M_{50}) contributed almost 20% to the estimated biomass. However, after 1984 this size category declined to the point that by 1991 virtually no Greenland halibut in this size range contributed to the estimates of stock biomass (Fig. 18.5). Since then, the contribution to stock biomass from this size group has remained extremely low (SCR Doc. 02/24).

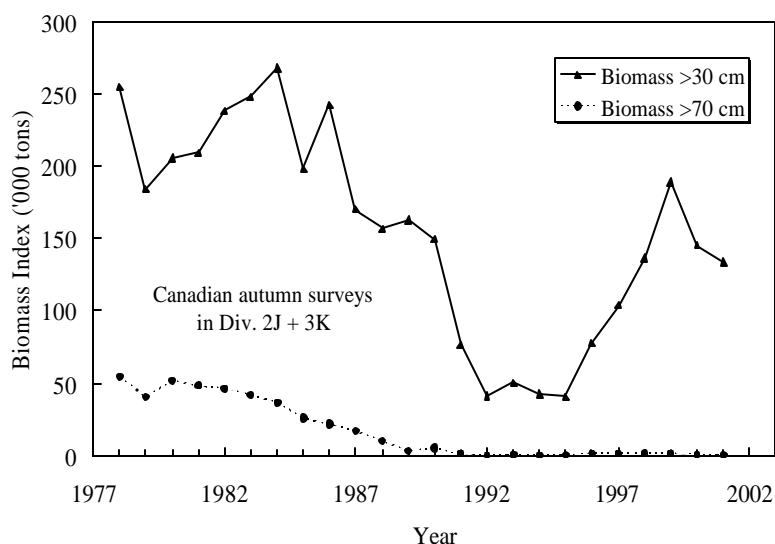


Fig. 18.5 Greenland halibut in Subarea 2 + Div. 3KLMNO: estimates of biomass for fish >30 cm and >70 cm from Canadian surveys in Div. 2J and 3K.

An examination of the age structure indicated that the ages 5+ abundance declined by over 80% from the peak values of the mid-1980s to the lowest point observed in 1994 (SCR Doc. 02/24). Abundance increased steadily at these ages from 1994 and peaked in 1999. The 1999 value was about double the 1997 and 1998 estimates but declined again somewhat in 2000 and 2001. The abundance index of ages 1-4 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.

Canadian stratified-random surveys in Div. 3LMNO (SCR Doc. 02/24). As part of the annual Canadian autumn survey (September to December), coverage in 1996-2001 was extended to Div. 3M (only Flemish Pass and Sackville Spur, deeper than 731 m in 1997-2001), as well as to strata in Div. 3NO deeper than 731 m. However, coverage of the deep water in the southern areas, particularly Div. 3O, was not as extensive as further north. Biomass estimated in Div. 3LMNO increased from 53 000 tons in 1996 to 84 000 tons in 1998, declined to 41 000 tons in 1999 and was estimated at 53 000 tons and 47 000 tons in 2000 and 2001, respectively. Survey coverage was most complete in 1998 as well as 2000 and 2001 especially the deep water. Unlike the situation in Subarea 2 and Div. 3K, there were few Greenland halibut younger than age 4 observed. Overall, biomass in Div. 3LMNO comprised about 20% of the total biomass estimated from the Canadian autumn surveys in 2001 including Div. 2H where biomass was estimated to be 37 000 tons.

EU stratified-random surveys in Div. 3M (SCR Doc. 02/12). These surveys indicated that the Greenland halibut biomass index on Flemish Cap in July in depths to 730 m, ranged from 4 300 tons to 8 600 tons in the 1988 to 1994 period (Fig. 18.6). The estimated biomass increased in each year since then, to reach a maximum value of 23 800 tons in 1998. The age composition data indicated that an increase in recruitment (1993-95 year-classes) was mainly responsible for the relatively high biomass in 1997-98. The biomass has been declining since then and by 2001 was about 14 000 tons. The 1993, 1994 and 1995 year-classes were represented by relatively high values at all ages with the estimate of the 1994 year-class at age 6 in 2000 the highest in the series. The estimate for age 1 in the 2001 survey (2000 year-class) was the second highest in the series. Few fish older than age 10 were encountered in any of these surveys, probably because no depths greater than 730 m were fished.

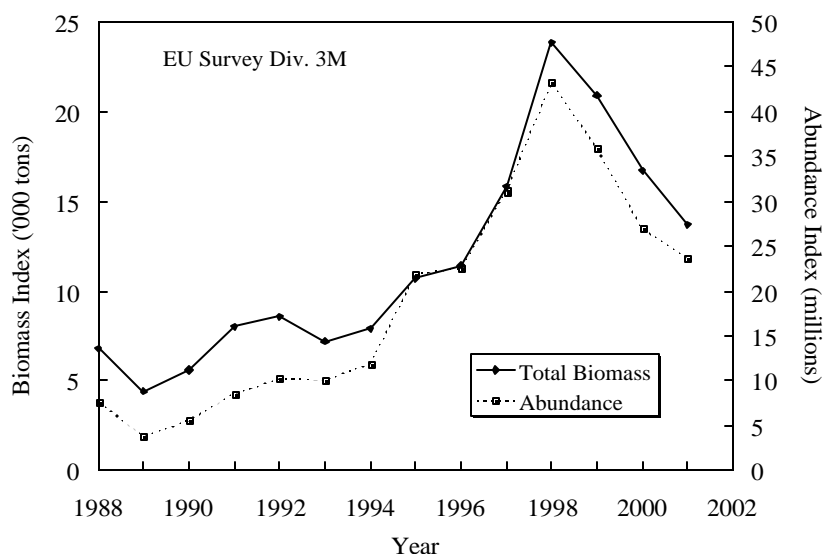


Fig. 18.6. Greenland halibut in Subarea 2 + Div. 3KLMNO: estimates of biomass and abundance from EU summer surveys in Div. 3M.

EU-Spain stratified-random surveys in Div. 3NO Regulatory Area (SCR Doc. 02/04). The estimated biomass increased from about 34 000 tons in 1996 to 148 000 tons in 1998, but declined since then to about 86 000 tons in 2001 (Fig. 18.7). In 2001, the size composition was dominated by fish in the 42 to 48 cm range although modes also occurred at 14 cm and 24 cm. Few fish above 60 cm were caught, consistent with previous surveys.

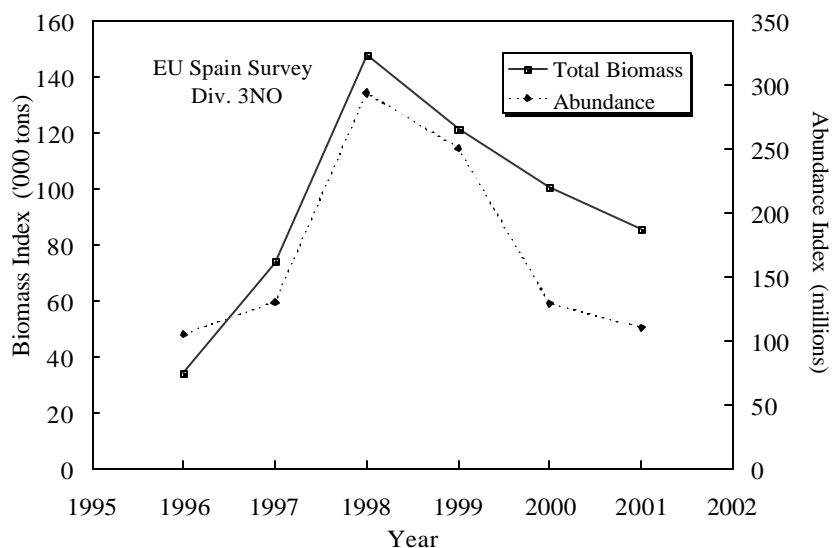


Fig. 18.7. Greenland halibut in Subarea 2 + Div. 3KLMNO: estimates of biomass and abundance from EU-Spain spring surveys in Div. 3NO.

Russian stratified-random survey in Div. 3LM (SCR Doc. 02/27). A Greenland halibut directed survey was carried out to a depth of 1 280 m during the spring of 2001. Estimated abundance and biomass of Greenland halibut constituted 14 million fish and 13 000 tons, respectively. Most fish

were in the length range of 40-50 cm mainly comprising ages 6 and 7 with mean lengths of 42 cm for males and 45 cm for females. A mode at 14 cm was also observed.

iii) Recruitment indices

A mixed linear (multiplicative) model was updated to provide an index of year-class strength from available research vessel survey datasets (SCR Doc. 02/21). For all survey series, abundance estimates at ages 1-4 were selected for the modelling exercise, as these are ages at which fishing mortality would be minimal. Only those year-classes having more than three observations were included in the analysis.

Seven independent data series were available for analysis: (i) the Canadian autumn Div. 2G series (Campelen trawl; 1996-99), (ii) the Canadian autumn Div. 2H series (Campelen trawl; 1996-1999, 2001), (iii) the Canadian autumn Div. 2J3KLMNO series (Campelen trawl; 1996-2001), (iv) the Canadian autumn Div. 2J3KL series (Engel trawl; 1981-1994), (v) the Canadian spring Div. 3L series (Yankee 41.5 trawl 1977-82; Engel trawl; 1984-95), (vi) the Canadian spring Div. 3LNO series (Campelen trawl; 1996-2001), and (vii) the EU July Div. 3M series (1992-2001). Abundance estimates were based on the standard swept-area calculations for all series.

Results indicated that strengths of the 1975-90 year-classes were relatively stable with the exception of the 1984-85 year-classes which were above the average of the period (Fig. 18.8). The 1990-92 year-classes appeared to be nearly the same as those of 1984-85. The 1993-95 year-classes were estimated to be well above average despite wide confidence intervals. The subsequent year-classes (1996-99) are about average. The 2000 year-class appears to be better than average although the confidence interval is large due in part to the low number of observations.

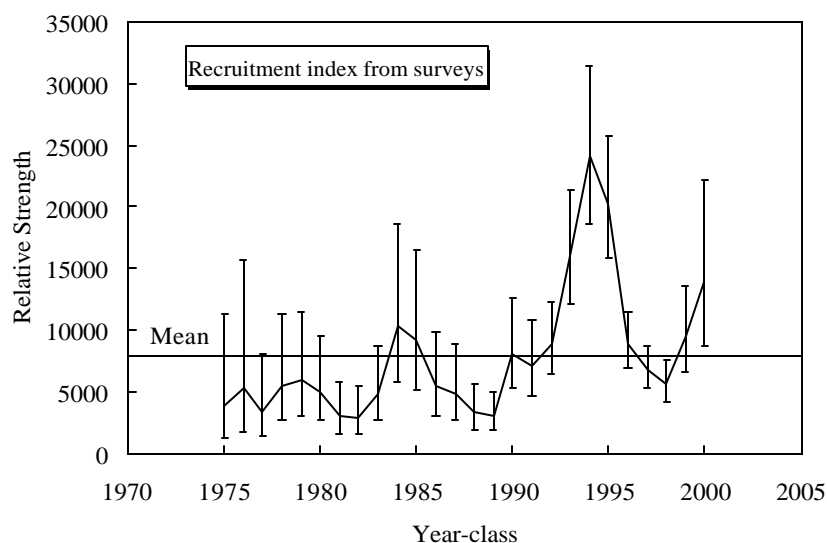


Fig. 18.8 Greenland halibut in Subarea 2 + Div. 3KLMNO: recruitment index from seven research vessel survey series.

c) **Estimation of Parameters**

A complete catch-at-age matrix from the commercial fishery was available from 1975-2001. Using fishery independent abundance indices i.e. the Canadian autumn surveys in Div. 2J and 3K from 1978-2001 and the EU surveys in Div. 3M from 1991-2001 for calibration, an age-structured model, Extended Survivors Analysis (XSA) was used to investigate the current population abundance at age (SCR Doc. 02/78).

d) **Assessment Results**

Based on the results of the XSA, this resource began an increasing trend in the mid-1990s, and this was consistent with the trends in commercial CPUE and most survey indices after 1999 (Fig. 18.9). The increase was propagated by the presence of strong recruitment from the 1993-95 year-classes. Although the absolute level of fishing mortality was unknown, in recent assessments it was considered to be relatively low and at a level that would allow rebuilding. As a result these year-classes were anticipated to contribute substantially to the catches during 2000-2002 and accelerate continued improvement in the stock as they progressed through the population. In the current XSA assessment there was substantial uncertainty in the abundance of the strong year-classes, since these year-classes do not appear to have contributed to the catches in proportions expected (SCR Doc. 02/81).

The continuing positive trend in the biomass from XSA after 1999 is inconsistent with most of the stock size indicators for this most recent period. It was therefore considered imprudent to formulate any projections from this assessment. In conclusion, it is now uncertain as to whether the fishing mortality in recent years was as low as previously thought.

Most stock size indicators from commercial CPUE and research vessel surveys suggest that presently the stock is either relatively stable or declining. The survey series in the NRA give the most negative trends in the stock. Given the current observations it is difficult to anticipate that the strong 1993-95 year-classes will offer much further growth to the stock. The stock size in the immediate future will therefore depend mainly on later year-classes, particularly those of 1996-98, which are estimated to be about average. Early indications are that the 2000 year-class may be strong, however, this year-class will not contribute significantly to the stock or the fishery for at least several more years.

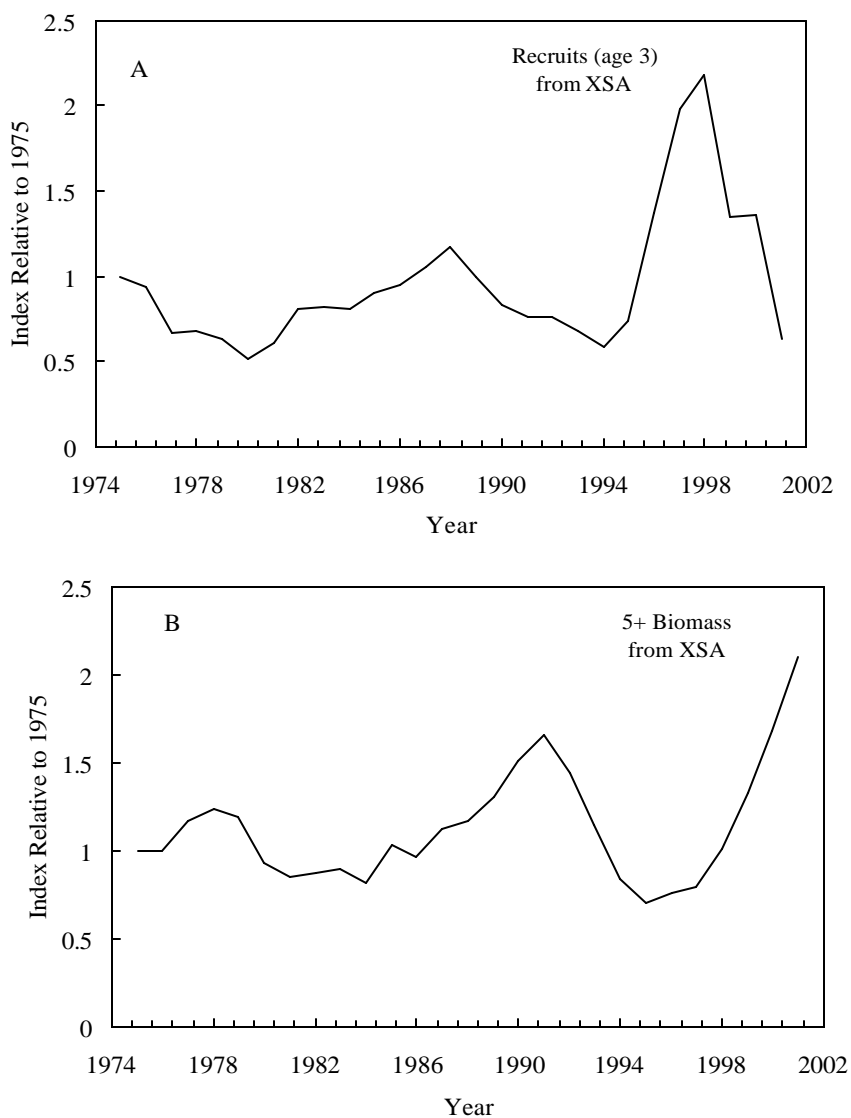


Fig. 18.9. Greenland halibut in Subarea 2 + Div. 3KLMNO: A) recruitment index (age 3) and B) 5+ Biomass, from XSA.

19. **Northern Shortfin Squid (*Illex illecebrosus*) in Subareas 3 and 4** (SCR Doc. 98/59, 01/57, 02/56; SCS Doc. 01/11, 02/4, 8, 13)

a) **Introduction**

i) **Description of the Fisheries**

In Subareas 3 and 4, a TAC of 150 000 tons was in place during 1980-98. 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 and 4 catches declined from 162 000 tons in 1979 to only 100 tons in 1986, but subsequently increased to 11 000 tons in 1990. Catches ranged between 1 000 tons and 6 000 tons during 1991-1995, then increased to 16 000 tons

in 1997. Catches subsequently declined during 1998-2001, from 2 000 tons to 60 tons (SCR Doc. 02/56).

Since this annual species is considered to constitute a single stock throughout Subareas 2 to 6, 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 25 000 tons during 1970-2000. During 1998-2001, catches declined from 24 000 tons to 4 000 tons (Fig. 19.1).

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

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
TAC SA 3+4	150	150	150	150	150	150	75	34	34	34
STATLANT 21A SA 3+4	2.8	6.0	1.1	8.8	15.7	1.9	0.3	0.3 ¹	<0.1 ¹	
STATLANT 21A SA 5+6	18.0	18.3	14.0	17.0	13.6	23.6	7.4	9.0 ¹	3.9 ¹	
STACFIS SA 3+4	2.7	5.9	1.0	8.7	15.6	1.9	0.3	0.4	<0.1	
STACFIS SA 5+6	18.0	18.3	14.0	17.0	13.6	23.6	7.4	9.0	3.9	
STACFIS Total SA 3-6	20.7	24.2	15.0	25.7	29.2	25.5	7.7	9.4	4.0	

¹ Provisional.

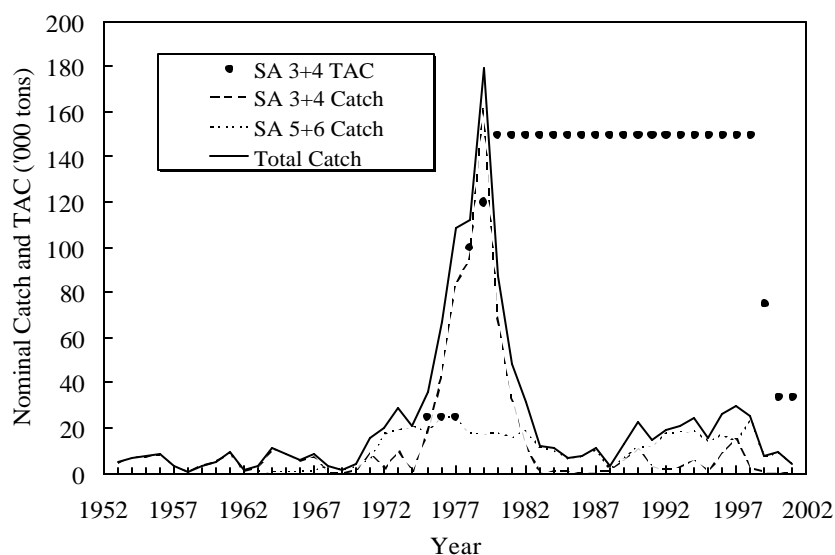


Fig. 19.1. Northern shortfin squid in Subareas 3+4: nominal catches and TACs in relation to catches from Subareas 5+6 and the total stock.

b) Input Data

i) Commercial fishery data

Nominal catch data were available for Subareas 3+4, during 1953-2001, and for Subareas 5+6 during 1963-2001. Catches from Subareas 5+6, prior to 1976, may not be accurate since distant-water fleets did not report all squid catch by species. The accuracy of catches prior to the mid-1970s, for Subareas 3+4, is unknown. Subarea 4 catches were updated to reflect the by-catch of squid in the Scotian Shelf silver hake fishery, during 1987-2001, a period of 100% fishery coverage by the Canadian Observer Program.

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 in Subarea 4 on the Scotian Shelf (Div. 4VWX) during July of 1970-2001, in the southern Gulf of St. Lawrence (Div. 4T) during September of 1971-2001, and in Subareas 5+6 during September – October of 1967-2001. Stratified mean weight (kg) and number per tow indices from the July survey in Div. 4VWX are assumed to represent relative biomass and abundance levels at the start of the fishing season, whereas those from Subareas 5+6 are assumed to represent levels at the end of the fishing season. Survey biomass indices (Fig. 19.2) were positively correlated between Subareas 4 and 5+6. These indices were also positively correlated with catches in Subareas 3-6 (SCR Doc. 98/59).

Abundance and biomass indices for Subarea 3 were derived from three additional surveys to address a 2001 research recommendation. Indices from the Canadian spring survey in Div. 3LNO+Subdiv. 3Ps and the EU July survey on the Flemish Cap (Div. 3M) do not appear to track the same trends as the July survey in Div. 4VWX. Indices from the Canadian autumn survey in Div. 2J+3KLNO, although lower in magnitude, appear to track trends in the July survey in Div. 4VWX, but further research is required to refine the Canadian autumn survey indices.

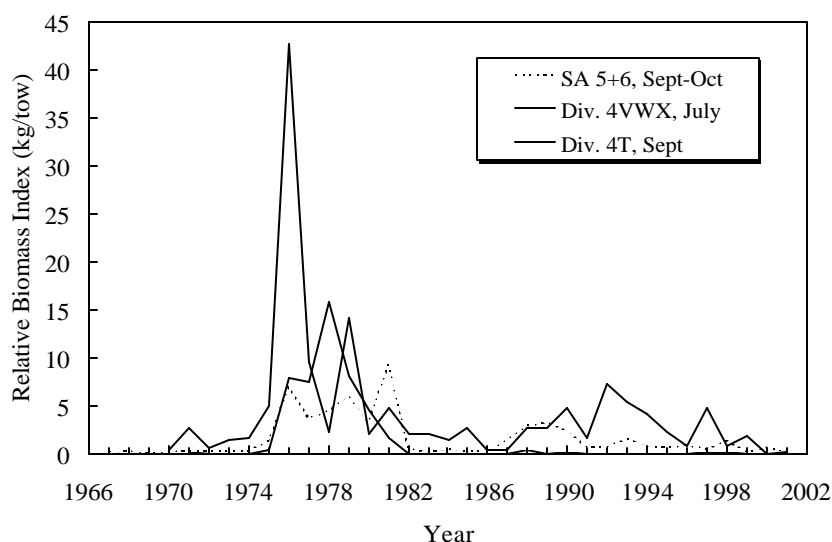


Fig. 19.2. Northern shortfin squid in Subareas 3+4: research survey biomass indices for Subarea 4, during July in Div. 4VWX and September in Div. 4T, and during autumn in Subareas 5+6.

iii) Biological studies

The range of mean mantle lengths from the Newfoundland inshore jig fishery, during September of 2001 (18.9-19.9 cm), were slightly larger than those observed in 2000, but remained smaller than during 1976-1982 (SCR Doc. 02/56, 57). No squid samples were obtained from the Subarea 4 fishery during 2001 (SCS Doc. 02/8).

Annual mean body weights of squid from the July survey in Div. 4VWX declined dramatically during 1982-1983, following much higher mean weights during 1976-1981 (Fig. 19.3). Mean body weight increased gradually thereafter, and in 1999, reached the highest value since 1981. Mean weight declined sharply to a record low in 2000, then increased slightly in 2001. Similar trends were evident in Subareas 5+6, with higher mean body weights during 1976-1981 than during 1982-2001.

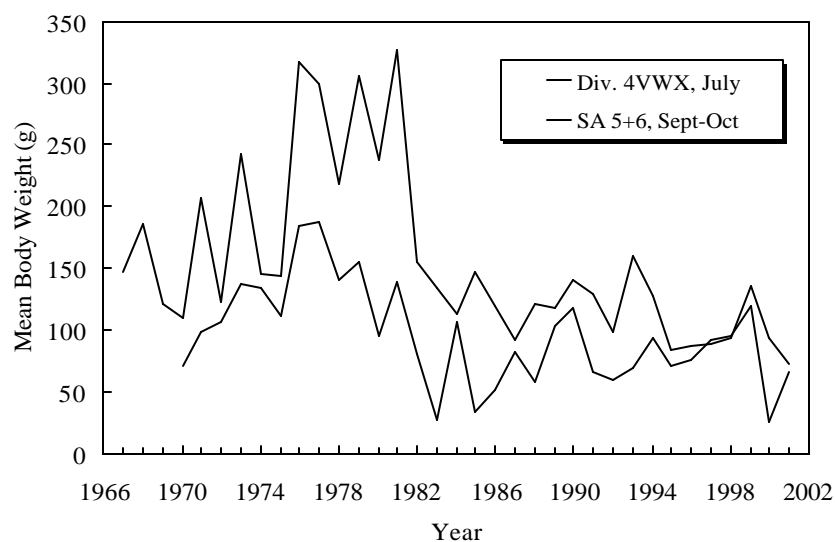


Fig. 19.3. Northern shortfin squid in Subareas 3+4: mean body weight in the July survey in Div. 4VWX and the autumn surveys in Subareas 5+6.

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. 19.4), and were much lower during 1982-2001.

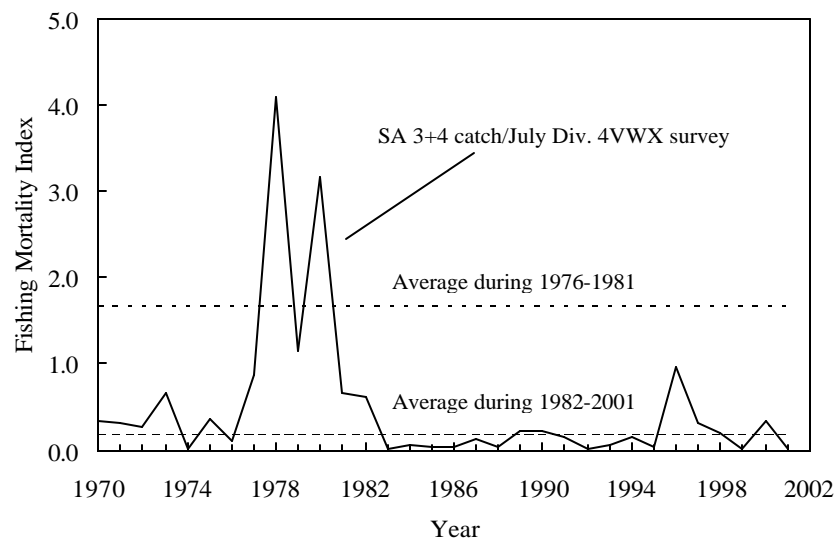


Fig. 19.4. Northern shortfin squid in Subareas 3+4: fishing mortality indices.

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 1982-2000. The high productivity period was associated with larger body size than the more recent low productivity period.

Effort in the Subarea 4 silver hake, squid and argentine fishery, in which squid has been a major component, declined during 2000 and 2001. Since 1997, squid catches in Subareas 3+4 have declined to less than 1 000 tons, and in 2001, were the second lowest since 1953.

Relative abundance and biomass indices, as well as mean body weight of squid caught in the Div. 4VWX survey, remained at low levels in 2001. Survey trends for Subareas 5+6 were similar. These data suggest that the Subareas 3+4 stock component remained in a state of low productivity during 2001.

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 *survey abundance and biomass indices for Subarea 3 be developed from a subset of strata in the Canadian multi-species bottom trawl survey that occurs during September-December.*

E. **MISCELLANEOUS TASKS**

20. **Analyses Pertaining to Other Fisheries Commission Requests** (Annex 1) (SCR Doc. 02/10, 19; SCS Doc. 02/18)

STACFIS noted that regarding pelagic *Sebastes mentella* redfish in NAFO Subareas 1-3, the Scientific Council was requested to review the most recent information on the distribution of this resource, as well as on the affinity of this stock to the pelagic redfish resource found in the ICES Sub-area XII, parts of Sub-areas Va and XIV and to the shelf stocks of redfish found in ICES Sub-areas V, VI and XIV, and NAFO Subareas 1-3.

While the discussion of this item took place at STACFIS, the report is given at Section VII.1.c of the Scientific Council Report.

IV. OTHER MATTERS

1. **New Designated Experts**

This matter was deferred to the September 2002 Meeting.

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.

PART B

Scientific Council Annual Meeting, 16-20 September 2002

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Scientific Council Meeting Participants, 16-20 September 2002:

Back Row (left to right): V. K. Babayan, V. A. Rihkter, A. Avila de Melo, U. Skuladottir, S. J. Correia, D. Cross, A. Vazquez, T. Saat, D. B. Atkinson, F. M. Serchuk, W. B. Brodie, F. Gonzalez, R. Alpoim, H. Murua, J.-C. Mahé, T. Ichii, K. V. Gorchinsky, V. N. Shibanov

Front Row (left to right): W. R. Bowering, M. J. Morgan, R. K. Mayo, M. Stein, D. E. Stansbury, T. Amaratunga, A. Nicolajsen

Missing from picture: C. Allen, D. Kulka, E. De Cárdenas



The Chairs, Scientific Council Meeting, 16-20 September 2002 (left to right): M. Stein, Chair STACPUB; R. K. Mayo, Chair Scientific Council; M. J. Morgan, Chair STACREC; D. E. Stansbury, Chair STACFIS



Scientific Council Outing sponsored by Galician Hosts, 15 September 2002

SCIENTIFIC COUNCIL ANNUAL MEETING, 16-20 SEPTEMBER 2002

REPORT OF SCIENTIFIC COUNCIL MEETING

Chair: R. K. Mayo

Rapporteur: T. Amaratunga

I. PLENARY SESSIONS

The Scientific Council met at the Galicia Congress and Exhibition Centre in Santiago de Compostela, Spain, during 16-19 September 2002. Representatives attended from Canada, Denmark (in respect of Faroe Islands and Greenland), Estonia, European Union (France, Germany, Portugal and Spain), Iceland, Japan, Russian Federation and United States of America.

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 Council noted the Scientific Council Special Session, Symposium on "Elasmobranch Fisheries: managing for sustainable use and biodiversity conservation" was successfully conducted during 11-13 September 2002. The Chair extended appreciation to the conveners.

The opening session of the Council was called to order at 0900 hours on 16 September 2002.

The Chair welcomed everyone to Santiago de Compostela, Galicia, Spain, and to this venue for the Meeting. The Assistant Executive Secretary was appointed rapporteur. The Chair particularly thanked the Galician hosts for the great facilities and support services offered for the meeting.

The Provisional Agenda was **adopted** as presented, noting some additional items will be addressed by Standing Committees.

The Council noted the Provisional Agenda for the Scientific Council Meeting on shrimp during 6-13 November 2002 in Nuuk, Greenland, was circulated 6 September 2002.

The Council noted that there were two errors in the STACFIS Report of the 6-20 June 2002, and agreed to circulate the corrections to participants at this Annual Meeting, and these corrections will be inserted in the Scientific Council Reports, 2002.

The Council reviewed the work plan noting scientific advice to the Fisheries Commission will be submitted on Tuesday, 17 September 2002, and the session was adjourned at 1010 hours.

The Council reconvened as needed and sessions were conducted through to 19 September 2002.

The concluding session was called to order at 1500 hours on 19 September 2002 when the Council addressed other outstanding agenda items and considered and **adopted** the reports of the Standing Committees (STACFIS, STACREC, STACPUB). The Council then considered and **adopted** its report of this Scientific Council Meeting.

The meeting was adjourned at 1550 hours on 19 September 2002.

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

The Report of the Scientific Council Symposium on "Elasmobranch Fisheries: managing for sustainable use and biodiversity conservation" is presented at Annex 1 of this Scientific Council Report.

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

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

II. REVIEW OF SCIENTIFIC COUNCIL RECOMMENDATIONS IN 2001 AND 2002

The Council noted that recommendations made by the Scientific Council through 2001 and 2002 will be addressed as needed under relevant agenda items at this meeting.

III. FISHERIES SCIENCE

The Council **adopted** the Report of the Standing Committee on Fisheries Science (STACFIS) as presented by the Chair, D. E. Stansbury. The full report of STACFIS is at Appendix I.

IV. RESEARCH COORDINATION

The Council **adopted** the Report of the Standing Committee on Research Coordination (STACREC) as presented by the Chair, M. J. Morgan. The full report of STACREC is at Appendix II.

V. PUBLICATIONS

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

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

1. *conveners of the Deep-sea Fisheries Symposium be asked to remind reviewers and authors of manuscripts to complete their work as soon as possible.*

VI. RESPONSE TO SPECIAL REQUEST FROM FISHERIES COMMISSION

1. **Distribution of Shrimp in Division 3M** (note: Scientific Council at its 6-20 June 2002 Meeting deferred this Item)

The Fisheries Commission had submitted to the Council: *for shrimp in Div. 3M, including the area in footnote 1 of Part I, G of the Conservation and Enforcement Measures (the Div. 3L 'box'), Scientific Council if requested, in advance of the annual NAFO meeting in September 2002, to provide information on the monthly distribution of shrimp by size as taken in the commercial fishery and to comment on these distributions in relation to the closed area of Div. 3M as defined by coordinates in footnote 2 of Part I, G of the Conservation and Enforcement Measures and the consequences to the stock of the following scenarios: a closure of the area during June 1 through December 31, and b) no closure at any time.*

The Council at this meeting responded:

In 1999 the Fisheries Commission requested Scientific Council to evaluate whether closure of the shallow part of the Flemish Cap for shrimp fisheries (approximately delineated by the 140 fathom depth contour) would be a precautionary-based measure. The Fisheries Commission agreed in September 2000 to endorse a closure for June- September in 2001. The Scientific Council was unable to assess the effect of the area closure with respect

to the Precautionary Approach but on the issue of the appropriateness of the area and timing Scientific Council recommended a whole year closure at the meeting of November 2000.

Monthly distributions of shrimp by size from the Icelandic fishery have now been analyzed. Small shrimp (two year olds) were generally more abundant in shallow water (<140 fath) in all months of the year. On average the proportion of two year olds in catches were twice as large in the shallow water compared to deeper water. The multiparous females were more abundant in deeper water (>140 fath) in all months except March and April (around hatching time) when they were more abundant in shallow water.

As the two year olds grow, within the year catchability increases and the proportion of two year olds in the catch doubles or triples from the period January to May to the period June to December. Historically catches in shallow water were larger in the period January-May (13.4%) compared to June-December (5.5%).

Therefore, if the area were closed, 12.4% of two year olds would be saved in January - May as compared to only 2.9% in June-December. However, in the event of targeting good year-classes of small shrimp a closure would save a larger proportion of the two year olds.

VII. REVIEW OF FUTURE MEETING ARRANGEMENTS

1. Scientific Council Meeting on Shrimp, November 2002

The Council noted its meeting on Northern shrimp will be held 6-13 November 2002 in Nuuk, Greenland. The Provisional Agenda, meeting dates and site were circulated to Contracting Parties in accordance with the Scientific Council Rules of Procedure, on 6 September 2002.

2. Scientific Council Meeting, June 2003

The Council was informed that the Alderney Gate venue in Dartmouth has informed the Secretariat of other commitments during the period 28 May to 2 June 2003. This is in conflict with the Scientific Council Meeting dates of 29 May to 12 June 2003 that the Council had agreed to earlier. Recognizing the suitability of venue, the Council discussed and agreed to re-schedule the meeting to 5 June to 19 June 2003. The meeting will now be held at the Alderney Landing, 2 Ochterloney Street, Dartmouth, during 5-19 June 2003.

3. Precautionary Approach Workshop, Spring 2003

The Council provisionally agreed to conduct a Workshop on the Precautionary Approach during 31 March to 4 April 2003 in St. John's, Newfoundland, Canada.

4. Special Session and Annual Meeting, September 2003

The Council noted that the Annual Meeting will be held during 15-19 September 2003, and the Scientific Council Special Session, the Workshop on Geostatistics Methods is scheduled for 10-12 September 2003. The meetings will be held in Dartmouth, Nova Scotia, Canada.

5. Scientific Council Meeting on Shrimp, November 2003

The Council provisionally noted the meeting on Northern shrimp would be held during 5-12 November 2003. The venue (and dates if needed) will be determined during the November 2002 Meeting.

6. Scientific Council Meeting, June 2004

The Council agreed to the date 3-17 June 2004 for this meeting to be held at the Alderney Landing, Dartmouth, Nova Scotia, Canada.

VIII. FUTURE SPECIAL SESSIONS

1. **Workshop on Mapping and Geostatistical Methods for Fisheries Stock Assessment for Special Session in 2003**

As requested by the Council in June 2002, the Council received an outline and course plan for a Workshop.

The Council noted the purpose of the Workshop is two fold:

- a) To introduce Scientific Council fisheries scientists, using practical demonstrations relevant to NAFO issues, to spatial techniques that can be applied to survey and environmental data to solve fisheries problems.
- b) To provide Scientific Council members with enough background that they can interpret GIS analyses.

GIS is a broad field and the Workshop can only touch upon some of the aspects of spatial analysis. It will focus on techniques that will be most useful to the user group. The Workshop will:

- show how the raw data (set attributes) can be effectively Visualized (mapping techniques), progressing through Point to Surface Transformation (i.e. methods such as Contouring, Voronoi, Potential Mapping, Kriging that produce the continuous surfaces required to facilitate spatial modeling),
- to Overlay Modeling, and geostatistics (outside expertise is required to deal with this aspect).
- evaluate mixed species interactions within the Precautionary Approach framework.

The workshop will be structured to introduce NAFO participants to a subset of techniques and concepts relevant to their work. Examples and demonstrations will use real data from the Grand Banks and Flemish Cap (see Data Sets). Where appropriate underlying theory and procedures of geostatistics will be elaborated to facilitate the understanding of GIS analyses.

Scientific Council agreed that the proposed workshop is important to the work of Scientific Council. Therefore, the Council has scheduled the workshop to be held in conjunction with the Annual meeting in 2003. The Council notes that the costs associated with running the workshop are \$5K CDN (for travel and expenses for the invited expert in geostatistics) and that amount be requested from the NAFO budget of 2003.

2. **Proposal for Special Session 2004**

Scientific Council discussed several variations on possible themes for a special session prior to the 2004 Annual Meeting. Themes included: 1) a session focused on a comprehensive review of available information on the Flemish Cap, and 2) factors related to changes in species composition in Subareas 2 and 3. However, there was no agreement on an appropriate theme for the 2004 session, and Scientific Council deferred a decision to the June 2003 Meeting when these and other topics will be discussed in further detail. It was agreed any proposal to be discussed in June 2003 should be submitted in written form.

IX. NAFO WORKING GROUPS OR MEETINGS

1. **Update on activities of NAFO WG on Reproductive Potential**

The Council had not received any update on the activities of the Working Group since the June 2002 Meeting. The Council anticipated the proposed scientific publications from the Working Group were proceeding on schedule.

2. Precautionary Approach Workshop, 2003

Since 1997, Scientific Council has dedicated considerable resources towards the development of a framework for implementing the Precautionary Approach. A proposed general framework was developed in 1997 to include limit and buffer reference points for fishing mortality and biomass. A Scientific Council Workshop on the Precautionary Approach to Fisheries Management was held in March 1998 to review methodology and propose reference points for some stocks. It is proposed that a second Workshop address reference points for additional priority stocks. The basis for reference points that have already been identified by Scientific Council should also be reviewed.

Terms of Reference for the Workshop are:

- Review the basis for existing PA reference points.
- Determine appropriate methodology to calculate reference points for data-limited stocks.
- Develop or revise additional reference points for the following stocks:
 - Greenland halibut in SA 2 and Div. 3LKMNO
 - American plaice in Div. 3LNO
 - Cod in Div. 3NO
 - Yellowtail flounder in Div. 3LNO
 - Redfish in Div. 3M
 - Cod in Div. 3M
 - Shrimp in SA 0 and 1
- Provide guidance to Designated Experts for calculating PA reference points for all remaining stocks for which sufficient data exist.

