PART A

Scientific Council Meeting, 6-20 June 2002

CONTENTS

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.

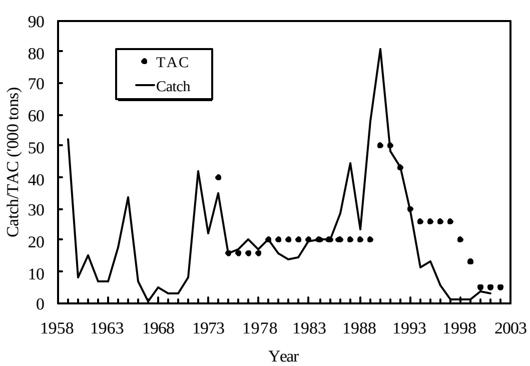
Redfish (Sebastes spp.) in Division 3M

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.

	Catch ('000 tons)		TAC ('000 tons)	
Year	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

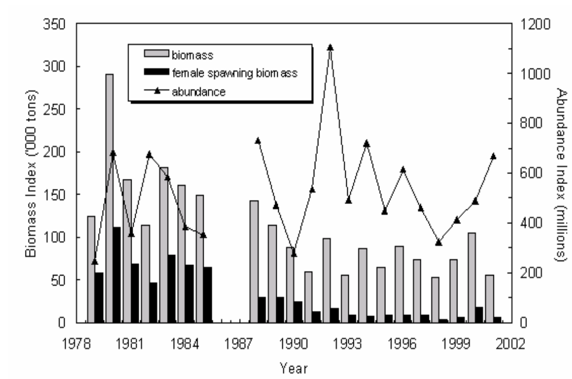
[1] Provisional.



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.

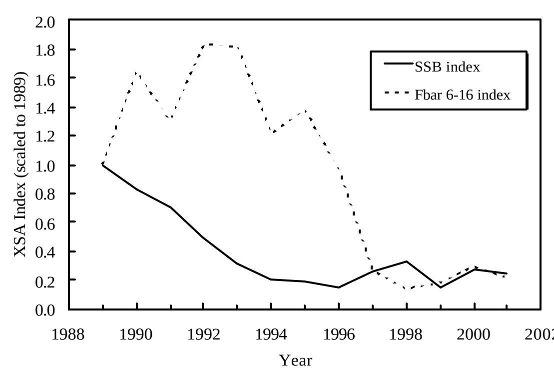
There are three survey series providing bottom biomass indices as well as length and age data for the Flemish Cap redfish stocks; Russia (1983-93, 1995-96 and 2001), EU (1988-2001) and Canada (1979-85 and 1996). The Russian survey was complemented with an acoustic estimate of the redfish pelagic component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

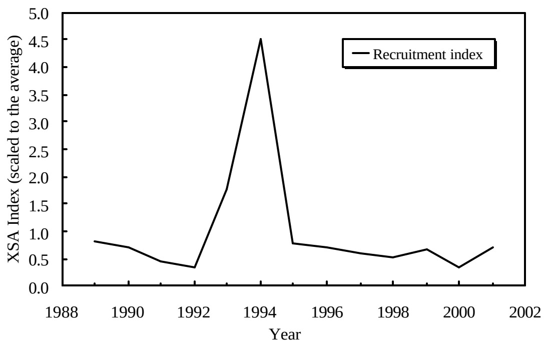


A virtual population analysis (XSA) and a surplus production analysis (ASPIC) were carried out for 1989-2001, providing indicators of stock biomass, female spawning biomass and fishing mortality trends.

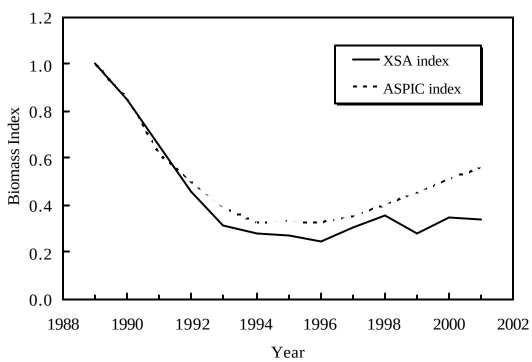
Fishing Mortality: Fishing mortality was at very high levels until 1995 and then has dropped to relatively low levels since 1997.



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



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 bellow 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.

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.

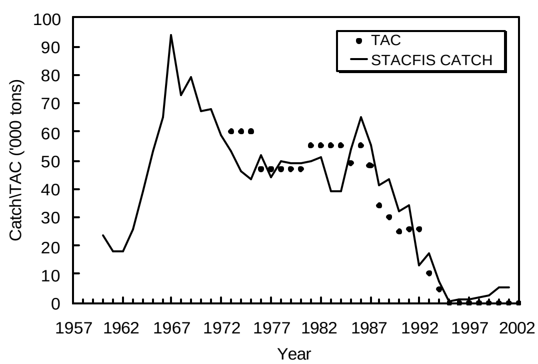
American Plaice (Hippoglossoides platessoides) in Divisions 3L, 3N and 3O

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.

	Catch ('000 tons)		TAC ('000 tons)	
Year	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.

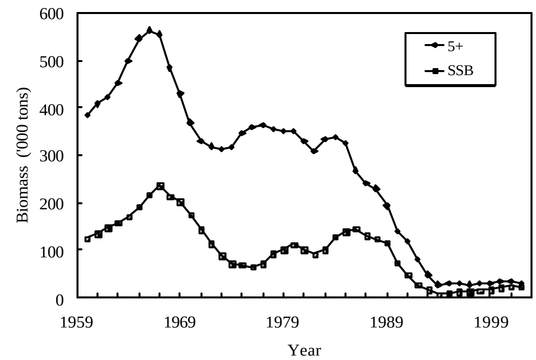


Data: Biomass and abundance data were available from several surveys. Age sampling from Canadian by-catch as well as length sampling from by-catch from Russia, EU-Spain and EU-Portugal was available.

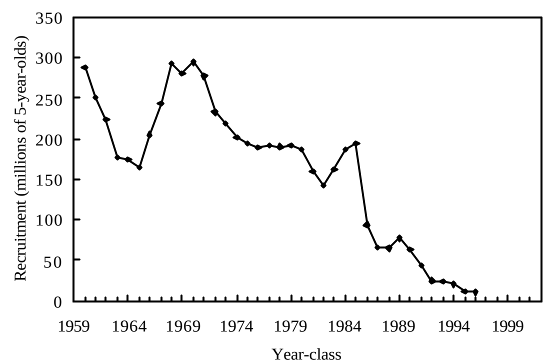
Assessment: An analytical assessment using the ADAPTive framework tuned to the Canadian spring and autumn surveys was used. Natural mortality was assumed to be 0.2 for all ages except from 1989 to 1996 it was assumed to be 0.53.

Biomass: Biomass is very low compared to historic levels.

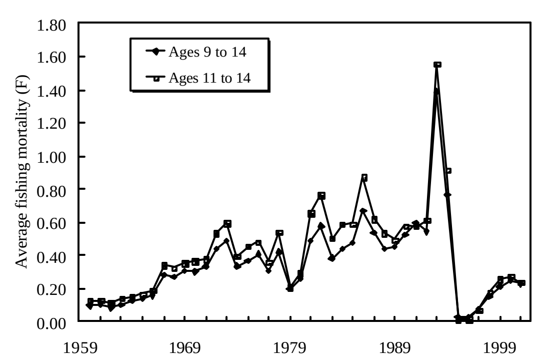
Spawning stock biomass: SSB declined to a very low level in 1994 and 1995. It has increased since then but still remains very low at just over 20 000 tons.



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.



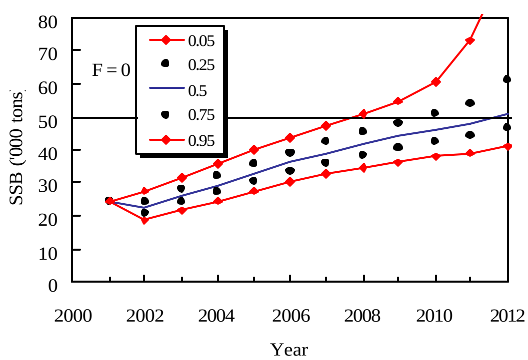
State of the Stock: The stock remains low compared to historic levels.

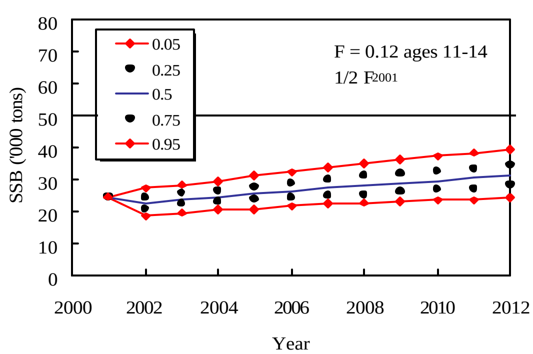
Recommendation: Scientific Council reiterates its recommendation of no directed fishing on American plaice in Div. 3LNO in 2003. By-catches be kept to the lowest possible level.

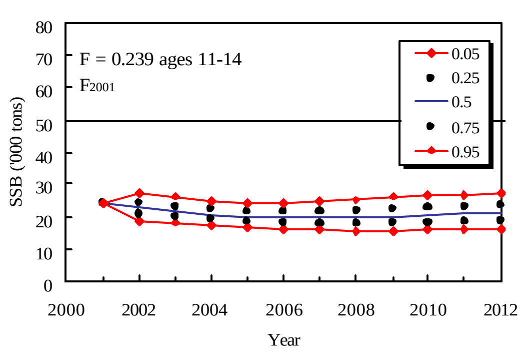
Reference Points: No good recruitment has been estimated for this stock at SSB below 50 000 tons and this could serve as a preliminary B_{lim}.

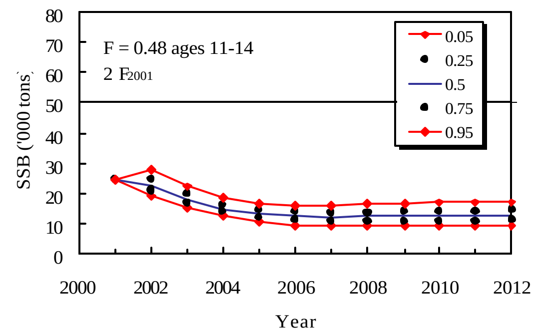
Medium term considerations: Simulations were carried out to compare population trajectories under different levels of by-catch fishing mortality. These simulations take into account the precision of the stock size estimates currently available.

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.

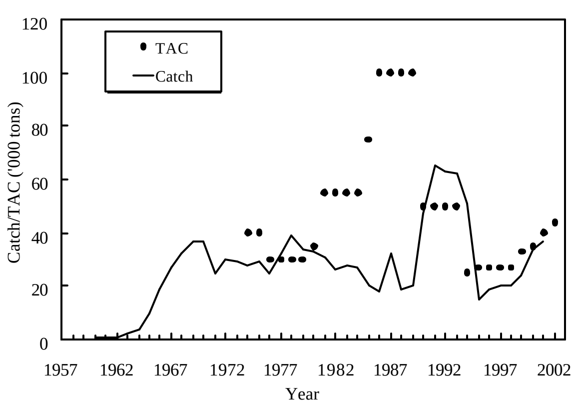
Greenland Halibut (Reinhardtius hippoglossoides) in Subarea 2 and Divisions 3KLMNO

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.

	Catch ('000 tons)		TAC ('000 tons)	
Year	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.

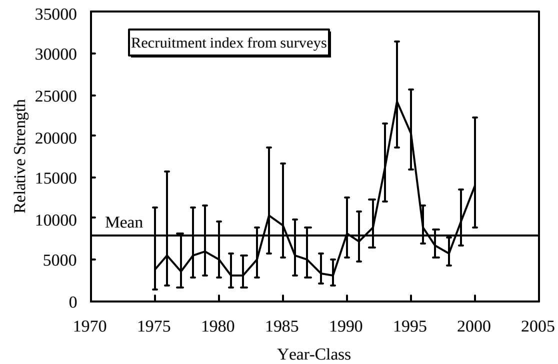


Data: CPUE data were available from international otter trawl fisheries throughout the stock area and the Portuguese otter trawl fishery in the NAFO Regulatory Area of Div. 3LMN. Abundance and biomass indices were available from research vessel surveys of Canada in Div. 2J+3KLMNO (1978-2001), EU in Div. 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.

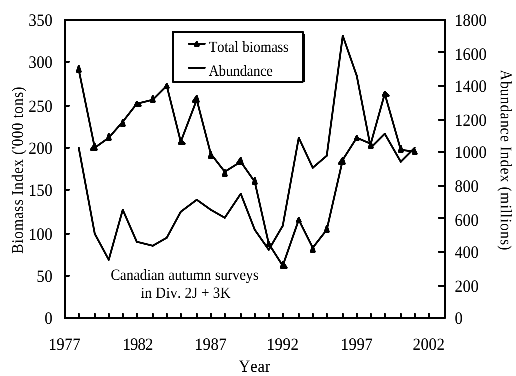
Fishing Mortality: While the absolute estimate of fishing mortality implied from the analysis was uncertain, it indicated that the fishing mortality for 2001 was relatively low in comparison to the early-1990s.

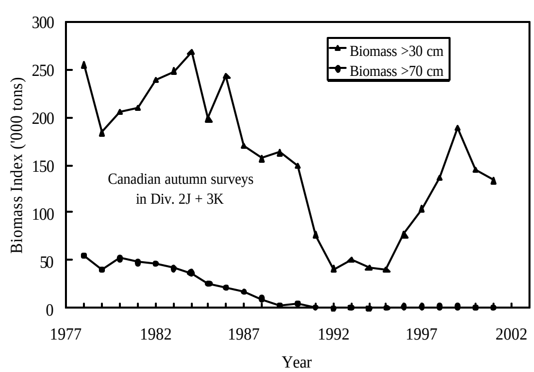
Recruitment: The level of recent recruitments is uncertain because expected strong year-classes did not recruit to the fishery according to the predictions made previously.

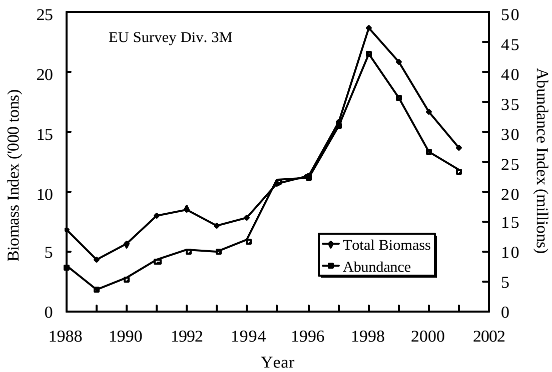


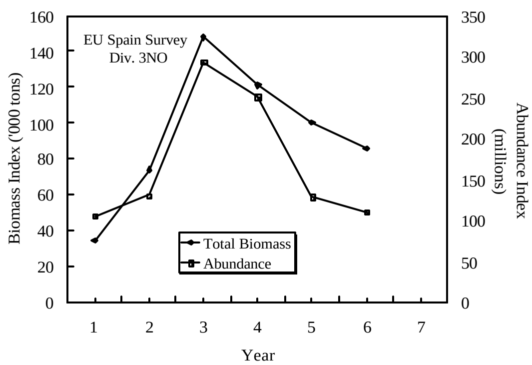
Biomass: As the dynamics of the population remain uncertain, it is not possible to determine an estimate of absolute biomass.

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.

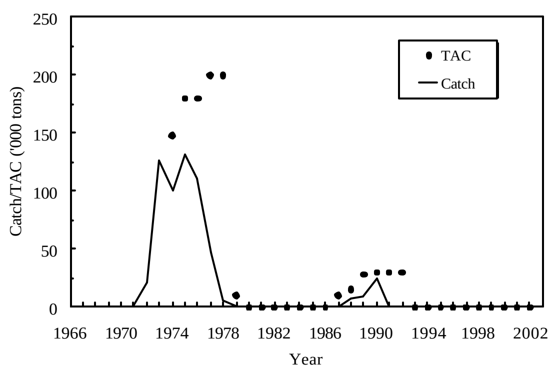
During previous assessments, Scientific Council has noted that fishing effort should be distributed in a similar fashion to biomass distribution in order to ensure sustainability of all spawning components.

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.

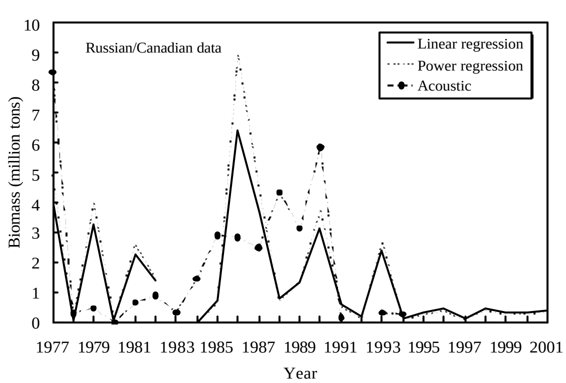
Capelin (Mallotus villosus) in Divisions 3N and 3O

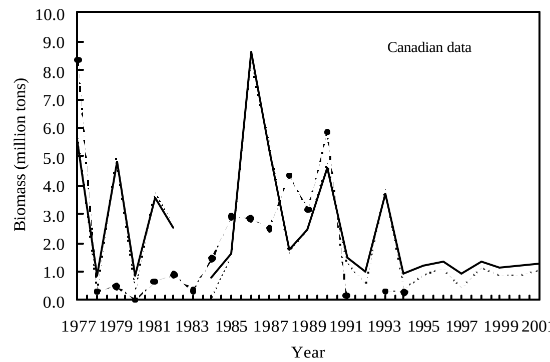
Fishery and catches: There has not been a directed fishery since 1993 when a moratorium was established, and no commercial catches have been reported since then.



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.

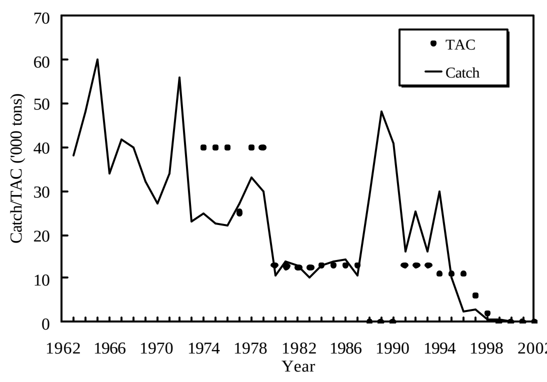
Cod (Gadus morhua) in Division 3M

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.

	Catch ('000 tons)		TAC ('000 tons)	
Year	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.

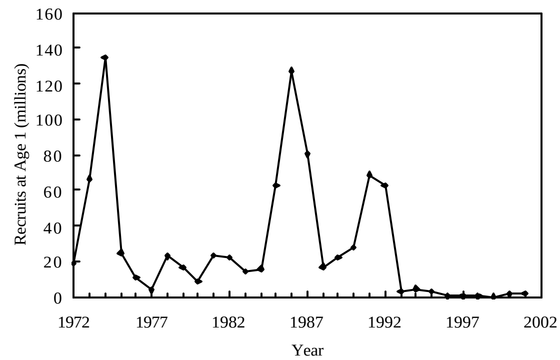


Data: Length and age composition of the 2000 and 2001 by-catches were available for Portuguese trawlers. Data were also available from the EU bottom-trawl and the Russian trawl surveys, both covering the whole distribution area of the stock.

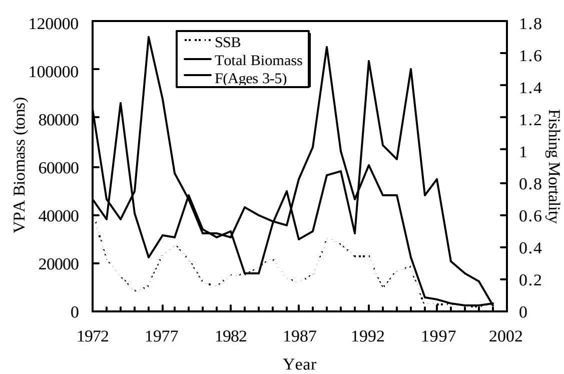
Assessment: An analytical assessment was presented. However, the analysis is strongly dependent on survey results at the current low levels of the commercial fishery.

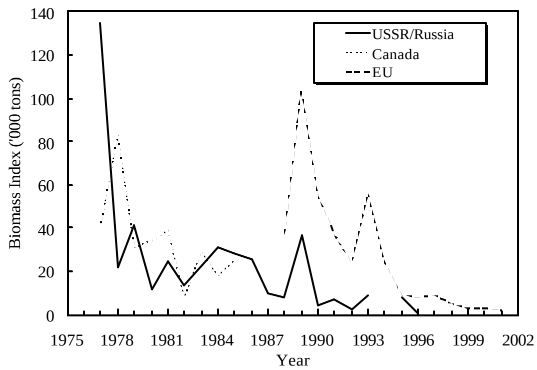
Fishing Mortality: The low fishing mortality since 1998 is consistent with the implementation of a moratorium on directed fishing in recent years.

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.

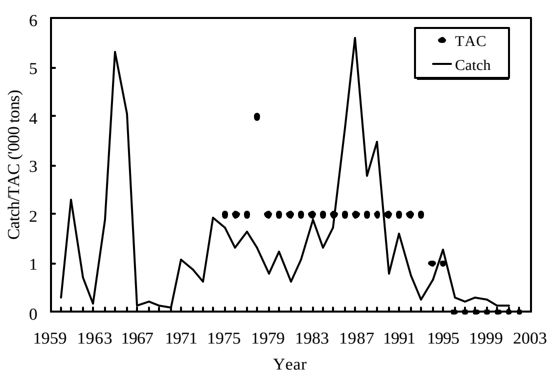
American Plaice (Hippoglossoides platessoides) in Division 3M

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.

	Catch ('000 tons)		TAC ('000 tons)	
Year	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.

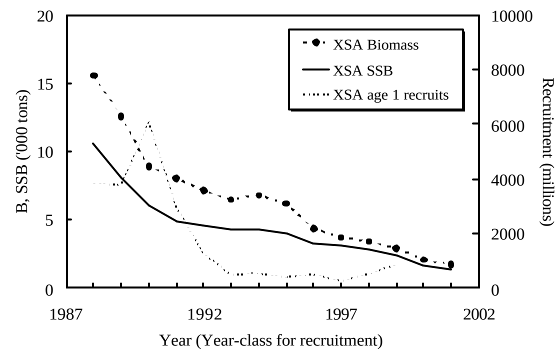


Data: Length compositions were available from the 1988 to 2001 fisheries. Abundance and biomass from surveys were available from USSR/Russia (1972-2001), EU (1988-2001) and Canada (1978-1996). Age-length keys were available from EU (1988-2001).

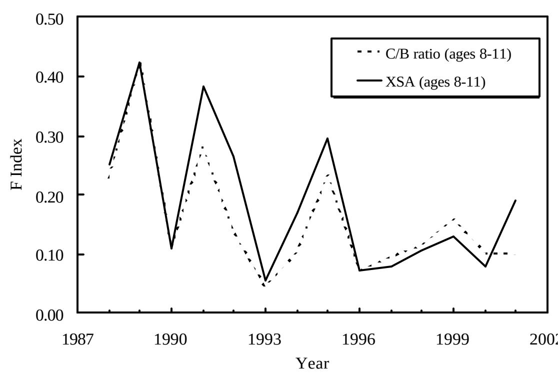
Assessment: An analytical assessment (XSA) was presented.

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.



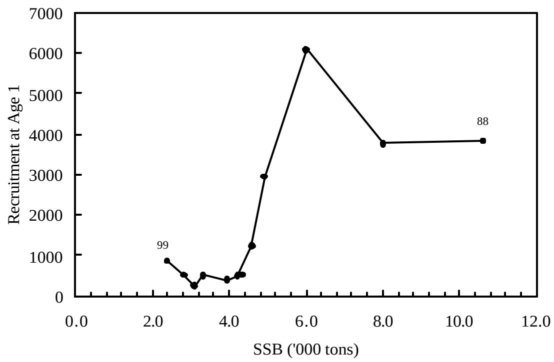
Fishing Mortality: The ratio of catch biomass to EU survey biomass (F index) and XSA fishing mortality declined from the mid-1980s to the mid-1990s, and fluctuated between 0.1 and 0.2 since 1996. F in 2001 estimated by XSA is at the level of the assumed natural mortality.



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.

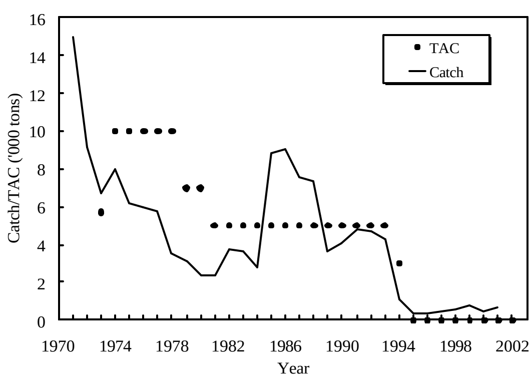
Witch Flounder (Glyptocephalus cynoglossus) in Divisions 3N and 3O

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.

	Catch ('000 tons)		TAC ('000 tons)	
Year	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

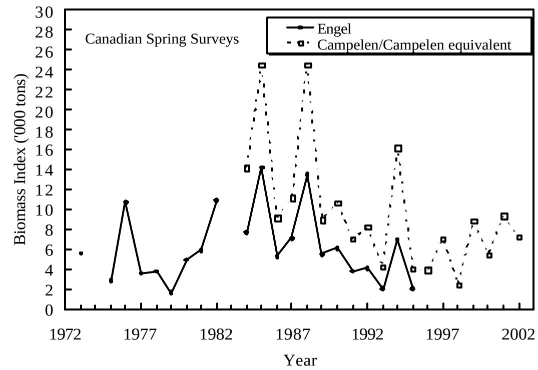
[1] Provisional.
ndf No directed fishing.



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.

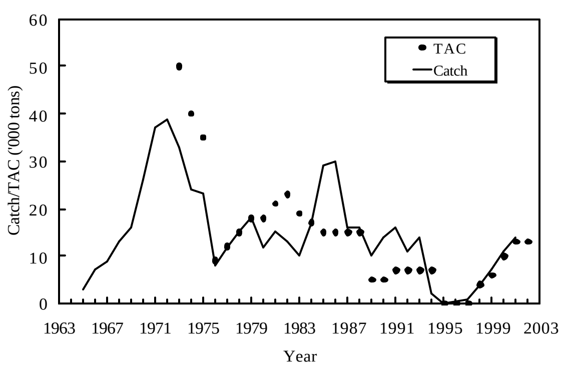
Yellowtail Flounder (Limanda ferruginea) in Divisions 3L, 3N and 3O

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.

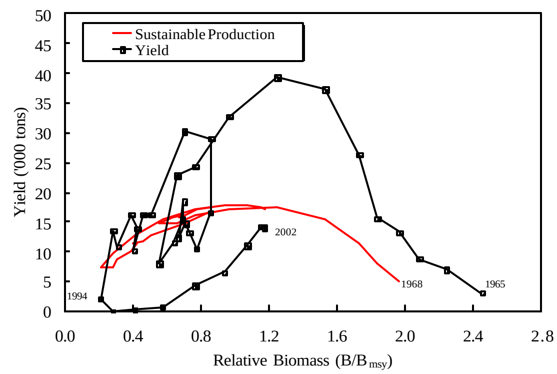
	Catch ('000 tons)		TAC ('000 tons)	
Year	STACFIS	21A	Recommended	Agreed
1999	7	7	6	6
2000	11	11[1]	10	10
2001	14	13[1]	13	13
2002				13

[1] Provisional.

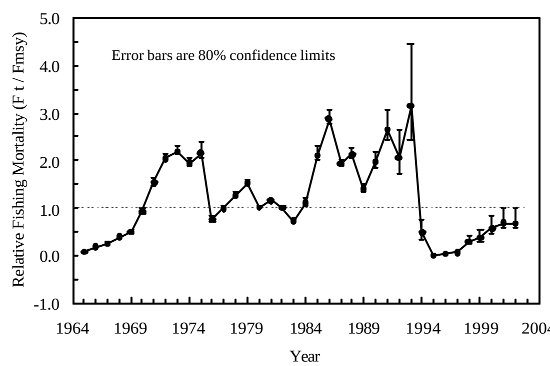


Data: CPUE from Canadian trawlers were available from 1965 to 2001. For 2001, length frequency data from the Canadian fishery, and from by-catches of Russian, Portuguese and Spanish trawlers were available. Abundance and biomass indices were available from: annual Canadian spring (1971-82; 1984-2001) 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).

