# PART A

## Scientific Council Meeting, 31 May-14 June 2001

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**Participants at Scientific Council Meeting, 31 May-14 June 2001** (Bottom to top – left to right):

A. Nicolajsen, F. Gonzalez, T. Amaratunga, E. A. Colbourne
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# REPORT OF SCIENTIFIC COUNCIL MEETING

31 May-14 June 2001

Chairman: W. B. Brodie Rapporteur: T. Amaratunga

## I. PLENARY SESSIONS

The Scientific Council met at the Alderney Landing, 2 Ochterloney Street, Dartmouth, Nova Scotia, Canada, during 31 May-14 June 2001, to consider the various matters in its agenda.

Representatives attended from Canada, Cuba, Denmark (in respect of Faroe Islands and Greenland), Estonia, 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.

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 31 May 2001.

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

The Assistant Executive Secretary informed 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.

In the review of the Provisional Agenda, the Chairman noted many additional tasks at hand resulting from many requests for advice from the Fisheries Commission. While noting that Standing Committees may include some changes to their individual agendas, the Council **adopted** the agenda as presented (see Agenda I, Part D, this volume).

The Council noted it had no request from observers to attend this meeting.

The Council noted this year's heavy workload for providing advice would require some additional work by the Standing Committees and that some Designated Experts and other experts would be requested to address these as needed.

The Chairman noted elections were needed to the Chair of Scientific Council, Vice Chair of Scientific Council and STACREC, and Chairs of STACFIS, STACPUB and STACFEN, to take office at the end of the NAFO Annual Meeting in September 2001. The Chairman was pleased to announce W. R. Bowering (Canada), M. Stein (EU-Germany) and A. Vazquez (EU-Spain) had agreed to form the nominating committee.

The Council welcomed E. Trippel (Canada) to present the Chairman's update on the progress of the Working Group on Reproduction Potential (see Section X below).

Having reviewed the work plan for each Agenda item, the opening session was adjourned at 1135 hours.

The Council reconvened briefly at 0915 hours on 1 June 2001, and reviewed the extensive list of requests for advice from the Fisheries Commission and Coastal States and nominated certain Designated Experts and experts to address them.

The Council through 9-13 June 2001 addressed various outstanding agenda items as needed. These are given in relevant sections of the report below. The Chairman also called for Executive Committee meetings as needed.

The concluding session was called to order at 0900 hours on 14 June 2001.

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 31 May-14 June 2001, noting changes as discussed during the reviews would be made by the Chairman and Assistant Executive Secretary.

The meeting was adjourned at 1215 hours on 14 June 2001.

The Reports of the Standing Committees are appended as follows: Appendix I. STACFEN, Appendix II. STACREC, Appendix III. STACPUB and Appendix IV. STACFIS.

The Agenda, List of Research (SCR) and Summary (SCS) Documents, List of Representatives, Advisers/Experts and Observers 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-XVII.

## II. REVIEW OF SCIENTIFIC COUNCIL RECOMMENDATIONS IN 2000

The Council noted recommendations made in 2000 pertaining to the work of the Standing Committees were addressed directly by the Standing Committees, while recommendations pertaining specifically to the Council's work were 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 Chairman, M. Stein. The full report of STACFEN is at Appendix I.

## IV. RESEARCH COORDINATION

The Council **adopted** the Report of the Standing Committee on Research Coordination (STACREC) as presented by the Chairman, R. K. Mayo. 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. *Contracting Parties should check to see what interest there is to having their national data included in the Northwest Atlantic Survey Database. Assuming there is interest, Contracting Parties should submit an inventory of applicable data, entailing number of records, data type and formats. Once available, the complete inventory of data will be used to evaluate the complexity and costs of conversion to the database format.*

2. *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*.

3. STACREC noted that the Conservation and Enforcement Measures Part VI, Program for Observers and Satellite Tracking (Section 3 d), is inconsistent with the Scientific Council protocols adopted by the Fisheries Commission in 2000 and therefore **recommended** that *the Chairman of the Scientific Council contact the Chairman of the Fisheries Commission to develop a means of resolving this inconsistency at the 2001 Fisheries Commission meeting.*

4. *the development of a training and operation manual for the collection of scientific data continue, and that the Scientific Council be represented at the September 2001 STACTIC meeting to further pursue this issue.*

5. *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.*

## V. PUBLICATIONS

The Council **adopted** the Report of the Standing Committee on Publications (STACPUB) as presented by the Chairman, O. Jørgensen. The full report of STACPUB is at Appendix III.

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

1. *each member of the Secretariat be given an individual e-mail address.*

2. *the Secretariat should routinely submit a report in June on the website usage to STACPUB.*

3. *an additional agenda item for future meetings should be introduced to include website use summaries and statistics.*

4. *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.*

   The Council noted consultations had taken place between the Chairs of Scientific Council and Fisheries Commission at this matter.

5. *the collection of papers being prepared by the Working Group on Reproductive Potential be edited by the Working Group Chairman, E. A. Trippel (Canada) and compiled into a single issue of the Journal of Northwest Atlantic Fishery Science during 2002.* STACPUB further **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*.

6. *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.*

## VI. FISHERIES SCIENCE

The Council **adopted** the Report of the Standing Committee on Fisheries Science (STACFIS) as presented by the Chairman, H.-J. Rätz. 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 2002

The Scientific Council and the Fisheries Commission during the Annual Meeting of September 2000 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 year 2002.

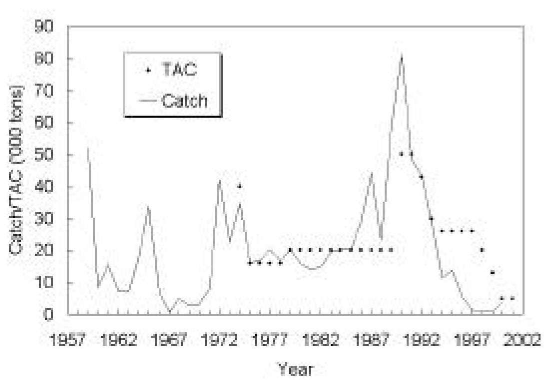
## *Redfish (Sebastes spp.) in Division 3M*

**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 Div. 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 1 100 tons was recorded mostly as by-catch in the Greenland halibut fishery. Despite low effort by Japanese fleet in 2000 there is an overall increase of the redfish catches to 3 900 tons in 2000. The decline in the Div. 3M redfish catches from 1990 to 1999 was related to the simultaneous quick decline of the stock biomass and fishing effort. The rapid expansion, beginning in 1993, of a shrimp fishery on Flemish Cap led to high levels of redfish by-catch in 1993-94. Despite the fact that since 1995 this by-catch fell to lower levels, it is still accounting for an important portion of the catch in numbers for the most recent years (averaging 42% of the total Div. 3M redfish catch in numbers in 1998-2000).

| | Catch[1] ('000 tons) | TAC ('000 tons) Recommended | Agreed |
|---|---|---|---|
| 1998 | 1.0 | 20 | 20 |
| 1999 | 1.1 | 10 | 13 |
| 2000 | 3.8 | 3-5 | 5 |
| 2001 | | 3-5 | 5 |

[1] Provisional, excluding redfish by-catch in the shrimp fishery in Div. 3M.



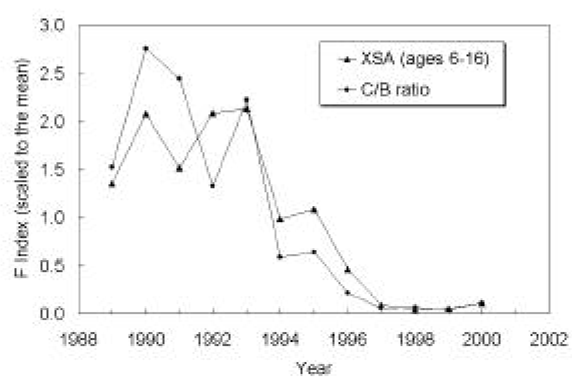

**Data**: Catch-at-age data were available from 1989-2000, including by-catch information from the shrimp fishery.

Catch rate data for 1959-93 were available from the NAFO database.

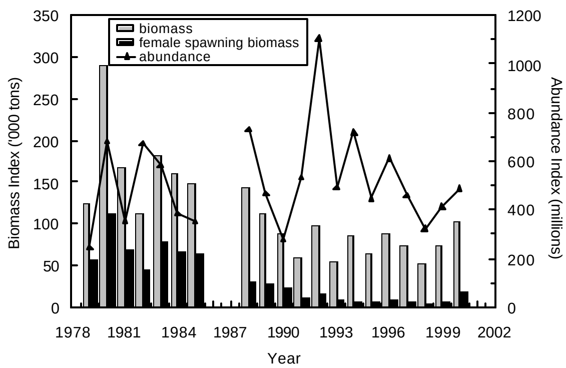
There are three survey series providing bottom biomass indices as well as length and age data for the Flemish Cap redfish stocks; Russia (1983-93 and 1995-96), EU (1988-2000) and Canada (1979-85 and 1996). The Russian survey was complemented with an acoustic estimate of the redfish pelagic component for the 1988-92 period.

**Assessment**: Survey bottom biomass and female spawning biomass were calculated from 1979-89 Canadian and 1988-2000 EU surveys. A virtual population analysis (XSA) and a surplus production analysis (ASPIC) were carried out for 1989-2000, providing indicators of stock biomass and fishing mortality trends.

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

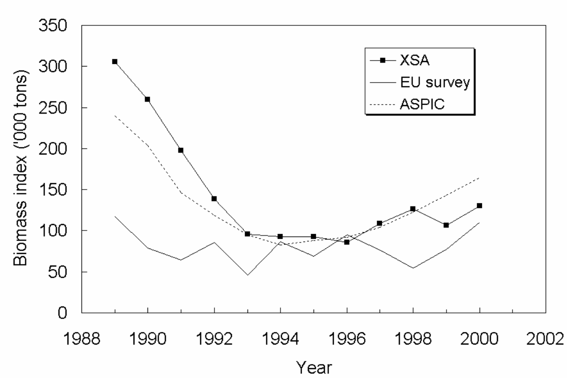



*Recruitment*: No other pulse of recruitment has occurred since 1990 and abundance at age 4 has been fluctuating over the more recent years at a low level, when compared to the average recruitment of the whole series.




*Biomass*: The stock experienced a steep decline from the late-1980s that continued until 1994, resulting in a decline of the beaked redfish female spawning biomass. Over the second half of the 1990s the decline in stock biomass and female spawning biomass appears to have halted. Despite the recent increases observed in survey biomass it is still unclear as to whether there has been any actual change.

Over the past 5 years, female spawning stock biomass has been about 20% of the total biomass. From 1989 to 1993 that proportion was about 32%.




**State of the Stock**: Scientific Council concluded that the total stock and spawning stock are currently at a low level compared to the earlier period in the time series. At the current low fishing mortality, and with growth of the relatively strong 1990 year-class, stock and spawning biomass should gradually increase.

**Recommendation**: The Council was unable to advise on a specific TAC for year 2002, 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 2002 be in the range of 3 000-5 000 tons.

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

**Special Comments:** By-catch of juvenile redfish in the shrimp fishery should be kept to the lowest possible level. Redfish by-catches in this shrimp fishery should be closely monitored with information on length distributions and weights and numbers caught being reported on a regular basis to Scientific Council each November during the assessment of shrimp in Div. 3M.

**Sources of Information**: SCR Doc. 01/19, 22, 45; SCS Doc. 01/09, 11, 18.

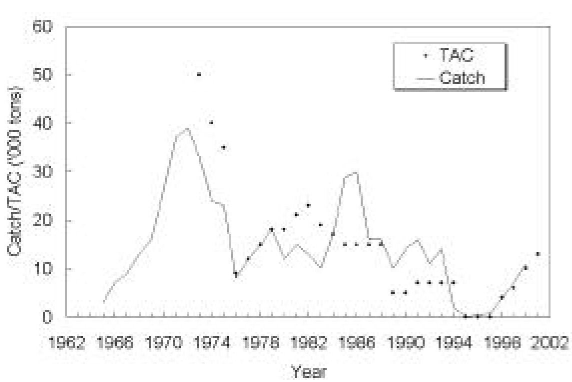
## *Yellowtail Flounder (Limanda ferruginea) in Divisions 3L, 3N and 3O*

**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 has been a moratorium on directed fishing from 1994 to 1997. Small catches were taken as by-catch in other fisheries. Prior to the moratorium, TACs had been exceeded each year from 1985 to 1993. The fishery was re-opened for 1998 and a catch of 4 400 tons was taken. In the 1999 and 2000 fisheries, catches of 6 700 tons and 11 120 tons, respectively were taken.

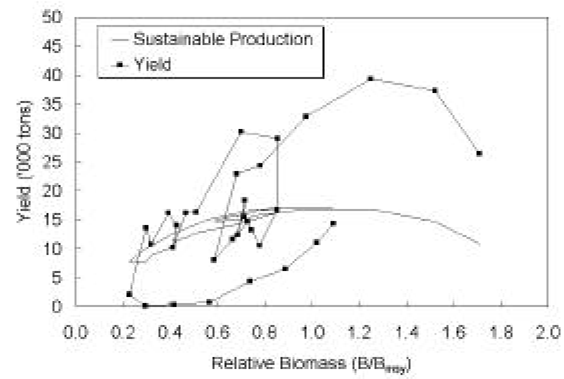
| | Catch[1] ('000 tons) | TAC ('000 tons) | |
|---|---|---|---|
| | | Recommended | Agreed |
| 1998 | 4 | 4 | 4 |
| 1999 | 7 | 6 | 6 |
| 2000 | 11 | 10 | 10 |
| 2001 | | 13 | 13 |

[1] Provisional.

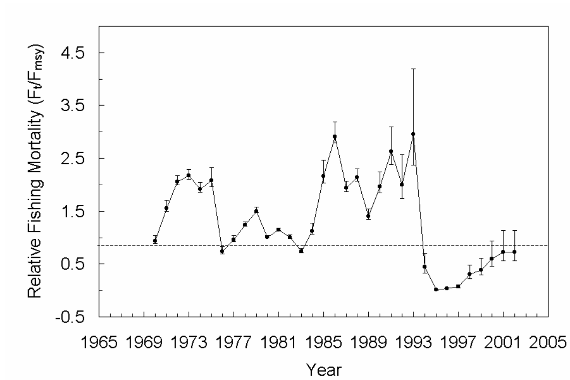



**Data**: Canadian CPUE data were available from 1965 to 2000. Limited by-catch sampling data from the Russian, Portuguese and Spanish trawler fleets were available. Abundance and biomass indices were available from: annual Canadian spring (1971-82; 1984-2000) and autumn (1990-2000) bottom trawl surveys; annual USSR/Russian spring surveys (1972-91); co-operative Canadian Dept. Fisheries and Oceans/Canadian fishing industry surveys (1996-2000); and Spanish surveys in the NAFO Regulatory Area of Div. 3NO (1995-2000).

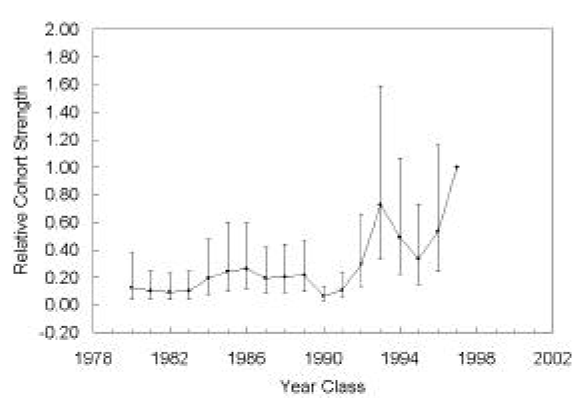
**Assessment**: An analytical assessment using a stock production model was presented to estimate stock status in 2002. Since 1994, when the moratorium (1994-97) was put in place, the estimated yield has been below sustainable production levels.



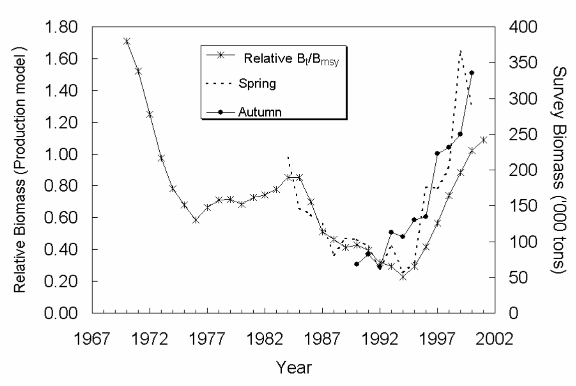

*Fishing Mortality*: Has been below $F_{msy}$ since 1994 and is projected to be 73% $F_{msy}$ in 2001 with an assumed catch of 14 300 tons (TAC + 10% over-run).




*Recruitment:* Recruitment has improved since 1990.




*Biomass:* The average 2000 survey biomass was estimated to be the highest in the time series at 311 000 tons. Relative biomass from the production model has been increasing since 1994 and is estimated to be above the level of $B_{msy}$ in 2001 and is projected to be above the level of $B_{msy}$ in 2002.




**State of the Stock**: Based on results of 2 additional surveys since the 2000 assessment, the current view is that the stock size has increased over the past year. The stock biomass is perceived to be at the level well above that of the mid -1980s.

**Recommendation**: The TAC for yellowtail flounder in Div. 3LNO for the year 2002 should not exceed 13 000 tons, based on the projection of F= 2/3 $F_{msy}$ and an assumed catch of 14 300 tons in the year 2001.

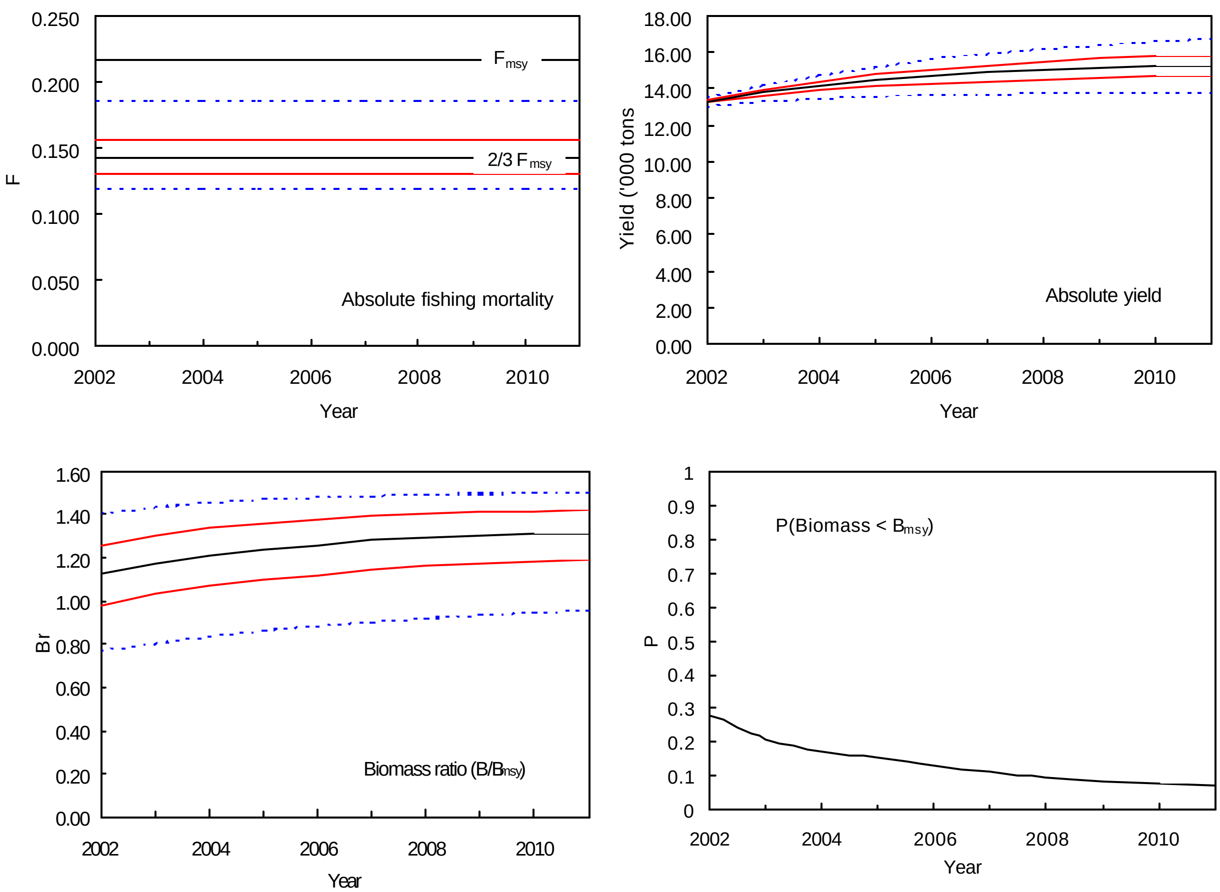
**Reference Points:** Scientific Council considered 2/3 $F_{msy}$ to be a fishing mortality target.

Scientific Council notes it is not in a position to propose reference points from an age based assessment 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 (see Figures below) were made to estimate yield for each year from 2002 to 2011 while constraining F at 2/3 $F_{msy}$. The results suggest that yield will increase to a maximum of 15 000 tons in the year 2011. The probability of biomass falling below $B_{msy}$ decreases to less than 10% by 2011.

**Sources of Information**: SCR Doc. 01/50, 69, 70, 71, 74, 76, 78; SCS Doc. 01/9, 11, 18.

Yellowtail flounder in Div. 3LNO: figures show 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, biomass 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 (TAC + 10% over-run) in 2001.



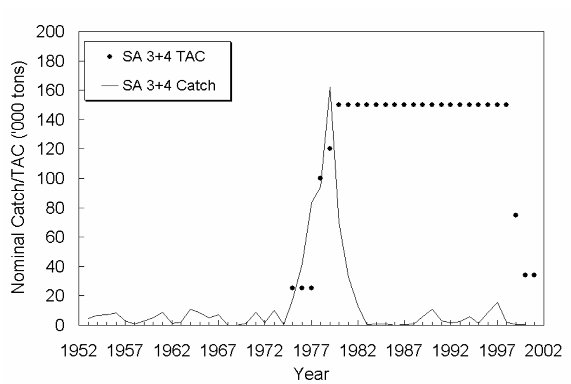
## *Short-finned Squid (Illex illecebrosus) in Subareas 3 and 4*

**Background**: The northern short-finned 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 1976-81, 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 1987-95, increased to 16 000 tons in 1997, and declined to 300 tons in 1999 and 2000. A TAC for Subareas 3+4 was first established in 1975 at 25 000 tons but was increased in 1978, 1979 and 1980. The TAC remained at 150 000 tons during 1980-98 and was set at 75 000 tons for 1999 and 34 000 tons for 2000-2001.

| | Catch[1] ('000 tons) | TAC ('000 tons) Recommended | Agreed |
|---|---|---|---|
| 1998 | 1.9 | na | 150 |
| 1999 | 0.3 | 19-34 | 75 |
| 2000 | 0.3 | 19-34 | 34 |
| 2001 | | | 34 |

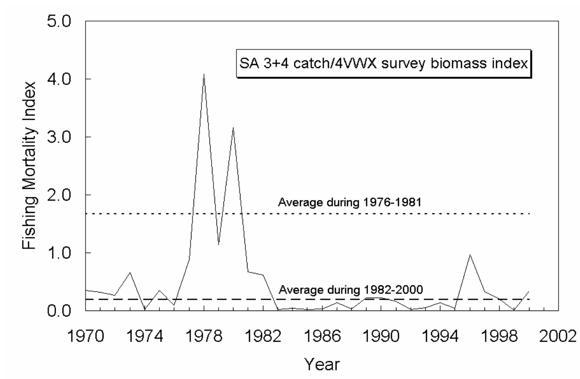
[1] Provisional.
na No advice provided.



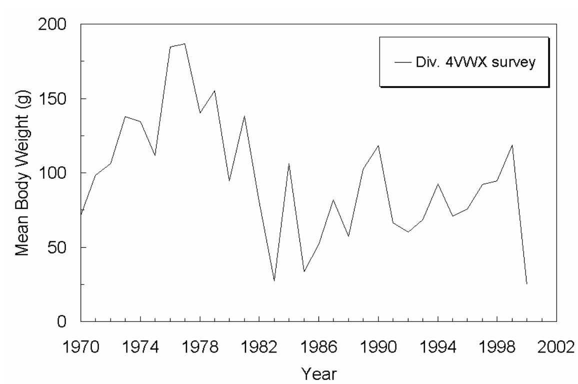

**Data:** Relative biomass and abundance indices were available from annual Canadian bottom trawl surveys conducted in July on the Scotian Shelf (Div. 4VWX, 1970-2000) and in September in the southern Gulf of St. Lawrence (Div. 4T, 1971-2000). The July survey indices are assumed to reflect relative stock size at the beginning of the fishing season. Size composition data were available from the Div. 4VWX survey and from the commercial inshore jig fishery in Subarea 3.

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

*Fishing Mortality:* Fishing mortality indices were highest during 1978-80 and averaged 1.67 during the period of highest catch (1976-81). During 1982-2000, fishing mortality indices were much lower and averaged 0.19.




*Mean Size*: Annual mean body weights of squid from the Div. 4VWX survey declined markedly during 1982-83, following a period of much higher mean weights during 1976-81. Mean body weight was the lowest on record in 2000, consistent with a very small mean length for squid from the Subarea 3 inshore jig fishery.




*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, indicative of low squid productivity, and reached their lowest level on record in 2000.

**State of the Stock:** Based on survey data, the short-finned squid resource in Subareas 3+4 remained at a low level in 2000.

**Recommendation:** The Scientific Council is unable to advise on a specific level of catch for year 2002.

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 year 2002 for short-finned 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 short-finned squid in Subareas 3-6 (and further south to Florida) are considered to comprise a unit stock.