The Workshop will develop reference points for data-rich stocks, based on results from Analytical Models. For data-limited stocks, proxy reference points will be developed based on survey data using methodology developed to address proxy reference points.

The Joint Fisheries Commission/Scientific Council Working Group on the Precautionary Approach and the Working Group of Technical Experts have identified several managerial areas of concern with the specification of the PA framework originally proposed by the Scientific Council. In particular, the Working Group questioned the requirement for a linear reduction in F between B_{target} and B_{lim} , and a fishery closure when the stock is below B_{lim} , and the suitability of F_{msy} as a limit reference point. Therefore, an additional term of reference is proposed for the Scientific Council Workshop:

- Re-examine the PA framework as described in NAFO SCS Doc. 97/12 and develop more precise definitions of terms and concepts consistent with the role of scientists and managers as agreed in NAFO FC Doc. 98/2.

A small Study Group working by correspondence in advance of the proposed Scientific Council Workshop may address this last term of reference.

X. SCIENTIFIC COUNCIL WORKING PROCEDURES AND PROTOCOL

1. Timetable and Frequency of Assessments

The following schedule of Scientific Council assessments reflects decisions that some stocks should be reviewed on a multi-year basis, with monitoring during the interim years. The basis for the monitoring evaluation varies among stocks. Scientific Council has not yet determined a consistent analytical basis for an

interim monitoring evaluation of the stocks under multi-year schedules. A formal delineation of the basis will be discussed at the June 2003 Scientific Council Meeting.

Since 1999, the Scientific Council has agreed to the following overall schedule (+ is assessment year, *i* is interim monitor, 0 no assessments) subject to the Fisheries Commission requests for advice and concurrence:

Stock	1999	2000	2001	2002	2003	2004	2005
-------	------	------	------	------	------	------	------

Current schedule

MULTI-YEAR ASSESSMENTS

American plaice in Div. 3LNO	+	<i>i</i>	+	+	+	<i>i</i>	+
Cod in Div. 3NO	+	<i>i</i>	+	<i>i</i>	+	<i>i</i>	+
Redfish in Div. 3LN	+	<i>i</i>	+	<i>i</i>	+	<i>i</i>	+
Witch flounder in Div. 2J3KL	+	+	+	<i>i</i>	+	<i>i</i>	+
Redfish in Div. 3M	+	+	+	+	+	<i>i</i>	+
Roughhead grenadier in SA 2+3	+	+	<i>i</i>	0	+	<i>i</i>	+
Redfish in SA 1	+	<i>i</i>	+	<i>i</i>	+	<i>i</i>	+
Other finfish in SA 1	+	<i>i</i>	+	<i>i</i>	+	<i>i</i>	+
Cod in Div. 3M	+	+	<i>i</i>	+	<i>i</i>	+	<i>i</i>
American plaice in Div. 3M	+	+	<i>i</i>	+	<i>i</i>	+	<i>i</i>
Witch flounder in Div. 3NO	+	+	<i>i</i>	+	<i>i</i>	+	<i>i</i>
Yellowtail flounder in Div. 3LNO	+	+	+	+	<i>i</i>	+	<i>i</i>
Northern shortfin squid in Subareas 3 and 4	+	+	+	+	<i>i</i>	+	<i>i</i>
Roundnose grenadier in SA 0+1	+	<i>i</i>	<i>i</i>	+	<i>i</i>	<i>i</i>	+

ANNUAL ASSESSMENTS

Greenland halibut in SA2 and Div. 3KLMNO	+	+	+	+	+	+	+
Northern shrimp in Div. 3M	+	+	+	+	+	+	+
Northern shrimp in Div. 3LNO	+	+	+	+	+	+	+
Northern shrimp in SA 0+1	+	+	+	+	+	+	+
Northern shrimp in Denmark Strait	+	+	+	+	+	+	+

Scientific Council's Additional Schedule

Capelin in Div. 3NO	+	+	+	+	+	<i>i</i>	+
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For American plaice in Div. 3LNO, the Council decided to leave this stock on its current 2-year timetable, after some debate. Several reasons were considered for changing the frequency of assessments to an annual basis, including an increasing trend in fishing mortality, and perceived increases in some survey indices. However, considering its advice from the 2001 Meeting that the stock remains at a low level, Scientific Council concluded that the current schedule of assessment was acceptable. During the interim monitoring, there is a need to continue to monitor the level of fishing mortality. However, the Fisheries Commission requested that a full assessment of American plaice in Div. 3LNO be conducted in 2002.

Based on its life history, capelin in Div. 3NO should be assessed on an annual basis. However, the Council concluded that insufficient data exist to reliably determine annual changes in abundance. Until sufficient data are available the stock will be assessed on a multi-year basis.

XI. OTHER MATTERS

1. Consideration of MoU with ICES

The Scientific Council considered a proposal presented by the Executive Secretary to develop a Memorandum of Understanding (MoU) with ICES and referred to it by General Council.

Scientific Council noted that it has had a long-standing working relationship with ICES in many scientific activities of mutual interest. The Council at present continues to work effectively with ICES, e.g. Scientific Council nominees attending ACFM Meetings of ICES, a Joint NAFO/ICES Working Group on Harp and Hooded Seals, conducting co-sponsored Symposia, etc. Under the circumstances Scientific Council is unclear as to the incremental benefits that would accrue through a formal document such as a MoU. It was accordingly decided there is not any need for a formal MoU at this stage. Scientific Council, however, agreed this matter could be considered at a later date based on any additional documentation that may be prepared outlining, in more detail, the benefits and advantages of any MoU.

2. Scientific Council Participation at ICES Precautionary Approach Meetings

ICES is expected to hold 2 meetings on the Precautionary Approach in the upcoming year. The Study Group on the Further Development of the Precautionary Approach to Fishery Management (SGPA) is scheduled to meet during 2-6 December 2002 to complete technical guidelines for revision of PA reference points. Following this meeting, a Study Group on Precautionary Reference Points for Advice on Fishery Management will meet during 24-28 February 2003 to propose revisions of the reference points currently in use by ACFM based on the guidelines developed at the 2-6 December 2002 SGPA meeting. Both meetings will take place at ICES headquarters.

ICES has invited NAFO to send an observer to each meeting. After careful consideration of the focus of each meeting, the Scientific Council selected Jean-Claude Mahé (EU) to represent the Scientific Council at the 2-6 December 2002 SGPA Meeting, and Ray Bowering (Canada) to represent Scientific Council at the 24-28 February 2003 Meeting.

3. Other Business

There was no other business.

XII. ADOPTION OF REPORTS

1. Consideration of Report of the Symposium on Elasmobranch Fisheries, 11-13 September 2002

The Scientific Council was presented with an overview of the Symposium by the co-convenor D. W. Kulka. The Council was informed that the Symposium was attended by 119 participants from 22 countries. The majority of the participants were from European countries, United States and Australia, where elasmobranchs and their exploitation are particularly important fisheries issues. However, the broad representation of countries highlighted the importance of elasmobranchs and their fisheries worldwide.

The Keynote address presented by Sarah Fowler (Naturebureau International and co-chair, IUCN Elasmobranch Species Specialist Group) summarized the current state of shark management issues worldwide. In addition to the Keynote address, 3 invited papers by J. A. Musick, M. Pawson and A. Punt, 53 oral presentations and 30 posters were presented. The proceedings were divided among four sessions: Life History and Demographic Analysis (convened by J. A. Musick); Stock Identity (M. Pawson); Stock Assessment (D. W. Kulka) and Harvest Strategies and Biodiversity Maintenance (T. Walker). The report of the Symposium is given at Annex 1 of the Scientific Council Report.

Considerable attention has been focused on elasmobranchs and their exploitation in recent years in various parts of the world. The Council was introduced to some general issues generated from the discussions at the symposium:

1. Elasmobranchs are generally more vulnerable to exploitation and are slower to recover than other fish species due to life history characteristics such as slow growth and low fecundity. Deep-water sharks are particularly vulnerable.
2. Of particular concern is the catch of elasmobranchs with low intrinsic rates of increase in the mixed species fisheries driven by other fish species, which are more productive. In some cases, the less common elasmobranchs may be extirpated while the target fishery remains viable.
3. Information for the management of elasmobranch stocks needs to be greatly improved. Unrestricted fishing with less than effective monitoring, management and controls is typical for many of the world fisheries.
4. Increased public awareness of the vulnerability of elasmobranch stocks and the impact of fishing over the past decade has led to a significant increase in the national and international fisheries management instruments directed toward this group, although many remain poorly implemented.

The Symposium participants also generated a set of (international) recommendations, presented in Annex 1. The Council reviewed and **adopted** the Report of the Symposium on "Elasmobranch Fisheries" as presented at Annex 1.

The Council was pleased with the success of the Symposium. The Council extended special thanks to D. W. Kulka (DFO/NAFO) for the extra attention he offered to this Symposium and to the co-conveners J. A. Musick (VIMS), M. Pawson (CEFAS) and T. Walker (MAFRI). The Council recognized this Symposium was very informative and a valuable contribution to the scientific work of the Scientific Council. While adopting the report of the Symposium, the Council agreed with the STACPUB proposal that the papers presented at the Symposium be published in the NAFO *Journal of Northwest Atlantic Fishery Science*.

2. **Committee Reports of Present Meeting (STACFIS, STACREC, STACPUB)**

The Council at its concluding session considered and **adopted** the reports of its Standing Committees, STACFIS, STACREC and STACPUB. These reports are given in Appendix I, II and III, respectively.

3. **Report of Scientific Council Present Meeting**

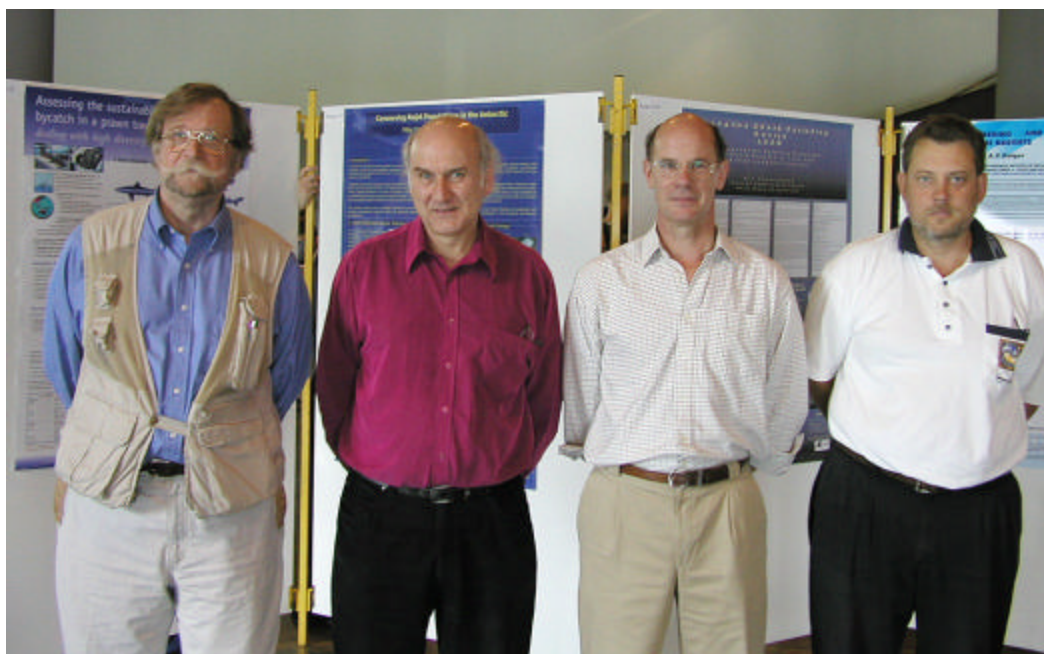
The Council at its concluding session on 19 September 2002 considered and **adopted** its own Report.

XIII. ADJOURNMENT

The Chair thanked the participants, and noted the contributions of the Committee chairs for their diligent work in completing their business. Special appreciation was extended to the Secretariat staff and the Assistant Executive Secretary for their support. Finally, the Chair expressed sincere appreciation to the Galician hosts for the fine facilities and to the staff of the Galician Congress Center for their technical and logistical support. There being no other business, the meeting was adjourned.



Participants of the Symposium on Elasmobranch Fisheries: Managing for Sustainable Use and Biodiversity Conservation
11-13 September 2002



Symposium Co-converors (left to right): John Musick, Terry Walker, Mike Pawson, David Kulka

ANNEX 1. SCIENTIFIC COUNCIL SPECIAL SESSION

REPORT OF THE SYMPOSIUM ON ELASMOBRANCH FISHERIES: MANAGING FOR SUSTAINABLE USE AND BIODIVERSITY CONSERVATION

Hosted by the Scientific Council of the Northwest Atlantic Fisheries Organization
11-13 September 2002

The **Symposium** *Elasmobranch Fisheries: Managing for Sustainable Use and Biodiversity Conservation*, was held at the Galicia Congress and Exhibition, Santiago de Compostela, Spain, and was co-convened by D. W. Kulka (DFO, NAFO), J. A. Musick (VIMS, co-chair, IUCN Elasmobranch Species Specialist Group), M. Pawson (CEFAS) and T. Walker (MAFRI) during 11-13 September 2002. It was attended by 119 participants from Argentina, Australia, Brazil, Canada, Faroe Islands, France, Germany, Ireland, Italy, Mauritania, Mexico, Namibia, New Zealand, Portugal, Russia, Scotland, South Africa, Spain, Sweden, The Netherlands, United Kingdom, and United States of America (refer to List of Participants).

R. K. Mayo, Chair of Scientific Council, opened the Symposium by welcoming the participants and presenting a brief overview of NAFO and its activities. The participants were welcomed to the Symposium and to Galicia by the host Government Minister, Hon. E. C Lopez Veiga, El Conselleiro de Pesca. As the Spanish host, he described Galicia as a place where fisheries were an important component of the economy and a way of life. He wished everyone a successful Symposium and an enjoyable stay in Santiago. D. W. Kulka then introduced the co-conveners and the Keynote speaker. He noted the wide international representation and as well, the volume and high quality of papers submitted.

The Keynote Address, given by Sarah Fowler (Naturebureau International and co-chair, IUCN Elasmobranch Species Specialist Group) summarized the current state of shark management issues worldwide. She pointed out that increased public awareness of the vulnerability of elasmobranch stocks and the impact of fishing over the past decade has led to a significant increase in the national and international fisheries management instruments directed toward this component. The recent history of international shark conservation and management initiatives and action plans for delivering conservation and sustainable use of elasmobranchs, particularly FAOs International Plan of Action (IPOA)-Sharks, was reviewed. Despite these initiatives, landing of and international trade in elasmobranchs has increased during the past decade. It was concluded that progress and commitment in all but a few fishing states has been less than adequate.

The remainder of the Symposium considered current research, advances and impacts of elasmobranch fisheries in many different locations around the world in the context of four themes: Life History and Demographic Analysis; Stock Identity; Stock Assessment and Harvest Strategies and Biodiversity Maintenance. Three invited speakers addressed specific issues within the four sessions. In addition to the invited papers, the program comprised 53 oral presentations and 30 posters.

SESSION 1. LIFE HISTORY AND DEMOGRAPHIC ANALYSIS (J. Musick, convener)

This session comprised 16 presentations: 8 focused on sharks, 4 on batoids 2 on Chimaeras and 2 were of a general nature concerning comparative life histories of elasmobranchs. Of the posters, 6 described life history aspects of batoids, 2 on sharks. The invited paper by J. A. Musick elaborated on the inherent vulnerability of elasmobranch fishes to over-harvesting and ultimately stock collapse because of their life history characteristics: slow growth, long lifespan, late maturation and low fecundity. These demographic parameters lead to low intrinsic rates of population increase, which in turn minimizes the rate of sustainable fishing mortality (F). Indeed, some species may be so constrained that even low levels of F may lead to negative population trajectories: exceptions are smaller species, which live in temperate or tropical environments.

A wide variety of subject matter was contained in the remaining session presentations. Among the papers presented was one on the application of life table models to Portuguese dogfish (*Centroscyllium coelelepis*). The author pointed out that matrix models in many instances might offer more insight into sustainable management of elasmobranch stocks than traditional assessment models. An investigation of the Irish ray fishery incorporated port sampling, commercial transaction data and logbook data to determine species, size and sex of batoids taken in this

mixed species fishery. Through the use of age/length keys the authors showed that total mortality (Z) was high, but demographic analysis of all species except *Raja montagui* still showed positive population growth. Aspects of age, growth and reproduction of the salmon shark, *Lamna ditropis*, were described for the eastern North Pacific. Growth rates of these sharks, which are endothermic, maintaining a constant, elevated body temperature, were higher than for ectothermic sharks inhabiting the same cold-water habitats. In addition, growth rate, length-at-age and weight-at-length were observed to be higher in eastern than in western Pacific salmon sharks.

The life history of the rabbitfish (*Chimaera monstrosa*) was documented. This species constitutes up to 15% of the discarded by-catch in deepwater trawl fisheries off Ireland. The authors, using sectioned fin spines to determine age and growth, showed that they are a long-lived (~40 years) species and as well are late maturing, with low fecundity. The age and growth of four commercial ray species was described from the Irish Sea. Smaller species had faster growth rates and all species had rather abrupt onset of maturity. Age, growth and reproduction were described in the barndoor skate (*Dipturus laevis*) a species severely depleted in the western North Atlantic. Age at maturity for this species was lower than previously assumed, and the species was found to be common in areas that have been closed to harvest on Georges Bank. Distribution, growth and reproduction were described in the white-spotted skate (*Bathyraja albomaculata*) from the Falkland Islands. Dorsal thorns were sectioned to determine age (although the method has not been validated) and age and size at maturity as well as seasonal reproductive and migration patterns were described.

Aspects of the reproductive biology of the thorny skate (*Amblyraja radiata*) was described in NAFO Division 3N. This large species apparently has slow growth and late maturity and limited fecundity. Age, growth and reproduction in the lesser-spotted dogfish (*Scyliorhinus canicula*) were described off Ireland. Males grow faster than females in this species, a situation common among elasmobranchs. However, the author also found that males reach a larger size. The combination of faster growth and larger size is unusual and the evolutionary implications of this were discussed.

Density dependent compensation was investigated in the sharpnose shark (*Rhizoprionodon terraenovae*) in the Gulf of Mexico. This species is a small subtropical shark with relatively fast growth. The author found that growth rate increased and length and age at maturity decreased in response to increased fishing mortality. No increase in fecundity was observed nor would it be expected in viviparous species in which the size of the uterus constrains the number of young that can be carried to term. Reproduction was reviewed in lamniform sharks, which are oophagous or adelphagous. In this group of large and commercially important species, developing embryos are nourished in utero by unfertilized eggs, produced in large numbers by the female.

Both fishery dependent and independent data sets were used to determine demographics and status of the dusky shark (*Carcharhinus obscurus*) in the western North Atlantic. The species takes 21 years to mature and has a 3-year reproductive cycle during which it produces around 810 young. This species has declined by 80-90%, and demographic modeling suggests that population recovery is in question even though the species is protected by recent fishing regulations. Despite protection, by-catch mortality remains high (>50%) in the directed shark long-line fishery. Another study found that size at maturity has declined in female spiny dogfish (*Squalus acanthias*) in the North Atlantic in response to over-fishing. Litter size remained constant, although the average size of recruits declined because of fewer large females (pup size is correlated with female size).

Data from the literature were used to create stage-based population models with subsequent elasticity analysis to determine how mortality (M) and fertility (F) influence population growth rates (r) in elasmobranchs. The author found a negative association between species size and elasticity of fecundity and a positive relationship between size and elasticity of adult and juvenile stages. Information from similar analyses might be useful in determining management strategies.

Sonic telemetry was used with fixed receivers in a small bay in Florida to obtain direct estimates of natural and fishing mortality in neonate blacktip sharks (*Carcharhinus limbatus*). Both natural and fishing mortality were found to be very high (60-90%) for the first 15 weeks of life after which survivorship increased drastically.

In the ensuing discussion, several relevant points were raised:

1. Breeding age of elasmobranchs should be defined as the age at which females actually bear young or lay eggs, and not when ova begin to mature. This is especially relevant to demographic modeling.
2. Size selectivity of fishing gear may affect the growth curves that result from sampling the catch and may not actually represent growth in the general population.
3. More research is needed on the effect of density-dependent compensation on vital rates in elasmobranchs.
4. More research is needed to provide empirical estimates of natural mortality by age.
5. More research is needed on demographics, stock structure, habitat utilization and both ontogenetic and seasonal migrations in deepwater elasmobranchs.
6. Managers need to pay closer attention to life history differences among species taken in mixed species fisheries. In mixed fisheries, different life history characteristics among the catch components can be problematic. Large, slow growing, long-lived elasmobranchs may be depleted or locally extirpated while more productive fishes continue to drive the fisheries.

SESSION 2. STOCK IDENTITY (M. Pawson, convener)

This session comprised 13 papers and 5 posters covering approaches to stock identification in relation to assessment and management; movement patterns and spatial structure; distribution and related population biology; population genetics; and a fisherman's perspective on fishery developments. These papers indicated that, even in fisheries with a long history of exploitation and management, there is often a lack of information on the relationship between stock structure and those parts of a species' population that are subject to exploitation.

Four papers reported studies on the behaviour of individual fish using fishery-independent techniques (archival, acoustic and satellite tags), and these have begun to reveal hitherto unsuspected patterns of movements (white sharks in Australia, basking shark off the west coast of the UK, thornback ray in the southern North Sea, and juvenile sandbar shark along the Virginia shore). In the first three cases, there is evidence of movement into areas where conventionally tagged individuals have not been recaptured. Philopatry – a tendency to stay in or return to a breeding, nursery or feeding area – was observed in all species. This has implications for assessments based on CPUE data, where local depletion may obscure overall population trends, and because the sampled population (for tagging or biological studies – usually where the species can most readily be caught) may not be representative of the population as a whole.

Two papers reported progress in the development of genetic markers for species recognition and stock delineation, of sharks in the western Atlantic and rays in the Mediterranean Sea respectively, but there is, as yet, little evidence that this approach may soon be used to identify management units. Several papers in this and other sessions have shown that measured population parameters (growth, maturity, meristics, etc.) vary considerably in time and space, partly because there are few, if any standardized protocols for data collection and analysis. This limits their use in stock identity.

Three papers presented the results of analyses of elasmobranch data from trawl surveys carried out with standard gear over a time series, for the NAFO Regulatory Area, waters around the British Isles and in the western Mediterranean, and showed that these are valuable indicators of stock structure and distribution. There are similar data sets and other sources of information that should be investigated with this goal in mind.

It was claimed in the paper introducing this session, that tagging studies, especially those providing information on scale and rate of dispersal and migrations and some ability to interpret why these are taking place, currently provide most of our knowledge on stock identity of elasmobranchs. This was borne out in the final paper, which stressed the complications that philopatry introduced both to knowledge of stock units and to our ability to interpret population trends and status from data representing only part of a self-supporting stock unit. Clearly, this provides a less than solid basis upon which to develop management actions, though development of spatial models that recognize these features in population structure, and in the patterns and evolution of fisheries, is a promising solution.

SESSION 3. STOCK ASSESSMENT (D. Kulka, convener)

Fourteen papers, presented orally, described fisheries and monitoring (4 papers) and highlighted a variety of assessment techniques applied to elasmobranch stocks (10 papers). The latter focused mainly on innovative modeling and assessment methodologies. Of the posters, 1 described biomass dynamics/catch effort trend analysis and 8 provided descriptions of fisheries or described development of elasmobranch assessment techniques.

Elasmobranchs often make up a significant component in fisheries directed for other species, particularly those prosecuted in deep water. This was illustrated in a study of the deep-water fisheries off Portugal. Portuguese dogfish (*Centroscymnus coelolepis*) and Leaf-scale Gulper shark (*Centrophorus squamosus*) made up the major part of total annual elasmobranch landings although a great deal of variation was observed among areas fished and fleets. Socio-economic implications were also discussed in the context of conservation vs. exploitation. Elasmobranch trawl fisheries in the Sicily Strait were also described. A monitoring program identified a complex catch including 26 species of elasmobranchs belonging to 11 families. *Raja batis* and several other unusual species (for the area) were reported to be common in the catches. Landings and discard amounts were estimated (more than half discarded) and depth relationships were given. Two fisheries for blue shark (*Prionace glauca*) were also described. Developments in a long-standing fishery off Baja California Mexico (dating back to the 1880s), namely new markets led to expansion of the fleet to larger vessels. Small vessels captured mainly juveniles while the larger vessels took larger fish. Moderate downward trends were observed. A recommendation for a new management unit was described. In the Bay of Biscay the value of careful monitoring practices was illustrated in a presentation describing a recently initiated experimental artisanal fishery. Fishery observers there recorded very detailed information on fishing locations and times, gears, species compositions and size and sex distributions in the catches. A dramatic drop in the CPUE over a short period (3 years) was observed.

Most of the papers described methodologies used to assess elasmobranchs. Very often, data (input) was the key limiting factor to model output (and subsequent provision of advice). Assessments often rely on very basic data such as species integrated catch series and catch rates, or fishery independent indices. For example, where CPUE is not species disaggregated, while the rate might remain relatively stable, some of the more vulnerable components (such as elasmobranchs) might well be in decline. One study showed how port sampling and survey data could be used to split aggregated catch data by species. The multispecies rajid fishery off the Falkland Is. is another case illustrating data deficiencies. In the absence of detailed biological knowledge or catch at age information or even a species-specific breakdown of the catches, simple production models incorporating species aggregated catch/effort data were used to estimate sustainable levels of exploitation. The status of sharks taken in nets set near beaches of South Africa (to minimize the risk of shark attack) was also assessed on the basis of limited information. Given that effort was relatively constant through space and time, catch was used an index of abundance. Although effort was not high, catches of 4 species showed a significant decline (after removing the confounding effect of the annual sardine run). Uncertainty about local stock depletion and philopatry was noted. The issue of local stock depletion that would not be observed in spatially aggregated assessments was also noted in several other papers.

Where appropriate data are available elasmobranch assessments, depending on the available data have been based on quite a variety of methods from demographic analysis, surplus production models and more recently models that require the use of age disaggregated input as well as knowledge of life history (age and growth), stock structure and spatial distribution. As is the case for all fish stock assessments no matter how sophisticated the model, the interpretation of the results are constrained by assumptions in the input variables. It was pointed out that applying different models or varying model input (for parameters such as M that are poorly estimated) can result in very different results.

In some cases, appropriately detailed data such as age-disaggregated data are available and a number of cases were illustrated. A European (NE Atlantic) research project (DELASS) was initiated in 2000 to remedy some of the deficiencies aimed at collecting the required data and developing appropriate stock assessment models. It was pointed out that ageing elasmobranchs is generally more difficult than for teleosts. Generally, vertebrae are used but spines also contain annual rings. One paper described the age and growth of bull sharks (*Carcharhinus leucas*) from the Gulf of Mexico. For this study, four different techniques were applied to enhance ring definition of the vertebrae. Validation was done by marginal increment analysis. The study also described the Von Berlanffy parameters for the species. An age-structured model was implemented using a Bayesian approach. Information from multiple gears and fishery independent surveys was applied to Atlantic sharpnose shark (*Rhizoprionodon terraenovae*). It was pointed

out that a good understanding of life history parameters was important to the integrity of the model. Conversely, limited knowledge of life history leads to uncertainty in the model outcome. One paper dealing with sandbar sharks (*Carcharhinus plumbeus*) presented an age/sex structured population dynamics model that took into account biological and fishery characteristics. This presentation illustrated the advantage of accounting for such aspects as pupping areas or spatial aspects of shark dynamics in the model. Another paper dealing with gummy sharks (*Mustelus anarcticus*) employed a variant of the Integrated Analysis Method, and an age/sex structured population dynamic model that incorporated catch/recapture information. Issues raised were the spatial consistency on the stocks peculiarities of the pupping process and fishery over time and gear composition, which affect the analysis. A Bayesian stock production assessment of NE Atlantic spurdog (*Squalus acanthius*) was fitted to survey and commercial CPUE data. Demographic techniques were used to convert prior distributions for age specific fecundity and natural mortality (based on tagging data and maximum age/length).

A GIS approach was used in one study to investigate changes in the fishery and abundance of kitefin shark (*Dalatias licha*). Fishing ground, depth, distance to fishing ports and seasonality in species catches were overlaid to yield a spatio-temporal perspective of the fishery. It was suggested that least cost pathways may be useful to managers for evaluating resource exploitation sustainability, identifying potential fishing grounds and selecting suitable resource conservation measures.

In the ensuing discussion at the end of the session, it was stressed that elasmobranchs exhibit life history traits such as slow growth, low fecundity and extended gestation period. Further, it was suggested that deep water sharks are even more vulnerable to exploitation than orange roughy, a deepwater teleost well known to decline rapidly soon after the implementation of fisheries. Thus, stocks often declined before proper assessments could be conducted (i.e. availability of appropriate time series). Problems in assessing elasmobranchs related mainly to the non-availability of appropriate input data in addition to the rate at which these species decline once they are exploited. Combining species and gears was recognized as less than appropriate, yet in many cases, only aggregated data were available. It was suggested that a more pre-emptive management approach is required for elasmobranchs in the form of conservative measures (management plans that include immediate implementation of quotas and restrictions). The main issue is not the methods (generally quite sophisticated) used to assess elasmobranchs but rather data deficiencies and less than adequate managements measures derived from the advice given (and the political will to implement same). The first key step is to improve the data through enhanced monitoring programs, including ones that involve the fishers or employ independent observers.

SESSION 4. HARVEST STRATEGIES AND BIODIVERSITY MAINTENANCE (T. Walker, convener)

Thirteen papers were presented relating to sustainable use, biodiversity conservation, and maintenance of ecosystem structure and function.

Sustainable use

Several papers were presented on the shark fishery of southern Australia. Together, they provided examples of fisheries where there is a long history of monitoring, biological research, stock assessment, and management. The invited speaker indicated that harvest strategies could be evaluated using deterministic models to capture the biology of the species taken and the dynamics of the fishery. Harvest strategies are evaluated in terms of performance measures that relate to average catches, catch variability, and resource conservation. The need for risk assessment as part of the assessment of fishery and good consultative processes engaging fishery managers, scientists, fishermen, and other stakeholders were emphasized. The fishery of southern Australia demonstrates that, with the one important exception of the school shark (*Galeorhinus galeus*), the target, by-product, and by-catch of chondrichthyan catches by gillnets and longlines in the fishery are sustainable. School shark was identified as having very low productivity and in need of tight fisheries management.

It was emphasized that chondrichthyans, having low biological productivity are vulnerable to the effects of fishing. Several species from other parts of the world were identified as having been markedly depleted: notably the sandbar shark (*Carcharhinus plumbeus*), spiny dogfish (*Squalus acanthias*), and several species of skate in the Atlantic. On a broader scale, dogfish and chimaeras occurring in deep water on the slopes of the continental shelves of the world appear to be at high risk. These animals inhabit cold water and have particularly low productivity; their habitat area is small compared with species inhabiting the continental shelves and abyssal plains. In contrast, species such as

gummy shark (*Mustelus antarcticus*) and Atlantic sharpnose shark (*Rhizoprionodon terraenovae*) were shown to be highly productive and provide for stable fisheries.

Attention was drawn to the need to give special protection to both pre-recruits and breeding animals in a harvested population. It was demonstrated that the mesh size used in a fishery could be tuned to minimize the impact on small sharks and large sharks. Choice of mesh size is a balance between the efficient take of target species and minimizing by-catch. It was also argued that closed areas are probably the only available method of conserving of some species. One paper drew attention to the value of fin trade data in Hong Kong. Whereas the data appear to be incomplete, careful application of raising factors to available numbers of fins in batches of known weight for known species (recorded by traders or determined from genetic testing) make it possible to estimate number of sharks killed. A major component of these sharks consisted of blue shark (*Prionace glauca*) and several other pelagic species taken in oceanic waters. More direct estimates of blue shark, shortfin mako (*Isurus oxyrinchus*), and porbeagle sharks (*Lamna nasus*) taken as by-catch in the tuna longline fishery of New Zealand were made from on-board observer programs. Following a decline in the catch during the early-1990s, there was a rapid rise in catch during the past 10 years, in response to the high demand for shark fins on Asian markets. As most of the catch of blue sharks comprises males, and based on evidence of stock structuring, the presenter emphasized the need for international collaboration for the assessment of these pelagic species.

Biodiversity conservation

Around the world, much of the chondrichthyan catch is reported as 'unspecified species' or is not reported at all. Several papers reported progress on evaluation of by-catch and by-product species through on-board observers during normal commercial fishing operations. Other papers reported progress on catch evaluation from fishery-independent trawl, longline, and gillnet surveys, or experimental fishing. Data were presented that indicate by catch of chondrichthyans can be reduced by the application of Turtle Exclusion Devices and other by-catch Reduction Devices.

There is an awareness that it is not feasible to undertake a detailed assessment of every species and that there is a need to apply rapid assessment techniques to identify those species at high risk and in need of special management or protection. Application of this approach was presented for northern Australia where species were compared on the basis of biological productivity and catch susceptibility. Biological productivity and catch susceptibility were quantified on the basis of various biological attributes (e.g. longevity, fecundity, proportion breeding, distribution in relation to the fisheries, position in water column in relation to the fishing gear).

Ecosystem structure and function

It was shown that most trawl, longline, and gillnet fisheries catch large numbers of chondrichthyan species and the number of animals taken varies greatly between species. In general, a small number of species dominate the catch. Chondrichthyans are clearly important in the ecosystem and some are apex predators. It also appears, in some regions at least, that the biggest animals in the ecosystem tend to be chondrichthyans.

Surveys of catches from the artisan fisheries of the coastline from Sierra Leone to Ghana indicate that the assemblages of the chondrichthyan fauna change from inshore across the continental shelf and down the continental slope. Another survey with trawl and longlines off the eastern and western coasts of Ireland indicate that dogfishes form the dominant species on the slope and that the predominance of dogfishes on the slope increases with increasing depth. Similarly, as indicated by a poster presentation, the dogfishes were much more significant in the fish communities of the deeply submerged seamounts than those of the more shallowly submerged seamounts of the Sierra Leone Rise in the Gulf of Guinea.

An ecosystem model for the Cantabrian Sea using ECOPATH was presented that incorporates fish biomass estimates, biological parameters, stomach contents data, and catches and discards. The model also includes the trophodynamics of phytoplankton, zooplankton, benthos, and demersal and pelagic communities. The model was used for evaluating the effects of various fishing gears and closed areas on chondrichthyan populations and catches. Other papers highlighted the complex spatial, temporal, and depth effects of stomach contents of sharks.

POSTER SESSION

A total of 30 posters were on display throughout the Symposium and there was a formal viewing session during the evening of September 11 where the authors were present to answer questions. Poster subject matter is summarized in the Session sections above.

SUMMING UP AND DISCUSSION

D. W. Kulka invited each of the chairs of the 4 sessions to present an overview of their session and to highlight what they considered to be the key results and concerns. The session specific outputs from these summaries have been incorporated in the report of each session described above.

CONCLUSION

Considerable attention has been focused on elasmobranchs and their exploitation in recent years in various parts of the world. The Council was introduced to some general issues generated from the discussions at the Symposium:

1. Elasmobranchs are generally more vulnerable to exploitation and are slower to recover than other fish species due to life history characteristics such as slow growth and low fecundity. Deep-water sharks are particularly vulnerable.
2. Of particular concern in the catch of elasmobranchs with low intrinsic rates of increase in the mixed species fisheries driven by other fish species which are more productive. In some cases, the less common elasmobranchs may be extirpated while the target fishery remains viable.
3. Information for the management of elasmobranch stocks needs to be greatly improved. Unrestricted fishing with less than effective monitoring, management and controls is typical for many of the world fisheries.
4. Increased public awareness of the vulnerability of elasmobranch stocks and the impact of fishing over the past decade has led to a significant increase in the national and international fisheries management instruments directed toward this group, although many remain poorly implemented.

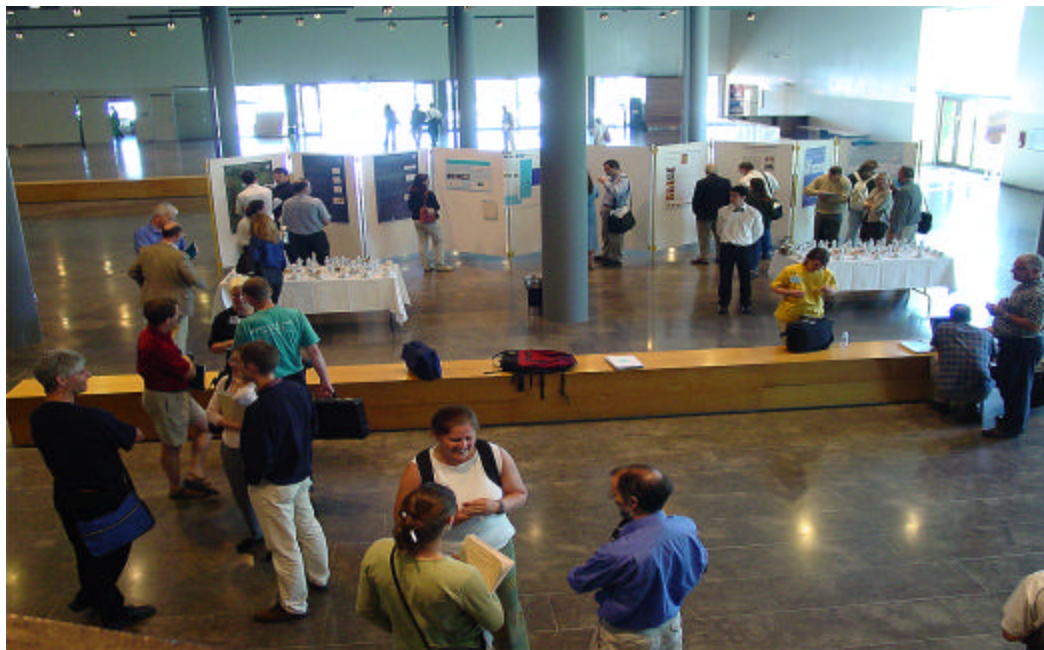
Many of these points were reiterated throughout the various theme sessions. In addition, participants at the 2002 NAFO Symposium on Elasmobranch Fisheries call for:

- NAFO to establish effective management measures for thorny skate and direct the NAFO Scientific Council to investigate the status and management needs of other elasmobranchs in NAFO waters;
- Fishing nations, regional fishery management organizations, and FAO to increase investment in elasmobranch biological and fishery research and management;
- NAFO and all fishing nations, even in the absence of complete fishery data, to implement precautionary quotas and measures to reduce by-catch for particularly vulnerable species;
- All shark-fishing nations, but especially the major fishing nations, to produce a National Plan of Action for their elasmobranchs;
- FAO and developed countries to provide the technical expertise to assist developing nations in the preparation of their National Plan of Action and the assessment and management of fisheries taking sharks.

The Chair of the NAFO Scientific Council thanked the host country for their support in making the Symposium possible. He also thanked the co-conveners for organizing such an interesting and varied collection of papers and posters, and the session chairs for helping the meeting to run smoothly. It is intended to publish a selection of the papers in the *Journal of Northwest Atlantic Fishery Science* within a target time frame of one year.



Co-conveners (left to right): Mike Pawson, David Kulka, John Musick and Terry Walker



Participants at Poster Presentations

SYMPOSIUM SCHEDULE***Wednesday, 11 September 2002**

0800-0830	Registration
0830-0837	Introduction (Scientific Council Chair, Convener)
0837-0912	Welcome Talk by E. Lopez-Veiga, Minister of Fisheries of the Galician Government.
0912-0942	Keynote Paper: FOWLER, S. International shark management: a status report.