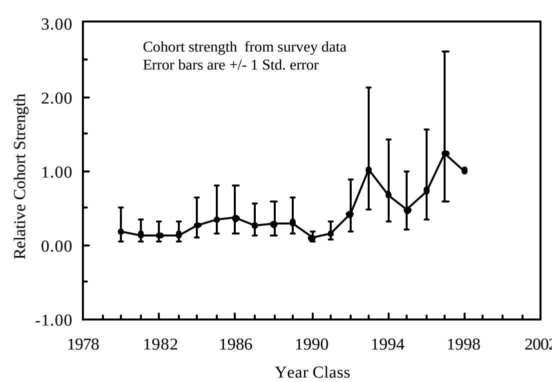
Assessment: An analytical assessment using a stock production model was presented to estimate stock status in 2002. Since the moratorium (1994-97), the estimated yield has been below sustainable production levels.



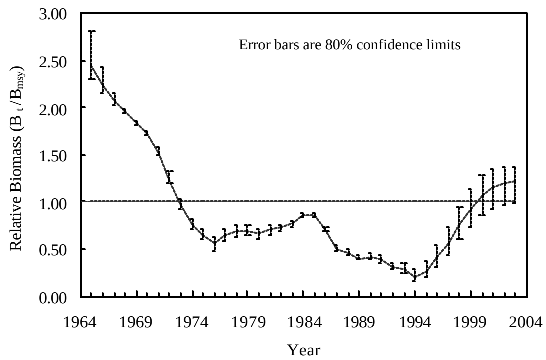
Fishing Mortality: Has been below F_{msy} since 1994 and is projected to be 68% of F_{msy} in 2002 with an assumed catch of 14 300 tons (TAC + 10% over-run).



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.

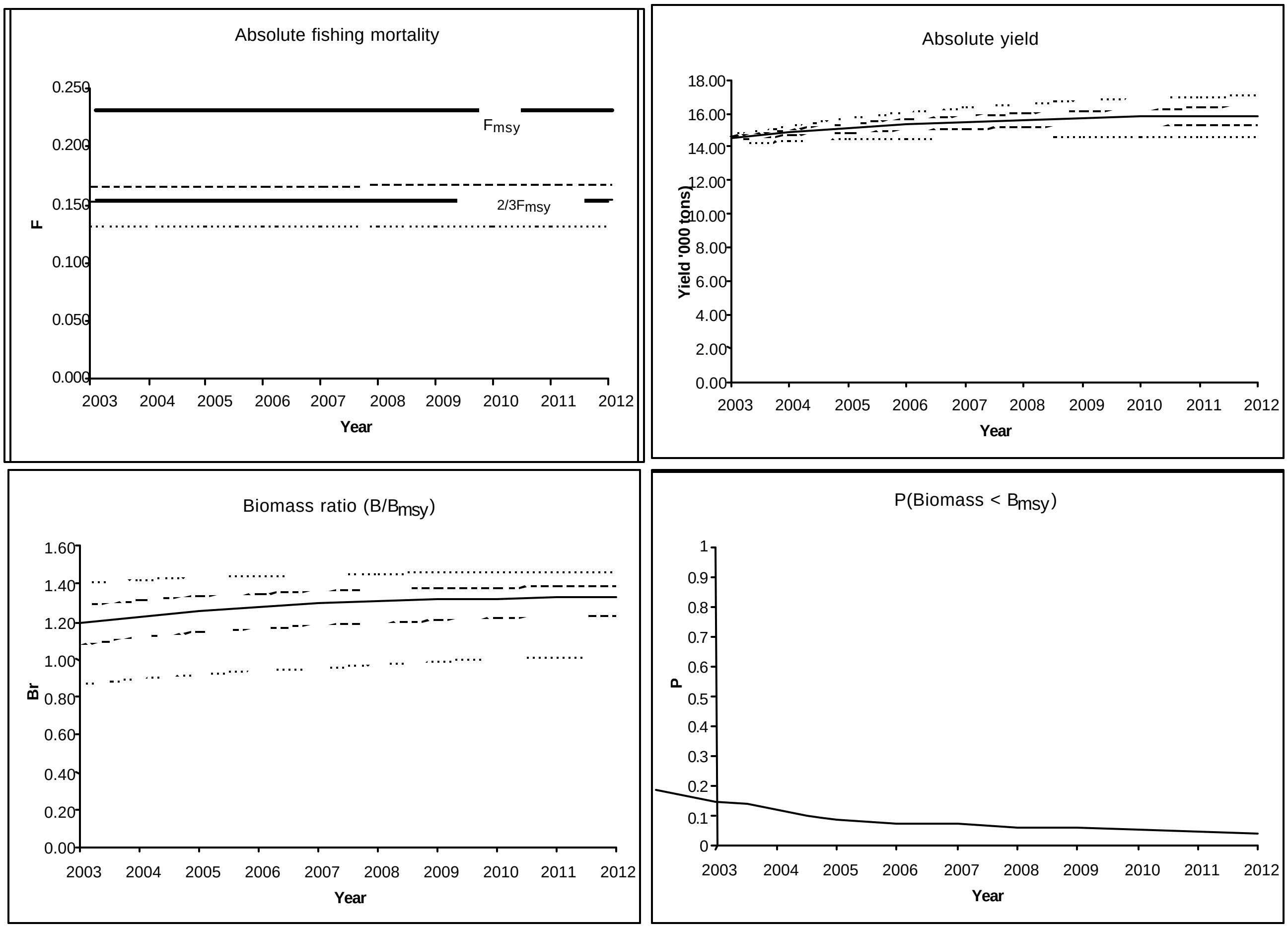
Reference Points: Scientific Council considered 2/3 F_{msy} to be a fishing mortality target.

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.



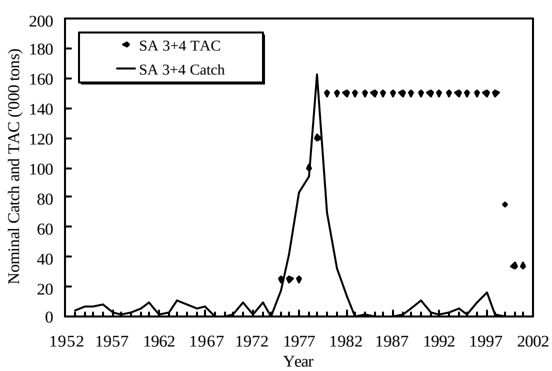
Northern Shortfin Squid (Illex illecebrosus) in Subareas 3 and 4

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.

	Catch ('000 tons)		TAC ('000 tons)	
Year	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

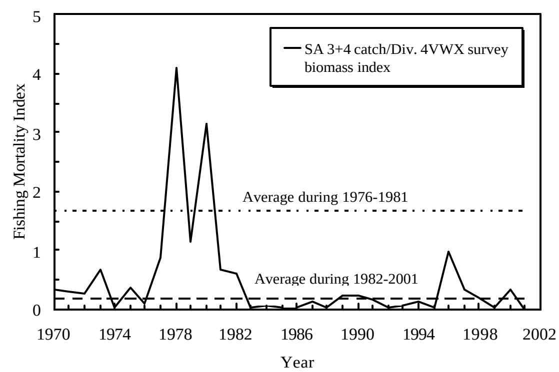
[1] Provisional.



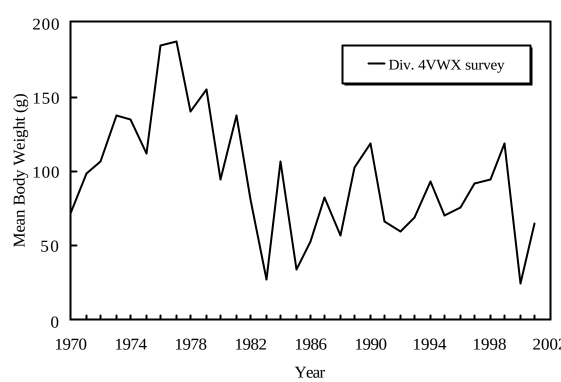
Data: Relative biomass and abundance indices were available from annual Canadian bottom trawl surveys conducted in Subarea 4 in July on the Scotian Shelf (Div. 4VWX, 1970-2001) and in September in the southern Gulf of St. Lawrence (Div. 4T, 1971-2001). The July survey indices are assumed to reflect relative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

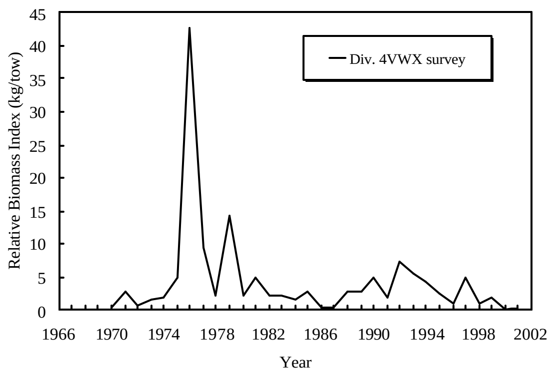
Fishing Mortality: Fishing mortality indices were highest during 1978-1980 and averaged 1.67 during the period of highest catch (1976-1981). During 1982-2001, fishing mortality indices were much lower and averaged 0.18.



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 3-6 (and further south to Florida) are considered to comprise a unit stock, and that the current assessment only applies to part of the area.

The 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 it's 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.

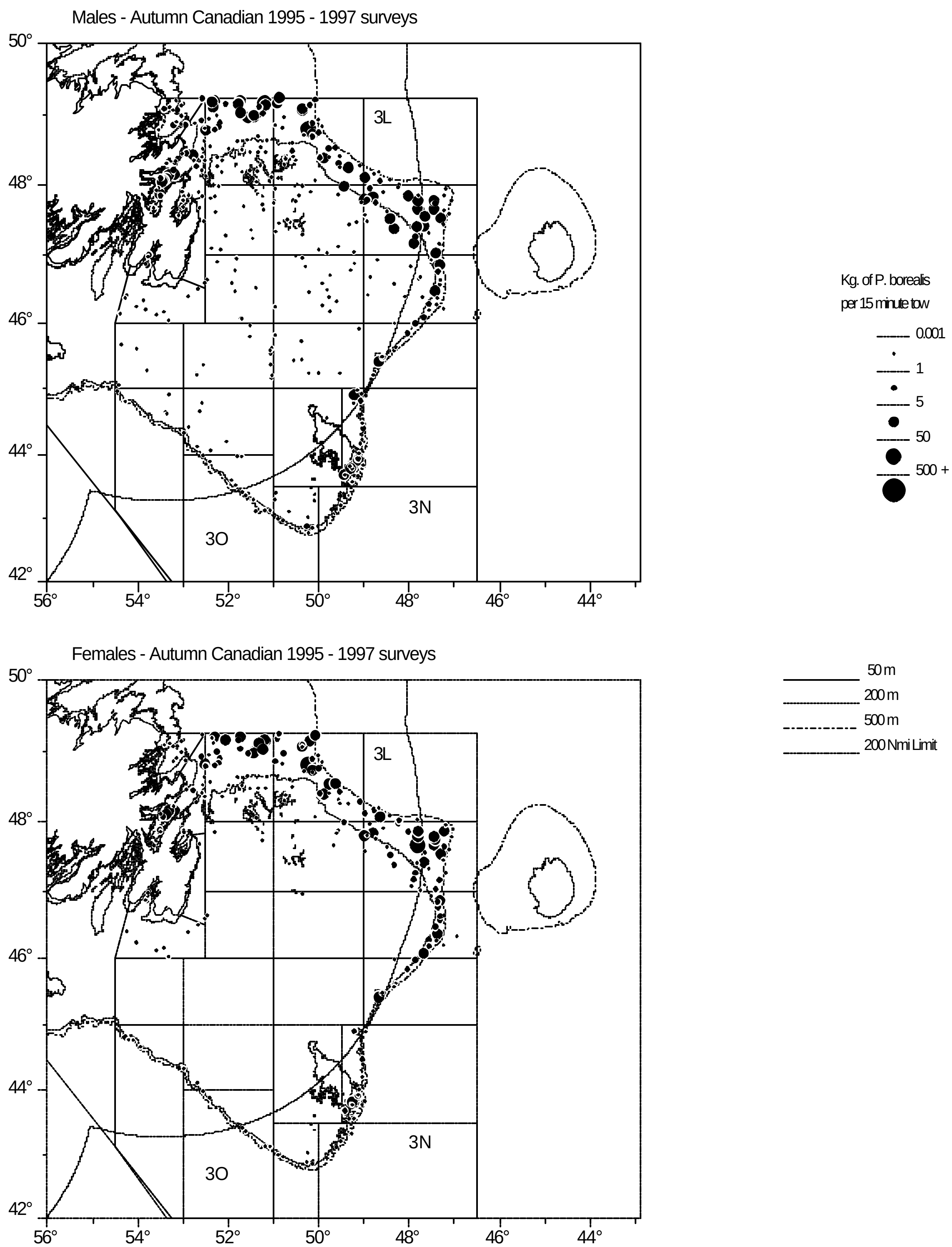


Fig. 1. Catches of male and female *P. borealis* obtained by autumn Canadian bottom trawl surveys into NAFO Div. 3LNO over 1995-1997.

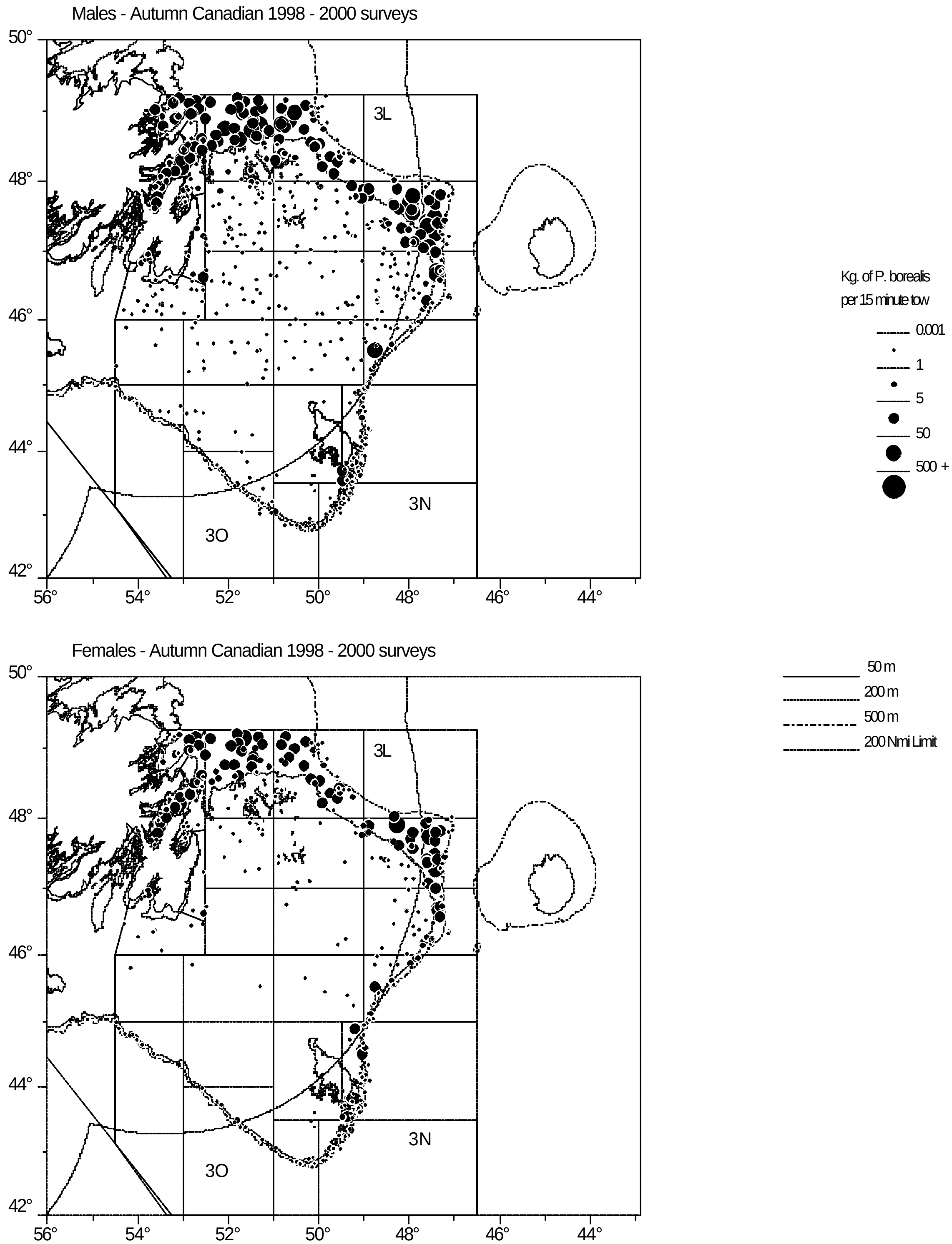


Fig. 2. Catches of male and female *P. borealis* obtained by autumn Canadian bottom trawl surveys in NAFO Div. 3LNO over 1999-2000.

Distribution by age group

Northern shrimp carapace length distributions in the NRA portion of Div. 3L were similarto 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.

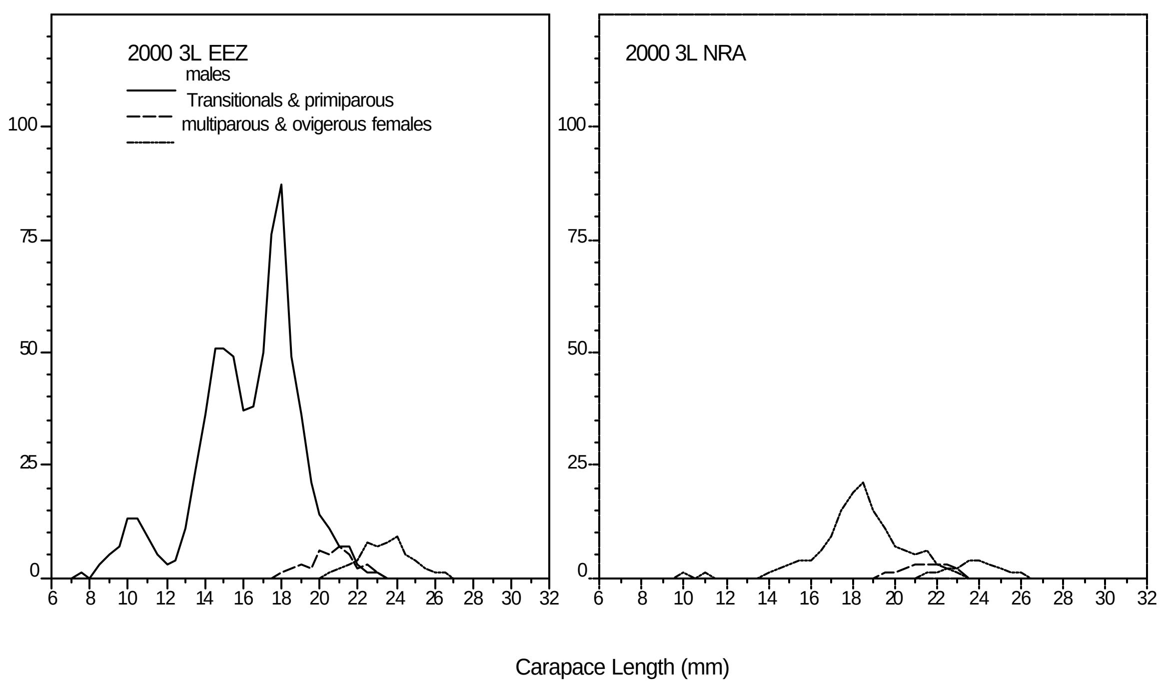


Fig. 3. *P. borealis* length frequencies illustrating similarities between shrimp within Div. 3L and those in the NRA.

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).

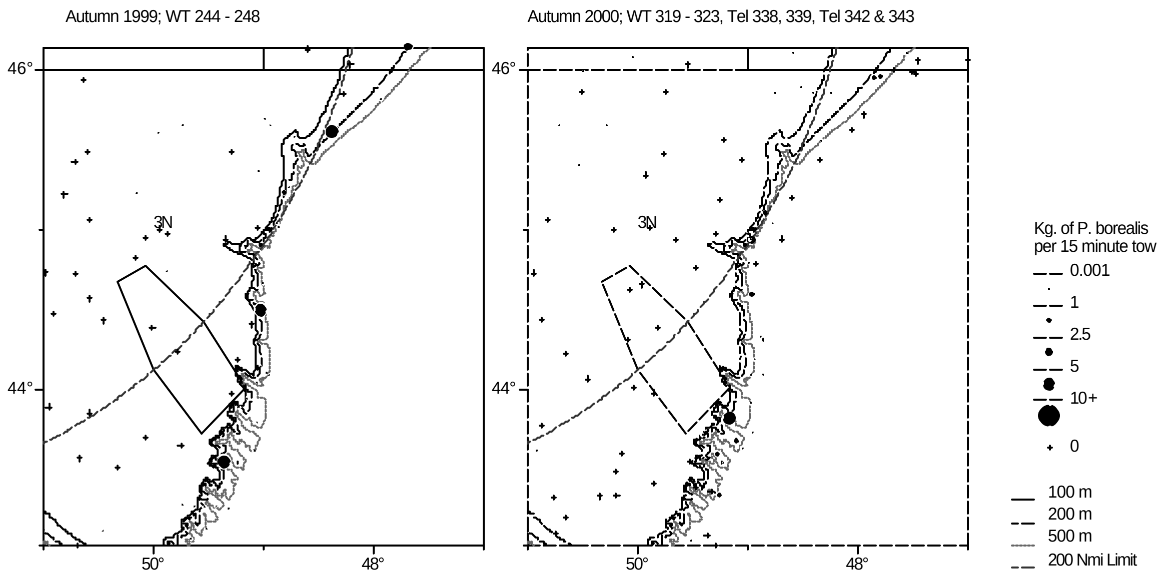


Fig. 4. Catches of Northern shrimp within the area defined within FC Working Paper 02/10 collected during autumn 1999 and 2000 Canadian research surveys.

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 (<= 40cm) 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:

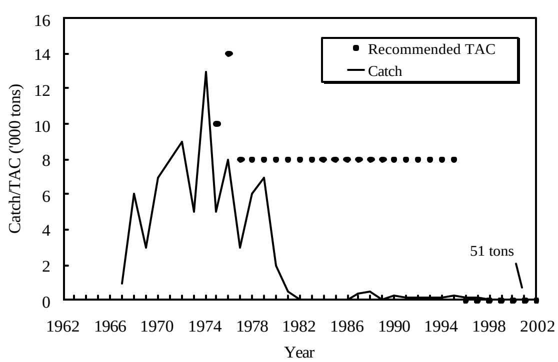
Roundnose Grenadier (Coryphaenoides rupestris) in Subareas 0 and 1

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*).

	Catch ('000 tons)		TAC ('000 tons)	
Year	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.

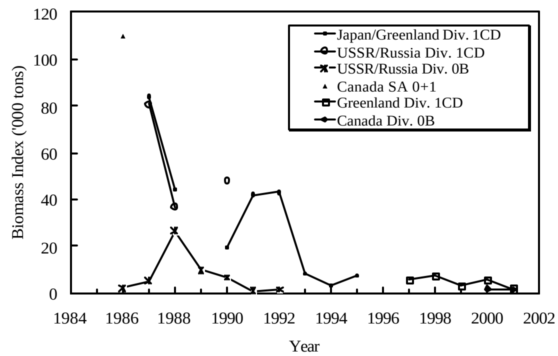


Data: Biomass estimates of roundnose grenadier from surveys in Div. 0B during the period 1986-92, from Div. 1CD during the period 1987-95, from Div. 1CD in 1997-2001 and Div. 0B in 2000-2001 were available.

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.

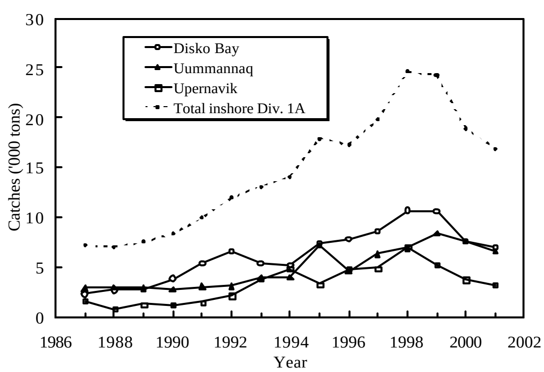
Greenland Halibut (Reinhardtius hippoglossoides) in Division 1A inshore

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.

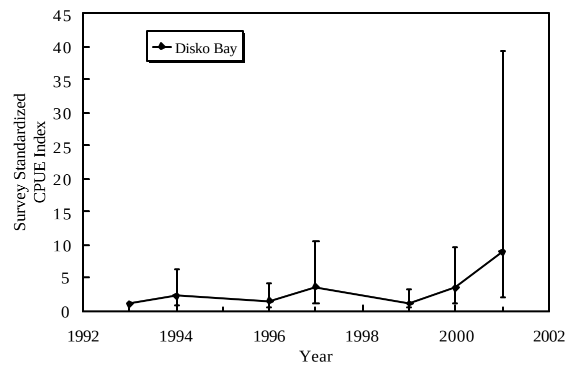
		Catch ('000 tons)	TAC ('000 tons)
	Year	STACFIS	Recommended
Disko Bay	1999	10.6	7.9
	2000	7.6[1, 2]	7.9
	2001	7.0[1]	7.9
	2002		7.9
Uummannaq	1999	8.4	6.0
	2000	7.6[1, 2]	6.0
	2001	6.6[1]	6.0
	2002		6.0
Upernavik	1999	5.3	4.3
	2000	3.8[1, 2]	4.3
	2001	3.2[1]	4.3
	2002		4.3

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

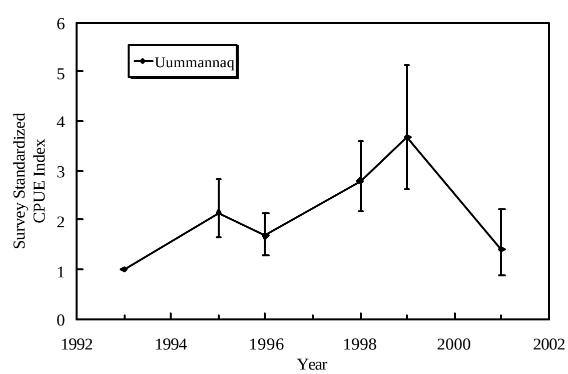


Data: Catch-at-age data were available for years 1988-2001 at Disko Bay, and for most years in this period at Uummannaq and Upernavik. Data on length frequency in commercial catches were available. A recruitment index for age 1 was available from trawl survey. Catch rates and length frequency were available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

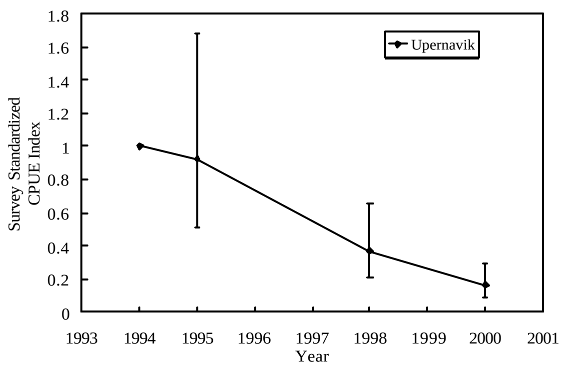
Assessment: *Disko Bay:* Survey results from 1993 onwards do not indicate any major changes in abundance, except for the year 2001, when the abundance-index was remarkably higher, although estimated with uncertainty. Length composition in the survey data indicated above average recruiting year-classes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

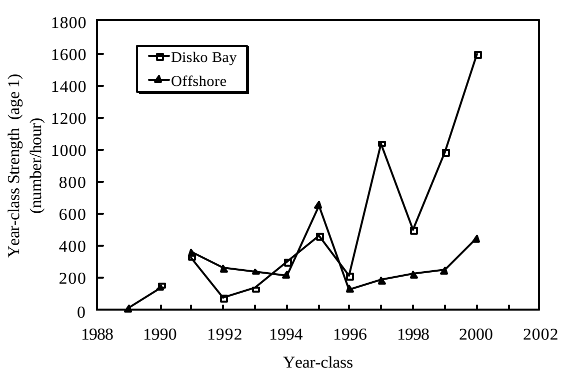


Upernavik: Survey results from 1993 onwards indicate a steady and significant decline in abundance. Mean length in both commercial and survey catches have decreased, most significantly in the winter fishery. In the traditional fishing grounds at Upernavik up to 73°45'N younger and fewer age groups are 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 Ummannaq 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.