**Sources of Information:** SCR Doc. 98/75, 01/57, 61; SCS Doc. 01/11, 12, 17.

**Response to Fisheries Commission Special Request for Scientific Advice in the Year 2002 Regarding Squid (*Illex*) in Subareas 3+4**

The Fisheries Commission stated: *For squid (Illex) in Subareas 3 and 4, the Scientific Council is requested to advise on the level of TAC in high abundance years and on the critieria which could be reliably used to forecast changes in productivity under an annual management regime. Scientists are encouraged to further analyze available data toward developing other possible indicators that could be used under an in-season management regime for squid, recognizing that the practical use of such indicators would require that they be available as early in the season as possible.*

The Scientific Council responded that in 2000, Scientific Council was unable to advise on any modification to the protocol for determining productivity of the short-finned squid resource in NAFO Subareas 3+4 to ensure its applicability in the long term. There are no new data available to address this issue. Furthermore, Scientific Council is not in a position to advise on a specific level of TAC that would be applicable during the high productivity regime.

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

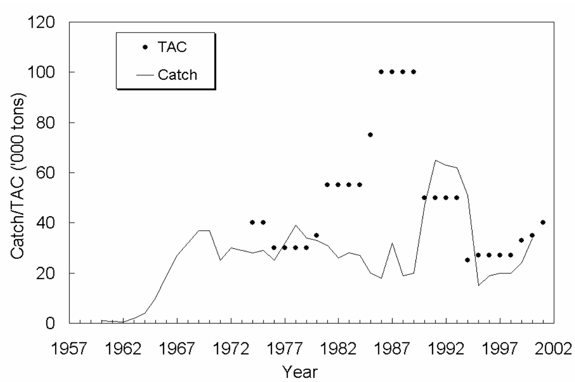
**Background**: The Greenland halibut stock in Subarea 2 and Div. 3KLMNO is considered to be part of a biological stock complex, which includes Subareas 0 and 1.

**Fishery and Catches**: Catches increased sharply in 1990 due to a developing fishery in the Regulatory Area in Div. 3LMN 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 2000 was estimated to be 34 000 tons, the highest since 1994.

Catches in the following table are best estimates.

| | Catch[1] | TAC[2] ('000 tons) | |
|---|---|---|---|
| | ('000 tons) | Recommended | Agreed |
| 1998 | 20 | | 27 |
| 1999 | 24 | ~30 | 33 |
| 2000 | 34 | ~30 | 35 |
| 2001 | - | 40 | 40 |

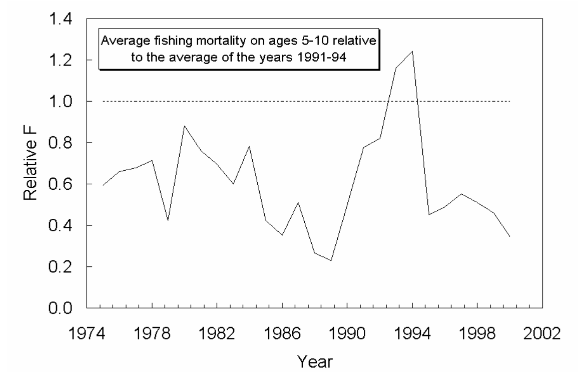
1 Provisional.
2 Established autonomously by Canada prior to 1995 and by the Fisheries Commission in 1995-2001.



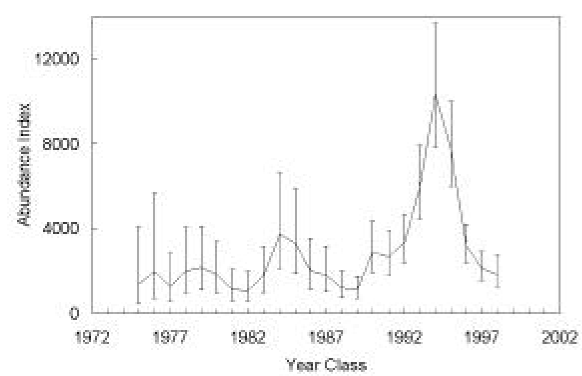

**Data**: CPUE data were available from international otter trawl fisheries throughout the stock area and the Portuguese otter trawl fishery in the Regulatory Area of Div. 3LMN. Abundance and biomass indices were available from research vessel surveys of Canada (1978-2000) and EU (1988-2000). International commercial catch-at-age data were available from 1975-2000.

**Assessment**: An analytical assessment using Extended Survivors Analysis (XSA) was reviewed to investigate population numbers in 2001.

*Fishing Mortality*: While the absolute estimate of fishing mortality implied from the analysis was uncertain, it indicated that the fishing mortality level for 2000 was relatively low in comparison to the early-1990s.

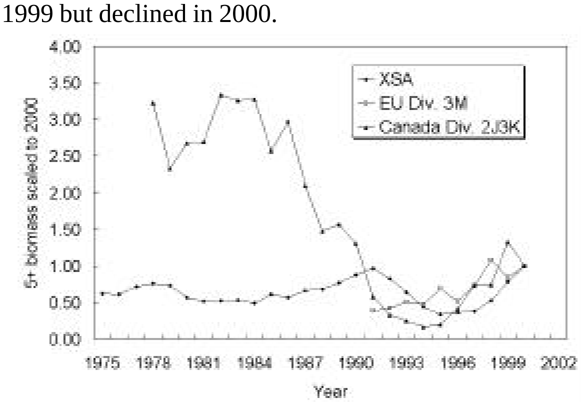



*Recruitment*: Above average recruitment indicated for the 1993-95 year-classes. The 1996 to 1998 year-classes appear to be average to below average. However, the comparability of the estimates may be significantly influenced by the change in survey gear in 1995.

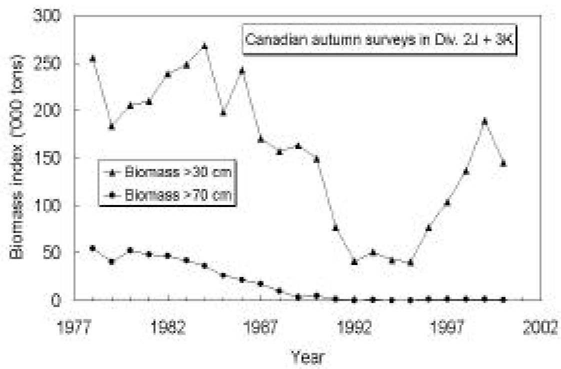



*Biomass*: As the dynamics of the population remain uncertain, it is not possible to determine an estimate of absolute biomass.

Most survey indices of biomass increased from 1996 to 1999 but declined in 2000.



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 somewhat in 2000. 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 appears to be recovering due to good recruitment and low fishing mortality but the biomass of fish over 70 cm is still low. There is concern that the major indices showed a decline in the recent 1-2 years.

**Catch Forecast:** Short-term projections indicate that there may be scope for catches to increase up to 44 000 tons in 2002 while maintaining the current fishing mortality. See Figure below.

**Recommendation:** The results of the assessment are considered uncertain. There is a high level of uncertainty associated with the estimates of the 1994 and 1995 year-classes, and these year-classes are expected to contribute significantly to the catches in 2001 and 2002. In addition, the high 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. The Scientific Council therefore recommends that the catch for 2002 should not exceed the 2001 level of 40 000 tons until the contribution of the 1994 and 1995 year-classes to the catches in 2001 can be evaluated during the 2002 assessment.

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.

**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.

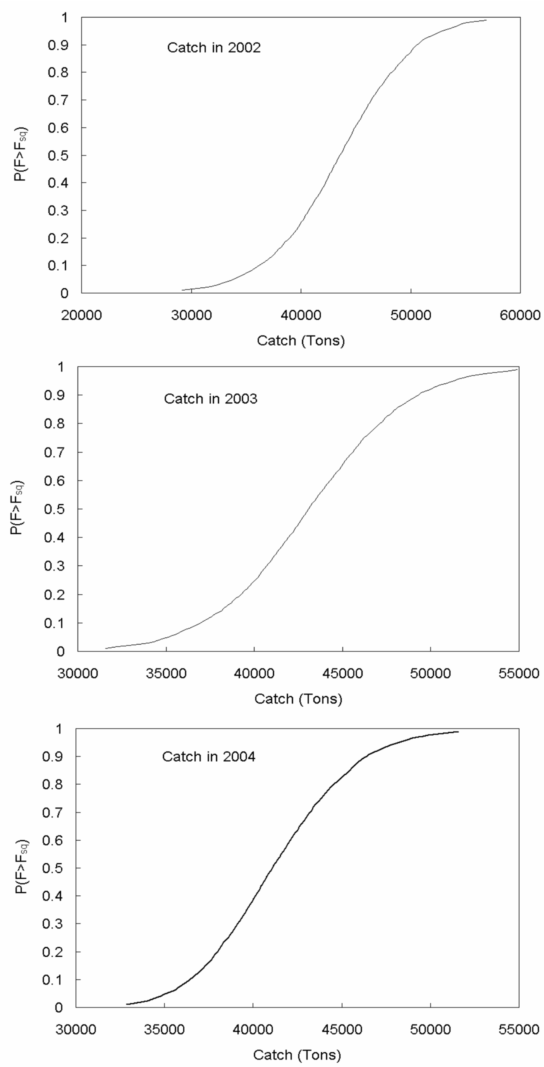
During previous assessments, Scientific Council has noted that fishing effort should be distributed in a similar fashion to biomass distribution in order to ensure sustainability of all spawning components. Application of this approach becomes increasingly important as the overall TAC is increased.

Scientific Council is also concerned that increased catches of Greenland halibut will result in increased catches of other species, some of which are currently under moratoria. 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. 01/10, 13, 22, 39, 44, 49, 79, 80; SCS Doc. 01/9, 11, 18.

Greenland halibut in Subareas 2+3: short-term catch projection at $F_{sq}$

| Year | 2002 | 2003 | 2004 |
|---|---|---|---|
| Deterministic | 43945 | 43434 | 41343 |
| P=0.05 X = | 33829 | 35156 | 35136 |
| P=0.50 X = | 43562 | 43071 | 41084 |
| P=0.95 X = | 52904 | 51317 | 48153 |



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

**Recommendation**: No advice possible.

**Special Comments**: Scientific Council has noted previously that there are data available from multi-species surveys in Div. 3NO that may be useful for evaluating the status of this capelin resource. Despite repeated recommendations that these data be examined and the results of the analyses be brought forward to review by Scientific Council, this has not happened. Scientific Council **recommends** that *data on capelin in Div. 3NO available from Canadian bottom trawl surveys be analyzed and the results be presented at the June 2002 Meeting*.

Scientific Council noted that NAFO has recognized the role that capelin play in the Northwest Atlantic ecosystem as a very important prey species for fish, marine mammals and seabirds. In acknowledgement of this, for many years Scientific Council has maintained the perspective that exploitation should not exceed 10% of the known spawning biomass. Historically, the spawning biomass was determined through the use of hydroacoustics.

Capelin have shown themselves, throughout the North Atlantic, to be amenable to enumeration through application of acoustic techniques. This approach has the added benefit that very little mortality is applied.

Given the unknown status of the resource in Div. 3NO coupled with the acknowledged important role of capelin in the ecosystem, Scientific Council **recommends** that *initial investigations to evaluate the status of Div. 3NO capelin utilize acoustic surveys to allow comparison with the historical time series*.

### b) Request for Advice on TACs and Other Management Measures for the Years 2002 and 2003

The Scientific Council and the Fisheries Commission during the Annual Meeting of September 2000 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 2002 and 2003.

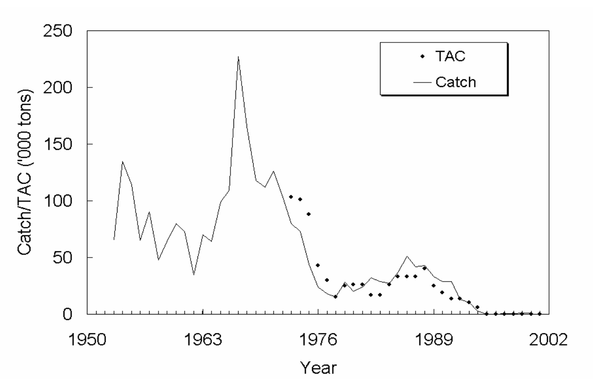
## *Cod (Gadus morhua) in Divisions 3N and 3O*

**Background**: This stock occupies the southern part of the Grand Bank of Newfoundland. Cod are found over the shallower parts of the bank in summer, particularly in the Southeast Shoal area (Div. 3N) and on the slopes of the bank in winter as cooling occurs.

**Fishery and Catches**: There has been no directed fishery since mid-1994.

| | Catch[1] | TAC ('000 tons) | |
|---|---|---|---|
| | ('000 tons) | Recommended | Agreed |
| 1998 | 0.6 | ndf | 0 |
| 1999 | 0.9 | ndf | 0 |
| 2000 | 1.0 | ndf | 0 |
| 2001 | | ndf | 0 |

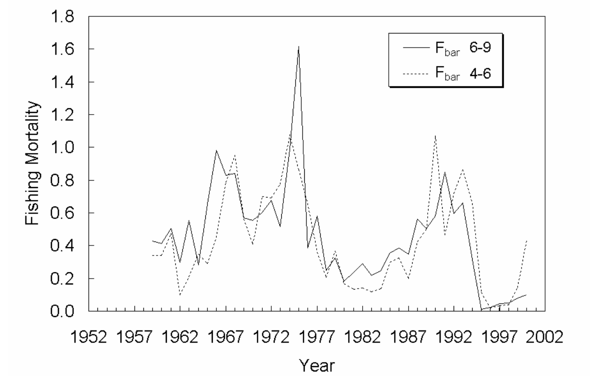
[1] Provisional.
ndf No directed fishery and by-catches of cod in fisheries targeting other species should be kept at the lowest possible level.



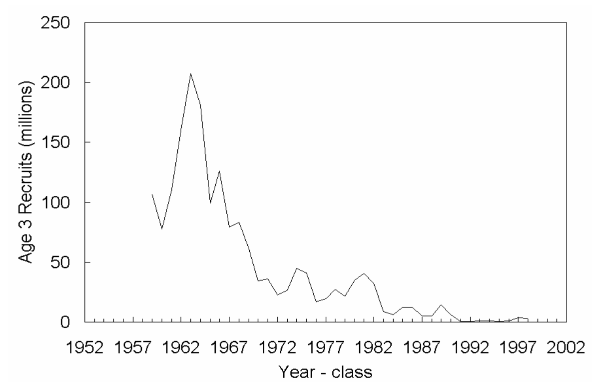

**Data**: Length and age composition were available from the 1999 and 2000 fisheries to estimate the total removals at age. Canadian spring and autumn survey data provided abundance, biomass and age structure information. Spanish spring survey data provided abundance and biomass information. Canadian juvenile research survey data were available up to 1994.

**Assessment**: An analytical assessment was presented to estimate population numbers in 2001.

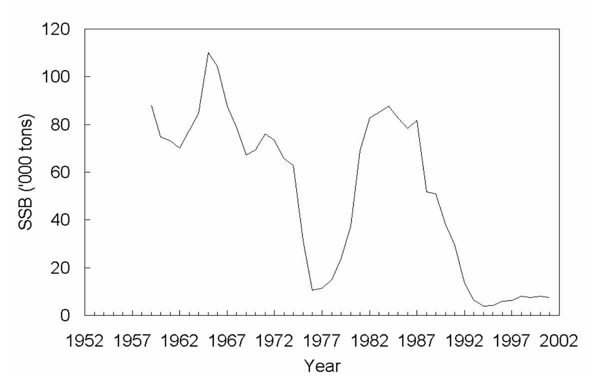
*Fishing Mortality:* Has increased on young fish in the last two years.




*Recruitment*: Recent surveys and the VPA suggest that all recent year-classes have been at a low level.




*Biomass*: The 2001 spawning biomass is estimated to be at an extremely low level.




**State of the Stock**: The stock remains close to its historical low with weak representation from all year-classes.

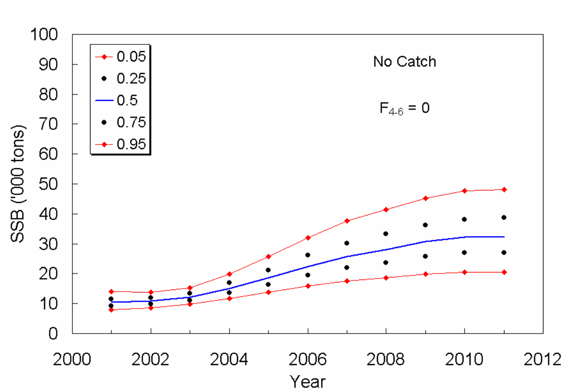
**Recommendation**: There should be no directed fishing for cod in Div. 3N and 3O in 2002 and 2003. Catches of cod should be kept at the lowest possible level and restricted to unavoidable by-catch in fisheries directing other species.

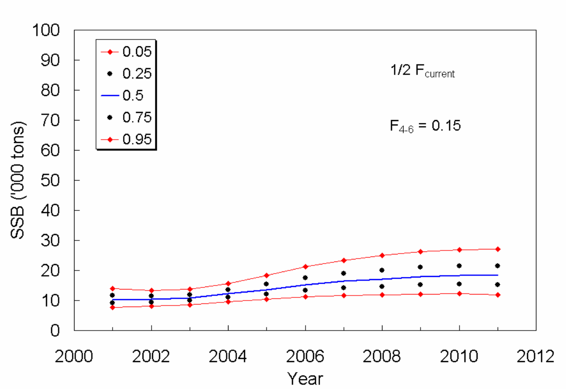
**Reference Points**: The current best estimate of $B_{lim}$ is 60 000 tons. It was also concluded that in the recent period of low productivity, there is an indication of even further reduction in recruitment at about half the $B_{lim}$ level. The Scientific Council recommended that it review in detail the biological reference points in the context of the PA framework when the SSB has reached half the current estimate of $B_{lim}$.

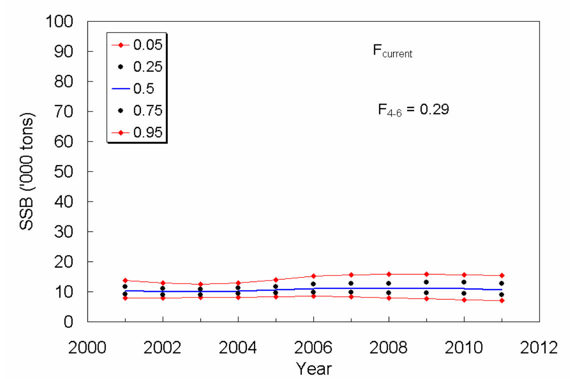
**Medium-term considerations**: Simulations were carried out to project the SSB for 10 years under various assumptions of spawner recruit regimes and different levels of fishing mortality. These simulations also take into account the precision of the stock size estimates currently available. These results suggest that recovery time will largely depend upon which recruitment regime prevails in the future.

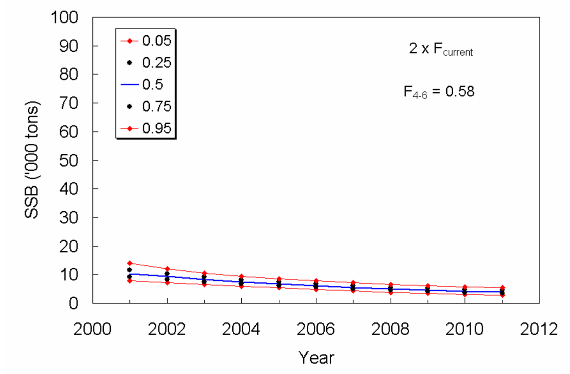
Under the current low recruitment regime observed since 1982, stock increase will be limited even in the absence of fishing mortality. Any level of fishing mortality will further impede stock recovery. Time to recovery will be increased with increased fishing mortality.

**Re-sampling from Low Recruitment Regime (1982-2000)**




**Special Comments:** Scientific Council is concerned that catches of cod have increased substantially since 1995 such that fishing mortality is now close to $F_{0.1}$ although the stock is currently under moratorium and at a very low SSB.

**Sources of Information**: SCR Doc. 01/67, 72, 78, SCS Doc. 01/09, 11, 18.

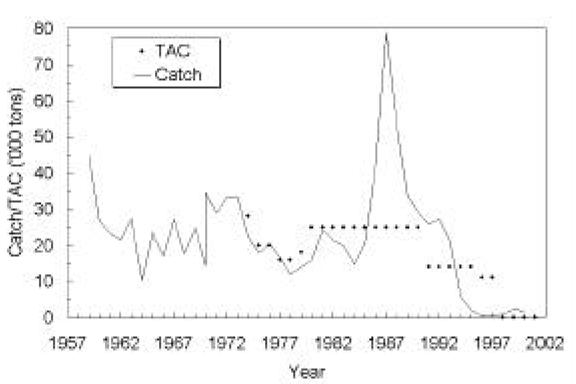
### *Redfish (Sebastes spp.) in Divisions 3L and 3N*

**Background**: There are two species of redfish, *Sebastes mentella* and *Sebastes fasciatus*, which occur in Div. 3LN and are managed together. These are very similar in appearance and are reported collectively as redfish in statistics. The relationship to adjacent NAFO Divisions, in particular to Div. 3O, is unclear and further investigations are necessary to clarify the integrity of the Div. 3LN management unit.

**Fishery and Catches**: Catches averaged about 22 000 tons from 1959 to 1985, increased sharply to an historical high of 79 000 tons in 1987 then declined steadily to about 500 tons in 1996. Catch increased to 850 tons by 1998 and was about 2 000 tons in 1999 and 2000. A moratorium on directed fishing was implemented in 1998. Catches since 1998 were taken as by-catch primarily in Greenland halibut fisheries by EU-Portugal, EU-Spain and Russia. A portion of the catches, in some years substantial, have been taken by non-Contracting Parties from 1987 to 1994. These countries have not fished in Div. 3LN since 1994.

| | Catch[1] ('000 tons) | TAC ('000 tons) Recommended | TAC ('000 tons) Agreed |
|---|---|---|---|
| 1998 | 0.9 | ndf [2] | 0 |
| 1999 | 2.3 | ndf [3] | 0 |
| 2000 | 1.7 | ndf [3] | 0 |
| 2001 | | ndf [3] | 0 |

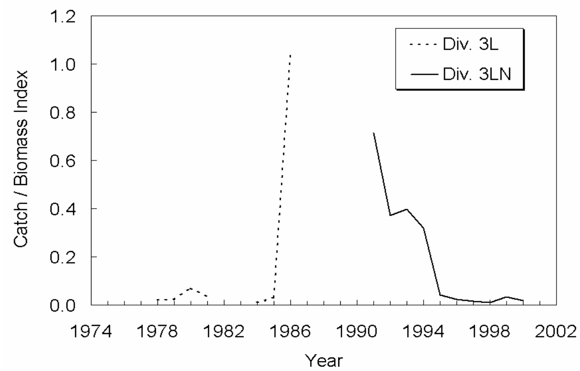
[1] Provisional.
[2] No directed fishing and by-catch kept at current low level.
[3] No directed fishing and by-catch kept at lowest possible level.




**Data**: Bottom trawl surveys conducted by USSR/Russia from 1984 to 1994, and by Canada from 1978 to 2000 are the basis for the assessment of stock status.

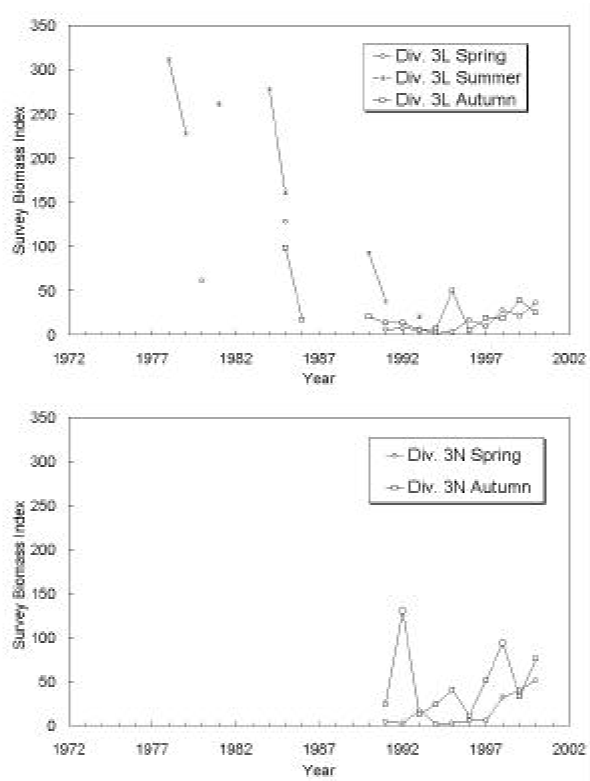
**Assessment**: No analytical assessment was possible.

*Fishing Mortality*: Reduced from relatively high levels in 1991-92 and has been relatively low since 1995 in both Div. 3L and Div. 3N.




*Recruitment*: No sign of good recruitment since the 1986 and 1987 year-classes.

*Biomass*: Estimates from recent surveys are considerably lower than those from the 1980s indicating a reduced and low stock size.




**State of the Stock**: Based on the available data, the stock appears to be at a very low level. There are indications of some increases in the stock since 1996 due to growth in weight of the relatively strong 1986-87 year-classes and possibly through some immigration of fish from Div. 3O to Div. 3N.

**Recommendation**: No directed fishing for redfish in Div. 3LN, and by-catches of redfish 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**: The most recent relatively good year-classes, those of 1986-87, are recruiting to the SSB. These same year-classes will make up the greatest proportion of the SSB until at least 2010.

The continuing uncertainties regarding the relationship between redfish in Div. 3LN and Div. 3O have important impacts on interpretation of available data.