SESSION 1: LIFE HISTORY AND DEMOGRAPHIC ANALYSIS*Session Chair: J. Musick*

Paper #	Time	
	0942-0945	Introduction
1.1	0945-1003	Invited Paper: MUSICK, J. Life history and demographic analysis.
1.2	1003-1021	CARVALHO, L., M. QUARESMA and I. FIGUEIREDO. First approach to the application of life table models to the Portuguese dogfish (<i>Centroscyrnus coelolepis</i>).
	1021-1039	Break
1.3	1039-1057	GALLAGHER, M., F. JEAL and C. P. NOLAN. An investigation of the Irish ray fishery in ICES Divisions VIIa and VIIg.
1.4	1057-1115	GOLDMAN, K. J. and J. A. MUSICK. Growth and demographic dynamics of salmon sharks in the eastern and western North Pacific: a spatially structured population?
1.5	1115-1133	CALIS, E., E. JACKSON, C. P. NOLAN and F. JEAL. An insight into the life history of the rabbitfish <i>Chimaera monstrosa</i> with implications for future resource management.
1.6	1133-1151	CARLSON, J. and I. BAREMORE. Changes in biological parameters of Atlantic sharpnose shark, <i>Rhizoprionodon terraenovae</i> , in the Gulf of Mexico: evidence for density-dependent regulation?
1.7	1151-1209	CASTRO, J. I. Patterns of reproduction in the <i>Oophagous lamniform</i> sharks.
1.8	1209-1227	FRISK, M. G., N. K. DULVY and T. J. MILLER. Combining elasticity analyses and life history traits of elasmobranchs as indicators of vulnerability to exploitation.
	1227-1330	Lunch
1.9	1330-1348	GALLAGHER, M., C. P. NOLAN and F. JEAL. Age, growth and maturity of the commercial ray species from the Irish Sea.
1.10	1348-1406	GEDAMKE, T., W. D. DUPAUL and J. A. MUSICK. Observations on the distribution and life history of the barndoor skate (<i>Dipturus laevis</i>) in the Georges Bank closed area II.

* The list of documents and the sequence of presentations may have changed during the Symposium.

Paper # Time

- 1.11 1406-1424 HENDERSON, A. C., A. I. ARKHIPKIN and J. N. CHTCHERBICH. Distribution, growth and reproduction of the white-spotted skate *Bathyraja albomaculata* around the Falkland Islands.
- 1.12 1424-1442 HEUPEL, M. R., C. A. SIMPFENDORFER and R. E. HUETER. Direct estimation of survival and mortality of juvenile blacktip sharks, *Carcharhinus limbatus*, using telemetry data.
- 1.13 1442-1500 DEL RÍO IGLESIAS, J. L. Some aspects of the thorny skate (*Raja radiata* Donovan, 1808) reproductive biology in NAFO Division 3N.
- 1500-1518 **Break**
- 1.14 1518-1536 IVORY, P. and F. JEAL. Age determination, growth and reproduction in the lesser-spotted dogfish, *Scyliorhinus canicula* (L.).
- 1.15 1536-1554 MARQUEZ-FARIAS, J. F., D. CORRO-ESPINOSA and J. L. CASTILLO-GENIZ. Biology of the pacific sharpnose shark, (*Rhizoprionodon longurio*), caught in Sinaloa, Mexico.
- 1.16 1554-1612 ROMINE, J. G., J. A. MUSICK and G. H. BURGESS. Life history parameters of the dusky shark, *Carcharhinus obscurus*, revisited and their implications to estimates of population increase.
- 1.17 1612-1630 SOSEBEE, K. A. Are density-dependent effects on elasmobranch maturity possible?
- 1630-1645 **Discussion**

SESSION 2: STOCK IDENTITY

Session Chair: M. G. Pawson

1645-1648 **Introduction****Paper # Time**

- 2.1 1648-1706 **Invited Paper:** PAWSON, M. G. and J. R. ELLIS. Stock identity of elasmobranchs in the North-east Atlantic in relation to assessment and management.
- 2.2 1706-1724 BRUCE, B. and J. STEVENS. Movement patterns and spatial structure of white sharks in Australia.
- 2.3 1724-1742 SIMS, D. W., E. J. SOUTHALL and J. D. METCALFE. Movements and behaviour of basking sharks (*Cetorhinus maximus*) as revealed by pop-up archival transmitting tags.
- 2.4 1742-1800 CONRATH, C. L. and J. A. MUSICK. A delineation of nursery habitat and migratory patterns of juvenile sandbar sharks, *Carcharhinus plumbeus*, in the western Atlantic Ocean.

Thursday, 12 September 2002

SESSION 2: STOCK IDENTITY CONT'D.**Paper # Time**

- 2.5 0833-0851 CERVIÑO, S., J. L. DEL RÍO and E. ROMÁN. Abundance and distribution of elasmobranchs in NAFO Regulatory Area (Divisions 3MNO).
- 2.6 0851-0909 ELLIS, J. R., B. B. RACKHAM and S. I. ROGERS. The distribution of chondrichthyan fishes around the British Isles and their conservation status.
- 2.7 0909-0927 DURÁN MUÑOZ, P. and E. ROMÁN. Distribution and biological aspects of deepwater sharks in North East and Central Atlantic.

Paper # Time

- 2.8 0927-0945 HARIDAE, N.-R., G. GARNES, G. LANGEDAL and J. E. DYB. Distribution and biology of Portuguese dogfish (*Centroscyrmus coelolepis*) and leafscale gulper shark (*Centrophorus squamosus*) at Hatton Bank and the Mid-Atlantic Ridge (33°-61°N).
- 2.9 0945-1003 REY, J., E. MASSUTI and L. GIL DE SOLA. Distribution and biology aspects of blackmouth catshark, *Galeus melastomus*, in the Alboran Sea (south-western Mediterranean).
- 2.10 1003-1021 MESEGUER, S. and J. REY. Distribution and biology of smallspotted catshark, *Scyliorhinus canicula*, in the Alboran Sea (western Mediterranean).
- 1021-1039 **Break**
- 2.11 1039-1057 PRINCE, J. D., P. RISELEY, T. I. WALKER, L. P. BROWN and A. E. PUNT. Assessing the costs and benefits of fishery-independent surveys in Australia's Southern shark fishery: results of a pilot survey.
- 2.12 1057-1115 VALSECCHI, E., M. VACCHI and G. NOTARBARTOLO DI SCIARA. Population genetics of two Mediterranean skate species (Genus *Raja*) of commercial interest.
- 2.13 1115-1133 HOENIG, J. and M. SHIVJI. Estimating species composition of shark catches from DNA assays: group testing reduces the number of laboratory tests.
- 2.14 1133-1151 DRAKE, S. C., J. A. DRAKE and M. L. JOHNSON. 2000 + UK shark tagging programme: an anglers led shark-tagging initiative in UK coastal waters.
- 2.15 1151-1209 HUETER, R. E., M. R. HEUPEL, E. J. HEIST and D. B. KEENEY. The implications of philopatry in sharks for the management of shark fisheries.
- 1209-1227 **Discussion**
- 1227-1345 **Lunch**

SESSION 3: STOCK ASSESSMENT

Session Chair: D. W. Kulka

1348-1351 **Introduction**

Paper # Time

- 1351-1409 **Invited Paper** – Not issued.
- 3.1 1309-1427 APOSTOLAKI, P. and M. MCALLISTER. Providing advice for the management of sandbar shark (*Carcharhinus plumbeus*). Application of an age- and spatially-structured model.
- 3.2 1427-1445 PRIBAC, F., A. E. PUNT, T. I. WALKER and B. L. TAYLOR. The value of length, age and tagging data in a stock assessment of a length selective fishery for gummy shark.
- 3.3 1445-1503 SIMPFENDORFER, C. A. and G. BURGESS. Assessment of the status of the Atlantic sharpnose shark (*Rhizoprionodon terraenovae*) using an age-structured population model.
- 1503-1521 **Break**
- 3.4 1521-1539 CLARKE, M. G., P. LORANCE and R. OFFICER. Approaches to the assessment of deepwater sharks in the northeast Atlantic.
- 3.5 1539-1557 DUDLEY, S. F. J. Shark catch trends and effort reduction in the beach protection program, KwaZulu-Natal, South Africa.

Paper #	Time	
3.6	1557-1615	FIGUEIREDO, I., L. S. GORDO and P. B. MACHADO. Deep-water sharks fisheries from off the Portuguese continental coast.
3.7	1615-1633	HAMMOND, T. R., C. DARBY, J. R. ELLIS and M. G. PAWSON. Bayesian assessment of NE Atlantic spurdog using a stock production model, with prior for intrinsic rate of increase set by demographic methods.
3.8	1633-1651	MACHADO, P. B. Finding trends on the fishery and abundance of kitefin shark, <i>Dalatias licha</i> (Bonaterre, 1788), from off Azores throughout a GIS spatial analysis.
3.9	1651-1709	SOLDAT, V. T. Spiny dogfish (<i>Squalus acanthias</i> L.) of the Northwest Atlantic Ocean (NWA).
3.10	1709-1727	WAKEFORD, R. C., A. J. AGNEW, D. A. J. MIDDLETON and J. H. W. POMPERT. Fisheries conservation of a multispecies skate and ray community in the Falkland Islands.
3.11	1727-1745	CRUZ-MARTÍNEZ, A., X. CHIAPPA-CARRARA and V. ARENAS-FUENTES. Age and growth of bull shark <i>Carcharhinus leucas</i> from the southern Gulf of Mexico.

Friday, 13 September 2002

SESSION 3: STOCK ASSESSMENT CONT'D.

Paper #	Time	
3.12	0833-0851	SCACCO, L., F. ANDARLORO, S. CAMPAGNUOLO, L. CASTRIOTA and M. VACCHI. Cartilaginous fish catches in the Sicily Strait trawl fisheries.
3.13	0851-0909	LUCIO, P., V. ORTIZ DE ZÁRATE, G. DIEZ, C. RODRÍGUEZ-CABELLO and M. SANTURTÚN. Description of an Experimental Artisanal Fishery Targeting Blue Shark in the Bay of Biscay, 1998-2000.
3.14	0909-0927	SOSA-NISHIZAKI O., E. FURLONG-ESTRADA, J. A. REYES-GONZÁLEZ and J. C. PÉREZ-JIMÉNEZ. Blue shark (<i>Prionace glauca</i>) fishery in Baja California, Mexico: an example of artisanal and middle scale fisheries interaction.
3.15	0927-0945	PASTOORS, M. A. Stock assessments of elasmobranchs in North-East Atlantic: making the most of the data.
	0945-1003	Discussion
	1003-1021	Break

SESSION 4. HARVEST STRATEGIES AND BIODIVERSITY MAINTENANCE

Session Chair: T. Walker

1021-1024 **Introduction**

Paper #	Time	
4.1	1024-1042	Invited Paper: PUNT, A. E., F. PRIBAC, B. L. TAYLOR and T. I. WALKER. Harvest strategy evaluation for school and gummy shark.
4.2	1042-1100	KYNE, P. M., A. J. COURTNEY, M. J. CAMPBELL, K. E. CHILCOTT, S. W. GADDES, C. T. TURNBULL, C. C. VAN DER GEEST and M. B. BENNETT. An overview of the elasmobranch by-catch of the Queensland east coast trawl fishery (Australia).
4.3	1100-1118	PRINCE, J. D. Gauntlet fisheries for elasmobranchs - the secret of sustainable shark fisheries.

Paper # Time

- 4.4 1118-1136 SACHSE, M. The role of the Australian Fisheries Management Authority in the management of the southern shark fishery.
- 4.5 1136-1154 CLARKE, M. W., R. OFFICER, D. STOKES and P. CONNOLLY. Comparisons of trawl and longline catches of deepwater elasmobranchs west and north of Ireland.
- 4.6 1154-1212 MARQUEZ-FARIAS, J. F. Fishery dependent gill net mesh selectivity for the shovelnose guitarfish, (*Rhinobatos productus*), taken in the artisanal ray fishery of the Gulf of California, Mexico.
- 1212-1330 **Lunch**
- 4.7 1330-1348 CLARKE, S. and M. MCALLISTER. Estimates of shark mortality associated with the Shark Fin Trade based on Hong Kong auction data.
- 4.8 1348-1406 FRANCIS, M. P., L. H. GRIGGS and S. J. BAIRD. By-catch of pelagic sharks in New Zealand tuna longline fisheries.
- 4.9 1406-1424 SÁNCHEZ, F., C. RODRIGUEZ-CABELLO and I. OLASO. The role of elasmobranchs in the Cantabrian Sea shelf ecosystem and the impact of fisheries on them.
- 4.10 1424-1442 STOBUTZKI, I., T. STEVENS, T. TARANTO, J. STEVENS, R. MCAULEY, R. BUCKWORTH and N. GRIBBLE. Assessing the regional impact of fishing on elasmobranchs in northern Australia: 148 species, 33 fisheries and limited data.
- 4.11 1442-1500 WALKER, T. I., A. S. GASON, R. J. HUDSON and I. A. KNUCKEY. Assessing impacts of fisheries on biodiversity of sharks and other chondrichthyans in south-eastern Australia and the Great Australian Bight.
- 1500-1518 **Break**
- 4.12 1518-1536 DOWD, W. W., J. A. MUSICK and R. BRILL. The role of elasmobranchs in coastal fisheries ecosystems: mass-balance and organismal bioenergetics approaches.
- 4.13 1536-1554 ELLIS, J. K. and J. A. MUSICK. Past and present diet of the sandbar shark in the lower Chesapeake Bay.
- 4.14 1554-1612 OLASO, I., F. VELASCO, F. SÁNCHEZ, A. SERRANO, C. RODRÍGUEZ-CABELLO and O. CENDRERO. Trophic relations of lesser spotted dogfish (*Scyliorhinus canicula*) and black mouth dogfish (*Galeus melastomus*) in the benthic and demersal communities of the Cantabrian Sea.
- 4.15 1612-1630 RAMOS, A., L. FERNÁNDEZ, and F. SALMERÓN. Chondrichthyes biodiversity on the central Gulf of Guinea continental shelf and slope (from Sierra Leona to Ghana)
- 1630-1645 **Discussion**
- 1645-1700 **Summary**

POSTER PRESENTATIONS***Life History*****Poster #**

- P.1 COELHO, R., L. BENTES, C. CORREIA, J. M. S. GONÇALVES, P. G. LINO, P. MONTEIRO, J. RIBEIRO and K. ERZINI. Fisheries biology of the undulate ray, *Raja undulata*, in the Algarve (southern Portugal).
- P.2 GALLAGHER, M., C. P. NOLAN and F. JEAL. The structure and growth processes of the caudal thorns of Bathyrhoids.
- P.3 JEAL, F., D. FOLEY and M. GALLAGHER. Gonad maturity and age in male rajids.

Poster #

- P.4 RODRIGUEZ-CABELLO, C. and F. SÁNCHEZ. Growth estimates of the lesser spotted dogfish (*Scyliorhinus Canicula*) in the Cantabrian Sea.
- P.5 SOSEBEE, K. A. and A. WHITTINGHAM. Maturity of skates in northeast United States waters.
- P.6 KESKIN, C., M. SUHENDAN, O. MUAMMER and N. UNSAL. Research on the relationship between meat yield quality and the liver weight of the thornback ray (*Raja clavata* L. 1758) in the Black Sea.
- P.7 STENBERG, C. Life history of the piked dogfish (*Squalus acanthias* L.) in Swedish waters.
- P.8 CHARVET-ALMEIDA, P., M. L. GÓES DE ARAÚJO, and M. PINTO DE ALMEIDA. Reproductive aspects of freshwater stingrays (Chondrichthyes: Potamotrygonidae) in the Brazilian Amazon Basin.

Abundance Survey (Fishery Independent)

- P.9 CLÒ, S., M. DALÙ, R. DANOVARO and M. VACCHI. Segregation of the Mediterranean population of *Centroscyrmnus coelolepis* (Chondrichthyes: Squalidae): a description and survey.
- P.10 DOLGOV, A. V., K. V. DREVETNYAK and E. V. GUSEV. Status of skates stocks in the Barents Sea.
- P.11 HEESSEN, H. J. L. The by-catch of rays in the Dutch flatfish fisheries.
- P.12 SHESTOPAL, I. P., O. V. SMIRNOV and A. A. GREKOV. Bottom long-line fishing for deepwater sharks on sea-mounts in the international waters of the North Atlantic.

Abundance (Fishery Dependent)

- P.13 ELÍAS, I., A. RODRÍGUEZ, E. HASAN, L. LOTO and R. AMOROSO. First observation of the tope shark, *Galeorhinus Galeus*, in the northern Patagonian Gulfs of Argentina.
- P.14 GADIG, O. B. F., R. C. NAMORA and F. S. MOTTA. Data on juvenile pelagic sharks occurring in the nearshore area of São Paulo State, Southern Brazil.
- P.15 MACÍAS, D., J. VALEIRAS, J. M. ORTIZ and J. M. DE LA SERNA. Large pelagic sharks as by-catch in the Mediterranean swordfish longline fishery: some biological aspects.

Tagging

- P.16 HOLTZHAUSEN, J. A. Trans-boundary bronze whaler (*Carcharhinus brachyurus*) tagging program between Namibia and Angola.

Biomass Dynamics/Catch-effort Trend Analysis

- P.17 BONFIL, R. Drawing blood from a stone?: stock assessment of the multispecies shark fishery of Yucatan, Mexico.
- P.18 CASTILLO-GÉNIZ, J. L., S. R. SORIANO-VELÁSQUEZ, F. SANCHO-VÁZQUEZ, S. R. RAMÍREZ-SANTIAGO and A. CID DEL PRADO. Characterization of the Mexican shark artisanal fishery off the Gulf of Tehuantepec, México.

Fishery Description/Monitoring

- P.19 CASTILLO-GÉNIZ, J. L., S. R. SORIANO-VELÁSQUEZ and J. F. MÁRQUEZ-FARIAS. The proposal of the Mexican official standard for sharks fisheries: the long awaited tool for conserving shark stocks in México.
- P.20 ERZINI, K., L. BENTES, R. COELHO, C. CORREIA, P. G. LINO, P. MONTEIRO, J. RIBEIRO and J. M. S. GONÇALVES. Semi pelagic longline and trammel net elasmobranch catches in the Algarve (southern Portugal): catch composition, catch rates and discards.
- P.21 GANCEDO, F. R., A. RUNZÓN, C. RODRIGUEZ-CABELLO, I. OLASO, F. SÁNCHEZ and O. CENDRERO. Overview of Continental Shelf elasmobranch fisheries in the Cantabrian Sea.

Poster #

- P.22 FERNÁNDEZ, L., F. SALMERÓN and A. RAMOS. Evolution of elasmobranch by-catch from the Spanish deepwater black hake trawling fishery off Mauritania.
- P.23 GUALLART, J. The fishery of the gulper shark (*Centrophorus granulosus*) in the Balearic Sea (Western Mediterranean).
- P.24 DE MATTOS, S. M.G. Coastal shark fishery off Pernambuco - Brazil: is there any possibility of management?
- P.25 PÉREZ-JIMÉNEZ, J. C., O. SOSA-NISHIZAKI, E. FURLONG-ESTRADA and D. CORRO ESPINOSA. Artisanal shark fishery at Tres Marias and Isabel Islands, Nayarit, México.
- P.26 SALMERÓN, F., A. CARROCEDA, L. FERNÁNDEZ and A. RAMOS. Analysis of the elasmobranch by-catch from the Spanish deepwater bottom longline fishery in Mauritanian waters.
- P.27 ABELLA, A. and F. SERENA. Comparison of elasmobranch catches of trawl surveys and commercial landings of the Port of Viareggio (North Tyrrhenian-South Ligurian Sea, Italy) in the last decade.
- P.28 DOLGOV, A. V. A. A. GREKOV, I. P. SHESTOPAL AND K. M. SOKOLOV. By-catch of skates in trawl and long-line fisheries in the Barents Sea.
- P.29 GÓES DE ARAÚJO, M. L., P. CHARVET-ALMEIDA, and M. PINTO DE ALMEIDA. Fishery and conservation of freshwater stingrays (Chondrichthyes: Potamotrygonidae) in the North of Brazil.

Various Methods

- P.30 HEESSEN, H. J. L. DELASS. Development of elasmobranch assessments.

By-catch Management/Fishery Description

- P.31 RAMOS, A., F. SALMERÓN, F. MOYA, A. CARROCEDA, P. GARCÍA-PASTOR and I. FERNÁNDEZ. Elasmobranch biodiversity and abundance on the seamounts of Sierra Leone Rise (Gulf of Guinea).

By-catch (Discards) Evaluation

- P.32 STOBUTZKI, I., M. MILLER, D. HEALES and D. BREWER. Assessing the sustainability of elasmobranch by-catch in a prawn trawl fishery: a method for dealing with high diversity and limited information.

By-catch Management/Fishery Description

- P.33 ENDICOTT, M. and D. J. AGNEW. Conserving rajid populations in the Antarctic.
- P.34 FRENTZEL-BEYME, B. Z. Proposal for a new method of selectively reducing shark bycatch in longline fisheries.

Ecosystem Structure and Function

- P.35 DOLGOV, A.V. Feeding and food consumption by the Barents Sea skates.
- P.36 MASSUTÍ, E. and J. MORANTA. Demersal assemblages and depth distribution of elasmobranchs from the continental shelf and slope trawling grounds of the Balearic Islands (western Mediterranean).

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Reception: E. Lopez-Veiga, Minister of Fisheries of the Galician Government and R. K. Mayo, Chair Scientific Council, at the Reception held for participants of the Symposium at Hotel AC Palacio Del Carmen, 11 September 2002.



Participants at Reception Room: Hotel AC Palacio Del Carmen

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

Chair: D. E. Stansbury

Rapporteurs: Various

I. OPENING

The Committee met at the Galicia Congress and Exhibition, Santiago de Compostela, Spain during 16-19 September 2002, to consider and report on matters referred to it by the Scientific Council, particularly those pertaining to the provision of scientific advice on certain finfish and invertebrate marine stocks. Representatives attended from Canada, Denmark (in respect of Faroe Islands and Greenland), Estonia, European Union (France, Germany, Portugal and Spain), Iceland, Japan, Russian Federation, and United States of America. Various scientists assisted in the preparation of the reports considered by the Committee.

The Chair, D. E. Stansbury (Canada), opened the meeting by welcoming participants. The agenda was reviewed and a plan of work developed for the meeting. The provisional agenda with no modifications was accordingly **adopted**.

II. NOMINATION OF DESIGNATED EXPERTS

STACFIS reviewed the list of Designated Experts for the stocks, which have to be assessed and for which management advice is requested. The final nomination of the Designated Experts will be conducted through the normal confirmation process between the various national institutes and the Secretariat. The nominations to date by STACFIS for the 2003 assessments are:

- From the Science, Oceans and Environment Branch, Northwest Atlantic Fisheries Centre, Department of Fisheries and Oceans, P. O. Box 5667, St. John's, Newfoundland A1C 5X1, Canada [Phone: listed below – Fax: + 709-772-4188 – E-mail: listed below]

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Shrimp in Div. 3LNO	D. C. Orr	+709-772-7343	orrd@dfo-mpo.gc.ca
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for	Squid in SA 3+4	L. Hendrickson
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III. STACFIS WORKING PROCEDURE

1. Presentation of Age-aggregated Survey Indices of Abundance and Biomass in STACFIS Reports

STACFIS considered the issue of how to present indices of abundance from surveys in a standard manner in its reports. Currently, these data are presented in a number of different ways. Forms of presentation are histograms and line graphs, population measures are abundance and biomass, and computational methods are swept area estimates, mean per tow, and model results.

STACFIS agreed that mean number or weight per tow was preferred over swept area estimates. Presenting the latter as indices in numbers of fish or biomass in tons has caused confusion between these measures and population estimates from models such as sequential population analysis. The calculation of actual area swept by the trawl is a key parameter in the swept area method, and it is not clear for some survey trawls whether door spread or wingspread should be the measure used. For some stocks, indices of abundance and biomass from surveys are several times larger than population estimates from SPA. It was noted that mean per tow indices, particularly when a stock area consists of more than one NAFO Division, are not currently presented in many assessments, and will require some work to calculate and compile. Whenever possible, indices should continue to be presented in SCR Documents as series disaggregated by Division.

There was also agreement that indices should not be presented with points standardized, e.g. to an individual data point, or to the mean of the series. Although STACFIS concluded that measures of variation should be presented for all survey indices, there was no agreement on the best way to show these measures of variation.

IV. OTHER MATTERS

1. Review of SCR and SCS Documents (SCR Doc. 02/121)

STACFIS reviewed a paper on "Biomass Partitioning and Catch History Summary". The paper provided considerable information on distribution with respect to the 200-mile limit, and catch histories. However, it was noted that there was insufficient time to deal adequately with material presented.

It was requested that a revised version of the paper be presented to the STACFIS Meeting of June 2003 and that the new version include a time series of the biomass proportion estimates and that seasonal patterns be examined comparing spring and autumn surveys. Also, it was suggested to remove NAFO Subdiv. 3Ps from all the calculations and provide a Table of maximum depth surveyed in each year. Concern was expressed about the utility of this work if distribution of the stock extends beyond Div. 3LNO.

2. Other Business

An errata sheet was circulated to Scientific Council and Fisheries Commission to correct a figure in the June 2002 STACFIS report on American plaice in Div. 3LNO and to clarify text in the June 2002 STACFIS report of Greenland Halibut in SA 2 + Div. 3KLMNO. STACFIS noted these corrections will also appear on the June 2002 Meeting Report (SCS Doc. 02/19) on NAFO website, and in the final publication of the Scientific Council Reports, 2002 at the end of the year.

There being no other business, the Chair extended particular gratitude to the Secretariat for their assistance and support, and the meeting was adjourned.

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

Chair: M. J. Morgan

Rapporteur: W. B. Brodie

The Committee met at the Galicia Congress and Exhibition Centre in Santiago de Compostela, Spain, during 16-19 September 2002 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), Estonia, European Union (France, Germany, Portugal, and Spain), Iceland, Japan, Russian Federation and United States of America. The Assistant Executive Secretary was in attendance.

1. Opening

The Chair opened the meeting by welcoming the participants, and W.B. Brodie (Canada) was appointed rapporteur. The agenda was modified to include Item 6, and **adopted**.

2. Fisheries Statistics

a) Progress Report on Secretariat Activities in 2000/2001

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

The Assistant Executive Secretary outlined the status of the STATLANT data submissions. Since the June 2002 meeting of STACREC, STATLANT 21A data for 2001 were received from E/DEU, and STATLANT 21 B data were received from EST, E/DNK, E/DEU, E/PRT, POL, and RUS. Greenland was added to the list of countries that have not submitted STATLANT 21A or 21B data for 2001.

ii) Publication of statistical information

STACREC noted that the FISHSTAT Plus program issued by FAO for STATLANT 21 data, and now available on the NAFO website, cannot be used at present to access data for 2001 as well as some data for 2000. The EUROSTAT representative reported that there were some problems with the user support provided by FAO for this software.

3. Review of FAO Fisheries Global Information System (FIGIS)

STACREC reviewed a draft partnership agreement concerning development and maintenance of the Fisheries Resources Monitoring System (FIRMS) within FAO's Fisheries Global Information System (FIGIS). FIRMS is a web-based collection of data on global fishery resource status and trends, including areas covered by regional fishery bodies (RFBs) such as NAFO. It is proposed that RFBs provide the necessary data for this system. STACREC noted several concerns with this approach, including workload issues for the Secretariat as well as Scientific Council, questions on maintenance of data and preserving the wording of scientific advice, possible involvement of some national agencies, and level of support provided by FAO. This system is being developed by FAO and further discussion will be required in STACREC as well as in other Committees within NAFO before specific recommendations concerning this project can be made.

4. NAFO Observer Program Protocol

There was nothing to report on this item.

5. Fleet-based Approach to Data Collection

There were no documents available for consideration, but STACREC had a brief discussion on the general issue. It was noted that Scientific Council had outlined its requirements for data collection in 2000 (SCS

Doc.00/23), and that these specified observer data were to be collected on a set-by-set basis. In discussing this, the issue of confidentiality and vessel identification was raised as a concern. Without any documentation, STACREC concluded that nothing further could be done with this agenda item at this time.

6. Review of Survey Activities in 2003-2004

The following schedule of proposed Russian research activities in the NAFO Regulatory Area (NRA) in 2003 and 2004 was presented. STACREC noted that a part of the Russian national quota would need to be allocated in order for these research surveys to be conducted.

Inventory of Russian research activities proposed in the NRA in 2003-2004

Period/Months	Research Program	Number of vessels	Area
April-May	Random-stratified multi-species demersal fish trawl survey	1	3M
March-August	Random-stratified bottom trawl shrimp survey and assessment of juvenile fish by-catches in the shrimp fishery	1	3M
April-June	Random-stratified Greenland halibut bottom trawl survey in NAFO Regulatory Area	1	3LMNO
June-July (2003 only)	Trawl-acoustic survey of pelagic Redfish in NAFO Regulatory Area (in frames of ICES international TAS)	1	1F, 2+3K
March-September	Selectivity of fishing gears for demersal Redfish	1	3M
July-November	Selectivity of fishing gears and investigation of biology and seasonal distribution of pelagic Redfish	5	1F, 2+3K
January-December	Selectivity of fishing gears for Greenland halibut	1	3LMNO

7. Other Matters

a) Review of SCR and SCS Documents

The results of a Greenland halibut (*Reinhardtius hippoglossoides*) otolith exchange between Spain, Canada and Portugal were described in SCR Doc. 02/142. A set of statistical and graphical methods was used to detect differences in terms of bias and precision. In general, there were no big differences in the recordings between the age readers. Most of the differences in ages were one or two years. The Spanish age reader had a tendency to assign lower ages to fish younger than 9 years old, and higher ages to the older ones, relative to the Canadian age readers. The age reader from Portugal, like the Spanish age reader, assigned higher ages to the older fish (>8 years old) than Canada, but for the younger fish the agreement was very good. Burning the otoliths before reading seems to enhance the last few annuli from the older fish. During the discussion of this paper, the importance was stressed of good agreement between age readers from several countries in the calculation of the catch-at-age.

b) **Other Business**

STACREC was informed that NEAFC has sent a letter to ICES requesting further areal breakdowns of catch data for ICES Divisions X and XII. These breakdowns of catch were to be included in the STATLANT 27A data.

The Chair thanked the participants for their valuable contributions to the Committee. Thanks were also extended to the rapporteur and to the Assistant Executive Secretary and staff of the NAFO Secretariat for their assistance. There being no other business, the Chair closed the September 2002 STACREC Meeting.

APPENDIX III. REPORT OF STANDING COMMITTEE ON PUBLICATIONS (STACPUB)

Chair: M. Stein

Rapporteur: S. J. Correia

The Committee met at the Galicia Congress and Exhibition Centre, Santiago de Compostela, Spain on 18 and 19 September 2002, 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 and Spain), Estonia, Iceland, Japan, Russian Federation and United States of America. The Assistant Executive Secretary was in attendance.

1. Opening

The Chair opened the meeting by welcoming the participants. The agenda as presented in the Provisional Agenda was **adopted**. S. J. Correia (USA) was appointed rapporteur.

2. Review of Recommendations from June 2002

- i) STACPUB had recommended that *the Secretariat provide a copy of the mailing list to each delegation's representatives. Representatives are requested to review the list and provide a list of names that are no longer involved with NAFO and that should be removed from the list.*

STACPUB noted that the Secretariat provided a copy of the mailing list to each delegation's representatives after the June 2002 Meeting. The Assistant Executive Secretary reported that some Contracting Parties have already submitted a list of names that are no longer involved with NAFO and these names have been removed from the mailing list.

- ii) STACPUB had recommended that *the Secretariat maintain the restricted website area for specific Scientific Council business, and that the restricted website name be changed on an annual basis in order to maintain restricted access.*

STACPUB noted that the Secretariat has changed the name of the restricted website area specific for Scientific Council business and Scientific Council members were notified of the site name change. The Secretariat will change the name at the end of the year.

- iii) STACPUB had recommended that *STACFEN's annual climate status summary report on essential climatic conditions in the NAFO Convention area be published on the website.*

STACPUB noted that STACFEN's annual climate status summary report was published on the website after the June 2002 Meeting.

- iv) STACPUB recommended that *"Informational bulletins" of interest to NAFO Contracting Parties, such as location of mooring of ocean current meters in the Flemish Pass, should also be published on the website.*

STACPUB noted that "Informational bulletins" were published on the website after the June 2002 meeting. STACPUB suggested that Scientific Council review new "Informational bulletins" in order to determine the most appropriate area of the website to place them.

- v) STACPUB had recommended that *Secretariat ask the host country to fund a social event during the Elasmobranch Symposium.*

STACPUB thanked our hosts for providing a wonderful social event during the Elasmobranch Symposium.

3. Review of Scientific Publications

a) Papers from June 2002 Meeting

The 7 June 2002 Environmental Mini-Symposium resulted in 8 papers. The Council agreed to consider them for a special Volume of the Journal. Authors were requested to submit their papers by 15 October 2002. To-date one paper has been submitted.

Status of Scientific Publications

i) Journal of Northwest Atlantic Fishery Science

Volume 30. There are presently 7 papers in Secretariat files for this issue.

Volume 31 containing papers from the 2001 Symposium on "Deep-sea Fisheries". A total of 47 papers have been received at the Secretariat and sent to Co-convenors for editorial review. To-date 8 including an Abstract are in the final galley stage, 11 have been received at the Secretariat for final technical edit, 16 reviews have been sent back to authors for revision and 1 has been rejected, 1 withdrawn and 10 (probable 1 reject) are still in referee stages of the review process. This issue is targeted for publication by late-2002.

A **special Volume** containing 8 peer-reviewed articles by members of the Working Group on Reproductive Potential is being prepared by the editor. This volume is intended to provide state-of-the-art techniques and methods used to estimate reproductive potential of fish stocks. In addition, it reviews and synthesizes published results and provides case studies of various approaches that may be used to integrate knowledge of stock reproductive potential into improving scientific advice for fishery resource management. It is anticipated that this publication will be available in late-2002 or early-2003.

ii) NAFO Scientific Council Studies

Studies Number 35 containing a complete narrative of the proceedings and 9 papers presented at the 2000 Workshop on Assessment Methods held during 13-15 September 2000 in Boston, USA, is in final stage of preparation and targeted to be published by late-2002.

Studies Number 36 the report of "The Canada-United States yellowtail flounder Age Reading Workshop, 28-30 November 2000, St. John's, Newfoundland" is targeted to be published by late-2002.

The volume of the **Studies** from the Working Group on Reproductive Potential, 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 over 50 fish stocks (all of the NAFO stocks and several ICES stocks) is being prepared. It is anticipated that this publication will be available in late-2002 or early-2003.

b) Status of the 2001 "Deep Sea Fisheries" Symposium Proceedings

STACPUB noted that nearly half of the manuscripts from the Deep-sea Fisheries Symposium are not ready for publication. STACPUB **recommended** that *conveners of the Deep-sea Fisheries Symposium be asked to remind reviewers and authors of manuscripts to complete their work as soon as possible.*

c) Information from the 2002 Elasmobranch Symposium

STACPUB **recommended** that *a summary of the Elasmobranch Symposium and a PowerPoint presentation summarizing the symposium be published on the NAFO website.*

d) **Status of Invitational Papers (Journal/Studies)**

STACPUB noted that no new information regarding the status of invitational papers was available.

e) **Other Reviews**

After consultation with K. Drinkwater, member of the publication group of the Edinburgh 2001 Symposium on "Hydrobiological Variability in the ICES Area during the 1990s", the chair informed the Committee that it is hoped that all of the papers will be ready for publication by the ICES Annual Science Conference at the beginning of October 2002. Over 75% of the papers and posters are ready now. There are a few lagging behind but most of them should be ready by then. Publication of the Symposium proceedings is envisaged for the end of the year 2002.

4. **Considerations of NAFO Website**

a) **Status of Implementation of Journal and Scientific Council Studies on Website**

Volumes 15-30 of the *Journal of Northwest Atlantic Fishery Science* are available on the website and the entire series is available on CD. *Scientific Council Studies* numbers 31-34 are available on the NAFO website. *Scientific Council Studies* numbers 15-34 are available on CD. Abstracts from all issues are available on web and the Secretariat is currently indexing papers.

b) **"Restricted site" for Scientific Council**

The code for restricted site was changed after the June 2002 meeting. The next schedule name change will occur at the end of this year. Scientific Council members will be notified of the change of the name site.

5. **Editorial Matters Regarding Scientific Publications**

STACPUB noted that no new information regarding editorial matters was available.

6. **Other Matters**

The Chair presented a summary of website usage for June through August 2002 based on information provided by the Secretariat. The website averaged 200 users per day with a peak occurring at the end of July. Website usage throughout this period was generally stable at about 200 users per day. A large peak in usage occurred at the end of July and this peak corresponded with the availability of June 2002 Scientific Council Report on the website. No problems were reported on website.

The Chair provided a brief description of users characterized by country and organization. Most hits were from Internet service providers located in the USA, followed by unknown country, unknown IP address, and Canada (other). Most users are from North America. The Chair thanked the Secretariat for providing information on website usage.

STACPUB noted that the requirement that presenters participating in NAFO Symposia submit both a research document for the Scientific Council and a manuscript for publication in a volume of symposium proceedings. Few symposia require submission of both research documents and manuscripts and this requirement has generated confusion among participants not familiar with NAFO procedures.

STACPUB **recommended** that *an additional agenda item for the 2003 June Meeting should be introduced to review the current requirement of submitting both research document and a manuscript for publication in Symposium Proceedings.*

There being no other business, 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.

PART C

Scientific Council Meeting, 6-13 November 2002

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Participants, Scientific Council Meeting, 6-13 November 2002 at Greenland Institute of Natural Resources, Nuuk, Greenland

Back (left to right): H. Siegstad, D. C. A. Auby, W. B. Brodie, S. Bakanev, P. Kanneworff, Á. Nicolajsen, T. Amaratunga, K. Wieland

Front: D. E. Stansbury, D. C. Orr, U. Skuláðóttir, C. Hvingel, R. K. Mayo



Participants at work



1. Old biological station
2. Klaus Nygaard's presentation to participants.
3. New building of Institute
4. View of harbour and Saddle Mountain.

5. Helle Siegstad in her boat.
6. Greenland Institute of Natural Resources
7. Fjord outing to see whales and icebergs (C. Hvingel's Boat in view).

REPORT OF SCIENTIFIC COUNCIL MEETING

6-13 November 2002

Chair: R. K. Mayo

Rapporteur: T. Amaratunga

I. PLENARY SESSIONS

The Scientific Council met at Greenland Institute of Natural Resources, Nuuk, Greenland, during 6-13 November 2002. Representatives attended from Canada, Denmark (in respect of Faroe Islands and Greenland), Iceland, Russian Federation and United States of America. The Assistant Executive Secretary was in attendance.

The Executive Committee and the Designated Experts met briefly before the opening to discuss the plan of work.

The opening session was called to order at 1015 hours on 6 November 2002

The Council noted that STACFIS would undertake the assessments of the stocks (see Appendix I), while the prognoses and advice would be undertaken by the Council.

The Provisional Agenda was considered and **adopted** with editorial changes (see Appendix II). The Assistant Executive Secretary was appointed rapporteur.

The session was adjourned at 1100 hours.

The Council welcomed STACFIS to conduct its business through 6-11 November 2002, noting most of the Council's work would be addressed through 11-13 November 2002.

The concluding session was convened at 0900 hours on 13 November 2002. The Council addressed the requests of the Fisheries Commission and the Coastal States and considering the results of the assessments, provided advice and recommendations.

The Council then considered and **adopted** the STACFIS Report, and considered its own report and **adopted** the report of this meeting of 6-13 November 2002.

The meeting was adjourned at 1810 hours on 13 November 2002.

The Report of Standing Committee on Fisheries Science (STACFIS) as **adopted** by the Council is given at Appendix I.

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

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

II. FISHERIES SCIENCE

The Council **adopted** the Report of Standing Committee on Fisheries Science (STACFIS) as presented by the Chair, D. E. Stansbury. The full report is given at Appendix I.