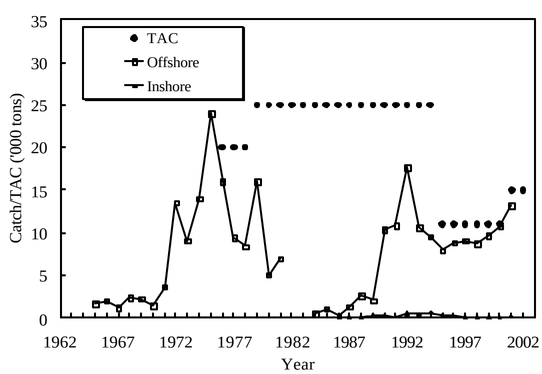
Greenland Halibut (Reinhardtius hippoglossoides) in Subarea 0 + Division 1A Offshore and Divisions 1B-1F

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.

	Catch ('000 tons)		TAC ('000 tons)	
Year	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.

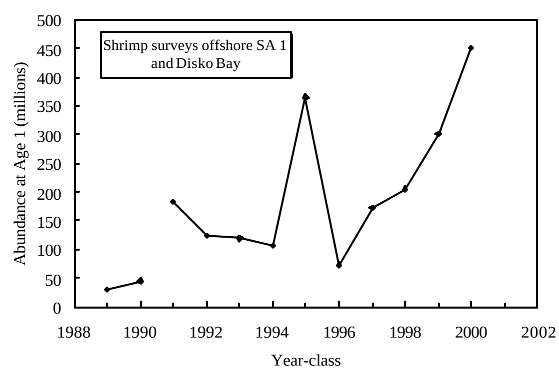


Data: Catch-at-age data were available for assessment from SA 0 and Div. 1CD. Standardized and unstandardized catch rates were available from Div. 0A and 1CD. Biomass estimates were available from surveys in Div. 0A, 0B, 1AB and 1CD. Recruitment data were available from surveys in Div. 1A-1F from 1989-2001.

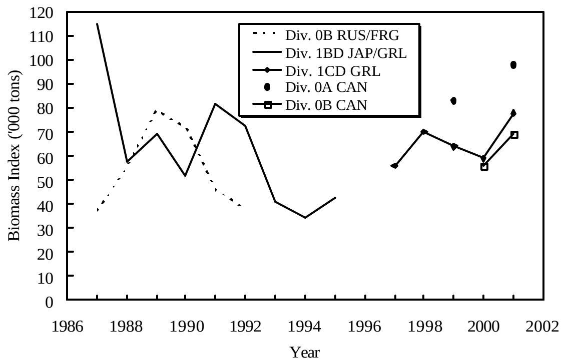
Assessment: No analytical assessment could be performed. Combined standardized catch rates for SA 0 + Div. 1CD during 1990-2000 and standardized catch rates from Div. 1CD during 1990-2001 have been stable.

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 at 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).

Gesotrophic 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 preformed in the Flemish Cap, were used to estimate geostrophic circulation over the bank and the heat flux across 47ºN. 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 ~0.07 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 ~0.03 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 km^3 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 the1960s. 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 themosalinographs 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 ($T>3^{o}C$; $S>34.5$) is found at the surface only at the outermost stations on the Cape Farewell Section. The 2001 temperature value ($1.74^{o}C$) is slightly above the average value of $1.67^{o}C$ 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 ($T\sim4.5^{o}C$, $S>34.95$) 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 ($3.5^{o}C<T<4.5^{o}C$; $34.5<S<34.88$) 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 3.5ºC 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 >4ºC). From 120 m to the bottom, all around the Cap, temperatures increase to 4ºC 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 lead 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^{o}C in October. Bottom temperatures at Station 27 were above normal (by ~0.5^{o}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^{o}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 Bonavista 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 hypothsized 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 complied 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).

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

Table 3. Continued.

Stock	Country[1]	Catch	CPUE	Sex	Length	Age	Individual Wt.	Maturity
		Biological Sampling						
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	+						
	RUS	+		+	+			
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.

		Biological Sampling						
Stock	Country[1]	Catch	CPUE	Sex	Length	Age	Individual Wt.	Maturity
SA 2+3 Greenland 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 *Temora longicornis*	-
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	1-11Oct
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	8-17Jan
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 Menduíña* (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 Menduíña* 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 Menduíña* which performed the bottom trawl. So, a comparative study was developed to transform the historical series of the C/V *Playa de Menduíña* (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.

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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.

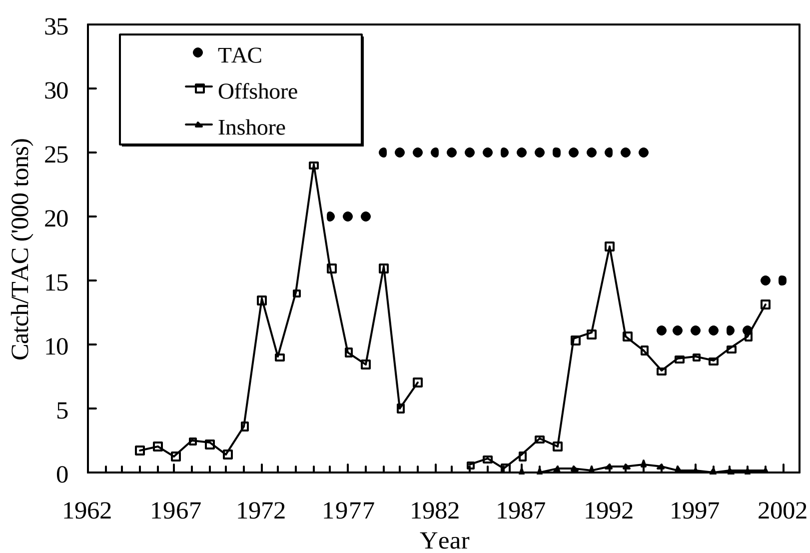


Fig. 1.1. Greenland halibut in Subareas 0+1 (excluding Div. 1A inshore): catches and TACs.

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, gilnetters 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.

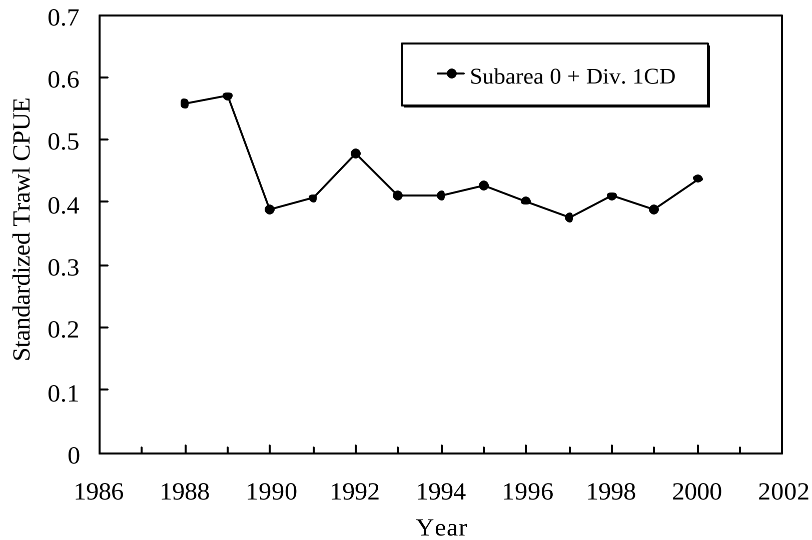


Fig. 1.2. Greenland halibut in Subareas 0+1 (excluding Div. 1A inshore): combined standardized trawl CPUE from SA 0 and Div. 1CD.

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 to1500 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:

	Canada		USSR(Russia)/GDR(FRG)		Japan/Greenland		Greenland		Total
Year	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.

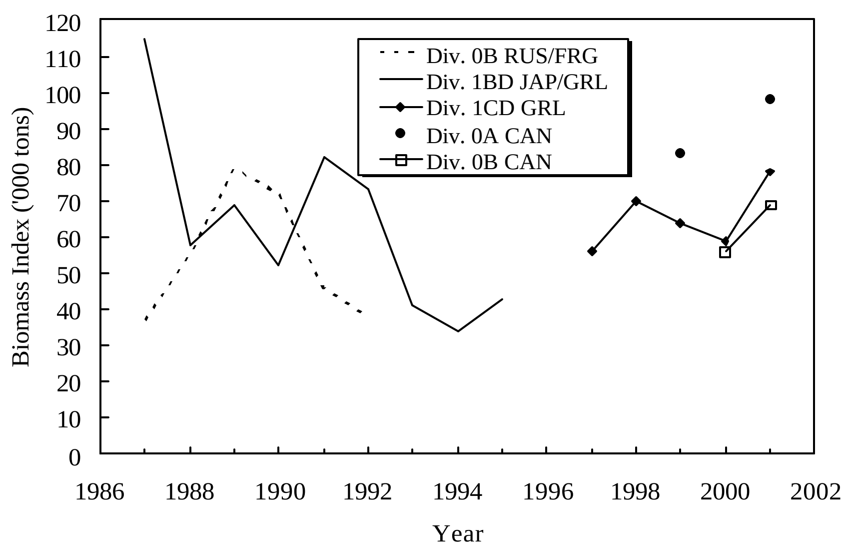


Fig. 1.3. Greenland halibut in Subareas 0+1 (excluding Div. 1A inshore): biomass estimates from surveys.

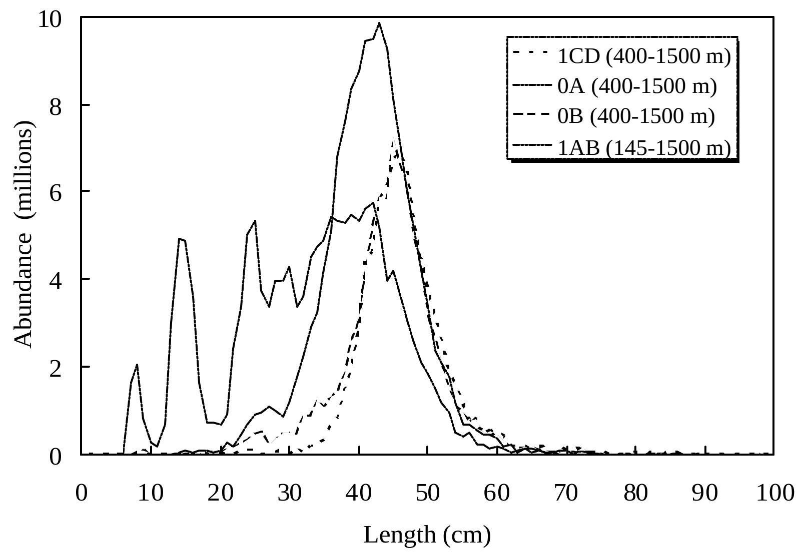


Fig. 1.4. Greenland halibut in Subareas 0+1: length composition from Div. 0A, Div. 0B and Div. 1CD (400-1500 m), and Div. 1AB (145-1 500 m) in 2001.

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).

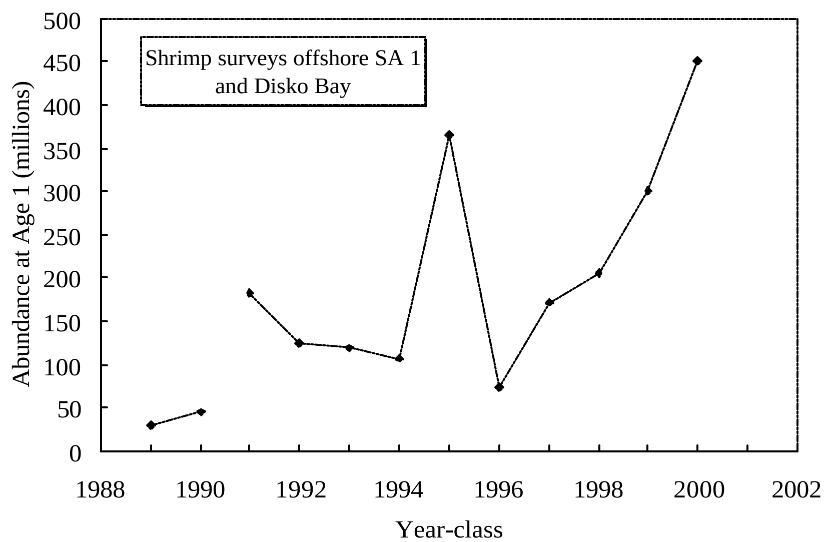


Fig. 1.5. Greenland halibut in Subareas 0+1: recruitment index at age 1 in Subarea 1 derived from the Greenland shrimp trawl surveys. Note that the survey coverage was not complete in 1989 and 1990.

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 northem 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.

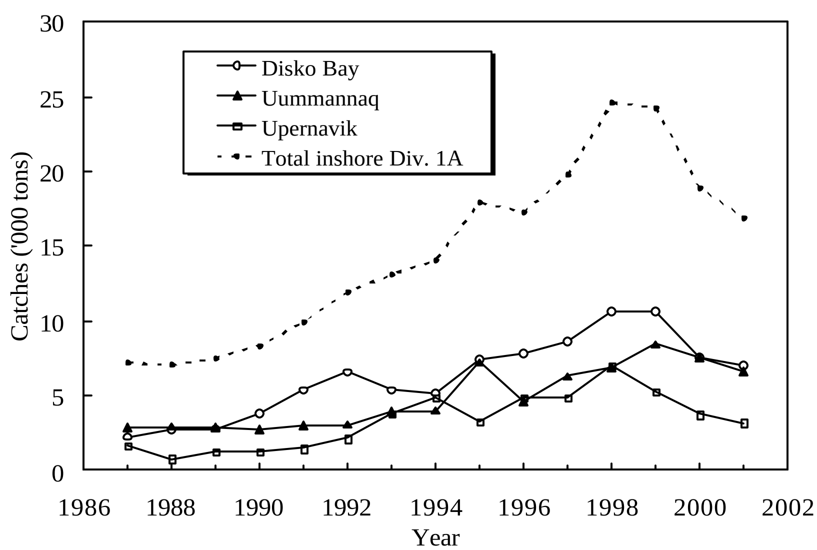


Fig. 2.1. Greenland halibut in Div. 1A: catches by area.

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 Itividup 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).

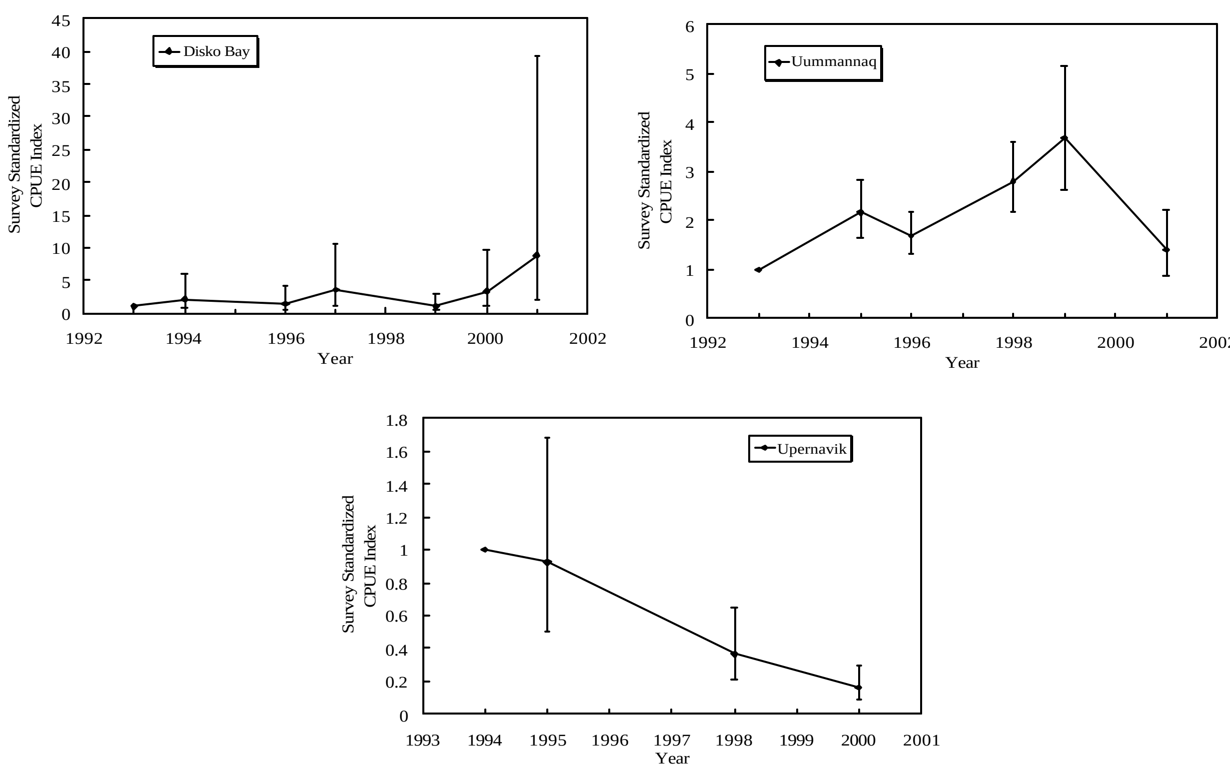


Fig. 2.2 Greenland halibut in Div. 1A: standardized and relativized CPUE index from longline surveys conducted in Div. 1A inshore areas.

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 thes e 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.

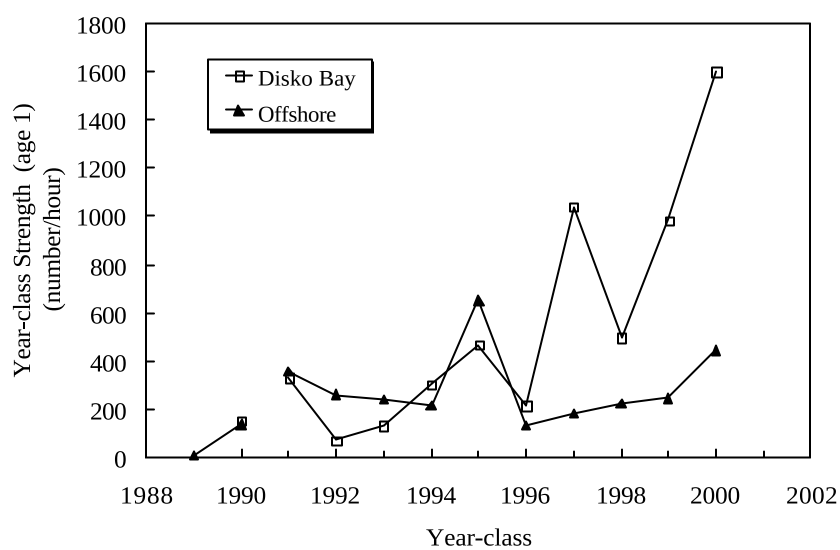


Fig. 2.3. Greenland halibut in Div. 1A: recruitment at age 1 on nursery grounds.

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: 14[2] tons, 24[3] tons, 30[4] tons, 28[5] tons, 3[6] tons.
ndf No directed fishing.

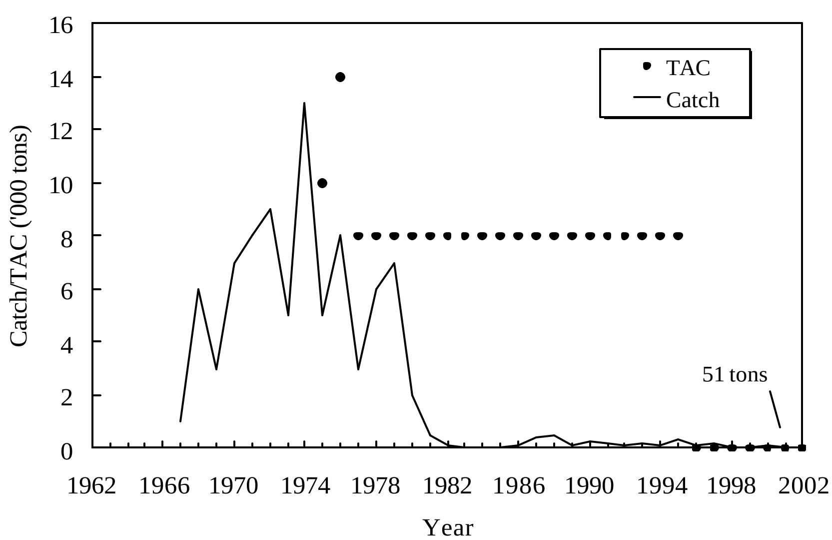


Fig. 3.1. Roundnose grenadier in Subareas 0+1: catches and recommended TACs.

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.

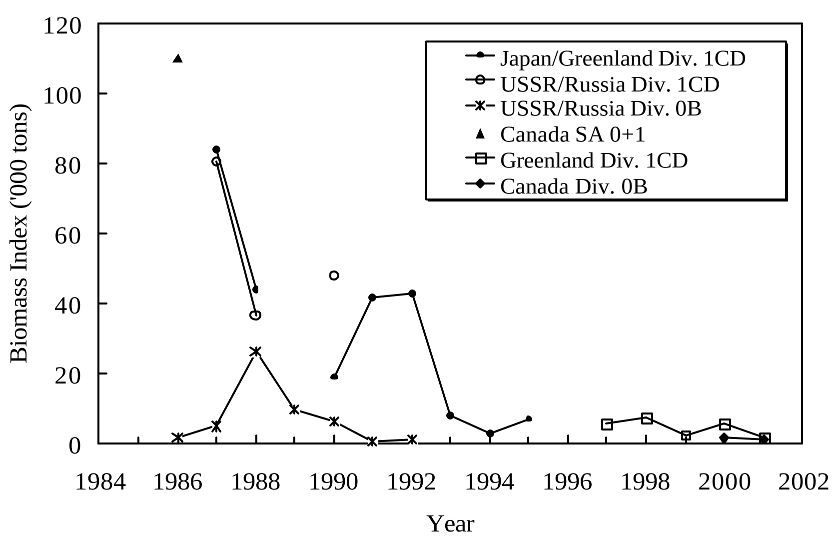


Fig. 3.2. Roundnose grenadier in Subareas 0+1: biomass estimates from USSR/Russian, Japan/Greenland and Greenland surveys in Div. 0B and Div. 1CD.

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.

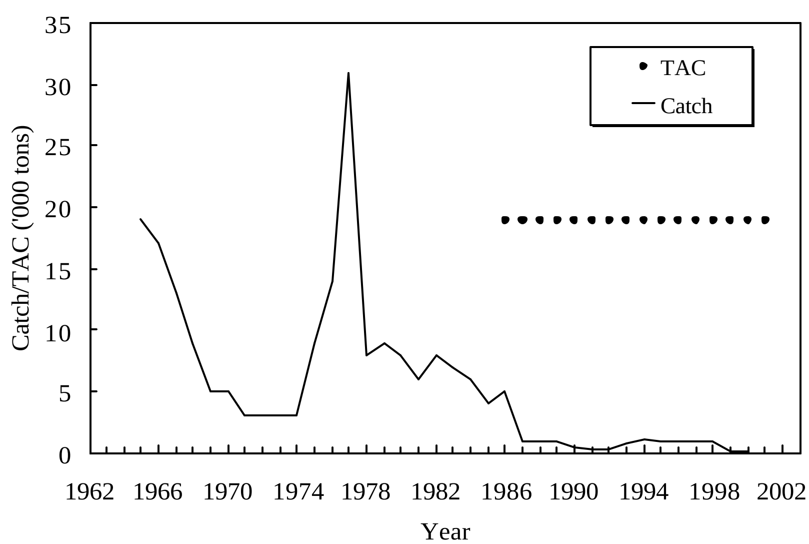


Fig. 4.1. Redfish in Subarea 1: catches and recommended TAC.

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.

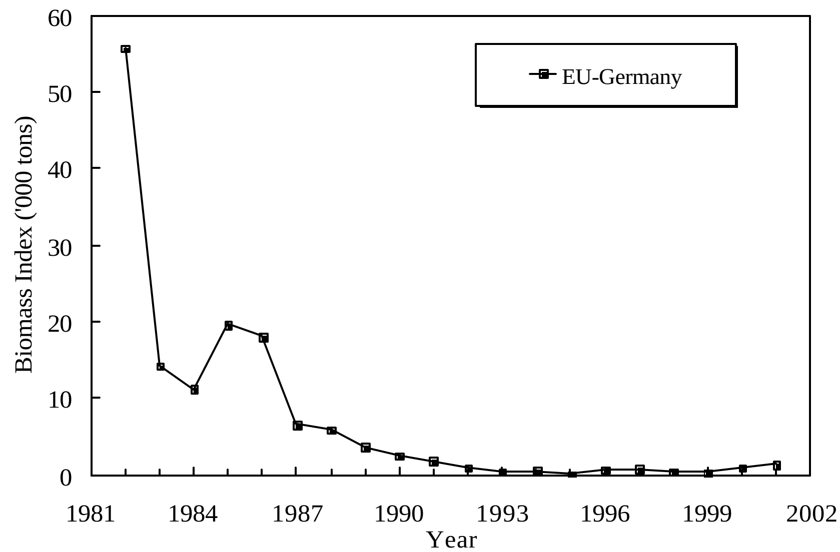


Fig. 4.2. Golden redfish in Subarea 1: survey biomass index

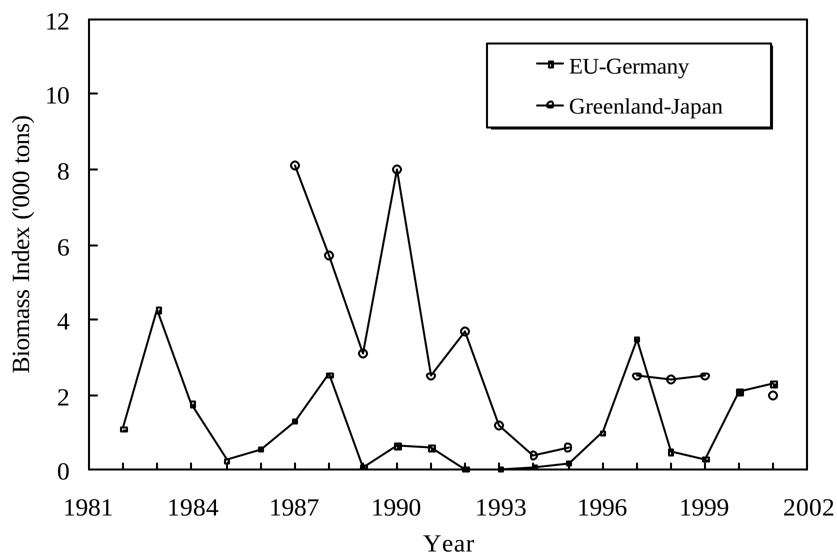


Fig. 4.3. Deep-sea redfish in Subarea 1: survey biomass index

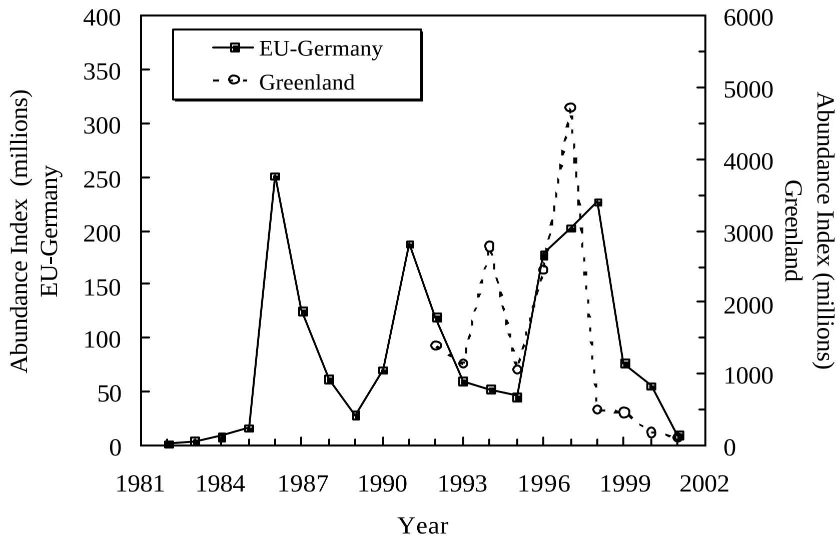


Fig. 4.4. Juvenile redfish (<17 cm) (deep-sea redfish and golden redfish combined) in Subarea 1: survey abundance indices. The Greenland survey data include the entire length range, but very few fish >16 cm.