Assessments of Div. 3LN redfish would be improved by data on the size of the pelagic component of this stock. Appropriate research is needed to eliminate this gap.

**Sources of Information**: SCR Doc. 01/62; SCS Doc. 01/9, 11, 18.

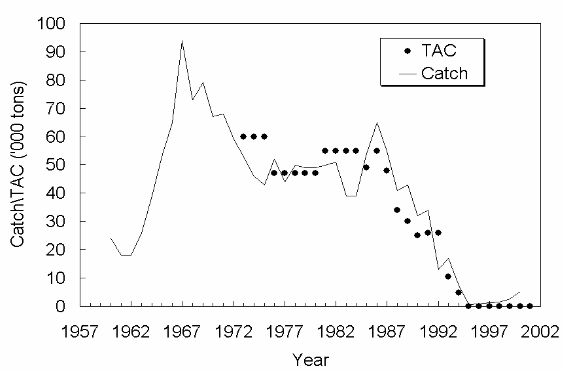
## *American plaice (Hippoglossoides platessoides) in Divisions 3L, 3N and 3O*

**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 2001. Even under moratorium catches have increased substantially in recent years.

| | | TAC ('000 tons) | |
|---|---|---|---|
| Year | Catch[1] ('000 tons) | Recommended | Agreed |
| 1998 | 1.6 | nf | 0 |
| 1999 | 2.5 | nf | 0 |
| 2000 | 5.2 | nf | 0 |
| 2001 | | nf | 0 |

[1] Provisional.
nf No fishing.



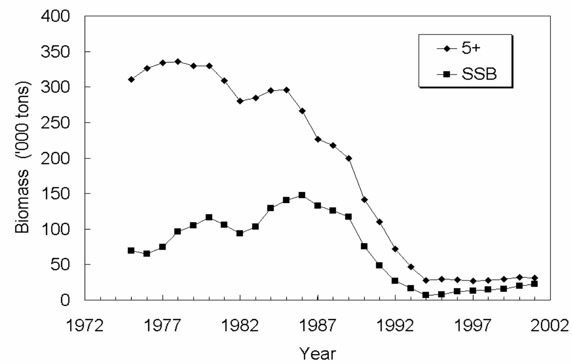

**Data:** Biomass and abundance data were available from several surveys. Age sampling from Canadian by-catch as well as length sampling from by-catch from Russia, EU-Spain and EU-Portugal were available.

**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 except for all ages from 1989 to 1996 it was assumed to be 0.53.

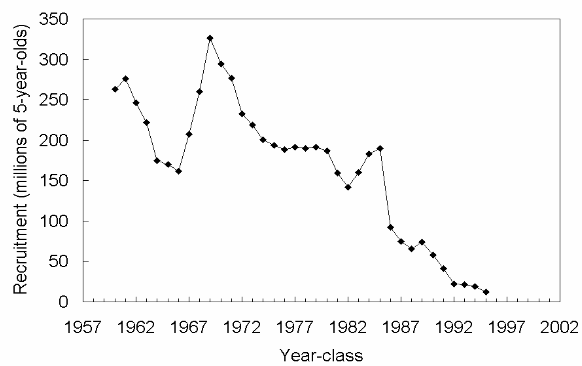
*Biomass:* Biomass is very low compared to historic levels.

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

*Biomass and SSB from VPA*:

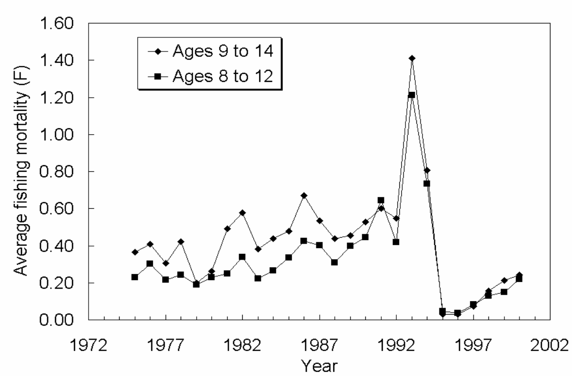



*Recruitment from VPA:*




*Recruitment:* There have been no good year-classes since the mid-1980s.

*Fishing mortality:* Fishing mortality has increased steadily since 1995 and is currently near $F_{0.1}$.



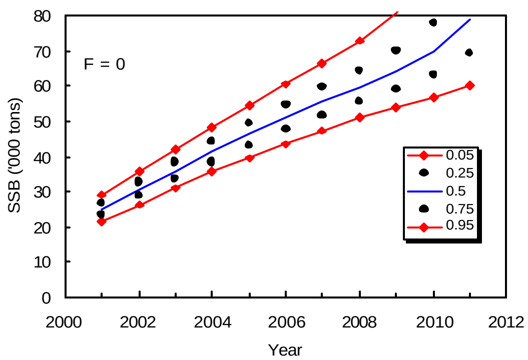

**State of the Stock:** The stock remains low compared to historic levels.

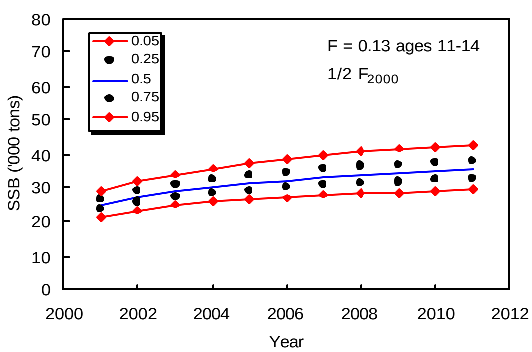
**Recommendation:** No directed fishing on American plaice in Div. 3LNO in 2002 and 2003. By-catches kept to the lowest possible level.

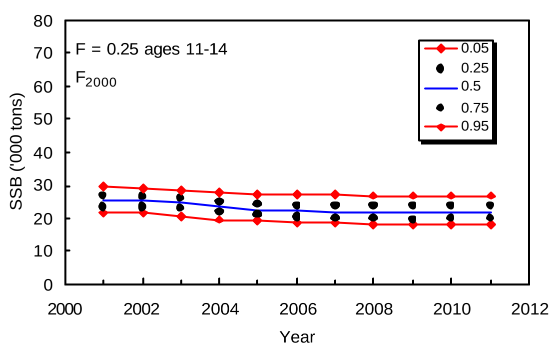
**Reference Points:** No good recruitment has been estimated for this stock at SSB below 50 000 tons. However, Scientific Council considered it too preliminary to be set as a $B_{lim}$.

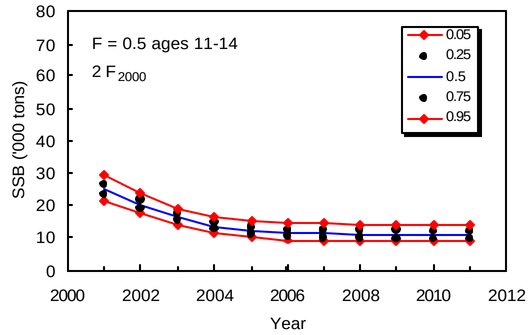
**Medium term considerations:** Simulations were carried out to compare population trajectories under different levels of by-catch fishing mortality. These simulations take into account the precision of the stock size estimates currently available.

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 now 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. Scientific Council is concerned that much of this catch is not truly 'by-catch' but rather is occurring as a result of directed fishing. Any catches will impede the recovery of this stock. Catches at or above the current level will cause further decline.

**Sources of Information:** SCR Doc. 01/4, 58, 59, 70; SCS Doc. 01/9, 11, 18.

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 possible with those stocks.

ii) **Witch flounder in Divisions 2J and 3KL**

The Scientific Council considerations were as follows:

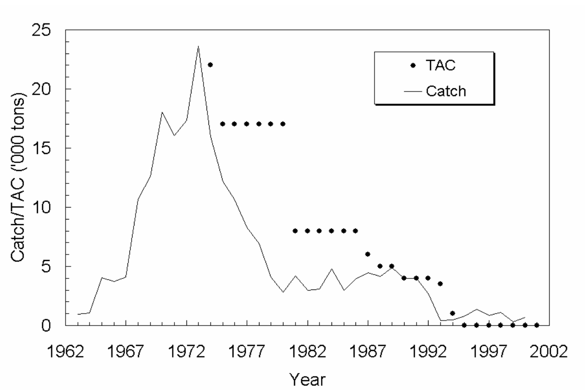
## *Witch Flounder (Glyptocephalus cynoglossus) in Divisions 2J, 3K and 3L*

**Background**: Historically, the stock occurred mainly in Div. 3K although recently the proportion of the stock in Div. 3L has been greater. In recent years, catches have been reported from the Flemish Pass area of Div. 3M. This is likely to represent an extension of the Div. 3L component of the stock. In the past, the stock had been fished mainly in winter and spring on spawning concentrations but is now only a by-catch of other fisheries.

**Fishery and Catches**: The catches during 1995-99 ranged between 300-1 400 tons including unreported catches. The 2000 catch was 700 tons.

| | Catch[1] ('000 tons) | TAC ('000 tons) Recommended | TAC ('000 tons) Agreed |
|---|---|---|---|
| 1998 | 1.1 | nf | 0 |
| 1999 | 0.3 | nf | 0 |
| 2000 | 0.7 | nf | 0 |
| 2001 | - | nf | 0 |

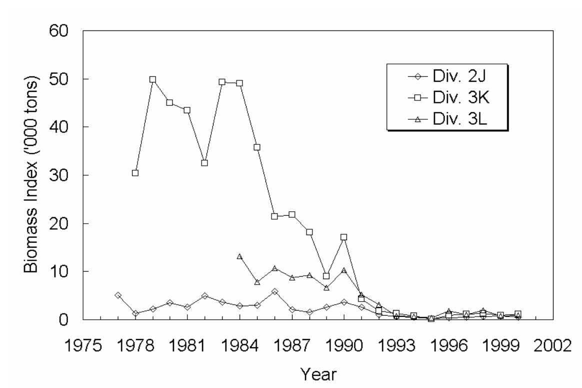
[1] Provisional. Includes estimates from Div. 3M since 1998.
nf No fishing.




**Data**: Abundance and biomass data were available from Canadian autumn surveys during 1978-2000. Age based data have not been available since 1993 and none are anticipated in the near future.

**Assessment**: No analytical assessment was possible.

*Biomass:* Survey biomass indices trended downwards rapidly since the mid-1980s and since 1995 have remained at an extremely low level.




*Recruitment:* No information was presented.

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

**Recommendation**: No directed fishing on witch flounder in the years 2002 and 2003 in Div. 2J, 3K and 3L 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:** The relationship between witch flounder in Div. 3M and the Div. 2J, 3K and 3L stock warrants investigation.

The next Scientific Council assessment of this stock will be in 2003.

**Sources of Information**: SCR Doc. 01/64; SCS Doc. 01/9, 11, 18.

iii) **Information on unregulated species in the Regulatory Area**

Fisheries Commission requested that: *the Scientific Council review all available information from both research vessel surveys and commercial catches on the relative biomass and geographic distribution of the following unregulated species/stocks occurring within the NAFO Regulatory Area: monkfish (Lophius americanus), wolffishes (Anarhichas lupus, A. minor, A. denticulatus), thorny skate (Amblyraja radiata), black dogfish (Centroscyllium fabricii), eelpouts (Lycodes spp.), longfin hake (Urophycis chesteri), and orange roughy (Hoplosthethus atlanticus).*

The Council responded that information on monkfish was presented to Scientific Council (SCR Doc. 01/47). Further information on other species will be prepared for the September 2001 Meeting. Accordingly, this item was deferred by the Scientific Council to September 2001.

iv) **Distribution of fishable biomass of main commercial species**

The Council deferred this item to its September 2001 Meeting.

v) **Medium-term development of several stocks under various assumptions**

The Council deferred this item to its September 2001 Meeting.

vi) **Distribution of juvenile American plaice and yellowtail flounder**

The Scientific Council was requested to: *review the distribution of juvenile American plaice and update the distribution of yellowtail flounder based on results from comprehensive research surveys. The Scientific Council is also requested to delineate further the areas of juvenile concentration in the Southeast Shoal area and its surroundings.*

The Council responded that:

The distribution of juvenile yellowtail flounder (0-3 years), and American plaice (0-3 years) on the southern Grand Bank were evaluated using geostatistics and the catch-at-age data from the annual stratified-random juveniles survey in autumn 1985-94 and the annual autumn Canadian surveys during 1995-99 (Fig 1). The surveys were conducted using small mesh shrimp trawls (SCR Doc. 01/78).

The analyses presented corroborates the previous identification of the yellowtail flounder nursery area in Div. 3N as being located on the Southeast Shoal (strata 375 +376) and the area neighboring to the west and south of the shoal (strata 360 + 361) (Fig. 2). An average of 82% of all the juveniles in Div. 3NO on the southern Grand Bank were found in this area during the time series.

Juvenile American plaice has shown a distribution shift in the areal concentration from being predominately in Div. 3N, specifically on the Tail of the Bank, up to 1990 and from 1992 onward to being predominately in Div. 3O. Since 1992, the highest densities, decreasing over time, were found in the Whale Deep-Whale Bank area and along the southwest slope of Div. 3O (see Fig. 1). Coincidental with the disappearance of the high densities of juveniles on the Tail of the Bank, was the disappearance of high densities in the nursery area on the northern slope of the Grand Bank in Div. 3L. By 1995, there were very few of any age-classes anywhere on the Grand Bank. The reasons for low abundance and absence from the traditional nursery areas in the north and the south may be related to the absence of large year-classes. During this time series, the size of Div. 3LNO stock has also declined to a very low level and the remnants are mainly concentrated on the Tail of the Bank in recent years. Should the stock of American plaice rebuild to levels seen in the mid-1980s, then it is expected that the Tail of the Bank and the northern slope of Div. 3L will once again be the major nursery areas on the Grand Bank.

Scientific Council noted that the yellowtail flounder nursery area is the only nursery area for which physical bounds can be defined with some certainty. From the time series analyses, on average 82% of juvenile yellowtail flounder in Div. 3NO, and 24% of juvenile American plaice in Div. 3NO were found in the Southeast Shoal (Strata 375 + 376) and the neighboring area to the west (stratum 361) and south (stratum 360) (Fig. 2 and 3; Table 1). This area would include the shallow (<100 m) portion of the Regulatory Area of Div. 3N.

Table 1. Juvenile American plaice and yellowtail flounder in Div. 3NO: percent abundance of juveniles found in the Southeast Shoal (strata 375 + 376) and neighboring area to the west (stratum 361) and south (stratum 360).

Yellowtail flounder

| Stratum | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | Mean | SD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 375 | 17.7 | 14.4 | 8.5 | 5.7 | 6.6 | 0.4 | 10.1 | 17.0 | 15.5 | 6.9 | 10.9 | 7.7 | 10.11 | 5.19 |
| 376 | 37.8 | 44.5 | 54.8 | 65.2 | 40.2 | 30.0 | 57.8 | 30.0 | 37.9 | 55.2 | 23.7 | 14.6 | 40.97 | 15.16 |
| 360 | 21.9 | 23.1 | 24.7 | 15.4 | 36.3 | 43.9 | 14.9 | 11.7 | 15.1 | 4.0 | 13.6 | 6.8 | 19.29 | 11.58 |
| 361 | 11.6 | 9.8 | 8.9 | 7.8 | 7.5 | 11.2 | 10.5 | 12.2 | 14.4 | 4.1 | 22.4 | 13.5 | 11.15 | 4.53 |
| Total | 89.0 | 91.7 | 97.0 | 94.0 | 90.5 | 85.5 | 93.3 | 70.9 | 82.9 | 70.1 | 70.7 | 42.6 | 81.5 | 15.6 |
| Mean | 22.2 | 22.9 | 24.2 | 23.5 | 22.6 | 21.4 | 23.3 | 17.7 | 20.7 | 17.5 | 17.7 | 10.7 | | |
| SD | 11.2 | 15.4 | 21.7 | 28.1 | 18.1 | 19.4 | 23.1 | 8.5 | 11.5 | 25.1 | 6.3 | 4.0 | | |

American plaice

| Stratum | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | Mean | SD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 375 | 0.4 | 0.0 | 0.1 | 0.1 | 0.0 | 0.6 | 0.9 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.3 |
| 376 | 14.2 | 0.3 | 0.5 | 2.2 | 3.9 | 0.5 | 0.3 | 0.0 | 0.1 | 0.1 | 0.1 | 2.0 | 4.2 |
| 360 | 55.8 | 52.8 | 34.5 | 31.0 | 8.9 | 6.1 | 21.8 | 7.4 | 0.6 | 5.4 | 3.2 | 20.7 | 20.1 |
| 361 | 1.4 | 0.4 | 0.4 | 0.8 | 0.2 | 0.4 | 0.6 | 1.9 | 0.6 | 0.5 | 0.1 | 0.7 | 0.5 |
| Total | 71.8 | 53.4 | 35.5 | 34.1 | 13.0 | 7.5 | 23.6 | 9.4 | 1.3 | 6.0 | 3.5 | 23.6 | 22.9 |
| Mean | 18.0 | 13.4 | 8.9 | 8.5 | 3.2 | 1.9 | 5.9 | 2.4 | 0.3 | 1.5 | 0.9 | | |
| SD | 26.0 | 26.3 | 17.1 | 15.0 | 4.1 | 2.8 | 10.6 | 3.4 | 0.3 | 2.6 | 1.6 | | |

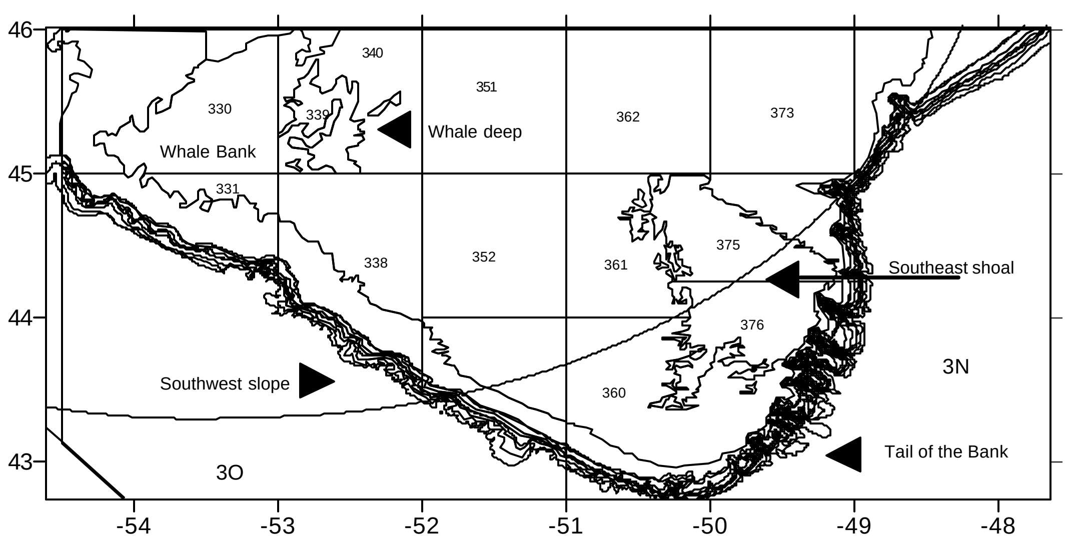



Fig. 1. Juvenile American plaice and yellowtail flounder in Div. 3NO: survey stratification scheme for the southern Grand Bank, Div. 3NO.

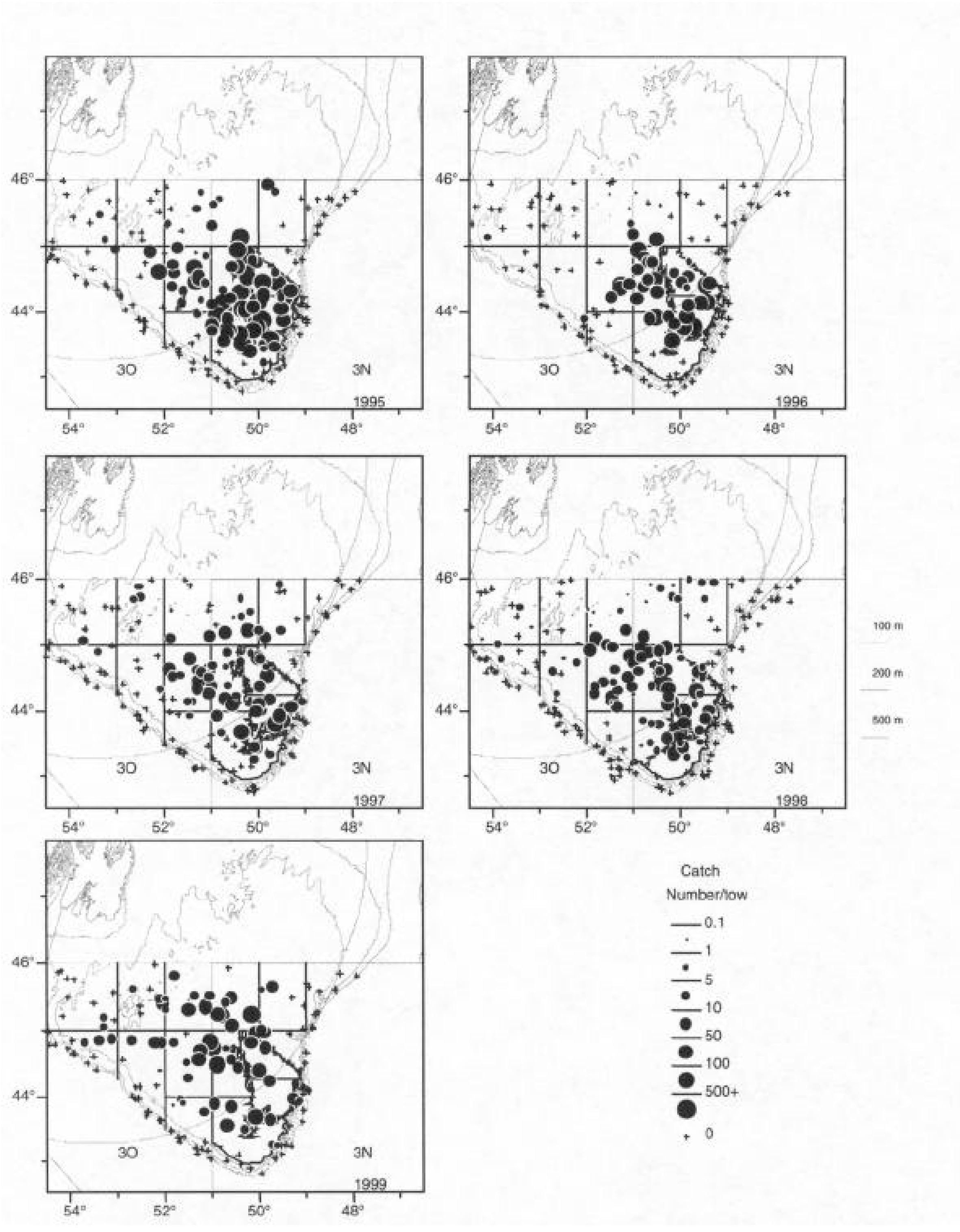



Fig. 2. Juvenile American plaice and yellowtail flounder in Div. 3NO: expanding symbol plots of standardized catches of juvenile yellowtail flounder from the annual autumn surveys on the Grand Bank, 1995-99.

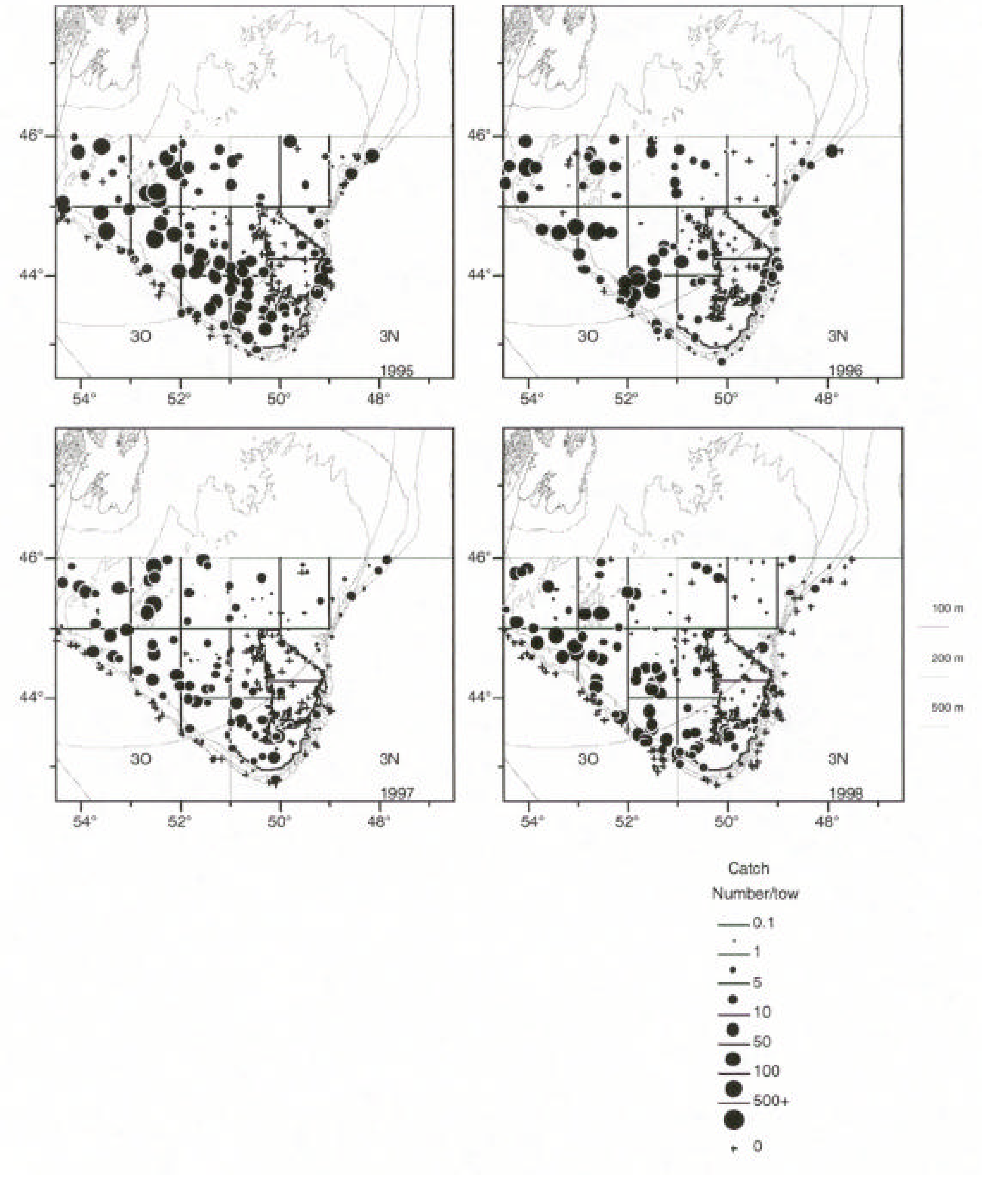



Fig. 3. Juvenile American plaice and yellowtail flounder in Div. 3NO: expanding symbol plots of standardized catches of juvenile American plaice from the annual autumn surveys on the Grand Bank, 1995-98.

vii) **Redfish in Div. 1F and Adjacent ICES Area**

Scientific Council **recommended** that *the pelagic redfish resource in the NAFO Convention Area (NCA) not be referred to as "redfish in Div. 1F" but more specifically as "pelagic S. mentella in the NAFO Convention Area".*

With regard to redfish in NAFO Division 1F, the Scientific Council was requested by the Fisheries Commission to: *review all available information on the distribution of this resource over time, as well as on the affinity of this stock to the pelagic redfish resource found in ICES Sub-area XII, parts of SA Va and XIV or the redfish found in NAFO Subareas 1-3*.