The Council's summary sheets and conclusions on Northern shrimp in Div. 3M, Northern shrimp in Div. 3LNO, Northern shrimp in Subareas 0+1 and Northern shrimp in Denmark Strait and off East Greenland are presented in Section III of this report. The recommendations with respect to stock advice appear therein.

The **recommendations** endorsed by the Council are as follows:

1. For Northern shrimp in Division 3M

- *work on age structured population models should be continued.*
- *biological and CPUE data from all fleets fishing for shrimp in the area, be submitted in advance of the 2003 Scientific Council Meeting on shrimp .*
- *a thorough investigation into the methods used to derive a CPUE index for shrimp be conducted and submitted in advance of the 2003 Scientific Council Meeting on shrimp.*

2. For Northern shrimp in Divisions 3LNO

- *biological and CPUE data from all fleets fishing for shrimp in the area, be submitted in advance of the 2003 Scientific Council Meeting on shrimp.*

3. For Northern shrimp in Subareas 0 and 1

- *sampling of catches by observers – essential for assessing stock age, size and sex composition – be re-established.*
- *annual length-weight relationships be constructed as routine part of survey analyses.*

4. For Northern shrimp in Denmark Strait and off East Greenland

- *a survey be conducted, to provide fishery independent data of the stock throughout its range.*
- *sampling of catches by observers – essential for assessing stock age, size and sex composition – be re-established.*

III. MANAGEMENT ADVICE AND RESPONSES TO SPECIAL REQUESTS

1. Responses to Fisheries Commission

a) Advice on TAC and Other Management Measures

The Scientific Council reviewed the STACFIS assessments of Northern shrimp in Div. 3M and Div. 3LNO, and the agreed summaries are as follows:

Northern shrimp (Pandalus borealis) in Division 3M

Background: The shrimp fishery in Div. 3M began in late-April 1993. Initial catch rates were favourable and, shortly thereafter, vessels from several nations joined. Since 1993 the number of vessels ranged from 46-110, and in 2002 there were approximately 40 vessels fishing shrimp in Div. 3M.

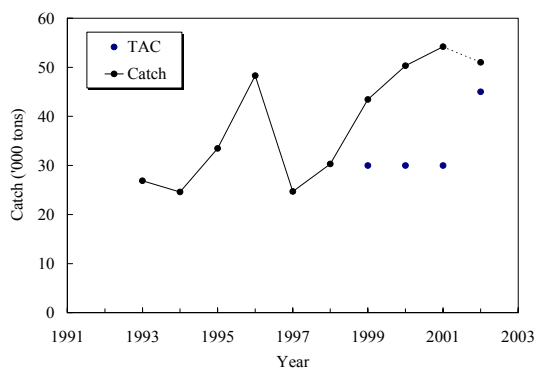
Fishery and catches: Total catches were approximately 27 000 tons in 1993, increased to 48 000 tons in 1996 and declined to 25 000 tons in 1997 and thereafter increased to 54 000 tons in 2001.

Year	Catch ('000 tons)		TAC ('000 tons)	
	STACFIS	21A	Recommended	Agreed
1999	43	42	30	er
2000	50	49 ¹	30	er
2001	54	39 ¹	30	er
2002	51 ²	38 ¹	45	er

¹ Provisional.

² Projected to end of 2002.

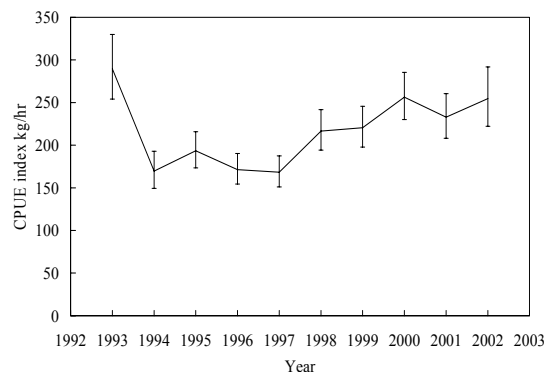
er Effort regulations.



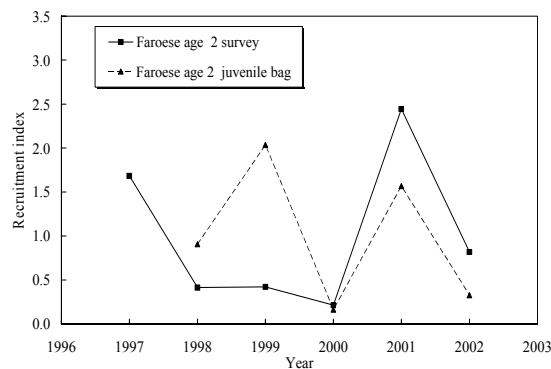
Data: Catch, effort and biological sampling data were available from several Contracting Parties. A standardized CPUE index was developed to account for changes in gear (single, double and triple trawl), fishing power and seasonality. Time series of size and sex composition data were available from three countries and survey indices were available from Faroese and EU research surveys.

Assessment: No analytical assessment is available and fishing mortality is unknown. Evaluation of stock status is based upon interpretation of commercial fishery and research survey data.

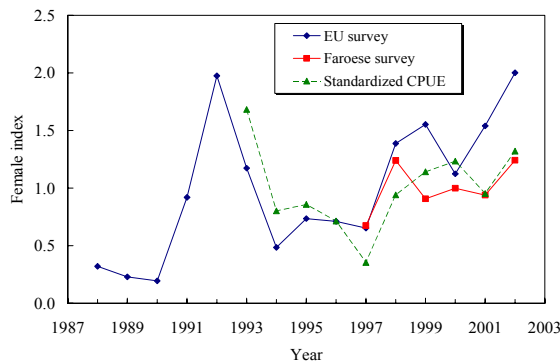
CPUE: Standardized catch rates declined between 1993 and 1994, varied without a trend to 1997, and increased to 2000 and remained stable thereafter.



Recruitment: The 1997 and 1999 year-classes are above average, while the 1998 and 2000 year-classes appear weak.



SSB: Indices of female biomass increased between 1997 and 1998 and fluctuated without a trend thereafter.



State of the Stock: Scientific Council is unable to estimate absolute stock size. Stock size indicators have been fluctuating without a trend since 1998 at a higher level compared to 1994-97. The 1997 year-

class was above average in 2002, but its contribution to the fishery will diminish after 2003. The 1999 year-class is above average and will be contributing to the fishery in 2003 and 2004. However the 1998 and 2000 year-classes appear to be weaker.

Recommendations: The stock appears to have sustained an average annual catch of about 45 000 tons since 1998 with no appreciable effect on stock biomass. Considering the strength of the 1997 year-class and the re-evaluation of the strength of the 1999 year-class in the current assessment to above average and that the 1999 year-class is expected to be the main contributor to the catch biomass in 2003 and 2004, the Scientific Council advises a catch of 45 000 tons for 2003 and 2004. Advice for the 2004 fishery will be reviewed at the September 2003 Scientific Council Meeting, when results from the 2003 summer surveys will be available.

Sources of Information: SCR Doc. 02/142, 149, 150, 155, 156, 159, 161, 163.

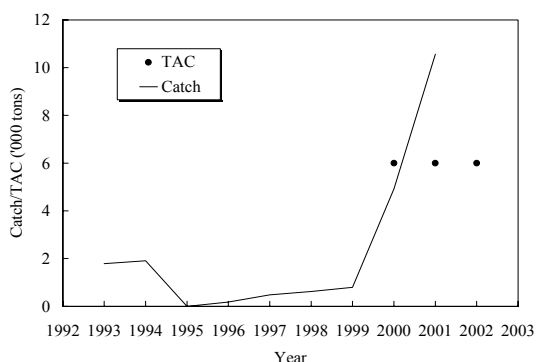
Northern shrimp (*Pandalus borealis*) in Divisions 3L, 3N and 3O

Background: Most of this stock is located in Div. 3L, and exploratory fishing began there in 1993. The stock came under TAC regulation in 2000, and fishing was restricted to Div. 3L.

Fishery and catches: Eight nations participated in the fishery in 2002. Canadian vessels took most of the catches in 2000 and approximately half the catch in 2001. There was insufficient data to determine catches in 2002. The use of a sorting grid to reduce by-catches of fish is mandatory for all fleets in the fishery. Recent catches from the stock are as follows:

Year	Catch ('000 tons)		TAC ('000 tons)	
	STACFIS	21A	Recommended	Agreed
1999	1	1	-	-
2000	5	5 ¹	6	6
2001	11	5 ¹	6	6
2002	na	na	6	6

¹ Provisional.
na Not available.



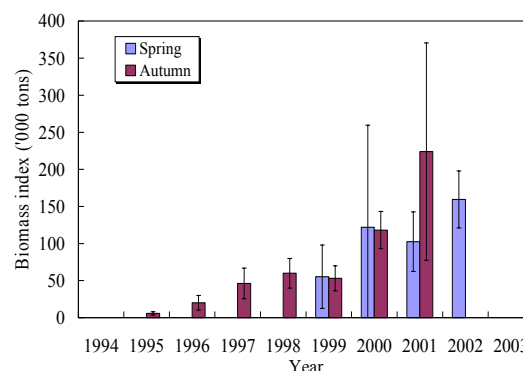
Data: Catch, effort and biological sampling data were available from Canadian vessels and from other Contracting Parties. Biomass and recruitment indices, and size and sex composition data were available from research surveys conducted in Div. 3LNO during spring (1999 to 2002) and autumn (1995 to 2001). Spanish survey data were available for the Div. 3NO NRA for the period 1995 – 2002.

Assessment: No analytical assessment is available. Evaluation of the status of the stock is based on interpretation of research survey indices and biological data.

Recruitment: The 1998 and 1999 year-classes are the two largest year-classes in the short time series.

Exploitation: No estimates of fishing mortality were available. An exploitation index was around 2-3% in 1998-99 and increased to 11-13% in 2000-2001.

Biomass: There was a significant increase in total biomass between 1995 and 1997, a period of stability between 1997 and 1999 and a significant increase thereafter.



State of the Stock: Scientific Council is not able to provide estimates of absolute stock size. The indices of stock size show that both the recruitment and SSB estimates have increased significantly since 1999 and at present are the highest observed. In addition the stock appears to be well represented by a broad range of size groups, and exploitation is low.

Recommendation: In 1999, Scientific Council advised that "the development of any fishery in the Div. 3L area take place in a gradual manner with conservative catch limits imposed and maintained for a number of years in order to monitor stock response". Scientific Council noted that in the adjacent shrimp stock to the north (Div. 3K to southern Div. 2J) the ratio of the TAC to the lower 95% confidence interval of the autumn survey biomass, in the previous year, was about 15%. This was the basis for determining a TAC of 6 000 tons for Div. 3LNO, which has been in place for the years 2000-2002.

For the Div. 3K to southern Div. 2J stock, the ratio of TAC to lower 95% confidence interval on biomass has remained around 11-15%, and there was a steady increase in biomass and TACs during the late-1990s. Scientific Council noted that there have been significant increases in biomass and recruitment in the Div. 3LNO stock since 1999. Applying a 15% exploitation rate to the lower 95% confidence interval of the biomass estimates, averaged over the last four surveys (autumn 2000-2001, spring 2001-2002), results in a catch of about 13 000 tons. Scientific Council considered that this was a prudent approach to advising an increased TAC, and therefore recommends that the TAC for

about 13 000 tons. Scientific Council considered that this was a prudent approach to advising an increased TAC, and therefore recommends that the TAC for shrimp in Div. 3LNO in 2003 and 2004 should not exceed 13 000 tons.

Scientific Council reiterates its recommendations that the fishery be restricted to Div. 3L and that the use of a sorting grate with a maximum bar spacing of 22 mm be mandatory for all vessels in the fishery. Advice for the 2004 fishery will be reviewed at the September 2003 Scientific Council Meeting, when results from the 2002 autumn survey will be available.

Sources of Information: SCR Doc. 02/143, 153, 159, 160.

b) Responses to Special Requests from the Fisheries Commission

The Scientific Council noted the Fisheries Commission at its meeting in September 2002 made a special request with respect to Shrimp in Divisions 3LNO: "*at a meeting in advance of the 2003 Annual Meeting to consider options available for the provision of annual advice as regards shrimp in Div. 3LNO and 3M in advance of the Annual Meetings*".

The Council's response to this issue is reported under Section III.3. below.

2. Responses to the Coastal States

The Scientific Council reviewed the STACFIS assessments for Northern shrimp in Subareas 0 and 1 and in Denmark Strait and off East Greenland, and the agreed summaries are as follows:

Northern shrimp (Pandalus borealis) in Subareas 0 and 1

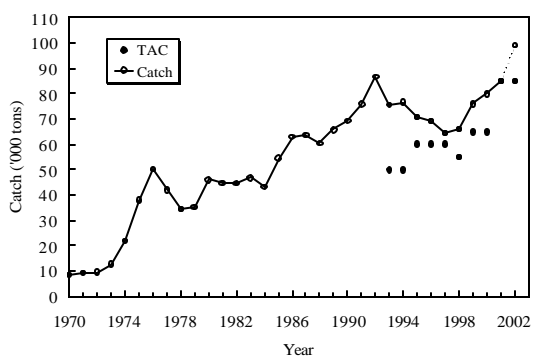
Background: A small-scale inshore fishery began in SA 1 during the 1930s. Since 1969 an offshore fishery has developed and the shrimp fishery is the largest fishery in Davis Strait.

Fishery and catches: The fishery is conducted by Greenland and Canada. Recent catches from the stock are as follows:

Year	Catch ('000 tons)		TAC ('000 tons)	
	STACFIS	21A	Recommended	Autonomous
1999	76.0	76.0	65.0	80.3
2000	79.9	79.9 ¹	65.0	80.3
2001	85.0	85.0 ¹	85.0	91.3
2002	99.0 ²		85.0	103.2

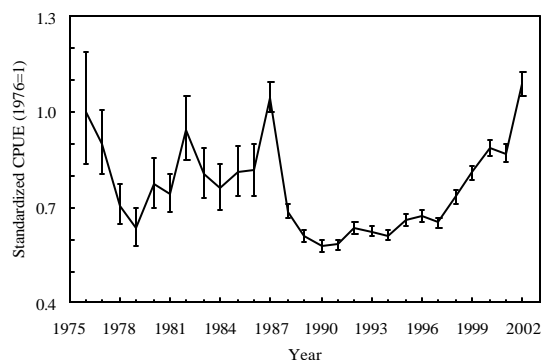
¹ Provisional.

² Projected to the end of 2002.

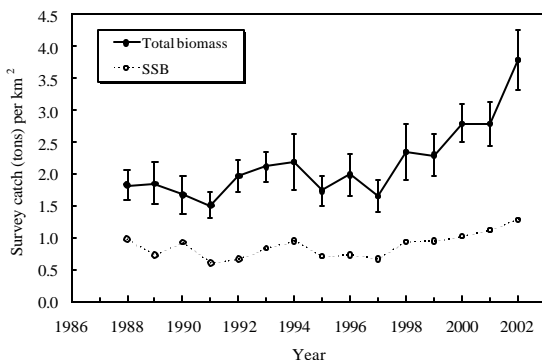


Data: Catch and effort data were available from all vessels. Biological sampling data were available from the offshore fishery. Time series of biomass and recruitment indices, size and sex composition data were available from research surveys. Series of cod biomass and cod consumption data were available.

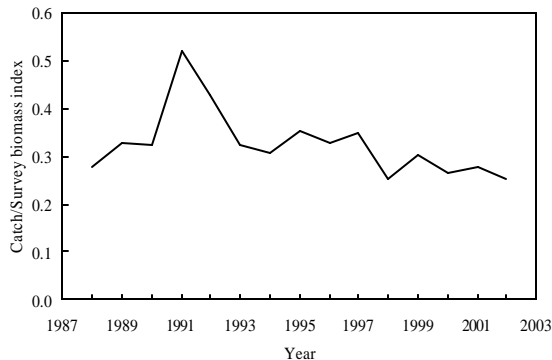
Indicators of biomass: The standardized CPUE series showed an increasing trend since 1990. The 2002 value is the highest of the time series.



The survey total biomass and SSB indices (female biomass) showed an increasing trend since 1997. For both indices the 2002 value is the highest of the series.

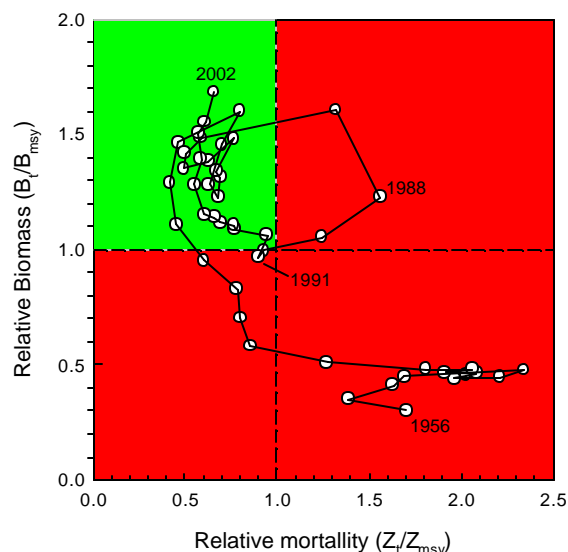


Exploitation rate: Indices of exploitation rate have shown a decline since the early-1990s.

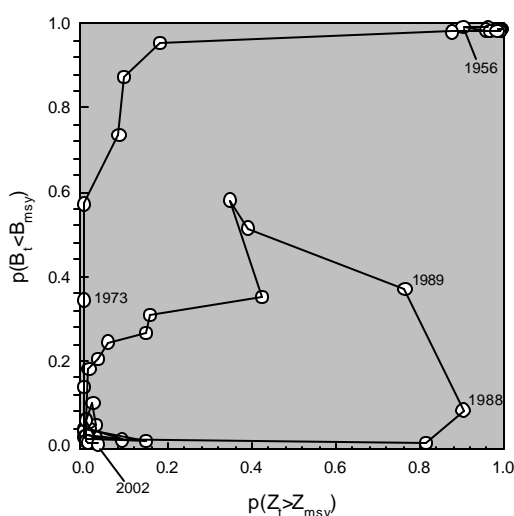


Assessment: An analytical assessment framework using a stochastic version of a surplus-production model that included an explicit term for predation by cod (*Gadus morhua*) was applied for the first time in 2002.

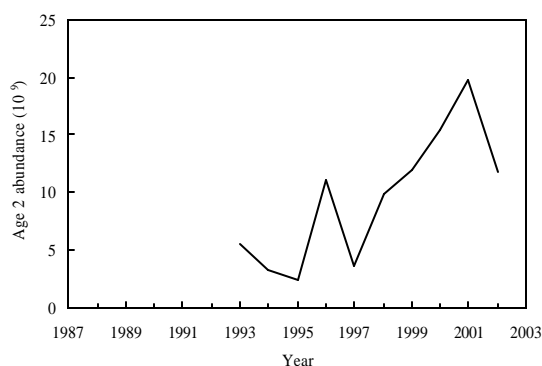
Mortality: The mortality caused by fishing and cod predation (Z) has been below the upper limit reference (Z_{msy}) for most of the time since 1970. Since 1997 mortality has been stable well below Z_{msy} . The estimated risk of current mortality being above Z_{msy} was less than 5%.



Biomass: Since the early-1970s the probability that biomass was below the optimum level (B_{msy}) was low for most years. Since the early-1990s the stock has increased and reached its highest level in 2002. The estimated risk of current stock biomass being below B_{msy} was less than 1%.



Recruitment: A recruitment index (age 2) showed an increasing trend from 1997 to 2001. The 2002 value is above the average of the time series.



State of the Stock: The stock biomass has increased since the early-1990s and reached its highest level recorded in 2002. Biomass is well above B_{msy} and mortality by fishery and cod predation is well below Z_{msy} . In addition a large 1999 year-class is expected to contribute to the fishery in 2003.

Recommendations: If catches exceed 100 000 tons in 2003, there is a greater than 10% risk of exceeding a mortality that is considered to be a limit reference point. Scientific Council therefore recommends that total catch of shrimp in Div. 0A and SA 1 in 2003 should not exceed 100 000 tons.

Given the high probabilities of the stock being considerably above B_{msy} , risk of stock biomass falling below this optimum level within a one-year period is low.

Risk associated with five optional catch levels for 2003 are as follows:

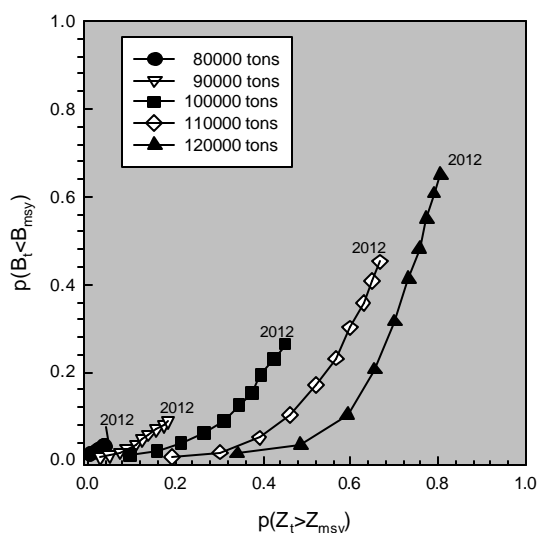
Catch option ('000 tons)	80	90	100	110	120
Risk of falling below B_{msy}	<1%	<1%	<1%	<1%	1%
Risk of exceeding Z_{msy}	1%	3%	10%	20%	34%

Medium Term Considerations: Ten-year projections of stock development were made using the assumption that the cod stock will remain at its low 2002 abundance. Five levels of annual catch: 80 000, 90 000, 100 000, 110 000 and 120 000 tons were investigated.

Catches less than or equal to 90 000 tons/yr will have a high probability of keeping biomass above B_{msy} , and there is a high probability that mortality will remain below the limit reference point.

With a catch of 100 000 tons/yr there is less than 10% risk of stock biomass falling below B_{msy} in the first five years. However, this level of exploitation might not be sustainable in the longer term, as risk of falling below optimum biomass continues to increase through time.

Catches greater or equal to 110 000 tons/yr are not likely to be sustainable in the longer term.



Reference Points: The limit reference point for mortality in the current assessment framework is Z_{msy} , i.e. Z ratio = 1. At this meeting Scientific Council was not in a position to define a reference for biomass (B_{lim}).

Special Comments: Predation by cod can have a major impact on shrimp stock size. If the cod stock were to increase rapidly above the current level, as seen in the late-1980s, consumption could reach the same level as the current catches within a 34 year period. Such an event should, however, be detected early by routine survey programs and management options can then be evaluated.

Sources of Information: SCR Doc. 02/144, 145, 146, 148, 151, 157, 158.

Northern shrimp (Pandalus borealis) in Denmark Strait and off East Greenland

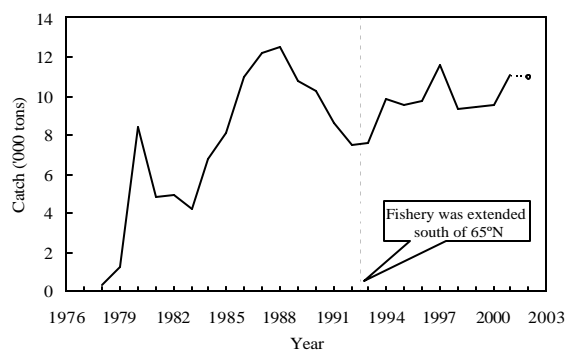
Background: The fishery began in 1978 in areas north of 65°N in Denmark Strait, where it occurs on both sides of the midline between Greenland and Iceland. Areas south of 65°N in Greenlandic waters have been exploited since 1993.

Fishery and Catches: Five nations participated in the fishery in 2002. Recent catches and recommended TACs are as follows:

Year	Catch ('000 tons)		TAC ('000 tons)	
	STACFIS	21A	Recommended	Agreed
1999	4.0	5.5	9.5	9.6
2000	3.5	6.1	9.6 ¹	9.6
2001	1.8	9.3	11.0 ¹	9.6
2002			11.0 ²	9.6

¹ Provisional catches.

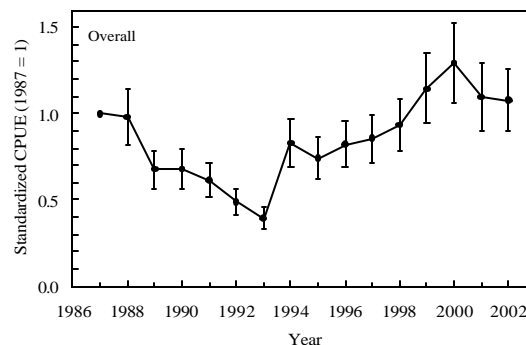
² Projected to the end of 2002.



Data: Catch, effort and biological sampling data were available from trawlers of several nations. Surveys have not been conducted since 1996.

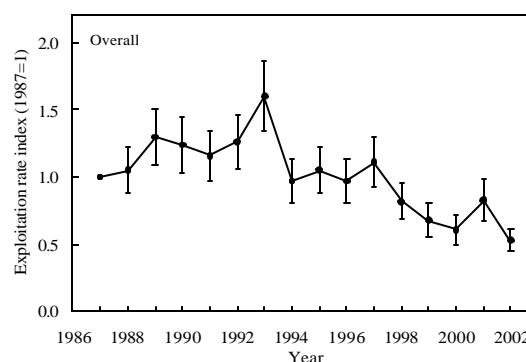
Assessment: No analytical assessment is available and fishing mortality is unknown. Evaluation of the status of the stock is based on interpretation of commercial fishery data and biological data.

CPUE: Combined standardized CPUE indices for the total area declined from 1987 to 1993 and increased thereafter to approximately the same level in 2001–2002 as at the start of the time series in 1987.



Recruitment: No recruitment estimates were available.

Biomass: No direct biomass estimates were available.



Exploitation rate: From 1998 through 2002 an exploitation rate index (catch/CPUE) has been at its lowest levels in the 16-year series.

State of the Stock: Scientific Council was not able to provide estimates of absolute stock size. Standardized CPUE data for all the areas combined indicate a general increasing trend in fishable biomass since 1993. The 2001 and 2002 values equal the relative high values of 1987 when the series started.

Recommendation: Since 1994, annual catches have remained near the recently recommended TAC of 9 600 tons, while stock biomass indices have increased. This increase may not, however, have continued after 1999. Scientific Council therefore advises that catches of shrimp in Denmark Strait and off East Greenland should not exceed 9 600 tons in 2003.

Sources of Information: SCR Doc. 02/147, 154.

3. Formulation of Advice Under a Precautionary Approach Framework

a) Workshop on the Precautionary Approach

The Council reviewed the Terms of Reference developed for the Spring 2003 Workshop on the Precautionary Approach, during its September 2002 Meeting. Noting the progress made with respect to the Precautionary Approach on Shrimp in Subareas 0 and 1 during this Meeting, the Council encouraged shrimp experts to participate in the Spring 2003 Workshop.

b) Methodology for Determining a TAC for Divisions 3LNO Shrimp

Scientific Council discussed several approaches for determining the basis for calculating the TAC for Div. 3LNO shrimp. The initial TAC of 6 000 tons recommended for 2000 was calculated in September 1999 and was based on applying a relative exploitation rate of 15% to the lower 95% confidence interval of the biomass estimate from the autumn 1998 bottom trawl survey conducted in Div. 3LNO. The rationale for this calculation was given as follows (NAFO Sci. Coun. Rep., 1999, page 214):

*It was noted that in the adjacent area immediately north of Div. 3L (southern Div. 2J+3K), the ratio of TAC to the lower 95% CI of the survey biomass is about 15%. The surveys in Div. 2J+3K are at the same time of year and with the same gear as Div. 3L. Applying a similar relative exploitation rate to the lower 95% CI of the 1998 survey biomass estimate in Div. 3L would translate into a catch of about 6 000 tons. Scientific Council **recommended** that if there is a shrimp fishery in Div. 3L, catches be restricted to no more than 6 000 tons for a number of years until the response of the resource to this catch level can be evaluated. In addition, Scientific Council **recommended** that fishing effort be distributed proportional to the distribution of biomass.*

In November 1999 Scientific Council advised "if there is a fishery in Div. 3L, catches be restricted to no more than 6 000 tons for a number of years until the response of the resource to this catch level can be evaluated". Scientific Council had advised that the catch be no more than 6 000 tons for 2000 and 2001. In November 2001, Scientific Council also advised a catch of no more than 6 000 tons for 2002. Noting that all current indices of stock size and recruitment are favorable, Scientific Council also acknowledged that the fishery had existed for only 2 years and the effect on the stock of the 2001 fishery could not be evaluated at that time.

Given the increases in biomass indices noted between 1998-1999 and 2000-2002 in the current assessment, Scientific Council reconsidered the basis for determining the TAC for this stock. Several approaches in addition to the existing method were considered including: increasing the relative exploitation rate from 15% to 30%, changing the basis from the lower 95% confidence interval to the mean biomass estimate, and deriving a TAC by direct comparison of shrimp biomass between Div. 3LNO and Div. 2J+3K or between Div. 3LNO and Div. 3M.

Although these proposed modifications were considered as possible alternatives, Scientific Council noted that application of the existing approach to the Div. 2J+3K fishery has resulted in continued increases in biomass and corresponding increases in the TAC and yield. On biological grounds, Scientific Council considered it appropriate to maintain consistent harvest strategies in Div. 2J+3K and Div. 3LNO shrimp fisheries on the basis that the linkages between shrimp stocks in these two areas are still uncertain. Further, direct comparison of biomass estimates between Div. 3LNO and Div. 3M may be problematic because the surveys in Div. 3LNO and Div. 3M are conducted in different seasons with different gear. Therefore, Scientific Council agreed to continue the existing approach until the impact of the fishery on the Div. 3LNO shrimp stock can be further evaluated.

To determine the 2003 TAC, Scientific Council applied the following rationale. As there has been a significant increase in biomass since 1999, it would be appropriate to consider only surveys conducted after 1999. Excluding the spring 2000 survey, which had a lower confidence interval less than zero, the average of the lower 95% of the confidence intervals in the remaining 4 surveys (spring 2001-2002, autumn 2000-2001) is 88 500 tons. Fifteen percent of this value is 13 300 tons.

4. **Timing Issues Relative to Advice for Division 3M and Divisions 3LNO Shrimp Stocks**

Scientific Council discussed its schedule of meetings for the assessment of shrimp stocks in Div. 3M and 3LNO. At present, assessments of these stocks, as well as those in Subareas 0 and 1 and in Denmark Strait and off East Greenland, are conducted at a mid-November meeting. Scientific Council provides advice for shrimp stocks in Div. 3M and 3LNO to the Fisheries Commission at the following Annual Meeting, and the advice is for the subsequent year. At the September 2002 Annual Meeting Fisheries Commission requested Scientific Council "*at a meeting in advance of the 2003 Annual Meeting to consider options available for the provision of annual advice as regards shrimp in Div. 3LNO and 3M in advance of the Annual Meetings*".

Issues with respect to timing of management advice: From a scientific perspective, there are a number of issues that affect the timing of the shrimp assessments:

- a) **Availability of data for assessments completed in November:** Generally the current year catch and sampling data available in November are adequate to extrapolate to the full year. There are some problems if fishing effort is higher than expected in November-December. Usually current-year surveys have been completed in time for inclusion in November assessments, although that is not the case for shrimp in Div. 3LNO, where the major annual survey is not completed until after the November meeting.
- b) **Appropriate peer review:** A good complement of experts on shrimp assessment, are required. Scientific Council had previously concluded that it was beneficial to conduct all its shrimp stock assessments during one meeting, where all or most of the shrimp scientists could attend.
- c) **Timing of the advice relative to the year in which the advice applies:** For the Fisheries Commission managed shrimp stocks, this has ranged from provision of current year advice, to providing advice for the next year and to providing advice for the year after the next. For a short-lived species such as shrimp, there would seem to be merit in providing advice as close as possible to the year in which the advice is applied.

From a management perspective, the key issue is the timeliness of Scientific Council advice based on the most recent information. For the Fisheries Commission managed stocks (Div. 3M and Div. 3LNO), this means having advice available at the September Annual Meeting. So clearly the November assessment of these stocks is not appropriate in terms of timing. Although Fisheries Commission held mid-term meetings in 2000 and 2002 in which they dealt with shrimp advice, the circumstances were exceptional, and Fisheries Commission has currently decided to deal with the November 2002 advice by mail vote, rather than convening a meeting. Point c) above is relevant in this case, i.e. it would seem harder to manage stocks if scientific advice is dated and the stock dynamics have changed in the interim.

Scientific Council considered several options to address the delay between the completion of the assessment and the delivery of advice to Fisheries Commission, including: 1) moving the November meeting to September, 2) holding a separate meeting for the Subarea 3 stocks and one for the stocks in Subareas 0 and 1 and in Denmark Strait and off East Greenland, and 3) providing for a second review and update of advice for the Subarea 3 stocks taking into account survey information that became available after the completion of the assessments.

Taking the above into account, Scientific Council considers it extremely important that the integrity of the peer review process be maintained by keeping the current practice of reviewing all shrimp stocks at a single meeting of experts in shrimp biology and assessment methods. Therefore, any revision to the meeting schedule must preserve the existing meeting structure where primary assessments are conducted and reviewed.

Taking into account the availability of commercial catch and biological sampling data, and the timing of various research vessel surveys, Scientific Council again concluded that the primary assessment meeting could not occur before the last week of October. Therefore, the option to move the meeting to September was rejected.

The third option above, however, preserves the integrity of the peer review process and provides for more timely advice based on the most recent survey data. Therefore, Scientific Council proposes the following assessment schedule for the shrimp stocks in Div. 3M and 3LNO:

- i) Full assessments will be conducted and reviewed in late-October or early-November and Scientific Council will provide advice for the year following the next Annual Meeting.
- ii) Scientific Council will then review advice in September of the following year prior to the Fisheries Commission meeting. Advice may be revised if additional information from research vessel surveys indicates a significant change in stock status compared to the original assessment.

The following timetable illustrates the above process:

For Northern shrimp in Div. 3M and 3LNO

Late October-early November 2003: Stock status determined through 2003 and advice provided for 2005.

September 2004: Advice for 2005 reviewed and revised if appropriate.

IV. OTHER MATTERS

1. Coordination with ICES Working Groups on Shrimp Stock Assessments

At its November 2001 meeting, Scientific Council noted that a proposal may be forwarded from ICES to conduct assessments of ICES shrimp stocks under the auspices of a joint NAFO/ICES Working Group. Since then no formal proposals were received and the issue was not addressed further. Scientific Council considers cooperation with ICES on matters of mutual scientific interest extremely important and, joint review of assessments of shrimp stocks in the Northwest and Northeast Atlantic mutually beneficial.

However, several logistical issues must be resolved before any proposal can be developed. The timing of data availability and provision of advice differ between NAFO and ICES. Scientific Council must provide advice to the NAFO Fisheries Commission at the September Annual Meeting for 2 stocks in Subarea 3 and to Coastal State Contracting Parties before the beginning of the calendar year for two stocks off Greenland. Within ICES, ACFM develops advice for North Sea and Skagerrak and Barents Sea shrimp stocks at an October meeting to be provided to ICES customers in December.

Scientific Council has determined that its primary shrimp assessment meeting shall take place in either late-October or early-November, with a review of advice for the two Subarea 3 stocks in the following September, just prior to the Fisheries Commission meeting. Communications with the ICES Secretariat indicates that the timing of a late-October/early-November meeting can be accommodated by ICES so that advice for the ICES stocks may be offered to customers on schedule.

2. Scientific Council Meeting on Northern Shrimp, 2003

The Council, noting its discussions with respect to possibly including the review of stocks from the ICES area (see Section IV.1), agreed to provisional dates of Monday 27 October 2003 to Friday 7 November 2003. This provides for additional time that may be needed if ICES stocks are considered.

The Council agreed to reconsider these dates at its June 2003 Meeting, should there be more information available from ICES on this matter.

The Council agreed the 2003 meeting will be held in Dartmouth, Nova Scotia, Canada.

3. **Scientific Council Meeting on Northern Shrimp, 2004**

The Council agreed to consider dates and location for the November 2004 Meeting at its 2003 Meeting, subject to the work load and outcome of the 2003 Meeting.

V. ADOPTION OF REPORTS

The Council at its session on 13 November 2002 considered and **adopted** the Report of STACFIS (see Appendix I). The recommendations made by STACFIS and endorsed by the Scientific Council are given therein in Sections II and III above. The Council then considered and **adopted** its own Report of this 6-13 November 2002 Meeting.

VI. ADJOURNMENT

The Chair thanked the participants, noting especially the efforts of the Designated Experts and STACFIS, and the support of the NAFO Secretariat. Special thanks were extended to colleagues at Pinngortitaleriffik, Greenland Institute of Natural Resources, Nuuk, for providing excellent meeting facilities and cordial hospitality during the course of the meeting. There being no other business, the meeting was adjourned at 1810 hr on 13 November 2002.

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

Chair: D. E. Stansbury

Rapporteur: Various

I. OPENING

The Committee met at Greenland Institute of Natural Resources, Nuuk, Greenland, during 6-13 November 2002, to consider and report on matters referred to it by the Scientific Council, particularly those pertaining to the provision of scientific advice on certain Northern shrimp stocks. Representatives attended from Canada, Denmark (in respect of Faroe Islands and Greenland), Iceland, Russian Federation and United States of America. The Assistant Executive Secretary was in attendance.

The Chair, D. E. Stansbury (Canada), opened the meeting on 6 November 2002 welcoming the participants. The Agenda was reviewed and a plan of work developed for the meeting. The provisional agenda was adopted (see Part D, this volume)

II. GENERAL REVIEW

1. Review of Recommendations in 2001 and 2002

STACFIS reviewed the recommendations from 2001 during considerations of each relevant stock.

2. Environmental Review

Division 3M During the summer of 2002 most areas of the water column over Flemish Cap, except for the near surface layer, were either at or above the long-term (1971-2000) average (SCR Doc. 02/152). Upper layer temperatures were generally 2°C below normal and intermediate-depth temperatures over the Cap were generally above normal by up to 2°C. Bottom temperatures ranged from above normal over the shallowest water depths to near normal below 150 m depth, similar to 2000 and 2001. Salinities over most of the upper water column during the summer of 2002 were similar to the spring of 2001, generally saltier-than-normal (by 0.25-0.5). In the deeper water (generally below 100-m depth) and near bottom, salinities were generally about normal. Both the measured currents and the geostrophic estimates, while showing considerable differences and variability between years, confirm the existence of a general anticyclonic circulation around Flemish Cap.

Divisions 3LNO. Data from spring and summer 2002 showed that temperatures on the Grand Bank were similar to 2001, and still above normal in many areas. The areal extent of bottom water, less than 0°C showed a large increase from the mid-1980s to 1997, very low values in 1998-1999, but has been increasing during 2000-2002. However, the extent of the cold intermediate layer (CIL) on the Grand Bank has remained below normal from 1998 up to and including 2002. At Station 27, except for the negative surface anomaly during spring and at intermediate depths during summer, temperatures were above normal for the first half of 2002. In general, during 2001-2002, temperatures have been declining compared to the record highs of 1998-1999, but remain above normal in most areas of the Grand Bank.

The spatial distributions and abundance of shrimp in Div. 3LNO were presented in relation to their thermal habitat, during spring surveys from 1998-2002 and autumn surveys from 1995-2001 (SCR Doc. 02/153). The highest numbers of shrimp were caught in the 2°-4°C temperature range during the spring surveys with lower numbers in the 1°-2°C and 4°-5°C ranges. During the autumn surveys most shrimp were caught in the 1°-3°C range. Cumulative frequency distribution of the number of shrimp caught and temperature indicated that only about 5% of the catches are associated with temperatures <1°C in the spring and about 30% are associated with temperatures <1°C in the autumn. About 80-90% of the shrimp were caught in the 2°-4°C temperature range during the spring, while only about 50% of the catch appeared in this temperature range during the autumn. In terms of available thermal habitat, about 30% of the surveyed region was covered with water in the 2°-4°C

temperature range during the spring, while about 40% was covered by water in this temperature range in the autumn. An apparent shift in the shrimp distribution towards colder water, further up on the Grand Bank and towards the inshore regions, occurred during the autumn and as a result a greater proportion (30%) of the catch shifted into the 0°-1°C temperature range. Very low numbers of shrimp were found in water <0°C and >4°C during both spring and autumn. Shrimp catches were mostly zero in all surveys in the shallow waters (<100 m) of the southeast Grand Bank, where temperatures generally range from 2°-7°C. In general, during the spring most of the large catches were found in the warmer water along the slopes of Div. 3LN, while in the autumn, larger catches were found in most areas of Div. 3L including the inshore areas and bays along the east coast of Newfoundland.