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.

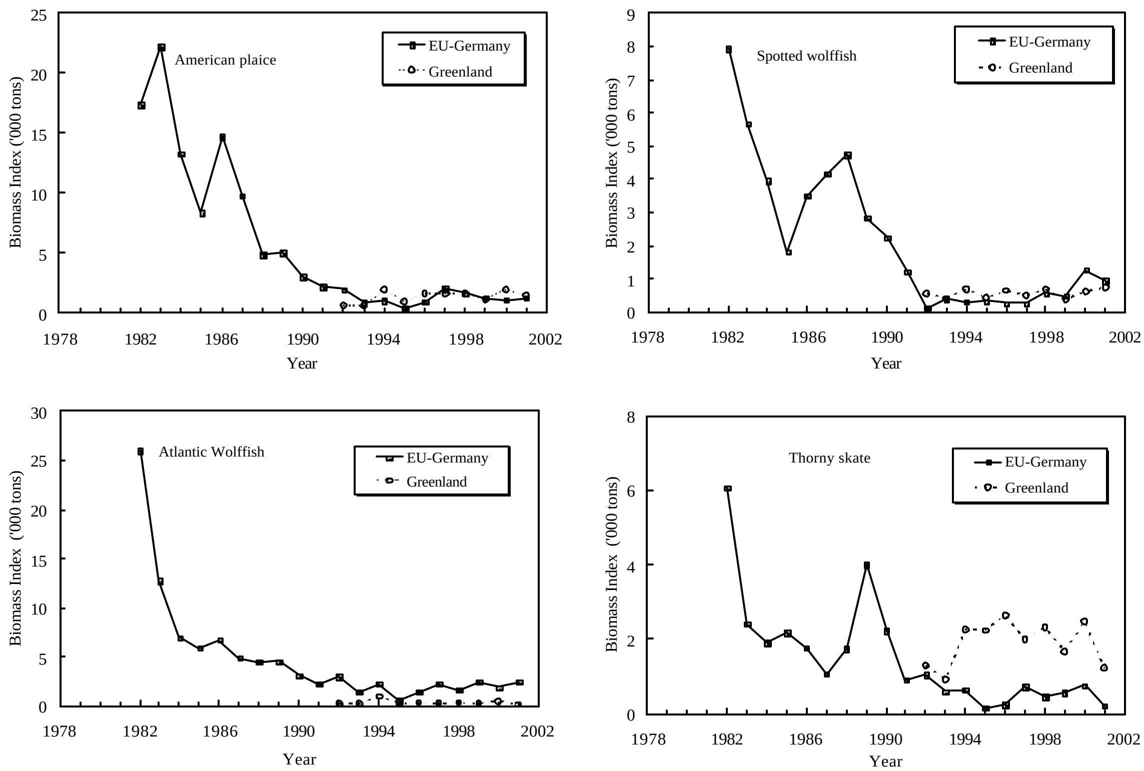


Fig. 5.1. Finfish in Subarea 1: survey biomass indices of various finfish species.

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.

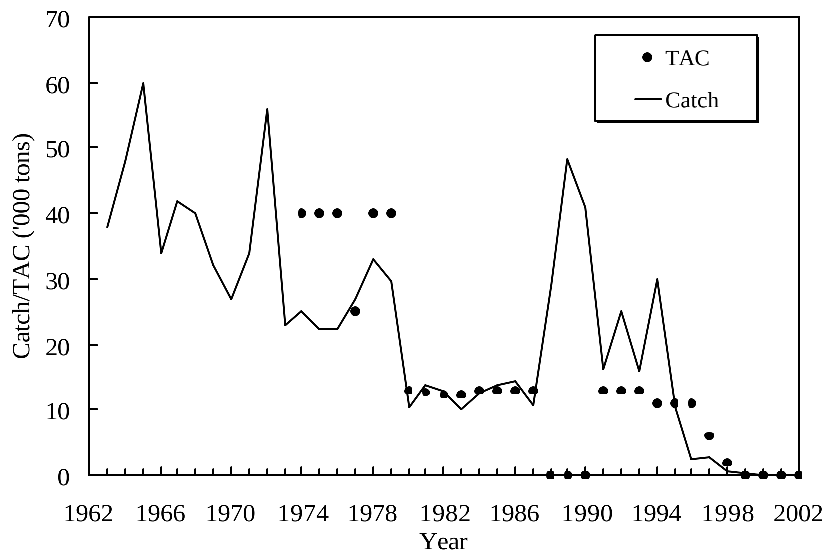


Fig. 6.1. Cod in Div. 3M: catches and TACs. Catch figures include estimates of misreported catches since 1988.

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.

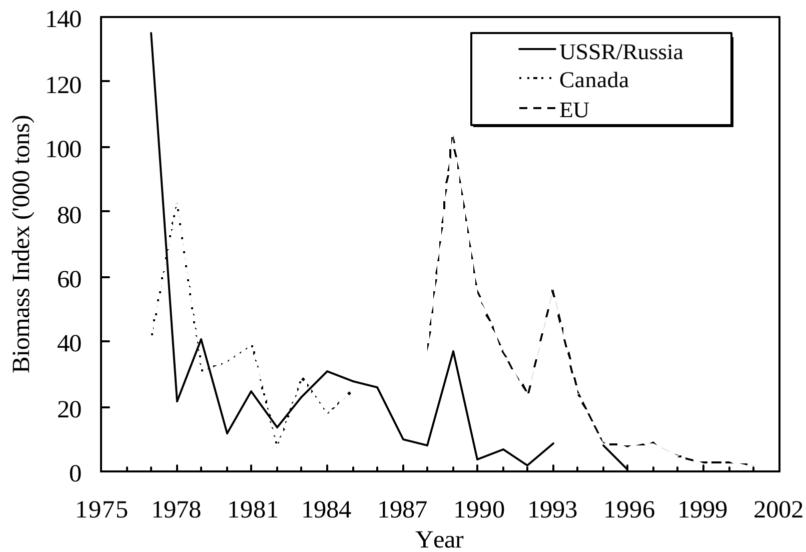


Fig. 6.2. Cod in Div. 3M: total biomass estimates from surveys.

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 bellow 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).

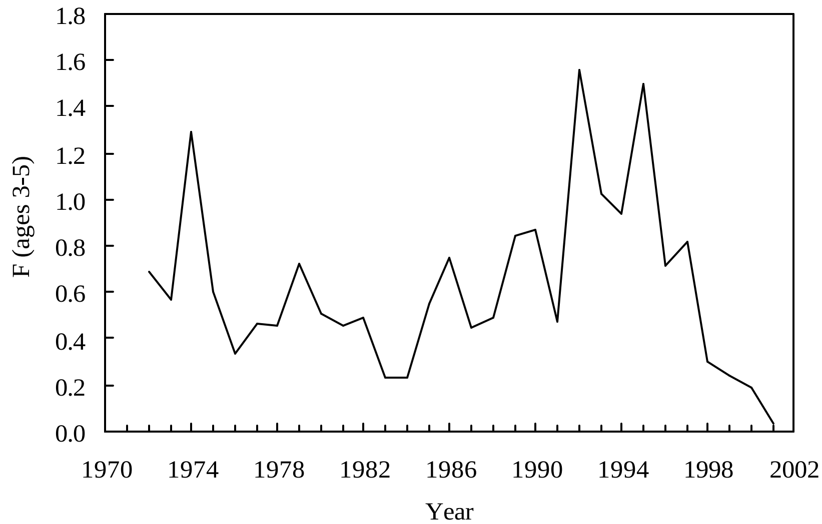


Fig 6.3. Cod in Div. 3M: results from Sequential Population Analysis (F)

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.

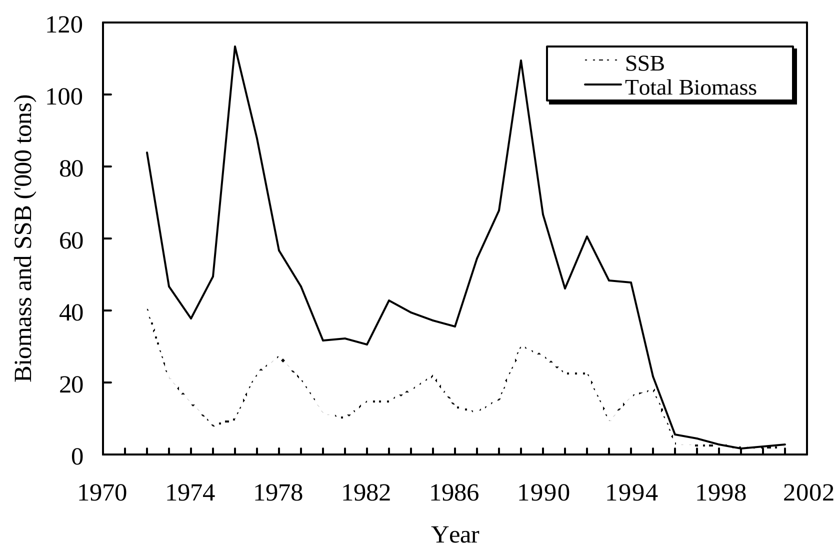


Fig 6.4. Cod in Div. 3M: results from Sequential Population Analysis.

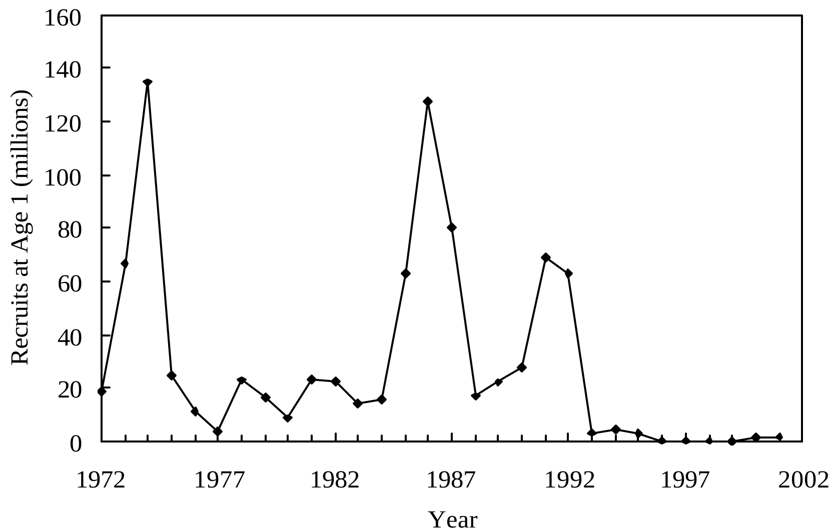


Fig 6.5. Cod in Div. 3M: results from Sequential Population Analysis (Recruits at age 1).

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.

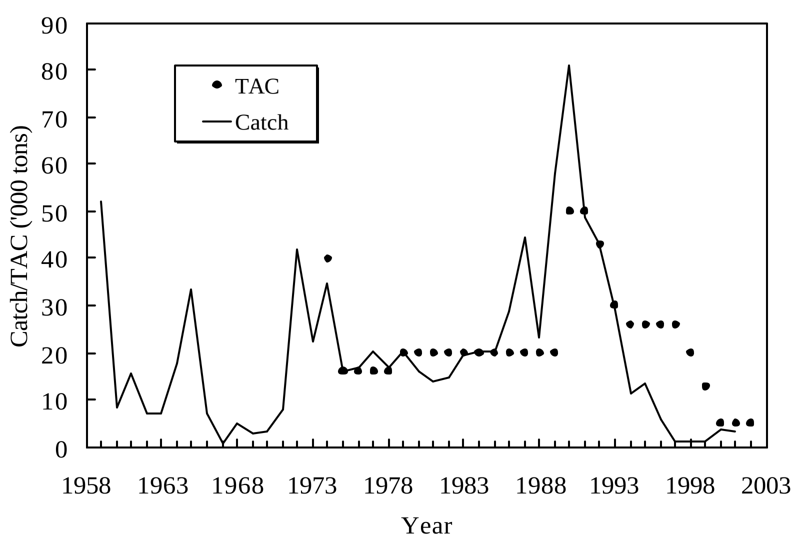


Fig. 7.1. Redfish in Div. 3M: catches and TACs.

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	*S. mentella*	*S. fasciatus*	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.

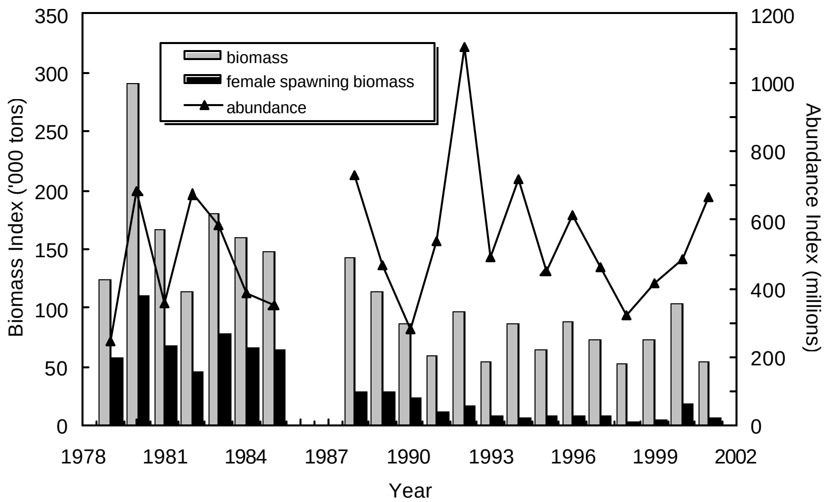


Fig. 7.2. Beaked redfish in Div. 3M: survey biomass, female spawning biomass and abundance from Canadian (1979-1985) and EU (1988-2001) surveys.

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 $F_{0.1}$ 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.

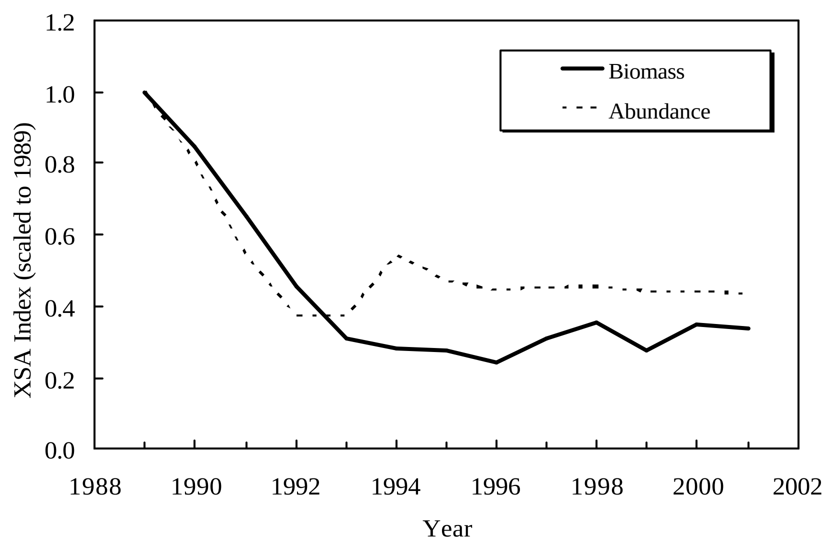


Fig. 7.3. Beaked redfish in Div. 3M: 4 plus biomass *versus* 4 plus abundance trends from XSA.

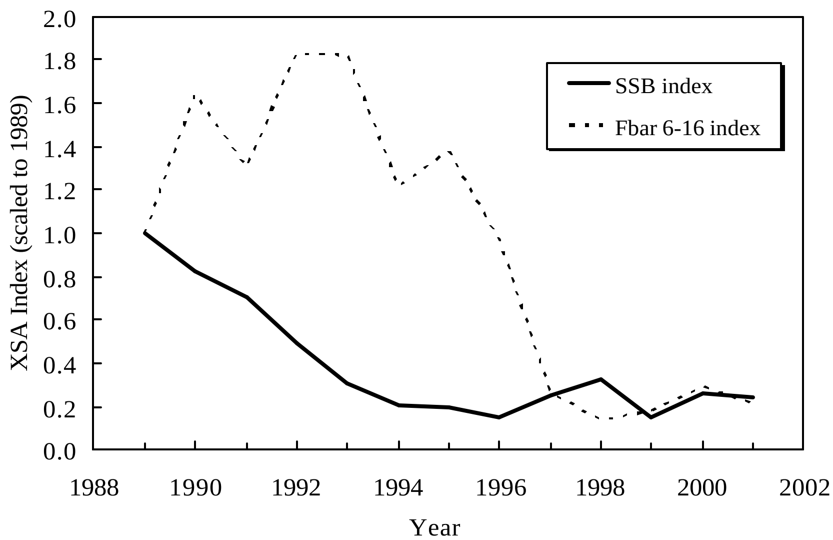


Fig. 7.4. Beaked redfish in Div. 3M: female spawning biomass and fishing mortality trends from XSA.

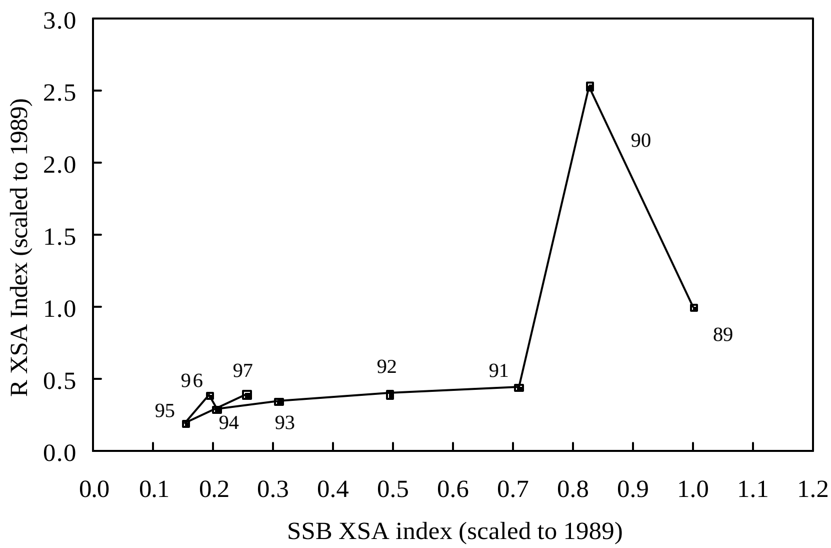


Fig. 7.5 Beaked redfish in Div. 3M: relative recruitment from XSA (year-classes indicated)

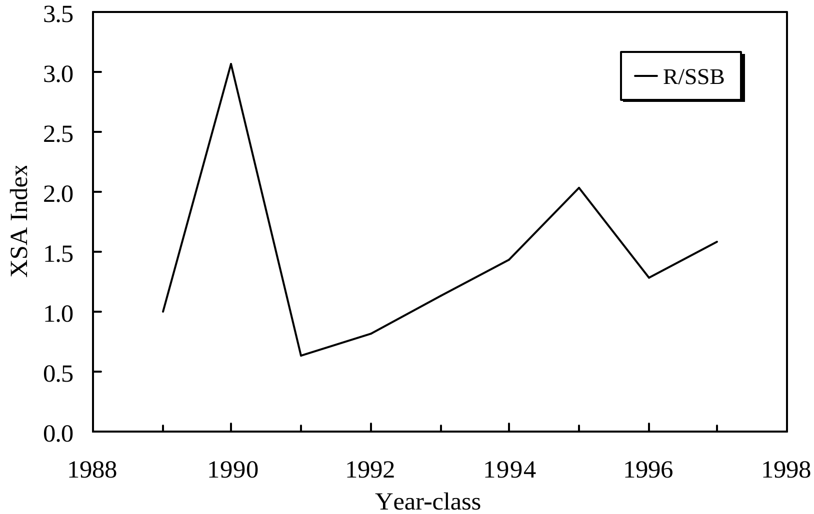


Fig. 7.6 Beaked redfish in Div. 3M: recruitment per thousand tons of SSB trend from XSA (recruits at age 4 four years later than SSB).

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).

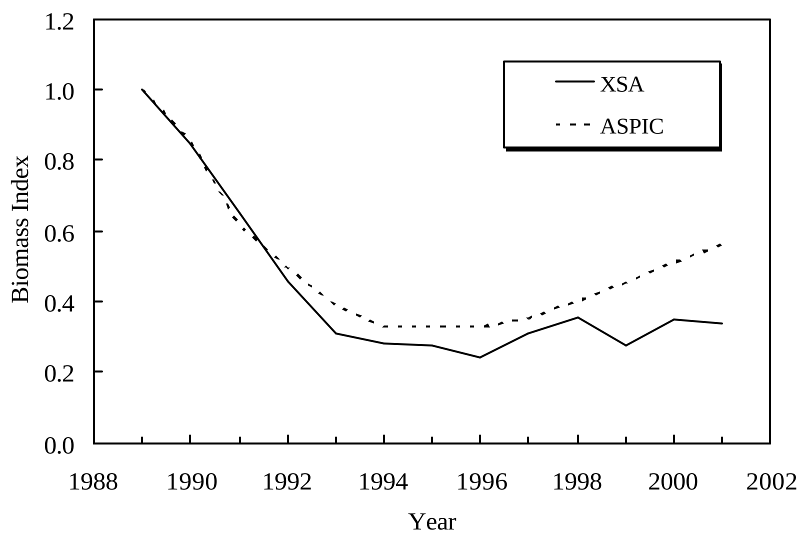


Fig. 7.7. Beaked redfish in Div. 3M: XSA and ASPIC total biomass trends.

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 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.*

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.

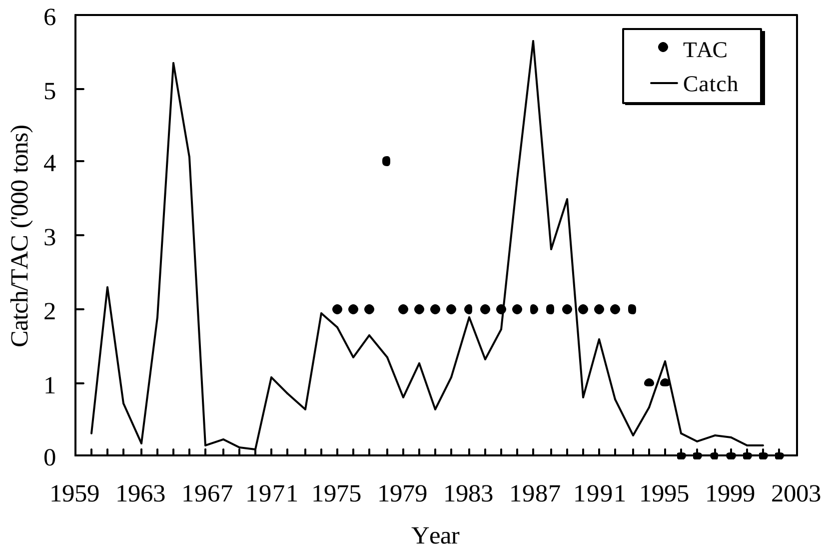


Fig. 8.1. American plaice in Div. 3M: STACFIS catches and agreed TACs.

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).

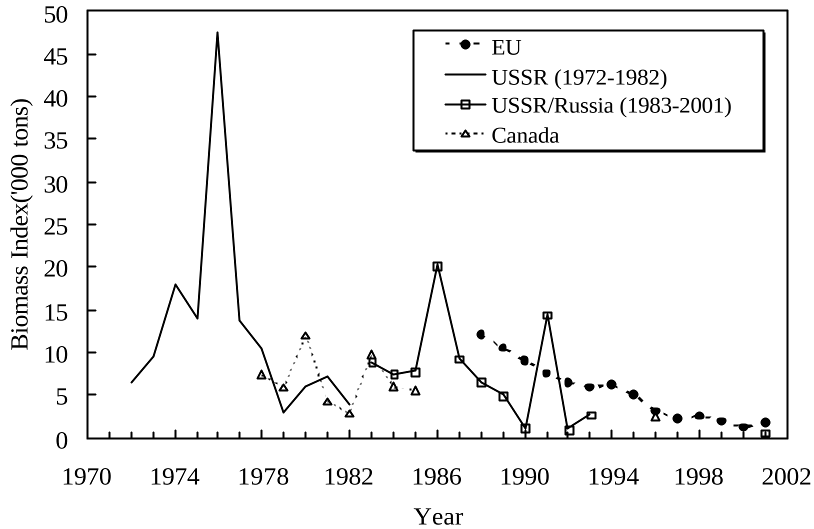


Fig. 8.2. American plaice in Div. 3M: trends in biomass index in the surveys.

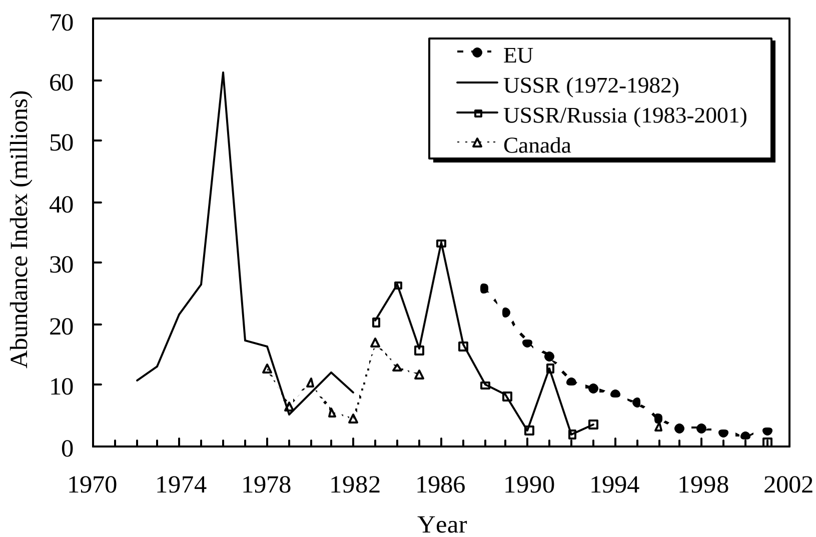


Fig. 8.3. American plaice in Div. 3M: trends in abundance index in the surveys.

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.

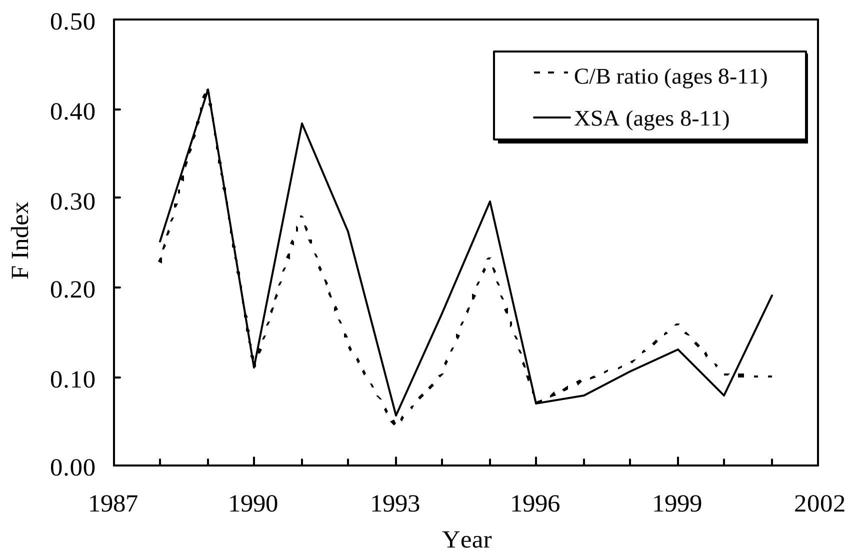


Fig. 8.4. American plaice in Div. 3M: fishing mortality trends: catch/biomass EU survey (ages 8-11) and XSA (ages 8-11).