The Scientific Council responded that information had been provided to Fisheries Commission during the September 2000 Annual Meeting (*NAFO Sci. Coun. Rep*., 2000, p. 182-183) indicating that since the initiation of systematic surveys in the early-1990s, the stock had been shown to be distributed in the ICES Sub-area XII, parts of SA Va and XIV. During the 1999 international survey, the stock was found distributed to a great extent inside the NAFO Regulatory Area (Div. 1F). Scientific Council also indicated that it considered the pelagic redfish distributed in NAFO Div. 1F as part of the pelagic stock previously distributed in the NEAFC Convention Area.

Scientific Council noted that detailed information addressing this request is contained in the STACFIS report of this meeting (Appendix IV, pages 182-183).

Scientific Council concluded that the redfish found in NAFO Div. 1F do constitute a part of the pelagic redfish in the NEAFC Area, and **recommended** that *the pelagic S. mentella resource should be managed in a compatible manner between NAFO and NEAFC. Scientific Council noted that Fisheries Commission has done this for the 2001 fishing year, but recommends that longer-term arrangements be made*.

Scientific Council was unable to evaluate the possible relationships between the pelagic redfish and the shelf stocks in the NAFO Convention Area and that ICES has also been unable to agree on the relationship of the pelagic redfish with those in the shelf areas of Iceland.

The Council noted another related **request on pelagic redfish was forwarded by the Coastal State Canada**:

With regard to redfish in Division 1F the Scientific Council was requested by Canada:

*a) to review the available information related to the biology and distribution of oceanic redfish in the north Atlantic and to provide, to the extent possible, commentary on possible links to the various shelf stocks in the northwest Atlantic.*

*b) to make recommendations on the most appropriate means of interaction with ICES with regards to this resource.*

Scientific Council responded that information pertaining to part (a) of the request is contained in the STACFIS report (at Appendix IV, pages 182-183). With regard to part (b), Scientific Council considered that it is important to have close, ongoing interaction between NAFO Scientific Council and ICES on the issue of pelagic *S. mentella*.

Scientific Council advises against the establishment of a Joint NAFO/ICES Working Group to examine this resource. The resource is assessed annually by the North-Western Working Group of ICES, and members of Scientific Council normally participate in these activities.

Scientific Council **recommended** that *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.*

Additionally, all documentation pertaining to pelagic *S. mentalla* provided to the North-Western Working Group of ICES should be made available to the Scientific Council.

Further, it is **recommended** that *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*.

viii) **Effect of increasing mesh size in Greenland halibut fishery**

The Fisheries Commission requested the Scientific Council to: *provide information on the long-term effects of increasing mesh size from 130 mm to 145 mm in yield-per-recruit and stock spawning biomass-per recruit for Greenland halibut in Subarea 2 and Divisions 3KLMNO and in reducing by-catch of other species in that fishery. The Scientific Council has also been requested to evaluate the medium term consequences in terms of yield and stock size of any such changes in mesh size.*

The Council commented as follows:

The species that are taken as by-catch within the Subarea 2 and Divisions 3KLMNO Greenland halibut fishery are American plaice, cod, yellowtail flounder, roughhead grenadier, roundnose grenadier, thorny skate, hake, monkfish, spotted wolfish, striped wolfish, redfish and witch flounder. For some of these species, Scientific Council has provided advice on this subject in earlier reports; *NAFO Sci. Coun. Rep*., 1995, 1997 and 1998.

The effects of a change in mesh selection on the yield- and SSB-per-recruit of Greenland halibut in Subarea 2 and Div. 3KLMNO, American plaice in Div. 3L, 3N and 3O and cod in Div. 3N and 3O were examined. Yield-per-recruit analysis was carried out using 130 mm and 145 mm partial recruitment vectors estimated from selection at length curves. It was assumed that trawlers using 130 mm mesh have landed all of the recent catches. The analyses did not consider the effects on species for which age based assessments were not available.

The results for Greenland halibut and American plaice are consistent with previous advice from Scientific Council. They indicate that there would be only marginal benefits to changing the mesh size from 130 mm to 145 mm, in the Greenland halibut fishery, on yield and SSB of the Greenland halibut and American plaice. For cod there would be large increases in SSB and yield only if effort were constrained.

Scientific Council repeats the conclusions reached in 1995, that it would be difficult to generate an exploitation pattern for trawlers that would be optimal for Greenland halibut in Subarea 2 and Div. 3KLMNO. Substantial improvements in the exploitation pattern could be achieved by adoption of alternative fishing methods such as, long lining and gill netting with 205 mm mesh, or by restricting fishing to waters deeper than 1 200 m (*NAFO Sci. Coun. Rep*., 1995, p. 41)

ix) **Methodology for scientific research for stocks under moratoria**

The Fisheries Commission requested the Scientific Council to: *provide advice regarding the methodology for scientific research on fish stocks under moratoria.*

The Scientific Council noted the main concerns for collapsed stocks under moratoria are to minimize the risk of the spawner biomass declining further and to maximize the probability of recovery in the medium term. The greatest threat for collapsed stocks may be by-catch in other fisheries leading to higher than desired levels of fishing mortality despite a moratorium on directed fishing. At the present time, there is some evidence that the recovery of several NAFO stocks that are under moratoria may be delayed or even prevented by current levels of by-catch, for example Div. 3LNO American plaice, Div. 3M cod and Div. 3NO cod. To enable Fisheries Commission to take into account by-catch when setting TACs, Scientific Council must be able to quantify these effects in its advice on by-catch implications on non-target stocks.

The evaluation of the effect of by-catch and discards on stock recovery may be hampered if the data are inaccurate. Observer estimates derived from fisheries which lack 100% observer coverage may not be representative of by-catch levels for the complete fleet. In addition, there are often only limited length and age composition samples of by-catch because of the unpredictable nature of the landings. Accurate catch data and adequate sampling are essential to calculate removals-at-age and carry out population modelling.

Analysis of research vessel data (or data collected from a scientifically designed precautionary approach monitoring program utilizing commercial vessels) for a stock under moratorium may lead to an estimate of relative stock size. Growth, maturity, condition and stomach content data are potentially useful in determining stock productivity. Spatial analysis of research vessel data can indicate the proportion of habitat occupied and degree of aggregation. Stocks reduced to the point where only a small portion of the habitat is utilized, or where the remaining fish are highly aggregated, may have greater vulnerability to environmental conditions or to natural and fishing mortality. These changes in fish distribution and behaviour may also influence survey catchability.

Age-disaggregated data from research vessel surveys can be analyzed in general linear models to determine relative year-class strength and total mortality rates. Low recruitment levels and/or high total mortality rates for stocks under moratoria may indicate a low probability of recovery in the medium term.

If analytical assessments are feasible then medium-term projections at different by-catch levels could provide useful insight into the extent to which recovery may be impeded. The partial recruitment in a by-catch fishery may be quite different to that which occurred in a directed fishery prior to moratorium, and this might require analysis. Medium-term projections for stocks under moratoria require some information on expected recruitment at low stock size. Stock-recruit data collected prior to the moratorium may not be very informative at low stock size and it may be necessary to consider the possibility that dispensation or 'regime shifts' may have occurred. In all cases greater understanding of by-catch effects and stock-recruit relationships will provide useful insight into relative probabilities of recovery for stocks under moratoria.

d) **Monitoring of Stocks for Which Multi-year Advice was Provided in 2000**

Last year (2000), the Scientific Council provided 2-year advice (for 2001 and 2002) for three stocks (cod in Div. 3M; witch flounder in Div. 3NO, and American plaice in Div. 3M). The Scientific Council reviewed the status of these three stocks at its June 2001 Meeting and found no significant change in status for any of the stocks. Therefore, the Scientific Council has not provided updated/revised advice for 2002 for these stocks. The next Scientific Council assessment of these stocks will be in 2002.

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. 1F. This section provides the Scientific Council responses where possible.

i) **Greenland halibut in Subareas 0-3**

The Scientific Council noted there was no information available at this meeting.

ii) **Cod in Div. 2J and 3KL**

The Council consideration on this stock is reported below:

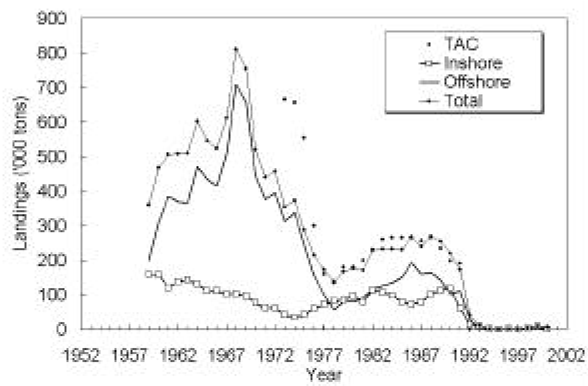
## *Cod (Gadus morhua) in Divisions 2J, 3K and 3L*

**Background**: Considerable uncertainty exists about the structure of the Div. 2J and 3KL stock. The available tagging, genetic, survey and biological data are consistent with the two hypothesis: a) the inshore constitutes a separate inshore subpopulation that is functionally separate from the offshore; and b) inshore and offshore fish together constitute a single functional population. The only over-wintering aggregation known to exist occurs in a deepwater inlet in northern Div. 3L, Smith Sound. Fish from this aggregation migrate seasonally out of the sound in the spring, mainly northward in Div. 3L and 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. This migration was much reduced in 2000. Slightly elevated abundances of fish were detected in 1999-2000 in surveys on the shelf near the boundary between southern Div. 3K and northern Div. 3L.

**Fishery and Catches**: The rapid decline in the resource in the early-1990s led to reduced TACs and eventually to a moratorium on commercial fishing in 1992. A recreational fishery was permitted in 1992-94, 1996, 1998 and 1999 but not in 1995 and 1997. Catches also came from sentinel surveys in 1995-99 and a commercial index fishery 1998. The commercial fishery was reopened in 1999 with a TAC of 9 000 tons for the inshore only. In 2000, a TAC of 7 000 tons was established for sentinel surveys and a commercial index fishery in the inshore for vessels under 65 feet.

| | Catch[1] ('000 tons) | TAC ('000 tons) | |
|---|---|---|---|
| | | Recommended[2] | Autonomous |
| 1998 | 4.5 | | 0 |
| 1999 | 8.5 | | 9 |
| 2000 | 5.4 | | 7 |

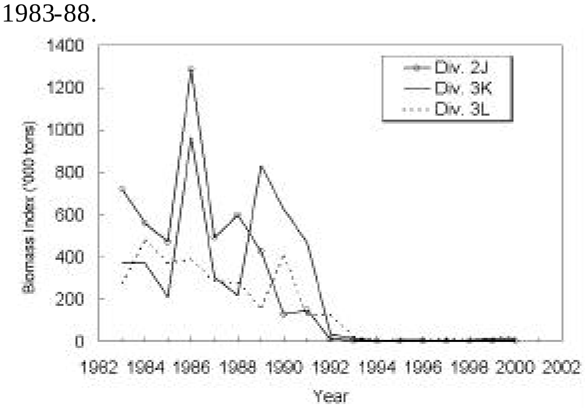
[1] Provisional.
[2] Advice not requested.




**Data**: Abundance and biomass indices were available from bottom-trawl surveys in autumn and spring (Div. 3L only). An acoustic survey of the only known over-wintering aggregation resulted in a biomass index and mark-recapture data provided estimates of exploitation rate and exploitable biomass. Removals-at-age in 2000 were constructed for the limited by-catch, the sentinel survey, a recreational fishery and the commercial index fishery.

**Assessment**: An analytical assessment of the Div. 2J and 3KL cod stock was attempted but changes in the distribution of fish relative to the survey area since the collapse, the change in the survey trawl in 1995, and the unaccounted for fish from the 1986 and 1987 year-classes, precluded obtaining an acceptable calibration of a sequential population analysis model. Stock status was estimated based on research vessel indices, mark-recapture data, an acoustic study in a limited area, and from sentinel and commercial index fishery catch at age data.

*Biomass*: The biomass index for the offshore area from the autumn research vessel survey in Div. 2J and 3KL declined abruptly in the early-1990s. The biomass index from the autumn survey in 2000 remains extremely low at only 2.5% of the average in the period 1983-88.



The biomass index from the spring research vessel survey in Div. 3L in 2000 is also very low compared to the 1980s.

Analysis of mark-recapture data using a simple migration model resulted in estimates of biomass in the inshore of Div. 3K and northern Div. 3L from 1998 to 2000 that have been relatively stable at about 40 000 tons. A more detailed model, but one which did not include migration (and which therefore will result in positively biased estimates), gave a biomass of no more than 77 000 tons in Div. 3KL in 2000. Fish in southern Div. 3L were found to comprise mostly seasonal migrants for Subdiv. 3Ps. Acoustic surveys in a small inlet in northern Div. 3L, Smith Sound, carried out in January each year provided indices of biomass of about 15 000 tons in 1999, 22 000 tons in 2000 and 31 000 tons in 2001.

Gillnet catch rates for the commercial index fisheries in 1998 and 2000 and the commercial fishery in 1999, showed a significant decline over the three-year period with a progressive shrinkage of the area of highest concentration to a restricted portion of northern Div. 3L. Catch rates in the sentinel gillnet fishery increased from 1995 to 1998 but declined from 1998 to 1999 and decreased further in 2000. Catch rates in the sentinel line trawl catch rates showed relatively little change from 1995 to 1996, increased in 1997, and declined again in 1998, 1999 and 2000.

*Mortality*: Total mortality estimates increased until 1992, coinciding with the beginning of the moratorium. The rates then declined until 1995, and since then have remained constant at levels similar to those observed in the late-1980s when there was a substantial fishery.

It appears that predation by seals has been an important source of mortality of cod since the start of the moratorium. There is also the possibility that predation by seals is preventing the recovery of the cod stock, not simply because considerable numbers of cod are being consumed but also because some of those cod eaten are mature fish.

*Recruitment*: The 1998 to 2000 year-classes are higher than earlier year-classes in the time series but are imprecisely estimated and all year-classes are extremely low compared with those that occurred prior to the collapse.

**State of the Stock**: Indices of exploitable biomass from commercial and sentinel catch rates and the autumn bottom-trawl survey in inshore strata show downward trends over the recent period but are inconsistent with estimates from tagging which indicate a stable biomass and an acoustic index for Smith Sound which shows an increase. Therefore, it cannot be said whether recent levels of exploitation have been sustainable. The commercial gillnet catch-rate data for the last three years suggests a progressive shrinkage of the area of highest concentration to a restricted portion of northern Div. 3L. The fact that only about 70% of the TAC was taken in the 2000 commercial index fishery is further cause for concern. Overall, there is no doubt that the Div. 2J and 3KL cod spawner biomass remains at an extremely low level and there is no evidence of a recovery. Any fishery on the remnant in the inshore will delay recovery of the stock.

**Sources of Information**: SCR Doc. 00/33, SCS Doc. 01/9, 11, 15.

iii) **By-catch of yellowtail flounder in Div. 3LNO**

Canada requested Scientific Council: *noting the increase in by-catch of 3LNO yellowtail flounder in other fisheries, in particular the skate fishery the Scientific Council is requested to comment on the potential impacts of these by-catches on the long-term sustainability of the yellowtail flounder resource*.

The Council noted that total catches of yellowtail flounder have been above the TAC in all years since the fishery re-opened: 9% in 1998 and 1999 and 11% in 2000. Scientific Council reiterates its concern that all removals (directed plus by-catch) above the advised catch will result in higher fishing mortality than intended. This will result in an immediate loss in yield available for the next fishing year and, if maintained, could impact the long-term sustainability of the resource.

iv) **By-catch of American plaice in Div. 3LNO**

Canada requested Scientific Council:

*Based on information available to date regarding the 2000 fisheries in the NAFO Regulatory Area, there appears to be significant discrepancies regarding by-catches of American plaice between observer reports and the STATLANT 21A information. Scientific Council is requested to review all available information and provide the best estimate of actual by-catch removals of American plaice in the NRA. Further, the Scientific Council is requested to comment on the potential impacts of these by-catches on the recovery of the resource. This will require that national scientists analyze their respective observer reports for the 2000 fishery and bring results to the June Scientific Council meeting for discussion.*

Scientific Council noted that estimates of the catch of American plaice in 2000 in Div. 3LNO ranged from about 2 400 tons as reported on STATLANT 21A forms compared to an agreed best estimate of catch used in the assessment of about 5 200 tons. Based on the assessment, this agreed catch translated into a fishing mortality of 0.25; about double that which would have been estimated had the STATLANT 21A data been accepted.

Scientific Council is very concerned about this level of fishing mortality as the spawning stock biomass is predicted to decline in coming years if this high exploitation rate continues. Even with a reduction in fishing mortality by 50%, the stock is projected to increase only at a slow rate.

Based on available information, Scientific Council is also concerned that an increasing portion of the American plaice catch from Div. 3LNO is being taken as a result of directed fishing activities rather than as unavoidable by-catch in fisheries directed for other species. As noted above, the increasing catches are having a negative impact on the recovery of this resource and Scientific Council **recommended** that *Fisheries Commission take all possible steps to ensure that by-catches of American plaice are reduced significantly and restricted to true and unavoidable by-catches in fisheries directed for other species*.

v) **Redfish in Div. 1F**

The Council noted the request from Canada on redfish in Div. 1F and responded to it in conjunction with a related special request from the Fisheries Commission (see above Section VII.1.C.vii on page 33).

b) **Request by Denmark (Greenland) for Advice**

i) **Redfish and other finfish in Subarea 1**

In the Scientific Council Report of 1999, in response to requests from Denmark (Greenland) the Scientific Council provided 2-year advice (for 2000 and 2001) for redfish and other finfish in Subarea 1. The following are in response to requests for advice in 2002 and 2003.

The Council noted that the redfish resource in Subarea 1 stated in the Denmark (Greenland) request will be referred to by the Scientific Council in future as **demersal redfish**.

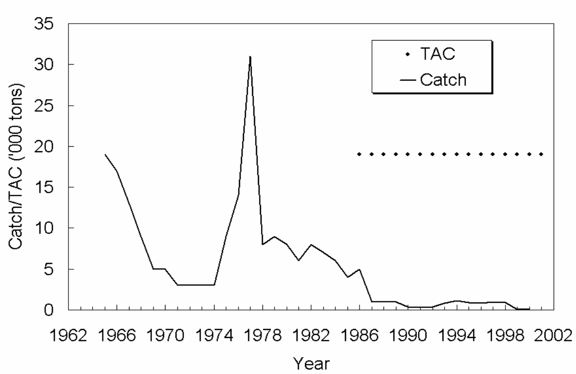
## *Demersal Redfish (Sebastes spp.) in Subarea 1*

**Background**: There are two species of commercial importance in Subarea 1, golden redfish (*Sebastes marinus*) and deep-sea redfish (*Sebastes mentella*). Relationships to other North Atlantic redfish stocks are unclear.

**Fishery Development and Catches:** During the last decade, redfish were taken mainly as by-catch in the trawl fisheries for cod and shrimp. Both redfish species golden redfish and deep-sea redfish were included in the catch statistics since no species specific data were available. Recent catch figures do not include the weight of substantial numbers of small redfish discarded by the trawl fisheries directed to shrimp.

| | Catch[1] | TAC ('000 tons) | |
|---|---|---|---|
| | ('000 tons) | Recommended | Autonomous |
| 1998 | 0.9 | ndf | 19 |
| 1999 | 0.1 | ndf | 19 |
| 2000 | 0.2 | ndf | 19 |
| 2001 | | ndf | 19 |

[1] Provisional.
ndf No directed fishing, by-catch be at the lowest possible level.

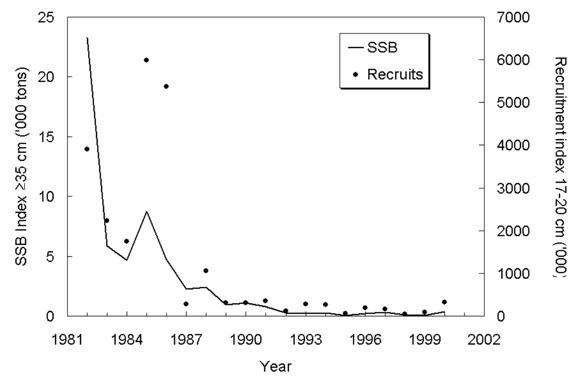



**Data:** No data on commercial CPUE were available. Spawning stock biomass and recruitment indices were calculated based on EU-Germany groundfish surveys.

**Assessment of Golden Redfish:** No analytical assessment of *Sebastes marinus* was possible.

*Recruitment*: Recruitment index has been low during the last decade.

*SSB*: SSB index has remained at a historical low since 1989.

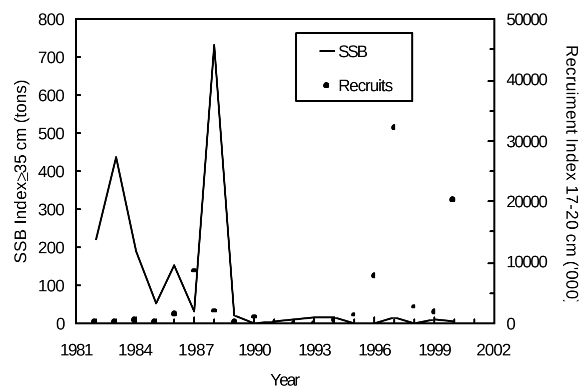



**State of the Golden Redfish Stock:** The stock of golden redfish in Subarea 1 remains severely depleted. There are indications that the probability of future recruitment is reduced at the current low SSB. Short-term recovery is very unlikely.

**Reference Points:** Based on available data, there appears to be a very high probability of decreased recruitment below SSB levels of 5 000 tons.

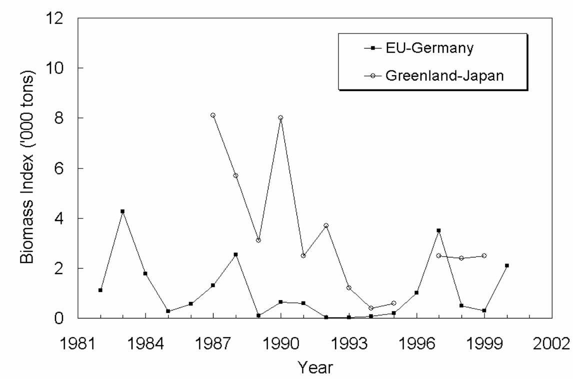
**Assessment of Deep-sea Redfish:** No analytical assessment of *Sebastes mentella* was possible.

*Recruitment*: Variation in recruitment indices is high, and the 1997 and 2000 estimates were considerably above average, the former one representing the maximum of the time series.




*SSB*: SSB index remained at the historical low level since 1989.

*Biomass*: Total stock biomass indices increased have been at very low level in 1998-99 but increased in 2000. The stock is composed of mostly immature fish.




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

**State of the Deep-sea Redfish Stock:** The spawning stock of deep-sea redfish in Subarea 1 remains severely depleted, and an increase is unlikely in the short term.

**Recommendation for Golden and Deep-sea Redfish Stocks:** No directed fishery should occur on redfish in Subarea 1 in 2002 and 2003. By-catches in the shrimp fishery should be at the lowest possible level.

**Special Comments:** The probability of recovery of the redfish stocks in Subarea 1 would be enhanced if the by-catch of demersal redfish taken in the shrimp fishery were significantly reduced. The introduction of mandatory sorting grids on 1 October 2000 will probably reduce this by-catch.