Subarea 1. (SCR Doc. 02/162) Bottom temperatures of West Greenland in depths between 150 and 600 m became significantly warmer during a period of 3 years in the late-1990s. Spatially weighted mean bottom temperature in the area covered by the West Greenland Bottom Trawl Survey for Northern shrimp increased from 1.7°C in 1995 to 3.3°C in 1998 and remained between 3.0 and 3.4°C thereafter. In 2002, the geographic distribution of bottom temperature was more uniform than in the previous years with values ranging from 1.7 to 5.6°C, and a spatially weighted average of 3.2°C.

3. Catches of Shrimp in Divisions 3LNO and 3M

STACFIS noted that STATLANT 21A data were not available from some fleets fishing in Div. 3L and Div. 3M in 2001. STACFIS used estimates of catches from Canadian surveillance, observers, quota reports and updated catch figures provided to the Designated Experts by some Contracting Parties to estimate catch in 2001. In 2002 quota reports, observer reports and surveillance estimates were not available for some fleets fishing shrimp in Div. 3L, and due to these inadequacies STACFIS was not able to project total catches to the end of 2002.

III. STOCK ASSESSMENTS

1. Northern Shrimp (*Pandalus borealis*) in Division 3M (SCR Doc. 02/142, 149, 150, 155, 156, 159, 161, 163)

a) Introduction

The shrimp fishery in Div. 3M began in late-April 1993. Initial catch rates were favourable and, shortly thereafter, vessels from several nations joined. Since 1993 the number of vessels ranged from 46-110, and in 2002 there were approximately 40 vessels fishing shrimp in Div. 3M.

Total catches were approximately 27 000 tons in 1993, increased to 48 000 tons in 1996, declined in 1997 and increased steadily to 2001 to 54 000 tons (Fig. 1.1). Catch statistics to 1 October 2002 indicate removals of about 39 000 tons. This will likely result in a total catch of about 51 000 tons by the end of the year.

Recent catches and TACs (tons) are as follows:

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Recommended TAC							30 000	30 000	30 000	45 000
STATLANT 21 A	20 648	19 773	19 341	39 042	23 916	30 035	42 041	49 184 ¹	39 147 ¹	38 242 ²
STACFIS	26 876	24 599	33 471	48 300	24 675	30 308	43 438	50 311	54 189	38 834 ²

¹ Provisional.

² STACFIS estimate to October.

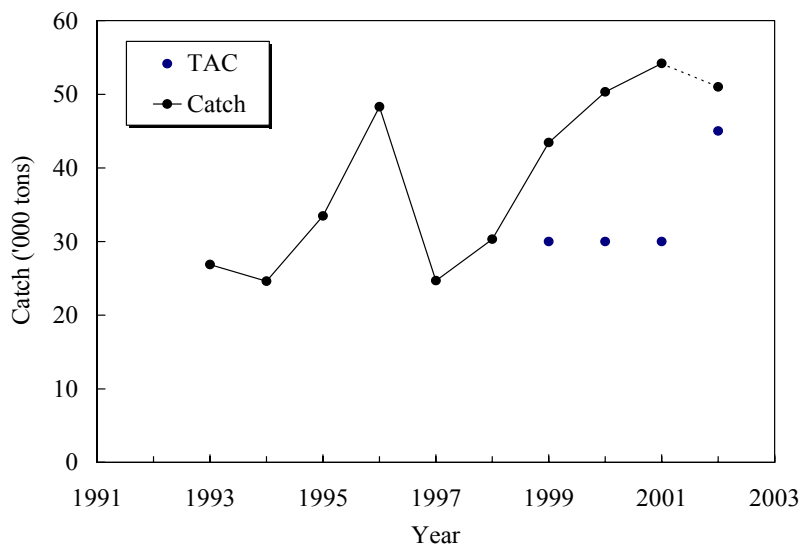


Fig. 1.1. Shrimp in Div. 3M: catches (2002 projected to end of the year) and TAC.

b) Input Data

i) Commercial fishery data (SCR Doc. 02/142, 149, 155, 159)

Effort and CPUE. Data from logbooks of Canadian, Greenlandic, Icelandic, Faroese and Norwegian vessels were available. A new series has been added from the Russian fishery. An unstandardized CPUE series is not considered to be reflective of stock status. A standardized CPUE series addressed differences due to seasonality, fishing power and gear (single, double and triple trawl). CPUE decreased from 1993 to 1994, varied without a trend to 1997 and increased until 2000, after which it remained stable (Fig. 1.2).

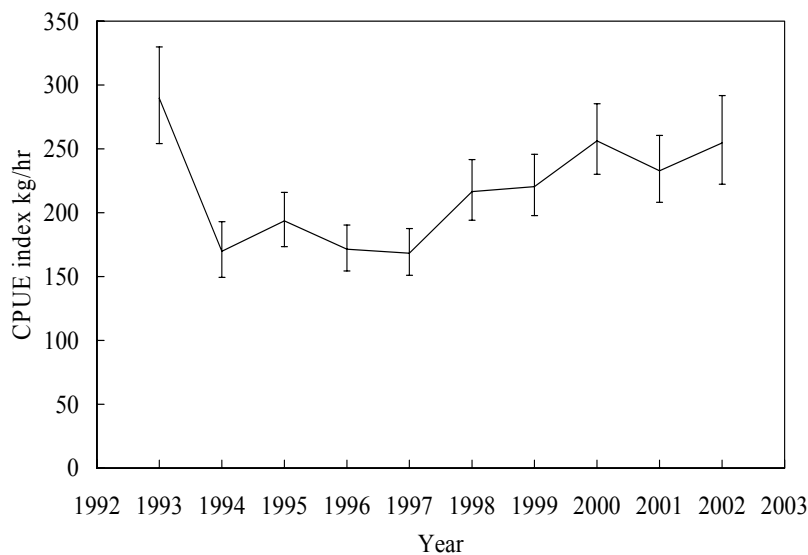


Fig. 1.2. Shrimp in Div. 3M: standardized CPUE indices (95% confidence interval).

Standardized CPUE Female SSB. A spawning stock index was calculated from the standardized CPUE as kg/hr of primiparous plus multiparous females. An index of spawning female biomass was also calculated in the EU and Faroese surveys. The spawning stock declined from 1993 to 1997, increased in 1998 and stayed stable thereafter (Fig. 1.3).

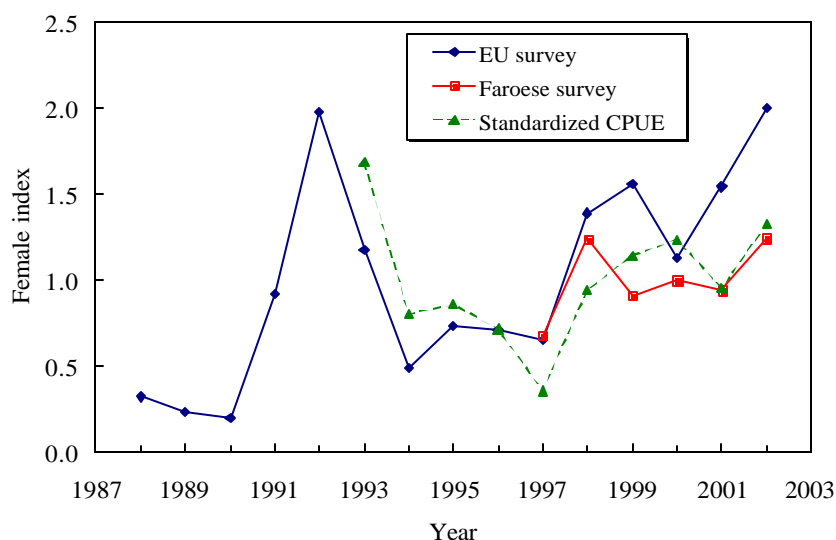


Fig. 1.3. Shrimp in Div. 3M: female biomass index from EU trawl surveys, 1988-2002, Faroese survey 1997-2002 and standardized female CPUE 1993-2002. Each series was standardized to the mean of that series.

Biological Data. Age composition was assessed from commercial samples obtained from Canada, Greenland, Russia and Iceland. Number per hour was calculated for each year-class by applying a weight/age relationship and the total number as calculated from the nominal catch and the standardized CPUE data.

The results in the Table below indicate that age 4 generally dominates the commercial catch in numbers. In both 2001 and 2002 the 1997 year-classes appears to be above average according to its contribution to the commercial catch rates. The 1998 year-class on the other hand, appears to be below average.

Age	Number per hour at age based on standardized CPUE						
	1996	1997	1998	1999	2000	2001	2002
1							
2	1 734	1 395	2 194	1 654	1 052	4 271	2 407
3	18 010	11 076	12 828	9 854	16 888	5 712	12 534
4	4 392	11 490	16 050	11 399	17 983	17 391	12 277
5	1 323	2 257	4 851	9 174	10 404	10 587	14 688
6	1 602	457	749	3 301	2 040	2 735	2 154
7	837	40	26	39	87	369	257
Total	27 899	26 714	36 697	35 421	48 455	41 065	44 316

ii) Research survey data

EU surveys (SCR Doc. 02/150). EU groundfish surveys have been conducted on Flemish Cap in July from 1988 to 2002. The 1994 and 1998 total biomass indices are likely biased due to changes in sizes of codend mesh. The female biomass is however, not considered to be affected by the change of gear. As shown in the Table below the female shrimp biomass increased rapidly in 1991 and 1992, declined to relatively low values in 1994 to 1997, increased in 1998, declined in 2000 to increase again to 2002 to the highest value in the series (Fig. 1.3). Age has been assessed from the length distributions of the EU surveys back to 1988. Results for age 4 indicate that the 1997 year-class was far above average in 2001 and also at age 5 in 2002. The 1998 year-class at age 4 appears not strong whereas the 1999 year-class at age 3 in 2002 appears very strong.

Year	Biomass Index (tons)	Average catch per mile (kg)	Standard Error	Female Biomass Index (tons)
1988	2 164	1.54	0.28	1 874
1989	1 923	1.37	0.24	1 340
1990	2 139	1.53	0.21	1 132
1991	8 211	5.83	0.71	5 362
1992	16 531	11.75	1.86	11 509
1993	9 256	6.57	1.04	6 839
1994	3 337*	2.37	0.35	2 823
1995	5 413	3.85	0.44	4 286
1996	6 502	4.62	0.34	4 149
1997	5 096	3.62	0.25	3 807
1998	16 844*	11.81	0.80	8 091
1999	12 430	8.83	0.67	9 051
2000	9 720	6.91	0.52	6 553
2001	14 106	10.02	0.65	8 977
2002	18 109	12.87	1.12	11 664

* not comparable to other years because of different codend mesh size.

In 2000 a small meshed juvenile bag was attached to the codend for the first time. The length frequency distributions obtained in the juvenile bag showed very distinctly the modes of ages 1 and 2 in 2000 and the two year olds in 2001. In 2002 the modes at age 1 and 3 are quite distinct.

Faroese survey (SCR Doc. 02/156, 161). Stratified-random surveys were conducted in June-July 1997-2002 by a Faroese shrimp trawler. Surveys utilized a juvenile bag attached to the codend since 1998. The total biomass index fluctuated between 16 000 and 22 000 tons in the years 1997 to 2001 and increased in 2002 to 28 000 tons. Results indicate that the 1997 and 1999 year-classes are above average and the 1998 and 2000 year-classes appear weak (Fig. 1.4).

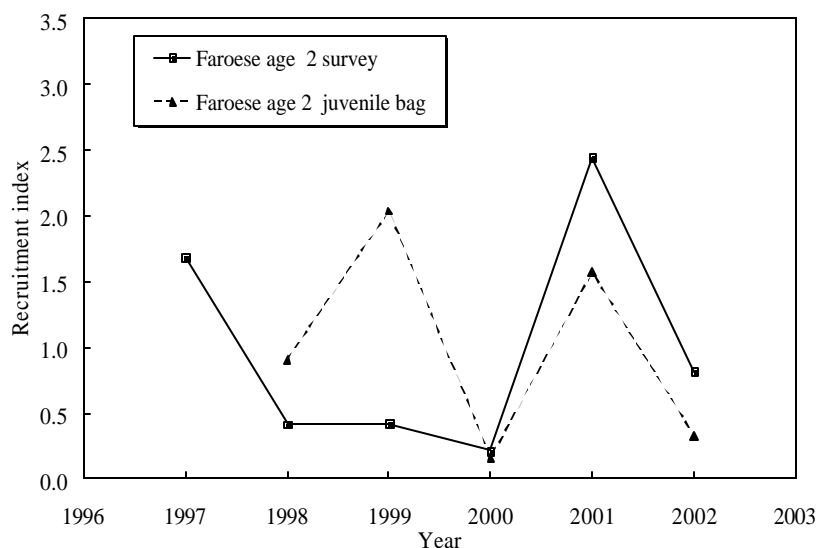


Fig. 1.4. Shrimp in Div. 3M: abundance indices at age 2 from the Faroese survey and from the juvenile bag. Each series was standardized to its mean.

c) Assessment Results

Commercial CPUE. Standardized catch rates declined between 1993 and 1994, varied without a trend to 1997, and increased to 2000, after which it remained stable.

Recruitment. The 1997 and 1999 year-classes are above average while the 1998 and 2000 year-classes appear weak.

Spawning Stock Biomass. Indices of female biomass increased between 1997 and 1998 and fluctuated without a trend thereafter.

State of the Stock. STACFIS is unable to estimate absolute stock size. Stock size indicators are fluctuating without a trend since 1998 at a higher level compared to 1994-1997. The 1997 year-class was above average in 2002, but its contribution to the fishery will diminish after 2003. The 1999 year-class is above average and will be contributing to the fishery in 2003 and 2004. However the 1998 and 2000 year-classes appear to be weaker.

STACFIS considers it important to recognize that its ability to assess the resource will improve with the continuation of a series of research surveys directed for shrimp, particularly if a juvenile bag is used.

d) Research Recommendations

STACIS **recommended** that, for shrimp in Div. 3M:

- *work on age structured population models should be continued.*
- *biological and CPUE data from all fleets fishing for shrimp in the area, be submitted in advance of the 2003 Scientific Council Meeting on shrimp .*
- *a thorough investigation into the methods used to derive a CPUE index for shrimp be conducted and submitted in advance of the 2003 Scientific Council Meeting on shrimp.*

2. Northern Shrimp (*Pandalus borealis*) in Divisions 3L, 3N and 3O (SCR Doc. 02/143, 153, 159, 160)

a) Introduction

This shrimp stock is distributed around the edge of the Grand Banks mainly in Div. 3L. The fishery began in 1993 and catches were around 1 800 tons. Exploratory fishing from 1996-99, resulted in catches ranging from 179 to 795 tons. In 2000, Fisheries Commission implemented a TAC of 6 000 tons, and fishing was restricted to Div. 3L. The catch in 2000 increased to 4 900 tons, 4 300 tons of which was caught by Canada. The remainder of the catch was taken by vessels from 9 other countries.

Catches from 1993 to 1999 are as reported in the STATLANT 21A database. Catches for 2000 and 2001 are STACFIS estimates based on additional data sources. STACFIS revised its catch estimate for the 2001 fishery up to 10 566 tons, with Canada taking just over 5 100 tons (Fig. 2.1). Reliable catch reports were not available for all countries in 2001, and estimates from other sources were used in these cases. For 2002, estimates of catch were not available for all countries, so STACFIS was not able to project total catches to the end of 2002. However, STACFIS noted that the total catch in 2002 was likely to be lower than that estimated for 2001, but that there was considerable uncertainty with estimates of catch in both years. The Canadian catch to date in 2002 is estimated to be about 5 500 tons, and is expected to be close to this figure for the full year.

In 2000, small vessels (less than 500 tons) caught about three-quarters of the Canadian catch. In 2001 and 2002 the Canadian quota was divided equally between the large and small vessel fleets. As a result, the proportion of catch taken by large vessels increased in 2001 and most of their catch came from twin trawls. In all years, most of the Canadian catch occurred along the northeast slope in Div. 3L, during spring and summer. The use of a sorting grid to reduce by-catches of fish is mandatory for all fleets in the fishery.

Recent catches and TACs (tons) for shrimp in Div. 3LNO (total) are as follows:

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Recommended TAC	-	-	-	-	-	-	-	6 000	6 000	6 000
STATLANT 21A	1 791	1 910 ¹	0	179	485	626	795	4 886 ²	5 323 ²	
STACFIS	1 791	1 910 ¹	0	179	485	626	795	4 920	10 566	na

¹ Faroes catch revised from 356 tons to 1 910 tons.

² Provisional catches.

na Not available.

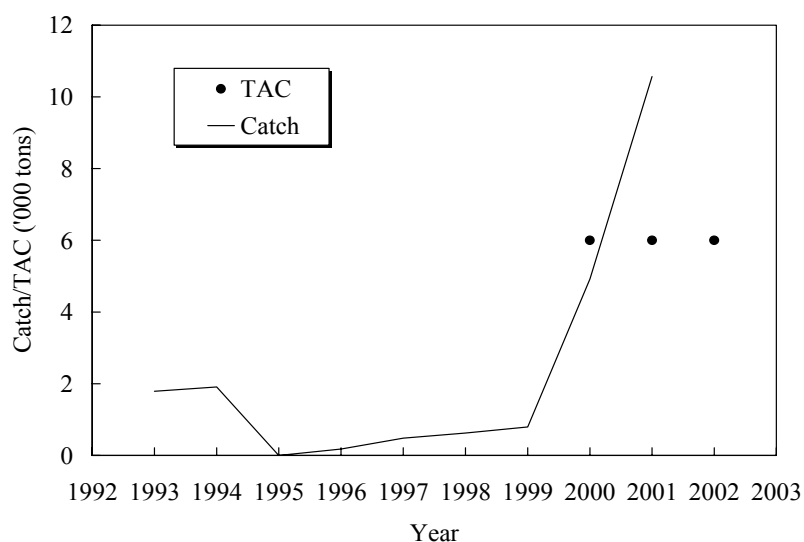


Fig. 2.1. Shrimp in Div. 3LNO: catches and TAC.

b) **Input Data**i) **Commercial fishery data** (SCR Doc. 02/160)

Fishing effort and CPUE. Catch and effort data were available from fishing records from Canadian vessels in Div. 3L from 2000 to 2002. Unstandardized catch rates (both single and double trawl) for large vessels increased in 2001 and again in 2002. CPUE from the Canadian small vessels increased between 2000 and 2001, but insufficient data from 2002 were available from this fleet for analysis at this time. Some CPUE data were available from a few vessels fishing in the NRA in Div. 3L, and were generally quite variable.

Catch composition. Observers sampled and measured Canadian catches (approximately 2-5% of the small vessel catches and over 90% of the large vessel catches were observed) in Div. 3L during 2001 and 2002. The length-frequency distributions in both years showed good representation at several size-classes, indicating that 5 or more year-classes were present. In 2001, females with carapace length (CL) between 22 and 26 mm (age 5+) dominated the catches by small vessels. The limited data for 2002 indicated catches by this fleet were dominated by males between 18.5 and 21 mm CL, believed to be from the 1997 and 1998 year-classes. In 2001, catches from the large vessels were dominated by male shrimp. In 2002, males and females were about equal in number in the catches, due to the sex change of a portion of the 1997 year-class. The 1998 year-class appeared to be relatively strong in both large and small vessel catches in 2002.

Groundfish by-catch. The shrimp fishery in Div. 3L overlaps the distribution of a number of groundfish species, including those under moratoria. Based on catches observed in the Canadian fishery by large vessels (≥ 500 GRT) in 2001 and 2002, estimated total groundfish removals in the Canadian fishery were obtained as follows:

	2001 Large Vessels		2002 Large Vessels	
	Est. catch (kg) ton of shrimp	Catch (kg)/ ton of shrimp	Est. catch (kg)	Catch (kg)/
Cod	229	0.10	164	0.07
American plaice	1 116	0.47	303	0.12
Redfish	972	0.41	1 424	0.58
Greenland halibut	5 660	2.35	4 754	1.94

Although no 2002 information from the small vessel fleet was available at this time, data from the 2001 fishery indicated that by-catch rates for cod, American plaice, and redfish, were similar to those of the large vessels, and were lower for Greenland halibut. Observer data on Norwegian by-catch in Div. 3L in 2001 (from an estimated 70 ton catch of shrimp) indicated no by-catch of cod, 0.44 kg of American plaice per ton of shrimp, 0.43 kg/ton for redfish, and 3.93 kg/ton for Greenland halibut.

ii) **Research survey data** (SCR Doc. 02/143, 160)

Canada has conducted stratified-random surveys in Div. 3LNO, using a Campelen shrimp trawl, during spring and autumn since late-1995. Data for shrimp were available from the autumn surveys in 1995-2001, and from spring surveys in 1999-2002. In all surveys, over 90% of the biomass was found in Div. 3L, distributed mainly along the northeast slope in depths from 185-550 m. Based upon confidence intervals, there was a significant increase in shrimp biomass/ abundance between 1995 and 1997, a period of stability between 1997 and 1999, and a significant increase thereafter. Spring surveys of 1999-2002 also showed a significant increase after 1999.

Canadian multispecies survey autumn and spring biomass indices are indicated below:

Year	Lower 95% C. I.	Autumn Estimate	Upper 95% C.I.	Lower 95% C.I.	Spring Estimate	Upper 95% C.I.
1995	3.6	5.9	8.2			
1996	10.2	20.1	29.9			
1997	25.5	46.2	66.9			
1998	40.1	59.9	79.8			
1999	36.2	53.1	70.1	12.6	55.3	98.1
2000	93.1	118.2	143.2	-15.9	122.8	259.5
2001	77.6	224.0	370.4	62.4	102.6	142.8
2002				121.1	159.5	197.9

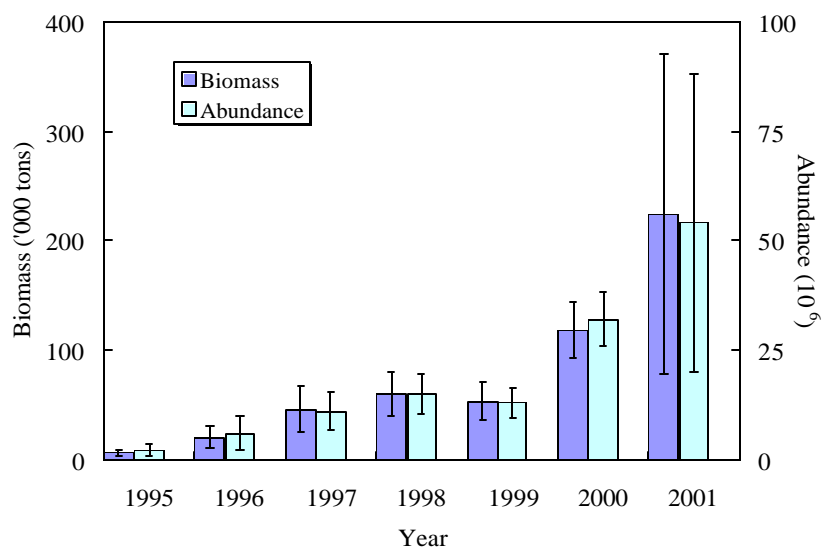


Fig. 2.2. Shrimp in Div. 3LNO: biomass and abundance estimates from Canadian autumn multi-species surveys (\pm 95% confidence intervals).

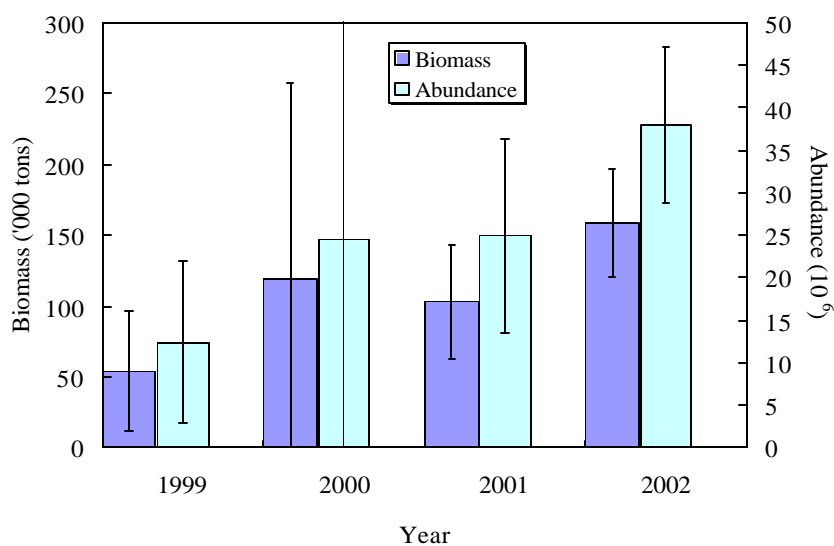


Fig. 2.3. Shrimp in Div. 3LNO: biomass and abundance estimates from Canadian spring multi-species surveys (\pm 95% confidence intervals).

Sex and length composition. Estimated total number (10^9) of shrimp in Div. 3LNO from autumn 1995 to spring 2002 are as follows:

Survey	Males	Females	Total	Males %	Female %
Autumn 1995	1.3	0.8	2.1	60.5	39.5
Autumn 1996	5.5	0.4	5.9	93.2	6.8
Autumn 1997	7.7	2.9	10.5	72.8	27.2
Autumn 1998	13.3	2.0	15.3	86.9	13.1
Spring 1999	9.7	3.0	12.7	76.5	23.5
Autumn 1999	10.4	2.6	13.1	79.8	20.2
Spring 2000	17.0	8.0	25.0	67.8	32.2
Autumn 2000	27.8	4.4	32.2	86.3	13.7
Spring 2001	19.2	5.7	24.9	77.1	22.9
Autumn 2001	45.8	8.3	54.1	84.7	15.3
Spring 2002	26.8	11.2	38.0	70.5	29.5

Autumn abundance of shrimp has increased to the highest levels in the time series during 2001 while spring abundance was highest during 2002. The proportion of females in the surveys has varied around the mean of 20% in recent surveys. Abundance estimates from the autumn 2001 survey were dominated by males with a modal length of 19.0 mm CL (1997 year-class). The relatively weak 1996 year-class was followed by the stronger 1997-99 year-classes. The relatively broad female size distribution suggests that it consisted of more than one year-class.

Trends in the SSB index from the autumn surveys were similar to those for total biomass (Fig. 2.4).

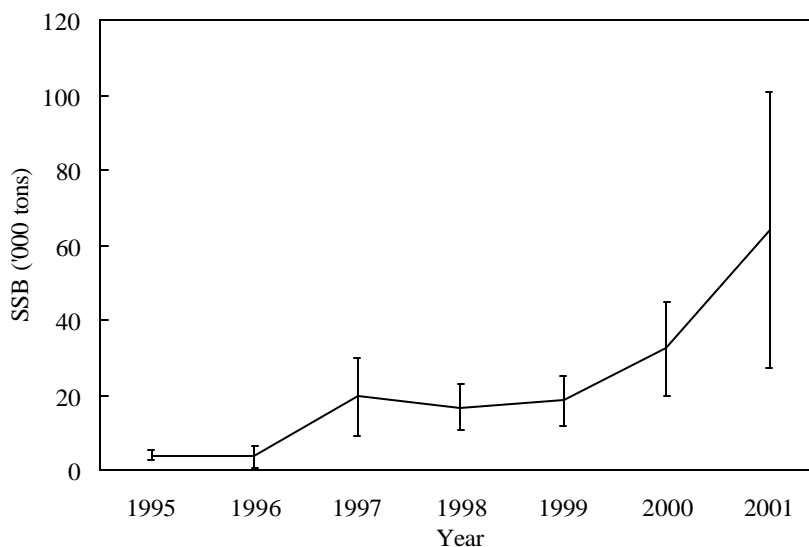


Fig. 2.4. Shrimp in Div. 3LNO: Spawning stock biomass (SSB) estimates from Canadian autumn multi-species surveys (\pm 95% confidence intervals).

A recruitment index (shrimp considered to be age 2) from the autumn surveys of 1995-2001 shows that the 1998 and 1999 year-classes are the two largest in the short time-series (Fig. 2.5). A comparable estimate of the 2000 year-class at age 2 was not available, as the autumn survey of 2002 was not completed at the time of the assessment.

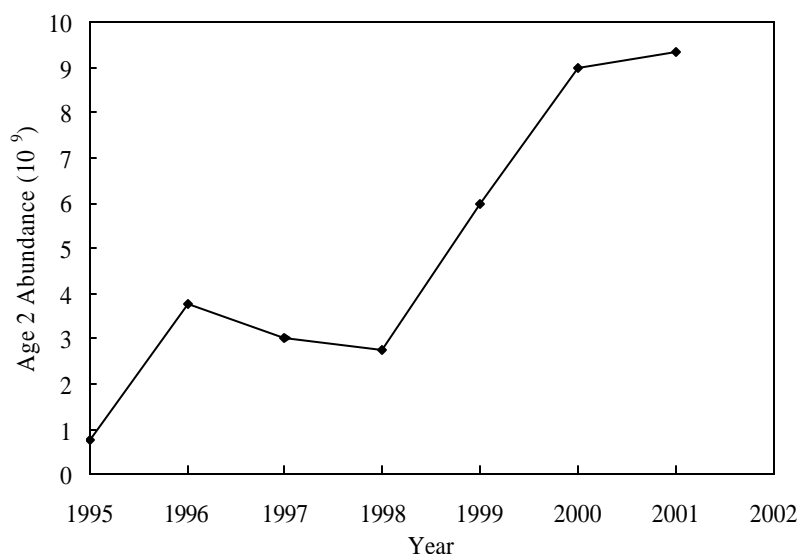


Fig 2.5. Shrimp in Div. 3LNO: age 2 recruitment index as determined from Canadian autumn multi-species surveys.

An index of exploitation was derived by dividing the catch in a given year by the lower 95% confidence limit on the autumn survey biomass from the preceding year. This index was around 2-3% in 1998-99, and increased to 11-13% in 2000-01, which were the first two years of TAC regulation. Insufficient data were available to estimate total catch for 2002, and therefore an exploitation index could not be calculated.

Data from the Spanish surveys in the NRA of Div. 3NO, conducted with a Campelen trawl, indicated an increase in the amount of shrimp found in 2002 in Div. 3N compared to 2001. Data from similar surveys in 1995-2000 were not considered to be comparable, as a groundfish trawl not suitable for shrimp surveys was used. Most of the shrimp in 2002 were found in the northeast corner of Div. 3N, near the border with Div. 3L. About 58% of shrimp in the catches were males, with modal lengths around 20 mm in the male component, 22.5 mm in the immature females, and 24 mm in the mature females.

c) Assessment Results

Recruitment. The 1998 and 1999 year-classes are the two largest year-classes in the short time series.

Biomass. There was a significant increase in SSB and total biomass between 1995 and 1997, a period of stability between 1997 and 1999, and a significant increase thereafter.

Exploitation. No estimates of fishing mortality were available. An exploitation index was around 2-3% in 1998-99 and increased to 11-13% in 2000-2001.

State of the Stock. STACFIS is not able to provide estimates of absolute stock size. The indices of stock size show that both the recruitment and SSB estimates have increased significantly since 1999 and at present are the highest observed. In addition the stock appears to be well represented by a broad range of size groups, and exploitation is low.

d) **Research Recommendation**

STACFIS **recommended** that, for shrimp in Div. 3LNO:

- *biological and CPUE data from all fleets fishing for shrimp in the area, be submitted in advance of the 2003 Scientific Council Meeting on shrimp.*

3. **Northern Shrimp (*Pandalus borealis*) in Subareas 0 and 1** (SCR Doc. 02/144, 145, 146, 148, 151, 157, 158)a) **Introduction**

The shrimp stock off West Greenland is distributed in Div. 0A and Subarea 1. Shrimp within this area is assessed as a single population. The Greenland fishery exploits the stock in Subarea 1 (Div. 1A to 1F) in offshore and inshore areas (primarily Disko Bay). The Canadian fishery has been restricted to Div. 0A since 1981.

Three fleet components, one from Canada and two from Greenland (vessels above and below 80 GRT) participated in the fishery since the late-1970s. The Canadian fleet and the Greenland large-vessel fleet have been restricted by areas and quotas since 1977. The fishery by the Greenland small-vessel fleet was unrestricted until January 1997, when quota regulation was imposed. The advised TAC for the entire stock in 2002 was 85 000 tons. In 2002, the Greenland authorities set a TAC for Subarea 1 of 91 150 tons, and a TAC for Subarea 0 of 12 040 tons was set by the Canadian authorities for the same year. The use of a sorting grid with 22 mm bar distance to reduce by-catches of fish is mandatory for both the Greenland large-vessel fleet and the Canadian fleet. Discarding of shrimp is prohibited.

Overall annual catch has increased from less than 10 000 tons in the early-1970s to more than 86 000 tons in 1992 (Fig. 3.1). Restrictions by the Greenlandic authorities to reduce effort and fishing opportunities elsewhere for the Canadian fleet then made catches decrease to about 65 000 tons in 1997. Since then overall catches have increased. The projected catch of 2002 is expected to be around 99 000 tons (Fig. 3.1) based on data through October 2002. In 2002 catches in Subarea 1 are expected to reach the catch quotas (TAC), whereas catches in Subarea 0 for 2002 most likely will be less than the quotas, due to fishing opportunities for the Canadian fleet elsewhere.

Recent nominal catches, projected figures for 2002 and recommended TACs (tons) for shrimp in Div. 0A and Subarea 1 are as follows:

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Recommended TAC ¹	50 000	50 000	60 000	60 000	60 000	55 000	65 000	65 000	85 000	85 000
SA 1	70 123	71 811	68 329	66 610	64 000	65 170	73 985	78 337	81 398	93 000 ²
Div. 0A	5 491	4 766	2 361	2 632	517	933	2 046	1 782	3 625	6 000 ²
Total STATLANT 21A	75 614	76 577	70 690	69 242	64 517	66 103	76 031	79 927 ³	85 023 ³	
Total STACFIS	75 614	76 577	70 690	69 242	64 517	66 103	76 031	79 927	85 023	99 000 ²

¹ Until 1994 the recommended TAC was only for offshore south of 71°N. After 1994, the recommended TAC included offshore north of 71°N and inshore.

² Catches projected to end of 2002.

³ Provisional.

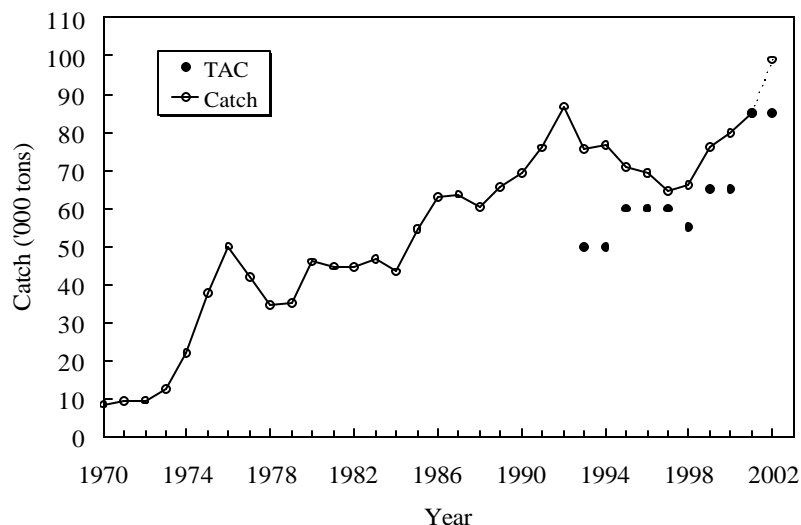


Fig. 3.1. Shrimp in Subareas 0 and 1: total catches (2002 projected to the end of the year) and recommended TAC. Prior to 1995 the recommended TAC was not for the entire area.

Until 1988, the fishing grounds in Div. 1B have been the most important. Since then, a southward expansion in the offshore fishery has taken place, and from 1990 catches in Div. 1C and 1D have exceeded those from Div. 1B. At the end of the 1980s, exploitation began in Div. 1E and 1F, and catches from these areas now account for about 20% of the total catch. The distribution of the fishery has not changed since 1996.

b) Input Data

i) Commercial fishery data

Fishing effort and CPUE. Catch and effort data from the shrimp fishery were available from fishing records from Canadian vessels in Div. 0A and from Greenland logbooks for Subarea 1 (SCR Doc. 02/151).

Multiplicative models were used to calculate fleet specific annual catch-rate indices. From these individual indices one unified time series covering 1976-2002 was derived. All fleets included in the analysis mainly exploit shrimp greater than 16 mm carapace length (CL). The CPUE indices are therefore indicative of the combined biomass of older males and the females.

The standardized CPUE series showed an increasing trend since 1990 (Fig. 3.2). The 2002 mean value is the highest in the time series.

An index of exploitation rate was calculated by dividing overall annual catch by the combined CPUE index values. This index indicated a decrease in exploitation rate of about 35% from 1992 to the late-1990s. For 2002 the indices indicate an exploitation rate at the level of the four most recent years (Fig. 3.3).

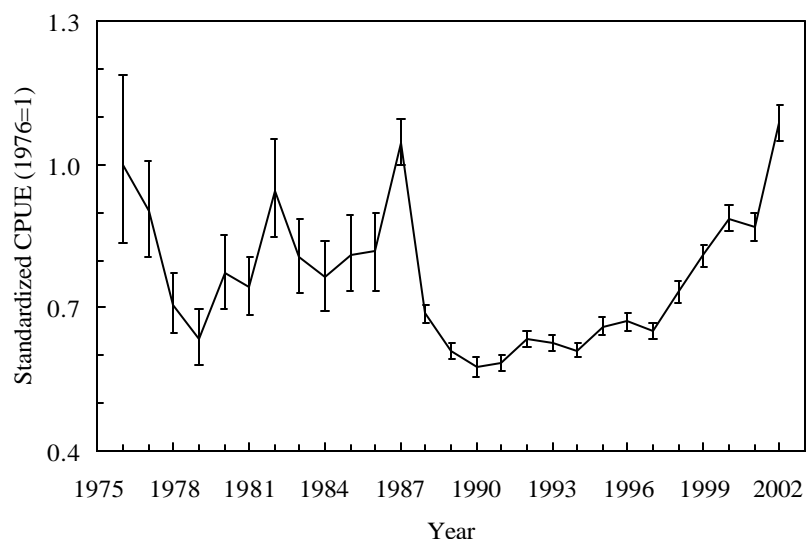


Fig. 3.2 Shrimp in Subareas 0 and 1: standardized CPUE index. Error bars are upper and lower quartiles.