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).

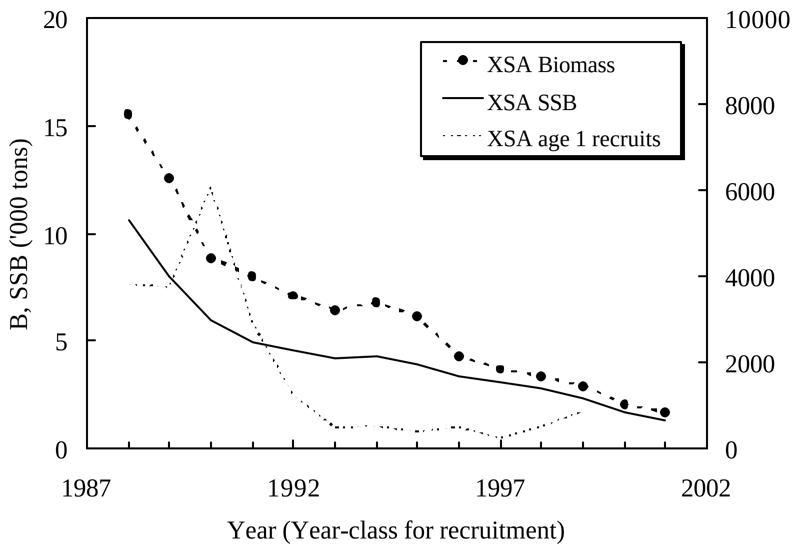


Fig. 8.5. American plaice in Div. 3M: biomass, spawning stock biomass (SSB) and corresponding recruitment from XSA

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).

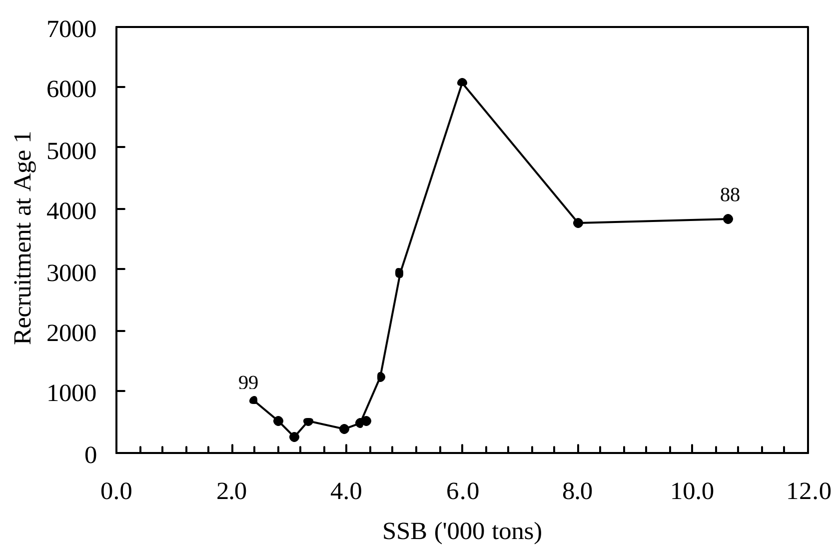


Fig. 8.6. American plaice in Div. 3M: SSB-Recruitment scatter plot.

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_{lim} (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.

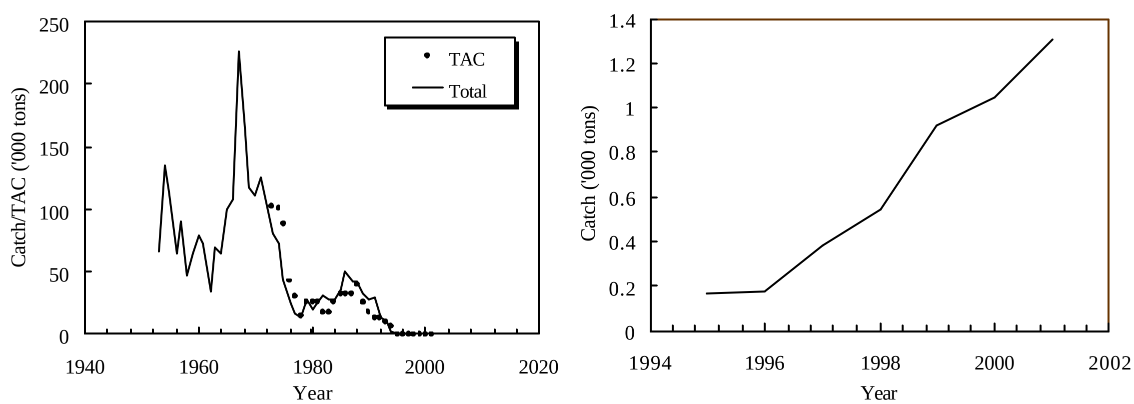


Fig 9.1. Cod in Div. 3NO: total catch and TACs. Panel at right highlights catches during the moratorium on directed fishing.

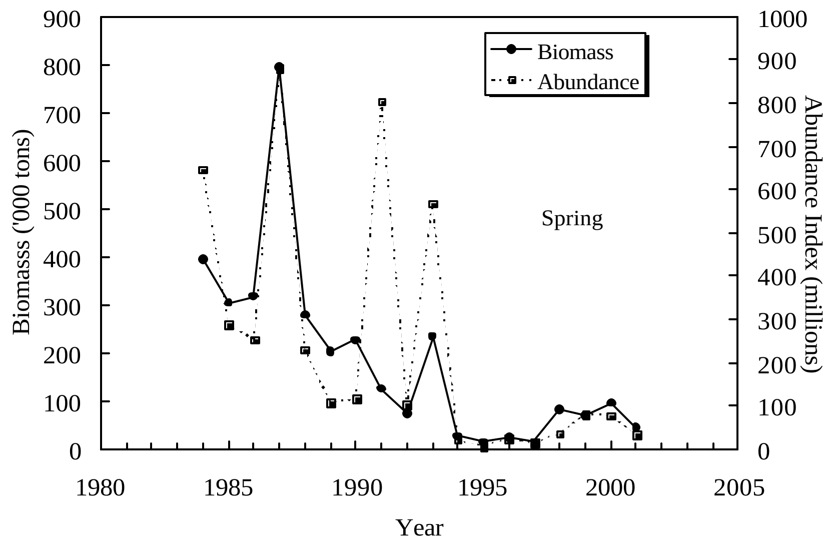


Fig 9.2. Cod in Div. 3NO: abundance and biomass indices from Canadian spring surveys.

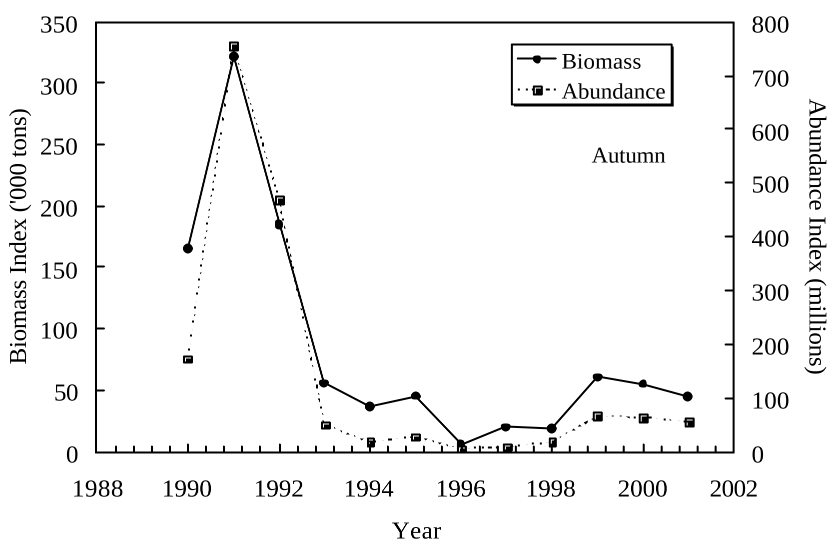


Fig 9.3. Cod in Div. 3NO: abundance and biomass indices from Canadian autumn surveys.

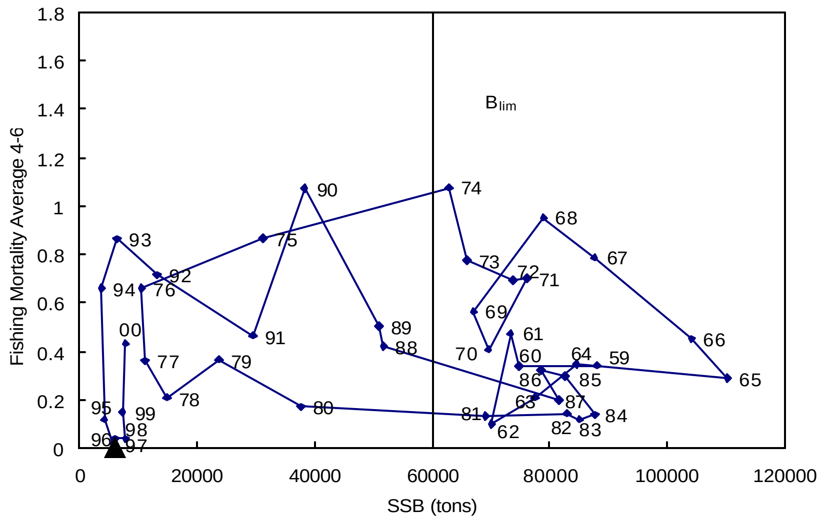


Fig. 9.4. Cod in Div. 3NO: Spawner stock scatter. The 2001 autumn survey (Q adjusted) estimate of spawning stock biomass is indicated by the triangle.

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.

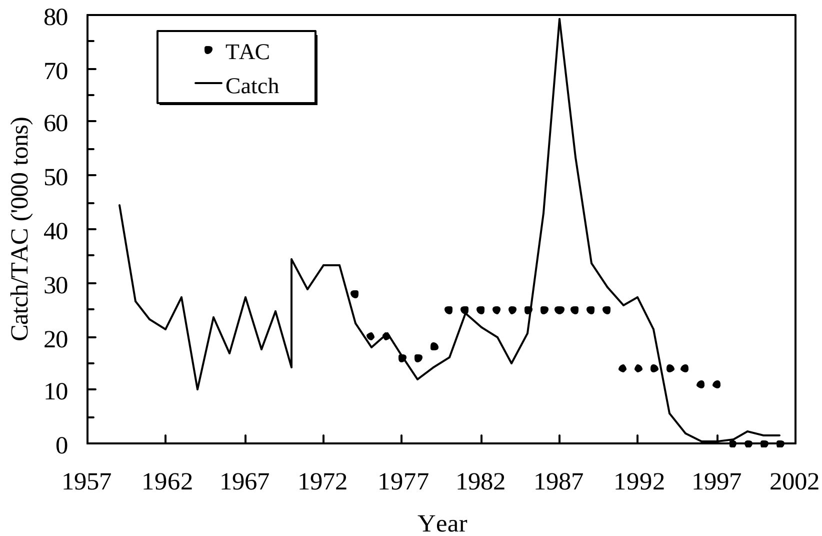


Fig. 10.1. Redfish in Div. 3LN: catches and TACs.

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.

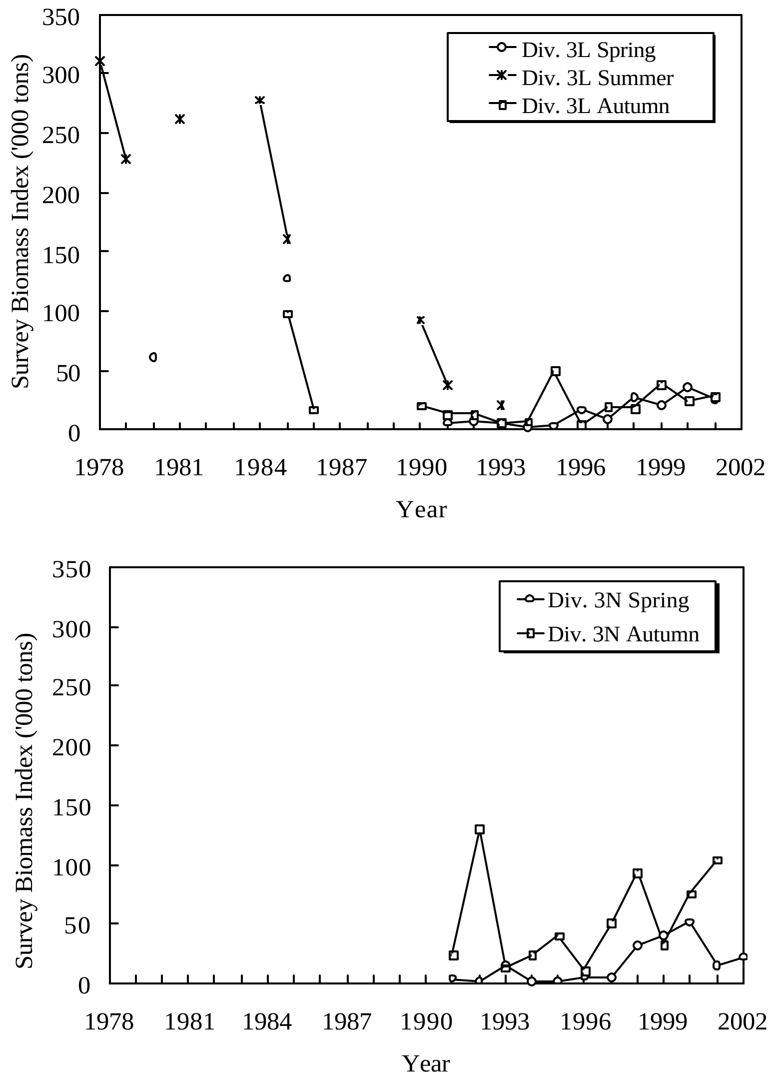


Fig. 10.2. Redfish in Div. 3LN: survey biomass indices from Canadian surveys in Div. 3L and Div. 3N in Campelen equivalent units for surveys prior to autumn 1995.

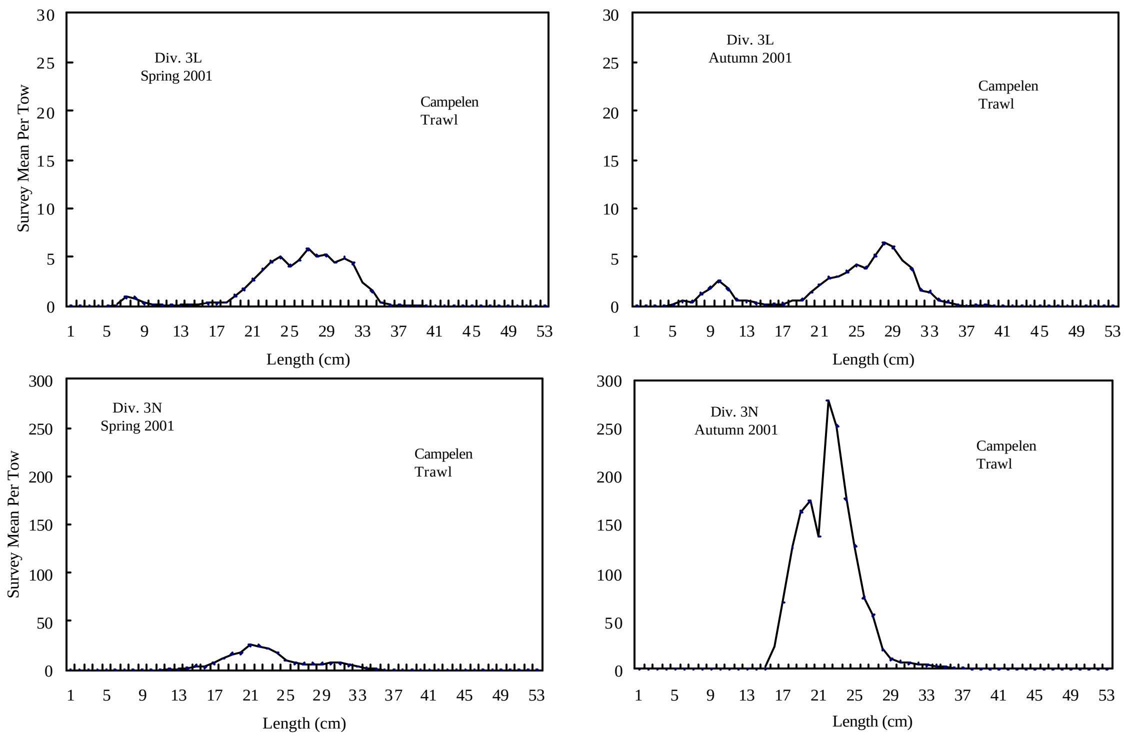


Fig. 10.3 Redfish in Div. 3LN: Size distribution (stratified mean per tow) from Canadian surveys in Div. 3L and Div. 3N for 2001.

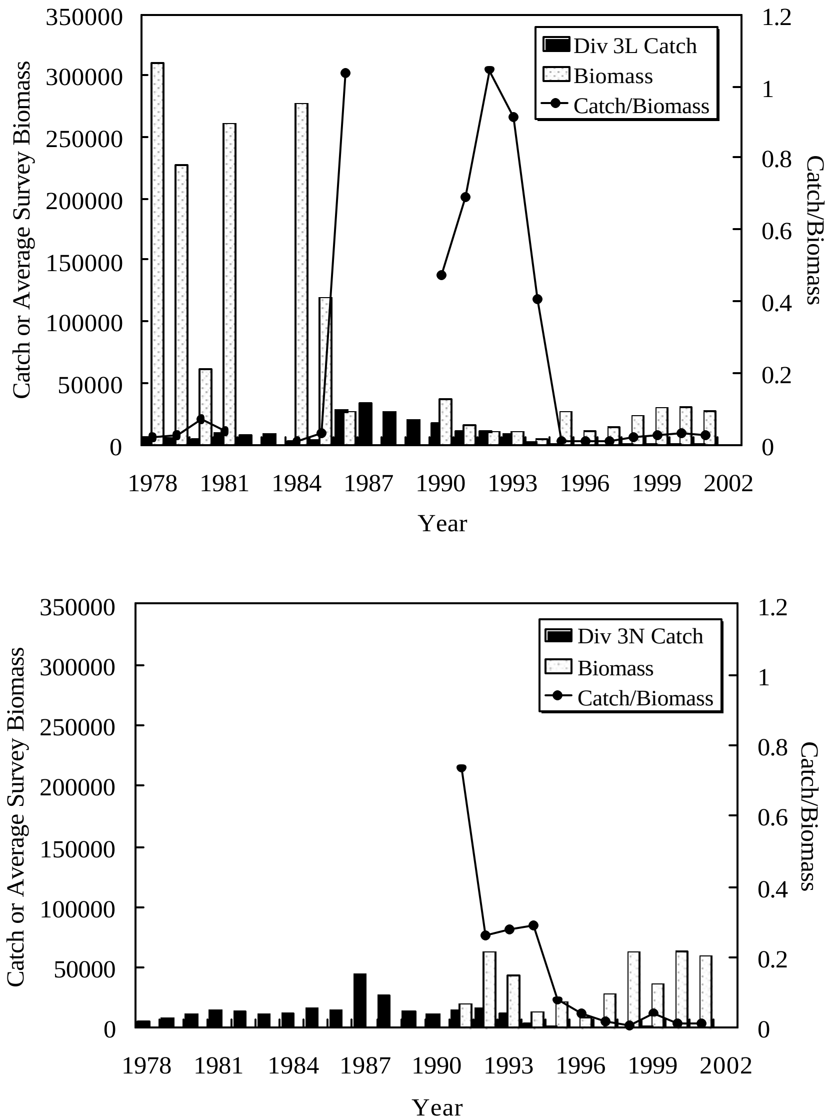


Fig. 10.4. Redfish in Div. 3LN: Redfish in Div. 3LN: Catch/Biomass ratios for Div. 3L and Div. 3N

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.

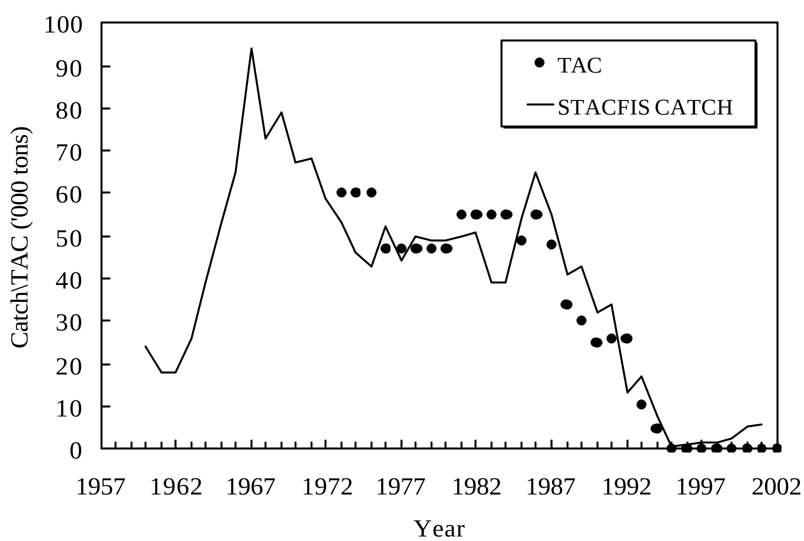


Fig. 11.1. American plaice in Div. 3LNO: catches and TACs.

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 estimates compared to Campelen equivalents) of that of the mid 1980s (SCR Doc. 02/70; Fig. 11.2).

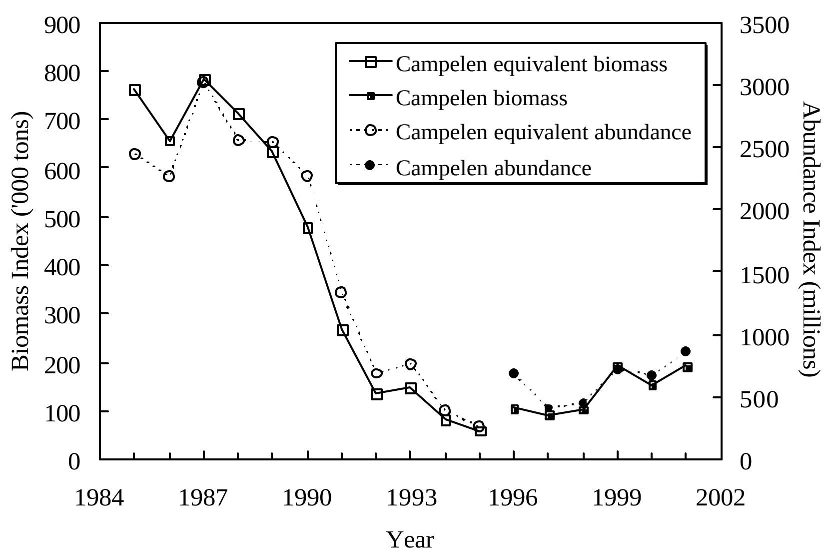


Fig. 11.2. American plaice in Div. 3LNO: biomass and abundance indices from Canadian spring surveys.

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.

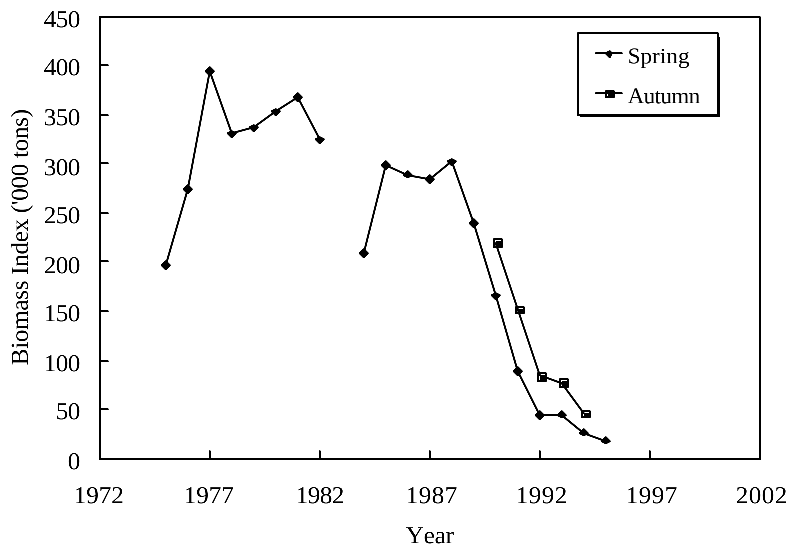


Fig 11.3. American plaice in Div. 3LNO: biomass index from Canadian spring surveys using the Engel groundfish trawl.

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.

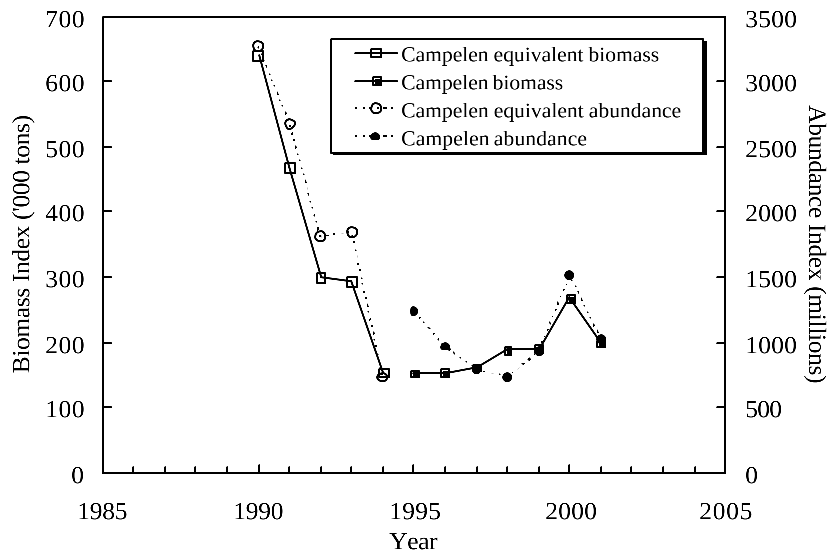


Fig. 11.4. American plaice in Div. 3LNO: biomass and abundance indices from autumn surveys.

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.

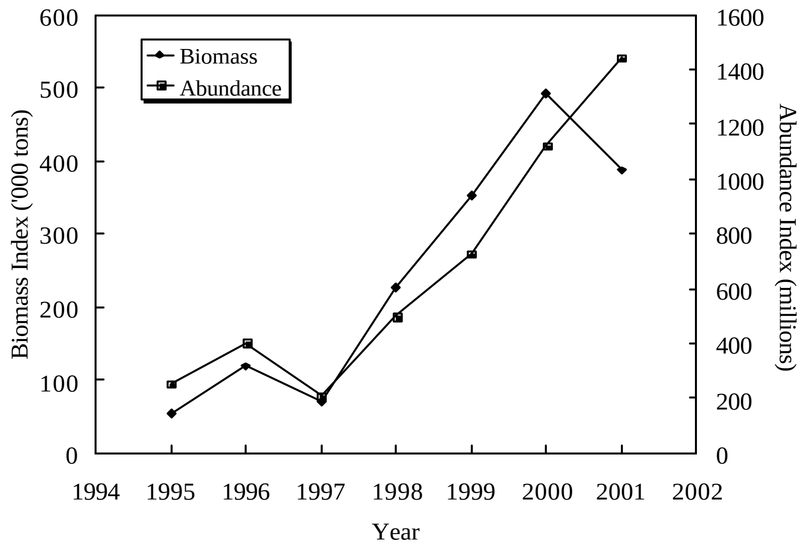


Fig. 11.5 American plaice in Div. 3LNO: biomass and abundance indices from the survey by EU-Spain.

Joint DFO-Industry surveys. Since 1996 grid surveys directed at yellowtail flounder have been conducted in Div. 3NO. 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).