**Sources of Information:** SCR Doc. 01/15, 23, 35; SCS Doc. 01/13, 21.

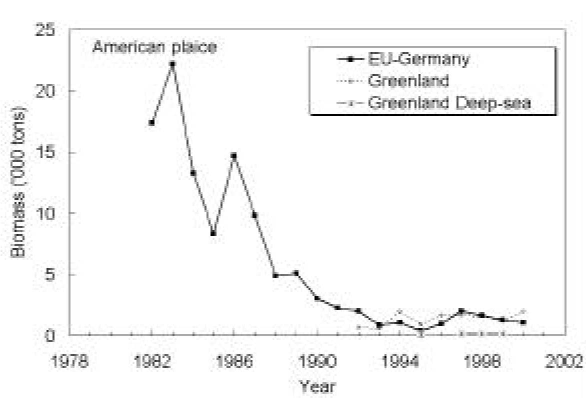
### *Other Finfish in Subarea 1*

**Background**: The resources of other finfish in Subarea 1 are mainly Greenland cod (*Gadus ogac*), American plaice (*Hippoglossoides platessoides*), Atlantic and spotted wolffishes (*Anarhichas lupus* and *A. minor*), thorny skate (*Raja radiata*), lumpsucker (*Cyclopterus lumpus*), Atlantic halibut (*Hippoglossus hippoglossus*) and sharks. No recommendations can be made for Greenland cod, lumpsucker, Atlantic halibut and sharks.

**Fishery Development and Catches:** Greenland cod are taken inshore by directed fisheries. Other species are mainly taken as by-catch offshore in trawl fisheries directed to shrimp, cod, redfish and Greenland halibut. In 2000, reported catches of other finfishes amounted to 3 046 tons, representing a decrease by about 2 000 tons, compared to the 1999 catch (4 983 tons). This was mainly caused by a lack of catch figures for Greenland cod. The catch figures do not include the weight of fish discarded by the trawl fisheries directed to shrimp.

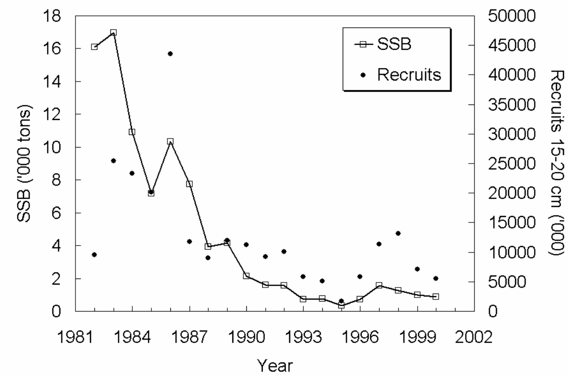
**Data:** No data on CPUE, length and age composition of the catches were available. Length frequencies were derived from the Greenland bottom trawl surveys. Assessments of recent stock abundance, biomass, and length structure for these stocks were based on annual bottom trawl surveys conducted by EU-Germany and Greenland. Spawning stock biomass and recruitment indices for American plaice and Atlantic wolffish were derived from EU-Germany survey data.

**Assessment of American plaice:** No analytical assessment was possible.



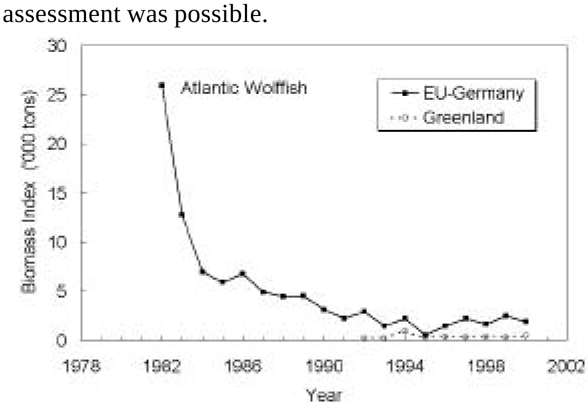

*Recruitment*: Indices have been low since the late-1980s with an increase to the average level in 1997-98 and values below average in 1999 and 2000.

*SSB*: During 1982-91, the SSB index decreased drastically to a very low level without a significant increase since then.



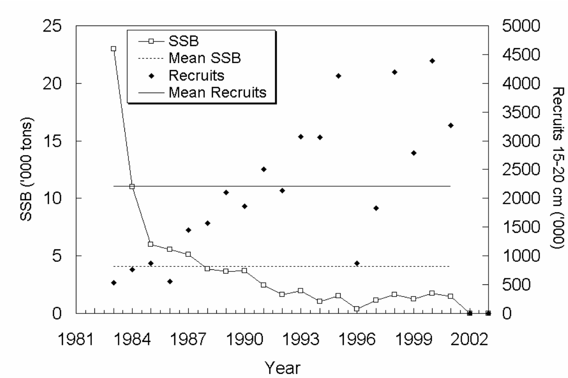

**State of the American plaice stock:** The stock remains severely depleted.

**Assessment of Atlantic wolffish:** No analytical assessment was possible.




*Recruitment*: Index increased steadily since the 1980s but varied considerably since 1995.

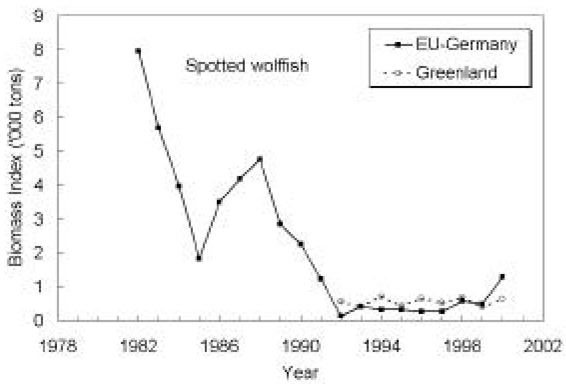
*SSB*: Since 1982, the SSB index decreased drastically and remained severely depleted since the early-1990s.

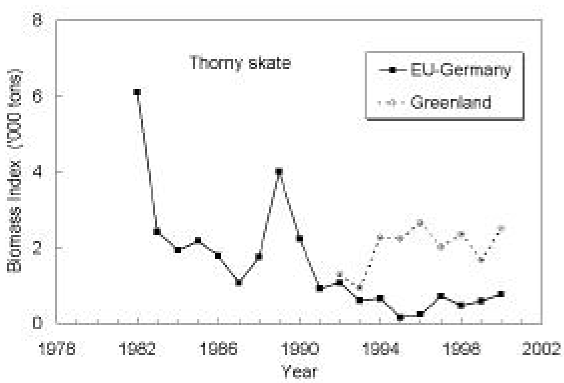



**State of the Atlantic wolffish stock:** The stock remains severely depleted despite a steady increase in recruitment since the early-1980s.

**Assessment of spotted wolffish and thorny skate:** No analytical assessment was possible.

*Biomass Indices*: Survey results revealed dramatic declines for spotted wolffish and thorny skate to a very low level.




**State of the stocks of spotted wolffish and thorny skate:** The stocks of spotted wolffish and thorny skate remain severely depleted.

**Recommendation for the stocks of American plaice, Atlantic wolffish, spotted wolffish and thorny skate:** No directed fishery in Subarea 1 for American plaice, Atlantic wolffish, spotted wolffish and thorny skate should occur in 2002 and 2003. By-catches of these species in the shrimp fisheries should be at the lowest possible level.

**Reference Points:** For all these stocks, Scientific Council is not in a position to propose reference points at this time.

**Special Comments:** The probability of recovery of these stocks would be enhanced if the by-catch taken in the shrimp fishery is significantly reduced. The introduction of mandatory sorting grids on 1 October 2000 will probably reduce this by-catch.

**Sources of Information:** SCR Doc. 01/17, 23, 35; SCS Doc. 01/13, 21.

ii) **Roundnose grenadier in Subareas 0 and 1**

The Scientific Council was requested by Denmark (Greenland) to: *continue to monitor the status of roundnose grenadier in Subareas 0 and 1.*

It was noted Scientific Council provided 3-year advice (for 2000-2002) for roundnose grenadier in Subareas 0+1 in 1999. The Scientific Council reviewed the status of this stock at this June 2001 Meeting and found no significant change in status. Therefore, the Scientific Council has not provided updated/revised advice for 2002 for this stock. The next Scientific Council assessment of this stock will be in 2002.

iii) **Distribution of biomass of Greenland halibut between SA 0 and SA 1**

Denmark (Greenland) requested the Scientific Council to: *in its 1993 report, the Scientific Council noted that the offshore component of Greenland halibut was distributed equally between Subareas 0 and 1. The Council is asked to up date the information on the distribution of Greenland halibut and provide advice on allocation of TACs to Subareas 0 and 1 offshore.*

The Council responded:

In 1999 Canada conducted a survey in Div. 0A in which the biomass was estimated at 83 000 tons. There have been no surveys covering Div. 1A. In 2000 Canada conducted a survey in Div. 0B where the biomass was estimated at 56 000 tons. A similar survey in Div. 1CD in 2000 estimated the biomass at 59 000 tons. Based on the surveys in 1987, 1988, and 1990 (*NAFO Sci. Coun. Rep*., 1993, p. 98) and the recent surveys in Div. 0B and Div. 1CD, the biomass seems to be distributed approximately 50:50 between the two Subareas 0 and 1. There are planned surveys that will cover SA 0 and Div. 1A-1D in 2001.

iv) **Greenland halibut in Div. 1A inshore**

The Scientific Council was requested by Denmark (Greenland) to: *provide advice on allocation of TACs distributed in areas of Ilulissat, Uummamannaq and Upernavik.*

The Council considerations are as given below.

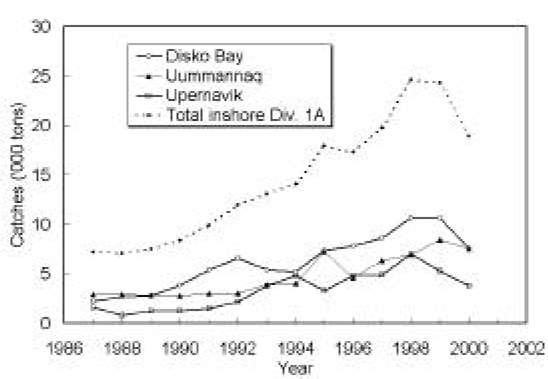
## *Greenland Halibut (Reinhardtius hippoglossoides) in Division 1A, inshore*

**Background**: The inshore stock is dependent for recruitment on immigration from the offshore nursery grounds in Div. 1A and 1B and the spawning stock in Davis Strait. 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 greater than 20 000 since 1998.

| | | Catches[1] ('000 tons) | TAC ('000 tons) Recommended |
|---|---|---|---|
| Disko Bay | 1998 | 10.7 | -[2] |
| | 1999 | 10.6 | 7.9 |
| | 2000[3] | 7.6 | 7.9 |
| | 2001 | | 7.9 |
| Uummannaq | 1998 | 6.9 | -[2] |
| | 1999 | 8.4 | 6.0 |
| | 2000[3] | 7.6 | 6.0 |
| | 2001 | | 6.0 |
| Upernavik | 1998 | 7.0 | -[2] |
| | 1999 | 5.3 | 4.3 |
| | 2000[3] | 3.8 | 4.3 |
| | 2001 | | 4.3 |

[1] Provisional.
[2] No TAC advised before 1999.
[3] The total catches are likely to have been underestimated by about 2 000 tons in Div. 1A inshore total.



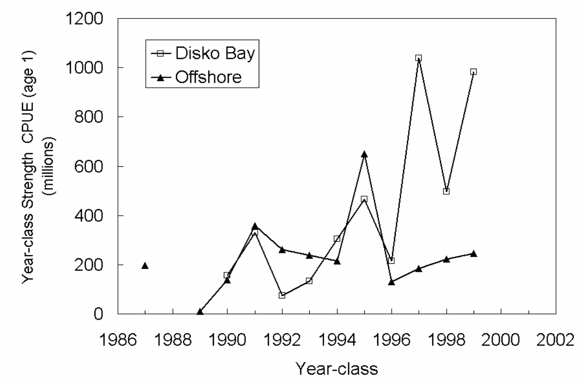

**Data**: Catch data available at the time of the assessment were very preliminary and are likely to have been underestimated by about 2000 tons. Catch-at-age data were available for years 1988-2000 at Disko Bay, and for most years in this period at Uummannaq and Upernavik. Data on mean length in commercial catches were available. A recruitment index for age 1, 2 and 3+ was available from trawl survey. Catch rates and mean lengths were available from inshore longline surveys.

**Assessment**: The stock component in Disko Bay is composed of younger and smaller individuals than in the other two areas. Survey results since 1993 do not indicate any major changes in abundance. Mean length composition in the survey has been stable in recent decade. The survey in 2000 did, however, show a decline in mean length in Torssukataq (northern part of Disko Bay). 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.

In Uummannaq survey results since 1993 do not indicate any major changes in abundance. Catch composition in the commercial fishery has changed significantly since the 1980s towards a higher exploitation of younger age groups, but have stabilized during latest years.

In Upernavik survey results for 1993-99 do not indicate any major changes in abundance but the 2000 survey indicated a reduction. Mean length compositions in both commercial and survey catches have decreased, especially in the commercial winter-fishery. New fishing grounds north of 73º45'N have been exploited only recently. Little information exists from these areas, and the stock components are considered virgin.

*Fishing mortality:* Estimate of fishing mortality in Disko Bay has shown a generally increasing trend from late-1980s to present. In Uummannaq and Upernavik fishing mortality could not be estimated but based on the increase in catches there is indication of an increase in fishing mortality.




*Recruitment*: Both offshore and in Disko Bay the numbers of one-year-olds from the 1999 year-class were above average. In Disko Bay it was the second highest on record. The 1997 year-class that was very strong inshore was not above average at age 3. A linkage between the recruitment at age 1-3 and the subsequent recruitment to the inshore fishery at age 6-7 have however not yet been established due to the short time series.

**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. Stock structure has also been stable although it consists of relatively few and young age groups compared to before 1990.

*Uummannaq:* Indices of abundance have been relatively stable since 1993. Stock structure has since the mid-1990s moved towards younger and fewer age groups but have stabilized in recent years.

*Upernavik:* Stock structure has since the mid-1990s 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 improvement in stock status in any of the three areas. Therefore, Scientific Council concludes that there be no change in the TACs recommended for 2000. The TAC for 2001 for each of the inshore areas are therefore recommended to be: Disko Bay 7 900 tons, Uummannaq 6 000 tons, and Upernavik 4 300 tons.

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

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

The lack of effort data from the commercial fishery impedes the assessment of the stocks.

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. 01/35, 48, 68; SCS Doc. 01/23.

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 stock for which the Scientific Council provided advice for the year 2002.

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 offshore, Div. 1A offshore and Div. 1B-1F. The Council considerations are as given below.

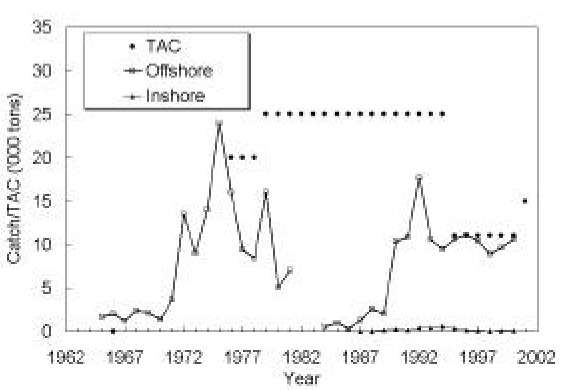
### *Greenland Halibut (Reinhardtius hippoglossoides) in Subarea 0 + Division 1A Offshore and Divisions 1B-1F*

**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.

| | Catch[1] ('000 tons) | TAC ('000 tons) | |
|---|---|---|---|
| | | Recommended | Autonomous |
| 1998 | 9 | 11 | 11 |
| 1999 | 10 | 11 | 11 |
| 2000 | 11 | 11 | 11 |
| 2001 | | 15[2] | |

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

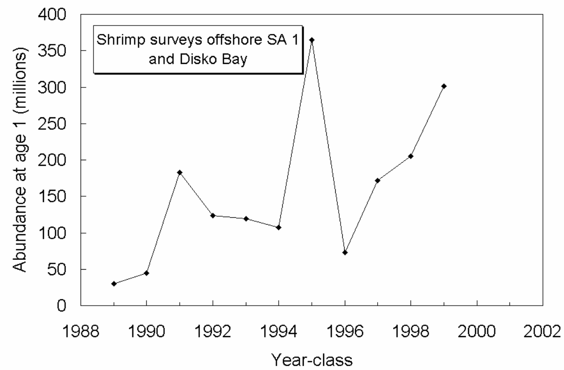



**Data**: Catch-at-age data were available for assessment from SA 0 and Div. 1CD. Standardized and unstandardized catch rates were available from Div. 1CD. Biomass estimates were available from surveys in Div. 1CD and 0B. Recruitment data were available from surveys in Div. 1A-1F from 1989-2000.

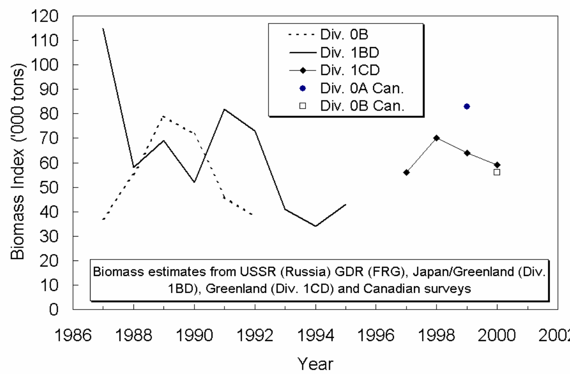
**Assessment**: No analytical assessment could be performed. Combined standardized catch rates for SA 0 + Div. 1CD have been stable during 1990-2000.

*Fishing Mortality*: Level not known.

*Recruitment*: Recruitment of the 1999 year-class at age one was the second largest in the time series.




*Biomass*: The biomass in Div. 1CD has decreased since 1998 but the 2000 estimate is above the estimate in 1997. A new survey in Div. 0B resulted in a biomass estimate of 56 000 tons.




**State of the Stock**: The age composition in the catches where most of the fishery takes place has been stable in recent years. Although the survey series from Subarea 1 in 1987-95 is not directly comparable with the series from 1997-2000, the decline in the stock observed in Subarea 1 until 1994 has stopped and the stock seems to be back at the level in the late-1980s and early-1990s.

**Recommendation**: The TAC for year 2002 should not exceed 11 000 tons for Div. 0B and 1B-1F where the fishery primarily has taken place since it began.

**Special Comments.** The relationship between Greenland halibut in Div. 0A + 1A (offshore) and the remaining areas needs to be resolved. In June 2000 Scientific Council recommended an additional TAC of 4 000 tons for Div. 0A + 1A offshore based on recent survey results. No new information was available at this meeting to update this advice.

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

**Sources of Information**: SCR Doc. 01/23, 35, 42, 43, 48; SCS Doc. 01/11, 13, 15, 21.

3. **Scientific Advice from Scientific Council on its Own Accord.**

a) **Roughhead Grenadier in Subareas 2 and 3**

The Scientific Council on its own accord considered roughhead grenadier in Subareas 2 and 3.

Based on information available the Council noted that the state of the stock is unknown and is therefore not able to provide advice at this time. The next Scientific Council assessment of this stock should be in 2003.

b) **Elasmobranchs**

The Council agreed to defer this discussion to its September 2001 Meeting.

## VIII. FUTURE SCIENTIFIC COUNCIL MEETINGS 2001 AND 2002

1. **Scientific Council Meeting and Special Session, September 2001**

The Council reconfirmed that the Annual Meeting will be held during 17-21 September 2001 in Varadero, Cuba. The Scientific Council Special Session, the Symposium on "Deep-sea Fisheries" will be held during 12-14 September 2001 at the same venue.

2. **Scientific Council Meeting, November 2001**

The Council reconfirmed its meeting on northern shrimp will be held during 7-14 November 2001, at NAFO Headquarters, 2 Morris Drive, Dartmouth, Nova Scotia, Canada.

3. **Scientific Council Meeting, June 2002**

The Council confirmed the Scientific Council Meeting will be held during 6-20 June 2002, at Alderney Landing, 2 Ochterloney Street, Dartmouth, Nova Scotia, Canada

The Council agreed the facilities at this venue were suitable for the meeting, however, it was agreed an audio system was needed to overcome the acoustic difficulties of the meeting room. The Council also agreed that a computer projector hooked onto the server was required. The Secretariat was requested to attend to these requirements for the June 2002 Meeting.

4. **Scientific Council Meeting and Special Session, September 2002**

The Council noted the Annual Meeting will be held during 11-20 September 2002 in Spain, but the meeting site had not been announced yet. The Scientific Council Special Session, the Symposium on "Elasmobranch Fisheries" (the exact title may change), will be held during 11-13 September 2002 at the same venue.

5. **Scientific Council Meeting, November 2002**

The Council confirmed its meeting on northern shrimp will be held in Nuuk, Greenland. The meeting dates and site will be finalized during the Scientific Council Meeting on northern shrimp in November 2001.

## IX. ARRANGEMENTS FOR SPECIAL SESSIONS

### 1. Progress report on Special Session in September 2001: Symposium on "Deep-sea Fisheries"

The co-conveners, J. Moore (NAFO/USA), J. Gordon (ICES/EU-United Kingdom) and T. Koslow (CSIRO/Australia), reported significant progress in the preparations for the Symposium on "Deep-sea Fisheries", to be held during 12-14 September 2001 in conjunction with the 17-21 September 2001 Annual Meeting in Varadero, Cuba.

A total of 55 papers for oral presentations and 63 papers for poster presentations have been accepted for the Symposium. Abstracts for all of these papers, currently being edited for the Abstract Booklet, will be issued at the Symposium.

The sessions are now set up and the entire schedule for the meeting arranged. The schedule will include the following themes:

- Deepwater fisheries, Part I
- Greenland halibut
- Impacts, assessments and management
- Biology of life histories
- Deepwater fisheries, Part II
- Redfish
- Fisheries ecology

Keynote presentations will be made by: R. L. Haedrich (Canada) for deepwater fisheries, T. Koslow for biology and life histories, M. Clark (New Zealand) on assessments and management, and J. D. M. Gordon for fisheries ecology.

The complete schedule with listed papers will be posted on the NAFO Website shortly.

### 2. Progress report on ICES/NAFO Symposium on Hydrobiological Variability in August 2001

The Council noted STACFEN addressed and reported on this item (see Appendix I, item 10, page 68)

### 3. Progress report on Special Session in 2002: the Symposium on "Elasmobranch Fisheries"

The Co-convenors reported significant progress in designing this Symposium. The organizer, D. Kulka (Canada) confirmed the participation of co-convenors M. Pawson (replacing Paddy Walker) (ICES), J. Musick, Virginia Institute of Marine Science (VIMS), USA, and T. Walker, Marine and Freshwater Resources Institute (MFRI), Australia. An appropriate title for the Symposium and the formulation of the theme sessions were being discussed. The following tentative themes have been identified: a) stock identity (in relation to assessment and management), or b) stock identity and structuring shark, skate, ray and chimaera populations, c) application of analytical models to assess the status of stocks in relation to sustainable exploitation d) methods for assessment, monitoring, and management of fisheries for sustainable and rational harvest, or methods for rapid assessment of by-catch species and for biodiversity conservation, e) species identification in relation to the collection of catch etc. statistics from fisheries, f) vulnerability of "low reproductive" elasmobranch stocks to exploitation, g) status of elasmobranchs worldwide or description of fisheries worldwide, h) biology of elasmobranches, and i) status of chondrichthyan fisheries of the world. Further to input from the Scientific Council, these will be finalized shortly. Suggested titles for the Symposium: a) The Foundations of Elasmobranch Stock Recovery Plans, or b) Elasmobranchs - Biology and Exploitation.

The Council noted NAFO Symposia are held in conjunction with the Annual Meetings of NAFO, and are considered as part of the Scientific Council meeting and called Scientific Council Special Sessions. In some years, events such as Scientific Council Workshops (e.g. in 2000) are included. Therefore, they are part of the NAFO Annual meeting budget each year.

The NAFO budget covers the costs of the meeting space and infrastructure including computer and other equipment. This also includes preamble material such as announcements, flyers, and communication with participants and publication of Abstracts. It is noted that Symposium reports are presented to the Scientific Council along with all papers (issued as SCR Documents) during the following week and all these records are archived at NAFO along with the Scientific Council Reports.

Post-symposium expenses relate to publications – usually Journal or Studies. Here too the NAFO budget usually anticipates and accommodates a standard (sized) publication (up to about 300 pages, and around 100 participants). However, more popular symposia (e.g. "Deep-sea Fisheries" in 2001) may warrant additional financial support. In such situations, the Scientific Council proposed that the Journal issue be sold to all participants. The proposed cost per volume could be about $35.00 for a book of up to about 300 pages and about $45.00 for larger books, noting that usual NAFO recipients of the book will continue to receive it.

A significant budget item that is not covered by NAFO is the support for "invited", "keynote" or such speakers (usually those from outside the NAFO participant circles). In recent years the Scientific Council has made special requests for such expenses (e.g. $8 000 for the 2001 Deep-sea Fisheries Symposium). The Scientific Council **recommended** that *a sum of $8 000 from the budget be requested for the Elasmobranch Symposium*. Additionally, the Scientific Council requested co-convenors to seek financial support from other sources including NGOs and Government Institutes (using the experience of the Shrimp Symposium in 1999).

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

The Council recalled its discussion of 1998 on a proposal for a Symposium on "Managing Marine Ecosystem Variability in the NAFO Area" prepared by a steering committee composed of S. J. Walsh (Canada), O. R. Godø (Norway) and M. Stein (EU-Germany). The Council noted this proposal was postponed then, in consideration of some Canadian initiatives on this theme.

The Council agreed to review the status of the Canadian initiatives and consider the suitability of this symposium topic for 2003, during its meeting in September 2001. The Council requested S. J. Walsh to research and report on this item noting that any proposal for 2003 should be finalized in September 2001 to ensure there would be adequate lead time for preparation.