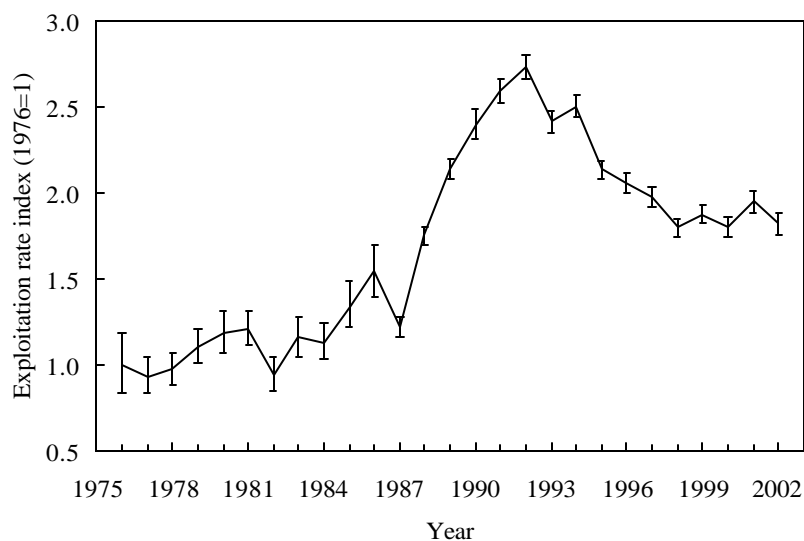


Fig. 3.3. Shrimp in Subareas 0 and 1: index of exploitation rate. Error-bars are upper and lower quartiles

Catch composition. Catch composition was assessed from samples obtained by observers in the commercial fishery in Div. 0A from 1981 to 2002, and in Subarea 1 from 1991 to 2002 (SCR Doc. 02/151). The mean size of shrimp caught has declined since 1991. In spite of these changes, the proportions of female to male shrimp in the catches seemed relatively stable until the late-1990s. Sparse sampling prohibited an analysis of catch composition for year 2002.

ii) Research survey data

Greenland trawl survey. Stratified-random trawl surveys have been conducted since 1988 in offshore areas (Div. 0A and Subarea 1) and since 1991 in inshore Subarea 1 (SCR Doc. 02/148). From 1993, the survey extended further south into Div. 1E and 1F.

Biomass. The survey biomass indices indicated a fairly stable stock size from 1988 to 1997. Since then a significant increasing trend was observed. The 2002-value is the highest of the time series (Fig. 3.4).

Within the survey area, large year-to-year variations in the distribution of biomass were observed as well geographically as over depth zones. Some areas account for a large proportion of the variances of the estimated biomasses. However, during recent years a more even geographical distribution was indicated (SCR Doc. 02/148, Fig. 1). During the recent period of increasing biomass indices an increased proportion of the biomass was seen in depths between 200-300 meters.

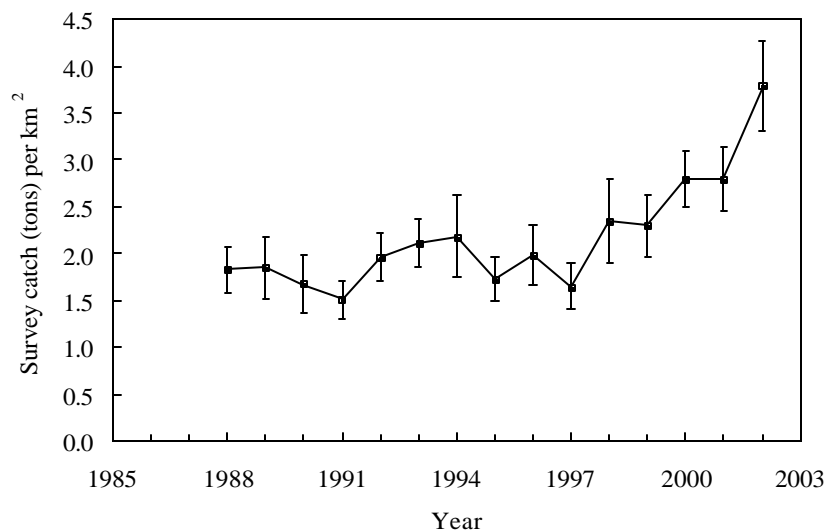


Fig. 3.4. Shrimp in Subareas 0 and 1: Survey estimates of biomass, ± 1 standard error.

Sex and length composition. Indices of total abundance (10^9) of shrimp in Div. 0A and SA 1 from 1988 to 2002 are as follows:

Year	Males	Females	Total	Males, %	Females, %
1988 ¹	24.3	9.9	34.2	71.0	29.0
1989 ¹	35.0	7.6	42.5	82.2	17.8
1990 ¹	28.5	10.0	38.5	74.1	25.9
1991	17.4	6.2	23.6	73.8	26.2
1992	29.7	7.3	36.9	80.3	19.7
1993	35.5	9.7	45.2	78.5	21.7
1994	33.9	10.9	44.8	75.7	24.3
1995	29.2	7.9	37.1	78.7	21.3
1996	41.4	8.1	49.5	83.7	16.3
1997	29.5	7.6	37.0	79.6	20.4
1998	42.9	11.5	54.5	78.8	21.2
1999	44.8	11.3	56.2	79.9	20.1
2000	66.7	12.7	79.4	84.0	16.0
2001	61.1	13.7	74.8	81.7	18.3
2002	90.6	16.7	107.2	84.5	15.5

¹ No inshore survey in 1988-90. The numbers in 1988 to 1990 represent an average of the estimated numbers of shrimp inshore from 1991-97 added to the actual estimates from the offshore area.

The index of total abundance of shrimp in 2002 was the highest in the series. The proportion of males in 2002 was above average of the values recorded in the time series.

The overall length-frequency distributions in 2002 showed a number of distinct male modes (at 8.5, 13, 18 and 20.5 mm CL), a mode of primiparous females at 24.5 mm CL and one of multiparous females at 25.5 mm CL (Fig. 3.5). The presence of several size groups of males in 2002 and, in particular, an abundant mode at 17.5 mm CL indicates good recruitment to the female group in coming years.

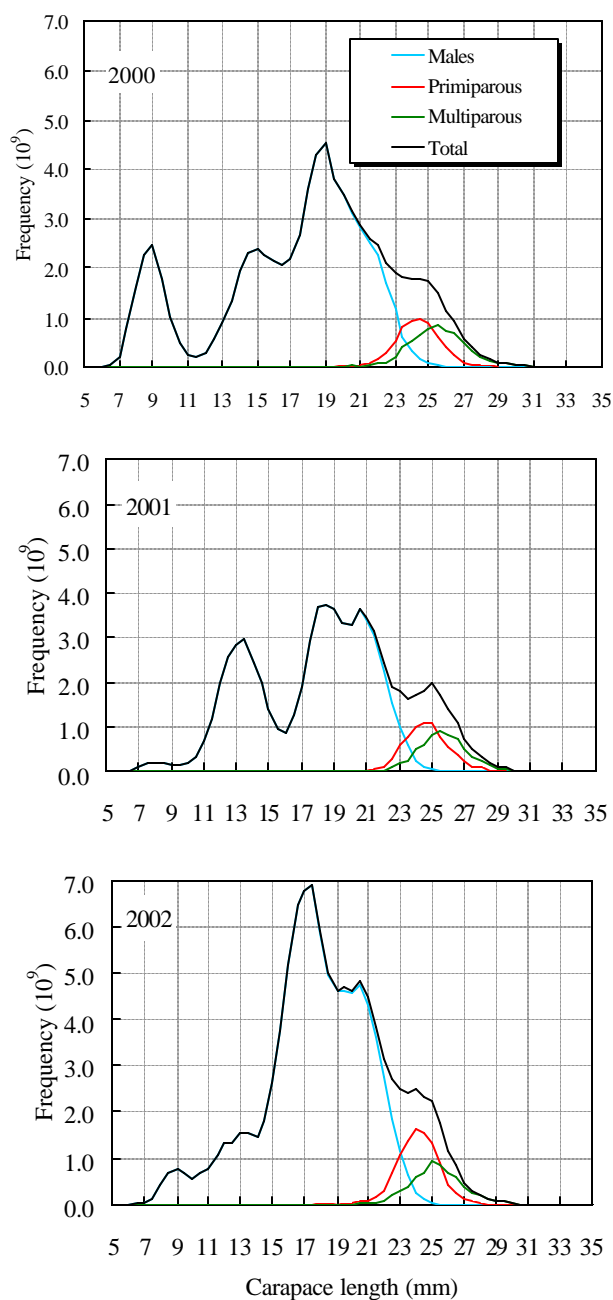


Fig. 3.5. Shrimp in Subareas 0 and 1: Numbers of shrimp by 0.5 mm CL length group in the total area during 2000-2002 (mesh size in the codend 20 mm stretched).

Index of recruitment. A recruitment index (shrimp at age 2) showed an increasing trend from 1997 to 2001 (Fig. 3.6). The 2002 value was down, equalling the 1999 value, however still above the average of the time series.

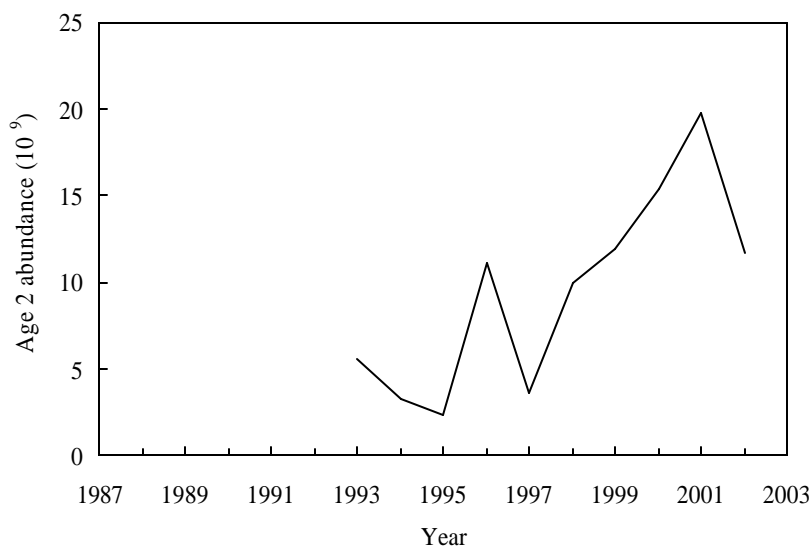


Fig. 3.6. Shrimp in Subareas 0 and 1: recruitment index (shrimp at age 2)

Spawning stock biomass (SSB). SSB showed an increasing trend since 1997 and the value in 2002 is the highest observed in the series (Fig. 3.7).

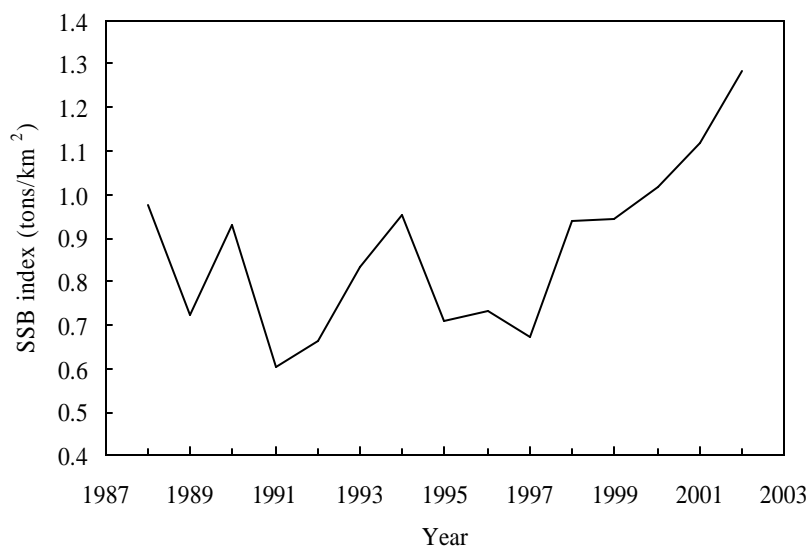


Fig. 3.7. Shrimp in Subareas 0 and 1: total female biomass index.

Exploitation rate. An index of exploitation rate calculated as proportion of total catch to corresponding survey estimates of 'fishable biomass' (shrimp ≥ 17 mm CL) is presented in Fig. 3.8. The index declined since 1991.

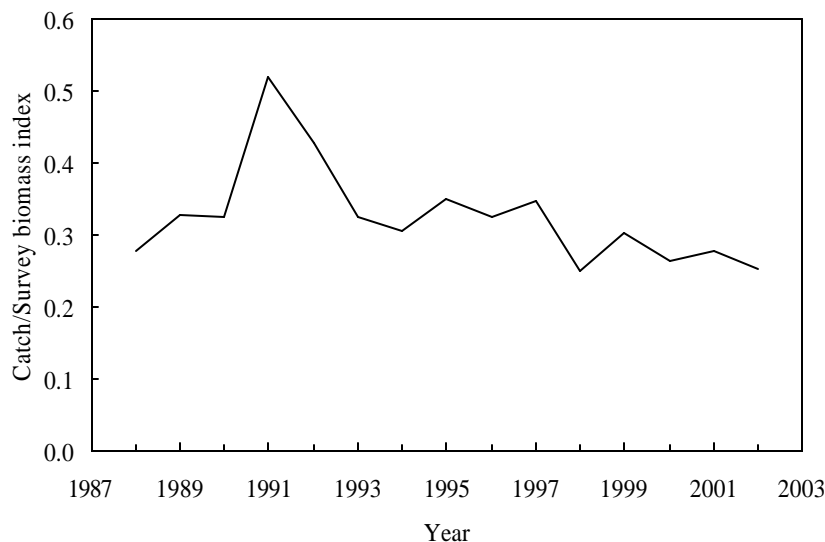


Fig. 3.8. Shrimp in Subareas 0 and 1: Index of exploitation rates calculated as proportion of total catch to corresponding survey estimate of fishable biomass.

iii) **Biological studies**

The SCR Doc. 02/144 presented data on individual length and weight of shrimp recorded during the West Greenland Bottom Survey for Northern shrimp and fish in 2001 and 2002. These data could not be satisfactorily described with a length-weight relationship established based on measurements conducted during the 1990s. Hence, a new one was presented that allowed the analysis of length frequencies in order to calculate female and fishable biomass from the 2001 and 2002 survey. A comparison of the two relationships for converting length to weight indicated further that the condition of Northern shrimp was lower in the past two years than in the 1990s.

A study on length frequencies and catches of shrimp obtained with juvenile bags and those retained in the trawl codend during the West Greenland Bottom Trawl Survey for Northern shrimp and fish was presented (SCR Doc. 02/145). The results showed that the two juvenile bags (mesh size: 6 mm, attached to the two sides of the twin codend) are adequate to sample the size range of the 1-group while estimates of the mean length of this age group based on trawl samples (mesh size: 20 mm in the codend) are biased. Trawl selection appeared to be less important for the 2-group, which is incompletely sampled by juvenile bags when attached to the 20 mm codend of the trawl. Correlation between juvenile bag and trawl catches of age 1 Northern shrimp was very poor. For both, high catch rates were found at the borders of the survey area and changes in the sampling procedure appears to be necessary in order to improve the reliability of abundance estimates for the 1-group. It was further concluded to move the attachment point of the juvenile bag up in front of the 20 mm codend liner, for future studies.

Length frequency distributions of shrimp from the West Greenland Bottom Trawl Survey for Northern shrimp and fish in the years 1993 to 2002 were analysed in order to provide age-based recruitment abundance indices (SCR Doc. 02/146). The original data were pooled into five major regions defined by latitudinal differences in bottom temperature. Modal analysis was used to estimate mean length and abundance for age 1 and 2. For both ages, mean length was significantly correlated with bottom temperature and indicated a change to faster growth in the past years. The

estimates of the 1-group abundance appeared to be seriously affected by low catchability due to trawl selection while the abundance indices for the 2-group were suitable to assess changes in recruitment. Age 2 abundance was regarded as a preferable measure of recruitment compared to the previously used index defined by a fixed size limit (<17 mm CL) because the length frequencies revealed substantial changes in growth in the past decade. In addition, the abundance at age 2 showed a highly significant correlation with the survey biomass applying a time lag of two years.

c) Estimation of Parameters

Parameters relevant for the assessment and management of the stock were estimated, based on a stochastic version of a surplus-production model that included an explicit term for predation by cod (*Gadus morhua*). The model was formulated in a state-space framework and Bayesian methods were used to construct "posterior" likelihood distributions of the parameters (SCR Doc. 02/158).

The model synthesized information from input priors (SCR Doc. 02/158) and the following data: a 14-year series of a survey biomass indices of shrimp larger than 17 mm CL (SCR Doc. 02/148), a 26-year series of combined CPUE indices (SCR Doc. 02/151), a 47-year series of a cod biomass estimates (SCR Doc. 02/158), and a short series (4 years) of estimates of the shrimp biomass consumed by cod based on stomach sampling (SCR Doc. 02/158).

Absolute biomass estimates had relatively high variances. For management purposes therefore it is desirable to work with biomass on a relative scale in order to cancel out the uncertainty of the "catchability" parameters (the parameters that scale absolute stock size). Biomass, B , is thus measured relative to the biomass that yields Maximum Sustainable Yield, B_{msy} . The estimated mortality, Z , refers to the removal of biomass by fishing and cod predation and is scaled to Z_{msy} - the mortality at MSY.

d) Assessment Results

The model estimated the median annual consumption by cod 1956-2002 in the range of 200 tons to about 100 000 tons, which is in the same order of magnitude as the catches taken by the fishery. The estimated consumption declined since 1960 as a result of a decline in cod abundance at West Greenland (Fig. 3.9). A short-lived resurgence of the cod stock in the late-1980s caused consumption to increase. The cod disappeared in the beginning of the 1990s and estimates of consumption went to zero.

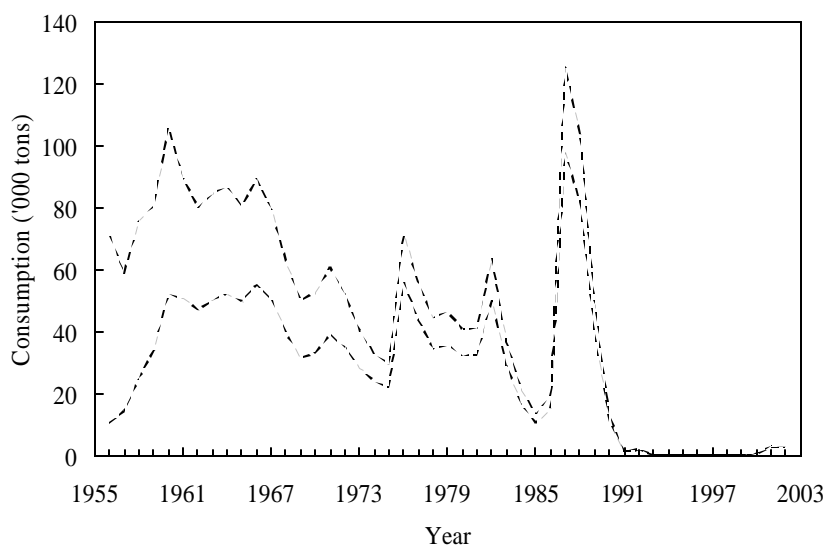


Fig. 3.9. Shrimp in Subareas 0 and 1: Estimated consumption of shrimp by cod. Dashed lines indicate 25th and 75th percentiles.

The shrimp stock has been exposed since the 1950s to two different environmental regimes: one with high and the other with low cod abundance. The analysis indicates that the stock dynamics have responded to the difference. The trajectory of the median estimate of 'biomass –ratio' (B_t/B_{msy}) plotted against 'mortality – ratio' (Z_t/Z_{msy}) (Fig. 3.10) starts in 1956 at half the optimum biomass ratio and at a mortality-ratio well above 1. The stock maintained itself in this region during the years when cod were abundant. When the cod stock declined in the late-1960s, and predation pressure was lifted (Fig. 3.9), shrimp stock biomass increased and eventually began cycling in the left upper corner of the graph (Fig. 3.10) during the current regime of low cod abundance.

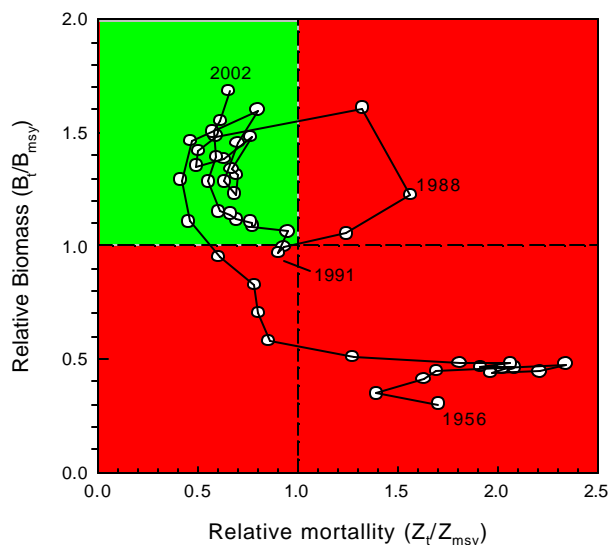


Fig. 3.10. Shrimp in Subareas 0 and 1: estimated annual median biomass-ratio (B/B_{msy}) and mortality-ratio (Z/Z_{msy}) 1956-2002.

Since the early-1970s the estimated median biomass-ratio ranged from about 0.96 to 1.67 (Fig. 3.10) and the probability that it had been below the optimum level was small for most years (Fig. 3.11), i.e. it seemed likely that the stock had been at or above its MSY level throughout the modern fishery. A steep decline in CPUE was noted in the late-1980s and early-1990s following a short-lived resurgence of the cod stock and the median estimate of biomass-ratio dipped just below the optimum in 1990-1991 (Fig. 3.10). The stock has increased since then and reached its highest level ever in 2002 with a median estimate of biomass-ratio of 1.67, corresponding to about 82% of estimated median carrying capacity. The estimated risk of stock biomass being below B_{msy} was less than 0.01 (Fig. 3.11).

The mortality ratio (Z ratio, which includes mortality by fishing and predation by cod) has been below 1 for most of the time since 1970, except for the period of high cod predation in the late-1980s (Fig. 3.10). Since 1997, annual median Z ratio has been stable at approximately 0.6, i.e. well below the optimum. The median of estimate for 2002 is 0.67 with a risk of only 0.04 of being above 1 (Fig. 3.11).

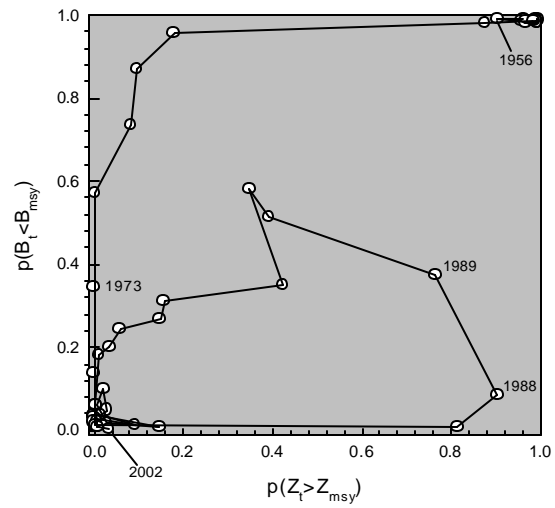


Fig 3.11. Shrimp in Subareas 0 and 1: risk of annual biomass being below B_{msy} and of mortality caused by fishing and cod predation being above Z_{msy} 1956-2002.

The median estimate of the maximum annual production surplus, available equally to the fishery the cod (MSY) was estimated to 101 400 tons (Fig. 3.12). The risk function relating the probability of exceeding MSY to the combined removal by fishery and cod predation is given as the integral of this distribution (Fig. 3.12).

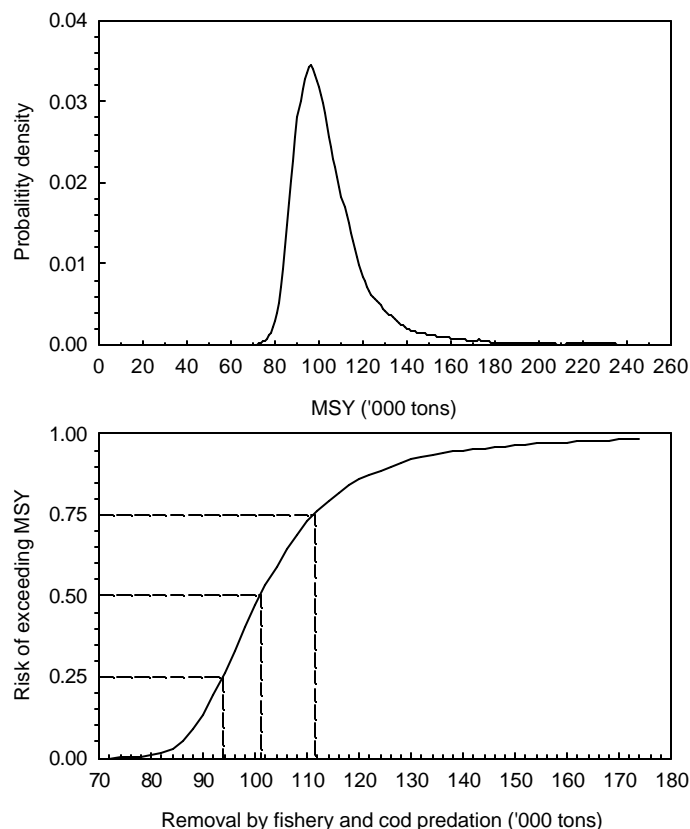


Fig. 3.12. Shrimp in Subareas 0 and 1: Posterior probability distribution of the maximum annual production surplus, available equally to the fishery the cod (MSY) (upper panel) and the cumulative probability of exceeding MSY.

Predation by cod can be significant (Fig. 3.9) and have a major impact on shrimp stock size. Currently the cod stock at West Greenland is at a very low level. A large cod stock that would significantly increase shrimp mortality could be established in two ways: Either by a slowly rebuilding process or by immigration of one or two large year-classes from areas around Iceland as seen in the late-1980s. An increase in cod abundance through growth of the existing stock would, however, be noted in an early phase during routine monitoring programs and fisheries management would have several years to respond before the shrimp stock is driven below optimal levels – given the current good condition of the stock. Management options given the scenario can be evaluated by STACFIS if and when the development of the cod stock warrants it.

For the medium term (10 years) it is considered unlikely that the cod stock will be able to re-establish itself to its historic high levels. Ten-year projections of stock development were made under the assumption that the cod stock will remain at its current low abundance. Five levels of annual catch: 80 000, 90 000, 100 000, 110 000 and 120 000 tons were investigated (Fig. 3.13).

The investigated catch options of 80 000 and 90 000 ton/yr have a small risk of being above MSY (Fig. 3.12) and the stock is therefore likely to remain above B_{msy} (Fig. 3.13) during the ten years of projection. The combined relative fishing and cod predation mortality, Z_t/Z_{msy} , has a high probability of being below 1 within this period (Fig. 3.14).

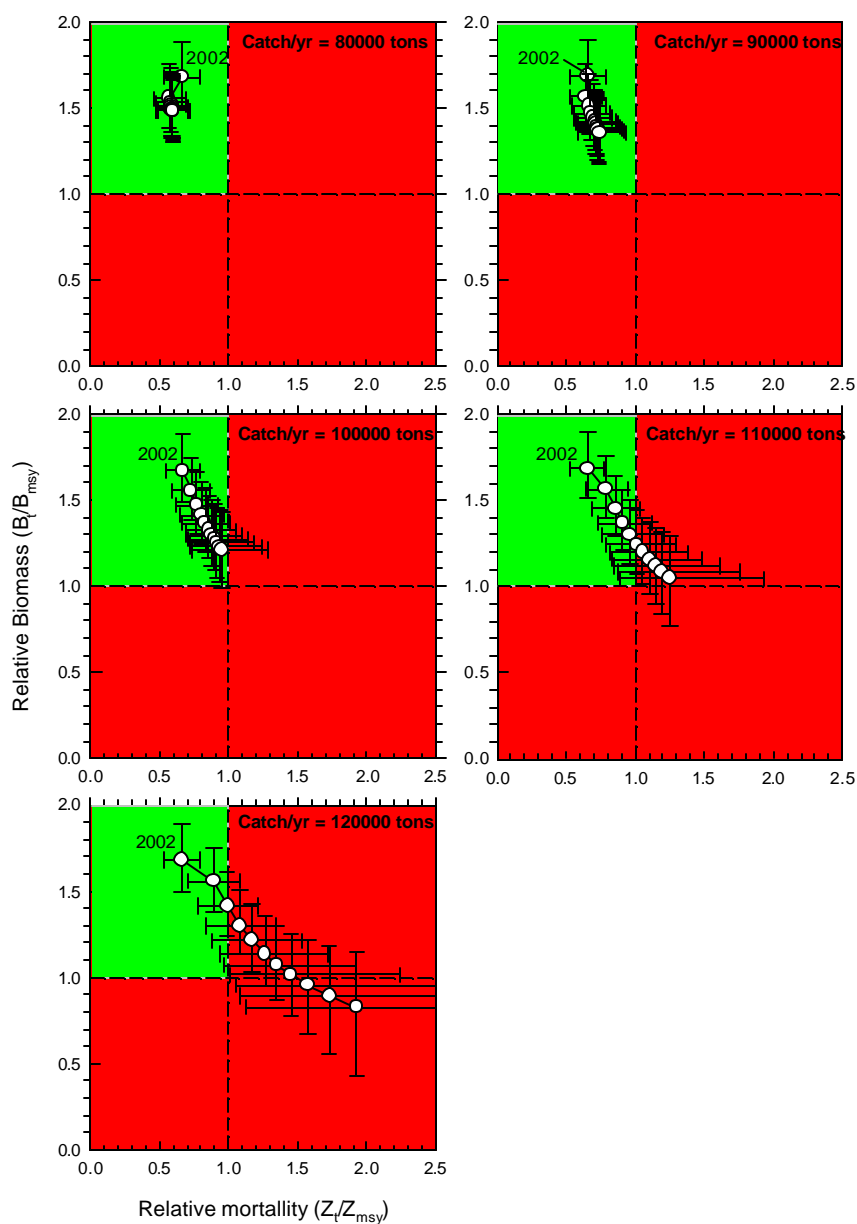


Fig. 3.13. Shrimp in Subareas 0 and 1: projections of stock development for the period 2002-2012 quantified in a biomass (B/B_{msy})-mortality (Z/Z_{msy}) continuum. Dynamics at 80 000, 90 000, 100 000, 110 000 and 120 000 tons of fixed annual catch levels are shown as medians with error-bars at the 25th and 75th percentiles. Dashed lines indicate level of biomass and mortality at MSY.

A catch option of 100 000 tons/yr will just about meet the estimated median MSY and is not likely to drive the stock below B_{msy} in the short to medium term (Fig. 3.13), i.e. the risk is less than 10% within the first five years and just above 25% after year 10 (Fig. 3.14). However, this level of exploitation might not be sustainable in the longer term, as risk of falling below B_{msy} continues to increase through time.

Fishing 110 000 tons/yr bears a 75% risk of being above MSY (Fig. 3.12), thus this catch level is not likely to be sustainable in the longer term. Owing to the current high stock level the risk of falling B_{msy} is still less than 20% after five years at this catch level, although after 10 years it is close to 50% (Fig. 3.14).

A catch of 120 000 tons/yr is associated with an 85% risk of exceeding MSY (Fig. 3.12) and the stock biomass will rapidly decline to below B_{msy} (Fig. 3.13). After just two years there is a 50% risk of exceeding Z_{msy} (Fig. 3.14).

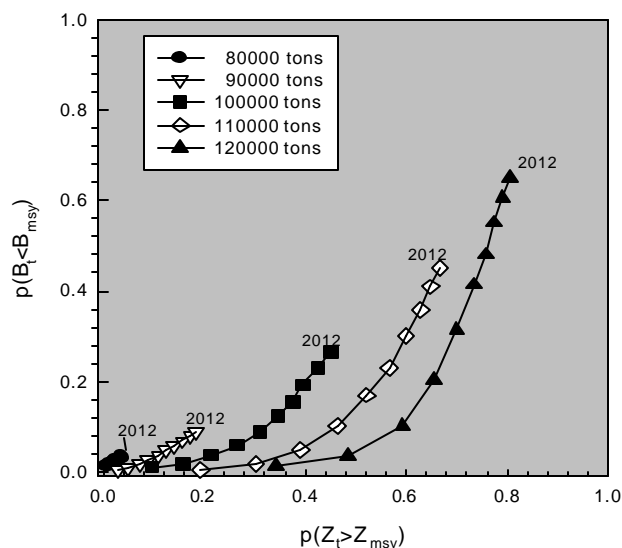


Fig.3.14. Shrimp in Subareas 0 and 1: risk of exceeding Z_{msy} and of driving the stock below B_{msy} by maintaining optional annual catch levels of 80 000-120 000 tons/yr during the period 2003-2012.

If on the other hand an abrupt increase in cod biomass resulting from immigration from other areas occurs, changes to shrimp stock condition may be much more rapid. Preliminary investigations of the event of an immigration of two large year-classes of cod were made by simulating a repetition of the short-lived resurgence of the cod stock seen in the late-1980s. The simulation showed that predation could within a 3-4 year period go from negligible to between 60 000 and 100 000 tons (upper and lower quartiles).

e) **Precautionary Approach**

The Precautionary Approach framework developed by Scientific Council defined a limit reference point for fishing mortality, F_{lim} , as equal to F_{msy} . The limit reference point for stock size measured in units of biomass, B_{lim} , is the spawning stock biomass below which unknown or "low" recruitment is expected. Buffer reference points, B_{buf} and F_{buf} , are also requested to provide a safety margin that will ensure a small risk of exceeding the limits.

The limit reference point for mortality in the current assessment framework is Z_{msy} , i.e. Z ratio = 1 and the risk of exceeding this point is given in this assessment. At this meeting STACFIS was not in a position to define B_{lim} . For one thing, stock-recruitment figures were only available for relative high stock sizes and extrapolation to define an area of "low recruitment" was not readily justified. Buffer reference points may not be needed in this framework as the risk of exceeding the limit reference can be directly calculated and uncertainty associated with the entire process is taken into account. However, STACFIS did not want to forestall the results expected to emerge from the Scientific Council Workshop on the Precautionary Approach in spring 2003.

f) **Assessment Summary**

CPUE. The standardized CPUE series showed an increasing trend since 1990. The 2002 mean value is the highest in the time series.

Recruitment. A recruitment index (shrimp at age 2) showed an increasing trend from 1997 to 2001. The 2002 value was down, equalling the 1999 value, however, still above the average of the time series.

SSB. SSB (female biomass) showed an increasing trend since 1997 and the value in 2002 is the highest observed in the series since 1988.

Exploitation rate. All indices of exploitation have shown a decline since the early-1990s.

State of the Stock. The stock biomass has increased since the early-1990s and reached its highest level recorded in 2002. Biomass is well above B_{msy} and mortality by fishery and cod predation is well below Z_{msy} . In addition the stock appears to be well represented by a broad range of size groups.

g) **Research Recommendations**

For shrimp in Div. 0A and Subarea 1, STACFIS **recommended** that:

- *sampling of catches by observers – essential for assessing stock age, size and sex composition – be re-established.*
- *annual length-weight relationships be constructed as routine part of survey data analyses.*

4. **Northern Shrimp (*Pandalus borealis*) in Denmark Strait and off East Greenland** (SCR Doc. 02/147, 154)

a) **Introduction**

Northern shrimp off East Greenland in ICES Div. XIVb and Va is assessed as a single population. The fishery started in 1978 and, up to 1993, occurred primarily in the area of Stredebank and Dohrnbank as well as on the slopes of Storfjord Deep, from approximately 65°N to 68°N and between 26°W and 34°W.

In 1993 a new fishery began in areas south of 65°N down to Cape Farewell. Access to all these fishing grounds depends heavily on ice conditions.

A multinational fleet exploits the stock. During the recent ten years, vessels from Greenland, Denmark, the Faroe Islands and Norway have fished in the Greenland EEZ. Only Icelandic vessels fish in the Icelandic EEZ.

In the Greenland EEZ, the minimum permitted mesh size in the codend is 44 mm, and the fishery is managed by catch quotas allocated to national fleets. In the Icelandic EEZ, the mesh size is 40 mm and there are no catch limits. In both EEZs, sorting grids with 22-mm bar spacing to reduce by-catch of fish are mandatory. Discarding of shrimp is prohibited in both areas.

Total catches increased rapidly to about 12 000 tons in 1987 and 1988, but declined thereafter to about 7 500 tons in 1992 and 1993. Following the extension of the fishery south of 65°N, catches increased again to about 11 500 tons in 1997. Catches in recent years have been between 9-11 000 tons (Fig. 4.1).

Catches in the northern area decreased from 6 100 tons in 1993 to about 3 000 tons in 1996, but increased again to about 4 000-4 500 tons in 1997 and 1998. In the most recent years catches from this area have been around 3 500-4 000 tons except for 2001 when only about 1 800 tons was taken. Catches in the

southern area increased from 1 500 tons in 1993 to about 7 500 tons in 1997, decreased to 4 800 tons in 1998 and then increased again to about 9 300 tons in 2001.

Recent nominal catches and recommended TACs (tons) are as follows:

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Recommended TAC	5 000	5 000	5 000	5 000	5 000	5 000	9 600	9 600	9 600	9 600
North of 65°N, Greenland EEZ	3 563	3 359	4 823	2 351	1 300	3 115	3 223	3 404	1 769	1 008
North of 65°N, Iceland EEZ	2 553	1 514	1 151	566	2 856	1 421	769	132	10	1 141
North of 65°N, total	6 116	4 873	5 974	2 917	4 156	4 536	3 992	3 536	1 779	2 149
South of 65°N, Greenland EEZ	1 532	4 939	3 532	6 796	7 433	4 785	5 475	6 058	9 274	4 827
Total STATLANT 21A	7 648	9 812	9 506	9 713	11 589	9 321	9 467	9 594 ¹	11 053 ¹	
Total STACFIS	7 648	9 812	9 506	9 713	11 589	9 321	9 467	9 594	11 053	6 976 ²

¹ Provisional catches as estimated by STACFIS.

² Catches 1 January to 1 November 2002.

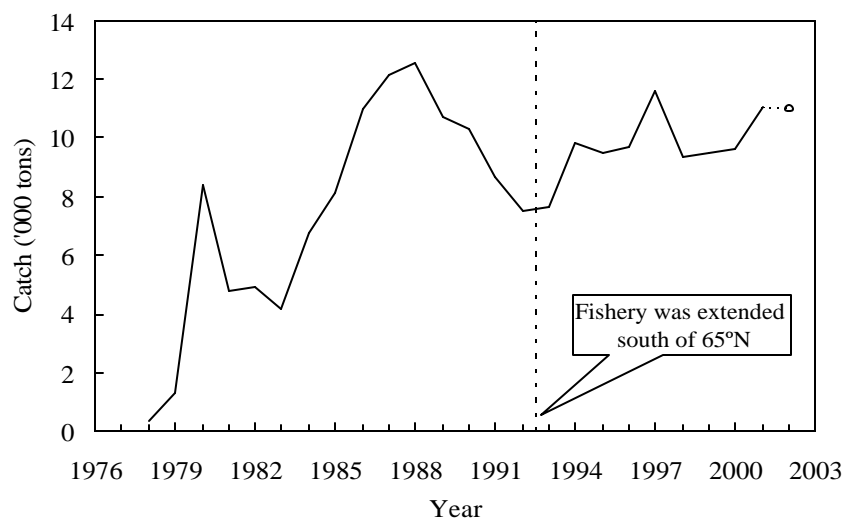


Fig. 4.1. Shrimp in Denmark Strait and off East Greenland: total catches (2002 projected to the end of the year based on 1 January to 1 November data).

b) Input Data

i) Commercial fishery data

Fishing effort and CPUE

Catch and effort (hours fished) from logbooks were available from Greenland, Norway, Iceland, Faroe Islands and EU -Denmark since 1980 and from EU-France for 1980 to 1991.

Standardized catch rates based on logbook data from Danish, Faroese, Greenlandic and Icelandic vessels in the northern area declined continuously from 1987 to 1993, showed a significant increase between 1993 and 1994 and fluctuated with a slightly increasing trend thereafter (Fig. 4.2). A

standardized catch-rate series for the same fleets (Iceland excluded) in the southern area also showed an increasing trend since 1993 (Fig. 4.3), to reach a peak in 1999 and declined thereafter.