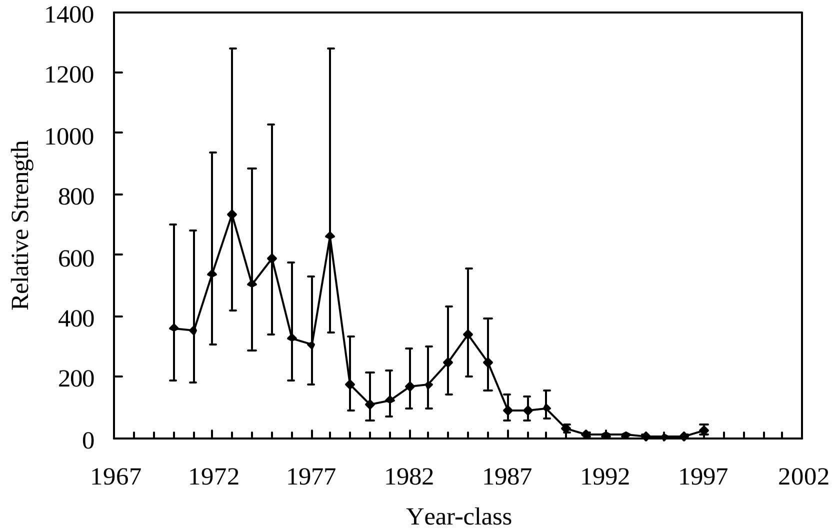


Fig. 11.6 American plaice in Div. 3LNO: estimates of relative cohort strength from Canadian surveys

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).

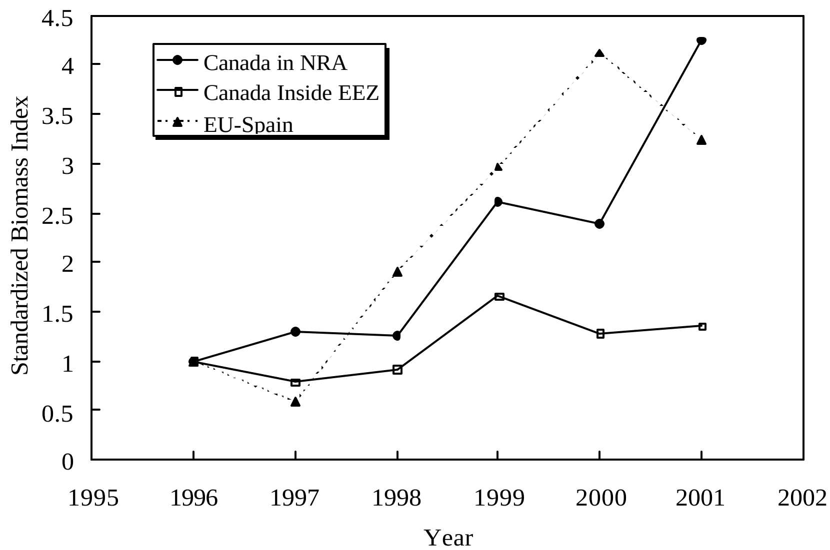


Fig. 11.7. American plaice in Div. 3LNO: Standardized biomass indices from Canadian spring and EU-Spain surveys.

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).

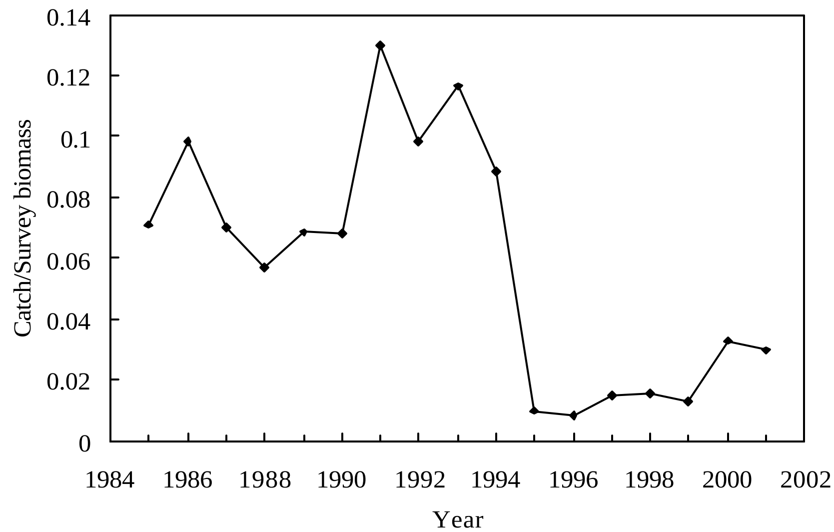


Fig. 11.8. American plaice in Div. 3LNO: catch to survey biomass ratios.

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.

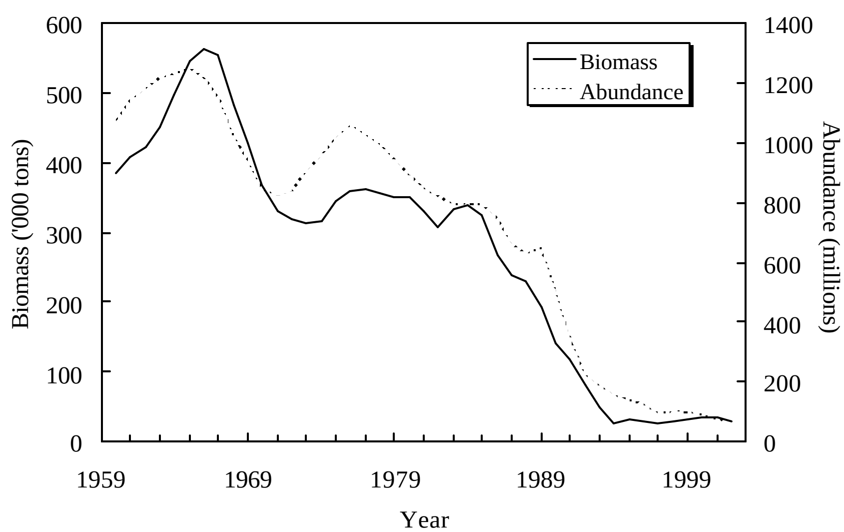


Fig. 11.9. American plaice in Div. 3LNO: Population abundance and biomass from VPA

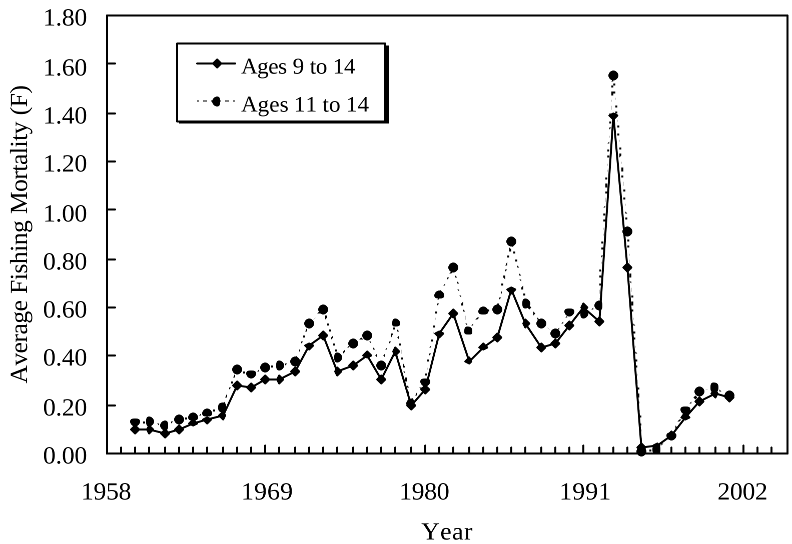


Fig. 11.10. American plaice in Div. 3LNO: Average fishing mortality from VPA.

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.

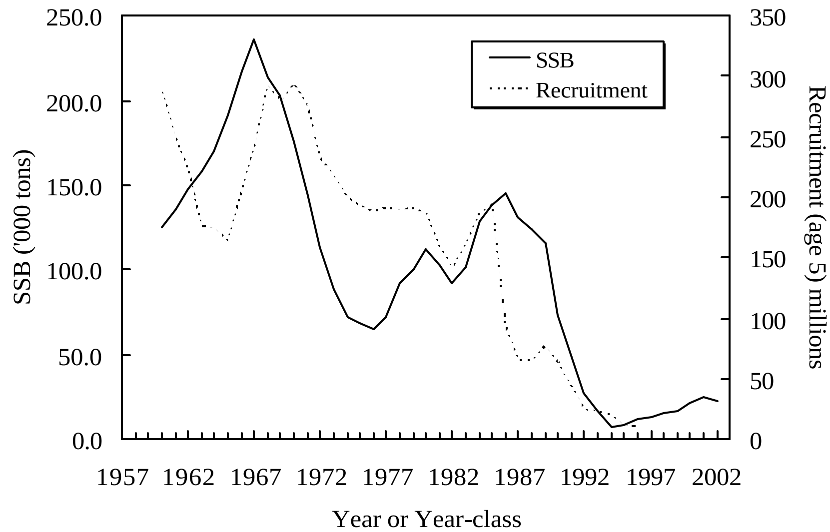


Fig. 11.11. American plaice in Div. 3LNO: Spawning stock biomass and recruitment from VPA.

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.

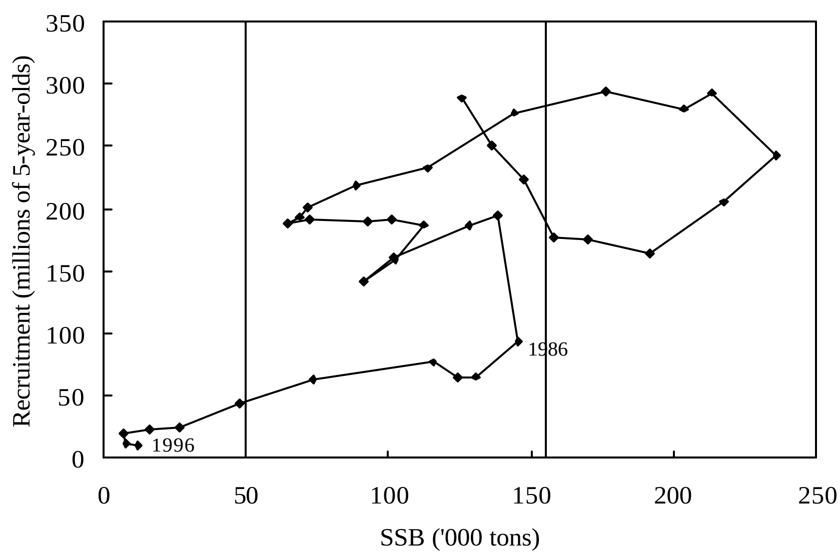


Fig. 11.12. American plaice in Div. 3LNO: spawning stock biomass recruitment relationship from VPA.

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 $F = 2 \times F_{2001}$

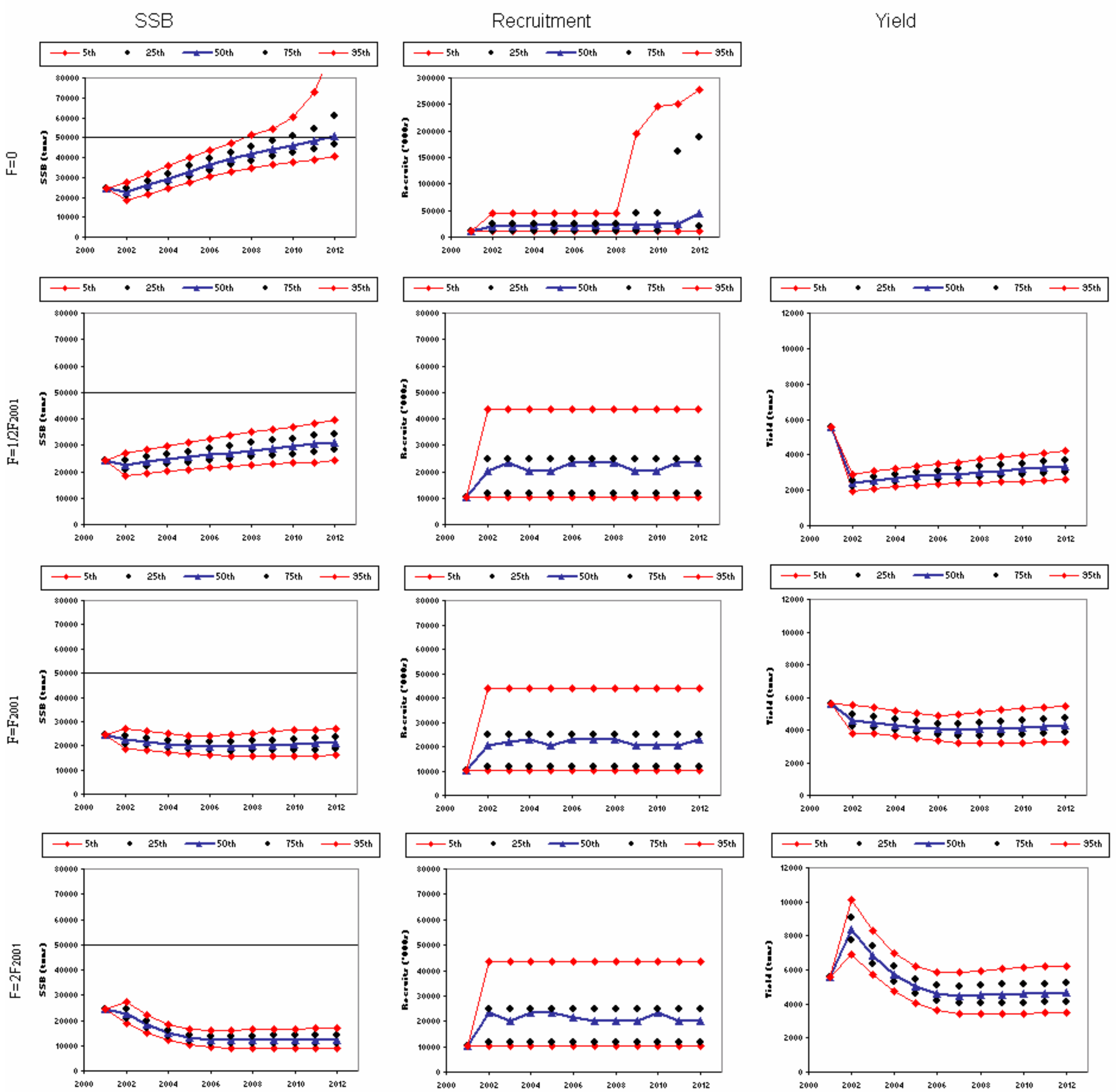


Fig. 11.13. American plaice in Div. 3LNO: median spawning stock biomass and yield from projections along with various percentiles

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.

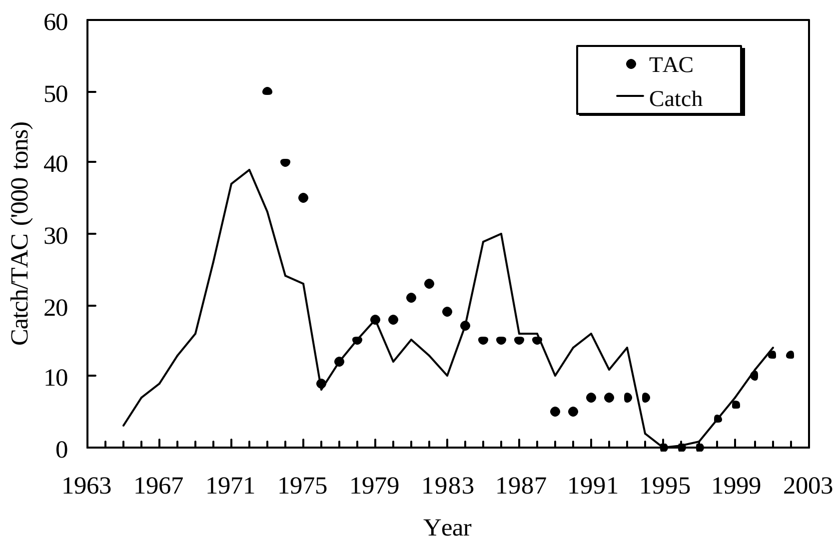


Fig. 12.1. Yellowtail flounder in Div. 3LNO: catches and TACs.

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).

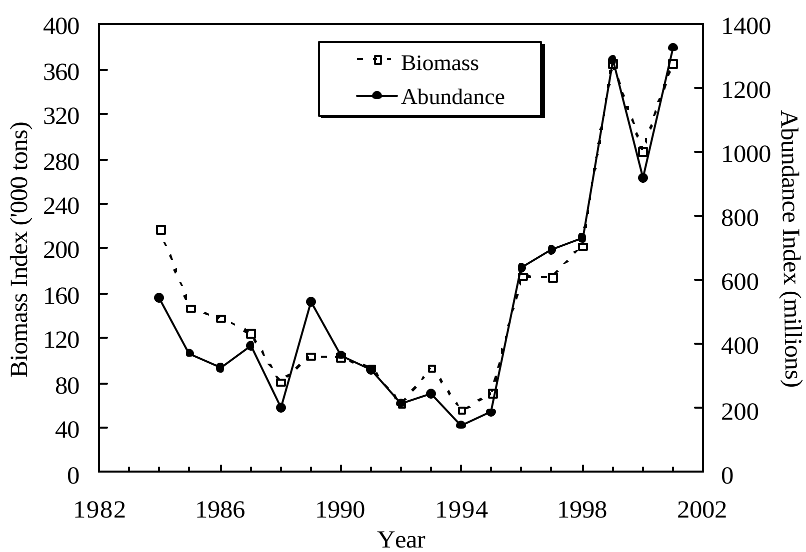


Fig. 12.2. Yellowtail flounder in Div. 3LNO: estimates of biomass and abundance from Canadian spring surveys.

Canadian stratified-random autumn surveys (SCR Doc. 02/43). Most of the biomass (78%) from the autumn survey in 2001was 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.

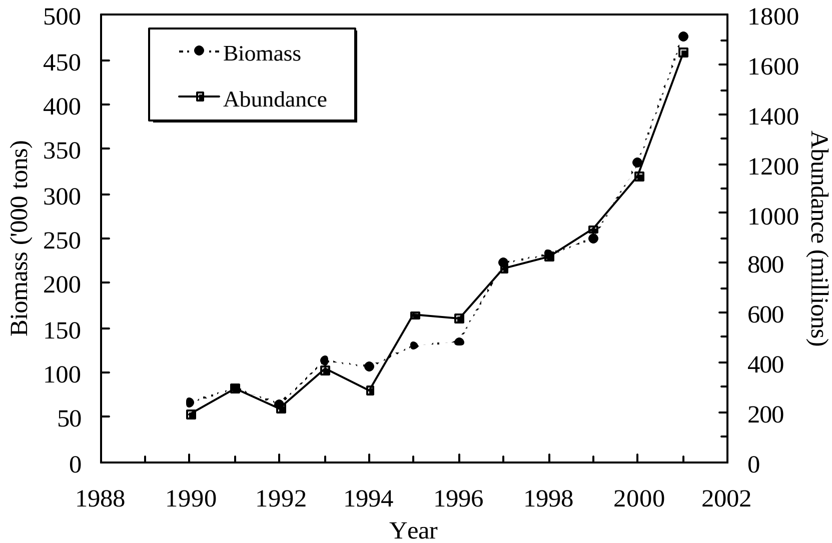


Fig. 12.3. Yellowtail flounder in Div. 3LNO: estimates of biomass and abundance from Canadian autumn surveys.

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.

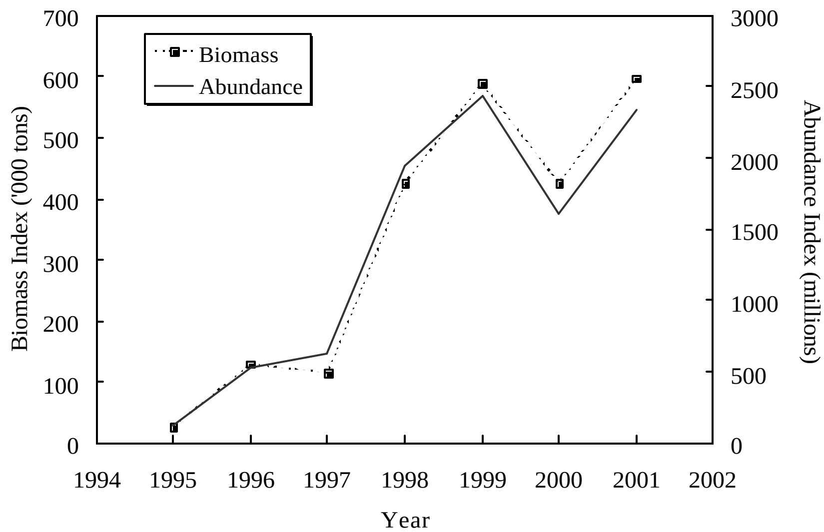


Fig. 12.4. Yellowtail flounder in Div. 3LNO: estimates of biomass from the Spanish spring surveys.

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).

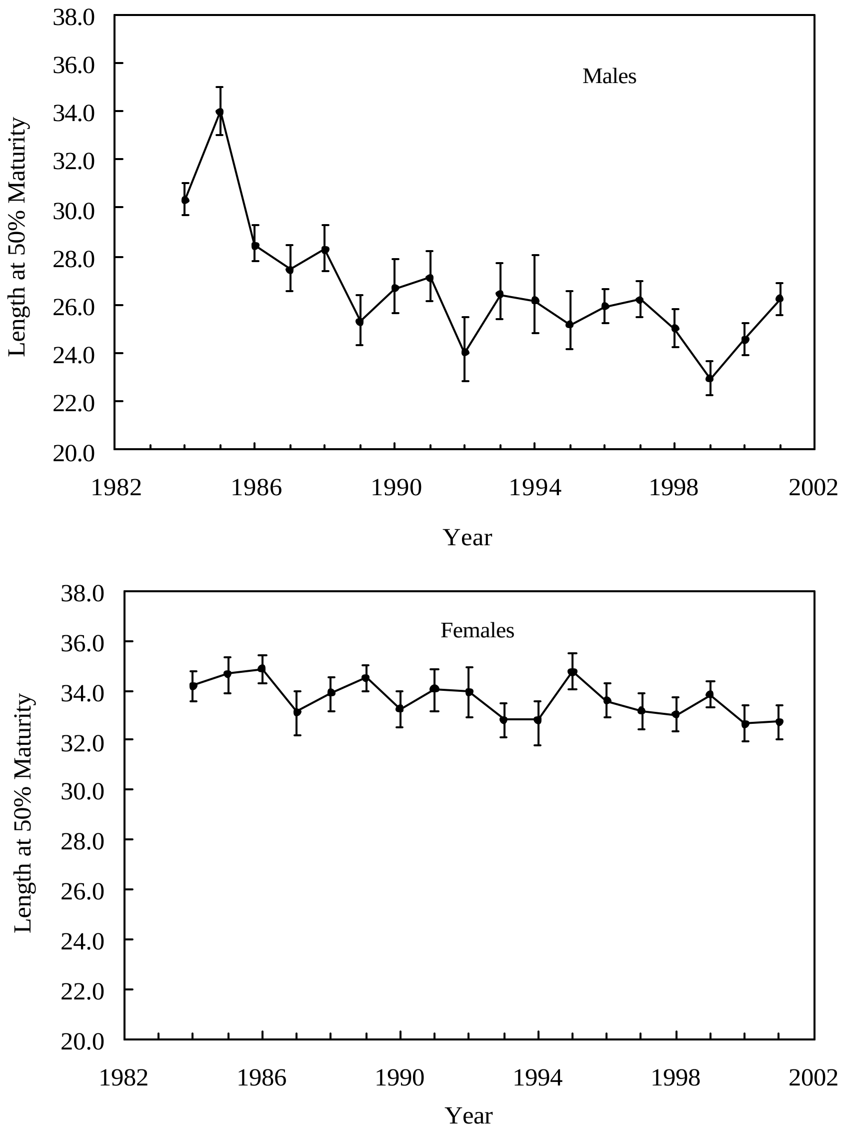


Fig. 12.5. Yellowtail flounder in Div. 3LNO: length at 50% maturity.

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).

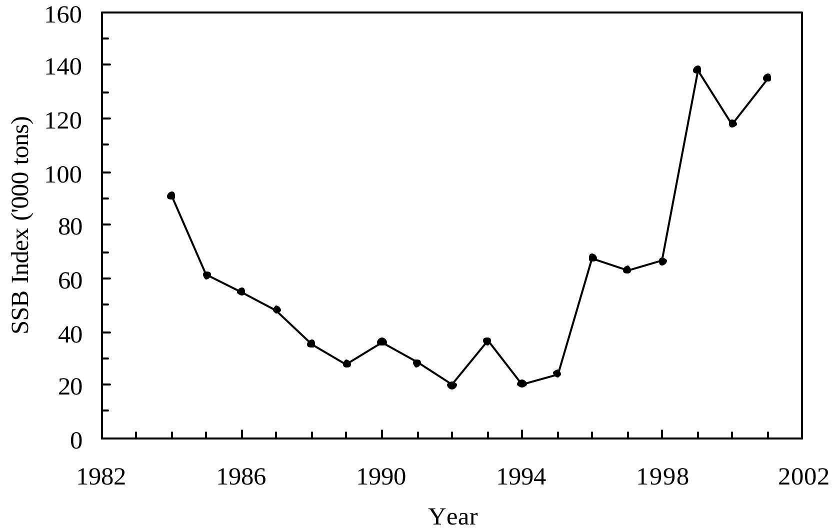


Fig. 12.6. Yellowtail flounder in Div. 3LNO: female spawning stock biomass index estimated from 1984 to 2001 annual spring surveys.

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.

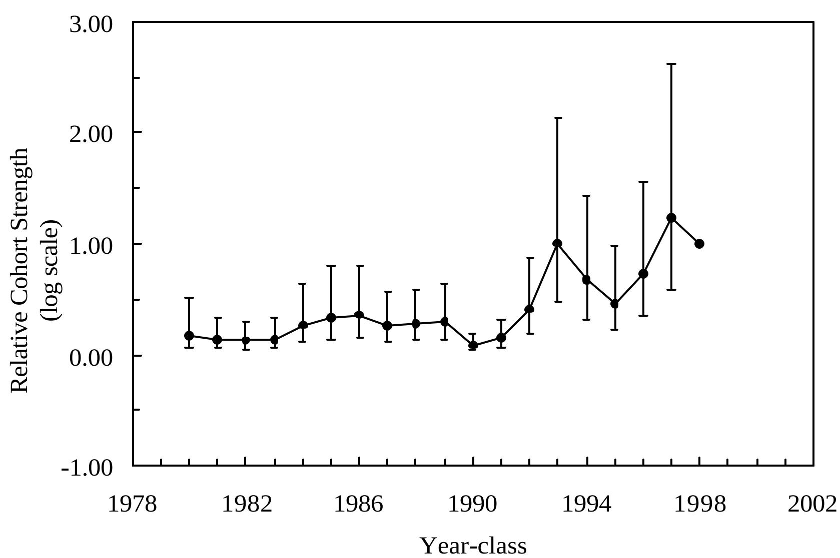


Fig. 12.7. Yellowtail flounder in Div. 3LNO: relative cohort strength with standard errors estimated from a multiplicative model using age 3 and 4 data from annual spring and autumn surveys.

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).

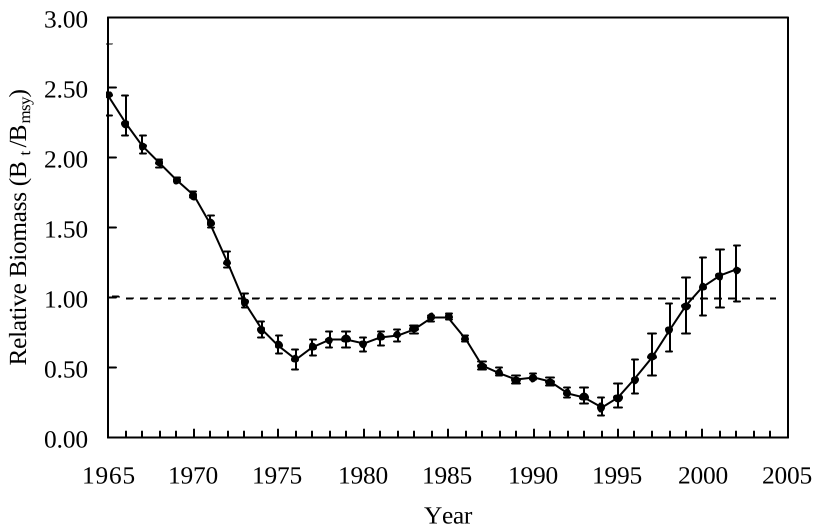


Fig. 12.8. Yellowtail flounder in Div. 3LNO: bias corrected relative biomass trends with 80% confidence intervals.