## X. REPORT OF THE WORKING GROUPS

1. **Working Group on Reproductive Potential**

Working Group Chairman, E. A. Trippel (Canada), presented the progress report of the Working Group activities. The Council was informed:

The 1$^{st}$ meeting of the NAFO Scientific Council Working Group on Reproductive Potential was held during 10-13 October 2000 at the Aquarium, San Sebastian, Spain and was hosted by AZTI. There were 14 participants from Canada, Denmark, Germany, Norway, Russia, Spain and the United States of America. Co-leaders of the four Terms of References (ToR) made presentations on the progress made and subsequent plans.

ToR 1: Co-leaders presented a preliminary version of four tables designed for the inventory of data on reproductive potential for marine fish stocks. The four tables comprised (i) available data for a specific stock; (ii) information on data format and quality, (iii) studies on reproductive potential, and (iv) data sources.

ToR 2: Co-leaders updated Working Group members on the necessary procedures used to estimate egg and larval production of fish stocks. Establishment of categories of reproductive biology of the species was made and protocol to estimate fecundity were identified respective to reproductive style (e.g. determinate spawner, batch spawner, etc.). An overview was presented of techniques used to estimate fecundity and egg quality of captive fish.

ToR 3: Co-leaders presented a variety of alternative methods used to measure fecundity to gain annual estimates of a stock's reproductive potential. Several body metrics that showed promise included condition factor and liver index. These could possibly be used to build long time series of reproductive potential, even for years for which no ovary collections were made for fecundity.

ToR 4: Co-leaders provided information on several approaches that could be used to include reproductive data in fisheries management advice. This group recommended that case studies be developed for data rich, data moderate and data poor stocks to reflect the wide variety of data available on reproductive potential. A comparison of the relative merit of using different proxies to estimate reproductive potential was suggested, especially as some data requirements are less tedious yet produce important predictive power.

The Working Group considered publications and next meeting. Participants endorsed the view to prepare material for the primary publication, and proposed a special volume of the *NAFO Journal of Northwest Atlantic Fishery Science*. Co-leaders of ToR 1 also agreed to submit a comprehensive set of tables for the proposed publication in the *NAFO Scientific Council Studies,* as well as prepare a summary manuscript for the *Journal*. The Working Group agreed a compilation of data relevant to ToR 1 would be particularly useful and provide an authoritative assemblage of data for many marine stocks of the North Atlantic and Baltic Sea.

In February 2001, the Working Group agreed that a 2nd Meeting of the Working Group on Reproductive Potential be held from 23-26 October 2001, at the Institute of Hyprorybflot, St. Petersburg, Russia. The focus of the meeting would be on critical review of manuscripts and their integration for a special volume. Working Group Members worked by correspondence with an update forwarded to the Chairman on 1 March 2001.

The Working Group Chairman reported that over the next several months, each manuscript is being completed for the 2nd Working Group Meeting. ToR Co-leaders are to discuss with their participants any problems in the meeting of deadlines. The Chairman requested that the view of the Scientific Council be sought with regard to publication of the suggested material. Editorial duties are proposed to be the responsibility of the Working Group Chairman, with publication year set as 2002.

The Scientific Council was pleased with the progress and the scientific value of the information being compiled as presented on 31 May 2001 by the Working Group Chairman. The Council agreed that the comprehensive Tables of ToR 1 be placed on the NAFO Website, with the eventual possibility of their becoming interactive and updated with new data as they become available for various stocks. The Scientific Council noted the relative importance of male reproductive potential to that of the female and inquired whether this would be accommodated in the report. Paternal relative to maternal reproductive potential is less studied, though the information that exists will be noted and appropriate methodology given.

The Council noted that STACPUB reviewed and agreed to the proposal for two publications and **endorsed** the recommendation that *the collection of papers being prepared by the Working Group on Reproductive Potential be edited by the Working Group Chairman, E. A. Trippel (Canada), and compiled into a single issue of the Journal of Northwest Atlantic Fishery Science during 2002.* The Council also **endorsed** the recommendation 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 Council noted the Working Group Chairman would work with the Assistant Executive Secretary for this publication.

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

This Working Group met in October 2000 and their report, along with the ICES ACFM report dealing with this, was available to Scientific Council. The main focus of this meeting was population assessments of the harp seal stocks in the Greenland Sea, and the White Sea and Barents Sea, as well as a population assessment of the hooded seal stocks in the Greenland Sea. The Working Group is scheduled to work by correspondence in 2001, and to hold a meeting in late summer or early autumn of 2002. The Working Group has also proposed that it sponsor a population modelling workshop, to be held in the winter of 2001-2002. Current terms of reference for the Working Group include review of the recommendations from the modelling workshop, and a review of diet and consumption studies. Scientific Council did not have any recommendations for the Working Group at this time. The Chair of Scientific Council was requested to follow up with the Chair of the Working Group regarding the workshop, and present a report to Scientific Council in September 2001.

## XI. NOMINATION AND ELECTION OF OFFICERS

The Chairman's proposal (31 May 2001) to appoint a Nominating Committee composed of W. R. Bowering (Canada), M. Stein (EU-Germany) and A. Vazquez (EU-Spain) was accepted. On 14 June 2001, the Chairman requested the Nominating Committee's proposals.

The Council noted the appointments were for two-year terms beginning at the end of the September 2001 Annual Meeting and the Chairman called for nominations and elections.

**Chairman Scientific Council.** For the office of Chairman of Scientific Council, the current Vice-Chairman, R. K. Mayo (USA) was nominated by the Committee. There being no other nominations, the Council elected him by unanimous consent.

**Vice-Chairman Scientific Council.** For the office of Vice-Chairman of Scientific Council, M. J. Morgan (Canada) was nominated by the Committee. There being no other nominations, the Council elected her by unanimous consent.

**Chairman STACPUB.** For the office of Chairman of the Standing Committee on Publications (STACPUB), M. Stein (EU-Germany) was nominated by the Committee. There being no further nominations, the Council elected him by unanimous consent.

**Chairman STACFIS.** For the office of Chairman of the Standing Committee on Fisheries Science (STACFIS), D. E. Stansbury (Canada) was nominated by the Committee. There being no other nominations, the Council elected him by unanimous consent.

**Chairman STACREC.** The Rules of Procedure determined that the Vice-Chairman would take the office of the Chairman of the Standing Committee on Research Coordination (STACREC). M. J. Morgan (Canada) was accordingly appointed to the office.

**Chairman STACFEN.** For the office of Chairman of the Standing Committee on Fisheries Environment (STACFEN), E. Colbourne (Canada) was nominated by the Committee. There being no other nominations, the Council elected him by unanimous consent.

## XII. REVIEW OF SCIENTIFIC COUNCIL WORKING PROCEDURES/PROTOCOLS

### 1. Implementation of Precautionary Approach

The Chairman noted that there had been no progress on the implementation of the Precautionary Approach since the Fisheries Commission addressed it in the winter of 2000, after it had adopted the report of the Scientific Council and Fisheries Commission Working Group.

The Fisheries Commission had in September 2000 proposed that a small group meeting in spring 2001 to consider an implementation decision. The Fisheries Commission noted much work still needed to be done, particularly with respect to terminology and the usage of Precautionary Approach at NAFO *versus* NEAFC. The Council noted its framework had not been adopted by the Fisheries Commission yet. However, the proposed spring 2001 Fisheries Commission Meeting on Precautionary Approach had not yet been held.

The Council was informed that the ICES Study Group on the Further Development of the Precautionary Approach to Fishery Management met during 2-5 April 2001 in Copenhagen to:

a) review the current status of the Precautionary Approach (PA) as implemented by ICES.

b) develop a framework for formulating advice by defining protocols for the establishment of:

   i) advice in data poor situations specifically when advising on the exploitation of deepwater species
   ii) advice in data rich situations
   iii) recovery plans

c) investigate the use of MSY ($F_{msy}$ and $B_{msy}$) as a biological reference point.

The Council was provided with a summary of that meeting by one of the attendees (C. Darby, EU-United Kingdom). It was noted ICES has implemented conservation reference points for 63 stocks. The technical basis for the current reference point values was documented. A range of comments on their use and interpretation was discussed. The study group indicated that the current values need to be further reviewed for consistency, and a policy is required on the frequency and reasons for updating them routinely.

Using the current reference points and advice, in 1999 the ICES ACFM identified 10 stocks that were seriously depleted and had recommendations for rebuilding plans, 9 stocks that were depleted but had no recommended rebuilding plans, and a further 41 stocks that were less seriously depleted and had no recommended rebuilding plan. The study group considered that formulation of the advice could be more consistent if a criterion key was used to diagnose the state of the stocks relative to the reference points, and then used to identify the need and time scale for rebuilding plans. The approach was tested with examples.

The group reviewed historical examples of crisis management of fish stocks in the ICES area, and recent emergency negotiation of recovery plans for seriously depleted stocks in the EU. Observations and suggestions were made about the character of the process, and the need for additional scientific knowledge.

The group had insufficient time to study the problem of data poor situations generally, but looked at the problem for two examples; the deep-water species and *Nephrops* stocks. For deep-water species it was concluded that the priority was not so much to determine reference points, as to make use of existing knowledge and advice, however limited.

The study group reviewed ICES views on the possible use of MSY and $F_{0.1}$ as reference points. The group was not persuaded as to the benefits of utilizing MSY due to the difficulties in its estimation. $F_{0.1}$ was considered to be a robust estimator that could be used as a reference point across a range of species and life history types.

## 2. NAFO Scientific Council Observership at ICES ACFM Meetings

W. R. Bowering (Canada) represented NAFO Scientific Council as the observer at the ICES, ACFM meeting during October 2000. A significant observation was the disturbing trend in declining groundfish resources in the northern part of the ICES area in the Northeast Atlantic with advice for substantial reductions in catches quotas for many stocks and moratoria advised for a number of cod stocks. There are many similarities now occurring in the ICES area with the events experienced in the NAFO area for about the past 10 years.

With concerns widely expressed throughout the North Atlantic for ecosystem based fisheries management, ICES has created a new advisory committee, Advisory Committee on Ecosystems (ACE), intended to address this issue. The Scientific Council agreed it is worth paying close attention to the progress of this committee as it may provide some insights as to how the Scientific Council may deal with similar issues in the NAFO area.

With respect to future observers from Scientific Council, the Council noted there is usually a problem with anyone attending the ACFM Meetings in May, because of the virtual overlap of those meetings with the NAFO Scientific Council Meeting.

With respect to the October 2001 Meeting of the ACFM, the Council welcomed C. Darby (EU-United Kingdom) to act as the observer and report back to Scientific Council.

3. **Summaries of Standing Committee Reports for NAFO Website**

At the June 2000 Meeting the Scientific Council agreed it should put meeting highlights on the web site after the June Scientific Council Meeting, summarizing the most important results.

The Council noted that an announcement titled "Meeting Highlights" should be put together by the Chairmen of STACFIS, STACFEN, STACREC and STACPUB and adopted by Scientific Council. It should be published on the web site together with the Scientific Council Reports and placed under "What's New/ Recent Events" on the web site.

Basically it should be short and only include information on stocks where the advice has been changed compared to the year before and a short update of the environmental conditions in the Northwest Atlantic. If there is any relevant new information from STACPUB and STACREC it should also be included.

The Scientific Council Chairman was requested to prepare a relevant summary, to be installed by the Secretariat on the website with links to the meeting report.

4. **Website and Technology Issues**

The Chairman reported that he had some discussions with the Fisheries Commission Chair. Scientific Council noted that no Working Group has been established as per its recommendation. They had noted that some Fisheries Commission information was already in the website content, particularly with respect to Annual Report of NAFO, Conservation and Enforcement Measures, etc. However, unlike the practice of the Scientific Council, Fisheries Commission Reports do not get finalized for public issuance for long periods after meetings. Additionally, General Council and Fisheries Commission Committee reports from intersessional meetings need to be adopted by the Constituent Bodies during the Annual Meeting.

The Council considered the possibility of publishing some approved reports and documents on the website, and noted that further discussion by the Chairs of the Constituent Bodies should clarify this.

5. **Facilitating Workload of Scientific Council During Annual Meeting in September**

The Council highlighted its concerns as expressed in its September 2000 Meeting regarding addressing *ad hoc* requests from the Fisheries Commission during the Annual Meetings, when the Scientific Council does not have the full complement of its Designated Experts and all of the data needed.

The Council agreed that the Chair should reiterate these concerns to the Fisheries Commission.

The Council additionally discussed the general issue of re-scheduling the timetable and frequency for assessments of certain stocks.

After considerable discussion, the Council agreed that the issue of re-scheduling for the following should be addressed in September 2001 Meeting:

- Redfish in Div. 3M
- Squid in Subareas 3+4
- American plaice in Div. 3LNO
- Yellowtail flounder in Div. 3LNO

## XIII. OTHER MATTERS

1. **Report on Second Meeting of FAO and Non-FAO Regional Fishery Bodies, Rome, Italy, 20-21 February 2001**

In accordance with the June 2000 recommendations of the Scientific Council, the Assistant Executive Secretary attended this second meeting of the Regional Fisheries Bodies (RFBs). The first one was held in February 1999. The outcome of that meeting was well received by the FAO Committee on Fisheries (COFI), and this meeting was convened based on the COFI recommendation that such meetings be held on a regular basis, preferably prior to the regular COFI Session.

The meeting elected the following:

| | |
|---|---|
| Chairperson: | Mr. Robin Allen, Director, Inter-American Tropical Tuna Commission (IATTC); |
| Vice-Chairperson: | Mr. Estebán de Salas, Executive Secretary, Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR); |
| Rapporteur: | Mr. Tissa Amaratunga, Assistant Executive Secretary, Northwest Atlantic Fisheries Organization (NAFO). |

The meeting agreed these officers would hold office till the beginning of the 3rd Meeting of the RFBs.

Noting the meeting would generally deal with initiatives and experiences of RFBs in the implementation of international instruments such as the United Nations Convention on the Law of the Sea (UNCLOS), UN Fishstock Agreement, Compliance Agreement and Code of Conduct for Responsible Fisheries, the discussions focused on the following:

i) External factors that may impact the work of RFBs and the management of fisheries (the focus was on ecosystem and environmental issues).

ii) Indictors to assess the performance of RFBs (on criteria with respect to UNCLOS, Code of Conduct, etc.).

iii) Review of some emerging issues in fisheries of relevance to RFBs .
- Cooperation in global status and trends (S&T) reporting in fisheries (since the February 1999 Consultation, and subsequent IPOA)
- Illegal, unreported and unregulated (IUU) Fishing
- Recent developments on criteria for listing commercially exploited fish in CITES (Convention on International Trade in Endangered Species of Wild Flora and Fauna).

iv) Opportunities and challenges for coordinating the marine RFBs and regional seas conventions:

It was highlighted that the participants of these meetings were representatives of RFB Secretariats who were not mandated for decision making at the meeting. Accordingly, comments were only presented as personal or expert advice, and it was recognized in principle the meeting is for the Secretariats of RFBs. A significant step was taken with the Chairman being requested liaise with RFB Secretariats well in advance of the next meeting in order that the RFBs could provide mandated inputs. FAO would continue to provide the Secretariat for these meetings.

It was agreed to change the title of the meeting to "Meeting of the Regional Fishery Bodies". The third Meeting was proposed for immediately after the next COFI Meeting of 2003.

The meeting was well attended with representatives from 24 RFBs, with 9 of them from FAO and 15 from non-FAO bodies. For NAFO, it was an excellent opportunity to look at global issues in respect of RFBs, to make personal contact with similar status representatives of other RFB Secretariats and learn about other RFBs. NAFO was well recognized as one of the oldest and leading RFBs with a rich history of science and management under ICNAF and NAFO.

## 2. Report on Second Technical Consultation on Illegal, Unreported and Unregulated Fishing, Rome, Italy, 22-23 February 2001

The Assistant Executive Secretary attended, this the Second Technical Consultation on Illegal, Unreported and Unregulated (IUU) Fishing in Rome, Italy, on 22 and 23 February 2001. This was a follow up to the Expert Consultation held in Sydney Australia during 15-19 May 2000, and the First Technical Consultation in Rome during 2-6 October 2000. The meeting was attended by 57 members of FAO and observers from one non-member nation of FAO. Representatives from a specialized agency of the United Nations attended as well as twelve observers from intergovernmental organizations and seven international non-government organizations. The previous Consultation Chair, Mr. A Jackson (United Kingdom) continued to Chair and the Hon. A. V. Fernándezz-Baca, Vice-Minister for Fisheries of Peru and Mr. M. S. O. Benaouf, Chief of Operations Service, Ministry of Fisheries from Mauritania, served as Vice-Chair of the Consultation and Rapporteur, respectively.

In the context of the Code of Conduct for Responsible Fisheries, the Consultations were to address the need to prevent, deter and eliminate IUU fishing with "a global plan of action to deal with all forms of "flags of convenience" through coordinated efforts by States, FAO, relevant regional fisheries management bodies…". The resulting technical report was due to be presented to FAO Committee on Fisheries (COFI) in 2001.

## 3. Participation at FAO Committee on Fisheries (COFI)

The Council noted that as recommended by the Scientific Council, the Assistant Executive Secretary attended the meeting of FAO and non-FAO Regional Fishery Bodies and the Technical Consultation on Illegal, Unreported and Unregulated Fishing during 20-23 February 2001 (see above). These were preparatory meetings, and held immediately prior to the COFI Meeting. Noting COFI meetings are held every two years and cover many other technical issues with respect to the UN and global fisheries, the Council considered the need to attend the COFI Meetings. The Council **recommended** that *in principal the Scientific Council saw the value of being represented at the COFI Meeting in 2003. The Council requested the Assistant Executive Secretary to keep the Council apprised of the progress and plans of COFI, and agreed that the Council will consider this matter at future meetings.*

## 4. Report on NAFO Intersessional Meetings

The Council noted NAFO intersessional meetings relevant to the work of the Scientific Council were those mainly on Observer Protocol and Conservation of Enforcement Measures addressed by STACTIC (27-29 June 2000 and 1-3 May 2001), and on pelagic redfish in the NAFO/NEAFC area addressed under the aegis of the Fisheries Commission (13-14 February 2001 and 27-29 March 2001). The meeting on the Precautionary Approach as proposed for spring 2001 by the Fisheries Commission in September 2000 has not been held yet.

The Council noted relevant information from these intersessionals were addressed and reported under the appropriate agenda items of this meeting.

## 5. Other Business

### a) STACPUB Sessions at Plenary

The Council was requested to consider this item by STACPUB.

The Council discussed the desirability of conducting STACPUB business in sessions open to all participants of the Scientific Council. It was particularly noted that in recent years some subjects discussed at STACPUB should be open to views at the plenary.

The Council, while agreeing to open STACPUB sessions, was concerned that the additional workload at plenary may affect the more pressing work of the Scientific Council and the Standing Committees, particularly STACFIS. After further review of the workloads, it was noted that agendas of all Standing Committees should be critically reviewed to eliminate overlap and duplications. The Council therefore agreed to change the format of the next June Meeting of the Scientific Council in 2002, to conduct

STACPUB business in the plenary forum in the same way STACFIS, STACREC and STACFEN conduct business.

The Council noted that the present STACPUB membership needs to be reviewed and agreed to address this issue at its meeting in September 2001.

b) **Sequential Population Analysis for Greenland Halibut**

Scientific Council recognized the substantial advances in developing sequential population models for the assessment of Greenland halibut in 1999 and 2000. However, there is still considerable uncertainty with the results of these models, and at present the results are used by Scientific Council only in an illustrative sense for *status quo* projections. To take advantage of the recent work and progress in this area a workshop should be held sometime prior to the June 2002 Scientific Council Meeting, and should consist of a group of 10-12 people, including the Designated Expert, other NAFO contributors and invited experts from outside Scientific Council. A logical venue might be the Northwest Atlantic Fisheries Centre (NAFC) in St. John's, Canada. Scientific Council **recommended** that *a workshop be held with a focus on sequential population analysis for the Greenland halibut stock in Subarea 2 and Div. 3KLMO. To assist with the cost of conducting this workshop, $3 000 in funding be sought from the NAFO budget*.

c) **Further Developments on Observer Program**

At the June, 2001 Meeting, STACREC noted the need for further communication between the Scientific Council and the Fisheries Commission to address issues relating to the Program for Observers and Satellite Tracking.

Scientific Council requested the Chair to communicate with the Fisheries Commission Chair to address: 1) Representation of Scientific Council at the September 2001 STACTIC Meeting, 2) Inclusion of Scientific Council issues on the September 2001 STACTIC Meeting agenda regarding: i) resolving the inconsistency between sections 3b) and 3d) of the Conservation and Enforcement Measures Part VI, Program for Observers and Satellite Tracking, and ii) continued discussion of the development of a training and operation manual for the collection of scientific data.

d) **Geostatistics Methodology for Studying Fish Stocks**

The Scientific Council noted that the recent promising developments in geostatistic methods for studying fish distribution and abundance. The Council agreed this matter be further reviewed at its meeting in September 2001, including the possibility of conducting a workshop on this topic.

## XIV. ADOPTION OF COMMITTEE REPORTS

The Council, during the course of the meeting, received summary presentations of the Standing Committee Reports, with focus on the recommendations. Having considered each recommendation and also the text of the reports, the Council during the concluding session on 14 June 2001 **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.

## XV. SCIENTIFIC COUNCIL RECOMMENDATIONS TO GENERAL COUNCIL AND FISHERIES COMMISSION

The Council Chairman undertook the task of addressing the relevant recommendations from this meeting report to submit them to the General Council and Fisheries Commission, and initiate communications as required.

## XVI. ADOPTION OF SCIENTIFIC COUNCIL REPORT

At its concluding session on 14 June 2001, the Council considered the Draft Report of the Meeting, and **adopted** the report with the understanding that the Chairman and the Assistant Executive Secretary will incorporate later the text insertions related to plenary sessions of 31 May-14 June 2001 and other modifications as discussed at plenary.

## XVII. ADJOURNMENT

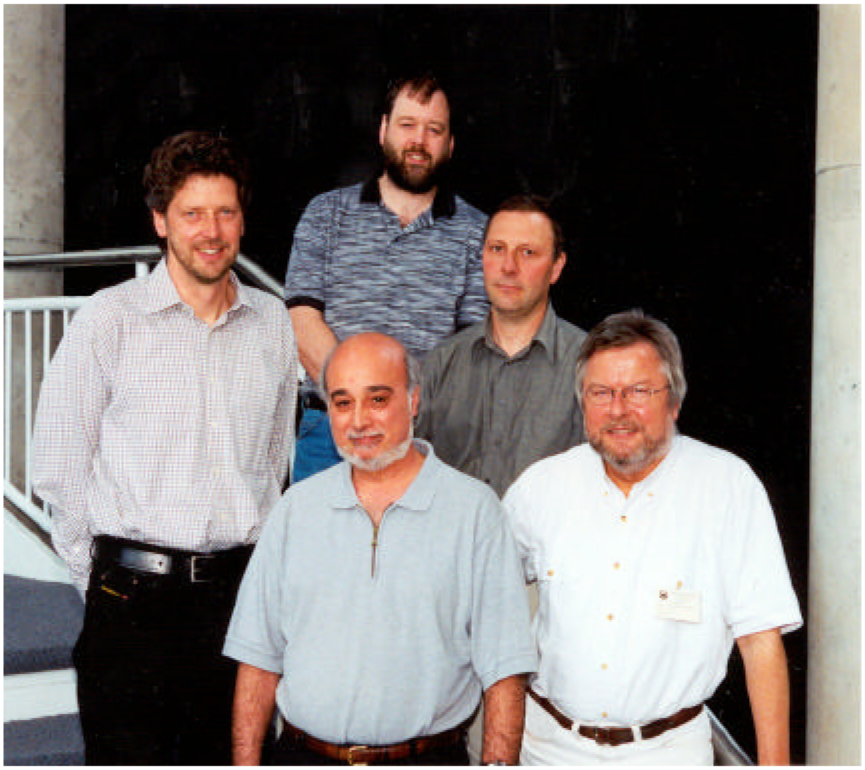
The Chairman expressed his gratitude to the Council members for their work and co-operation during the meeting. He was especially pleased to note the excellent co-operative efforts on a number of stocks, resulting in improved assessments. Special thanks were extended to the Designated Experts and the Standing Committee Chairs for their commitment and for carrying out an extra workload during the meeting.

The Chair thanked the Assistant Executive Secretary for his work as rapporteur. The Secretariat was congratulated for its fine efforts and support during the meeting, and for providing an excellent LAN at the meeting site.

The Chair noted the Chair of STACFIS had a particular heavy workload and congratulated him for leading the Committee through efficient and thorough dis cussions on all stock assessments.

There being no further business, the Chairman wished everyone a safe trip home and closed the meeting.

The members of the Scientific Council extended a special thank you to the Council Chairman for a well-conducted and productive meeting.



**The Chairs, Scientific Council Meeting, 31 May-14 June 2001 (Top to Bottom)**:

W. B. Brodie, Chair Scientific Council
H.-J. Rätz, Chair STACFIS, O. Jørgensen, Chair STACPUB
R. K. Mayo, Chair STACREC, M. Stein, Chair STACFEN

**STACFEN in session during the 31 May-14 June 2001 Meeting**.

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

Chairman: M. Stein Rapporteur: K. Drinkwater

The Committee met at Alderney Landing, 2 Ochterloney Street, Dartmouth, Nova Scotia, Canada, on 1 June 2001, to consider environment-related topics and report on various matters referred to it by the Scientific Council. Representatives attended from Canada, Cuba, 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.

### 1. Opening

The Chairman welcomed the members to the annual June meeting of STACFEN. The Committee discussed the work plan, noted the following documents would be reviewed: SCR Doc. 01/ 2, 3, 7, 8, 25, 28, 32, 36; SCS 01/11, 15, 19. K. Drinkwater (Canada) was appointed rapporteur.