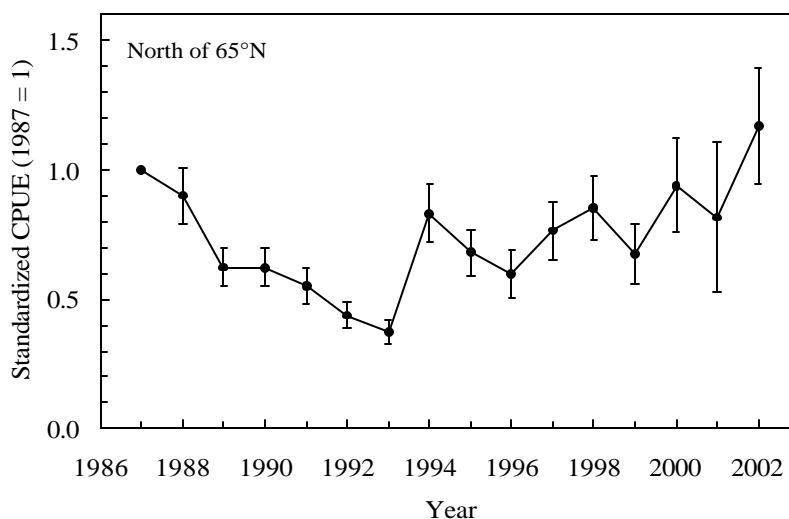


Fig. 4.2. Shrimp in Denmark Strait and off East Greenland: annual standardized CPUE (1987 = 1) with ± 1 SE calculated from logbook data from Danish, Faroese, Greenlandic and Icelandic vessels fishing north of 65°N.

A combined standardized catch-rate index for the total area decreased steadily from 1987 to 1993, showed a significant increase between 1993 and 1994, and continued thereafter with an increasing trend. The 2001 and 2002 values equal that at the start of the time series in 1987 (Fig. 4.4).

A re-evaluation of basic logbook input data for 1997-2001 were made in 2002. STACFIS noted that whereas the 2001 analysis, showed northern-area standardized CPUE to peak in 1998, the 2002 analysis did not. The trend in the southern area index did not change by the data re-evaluation, however the 1997-2001 index values were noted to be higher relative to previous years in the series than seen in last years analyses. Only minor changes were noted in the overall index.

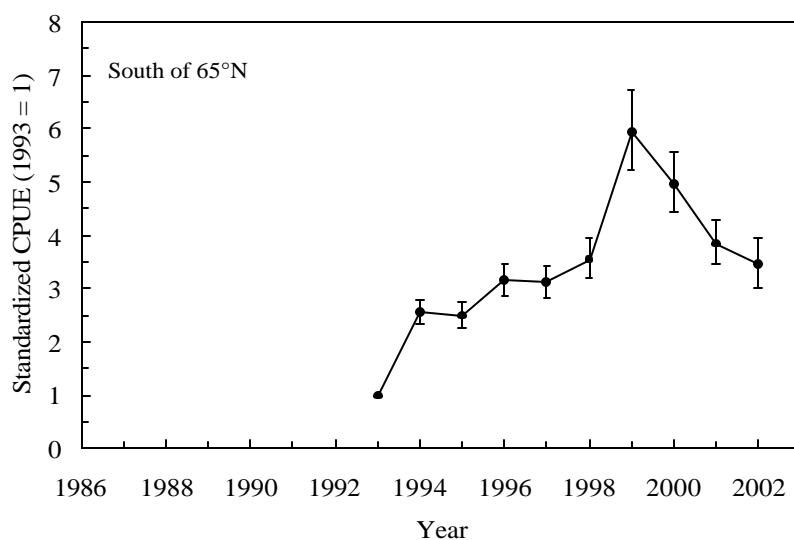


Fig. 4.3. Shrimp in Denmark Strait and off East Greenland: annual standardized CPUE (1993 = 1) with ± 1 SE calculated from logbook data from Danish, Faroese and Greenlandic vessels fishing south of 65°N.

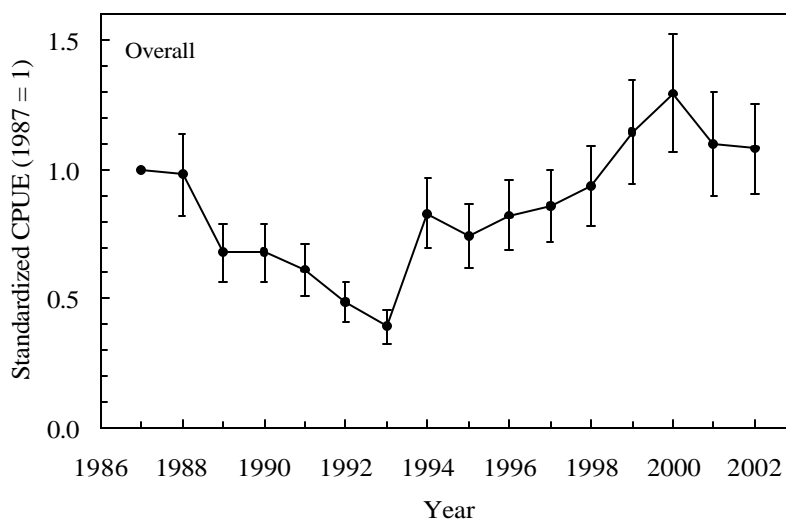


Fig. 4.4. Shrimp in Denmark Strait and off East Greenland: annual standardized CPUE-indices (1987 = 1) with ± 1 SE combined for the total area.

An index of exploitation rate (catch divided by standardized CPUE) for the total area decreased from 1993 to 1994, remained stable until 1997 and then declined further. Recent levels are the lowest of the time series (Fig. 4.5).

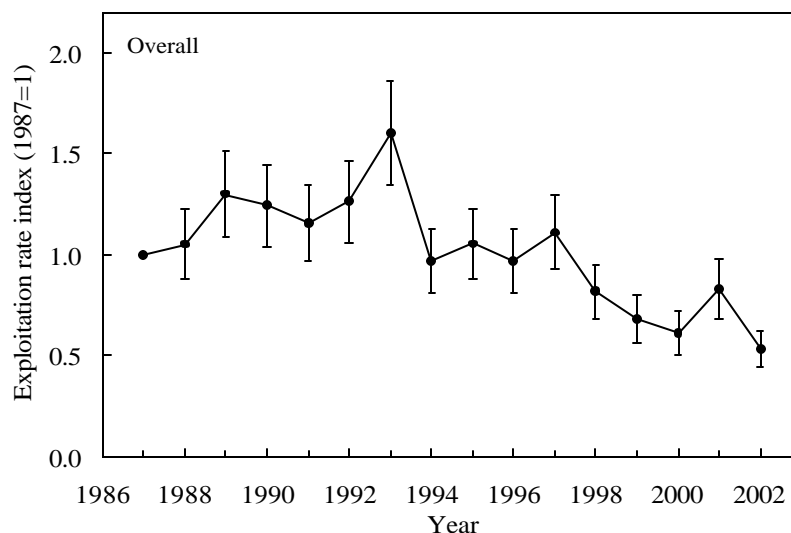


Fig. 4.5. Shrimp in Denmark Strait and off East Greenland: annual standardized exploitation-rate indices (1987 = 1) with ± 1 SE combined for the total area.

Biological data. Since 1991 samples representing between 0.1% and 3% of the annual catch in the total area were taken onboard vessels for obtaining annual estimates of size and sex composition. However, only few samples were available for 2001 and 2002. The overall results, however, agree with information from logbooks on landings by product class and with anecdotal information from the industry. Catches from all years consisted of relatively large shrimp with mean carapace length (CL) >25mm. Shrimp smaller than 17 mm CL have always been less than 0.1% by number, so recruitment to the fishery can not be predicted.

Samples from the fishery in the northern area indicated that the catches in late-1980s and the 1990s were dominated by females, but that males were more abundant in 2000. Insufficient sampling was done in the northern area in 2001 and 2002.

Samples from the fishery in the southern area showed a numerical dominance of males in most years, except for 1994, when females were more numerous. Compared with the most recent years an increase in the average size caught was indicated for 2001 but samples only represented 0.4% of the catches. No sampling was done in the southern areas in 2002.

ii) Research survey data

No surveys have been conducted since 1996. Therefore, in particular, there is no direct estimate of biomass and no information on pre-recruits.

c) Assessment Results

Commercial CPUE. Combined standardized CPUE indices for the total area declined from 1987 to 1993 and increased thereafter to approximately the same level in 2001–2002 as at the start of the time series in 1987.

Recruitment. No recruitment estimates were available.

Biomass. No direct biomass estimates were available.

Exploitation rate. From 1998 through 2002 the exploitation rate index (catch/CPUE) has been at its lowest levels in the 16-year series.

State of the stock. STACFIS was not able to provide estimates of absolute stock size. Standardized CPUE data for all the areas combined indicate a general increasing trend in fishable biomass since 1993. The 2001 and 2002 values equals the relative high values at which the series started in 1987.

d) **Research Recommendations**

For shrimp in Denmark Strait and off East Greenland, STACFIS **recommended** that:

- *a survey be conducted, to provide fishery independent data of the stock throughout its range.*
- *sampling of catches by observers – essential for assessing stock age, size and sex composition – be re-established.*

IV. OTHER BUSINESS

1. **Designated Experts**

In its review of the status of Designated Experts with respect to assessment of shrimp stocks, STACFIS was informed that H. Siegstad (Denmark/Greenland) would not continue as Designated Expert for Northern shrimp in Subareas 0 and 1. The Committee accepted the nomination of C. Hvingel to the position. Noting final confirmation will be made through the Greenland Institute of Natural Resources, STACFIS welcomed:

- From Greenland Institute of Natural Resources, P. O. Box 570, DK-3900 Nuuk, Greenland [Phone: +299 32 1095 – Fax: +299 32 5957 – E-mail: hvingel@natur.gl]

for Northern shrimp in Subareas 0+1

C. Hvingel

2. **Adjournment**

There being no other business, the Chairman expressed his gratitude to the members of the Committee for their valuable contributions, especially from the Designated Experts and encouraged them to continue the work on ageing of shrimp, and to the Secretariat for the excellent support in any respect, and adjourned the meeting.

PART D

Miscellaneous

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AGENDA I**SCIENTIFIC COUNCIL MEETING, 6-20 JUNE 2002**

- I. Opening (Chair: R.K. Mayo)
 - 1. Appointment of Rapporteur
 - 2. Adoption of Agenda
 - 3. Attendance of Observers
 - 4. Plan of Work
 - 5. Report of Proxy Votes (by Executive Secretary)
- II. Review of Scientific Council Recommendations in 2001
- III. Fisheries Environment (STACFEN Chair: E. Colbourne)
 - 1. Opening
 - a) Plan of work, appointment of rapporteur
 - 2. Chairman's Introduction, Report on Intersessional Activities
 - 3. Review of Recommendations in 2001
 - 4. Mini-symposium on Hydrographic Variability in NAFO Waters 1991-2000
 - 5. Review of Environmental Conditions
 - a) Marine Environmental Data Service (MEDS) Report for 2001
 - b) Review of environmental studies in 2001
 - i) Results from physical oceanographic studies
 - ii) Results from interdisciplinary studies
 - c) Overviews of environmental conditions in 2001
 - 6. Long-term Environmental Indicators
 - a) Review of environmental indicators
 - b) Formulation of recommendations based on environmental conditions in 2001
 - 7. Environmental Indices (Implementation in the Assessment Process)
 - 8. Review of Trans-Atlantic Environmental Conditions
 - a) Review of hydrographic and larval studies
 - b) Establishing a study group
 - 9. The Production of a NAFO Annual Ocean Climate Status Summary
 - 10. Cooperative Research Programs
 - a) Russian/German assessment of short-term climate variations in the Labrador Seas
 - b) Other research programs
 - 11. National Representatives
 - 12. Other Matters

IV. Publications (STACPUB Chair: M. Stein)

1. Opening
 - a) Appointment of rapporteur
2. Review of Recommendations in 2001
 - a) Recommendations in June
 - b) Recommendations in September
3. Review of Publications
 - a) Publications
 - i) Journal of Northwest Atlantic Fishery Science
 - ii) NAFO Scientific Council Studies
 - iii) NAFO Statistical Bulletin
 - iv) NAFO Scientific Council Reports
 - v) Index and Lists of Titles
 - vi) Others
 - b) Review of mailing lists and continuation of printed copies
4. Production Costs and Revenues for Scientific Council Publications
5. Electronic Communications, Including NAFO Website
 - a) Public access areas of website
 - b) Password protected areas of website for Scientific Council
6. Promotion and Distribution of Scientific Publications
 - a) Invitational papers
 - b) NAFO website
 - c) Scientific Citation Index (SCI)
 - d) CD-ROM versions of reports, documents
 - e) New initiatives for publications
7. Editorial Matters Regarding Scientific Publications
 - a) Review of Editorial Board
 - b) Progress report of publication of 2000 workshop workbook
 - c) Progress report of publication of symposium proceedings
8. Papers for Possible Publication
 - a) Review of proposals resulting from 2001 Meetings
 - i) Papers nominated by STACPUB
 - ii) Up-date since June 2001
 - b) Review of contributions to the June 2002 Meeting
9. Funding of Future NAFO Symposia
10. Other Matters
 - a) Highlights of Scientific Council Meeting
 - b) Other business

V. Research Coordination (STACREC Chair: M. J. Morgan)

1. Opening
2. Review of Recommendations in 2001

3. Fishery Statistics

- a) Progress report on Secretariat activities in 2001/2002
 - i) Acquisition of STATLANT 21A and 21B reports for recent years
 - ii) Inter-agency data harmonization
- b) CWP Sessions 2002/2003
 - i) Report on CWP Intersessional Meeting, Rome, 21-22 March 2002
 - ii) CWP 20th Session, January 2003
 - Review of agenda
 - New proposals
- c) Reporting of catch statistics in Scientific Council Summary Sheets

4. Research Activities

- a) Biological sampling
 - i) Report on activities in 2001/2002
 - ii) Report by National Representatives on commercial sampling conducted
 - iii) Report on data availability for stock assessments (by Designated Experts)
- b) Biological surveys
 - i) Review of survey activities in 2001 (by National Representatives and Designated Experts)
 - ii) Surveys planned for 2002 and early-2003
 - iii) Northwest Atlantic Survey Database

5. NAFO Observer Protocol

- a) Report on STACTIC Intersessional meeting in May 2002
- b) Results of discussions on Conservation and Enforcement Measures
- c) Training manual
- d) Conversion of NAFO Observer Program data into electronic format

6. Review of SCR and SCS Documents

7. Other Matters

- a) Tagging activities
- b) Conversion factors
- c) Comparative fishing between Canada and EU-Spain
- d) Research activities
- e) Use of GRT vs. GT in recording effort data
- f) Other business

VI. Fisheries Science (STACFIS Chair: D. E. Stansbury)

1. Opening

2. General Review

- a) Review of recommendations in 2001
- b) General review of catches and fishing activity

3. Stock Assessments

- a) Stocks within or partly within the Regulatory Area, as requested by the Fisheries Commission with the concurrence of the Coastal State (Annex 1) (Northern shrimp in Div. 3M and Div. 3LNO will be undertaken during Scientific Council Meeting 6-13 November, 2002):
 - Cod (Div. 3NO (monitor); Div. 3M)
 - Redfish (Div. 3LN (monitor); Div. 3M)
 - American plaice (Div. 3LNO; Div. 3M)
 - Witch flounder (Div. 2J and 3KL (monitor, see also Annex 1, Item 7); Div. 3NO)

- Yellowtail flounder (Div. 3LNO)
 - Northern shortfin squid (Subareas 3 and 4) (see also Annex 1, Item 6)
 - Greenland halibut (Subareas 2 and 3)
 - Capelin (Div. 3NO)
- b) Analyses pertaining to other Fisheries Commission requests (Annex 1)
- Pelagic *S. mentella* (redfish) (Subareas 1-3) (Item 8)
- c) Stocks within the 200-mile fishery zone in Subareas 0 to 4, as requested by Canada (Annex 2)
- Greenland halibut in Subareas 0-3 (Item 1)
 - Cod in Div. 2J and 3KL (Item 3)
 - Redfish in Div. 3O (Item 4)
- d) Stocks within the 200-mile fishery zone in Subarea 1 and at East Greenland as requested by Denmark (Greenland) (Annex 3) (Northern shrimp in Denmark Strait and off East Greenland will be undertaken during Scientific Council Meeting, 6-13 November 2002):
- Roundnose grenadier in Subareas 0 and 1 (3 year) (Item 2)
 - Demersal redfish and other finfish in Subarea 1 (monitor) (Item 1)
 - Distribution of Greenland halibut biomass between Subarea 0 and Subarea 1 (Item 3)
 - Greenland halibut in Div. 1A inshore (Item 3)
- e) Stocks overlapping the fishery zones in Subareas 0 and 1, as requested by Canada and by Denmark (Greenland) (Annexes 2 and 3) (Northern shrimp in Subareas 0 and 1 will be undertaken during Scientific Council Meeting, 6-13 November 2002):
- Greenland halibut (Subareas 0 and 1) (Annex 2, Item 1; Annex 3, Item 3)
4. Other Matters
- a) New Designated Experts
- b) Other business

VII. Management Advice and Responses to Special Requests

1. Fisheries Commission (Annex 1)
- a) Request for advice on TACs and other management measures for year 2003
- i) Redfish in Div. 3M
 - ii) American Plaice in Div. 3LNO (see Item 2)
 - iii) Greenland halibut in Subareas 2 and 3
 - iv) Capelin in Div. 3NO
- b) Request for advice on TACs and other management measures for the years 2003 and 2004
- i) Cod in Div. 3M
 - ii) American plaice in Div. 3M
 - iii) Witch flounder in Div. 3NO
 - iv) Yellowtail flounder in Div. 3LNO
 - v) Northern shortfin squid in Subareas 3 and 4 (see also Item 6)
- c) Special requests for management advice (see Items 4-9)
- i) Formulation of advice under the precautionary approach (Items 4 and 5) (note: Working Group of (FC/SC) Technical Experts on Precautionary Approach Meeting, Dartmouth, 20-21 June 2002)
 - ii) Relationship of witch flounder in Div. 2J and 3KL to Div. 3M (Item 7)
 - iii) Distribution of shrimp in Div. 3M (see also Item 3g)
 - iv) Pelagic *S. mentella* (redfish) in Subareas 1-3 and adjacent ICES area (Item 8) (note: *Ad hoc* Working Group on Management of Oceanic Redfish Meeting, Dartmouth, 24-26 June 2002)
 - v) Distribution of shrimp in Div. 3LNO (Item 9)

- d) Monitoring of stocks for which multi-year advice was provided in 2001
 - i) Cod in Div. 3NO
 - ii) Redfish in Div. 3LN
 - iii) Witch flounder in Div. 2J and 3KL (see also Item 7)

2. Coastal States

- a) Request by Canada for advice (Annex 2)
 - i) Greenland halibut in Subareas 0-3 (Item 1)
 - ii) Cod in Div. 2J and 3KL (Item 3)
 - iii) Redfish in Div. 3O (Item 4)
- b) Request by Denmark (Greenland) for advice (Annex 3)
 - i) Multi-year advice for Roundnose grenadier in Subareas 0 and 1 for 2003-2005 (Item 2)
 - ii) Demersal redfish and other finfish in Subarea 1 (monitor) (Item 1)
 - iii) Greenland halibut in Div. 1A inshore (Item 3)
- c) Request by Canada and Denmark (Greenland) for advice on TACs and other management measures
 - i) Greenland halibut in Subareas 0 and 1

VIII. Future Scientific Council Meetings 2002 and 2003

1. Scientific Council Meeting and Special Session, September 2002
2. Scientific Council Meeting, November 2002 (assessment of shrimp stocks)
3. Scientific Council Meeting, June 2003
4. Scientific Council Meeting and Special Session, September 2003
5. Scientific Council Meeting, November 2003 (assessment of shrimp stocks)

IX. Arrangements for Special Sessions

1. Progress Report on Special Session in 2002: The Symposium on "Elasmobranch Fisheries"
2. Topic for Special Session in 2003
3. Topic for Special Session in 2004

X. Reports of Working Groups

1. Working Group on Reproductive Potential (Chair: E. A. Trippel)
2. Joint NAFO-ICES Working Group on Harp and Hooded Seals

XI. Review of Scientific Council Working Procedures/Protocol

1. Implementation of Precautionary Approach
 - a) Report of the 2002 ICES PA Workshop
 - b) Further development of PA methodology
2. NAFO Scientific Council Observership at ICES ACFM Meetings
3. Website and Technology Issues
4. Facilitating Workload of Scientific Council During Annual Meeting in September

XII. Other Matters

1. Report of CWP Intersessional Meeting, Rome, Italy, 21-22 March 2002
2. Report of FAO Technical Consultation on Status and Trends, Rome, Italy, 25-28 March 2002
3. Participation in FAO Committee on Fisheries (COFI)
4. Report on NAFO Intersessional Meetings
5. Meeting Highlights for NAFO Website
6. Other Business

XIII. Adoption of Committee Reports

1. STACFEN
2. STACREC
3. STACPUB
4. STACFIS

XIV. Scientific Council Recommendations to General Council and Fisheries Commission

XV. Adoption of Scientific Council Report

XVI. Adjournment

ANNEX 1. FISHERIES COMMISSION'S REQUEST FOR SCIENTIFIC ADVICE ON MANAGEMENT IN 2003 OF CERTAIN STOCKS IN SUBAREAS 3 AND 4

1. The Fisheries Commission with the concurrence of the Coastal State as regards the stocks below which occur within its jurisdiction, requests that the Scientific Council, at a meeting in advance of the 2002 Annual Meeting, provide advice on the scientific basis for the management of the following fish and invertebrate stocks or groups of stocks in 2003:

Redfish (Div. 3M)
 Shrimp (Div. 3M, 3LNO)
 Greenland halibut (Subarea 2 and Div. 3KLMNO)
 Capelin (Div. 3NO)

2. The Fisheries Commission with the concurrence of the Coastal State as regards the stocks below which occur within its jurisdiction, requests that the Scientific Council, at a meeting in advance of the 2002 Annual Meeting, provide advice on the scientific basis for the management of the following fish stocks on an alternating year basis:

Cod (Div. 3NO; Div. 3M)
 Redfish (Div. 3LN)
 Yellowtail flounder (Div. 3LNO)
 American plaice (Div. 3LNO; Div. 3M)
 Witch flounder (Div. 2J3KL; Div. 3NO)
 Squid (Subareas 3 and 4)

- In 2001, advice was provided for 2002 and 2003 for cod in 3NO, witch flounder in 2J3KL and redfish in 3LN. These stocks will next be assessed in 2003.
- In 2001, advice was provided for 2002 and 2003 for American plaice in 3LNO. The Fisheries Commission with the concurrence of the Coastal State, requests Scientific Council in advance of the 2002 Annual Meeting, to conduct a full analytical assessment of American plaice in Div. 3LNO and to review its advice for 2003. Scientific Council is further requested to analyse and comment on the precision of the estimates of the recent increase in fishing mortality. The next assessment will then take place in 2003 as per the alternate year schedule.
- In 2002, advice will be provided for 2003 and 2004 for cod in 3M, American plaice in 3M, yellowtail flounder in 3LNO, witch flounder in 3NO and squid in SA 3 & 4. These stocks will next be assessed in 2004.

The Fisheries Commission requests the Scientific Council to continue to monitor the status of all these stocks annually and, should a significant change be observed in stock status (e.g. from surveys) or in by-catches in other fisheries, provide updated advice as appropriate.

3. The Commission and the Coastal State request the Scientific Council to consider the following in assessing and projecting future stock levels for those stocks listed above:
 - a) The preferred tool for the presentation of a synthetic view of the past dynamics of an exploited stock and its future development is a stock assessment model, whether age-based or age-aggregated.
 - b) For those stocks subject to analytical-type assessments, the status of the stocks should be reviewed and management options evaluated in terms of their implications for fishable stock size in both the short and long term. As general reference points, the implications of fishing at $F_{0.1}$ and F_{2001} in 2003 and subsequent years should be evaluated. The present stock size and spawning stock size should be described in relation to those observed historically and those expected in the longer term under this range of options.
 - c) For those stocks subject to general production-type assessments, the time series of data should be updated, the status of the stock should be reviewed and management options evaluated in the way described above to the extent possible. In this case, the general reference points should be the level of fishing effort or fishing mortality (F) which is calculated to be required to take the MSY catch in the long term and two-thirds of that effort level.
 - d) For those resources for which only general biological and/or catch data are available, few standard criteria exist on which to base advice. The stock status should be evaluated in the context of management requirements for long-term sustainability and the advice provided should be consistent with the precautionary approach.
 - e) Spawning stock biomass levels considered necessary for maintenance of sustained recruitment should be recommended for each stock. In those cases where present spawning stock size is a matter of scientific concern in relation to the continuing reproductive potential of the stock, management options should be offered that specifically respond to such concerns.

- f) Information should be provided on stock size, spawning stock sizes, recruitment prospects, fishing mortality, catch rates and TACs implied by these management strategies for the short and the long term in the following format:
- I. For stocks for which analytical-type assessments are possible, graphs of all of the following for the longest time-period possible:
 - historical yield and fishing mortality;
 - spawning stock biomass and recruitment levels;
 - catch options for the year 2003 and subsequent years over a range of fishing mortality rates (F) at least from $F_{0.1}$ to F_{\max} ;
 - spawning stock biomass corresponding to each catch option;
 - yield-per-recruit and spawning stock per recruit values for a range of fishing mortalities.
 - II. For stocks for which advice is based on general production models, the relevant graph of production as a function of fishing mortality rate or fishing effort. Age-aggregated assessments should also provide graphs of all of the following for the longest time-period possible:
 - exploitable biomass (both absolute and relative to B_{MSY})
 - yield/biomass ratio as proxy for fishing mortality (both absolute and relative to F_{MSY})
 - estimates of recruitment from surveys, if available.
 - III. Where analytical methods are not attempted, the following graphs should be presented, for one or several surveys, for the longest time-period possible:
 - time trends of survey abundance estimates, over:
 - an age or size range chosen to represent the spawning stock (SSB)
 - an age or size-range chosen to represent the fishable stock biomass
 - recruitment proxy or index for an age or size-range chosen to represent the recruiting population.
 - fishing mortality proxy, such as the ratio of reported commercial catches to a measure of the fishable stock.

For age-structured assessments, yield-per-recruit graphs and associated estimates of yield-per-recruit based reference points should be provided. In particular, the three reference points, actual F , $F_{0.1}$ and F_{\max} should be shown.

- g) For shrimp in Div. 3M, including the area in footnote 1 of Part I, G of the Conservation and Enforcement Measures (the 3L 'box'), Scientific Council is requested, in advance of the annual NAFO Meeting of September 2002, to provide information on the monthly distribution of shrimp by size as taken in the commercial fishery and to comment on these distributions in relation to the closed area of Div. 3M as defined by co-ordinates in footnote 2 of Part I, G of the Conservation and Enforcement Measures and the consequences to the stock of the following scenarios: a) closure of the area during June 1 through December 31, and b) no closure at any time.
4. Noting the progress made by the Scientific Council on the development of a framework for implementation of the Precautionary Approach, the Fisheries Commission requests that the Scientific Council provide the following information for the 2002 Annual Meeting of the Fisheries Commission for stocks under its responsibility requiring advice for 2003, or 2003 and 2004:
- a) the limit and target precautionary reference points described in Annex II of the UN Fisheries Agreement indicating areas of uncertainty (when precautionary reference points cannot be determined directly, proxies should be provided);
 - b) information including medium term considerations and associated risk or probabilities which will assist the Commission to develop the management strategies described in paragraphs 4 and 5 of Annex II in the Agreement;
 - c) information on the research and monitoring required to evaluate and refine the reference points described in paragraphs 1 and 3 of Annex II of the Agreement; these research requirements should be set out in the order of priority considered appropriate by the Scientific Council;
 - d) any other aspect of Article 6 and Annex II of the Agreement which the Scientific Council considers useful for implementation of the Agreement's provisions regarding the precautionary approach to capture fisheries;
 - e) propose criteria and harvest strategies for re-opening of fisheries and for new and developing fisheries; and
 - f) to work toward the harmonization of the terminology and application of the precautionary approach within relevant advisory bodies.

5. In addition, the following elements should be taken into account by the Scientific Council when considering the precautionary approach:

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

References to “risk” and to “risk analyses” should refer to estimated probabilities of stock population parameters falling outside biological reference points.

- b) Where reference points are proposed by the Scientific Council as indicators of biological risk, they should be accompanied by a description of the nature of the risk incurred if the reference point is crossed (e.g. short-term risk of recruitment overfishing, loss of long-term yield, etc.)
 - c) When a buffer reference point is proposed in order to maintain a low probability that a stock, measured to be at the buffer reference point may actually be at or beyond the limit reference point, the Scientific Council should explain the assumptions made about the uncertainty with which the stock is measured, and also the level of ‘low probability’ that is used in the calculation.
 - d) Wherever possible, short and medium term consequences should be identified for various exploitation rates (including no fishing) in terms of yield, stability in yield from year to year, and the risk or probability of moving the stock beyond B_{lim} or B_{buf} . Whenever possible, this information should be cast in terms of risk assessments relating fishing mortality rates to the risks of falling below B_{lim} and B_{buf} , as well as of being above F_{lim} and F_{buf} , the risks of stock collapse and recruitment overfishing, as well as the risks of growth overfishing and the consequences in terms of both short and long term yields.
 - e) When providing risk estimates, it is very important that the **time horizon** be clearly spelled out. By way of consequence, risks should be expressed in timeframes of 5, 10 and 15 years (or more), or in terms of other appropriate year ranges depending on stock specific dynamics. Furthermore, in order to provide the Fisheries Commission with the information necessary to consider the balance between risks and yield levels, each harvesting strategy or risk scenario should include, for the selected year ranges, the risks and yields associated with various harvesting options in relation to B_{lim} (B_{buf}) and B_{target} and F_{lim} (F_{buf}) and F_{target} .
6. For squid (*lllex*) in Subareas 3 and 4, the Scientific Council is encouraged to further analyze available data toward developing possible indicators that could be used under an in-season management regime.
7. The Fisheries Commission, with the concurrence of the Coastal State, requests that the Scientific Council comment on the possible relationship of witch flounder in 2J3KL to that reported as caught in Div. 3M based on examination of all survey and biological data available.
8. Regarding pelagic *S. mentella* redfish in NAFO Subareas 1-3, the Scientific Council is requested to review the most recent information on the distribution of this resource, 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 to the shelf stocks of redfish found in ICES Sub-areas V, VI and XIV, and NAFO Subareas 1-3.
9. With regard to shrimp in Divisions 3LNO, the Fisheries Commission, with the concurrence of the Coastal State, requests that the Scientific Council, in advance of the September 2002 Annual Meeting, provide information on the geographical distribution of this resource including the relative and seasonal distribution inside and outside the NAFO Regulatory Area by both Division and age group. With reference to the proposed closed area in the region of the South East Shoal in Div. 3N as referenced in FC Working Paper 02/10, Scientific Council is further requested to provide information on the abundance and distribution of shrimp in the area proposed for closure.
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**ANNEX 2. CANADIAN REQUEST FOR SCIENTIFIC ADVICE ON MANAGEMENT IN 2003
OF CERTAIN STOCKS IN SUBAREAS 0 TO 4**

1. Canada requests that the Scientific Council, at its meeting in advance of the 2002 Annual Meeting of NAFO, subject to the concurrence of Denmark (on behalf of Greenland), provide advice on the scientific basis for management in 2003 of the following stocks:

Shrimp (Subareas 0 and 1)
Greenland halibut (Subareas 0 and 1)

The Scientific Council has noted previously that there is no biological basis for conducting separate assessments for Greenland halibut throughout Subareas 0-3, but has advised that separate TACs be maintained for different areas of the distribution of Greenland halibut. The Council is asked therefore, subject to the concurrence of Denmark (on behalf of Greenland) as regards Subarea 1, to provide an overall assessment of status and trends in the total stock throughout its range and comment on its management in Subareas 0+1 for 2003. In particular, the Council is asked to advise on appropriate TAC levels separately for Division 0B+1B-F (offshore), for SA 2+Division 3K and for Divisions 3LMNO, and to make recommendations on the distribution of fishing effort within each of these three geographic areas.

Given that Greenland halibut in the offshore area of Division 0A+1A is currently being managed separately from the remainder of SA 0+1, the Scientific Council is requested to:

- a) provide an assessment of the status of the Greenland halibut stock component in Division 0A+1A;
- b) advise on an appropriate TAC level for 2003 for Greenland halibut in the offshore area of Division 0A+1A and any other management measures the Scientific Council deems appropriate to ensure the sustainability of the resource;
- c) comment on the relationship between Greenland halibut in the offshore area of Division 0A+1A and the remainder of SA 0+1 as well as the potential impact of any fishery in Division 0A+1A on stock development throughout SA 0+1; and
- d) outline the elements of a scientific program necessary to provide a detailed response to "c" above and the timeframe if such a program were implemented.

With respect to shrimp, it is recognized that the Council may, at its discretion, delay providing advice until later in the year, taking into account data availability, predictive capability, and the logistics of additional meetings.

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

- a) For those stocks subject to analytical-type assessments, the status of the stock should be reviewed and management options evaluated in terms of their implications for fishable stock size in both the short- and long-term. The implications of no fishing as well as fishing at $F_{0.1}$ and F_{2001} in 2003 and subsequent years should be evaluated in relation to precautionary reference points of both fishing mortality and spawning stock biomass. The present stock size and spawning stock size should be described in relation to those observed historically and those to be expected in the longer term under this range of fishing mortalities, and any other options Scientific Council feels worthy of consideration under a precautionary framework.

Opinions of the Scientific Council should be expressed in regard to stock size, spawning stock sizes, recruitment prospects, catch rates and catches implied by these management strategies for the short- and long-term. Values of F corresponding to the reference points should be given. Uncertainties in the assessment should be evaluated and presented in the form of risk analyses related to B_{lim} (B_{buf}) and B_{target} , and F_{lim} (F_{buf}) and F_{target} .

- b) For those stocks subject to general production-type assessments, the time series of data should be updated, the status of the stock should be reviewed and management options evaluated in the way described above to the extent possible. Management options should be within the precautionary framework.
- c) For those resources for which only general biological and/or catch data are available, few standard criteria exist on which to base advice. The stock status should be evaluated in the context of management requirements for long-term sustainability and management options evaluated in the way described above to the extent possible. Management options should be within the precautionary framework.

d) Presentation of the results should include the following:

I. For stocks for which analytical-type assessments are possible:

- A graph of historical yield and fishing mortality for the longest time period possible;
- A graph of spawning stock biomass and recruitment levels for the longest time period possible;
- Graphs and tables of catch options for the year 2003 and subsequent years over a range of fishing mortality rates (F) at least from $F = 0$ to $F_{0.1}$ including risk analyses;
- Graphs and tables showing spawning stock biomass corresponding to each catch option including risk analyses;
- Graphs showing the yield-per-recruit and spawning stock per recruit values for a range of fishing mortalities.

II. For stocks for which advice is based on general production models, the relevant graph of production on fishing mortality rate or fishing effort.

In all cases, the reference points, $F = 0$, actual F , and $F_{0.1}$ should be shown.

3. For the cod stock in Divisions 2J+3KL, the Scientific Council is requested to report on recent trends in the total and spawning biomass based on the most recent stock status update.

4. With respect to redfish stock in Division 3O, the Scientific Council is requested provide the following:

- a) Information on the fishing mortality on redfish in Division 3O in recent years, as well as information on by-catches of other groundfish in the 3O redfish fishery;
- b) Information on abundance indices and the distribution of the stock in relation to groundfish resources, particularly for the stocks which are under moratorium;
- c) Information on the distribution of redfish in Division 3O, as well as a description of the relative distribution inside and outside the NAFO Regulatory Area;
- d) Advice on reference points and conservation measures that would allow for exploitation of this resource in a precautionary manner;
- e) Information on annual yield potential for this stock in the context of (d) above;
- 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;
- 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); and
- h) Information on the size composition in the current catches and comment on these sizes in relation to the size at sexual maturity.

P. S. Chamut
 Assistant Deputy Minister
 Fisheries Management, Department of Fisheries and Oceans
 Ottawa, Canada

**ANNEX 3. DENMARK (GREENLAND) REQUEST FOR SCIENTIFIC ADVICE ON MANAGEMENT
IN 2003 OF CERTAIN STOCKS IN SUBAREAS 0 AND 1**

1. In the Scientific Council report of 2001 scientific advice on management of redfish (*Sebastes* spp.) and other finfish in Subarea 1 was given for 2002 and 2003. Denmark on behalf of Greenland, requests the Scientific Council to continue to monitor the status of these stocks 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.
2. Advice for Roundnose grenadier in Subareas 0+1 was in 1999 given as a 3-year advice (for 2000, 2001 and 2002). Denmark, on behalf of Greenland, requests the Scientific Council in advance of the 2002 Annual Meeting, provide advice on the scientific basis for the management of Roundnose grenadier in Subarea 1 for 2003, 2004 and 2005.
3. Subject to the concurrence of Canada, the Scientific Council is also requested to provide advice on the scientific basis for the management of Greenland halibut overlapping Subareas 0 and 1.

In its 1993 report, the Scientific Council noted that the offshore component of Greenland halibut was distributed equally between Subareas 0 and 1. The Council is asked to update the information on the distribution of Greenland halibut and provide advice on allocation of TACs to Subarea 0 and Subarea 1 offshore.

Further, for Subarea 1 inshore, the Council is asked to provide advice on allocation of TACs distributed in areas of Ilulissat, Uummannaq and Upernavik, respectively.

4. Denmark, on behalf of Greenland, further requests the Scientific Council of NAFO before December 2002 to provide advice on the scientific basis for management of Northern shrimp (*Pandalus borealis*) in Subareas 0 and 1 in 2003 and as many years forward as data allow.

Further, the Council is requested to advice, in co-operation with ICES, on the scientific basis for management of Northern shrimp (*Pandalus borealis*) in the Denmark Strait and adjacent areas east of southern Greenland in 2003, and as many years forward as data allow.

On behalf of
The Ministry for Fisheries, Hunting & Settlements
Sincerely
Gedion Jeremiassen
Director

AGENDA II**SCIENTIFIC COUNCIL ANNUAL MEETING, 16-20 SEPTEMBER 2002**

- I. Opening (Chair: R.K. Mayo)
 - 1. Appointment of rapporteur
 - 2. Adoption of agenda
 - 3. Attendance of observers
 - 4. Plan of work (Annex 1)
- II. Review of Scientific Council Recommendations from June 2002
- III. Fisheries Science (STACFIS Chair: D.E. Stansbury)
 - 1. Opening
 - 2. Nomination of Designated Experts
 - 3. STACFIS Working Procedures
 - 4. Other Matters
 - a) Review of SCR and SCS documents (if necessary)
 - b) Other business
- IV. Research Coordination (STACREC Chair: M.J. Morgan)
 - 1. Opening
 - 2. Fisheries Statistics
 - a) Progress reports on Secretariat activities
 - i) Acquisition of STATLANT 21 data
 - ii) Publication of statistical information
 - 3. Review of FAO Fisheries Global Information System (FIGIS)
 - 4. NAFO Observer Program Protocols
 - 5. Fleet Based Approaches to Data Collection
 - 6. Review of Survey Activities in 2003 and 2004
 - 7. Other Matters
 - a) Review of SCR and SCS documents (if necessary)
 - b) Other business
- V. Publications (STACPUB Chair: M. Stein)
 - 1. Opening
 - 2. Review of recommendations from June 2002
 - 3. Review of Scientific Publications
 - a) Papers from June 2002 meeting
 - b) Status of the 2001 "Deep Sea Fisheries" Symposium proceedings
 - c) Information from the 2002 Elasmobranch Symposium
 - d) Status of invitational papers (Journal/Studies)
 - e) Other reviews
 - 4. Consideration of NAFO Website
 - a) Status of implementation of Journal and Scientific Council Studies on website
 - b) "Restricted site" for Scientific Council

5. Editorial Matters Regarding Scientific Publications
 6. Other Matters
- VI. Response to Special Requests from Fisheries Commission
1. Distribution of shrimp in Div. 3M (note: Scientific Council at its 6-20 June 2002 Meeting deferred this item) *
- VII. Review of Future Meeting Arrangements
1. Scientific Council Meeting on shrimp, November 2002
 2. Scientific Council Meeting, June 2003
 3. Precautionary Approach Workshop, Spring 2003
 4. Special Session and Annual Meeting, September 2003
 5. Scientific Council Meeting on shrimp, November 2003
 6. Scientific Council Meeting, June 2004
- VIII. Future Special Sessions
1. Progress Report on Geostatistics Workshop, September 2003
 2. Proposal for Special Session 2004
- IX. NAFO Working Groups or Workshops
1. Update on activities of NAFO WG on Reproductive Potential
 2. Precautionary Approach Workshop, 2003
 - List of stocks to be examined
 - Development of Terms of Reference
 - Meeting Venue and Dates
- X. Scientific Council Working Procedures and Protocol
1. Timetable and frequency of assessments:
 - Capelin in Div. 3NO
 - Roundnose grenadier in Subareas 2 and 3
- XI. Other Matters
1. Consideration of MoU with ICES
 2. Participation at ICES Precautionary Approach Meetings
 3. Other business
- XII. Adoption of Reports
1. Consideration of Report of the Symposium on Elasmobranch Fisheries, 11-13 September 2002
 2. Committee Reports STACFIS, STACREC, STACPUB
 3. Report of Scientific Council
- XIII. Adjournment

* The Fisheries Commission (SCS Doc. 02/1) requested the Scientific Council to provide advice on the scientific basis for management in 2003 of Shrimp in Div. 3M, and additionally,

(Item 3g): "For shrimp in Div. 3M, including the area in footnote 1 of Part I, G of the Conservation and Enforcement Measures (the 3L 'box'), Scientific Council is requested, in advance of the annual NAFO Meeting of September 2002, to provide information on the monthly distribution of shrimp by size as taken in the commercial fishery and to comment on these distributions in relation to the closed area of Div. 3M as defined by co-ordinates in footnote 2 of Part I, G of the Conservation and Enforcement Measures and the consequences to the stock of the following scenarios: a) closure of the area during June 1 through December 31, and b) no closure at any time."