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.

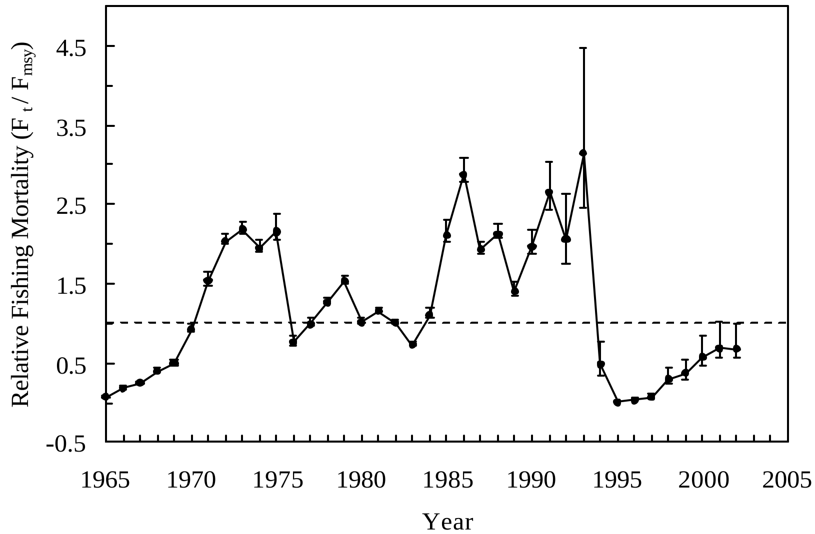


Fig. 12.9. Yellowtail flounder in Div. 3LNO: bias corrected relative fishing mortality trends with 80% confidence intervals.

Since 1994, when the moratorium (1994-97) was put in place the estimated yield has been below sustainable production levels (Fig. 12.10).

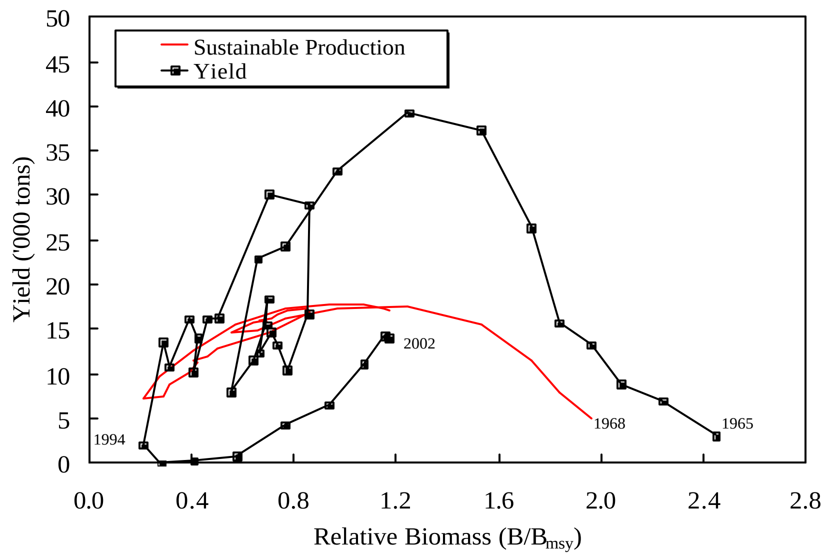


Fig. 12.10. Yellowtail flounder in Div. 3LNO: yield trajectory.

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	Percentiles					**2004 F**	Percentiles				
F multiplier	**5**	**25**	**50**	**75**	**95**	**F multiplier**	**5**	**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
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

2003 Yield	Percentiles					**2004 Yield**	Percentiles				
F multiplier	**5**	**25**	**50**	**75**	**95**	**F multiplier**	**5**	**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
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

2003 B/B $_{msy}$	Percentiles					**2004 B / B $_{msy}$**	Percentiles				
F multiplier	**5**	**25**	**50**	**75**	**95**	**F multiplier**	**5**	**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
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.

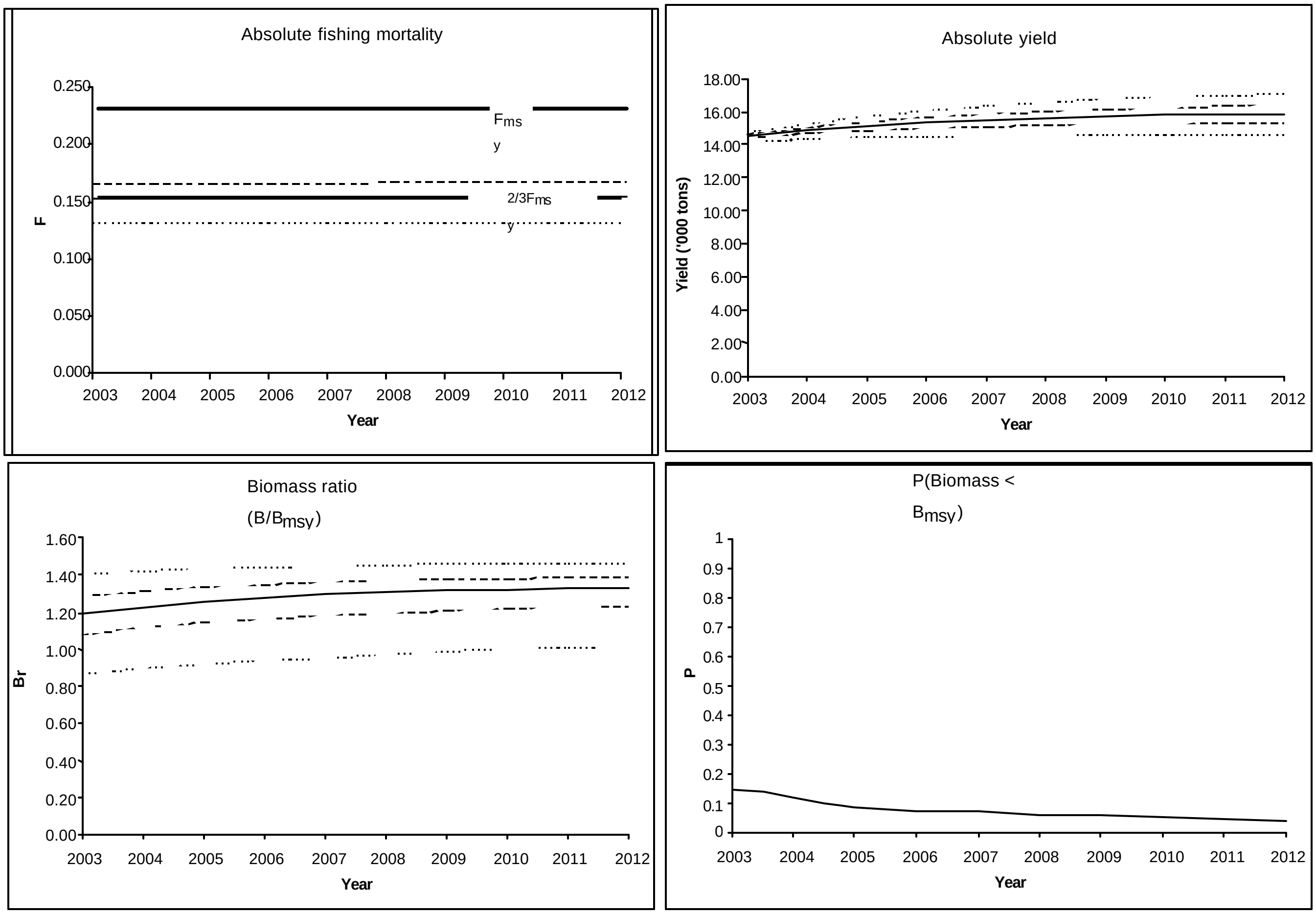


Fig. 12.11 Yellowtail flounder in Div. 3LNO: medium term projections at a constant fishing mortality of 2/3 F_{msy}. The figures show the 5th, 25th, 50th, 75th and 95th percentiles of fishing mortality, yield, and biomass/B_{msy}. The probability of biomass being less than B_{msy} is also given. The 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).

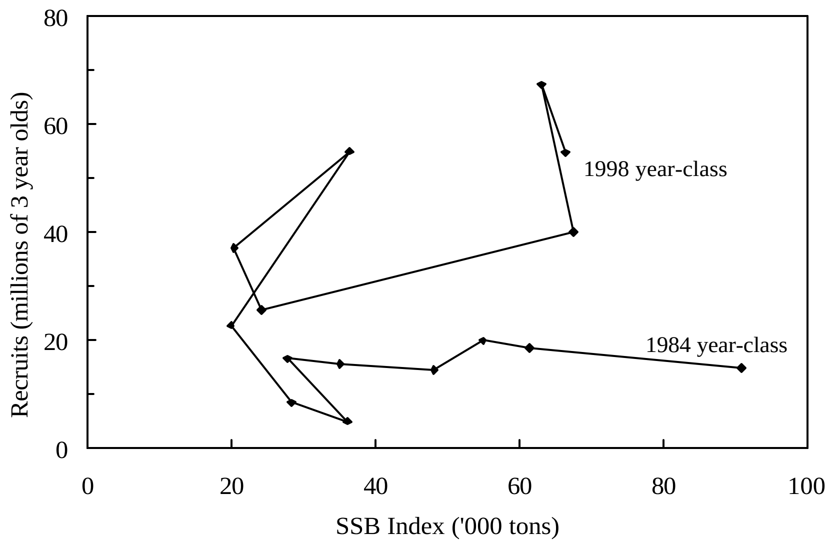


Fig. 12.12. Yellowtail flounder in Div. 3LNO: stock/recruitment plot.

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).

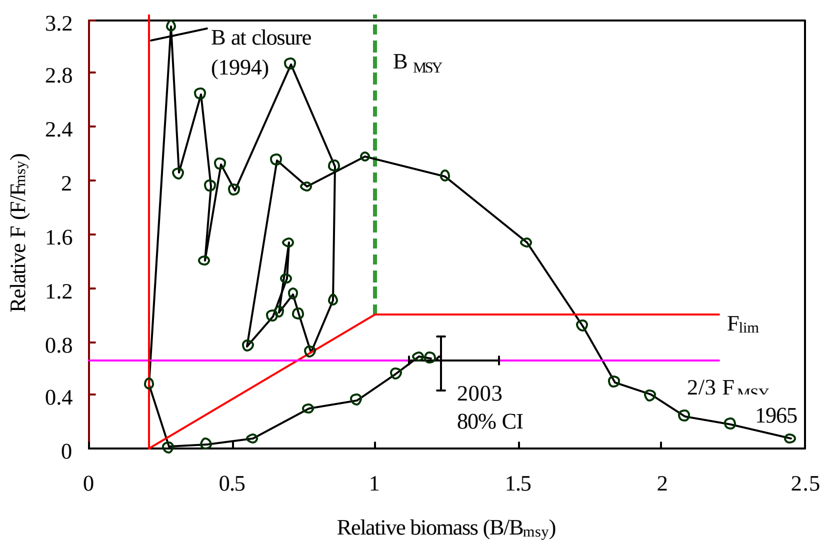


Fig. 12.13. Yellowtail flounder in Div. 3LNO: stock trajectory estimated in the surplus production analysis under precautionary approach framework.

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.

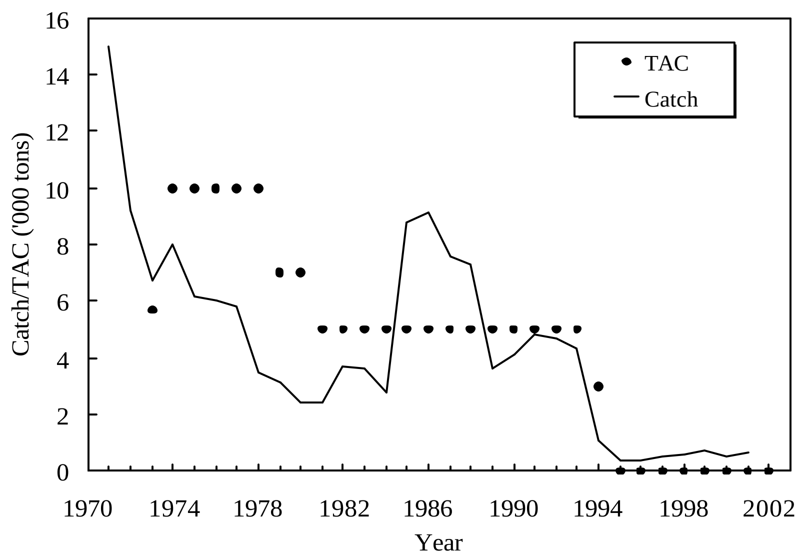


Fig. 13.1. Witch flounder in Div. 3NO: catches and TACs.

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.

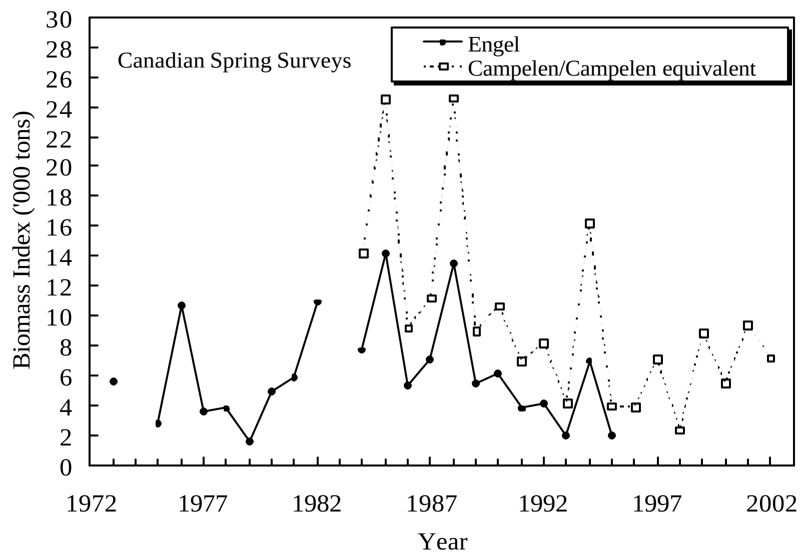


Fig. 13.2. Witch flounder in Div. 3NO: estimates of biomass.

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.

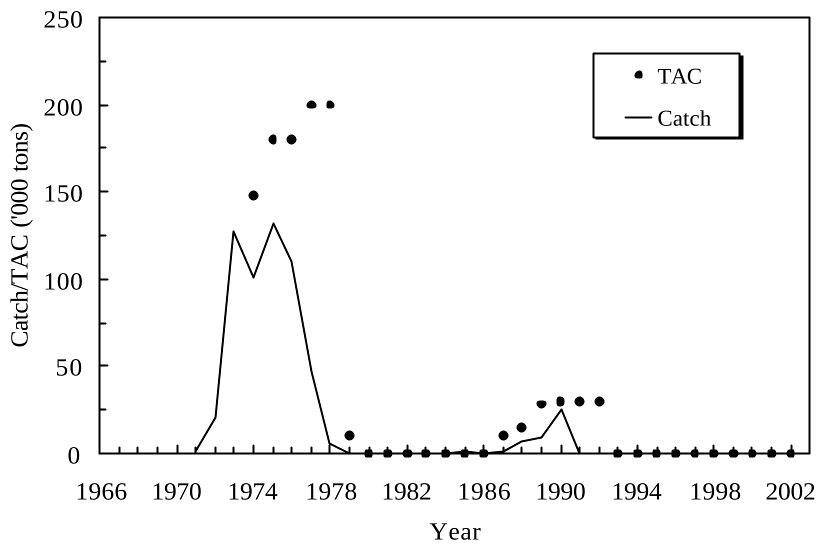


Fig. 14.1. Capelin in Div. 3N and 3O: catches and TACs.

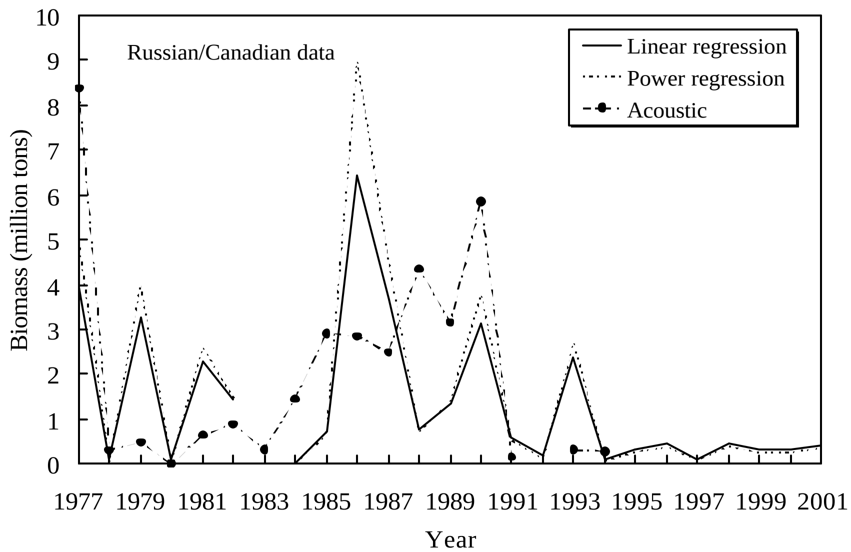
b) **Input Data**

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 2000[1]) 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).



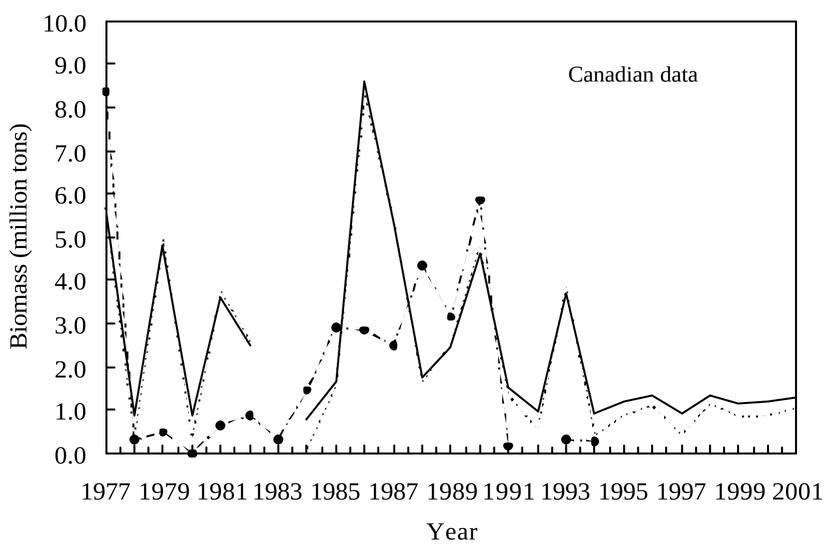


Fig. 14.2. Capelin in Div. 3LNO: biomass estimates in 1977-2001.

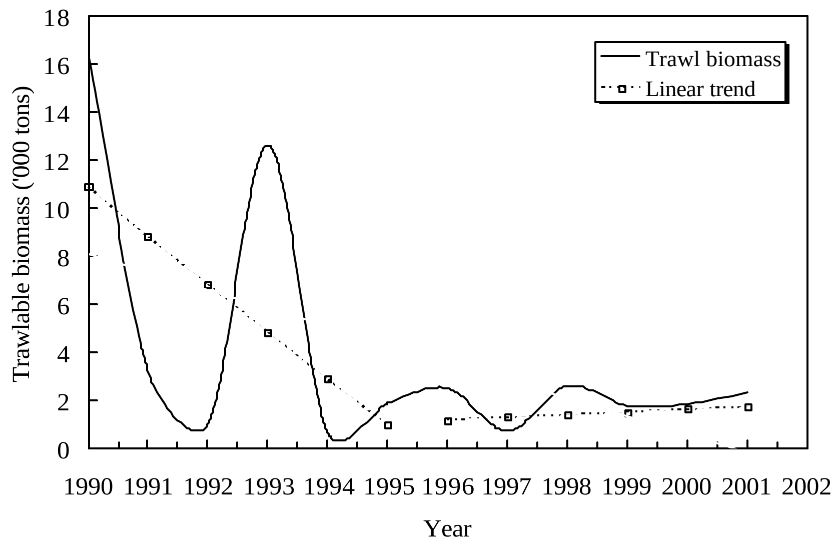


Fig. 14.3. Capelin in Div. 3LNO: trawlable biomass and linear trend in 1990-1995 (Engel) and 1996-2001 (Campelen).

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.

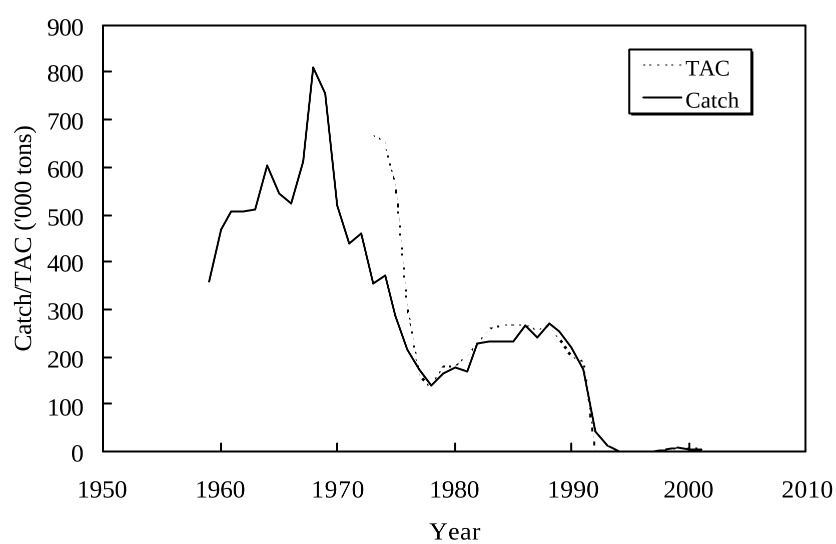


Fig. 16.1. Cod in Div. 2J+3KL: landings and TACs.

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.

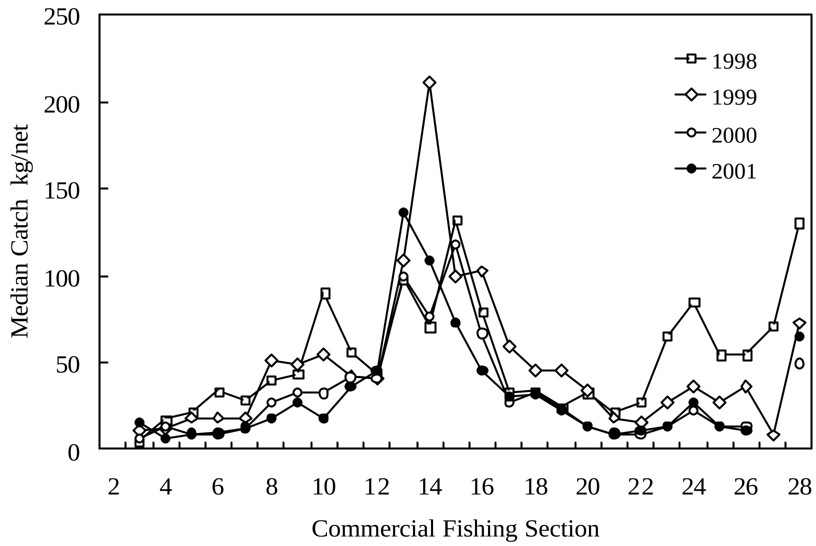


Fig. 16.2. Cod in Div. 2J+3KL: Median gillnet catch rates from the commercial fishery for the years 1998-2001 (refer to Fig. 1c in SCR Doc. 01/33 for definition of fishing sections).

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.

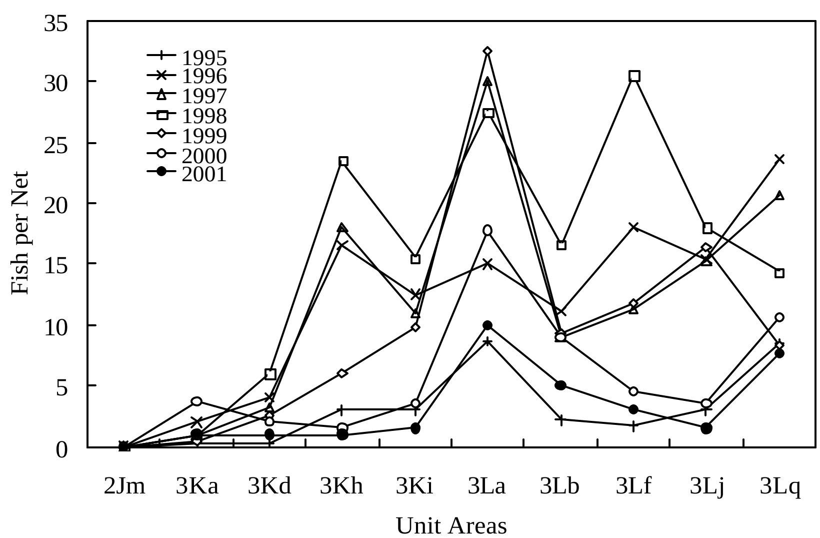


Fig. 16.3. Cod in Div. 2J+3KL: Median sentinel fishery gillnet catch rate for 1995-2001 by unit area (refer to Fig. 1b in SCR Doc. 01/33 for definition of unit areas).

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.

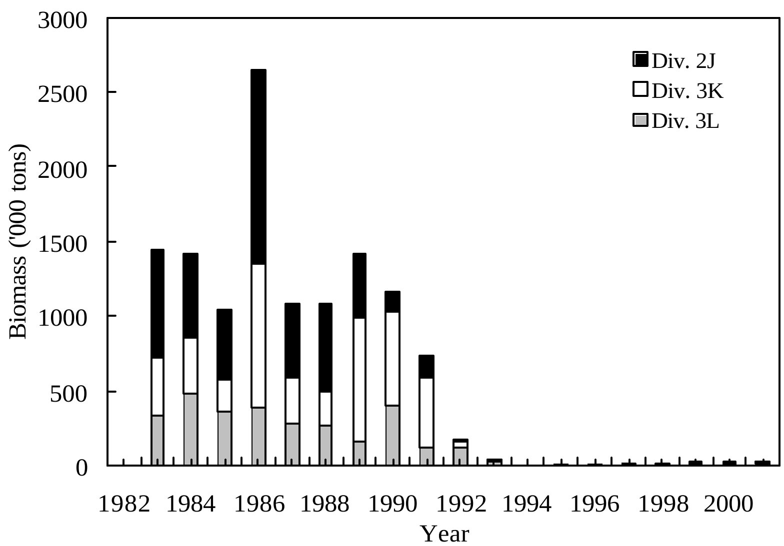


Fig. 16.4. Cod in Div. 2J+3KL: abundance and biomass indices from autumn surveys.

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.

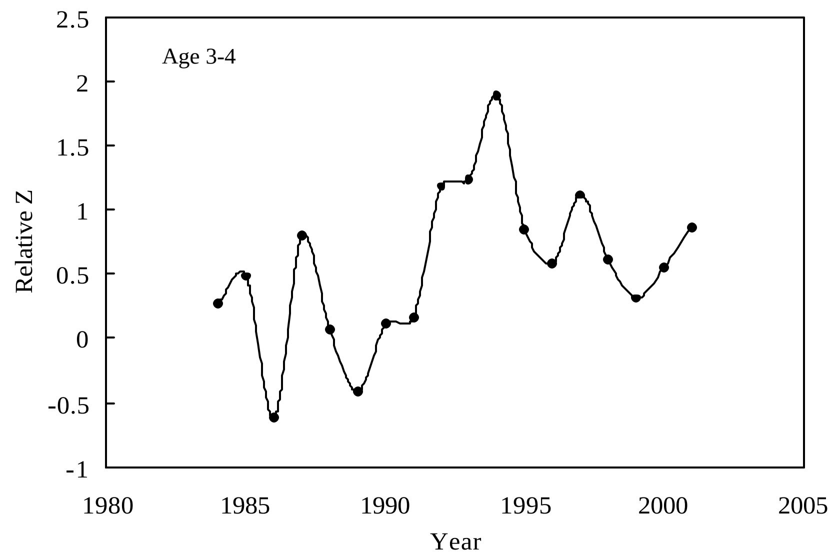


Fig. 16.5. Cod in Div. 2J+3KL: mortality rate (Z) for age 4 fish calculated from the Canadian autumn research vessel bottom-trawl data for 1984-2001.