### 2. Chairman's Introduction and Intersessional Report

The Chairman reported that his primary work between sessions was involved in preparing for this meeting and securing funds for the invited speaker. The Chairman expressed his pleasure at having Gerd Wegner (EU-Germany) as this year's invited lecturer.

After 17 years as Chairman, M. Stein informed STACFEN that this would be his last meeting as Chair although he planned to continue on as a member of the Committee.

### 3. Review of Recommendations in 2000

STACFEN had recommended that *NAFO's financial contribution to the Joint ICES/NAFO Symposium on "Hydrobiological Variability During the 1990s", August 2001, Edinburgh, Scotland, include the equivalent of GB 3 500 (approximately CDN $8 000) to cover partial costs of conducting the Symposium.* The Chairman reported that the funding had been sent by NAFO and that those organizing the Symposium had acknowledged their receipt.

### 4. Invited Lecture

The Chairman introduced G. Wegner (Institut für Seefischerei, Hamburg, Germany) who presented a talk entitled "*EU Concerted Action on Stock Assessment and Prediction (SAP): Aim, Procedure and Results*". The following is a brief summary.

The SAP initiative was a multinational European concerted action that ran from 1998 to 2001 to which some Canadian and US experts were asked to participate. Its objectives were to examine ways to reduce uncertainties in stock assessment, to investigate whether existing oceanographic and biological time series could be used for testing theories about stocks and recruitment and to propose coordinated research to help to improve stock assessments.

The main research areas included the physical environment, species interactions and stock assessment models. Geographically, the work compared and contrasted four areas; the Northeast Atlantic, the North Sea, the East Atlantic and the Mediterranean. Tasks set by SAP included determining shortcomings in stock assessment (sources of errors, time horizon for predictions), limits on predictability, scientific knowledge potentially useful in fish stocks predictions such as information on the physical environment and plankton, case studies and scientific communication. A total of six meetings were held with a final Symposium held in Bergen during December 2000. A final report of that meeting will be published by the end of 2001.

SAP noted several important issues that needed to be addressed, such as insufficient information concerning discards, low quality of catch data for some species, mixture of species in industrial fisheries, few assessments that take into account the effect of the environment, no regular stock assessments for some species, and inter-calibration between different national research surveys. Of particular interest to STACFEN, various physical oceanographic effects were highlighted including those of temperature, transport, tidal mixing, winter cooling, upwelling, and the North Atlantic Oscillation (NAO) index with influences upon growth, maturation, feeding, recruitment and mortality on fish stocks.

Future research needs were identified including additional analysis of environmental time series such as the NAO and their links with fish stocks, current measurements for egg and larval drift predictions, simulation of the effects of the environment, regional specific information in terms of the prediction of the impact of management actions and the use of ecological models. Longer-term predictions were considered to be of increasing importance on time scales of 1-3 years (considered short-term predictions such as TACs), 5-10 years (medium term such as SSB) and 10-30 years (long-term predictions, again estimates of SSB). A new organization to examine stock assessments that would include both ICES countries and those of the Mediterranean. It would be called the Sustainable Fisheries Research Organization (SFRO) and coordinate research on fisheries biology, fish-environment linkages, stock assessment models and statistical methods, new methods of sustainable management as well as dealing with economic, social, legal and political issues.

Finally a brief summary of the December Symposium and some of the presentations was provided.

Following questions and further discussion of the SAP, the Chairman thanked the speaker for a very interesting presentation.

## 5. Review of Environmental Conditions

### a) Marine Environmental Data Service (MEDS) Report for 2000 (SCR Doc. 01/28)

The inventory of oceanographic data obtained by MEDS during 2000 was presented along with information on several new initiatives.

#### i) Hydrographic data collected in 2000

Data from 5 067 oceanographic stations collected in the NAFO area sent in delayed mode to MEDS in 2000 have been archived, of which 2872 were CTDs, 1 895 were BTs and 300 were bottles. An additional 2 384 stations were received directly by MEDS but are not yet archived. A total of 5 320 stations were received through IGOSS (Integrated Global Ocean Service System) and have been archived. An additional 72 CTD stations were occupied but have not been received by MEDS.

#### ii) Historical hydrographic data holdings

Data from 39 435 oceanographic stations collected prior to 2000 were obtained during the year, up by over 21 000 compared to those received in 1999.

#### 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 with over 5590 stations in the Northwest Atlantic being received during 2000, a decrease over 1999 of 36%.

#### iv) Drift-buoy data

A total of 141 drift-buoy tracks were received by MEDS during 2000 representing over 282 buoy months. The total number of buoys increased by 3 over 1999 but the number of buoy months was down by approximately 30%.

v) **Wave data**

In 2000, 114 292 wave spectra were processed, mostly from the permanent network of moored wave buoys in the area. This represents almost an 8% increase compared to 1999.

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 47 stations were processed during 2000, an increase of 16 stations from 1999 and a similar number to 1998.

vii) **Recent Activities**

MEDS reported on five other initiatives. (1) Since 1998, MEDS has been acquiring and archiving data from the profiling buoys, known as PALACE floats. In 2000, 7 201 profiling floats were archived. (2) MEDS became involved in an underway sea surface salinity project with 5 other countries. Issues such as quality control, archiving in a standard format and dissemination of the data are being discussed. (3) Three CD-ROMs were produced in 2000 including the 2$^{nd}$ edition World Ocean Circulation Experiment (WOCE) dataset. A CD that includes positional drift buoy data from the Arctic from 1979 to 1999 is now available as well as a CD containing data acquired during the Canadian Joint Global Ocean Flux Study (JGOFS). (4) MEDS continues to be involved with the Canadian Atlantic Zona Monitoring Program (AZMP) and has assumed the responsibility for leading the data management team. A website displaying indices also allows easy access to the data. (5) MEDS is involved in two projects to make data and visualization tools available through the Internet. One is through MEDS participation as a WOCE Data Assembly Centre (DAC) and the other is a joint project with the US NODC, PMEL in Seattle and the University of Hawaii.

Following the presentation, there was a discussion regarding the MEDS station inventory. The Chairman suggested that a web version of the form should be developed that could be e-mailed back to MEDS. MEDS representative indicated that the Chairman was the only one who filled out these forms. The Chairman commented that more countries should be completing these forms and the National Representatives nominated by STACFEN as responsible for hydrographic data submissions (see section 8 below) should be ensuring that they are completed, and oceanographic data be submitted to MEDS.

b) **Review of Environmental Studies in 2000**

i) **Results of physical oceanographic studies**

**Subareas 0 and 1**. A survey of oceanographic stations along the West Greenland standard sections was carried out from 29 June-10 July 2000 (SCR Doc. 01/2). High sea-surface temperatures observed off West Greenland were attributed to mild atmospheric conditions. At Fyllas Bank, near surface temperatures were just below 1999 values but still were well above normal. Near surface salinities at Fyllas Bank were below the long-term mean and decreased slightly compared to the summer of 1999. Cold, low salinity waters at mid-depths at the edge of Fyllas Bank (Station 4) suggest a relatively high inflow of Polar Waters from the East Greenland Current. Pure Irminger Water was absent from West Greenland even in the Cape Farewell Region, which is highly unusual. Results from a numerical model of the circulation were presented. Of special interest was the presence of a large-scale eddy north of 66ºN transporting cold Polar Water from the Baffin Current towards West Greenland.

Examination of climatic conditions around Greenland (SCR Doc. 01/3) shows that the mean annual air temperature in 2000 at Nuuk was warmer-than-normal. Ice conditions in 2000 were generally light except off southwest Greenland where ice was observed around Cape Farewell from the beginning of the year until August. Sea-surface temperatures off Greenland were generally colderthan-normal, in contrast to the warm surface temperatures on the Labrador side of the Labrador Sea. Subsurface ocean temperatures during the October hydrographic survey conducted by EU -Germany were warmer-than-normal at Fyllas Bank. At Station 4 along the Fyllas Banks section, the upper 200 m of water recorded the warmest conditions ever observed in the 38-year record. Warm saline water of Irminger Current origin was found at least as far north as Fyllas Bank. This is similar to 1999 but contrasts with the total absence of this water off West Greenland during June (see above).

**Subareas 2, 3 and 4**. Hydrographic conditions on Flemish Cap were described from a CTD survey (94 stations) conducted during July 2000 (SCR Doc. 01/24). As in past years, the warmest waters were found over the central region of the Cap and the coldest tended to be on its northern flank. The temperatures and salinities in the upper 200 m were above values recorded during most of the 1990s but were slightly lower than those observed in 1999. Below 200 m was a well-developed layer surrounding the Cap with temperatures >4ºC. This is believed to form through mixing with North Atlantic waters and by the high residence time due to the anticyclonic gyre around the Cap.

The Canadian Research Report (SCS Doc. 01/15) provided a description of environmental information collected in the Newfoundland Region during 2000. This included physical, chemical and biological data gathered as part of the Atlantic Zona Monitoring Program, which began in 1998. This includes Station 27 where a full suite of measurements, including plankton samples, were taken and several cross-shelf transects. Comparisons between 2000 and 1999 indicated that the depth at which depletion of nitrate and silicate occurred was deeper in 1999, suggesting that mixing might not have penetrated as deeply in 2000. Consistent with this the phytoplankton bloom in 2000 was shallower than in 1999. Also, there was little evidence of an autumn bloom on the southern Grand Banks in 2000, in contrast to the distinct bloom in 1999. The zooplankton abundance in 2000 was at its highest level since 1996 with the large calanoid nauplii, being twice that observed in 1999. Physical observations indicate that temperatures continued to be warmer-than-normal but fell slightly compared to 1999.

The Russian Research Report (SCS Doc. 01/11) indicated that examination of environmental conditions in 2000 was carried out through work on sea-surface temperatures and thermal boundaries between water masses. The surface temperature data revealed that in 2000 the waters from the Labrador Sea to the Gulf of Maine were higher than normal. The Gulf Stream was observed north of its typical position during 2000.

**Subareas 5 and 6**. The United States Research Report (SCS Doc. 01/19) listed several ongoing programs. The Narragansett Laboratory during 2000 occupied their standard sections across the Middle Atlantic Bight south of New York and across the Gulf of Maine from Boston to Cape Sable. A paper based upon the historical data collected along these sections are in preparation including one on the temperature and salinity variability during the 1990s and should be published by late-2001. Several papers on zooplankton abundance and species composition are also in preparation or review. Six standard seasonal cruises cover Cape Hatteras through into the Gulf of Maine were completed. Analysis of the GLOBEC field studies on Georges Bank is underway. Cod and haddock larval abundance appears to have been high during 1998 and whereas this appears to be a good year-class for haddock, it has not been the case for cod. Causes are unknown but hope to be developed as part of the GLOBEC analysis.

ii) **Results from interdisciplinary studies** (SCR Doc. 01/7, 32)

Near-bottom temperatures and their anomalies over the Grand Banks (Div. 3LNO) during 1990-99 were compared to the spatial distributions of yellowtail flounder catches obtained during spring and autumn surveys (SCR Doc. 01/32). Large interannual variations in the near-bottom thermal habitat for yellowtail flounder were observed from the cold sub-zero degree conditions of the early-1990s to the relatively warm waters of the late-1990s. The percentage of bottom covered by >0ºC waters changed from only around 40% in the early-1990s to almost 100% by 1999. Yellowtail flounder generally prefer the warmer conditions. Indeed, increased catches expressed as numbers per tow were observed as the waters warmed. In addition, the yellowtail flounder increased their spatial distribution in accordance with the spread of the 0ºC isotherm. It was felt that these results were most likely caused by an increase in catchability with higher temperatures. This generated debate on the need to adjust abundance estimates for catchability and the role of stock abundance on the distribution.

As part of the Russian-German Data Evaluation Project (see below) a statistical analysis of the possible causes of cod recruitment for West Greenland was undertaken. Using multiple linear regression, possible forcing functions included spawning stock biomass (SSB), sea-surface temperature (SST), air temperatures and winds. Results suggest the possibility of different mechanisms controlling recruitment at different times. During the 1950s and 1960s with high sea surface temperatures and a strong SSB off West Greenland, local recruitment was high. In the 1970s and 1980s under declining SSB, recruitment depended upon advection of larvae from Iceland. During the 1990s, the West Greenland SSB was at very low values and recruitment was almost non-existent.

c) **Overview of Environmental Conditions in 2000** (SCR Doc. 01/36)

A review paper was presented based on several long-term oceanographic and meteorological data sets. The highlights follow.

i) Annual air temperatures throughout the Northwest Atlantic were above normal in 2000 but slightly lower than the record highs set in 1999.

ii) The atmospheric circulation was intense in 2000 with the centre of activity over the eastern side of the Atlantic. This resulted in a relatively high NAO index, at a level similar to 1999 levels. The index was similar to the values of the early-1990s.

iii) While ice formed on schedule or slightly later-than-usual, the warm temperatures during the winter resulted in an early disappearance and shorter ice duration in 2000 than normal off southern Labrador, Newfoundland and in the Gulf of St. Lawrence. Little to no ice reached the Scotian Shelf. Although there was slightly more ice in 2000 compared to 1999, sea ice conditions for the past three years have been light.

iv) During 2000, the number of icebergs to reach south of 48°N increased dramatically relative to 1999 (from 22 to 843).

v) Annual sea surface temperatures (SSTs) from satellite imagery and measured *in situ* indicated warmer-than-normal values, continuing a trend that was established over the past several years.

vi) Temperatures off Newfoundland and Labrador during 2000 were warmer-than-normal throughout most of the water column.

vii) The area of CIL (Cold Intermediate Layer) water increased to above normal values and the largest area in the past 6 years from southern Labrador to northern Newfoundland. On the Grand Bank the CIL area was similar to 1999 and was slightly below normal. The CIL volume during the autumn of 2000 rose compared to 1999.

viii) The CIL waters in the Gulf of St. Lawrence warmed significantly during 2000 and for the first time since 1985 rose above normal. The bottom area of the Magdalen Shallows covered by temperatures <1°C decreased although there was more water <0°C compared to 1999.

ix) Deep-water temperatures on the Scotian Shelf (Emerald Basin) continued to remain higher-than-normal.

x) Warmer-than-normal waters were observed over substantial portions of the bottom and at intermediate waters over the northeastern Scotian Shelf for the second year in succession.

xi) Density stratification on the Scotian Shelf continued high during 2000 but decreased relative to 1999.

xii) Both the shelf/slope front and the north wall of the Gulf Stream moved further northward during 2000 with both north of their climatological mean positions.

6. **Long-term Environmental Indicators**

a) **Review of Environmental Indicators** (SCR Doc. 01/25)

The variability during the 1990s of meteorological (air temperatures, winds, NAO index), sea-ice and oceanographic variables (sea-surface temperatures, subsurface temperatures and salinities, water masses) off West Greenland revealed significant warming during the second half of the decade, especially in the last 2 years. This warming was observed in both air and ocean temperatures. During those years of greatest warming, Irminger Water was observed farther north than in the previous years. It was noted that this recent warming occurred during years with a high NAO index. Statistically in the past, high NAO index typically was associated with cold conditions in West Greenland.

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

There were no recommendations formulated.

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

A lively discussion was held on how environmental information should be incorporated into stock assessments. There were diverse opinions all the way from the views that environmental information was useless for management purposes, to it was essential for stock assessments. For example, catchability effects related to temperature may have to be accounted for in order to obtain good estimates of stock abundance. Activities related to incorporating environmental data into assessments was seen as a way to further promote cooperative work between oceanographers and assessment biologists. Some examples where environment has been used in stock assessment were provided, including in the assessment of squid. Also, the assessment of American plaice was done under two different productivity regimes. Some felt that the latter was a good example of how environmental information could be used, i.e. building different scenarios. Discussions were also held on the inclusion of environmental variables in the precautionary approach. If recruitment trends were established from environmental variables, then one could use these for prediction. 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. Forecasting of the environment using statistical techniques also looks promising.

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

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

A discussion was held on whether STACFEN should become actively involved in multi-national trans-Atlantic studies. Two items in particular led to this discussion.

A recent request to NAFO for hydrographic and biological data (including fish larvae) collected during the multinational NORWESTLANT Program in the 1960s in the Labrador Sea led to discussions concerning the fate of these data. This program was initiated within ICNAF with help from ICES. While it is believed that much of the temperature and salinity data reside at MEDS, it is believed that the biological data are not in any electronic format. While some of these data may reside on paper, it was felt that making them available electronically would allow more scientists to access them. Discussions were held on whether STACFEN should be involved in resurrecting and reinterpreting such data (see below).

K. Drinkwater reported that at the EurOCEAN 2000 meeting held in Hamburg, Germany, during August 2000, a special GLOBEC (Global Ocean Ecosystem Dynamics) session discussed the possibility of trans-

Atlantic studies. The biggest impediment to such programs was seen to be the differences between funding agencies, in terms of different objectives, priorities, time schedules, and review processes. The Committee was informed by K. Drinkwater the EU, US and Canadian funding agencies hold discussions to make it easier to launch a truly trans-Atlantic study. As a first step, the EU and American agencies promised to meet to begin discussions on such a process. Such a meeting has occurred but the outcome has yet to be publicly announced. To facilitate a trans-Atlantic study, a draft proposal of such a study was developed at the 2000 Annual Science Conference of ICES at Brugge in Belgium. This proposal was led by Peter Wiebe, Woods Hole, Mass., USA, and involved a synthesis of studies on *Calanus finmarchicus*. Much work has been undertaken under TASC (Trans-Atlantic Study of *Calanus*) and the US and Canadian GLOBEC programs. The proposal was directed at filling in the gaps and to model the life history of *Calanus*. A related meeting is scheduled for late June 2001 in Halifax, Nova Scotia, sponsored by the Canadian Department of Fisheries and Oceans and chaired by Dr. Erica Head. It is intended to bring together scientists that have been involved in *Calanus* studies throughout the Atlantic and in particular to develop a field study in the Labrador Sea.

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

The formation of a special study group to consider either involvement in data retrieval of the NORWESTLANT program or involvement in trans-Atlantic field studies was discussed. Commitment to such a Study Group was not forthcoming at the present time, so the Chairman decided to have this reconsidered at the next STACFEN meeting in June 2002.

c) **ICES Ocean Climate Status Summary**

The ICES Working Group on Oceanic Hydrography (WGOH) has published an Annual ICES Ocean Climate Status Summary based primarily upon standard stations and sections. This is the ICES equivalent to the annual environmental reviews published by NAFO. It is briefer in format than NAFO reviews, but is broader in geographic scope as it includes both the Northeast and the Northwest Atlantic. The Chairman of STACFEN submitted a copy of a working paper by Bill Turrell, Chairman of the WGOH, discussing his concerns about timely submission of data to data centers for production of the ICES annual climate summary and how the summary should evolve (SCR Doc. 01/79). Of particular note is the request that the ICES Oceanographic Data Centre be used as the Regional Data Centre for the ICES Standard Sections and Stations. Again, these include sections and stations in the NAFO area. Since MEDS has rapid-transmission to ICES, submitting of standard section data to MEDS should insure that it gets to ICES quickly. Still, this only works if national data centers or individual scientists submit such data to MEDS as soon as possible after collection of the data. The Chairman reminded STACFEN members the importance of ensuring that their environmental data be submitted to MEDS in a timely manner.

9. **Cooperative Research Programs**

a) **Russian/German Data Evaluation** (SCR Doc. 01/8)

The Chairman presented the Sixth Report on the Joint Russian/German Project "Assessment of short-time climatic variations in the Labrador Sea". A workshop was held on 23-27 April 2001 in Hamburg, Germany. The relationship between physical variables (air temperatures, winds and SSTs) and cod recruitment off West Greenland and Iceland were analyzed. Results were presented to STACFEN in the form of a Research Document (SCR Doc. 01/7, see above). The next workshop on this project is scheduled for 27 August to 3 September 2001 in Murmansk, Russia.

b) **Other Research Programs**

There were no other research programs considered by the Committee.

## 10. ICES/NAFO Symposium on Hydrobiological Variability

The ICES symposium on *Hydrobiological Variability in the ICES Area, 1990-1999* will be held in 2001 in Edinburgh, UK. The co-conveners are J. Meincke (Germany) and B. Dickson (UK). In 1998, STACFEN suggested that NAFO help co-sponsor the Symposium and a recommendation was made to provide financial support. This was supported and NAFO contribution has been sent (see item 2 above). Although NAFO is not mentioned specifically in the title of the symposium, it is acknowledged as a co-sponsor in all promotional material. In addition, NAFO representatives have been involved in the organization of the meeting. The Chairman of the STACFEN, M. Stein, is on the Steering Committee for the Symposium and K. Drinkwater is on the editorial board for publication of the symposium proceedings. Given that both NAFO and ICES would have been proposing to hold similar symposia on a review of the 1990s early in the next decade, a single symposium was felt to be more efficient. In addition to allowing the traditional regional focus that separate symposia would foster, it was agreed the joint meeting will provide the opportunity to place both the ICES and NAFO areas into a larger-scale perspective through comparisons of different areas around the North Atlantic. Support for the Symposium was overwhelming. Presently there are 40 oral presentations and 72 poster presentations scheduled. It was noted that the day prior to this decadal symposium, a one-day symposium on the Continuous Plankton Recorder (CPR) would be held at the same location. It celebrates the 75$^{th}$ anniversary of the CPR.

## 11. National Representatives

The national representatives responsible for hydrographic data are: E. Valdes (Cuba), S. Narayanan (Canada), E. Buch (Denmark), A. Battaglia (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

### Acknowledgements

The Chairman noted that he has been in the office for seventeen years and will be stepping down this year. He wished to thank STACFEN members and the NAFO Secretariat for their support and thanked the rapporteur for his work over the years. The Chairman of the Scientific Council, Bill Brodie, then thanked Manfred Stein for his many years of service to STACFEN and NAFO. The Chairman then closed the meeting.

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

Chairman: R. K. Mayo Rapporteur: E. F. Murphy

The Committee met at the Alderney Landing, 2 Ochterloney Street, Dartmouth, Nova Scotia, Canada, during 31 May-14 June 2001, to discuss matters pertaining to statistics and research referred to it by the Scientific Council. Representatives attended from Canada, Cuba, Denmark (in respect of Faroe Islands and Greenland), Estonia, 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 Chairman opened the meeting by welcoming the participants. E. F. Murphy was appointed rapporteur.

## 2. Review of Recommendations in 2000

### a) From the June 2000 Meeting

i) STACREC had recommended that *the Executive Secretary write to the national delegates of the USA and Denmark (in respect of Faroe Islands and Greenland) with reference to their obligations on the submission of data to NAFO*. STACREC further recommended that *the Scientific Council should prepare a document for submission to the General Council and the Fisheries Commission on the adverse effect the absence of the STATLANT 21A and 21B data was having on the work of the Scientific Council.*

STACREC was informed that the Executive Secretary wrote to the head delegates in July 2000 and a reminder was sent in March 2001. No response was received from USA. Faroe Islands had ensured data would be submitted by end of May 2001. STACREC noted the Faroe Islands 21B data for 1995 to 2000 have now been submitted.

ii) STACREC had recommended that the *Secretariat should extract from Scientific Council reports the annual estimates of the total catches for each stock for the period from 1985 used by STACFIS in its assessment work and report them alongside the annual STATLANT nominal catches.*

The Secretariat compiled a paper (SCS Doc. 01/5), and it is proposed that this be published with catch data updated through 2000.

iii) STACREC had recommended that *for the fiscal year 2001, the following nominees be supported by the NAFO budget for meeting attendance: i) the Assistant Executive Secretary to the February 2001 meeting of the FAO and Non-FAO Regional Fishery Bodies or Arrangements and the associated CWP Intersessional Meeting at FAO Headquarters, Rome, Italy, and ii) the Assistant Executive Secretary and the STACREC Chairman to the CWP 19th Session in Noumea, New Caledonia (9-13 July 2001).*

The budget approval was received for attendance at these meetings. The Assistant Executive Secretary attended the Rome Meetings in February 2001, and he and the STACREC Chair will attend CWP 19th Session.

iv) STACREC had recommended that *the comparative fishing in Div. 3NO be continued during future spring surveys conducted by EU-Spain and Canada.*

Comparative fishing studies between EU-Spain and Canada were carried out during May 2001.

## 3. Fishery Statistics

### a) Progress Report on Secretariat Activities in 2000/2001

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

The Assistant Executive Secretary outlined the status of the STATLANT data submissions for recent years. The following table shows the dates when STATLANT 21A and 21B submissions were received at the Secretariat through June 2001.