AGENDA III**SCIENTIFIC COUNCIL MEETING, 6-13 NOVEMBER 2002****I. Opening (Chair: R. K. Mayo)**

1. Appointment of rapporteur
2. Adoption of agenda
3. Plan of work

II. Fisheries Science (STACFIS Chair: D. Stansbury)

1. Review of Recommendations in 2001 and 2002
2. General environmental review
3. Stock assessments (Annexes 1, 2 and 3)
 - Northern shrimp (Div. 3M)
 - Northern shrimp (Div. 3LNO)
 - Northern shrimp (Subareas 0 and 1)
 - Northern shrimp (in Denmark Strait and off East Greenland)
4. Other business

III. Formulation of Advice (see Annexes 1, 2 and 3)

1. Advice for Northern shrimp
 - Northern shrimp (Div. 3M)
 - Northern shrimp (Div. 3LNO)
 - Northern shrimp (Subareas 0 and 1)
 - Northern shrimp (in Denmark Strait and off East Greenland)
2. Formulation of advice under a Precautionary Approach framework
3. Timing Issues Relative to Advice for Div. 3M and Div. 3LNO shrimp stocks

IV. Other Matters

1. Coordination with ICES Working Groups on shrimp stock assessments
2. Scientific Council Meeting on Northern shrimp, November 2003
3. Scientific Council Meeting on Northern shrimp, November 2004

V. Adoption of Reports**VI. Adjournment**

LIST OF RESEARCH AND SUMMARY DOCUMENTS, 2002

RESEARCH DOCUMENTS (SCR)

SCR No.	Ser. No.	Author(s) and Title
02/1 ^a	N4596	RIKHTER, V. A. On the reasons of correlation between recruitment dynamics of some commercial fish populations in the Northwestern Atlantic Ocean (NAFO Subareas 24) and probability of forecasting the trends in dynamics of their biomass for several years ahead. (12 pages)
02/2 ^a	N4600	GONZÁLEZ TRONCOSO, D., X. PAZ and E. ROMÁN. Abundance, biomass and population structure for American plaice from the surveys conducted by Spain in the NAFO Regulatory Area of Divisions 3NO, 1995-2001. (14 pages)
02/3 ^a	N4601	PAZ, X., D. GONZÁLEZ TRONCOSO and E. ROMÁN. Yellowtail flounder data from the surveys conducted by Spain in the NAFO Regulatory Area of Divisions 3NO, 1995-2001. (12 pages)
02/4 ^a	N4602	GONZÁLEZ TRONCOSO, D., E. ROMÁN and X. PAZ. Results for the Greenland halibut in the Spanish spring survey in the NAFO Regulatory Area of Divisions 3NO, 1996-2001: abundance, biomass and population structure. (12 pages)
02/5 ^a	N4603	PAZ, X., D. GONZÁLEZ TRONCOSO and P. DURÁN MUÑOZ. Comparative exercise of efficiency between C/V <i>Playa de Menguña</i> and R/V <i>Vizconde de Ezain</i> in the NAFO Divisions 3NO in May 2001. (25 pages)
02/6 ^a	N4607	ORR, D. C., D. KULKA and J. FIRTH. Groundfish by-catch in the Canadian small (<500 tons; LOA < 100') and large (=>500 tons) vessel Division 3L shrimp fishery, during 2000 and 2001. (6 pages)
02/7 ^a	N4608	STEIN, M. and V. A. BOROVKOV. Eighth Report of Joint Russian/German Project "assessment of short-time climatic variations in the Labrador Sea". (2 pages)
02/8 ^a	N4609	STEIN, M. Climatic overview NAFO Subarea 1 – 1991-2000. ¹ (19 pages)
02/9 ^a	N4610	VASKOV, A. A. Assessment of redfish stock on the Flemish Cap based on data from the Russian trawl survey in 2001. (16 pages)
02/10 ^a	N4611	BAKAY, Yu. I. and S. P. MELNIKOV. Vertical structure of <i>Sebastes mentella</i> concentrations in the pelagic open part of the Irminger Sea. (21 pages)
02/11 ^a	N4612	VINNICHENKO, V. I., V. N. MASHKOV and V. N. KHLIVNOY. Brief results of Russian investigations and fishery for thorny skate (<i>Raja radiata</i>) in NAFO Regulatory Area in 2000-2001. (9 pages)
02/12 ^a	N4613	VAZQUEZ, A. Results from bottom trawl survey on Flemish Cap of July 2001. (43 pages)

^a Scientific Council Meeting, 6-20 June 2002.

¹ SCR Documents for Mini Symposium on "Environmental Conditions in the NAFO Water of the Northwest Atlantic during the Decade of the 1990s".

SCR #	Serial #	Author(s) and Title
02/13 ^a	N4614	BAKEY, Yu. I. and I. V. BAKAY. Ecological and geographical description of parasite fauna of Acadian redfish <i>Sebastes fasciatus</i> Storer. (16 pages)
02/14 ^a	N4615	PAVLOV, V. A. By-catches of snow crab <i>Chionoecetes opilio</i> in Russian bottom trawl fishery in Divisions 3NO in 2001. (5 pages)
02/15 ^a	N4616	MELINIKOV, S. P. and Yu. I. BAKAY. Spatial structure of pelagic concentrations of <i>Sebastes mentella</i> of the Irminger Sea and adjacent waters. (22 pages)
02/16 ^a	N4617	BUCH, E., M. H. NIELSEN and S. A. PEDERSEN. Ecosystem variability and regime shift in West Greenland waters. ¹ (19 pages)
02/17 ^a	N4618	BUCH, E. and M. H. NIELSEN. Oceanographic investigations off West Greenland 2001. (17 pages)
02/18 ^a	N4619	MURUA, H. A review of roughhead grenadier (<i>Macrourus berglax</i>) biology and population structure on Flemish Cap (NAFO Division 3M), 1991-2001, based on Flemish Cap survey data. (18 pages)
02/19 ^a	N4621	VASKOV, A., S.MELNIKOV and V. SHIBANOV. Russian investigations and fishery of beaked redfish <i>Sebastes mentella</i> in the Labrador and Irminger Seas. (10 pages)
02/20 ^a	N4622	SHIBANOV, V. N., K. V. GORCHINSKY and V. S. MAMYLOV. An attempt to estimate dynamics of capelin stock on the Grand Bank using trawlable biomass data from Canadian bottom trawl surveys, spring 1990-2001. (10 pages)
02/21 ^a	N4625	HEALEY, B. P., N. G. CADIGAN and W. B. BRODIE. Analysis of pre-recruit data from surveys for Greenland halibut in NAFO Subarea 2 and Divisions 3KLMNO. (15 pages)
02/22 ^a	N4626	RÄTZ, H.-J. and C. STRANSKY. Stock status update for other finfish in NAFO Subarea 1. (5 pages).
02/23 ^a	N4627	RÄTZ, H.-J. and C. STRANSKY. Stock status update for demersal redfish in NAFO Subarea 1. (8 pages)
02/24 ^a	N4630	BOWERING, W. R. Greenland halibut (<i>Reinhardtius hippoglossoides</i>) in NAFO Subarea 2 and Divisions 3KLMNO: stock trends based on Canadian research vessel survey results during 1978-2001. (40 pages)
02/25 ^a	N4631	CABANAS, J. M. Hydrographic conditions on Flemish Cap in July 2001. (10 pages)
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02/27 ^a	N4633	IGASHOV, T. M. Assessment of Greenland halibut (<i>Reinhardtius hippoglossoides</i>) Stock on the Flemish Cap (Division 3M) by data of the Russian trawl survey of 2001. (9 pages)
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02/30 ^a	N4637	JØRGENSEN, O. A. Survey for Greenland halibut in NAFO Divisions 1A-1D, 2001. (31 pages)
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02/35 ^a	N4646	STRANSKY, C. Otolith shape analysis of Irminger Sea redfish (<i>Sebastes mentella</i>): preliminary results. (7 pages)
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02/41 ^a	N5652	COLBOURNE, E. B. and C. FITZPATRICK. Physical oceanographic conditions in NAFO Subareas 2 and 3 on the Newfoundland and Labrador Shelf during 2001. (27 pages)
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02/56 ^a	N4668	HENDRICKSON, L. C., E. G. DAWE and M. A. SHOWELL. Assessment of northern shortfin squid (<i>Illex illecebrosus</i>) in Subareas 3+4 for 2001. (17 pages)
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02/66 ^a	N4678	SHELTON, P. A., G. R. LILLY, J. BRATTEY, N. G. CADIGAN, B. P. HEALEY, E. F. MURPHY and D. E. STANSBURY. Northern (2J+3KL) cod stock status update. (9 pages)
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02/71 ^a	N4684	STEPHEN J. WALSH, S. J., W. B. BRODIE, M. J. MORGAN, D. POWER, K. S. DWYER and C. DARBY. Stock assessment and management of the Grand Bank yellowtail flounder stock. (54 pages)
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02/83 ^b	N4702	CLÒ, S., M. DALÙ, R. DANOVARO and M. VACCHI. Segregation of the Mediterranean population of <i>Centroscyrnus coelolepis</i> (Chondrichthyes: Squalidae): a description and survey. (Symposium Poster) (3 pages)

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02/84 ^b	N4703	SOLDAT, V. T. Spiny dogfish (<i>Squalus acanthias</i> L.) of the Northwest Atlantic Ocean (NWA). (Symposium Oral) (33 pages)
02/85 ^b	N4706	MASSUTÍ, E. and J. MORANTA. Demersal assemblages and depth distribution of elasmobranchs from the continental shelf and slope trawling grounds off the Balearic Islands (western Mediterranean). (Symposium Poster) (20 pages)
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02/97 ^b	N4718	KYNE, P. M., A. J. COURTNEY, M. J. CAMPBELL, K. E. CHILCOTT, S. W. GADDES, C. T. TURNBULL, C. C. VAN DER GEEST and M. B. BENNETT. An overview of the elasmobranch by-catch of the Queensland east coast trawl fishery (Australia). (Symposium Oral) (11 pages)
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02/106 ^b	N4727	DEL RÍO, J. L., E. ROMÁN and S. CERVIÑO. Abundance and distribution of elasmobranchs in NAFO Regulatory Area (Divisions 3MNO). (Symposium Oral) (24 pages)
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02/110 ^b	N4731	PÉREZ-JIMÉNEZ, J. C., O. SOSA-NISHIZAKI, E. FURLONG-ESTRADA and D. CORRO-ESPINOSA. Artisanal shark fishery at Tres Marias and Isabel Islands, Nayarit, México. (Symposium Poster) (17 pages)
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02/116 ^b	N4737	SIMPFENDORFER, C. A. and G. BURGESS. Assessment of the status of the Atlantic sharpnose shark (<i>Rhizoprionodon terraenovae</i>) using an age-structured population model. (Symposium Oral) (10 pages, revised)
02/117 ^b	N4738	RODRIGUEZ-CABELLO, C., F. SÁNCHEZ and F. VELASCO. Growth of the lesser spotted dogfish (<i>Scyliorhinus canicula</i> (L., 1758)) in the Cantabrian Sea, based on tag-return data. (Symposium Poster) (13 pages)
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02/123 ^b	N4745	OLASO, I., F. VELASCO, F. SÁNCHEZ, A. SERRANO, C. RODRÍGUEZ-CABELLO and O. CENDRERO. Trophic relations of lesser spotted dogfish (<i>Scyliorhinus canicula</i>) and black mouth dogfish (<i>Galeus melastomus</i>) in the benthic and demersal communities of the Cantabrian Sea. (Symposium Oral) (14 pages)
02/124 ^b	N4746	DUDLEY, S. F. J. Shark catch trends and effort reduction in the beach protection program, KwaZulu-Natal, South Africa. (Symposium Oral) (21 pages)
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02/127 ^b	N4749	CLARKE, M., L. BORGES, R. OFFICER and D. STOKES. Comparisons of trawl and longline catches of deepwater elasmobranchs west and north of Ireland. (Symposium Oral) (17 pages)
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02/129 ^b	N4751	WAKEFORD, R. C., D. A. J. MIDDLETON, D. J. AGNEW, J. H. W. POMPERT and V. V. LAPTIKHOVSKY. Management of the Falkland Islands multispecies ray fishery: addressing sustainability and diversity. (Symposium Oral) (23 pages)
02/130 ^b	N4752	GALLAGHER, M. J., C. P. NOLAN and F. JEAL. The structure and growth processes of caudal thorns. (Symposium Poster) (7 pages)
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02/132 ^b	N4754	MACHADO, P. B., M. R. PINHO and P. N. DUARTE. Finding trends on the fishery and abundance of kitefin shark, <i>Dalatias licha</i> (Bonaterre, 1788), from off Azores, throughout a GIS spatial analysis. (Symposium Oral) (16 pages)
02/133 ^b	N4755	APOSTOLAKI, P., E. A. BABCOCK and M. MCALLISTER. Providing advice for the sustainable exploitation of the sandbar shark (<i>Carcharhinus plumbeus</i>) off the U.S. east coast. Application of a fleet-disaggregated, age-structured model. (Symposium Oral) (15 pages)
02/134 ^b	N4756	SOSEBEE, K. A. Maturity of skates in Northeast United States waters. (Symposium Poster) (17 pages)

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02/135 ^b	N4757	HOLTZHAUSEN, J. A. Trans-boundary bronze whaler (<i>Carcharhinus brachyurus</i>) tagging program between Namibia and Angola. (Symposium Poster) (4 pages)
02/136 ^b	N4758	CLARKE, M., M. GIRARD, N.-R. HAREIDE, P. LORANCE and R. OFFICER. Approaches to assessment of deepwater sharks in the Northeast Atlantic. (Symposium Poster) (16 Pages)
02/137 ^b	N4759	DE LA SERNA, J. M., J. VALEIRAS, J. M. ORTIZ, and D. MACÍAS. Large pelagic sharks as by-catch in the Mediterranean swordfish longline fishery: Some biological aspects. (Symposium Poster) (8 pages)
02/138 ^b	N4760	FIGUEIREDO, I., L. CARVALHO, M. QUARESMA, and M. CLARKE. First approach to the application of life table models to Portuguese dogfish (<i>Centroscymnus coelolepis</i> , Bocage and Capello, 1864). (Symposium Oral) (11 pages)
02/139 ^b	N4761	PRINCE, J. D. Gauntlet fisheries for elasmobranchs – the secret of sustainable shark fisheries. (Symposium Oral) (16 pages)
02/140 ^b	N4762	SOSA-NISHIZAKI, O., E. FURLONG-ESTRADA, J. A. REYES-GONZÁLEZ and, J. C. PÉREZ-JIMÉNEZ. Blue shark (<i>Prionace glauca</i>) fishery in Baja California, Mexico: an example of artisanal and middle scale fisheries interaction. (Symposium Oral) (6 pages)
02/141 ^b	N4763	ALPOIM, R., E. ROMAN, B. GREENE, R. BURRY and W. R. BOWERING. Greenland halibut (<i>Reinhardtius hippoglossoides</i>) otolith exchange between Spain, Canada and Portugal. (14 pages)
02/142 ^c	N4771	CASAS, J. M. and J. L. DEL RÍO. The Spanish shrimp fishery on Flemish Cap (NAFO Division 3M) in 2001. (4 pages)
02/143 ^c	N4772	DIAZ, P., T. PATROCINIO and X. PAZ. Increased catches of northern shrimp (<i>Pandalus borealis</i> , Kroyer) in a 2002 Spanish bottom trawl survey in NAFO Division 3N. (11 pages)
02/144 ^c	N4773	WIELAND, K. A new length-weight relationship for northern shrimp (<i>Pandalus borealis</i>) off West Greenland (NAFO Subareas 0+1). (4 pages)
02/145 ^c	N4774	WIELAND, K. The use of fine-meshed bags for sampling juvenile northern shrimp (<i>Pandalus borealis</i>) in the West Greenland bottom trawl survey. (11 pages)
02/146 ^c	N4775	WIELAND, K. Abundance indices for juvenile (age 1 and 2) northern shrimp (<i>Pandalus borealis</i>) off West Greenland (NAFO Subareas 0+1), 1993-2002. (20 pages)
02/147 ^c	N4776	HVINGEL, C. Data for the assessment of the shrimp (<i>Pandalus borealis</i>) stock in Denmark Strait/off East Greenland, 2002. (26 pages)
02/148 ^c	N4777	KANNEWORFF, P. and K. WIELAND. Stratified-random trawl survey for northern shrimp (<i>Pandalus borealis</i>) in NAFO Subareas 0+1 in 2002. (25 pages)

^b Scientific Council Annual Meeting, 16-20 September 2002.

^c Scientific Council Meeting, 6-13 November 2002.

SCR #	Serial #	Author(s) and Title
02/149 ^c	N4778	SIEGSTAD, H. The Greenland fishery for northern shrimp (<i>Pandalus borealis</i>) on Flemish Cap, NAFO Division 3M in 2002. (4 pages)
02/150 ^c	N4779	DEL RIO, J. L., J. M. CASAS and T. PATROCINIO. Northern shrimp (<i>Pandalus borealis</i>) on Flemish Cap in July 2002. (21 pages)
02/151 ^c	N4780	HVINGEL, C. The fishery for northern shrimp (<i>Pandalus borealis</i>) off West Greenland, 1970-2002. (19 pages)
02/152 ^c	N4781	COLBOURNE, E. Oceanographic conditions on the Flemish Cap in NAFO Division 3M during the summer of 2002. (14 pages)
02/153 ^c	N4782	COLBOURNE, E. and D. C. ORR. The distribution and abundance of northern shrimp (<i>Pandalus borealis</i>) in relation to bottom temperatures in NAFO Divisions 3LNO based on multi-species surveys from 1995-2002. (14 pages)
02/154 ^c	N4783	SKÚLADÓTTIR, U. The Icelandic shrimp fishery (<i>Pandalus borealis</i>) in the Denmark Strait in 2002. (5 pages)
02/155 ^c	N4784	SKÚLADÓTTIR, U. The Icelandic shrimp fishery (<i>Pandalus borealis</i> Kr.) at Flemish Cap in 1993-2002. (33 pages)
02/156 ^c	N4785	NICOLAJSSEN, Á. Biomass estimate, growth, length and age distribution of the northern shrimp (<i>Pandalus borealis</i>) stock on Flemish Cap (NAFO Division 3M) in June 2002. (20 pages)
02/157 ^c	N4786	HVINGEL, C. Assessment, prediction and risk analysis of stock development: shrimp off West Greenland, 2002. (10 pages)
02/158 ^c	N4787	HVINGEL, C. and M. C. S. KINGSLEY. A framework for the development of management advice on a shrimp stock using a Bayesian approach. (28 pages)
02/159 ^c	N4788	BAKANEV, S. V. Russian fishery for northern shrimp (<i>Pandalus borealis</i>) on Flemish Cap Bank, NAFO Division 3M and Grand Bank, Division 3L, in 2001 and January-September 2002. (9 pages)
02/160 ^c	N4789	ORR, D. C., P. VEITCH and D. SULLIVAN. An update of information pertaining to northern shrimp (<i>Pandalus borealis</i> Krøyer) and groundfish in NAFO Divisions 3LNO. (55 pages)
02/161 ^c	N4790	NICOLAJSSEN, Á. and S. BRYNJOLFSSON. Young northern shrimp (<i>Pandalus borealis</i>) index for Flemish Cap (Division 3M) 2002. (4 pages)
02/162 ^c	N4791	WIELAND, K. and P. KANNEWORFF. Bottom temperature on West Greenland shrimp fishing grounds in 1991 to 2002. (5 pages)

^c Scientific Council Meeting, 6-13 November 2002.

SCR #	Serial #	Author(s) and Title
02/163 ^c	N4793	SKÚLADÓTTIR, U. and D. ORR. The assessment of the international fishery for shrimp (<i>Pandalus borealis</i>) in Division 3M (Flemish Cap), 1993-2002. (17 pages)

SUMMARY DOCUMENTS (SCS)

SCS No.	Ser. No.	Author(s) and Title
02/1 ^a	N4594	FISHERIES COMMISSION. Fisheries Commission's request for scientific advice on management in 2003 of certain stocks in Subareas 3 and 4. (4 pages)
02/2 ^a	N4595	JEREMIASSEN, G. Denmark (Greenland) request for scientific advice on management in 2003 of certain stocks in Subareas 0 and 1. (1 page)
02/3 ^a	N4598	CHAMUT, P. S. Canadian request for scientific advice on management in 2003 of certain stocks in Subareas 0 to 4. (2 pages)
02/4 ^a	N4597	RIKHTER, V. A., I. K. SIGAEV, VASKOV, A. A., K. V. GORCHINSKY, T. M. IGASHOV, V. M. KISELEVA, S. E. LOBODENKO and S. P. MELNIKOV. Russian research report for 2001. (25 pages)
02/5 ^a	N4599	MARSHALL, B. Provisional index and list of titles of research and summary documents of 2001. (43 pages)
02/6 ^a	N4604	ALPOIM, R., J. VARGAS, E. SANTOS and A. M. ÁVILA DE MELO. Portuguese research report for 2001. (49 pages)
02/7 ^a	N4623	DEL RIO, J. L., P. DURÁN MUÑOZ, A VÁZQUEZ, H. MURUA, E. ROMÁN and F. GONZALEZ. Spanish research report for 2001. (26 pages)
02/8 ^a	N4620	NAFO SECRETARIAT. List of biological sampling data for 2001. (24 pages)
02/9 ^a	N4628	RÄTZ, H.-J., M. STEIN and C. STRANSKY. German research report for 2001. (5 pages)
02/10 ^a	N4629	TREBLE, M., S. COSENS and D. PARMITER-RICHARDS. Canadian research report for 2001. (24 pages)
02/11 ^a	N4634	NAFO SECRETARIAT. Report of the Inter-Sessional Meeting of the Coordinating Working Party on Fishery Statistics, 21-22 March 2002, Rome, Italy. (9 pages)
02/12 ^a	N4638	NAFO SECRETARIAT. Report of the Coordinating Working Party on Fishery Statistics (CWP). (73 pages)
02/13 ^a	N4639	NAFO SECRETARIAT. Historical nominal catches for selected stocks. (7 pages)
02/14 ^a	N4640	NAFO SECRETARIAT. Notes on acquisition and publications of statistics since June 2001 (2 pages).

^a Scientific Council Meeting, 6-20 June 2002.

^c Scientific Council Meeting, 6-13 November 2002.

SCS No.	Ser. No.	Author(s) and Title
02/15 ^a	N4641	SOSEBEE, K. A. and W. L. GABRIEL. United States research report for 2001. (17 pages)
02/16 ^a	N4657	SIEGSTAD, H. Denmark/Greenland research report for 2001. (9 pages)
02/17 ^a	N4681	NAFO SECRETARIAT. Tagging activities reported for the Northwest Atlantic in 2001 and early-2002. (19 pages)
02/18 ^a	N4694	GONZALEZ, F. and D. POWER. A report on the deliberations of the North-Western Working Group as it pertains to stock structure, distribution and state of the <i>Sebastes mentella</i> in ICES Sub-areas V, XII and XIV and the NAFO Convention area. (10 pages)
02/19 ^a	N4698	NAFO. Report of Scientific Council Meeting, 6-20 June 2002. (195 pages)
02/20 ^b	N4764	NAFO. Report of Scientific Council Meeting, 16-20 September 2002. (55 pages)
02/21 ^b	N4770	DESIGNATED EXPERTS. Collection of Working Papers for the Scientific Council Precautionary Approach Workshop of 2003. (32 pages)
02/22 ^c	N4794	NAFO. Scientific Council Meeting Report, 6-13 November 2002. (56 pages)
02/23 ^c	N4796	NAFO SECRETARIAT. A compilation of research vessel surveys on a stock-by-stock basis. (23 pages)

^a Scientific Council Meeting, 6-20 June 2002.

^b Scientific Council Annual Meeting, 16-20 September 2002.

^c Scientific Council Meeting, 6-13 November 2002.

APPENDIX VII. LIST OF REPRESENTATIVES AND ADVISERS/EXPERTS, 2002

Meetings*

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Meetings*

- A Scientific Council Meeting, 6-20 June 2002
- B Scientific Council Annual Meeting, 16-20 September 2002 (Note: Symposium participants are listed with its report).
- C Scientific Council Meeting, 6-13 November 2002.

¹ Attended Mini Symposium on "Environmental Conditions in the NAFO Water of the Northwest Atlantic during the Decade of the 1990s" only.

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Meetings*

- A Scientific Council Meeting, 6-20 June 2002
- B Scientific Council Annual Meeting, 16-20 September 2002 (Note: Symposium participants are listed with its report).
- C Scientific Council Meeting, 6-13 November 2002.

Meetings*

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Meetings*

- A Scientific Council Meeting, 6-20 June 2002
- B Scientific Council Annual Meeting, 16-20 September 2002 (Note: Symposium participants are listed with its report).
- C Scientific Council Meeting, 6-13 November 2002.

Meetings*

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Meetings*

- A Scientific Council Meeting, 6-20 June 2002
 B Scientific Council Annual Meeting, 16-20 September 2002 (Note: Symposium participants are listed with its report).
 C Scientific Council Meeting, 6-13 November 2002.

¹ Attended Mini Symposium on "Environmental Conditions in the NAFO Water of the Northwest Atlantic during the Decade of the 1990s" only.

Meetings***NAFO SECRETARIAT**

T. Amaratunga, Assistant Executive Secretary	A	B	C
D. C. A. Auby, Secretary	A	B	C
G. Moulton, Statistical/Conservation Measures Officer	A	B	
B. L. Marshall, Statistical Clerk	A		
C. L. Kerr, Statistical/Reception Clerk	A		
F. D. Keating, Administrative Assistant		B	
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Gisela Diaz López	B
Tegra Barreiro Martinez	B
Ana Maria Castro Fernández	B
Yolanda di Giacovo	B
Paloma Gonzalez Fontanais	B
Isabel Tembra Iglesias	B
José Antonio Lourido Santiago	B
David Fragio Agra	B
Alberto Puga de Jesús	B

Meetings*

- A Scientific Council Meeting, 6-20 June 2002
- B Scientific Council Annual Meeting, 16-20 September 2002 (Note: Symposium participants are listed with its report).
- C Scientific Council Meeting, 6-13 November 2002.

LIST OF RECOMMENDATIONS IN 2002

The following are the specific **recommendations made by the Scientific Council** at its meetings through 2002 besides those made with respect to scientific advice on stocks considered. The recommendations with respect to stock advice appear in the stock-by-stock Summary Sheets presented in this publication. Recommendations listed under the Standing Committees were **endorsed** by the Scientific Council.

All recommendations listed here were **adopted** by the Scientific Council and are presented as they appear in this publication under the relevant sections and pages mentioned.

Scientific Council Meeting, 6-20 June 2002

SCIENTIFIC COUNCIL

NOTE: All 6-20 June 2002 recommendations pertaining to the work of the Scientific Council, except those related to stocks under STACFIS, were listed in Part A, Sections III, IV and V. These and other recommendations pertaining to all Constituent Bodies of NAFO are presented below under the relevant section and subject headings.

XI. REVIEW OF SCIENTIFIC COUNCIL WORKING PROCEDURES/PROTOCOL

1. Implementation of Precautionary Approach

b) Further Development of PA Methodology (page 49)

- *in preparation for a Precautionary Approach Workshop in 2003, each Designated Expert is requested to identify data requirements and specific approaches for their stock and present the information for further discussion at the September 2002 Scientific Council Meeting.*
- *\$5 000 be requested to fund travel costs for 2 invited experts to participate in a 2003 Workshop.*

XII. OTHER MATTERS

3. Participation in FAO Committee on Fisheries (COFI) (Page 51)

- *the Assistant Executive Secretary attend the Twenty-fifth Session of the Committee on Fisheries (COFI) to be held in Rome, Italy during 24-28 February 2003, and the meeting of the Regional Fishery Bodies to be held immediately after the COFI Meeting.*

4. Report on NAFO Intersessional Meetings (page 51)

- *Fisheries Commission and General Council take the necessary steps to ensure that Contracting Parties adhere to the protocols for collecting data for scientific purposes as adopted by the Fisheries Commission, and that provisions be made to allow the Secretariat to develop a database to facilitate access and analysis of these data by Scientific Council.*

6. Other Business

b) Multi-species Fisheries Considerations (page 52)

- *the issue of fleet-based approaches to data collection and collation be included as an agenda item for discussion by Scientific Council during the September 2002 Meeting, and that during the summer, representatives of Contracting Parties should consider what analyses may be required and prepare any documentation considered appropriate to aid in the September discussions.*

FISHERIES ENVIRONMENT (STACFEN)**4. Mini-Symposium on Hydrographic Variability in NAFO Waters, 1991-2000** (page 59)

- *the proceedings of the mini-Symposium on "Hydrographic Variability in NAFO Waters for the Decade 1991-2000 in Relation to Past Decades" be published in a special issue of the Journal of the Northwest Atlantic Fisheries Science.*

6. Long-term Environmental Indicators**b) Formulation of Recommendations Based on Environmental Conditions** (page 64)

- *further studies be conducted attempting to link climate and fisheries and to bring forward such studies for review at STACFEN.*
- *the STACFEN Chair, or designate, be included in the presentation of scientific advice from the Scientific Council to the Fisheries Commission at its September 2002 meeting, and further that such presentations be made every 5 years or more frequently if significantly large changes in the environment are observed.*

9. The Production of a NAFO Annual Ocean Climate Status Summary (page 66)

- *an annual climate status report beginning in 2003 to describe environmental conditions during the previous year be produced, that this be compiled prior to the annual June Meeting and posted prominently on the NAFO website.*

PUBLICATIONS (STACPUB)**3. Review of Scientific Publications****b) Review of Mailing Lists and Continuation of Printed Copies** (page 72)

- *the Secretariat provide a copy of the mailing list to each delegation's representatives. Representatives are requested to review the list and provide a list of names that are no longer involved with NAFO and that should be removed from the list.*

5. Electronic Communications, Including NAFO Website**a) Public Access Areas of Website** (page 72)

- *the Secretariat maintain the restricted website area for specific Scientific Council business, and that the restricted website name be changed on an annual basis in order to maintain restricted access.*

6. Promotion and Distribution of Scientific Publications**b) NAFO Website** (page 72)

- *STACFEN's annual climate status summary report on essential climatic conditions in the NAFO Convention Area be published on the website.*
- *"Informational bulletins" of interest to NAFO Contracting Parties, such as location of mooring of ocean current meters in the Flemish Pass, should also be published on the website.*

9. **Funding of Future NAFO Symposia** (page 74)

- *Secretariat asks the host country to fund a social event during the Elasmobranch Symposium.*

RESEARCH COORDINATION (STACREC)

3. **Fishery Statistics**

b) **CWP Sessions 2002/2003**

ii) **CWP 20th Session, January 2003** (page 77)

- *the Assistant Executive Secretary attend the CWP 20th Session to be held in the Seychelles during 21-24 January 2003.*
- *the Rules of Procedure of the Scientific Council be modified to include participation at CWP sessions in the functions of the Vice-Chair who is also the Chair of STACREC and that the Scientific Council Chair address the budgetary aspect of this to the Executive Secretary with respect to the attendance at the 20th CWP Session and subsequent sessions.*

c) **Reporting of Catch Statistics in Scientific Council Summary Sheets** (page 77)

- *STACFIS Tables and the Scientific Council Summary Sheets should include both the catch data used by STACFIS in the stock assessments and the officially reported STATLANT 21A data.*

5. **NAFO Observer Protocol** (page 86 and 87)

- *the Conservation and Enforcement Measures Part VI, Program for Observers and Satellite Tracking, be amended to formally incorporate the Scientific Council protocols as specified in NAFO SCS Doc. 00/23 and as adopted by the Fisheries Commission in September 2000. Specifically, that Section 3.d of the Conservation and Enforcement Measures Part VI, Program for Observers and Satellite Tracking be amended to be consistent with the requirements of SCS Doc. 00/23 in that set-by-set information shall be available to any Contracting Party that requests it.*
- *the development of a training and operation manual for the collection of scientific data in the Observer Program and Satellite Tracking continue, and that the Scientific Council be represented at the September 2002 STACTIC Meeting to further pursue this issue.*
- *the Observer Program Access database developed by Canada be adapted by the NAFO Secretariat to capture data collected under the NAFO Program for Observers and Satellite Tracking, with highest priority given to inclusion of current data and secondary priority given to capturing the historic data.*
- *the Secretariat conduct a trial converting 2002 fishery data from the Observer Program to the Access electronic database with a view to establishing a budget for further conversion of observer data.*

7. **Other Matters**

d) **Research Activities** (page 90)

- *in future years the Secretariat compile the reports of research activities as a working document for the June Meeting, and that it then be presented to STACREC as a SCS document at its September Meeting.*

f) **Other Business** (page 90)

- *Contracting Parties report the catches of wolffish by species, and the STATLANT questionnaires be modified to distinguish between the spotted wolffish (*Anarhichas minor*), Northern wolffish (*A.**

denticulatus) and the striped or Atlantic wolffish (*A. lupus*) and that the Secretariat inform Contracting Parties of this request (including all necessary information) as soon as possible.

FISHERIES SCIENCE (STACFIS)

A. STOCKS OFF GREENLAND AND IN DAVIS STRAIT

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

Research Recommendations (page 97)

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 2003.*

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

Research Recommendations (page 103)

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

STACFIS **recommended** that *studies of the longline survey in Div. 1A be continued to investigate if the observed variation in CPUE is caused by natural behaviour of the Greenland halibut or if it is due to survey design.*

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.*

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

Research Recommendation (page 107)

STACFIS **recommended** that *studies on maturation and reproduction of demersal redfish in Subarea 1 should be carried out.*

Other Finfish in Subarea 1

Research Recommendations (page 108)

STACFIS **recommended** that *for Subarea 1, the length disaggregated abundance and biomass data for American plaice, Atlantic wolffish, spotted wolffish and thorny skate, derived from the Greenland shrimp/groundfish survey, should be split by recruits and SSB, respectively.*

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

B. STOCKS ON THE FLEMISH CAP

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

Assessment Results (page 122)

STACFIS noted that measures should be taken to reduce significantly the actual proportion of very small

redfish (<12 cm) in the by-catch of the Div. 3M shrimp fishery. In order to assist in developing possible approaches to achieve this, STACFIS **recommended** that *information on the distribution on shrimp and small redfish (<12 cm) be compiled for review during the June 2003 meeting of Scientific Council.*

STACFIS **recommended** that *an update of the Div. 3M redfish by-catch information be compiled on a 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.*

American Plaice (*Hippoglossoides platessoides*) in Division 3M

Future Studies (page 127)

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

C. STOCKS ON THE GRAND BANK

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

Current and Future Studies (page 134)

STACFIS **recommended** that *further studies be carried out to further clarify stock structure of redfish stock of interest to NAFO.*

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

Research survey data (page 147)

STACFIS **recommended** that *these comparative trials between Canada and EU-Spain be continued and that an analysis of the 2001 and 2002 comparative fishing trials results be presented in June 2003.*

Estimation of Parameters (page 152)

STACFIS **recommended** that *further exploration of the ASPIC model with yellowtail flounder data be conducted for 2003, including sensitivity of the model to various indices and to convergence criteria.*

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

Research Recommendation (page 161)

STACFIS **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.*

D. Widely Distributed Stocks

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

Research Recommendation (page 179)

For northern shortfin squid in Subareas 3+4, STACFIS **recommended** that *survey abundance and biomass indices for Subarea 3 be developed from a subset of strata in the Canadian multi-species bottom trawl survey that occurs during September-December.*

Scientific Council Meeting, 16-20 September 2002

PUBLICATIONS (STACPUB)

3. Review of Scientific Publications

b) Status of the 2001 "Deep Sea Fisheries" Symposium Proceedings (page 226)

- STACPUB noted that nearly half of the manuscripts from the Deep-sea Fisheries Symposium are not ready for publication. STACPUB **recommended** that *conveners of the Deep-sea Fisheries Symposium be asked to remind reviewers and authors of manuscripts to complete their work as soon as possible.*

c) Information from the 2002 Elasmobranch Symposium (page 226)

- STACPUB **recommended** that *a summary of the Elasmobranch Symposium and a PowerPoint presentation summarizing the symposium be published on the NAFO website.*

6. Other Matters (page 227)

- STACPUB **recommended** that *an additional agenda item for the 2003 June Meeting should be introduced to review the current requirement of submitting both research document and a manuscript for publication in Symposium Proceedings.*

Scientific Council Meeting, 6-13 November 2002

FISHERIES SCIENCE (STACFIS)

III. STOCK ASSESSMENTS

1. Northern Shrimp (*Pandalus borealis*) in Division 3M

d) Research Recommendations (page 254)

STACIS **recommended** that, for shrimp in Div. 3M:

- *work on age structured population models should be continued.*
- *biological and CPUE data from all fleets fishing for shrimp in the area, be submitted in advance of the 2003 Scientific Council Meeting on shrimp .*
- *a thorough investigation into the methods used to derive a CPUE index for shrimp be conducted and submitted in advance of the 2003 Scientific Council Meeting on shrimp.*

2. Northern Shrimp (*Pandalus borealis*) in Divisions 3L, 3N and 3O

d) Research Recommendations (page 260)

STACFIS **recommended** that, for shrimp in Div. 3LNO:

- *biological and CPUE data from all fleets fishing for shrimp in the area, be submitted in advance of the 2003 Scientific Council Meeting on shrimp.*

3. Northern Shrimp (*Pandalus borealis*) in Subareas 0 and 1

g) Research Recommendations (page 273)

For shrimp in Div. 0A and Subarea 1, STACFIS **recommended** that:

- *sampling of catches by observers – essential for assessing stock age, size and sex composition – be re-established.*
- *annual length-weight relationships be constructed as routine part of survey data analyses.*

4. Northern Shrimp (*Pandalus borealis*) in Denmark Strait and off East Greenland

c) Research Recommendations (page 278)

For shrimp in Denmark Strait and off East Greenland, STACFIS **recommended** that:

- *a survey be conducted, to provide fishery independent data of the stock throughout its range.*
- *sampling of catches by observers – essential for assessing stock age, size and sex composition – be re-established.*