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.

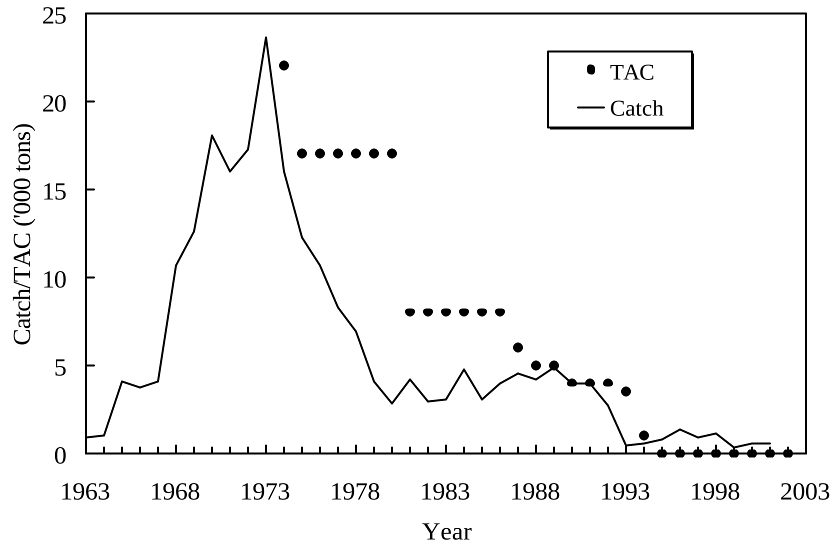


Fig. 17.1. Witch flounder in Div. 2J, 3K and 3L: catches and TAC

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.

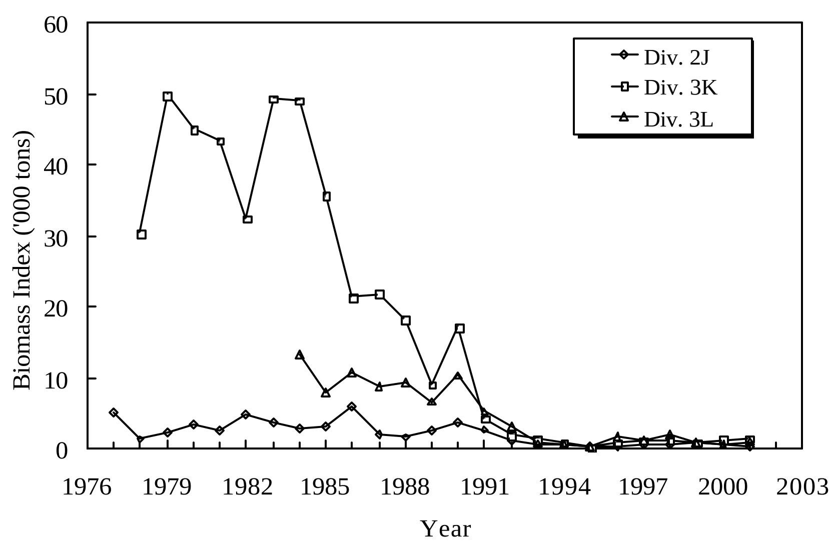


Fig. 17.2. Witch flounder in Div. 2J, 3K and 3L: biomass indices from Canadian autumn surveys.

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.

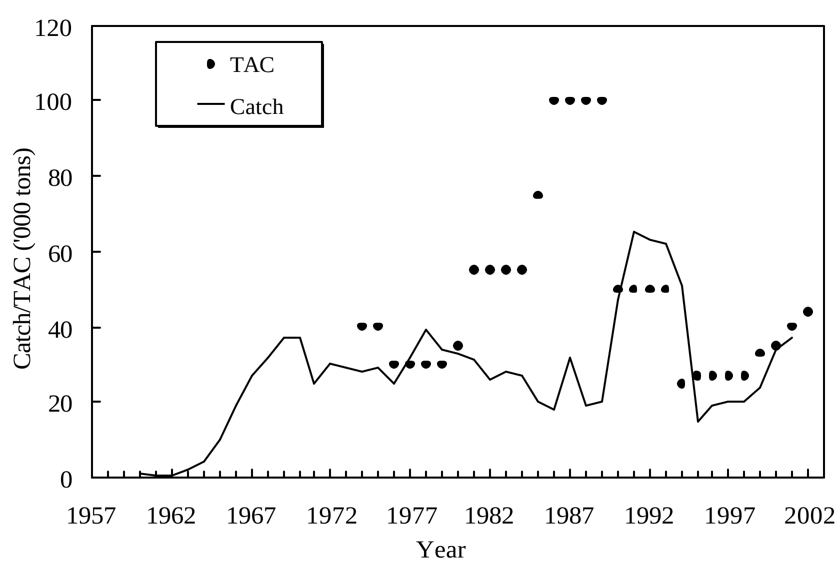


Fig. 18.1. Greenland halibut in Subarea 2 + Div. 3KLMNO: catches and TACs.

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).

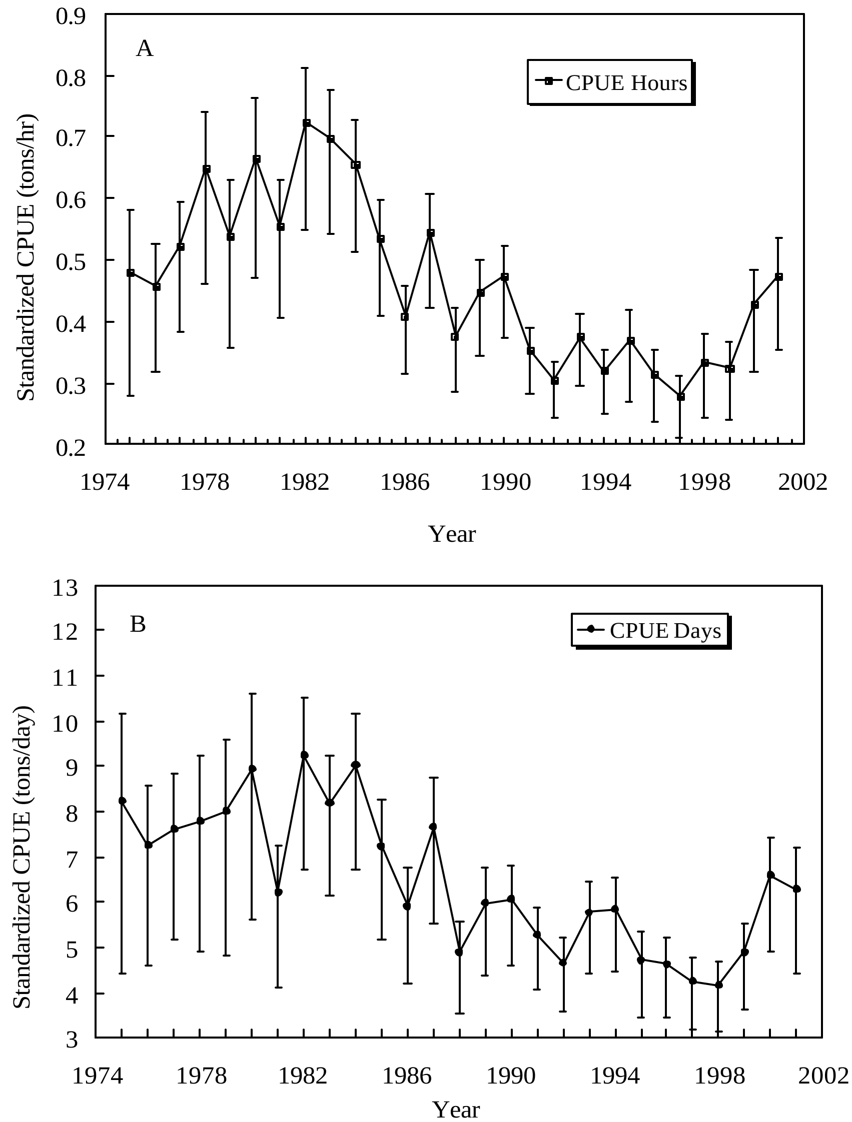


Fig. 18.2 Greenland halibut in Subarea 2 + Div. 3KLMNO: standardized CPUE based on A) hours fished and B) days fished from the international fishery.

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.

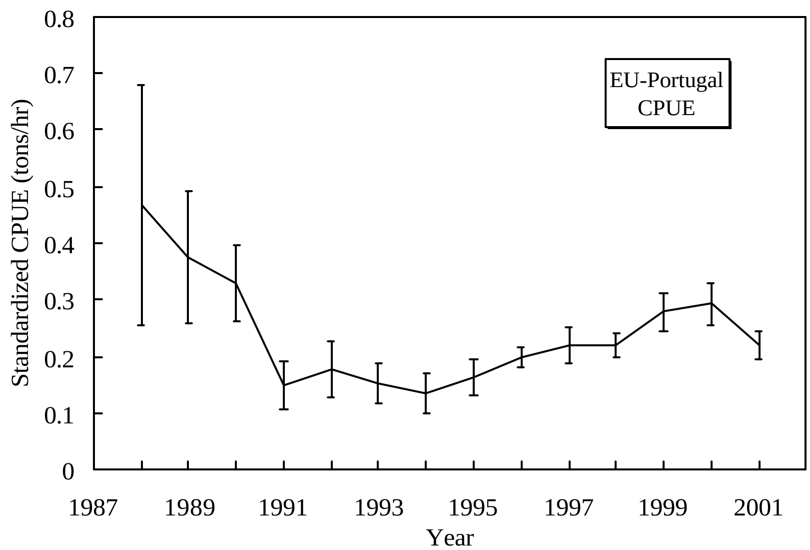


Fig. 18.3 Greenland halibut in Subarea 2 + Div. 3KLMNO: standardized CPUE from the EU-Portugal trawlers with scientific observers in Div. 3LMN.

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 5-9 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.

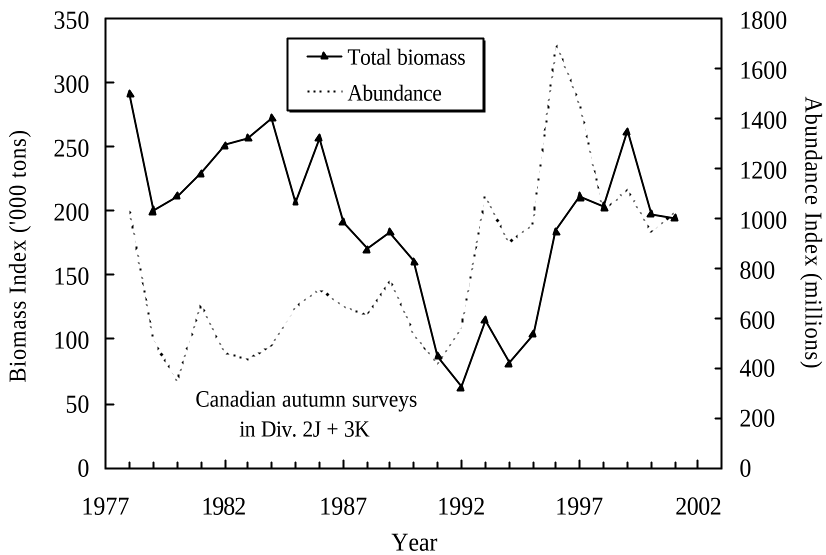


Fig. 18.4. Greenland halibut in Subarea 2 + Div. 3KLMNO: estimates of biomass and abundance from Canadian autumn surveys in Div. 2J and 3K.

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).

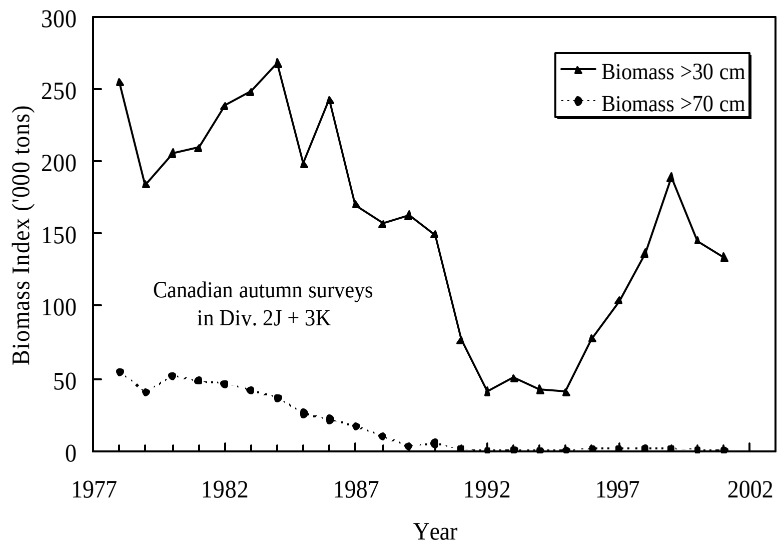


Fig. 18.5 Greenland halibut in Subarea 2 + Div. 3KLMNO: estimates of biomass for fish >30 cm and >70 cm from Canadian surveys in Div. 2J and 3K.

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.

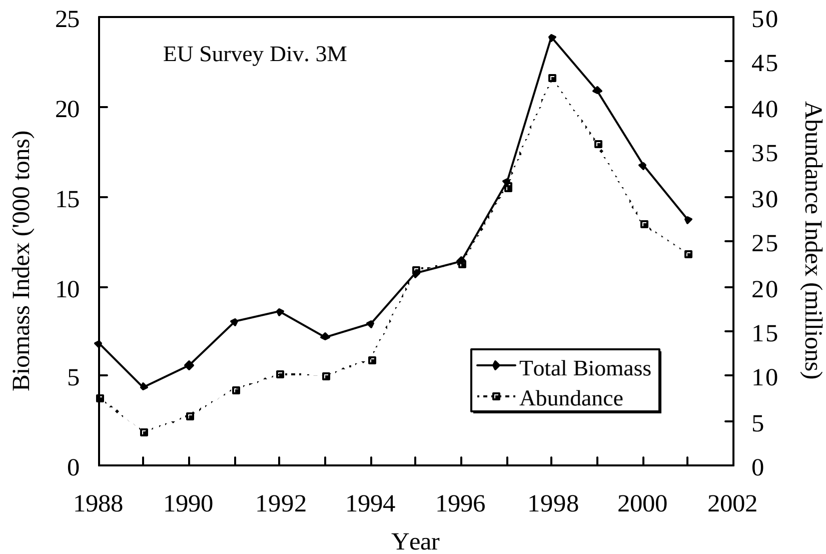


Fig. 18.6. Greenland halibut in Subarea 2 + Div. 3KLMNO: estimates of biomass and abundance from EU summer surveys in Div. 3M.

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.

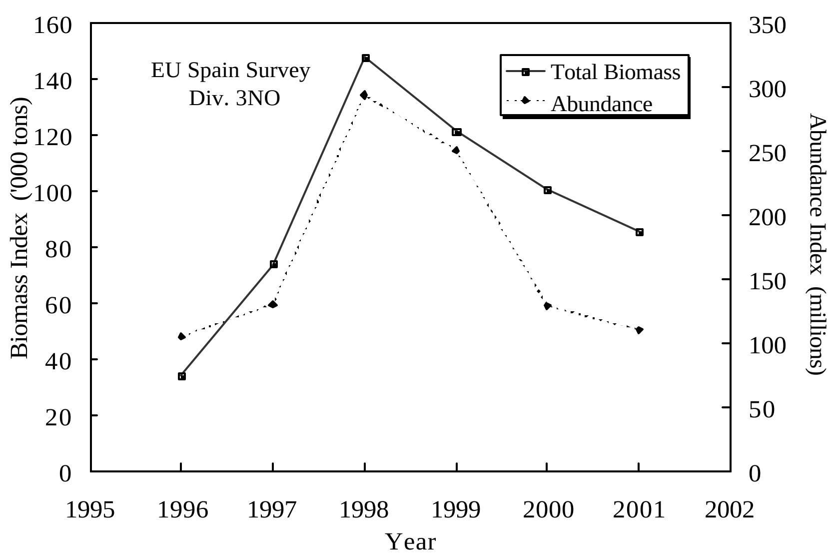


Fig. 18.7. Greenland halibut in Subarea 2 + Div. 3KLMNO: estimates of biomass and abundance from EU-Spain spring surveys in Div. 3NO.

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.

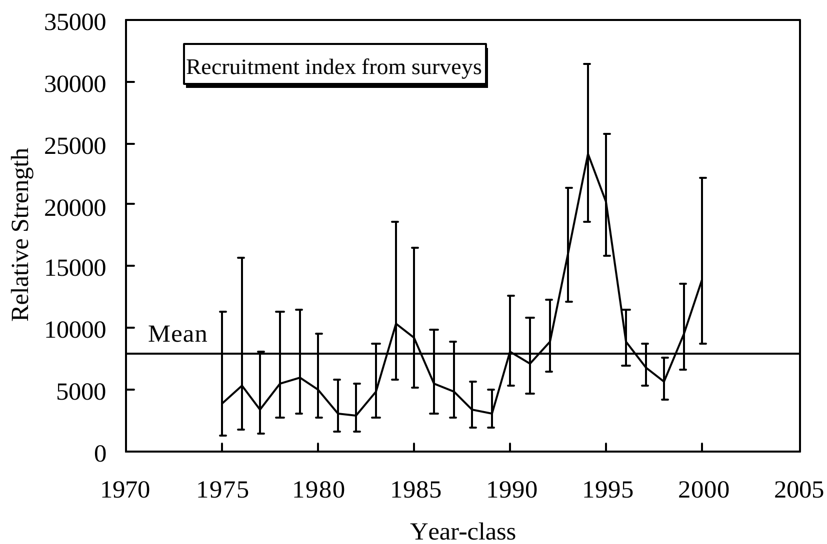


Fig. 18.8 Greenland halibut in Subarea 2 + Div. 3KLMNO: recruitment index from seven research vessel survey series.

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.

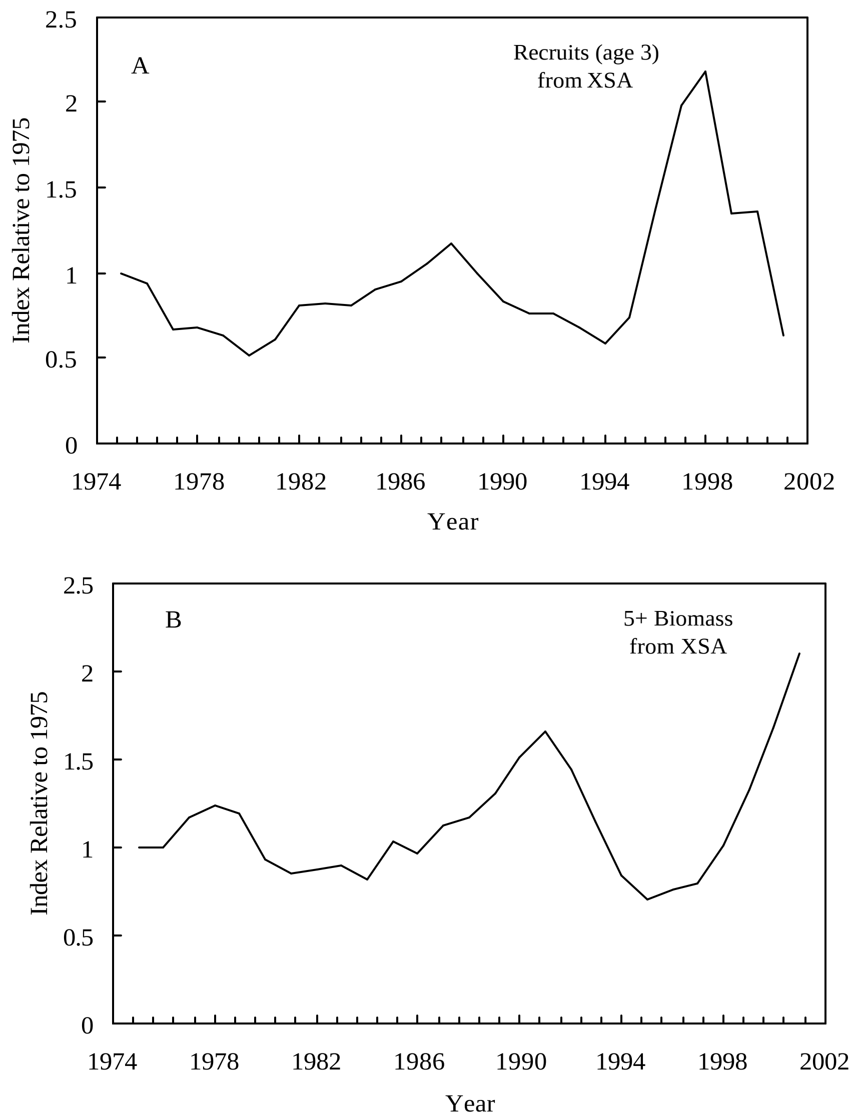


Fig. 18.9. Greenland halibut in Subarea 2 + Div. 3KLMNO: A) recruitment index (age 3) and B) 5+ Biomass, from XSA.

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.

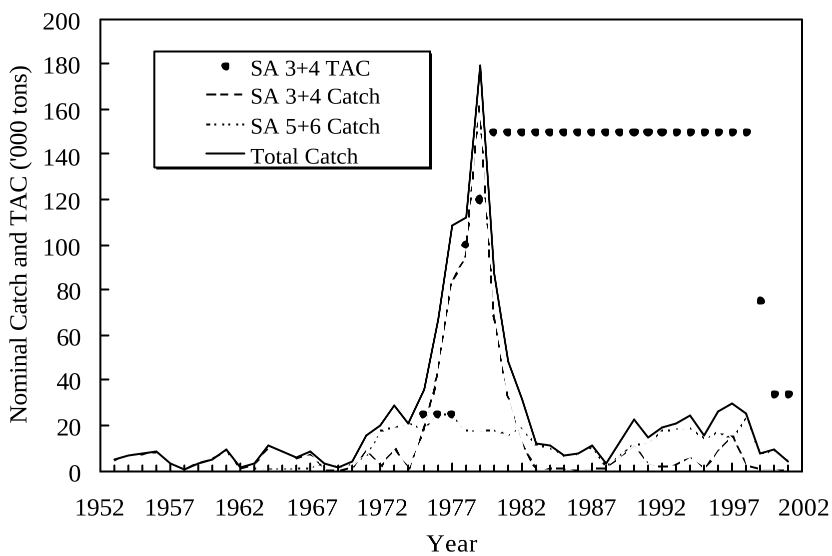


Fig. 19.1. Northern shortfin squid in Subareas 3+4: nominal catches and TACs in relation to catches from Subareas 5+6 and the total stock.

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.

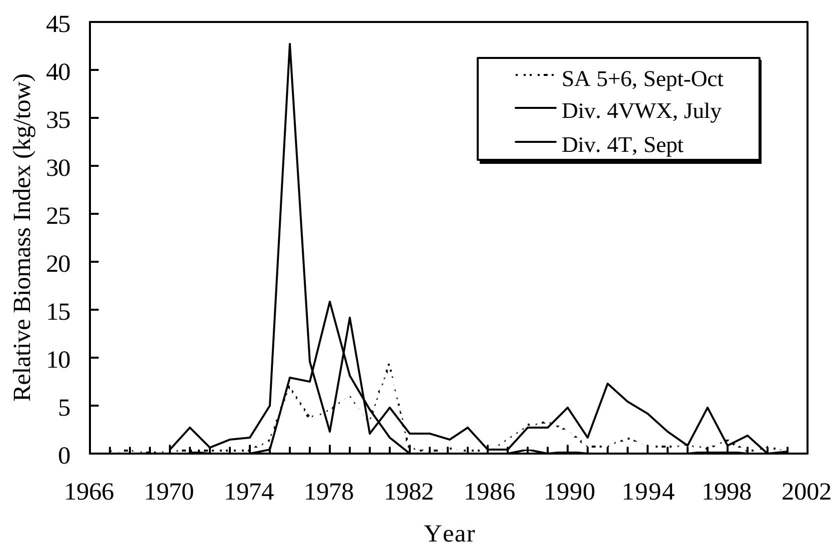


Fig. 19.2. Northern shortfin squid in Subareas 3+4: research survey biomass indices for Subarea 4, during July in Div. 4VWX and September in Div. 4T, and during autumn in Subareas 5+6.

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.

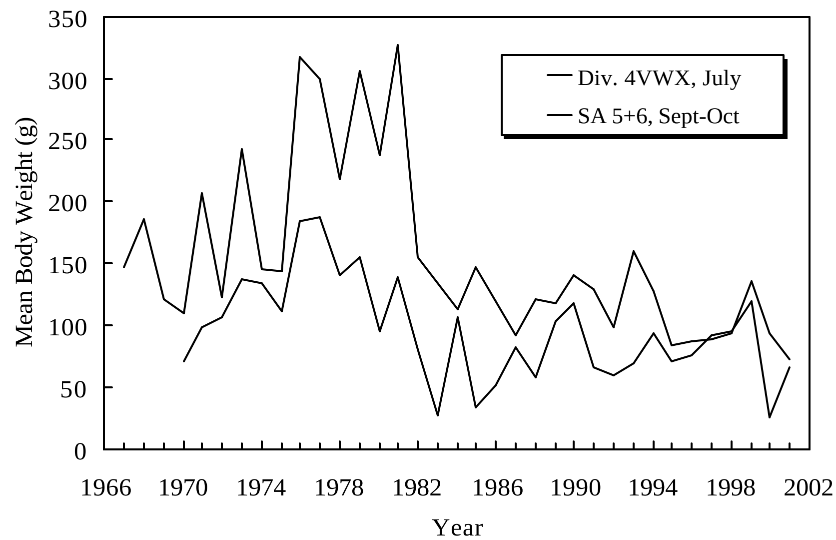


Fig. 19.3. Northern shortfin squid in Subareas 3+4: mean body weight in the July survey in Div. 4VWX and the autumn surveys in Subareas 5+6.

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.

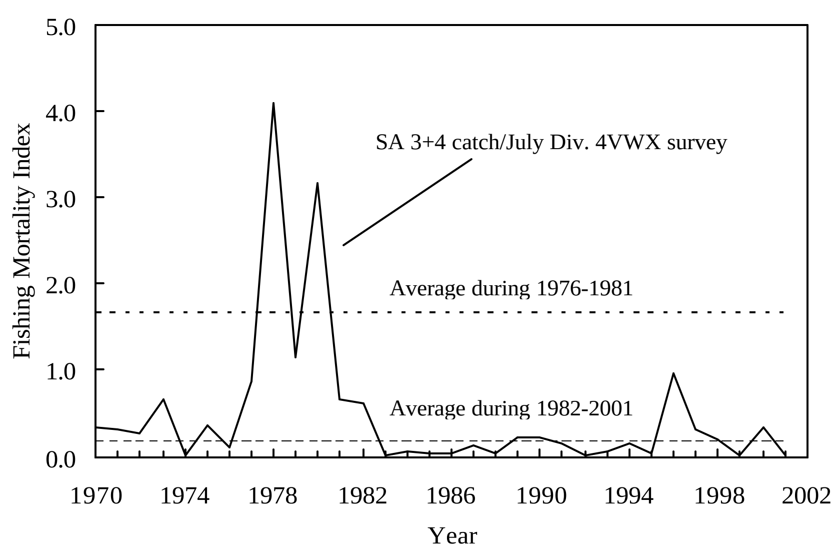


Fig. 19.4. Northern shortfin squid in Subareas 3+4: fishing mortality indices.

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.