Table 1. Dates of receipt of STATLANT 21A and 21B reports for 1998-2000 at the Secretariat up to June 2001.

| Country/ Component | STATLANT 21A (deadline, 15 May) | | | STATLANT 21B (deadline, 30 June) | | |
|---|---|---|---|---|---|---|
| | 1998 | 1999 | 2000 | 1998 | 1999 | 2000 |
| BGR* | - | - | - | - | - | |
| CAN-CA** | 04 Jun 01 | 04 Jul 00 | - | 04 Jun 01 | 04 Jul 00 | |
| CAN-M | 10 May 99 | 12 May 00 | 17 May 01 | 30 Nov 99 | 12 Feb 00 | |
| CAN-N | 14 Jul 99 | 18 May 00 | 15 May 01 | 25 Feb 00 | - | |
| CAN-Q | 10 May 99 | 09 Jun 00 | 22 May 01 | 04 Nov 99 | 30 Apr 01 | |
| CUB | 10 Aug 99 | 01 Jun 00 | 31 May 01 | 10 Aug 99 | 01 Jun 00 | 31 May 01 |
| EST | 17 May 99 | 03 May 00 | 08 May 01 | 21 Oct 99 | 03 May 00 | |
| E/DNK | 07 Jun 99 | 17 May 00 | No fishing | 27 Mar 00 | 29 Jun 00 | No fishing |
| E/FRA-M | No fishing | No fishing | | No fishing | No fishing | |
| E/DEU | 23 Apr 99 | 04 May 00 | 10 May 01 | 27 Apr 99 | 05 Jul 00 | |
| E/NLD | No fishing | No fishing | No fishing | No fishing | No fishing | No fishing |
| E/PRT | 26 Apr 99 | 16 May 00 | 14 May 01 | 27 Aug 99 | - | |
| E/ESP | 01 Jun 99 | 29 May 00 | 31 May 01 | 07 Sep 99 | 19 Sep 00 | |
| E/GBR | 11 May 99 | No fishing | No fishing | 29 Mar 00 | No fishing | No fishing |
| FRO | 07 Jun 01 | 07 Jun 01 | 07 Jun 01 | 07 Jun 01 | 07 Jun 01 | 07 Jun 01 |
| GRL | 28 May 99 | 18 Aug 00 | - | 26 Oct 99 | - | |
| ISL | 07 Jun 99 | 26 May 00 | - | 23 Nov 99 | 02 Aug 00 | |
| JPN | 29 Apr 99 | 11 Apr 00 | 11 Apr 01 | 14 Apr 99 | 11 Apr 00 | 11 Apr 01 |
| KOR | No fishing | - | - | No fishing | - | |
| LVA | 14 May 99 | 12 May 00 | 22 May 01 | 14 May 99 | 12 May 00 | 22 May 01 |
| LTU | 29 Nov 99 | 28 May 01 | 16 May 01 | 29 Nov 99 | 28 May 01 | |
| NOR | 25 May 99 | 09 May 00 | 28 May 01 | Partial | Partial | |
| POL | 10 May 99 | 21 Jun 00 | - | 14 Oct 99 | 06 Jul 00 | |
| ROM* | - | - | - | - | - | |
| RUS | 01 Jun 99 | 04 May 00 | 06 Jun 01 | 01 Jun 99 | 05 Jun 00 | |
| USA | - | - | - | - | - | |
| FRA-SP | 02 Jun 99 | 04 May 00 | 26 Jan 01 | 02 Jun 99 | 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).

#### ii) Publication of statistical information

STATLANT 21A data were used for the compilation of SCS Doc. 01/10 on "*Historical Nominal Catches for Selected Stocks*" and SCS Doc. 01/ 14 on "*Provisional Nominal Catches in the Northwest Atlantic, 1999*".

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

In accordance with the Scientific Council recommendation of June 2000 regarding missing data, the Executive Secretary wrote to USA and Faroe Islands in July 2000 (GF/00-415) and followed up with a reminder on 19 March 2001 (SC-01/29). Information received from Faroe Islands on 9 April 2001 indicated their outstanding data since 1995 should be completed and forwarded to the Secretariat by the end of May 2001 (all 1995-2000 STATLANT 21B data from the Faroe Islands were received by the Secretariat on 7 June 2001).

As agreed by the Scientific Council in 2000, Volume 44 of NAFO *Statistical Bulletin* was compiled from STATLANT 21B information available from Contracting Parties. At the time of printing in December 2000 the USA data for 1994 had not been received. The *Statistical Bulletin* Tables 1, 2 and 3 were compiled in the usual manner, and for USA, data without Division information were available to incorporate total catch by species (giving total catch by species with no Divisional breakdown); however, Tables 4 and 5 excluded USA STATLANT 21B data because the information required for these tabulations was not available.

Publication of *NAFO Statistical Bulletin*, Volumes 45 to 48 has been seriously delayed due to missing data. Table 2 shows data have not been submitted from USA for 1995-98. Also 1999 shows many outstanding entries causing a delay on Vol. 49.

Table 2. List of countries that have not submitted STATLANT 21A and 21B data through 1995-99. (N.B. Bulgaria and Romania have not reported in recent years.)

| STATLANT 21A | | | | | STATLANT 21B | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1995 | 1996 | 1997 | 1998 | 1999 | 1995 | 1996 | 1997 | 1998 | 1999 |
| USA | USA | USA | USA | USA | USA | USA | USA | USA | Can-N<br>Greenland<br>Portugal<br>USA |

STACREC agreed that Volumes 45-48 of the NAFO *Statistical Bulletins* should now be compiled from 1995 to 1998 STATLANT 21B information, in accordance with the procedures applied to the compilation of Volume 44.

It was suggested that consideration be given to electronic publication of partial STATLANT data in the future, but in such cases, there must be accompanying warnings about the incomplete nature of the data.

In accordance with the Scientific Council recommendation of June 2000 to prepare a table comparing STACFIS estimates and STATLANT catch data, the Secretariat compiled SCS Doc. 01/5. Data were compiled from catches used in STACFIS assessments in NAFO *Scientific Council Reports* and the finalized STATLANT 21A database. Designated Experts were requested to verify the information in SCS Doc. 01/5, as this compilation, revised as needed, will be published.

iii) **Considerations on internet site for statistical data**

STACREC noted STATLANT 21A data were currently updated on the NAFO Website. It was noted Scientific Council had agreed STATLANT 21B data will not be uploaded, but the Secretariat has attended to all individual requests for data.

Noting that the FISHSTAT program is a large software program, the NAFO website would be set up such that the software will be linked remotely to communicate with the STATLANT database which is posted on the NAFO website. The goal of using FISHSTAT is to create user-friendly interfaces that may enable direct compilations of statistical information currently published in the NAFO *Statistical Bulletin*.

The EUROSTAT representative reported that, with the collaboration of FAO, a procedure had been written to convert the NAFO STATLANT 21A data files to the format necessary to run under the FAO FISHSTAT Plus program. This procedure has now been tested on the NAFO Secretariat computer system, permitting the Secretariat to prepare routinely an up-dated data-file for loading on the NAFO website. Users would soon be able to download this file with the FISHSTAT Plus program and consult the NAFO STATLANT 21A data from 1960 onwards.

iv) **Interagency data harmonization (NAFO/FAO)**

Secretariat has continued interactions with FAO to harmonize data. During the Assistant Executive Secretary visit to Rome in February 2001, further consultations showed FAO had revised most of their data, noting NAFO data were, in principle, the appropriate official statistics.

The EUROSTAT representative reported that, following the CWP initiative at its intersessional meeting at ICES Headquarters in February 2000, the catch data from the various Atlantic agencies for the period 1950-98 had been integrated in a single file in the FAO FISHSTAT Plus format. Wherever possible the data at the level of the STATLANT A questionnaires (annual data by species, by country and by statistical sub-division) had been included. This file was now available for down-loading from the FAO website (ftp://ftp.fao.org/fi/stat/windows/fishplus/atlant.zip) for use with the FAO FISHSTAT Plus program (available from ftp://ftp.fao.org/fi/stat/windows/fishplus/fst_plus.zip). Although the basic data had been obtained from the various agency websites, notes with the data file recognized that EUROSTAT was tasked the reformatting and presentation of the data. The CWP-19 session would be reviewing the success of this work, the procedure for up-dating the file and the possibility of extending the operation to include data from inland waters and the other oceans.

v) **Use of scientific names in STATLANT data**

In 2000 STACREC added 4 new species of skates to the list of species to be reported on STATLANT questionnaires. In addition, following the recent publication of a revision to the genera of several species of skates, STACREC amended the list of names to reflect these taxonomic revisions. The decision to go forward with the new scientific names for these skate species was based primarily on the paper by McEachran and Dunn (1998). The primary author of this paper is an authority on skate taxonomy, and the American Fisheries Society (AFS) has accepted these revisions as well. The revised edition of Catalog of Fishes (Eschmeyer, 1998, revised in November 2000) has also accepted these changes.

(McEachran, J. D., and K. A. Dunn. 1998. Phylogenetic analysis of skates, a morphologically conservative clade of elasmobranchs (Chondrichthyes: Rajidae). *Copeia*, **2**: 271-290.)

The seven species were formerly considered to be in the genus *Raja*. The new names are as follows: little skate – *Leucoraja erinacea*; arctic skate – *Amblyraja hyperborea*; barndoor skate – *Dipturus laevis*; winter skate – *Leucoraja ocellata*; spinytail skate – *Bathyraja spinicauda*; thorny skate – *Amblyraja radiata*; and smooth skate – *Malacoraja senta*.

STACREC considers these revised genera to represent the most up-to-date information on skate taxonomy and agreed that FAO/CWP should be requested to incorporate these revisions on the STATLANT 21 forms.

vi) **Use of GRT *vs* GT in recording effort data** (SCR Doc. 01/5)

The EUROSTAT representative presented a paper (SCR Doc. 01/5) demonstrating that the Gross Tonnage (GT) (London Convention, 1969) of a vessel was significantly greater than the Gross Registered Tonnage (GRT) (Oslo Convention, 1947). This change from GRT to GT was taking place at different rates in different countries and was generally spread over a number of years. NAFO Contracting Parties were requested to submit on the STATLANT 21B questionnaire catch and effort data by tonnage classes of fishing vessels and the change in the method of measuring tonnage of vessels brought into doubt the comparability of catch and effort data for individual vessel tonnage classes over time.

STACREC recognized this problem. It was proposed that other agencies be consulted to see how they may have resolved it. In the meantime it was important that the potential risks be brought to the attention of users of the catch and effort data.

b) **CWP Sessions 2001**

i) **Report on the CWP intersessional meeting, Rome, 20-21 February 2001**

STACREC noted the intersessional meetings were *ad hoc* consultations during 20-23 February 2001 in Rome. The Assistant Executive Secretary contributed NAFO's input toward revising and developing the Agenda for CWP-19. Consultations also included STATLANT questionnaire issues, FAO development of FIGIS software and other statistical considerations.

ii) **CWP 19th session, July 2001**

STACREC was presented the Provisional Agenda for CWP 19th Session to be held during 10-13 July 2001 in New Caledonia. The review of the Agenda suggested that NAFO's contributions be formulated by the Assistant Executive Secretary and STACREC Chairman, particularly focusing on recent developments within Scientific Council and the possible further developments with respect to statistical information and dissemination.

4. **Research Activities**

a) **Biological Sampling**

i) **Report on activities 2000/2001**

STACREC noted and reviewed the listings of Biological Sampling Data prepared by the NAFO Secretariat. These listings (SCS Doc. 01/12) include biological sampling data for 2000 reported to the Secretariat prior to the present meeting.

ii) **Report by national representatives on commercial sampling**

**EU-Portugal:** Data on catch rates and length composition were obtained from trawl catches for Greenland halibut (Div. 3LMN). 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) and witch flounder (Div. 3LMNO). Information can be found in SCS Doc. 01/9.

**EU-Spain:** Commercial samplings from the 2000 fisheries were reported in SCS Doc. 01/18.

**Canada:** Commercial samplings from the 2000 fisheries were reported in SCS Doc. 01/12.

**EU- France:** No commercial sampling was conducted by France in 2000 on fisheries related to stock assessments. The small Greenland halibut fishery in Div. 2J was covered by Canadian observers.

**Russia:** Samples were obtained from commercial bottom trawl fisheries directed to Greenland halibut in Div. 3LMNO and to redfish in Div. 3M. Length and age data from Greenland halibut, roughhead grenadier, redfish, American plaice, other flatfishes, skates and sharks were collected by observers on-board trawlers during January-December 2000 (in Subarea 3). Catch rate data were also taken.

iii) **Report on data availability for stock assessments**

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

Table 3. Available data from the commercial fisheries related to stock assessment (2000). (+ is data available).

| | | | | Biological Sampling | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Stock | Country [1] | Catch | CPUE | Sex | Length | Age | Individual | Weight | Maturity |
| Div. 2J3KL Cod | CAN-N | + | + | + | + | + | + | + | |
| | RUS | + | | + | + | + | + | + | |
| Div. 3M Cod | RUS | + | | | | | | | |
| Div. 3NO Cod | RUS | + | | + | + | + | + | + | |
| SA 1 Redfish | GRL | + | | | | | | | |
| | RUS | + | | + | + | + | + | + | |
| Div. 3M Redfish | EU/PRT | + | | + | + | + | | | |
| | EU/ESP | + | | | + | | | | |
| | RUS | + | | + | + | + | | | |
| | JPN | + | | | | | | | |
| Div. 3LN Redfish | EU/PRT | + | | | + | | | | |
| | EU/ESP | + | | | + | | | | |
| | RUS | + | | | + | + | | | |
| Div. 3M American plaice | EU/PRT | + | | + | + | + | | | |
| | EU/ESP | + | | | | | | | |
| | JPN | + | | | | | | | |
| | RUS | + | | | | | | | |
| Div. 3LNO American plaice | CAN | + | | | + | + | | | |
| | EU/ESP | + | | | + | + | | | |
| | EU/PRT | + | | + | + | | | | |
| | RUS | + | | | + | | | | |
| | EST | + | | | | | | | |
| | JPN | + | | | | | | | |
| Div. 3NO Witch flounder | RUS | + | | | + | | | | |
| | CAN | + | | + | + | + | + | + | |
| Div. 3LNO Yellow-tail flounder | CAN | + | + | + | + | + | + | + | |
| | RUS | + | | + | + | + | + | + | |
| SA 0 + 1B-F Greenland halibut | GRL | + | + | | + | + | + | | |
| | CAN | + | + | + | + | + | + | | |
| | EU/FRG | + | + | | | + | + | | |
| | NOR | + | + | | | | | | |
| | RUS | + | | | | | | | |

Table 3. Continued.

| Stock | Country[1] | Biological Sampling | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Catch | CPUE | Sex | Length | Age | Individual | Weight | Maturity |
| SA 1A Greenland halibut | GRL | + | | + | + | + | + | + | |
| SA 2+3 Greenland halibut | CAN | + | + | + | + | + | + | | |
| | EU/ESP | + | + | + | + | + | + | | |
| | EU/PRT | + | + | + | + | + | + | | |
| | EU/FRA | + | | + | + | | | | |
| | RUS | + | | + | + | + | + | | |
| | JPN | + | | + | + | | | | |
| SA 0+1 Roundnose grenadier | GRL | + | | | | | | | |
| | RUS | + | | | | | | | |
| SA 2+3 Roundnose grenadier | no data available | | | | | | | | |
| SA 2+3 Roughhead Grenadier | EU/ESP | + | | + | + | + | + | + | |
| | EU/PRT | + | | | | | + | + | |
| | RUS | + | | | + | + | + | + | |
| Div. 3NO Capelin | no data available | | | | | | | | |
| SA 3+4 Squid | CAN | + | | | | | | | |
| | RUS | + | | | | | | | |
| SA 1 Other Finfish | GRL | + | | | | | | | |
| Div. 3L Shrimp[2] | CAN | + | + | + | + | + | + | | + |
| | EST | + | | | | | | | |
| | FRO | + | + | + | + | + | | | |
| | ISL | + | + | + | + | + | | | + |
| | LAT | + | | | | | | | |
| | LIT | + | | | | | | | |
| | NOR | + | | | | | | | |
| | EU/PRT | + | | | | | | | |
| | EU/ESP | + | | | | | | | |
| | RUS | + | + | | | | | | |
| Div. 3M Shrimp[2] | CAN | + | + | + | + | + | | | + |
| | EST | + | | | | | | | |
| | FRO | + | + | + | + | | | | + |
| | ISL | + | + | + | + | + | | | + |
| | LAT | + | | | | | | | |
| | LIT | + | | | | | | | |
| | NOR | + | | | | | | | |
| | EU/ESP | + | + | + | + | | | | + |
| | RUS | + | + | + | + | | | | + |

Table 3. Continued.

| | | Biological Sampling | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Stock | Country [1] | Catch | CPUE | Sex | Length | Age | Individual | Weight | Maturity |
| SA 0+1 Shrimp [2] | GRL | + | + | + | + | | | | |

[1] Country abbreviations as per Statistical Bulletin.
[2] Provided at November 2001 Meeting.

b) **Biological Surveys**

i) **Review of survey activities in 2000**

An inventory of biological surveys conducted in 2000 as submitted by National Representatives and Designated Experts was prepared by the Secretariat

Table 4. Inventory of biological surveys conducted in the NAFO Area during 2000.

| Subarea | Division | Country [1] | Month | Type of survey | No. of sets |
|---|---|---|---|---|---|
| | | | | **Stratified-random Surveys** | |
| 0 | B | CAN-CA | 10 | Groundfish assessment | 69 |
| 1 | A | GRL | 5-6 | Snow Crab | 40 (12) |
| 1 | A-F | GRL | 7-9 | Shrimp and groundfish trawl | 232 |
| 1 | B | GRL | 5-6 | Snow Crab | 56 (12) |
| 1 | B-F | FRG | 9-10 | Groundfish survey off West Greenland | 73 |
| 1 | C-D | GRL | 9-10 | Greenland halibut deep-sea trawl | 30 |
| 2+3 | JK+LMNO | CAN-N | 10-12 | Multi-species survey | 744 |
| 3 | LNO | CAN-N | 5-6 | Multi-species survey | 104 |
| 3 | M | EU/ESP + EU/ PRT | 7 | Groundfish | 120 |
| 3 | M | FRO | 6 | Shrimp | 61 |
| 3 | NO | EU/ESP | 5 | Groundfish | 132 |
| 3 | Ps | CAN-N | 4 | Multi-species survey | 171 |
| 3 | Ps | CAN-N | 4-5 | Scallop survey | 90 |
| 4 | X | USA | 5 | Spring bottom trawl | 32 |
| 4 | X | USA | 5 | Ecosystems monitoring | 13 |
| 4 | X | USA | 10 | Autumn bottom trawl | 38 |
| 4 | X | USA | 10 | Ecosystems monitoring | 12 |
| 5 | YZ | USA | 2 | Winter bottom trawl | 58 |
| 5 | YZ | USA | 2 | Ecosystems monitoring | 12 |
| 5 | YZ | USA | 4 | Spring bottom trawl | 143 |
| 5 | YZ | USA | 4 | Ecosystems monitoring | 67 |
| 5 | YZ | USA | 7,8 | Northern shrimp | 55 |
| 5 | YZ | USA | 9,10 | Autumn bottom trawl | 188 |
| 5 | YZ | USA | 9,10 | Ecosystems monitoring | 62 |
| 5 | Z | USA | 7,8 | Sea scallops | 259 |
| 6 | ABC | USA | 2 | Winter bottom trawl | 72 |
| 6 | ABC | USA | 2 | Ecosystems monitoring | 31 |
| 6 | ABC | USA | 3 | Spring bottom trawl | 158 |
| 6 | ABC | USA | 3 | Ecosystems monitoring | 43 |
| 6 | ABC | USA | 3 | Sea scallops | 251 |
| 6 | ABC | USA | 9 | Autumn bottom trawl | 111 |
| 6 | ABC | USA | 9 | Ecosystems monitoring | 45 |

Table 4. Continued.

| Subarea | Division | Country [1] | Month | Type of survey | No. of sets |
|---|---|---|---|---|---|
| | | | | **Other Surveys** | |
| 1 | A | GRL | 7-8 | Longline, inshore Greenland halibut | 36 |
| 1 | D-F | GRL | 6-7 | Gillnets, inshore juvenile cod | 144 |
| 2+3 | J+K | CAN-N | 4-5 | Harp seal | - |
| 3 | K | CAN-N | 9 | White Bay/Notre Dame Bay snow crab trawl/trap | - |
| 3 | KL | CAN-N | 4-5 | Capelin distribution and abundance | - |
| 3 | KLNO | CAN-N | 10-11 | Physical/Biological oceanography | - |
| 3 | L | CAN-N | 1 | Cod habitat and acoustics | - |
| 3 | L | CAN-N | 1 | Overwintering acoustic | - |
| 3 | L | CAN-N | 5 | Sediment/Zooplankton | - |
| 3 | L | CAN-N | 5-6 | Inshore cod acoustics | - |
| 3 | L | CAN-N | 5-6 | Avalon snow crab trawl/trap | - |
| 3 | L | CAN-N | 7 | Predator/prey interactions | - |
| 3 | L | CAN-N | 7 | Fish/Seabird Interactions | - |
| 3 | L | CAN-N | 7-8 | Bonavista Bay snow crab trawl.trap | - |
| 3 | L | CAN-N | 9-10 | Conception Bay snow crab trawl/trap | - |
| 3 | L | CAN-N | 11-12 | Herring acoustics | - |
| 3 | LMNO | CAN-N | 4 | Physical and biological oceanography | - |
| 3+4 | 3P4V | CAN-N | 8 | Redfish trawl (stratified-random) + acoustic component | 118 |
| 3 | Ps | CAN-N | 3-4 | Cod tagging | - |
| 3 | Ps | CAN-N | 3-4 | Herring acoustics | - |
| 3 | Ps | CAN-N | 4 | Inshore cod tagging | - |
| 3 | Ps | CAN-N | 4 | Inshore pre-spawning cod trawl/acoustics | - |
| 3 | Ps | CAN-N | 6 | Inshore cod tagging | - |
| 3 | Ps | CAN-N | 11 | Cod tagging/tagging mortality | - |
| 4 | R | CAN-N | 8 | Scallops | - |
| 4 | VsW | CAN-M | 9 | Pollock hydroacoustics | - |
| 4 | X | USA | 2 | CMER-GLOBEC Plankton Study | - |
| 4 | X | USA | 6 | Ecosystems monitoring | 15 |
| 4 | X | USA | 7,8 | Northern right whale | - |
| 4 | X | USA | 8 | Ecosystems monitoring | 13 |
| 4 | X | USA | 8 | Porbeagle Shark Tagging | - |
| 4 | X | USA | 11 | Ecosystems monitoring | 14 |
| 5 | YZ | USA | 5,6 | Ecosystems monitoring | 59 |
| 5 | YZ | USA | 7,8 | Northern right whale | - |
| 5 | YZ | USA | 8 | Ecosystems monitoring | 48 |
| 5 | YZ | USA | 9,10 | Atlantic herring hydroacoustic | - |
| 5 | YZ | USA | 11 | Ecosystems monitoring | 61 |
| 5 | Z | USA | 6 | Benthic Habitat | - |
| 5 | Z | USA | 10 | Fishing Power | 7 |
| 5 | Z | USA | 11 | Benthic Habitat | - |
| 5 | Z | USA | 11,12 | Deepwater systematics | - |
| 6 | ABC | USA | 5 | Ecosystems monitoring | 46 |
| 6 | ABC | USA | 10,11 | Ecosystems monitoring | 42 |

[1] Country abbreviations as per Statistical Bulletin.

ii) **Surve ys planned for 2001 and early-2002**

An inventory of biological surveys planned for 2001 and early-2002 as submitted by National Representatives and Designated Experts was prepared by the Secretariat.

Table 5. Biological surveys planned for the NAFO Area in 2001 and early-2002.

| Area/Div. | Country [1] | Type of Survey | Dates |
|---|---|---|---|
| | | **Stratified-random Surveys** | |
| 0AB | CAN-CA | Groundfish assessment | Sep-Oct |
| 1A-B | GRL | Snow crab | May-Jun |
| 1A-D | GRL | Greenland halibut deep-sea trawl | Sep-Oct |
| 1A-F | GRL | Shrimp and groundfish trawl | Jul-Sep |
| 1B-F | EU-FRG | Groundfish survey off West Greenland | 12 Oct-23 Nov |
| 1C-D | GRL | Greenland halibut deep-sea | Nov |
| 2HJ+ 3KLMNO | CAN-N | Multi-species | Oct-Dec |
| 2J+3KL | CAN-N | Oceanography | 12-26 Nov |
| 2J+3KLMNO | CAN-N | Multi-species – Grand Banks | Oct-Dec |
| 3LNO | CAN-N | Multi-species | May-Jun |
| 3L | CAN-N | Egg production SA methods | 11-22 May |
| 3L | CAN-N | Avalon Channel NSERC | 23-26 May |
| 3L | CAN-N | Crab trapping/Trawling | 27 May-13 Jun |
| 3L | CAN-N | Capelin/Seabird interactions | 13-28 Jul |
| 3L | CAN-N | Crab trapping/Trawling – Bonavista | 29 Jul-10 Aug |
| 3L | CAN-N | Egg production SA methods | 11-22 Aug |
| 3L | CAN-N | Avalon Channel NSERC | 23-26 Aug |
| 3L | CAN-N | Crab trapping/Trawling | 7-22 Sep |
| 3L | CAN-N | Crab trapping/Trawling – Conception | 5-15 Oct |
| 3L | CAN-N | Inshore cod population dynamics | 10-25 Jan 2002 |
| 3M | EU/ESP+EU/PRT | Groundfish | May |
| 3M | FRO | Shrimp | 20-25 Jun |
| 3M | RUS | Groundfish | 15 May-14 Jun |
| 3NOP | EU-ESP | Groundfish | Jul |
| 3Ps | CAN-N | Multi-species | 6 Apr-1 May |
| 3Ps | CAN-N | Cod spawning – South Coast | 1-20 Apr |
| 3Ps | CAN-N | Inshore cod tagging | 24 Apr-9 May |
| 3Ps | CAN-N | Inshore cod tagging | 15-29 Jun |
| SA 3 | CAN-N | Herring | 5 Nov-6 Dec |
| SA 3 | CAN-N | Herring | 11 Mar-2 Apr 2002 |
| 4X+5YZ | USA | Ecosystems monitoring | 18-26 Jan |
| 4X+5YZ +6ABC | USA | Spring bottom trawl | 26 Feb-20 Apr |
| 4X+5YZ + 6ABC | USA | Ecosystems monitoring | 21 May-8 Jun |
| 4X+5YZ + 6ABC | USA | Autumn bottom trawl | 4 Sep-26 Oct |
| 4X+5YZ + 6ABC | USA | Spring bottom trawl | 4 Mar-26 Apr 2002 |
| 5YZ | USA | Northern shrimp | 23 Jul-4 Aug 4 |
| 5Z+6ABC | USA | Winter bottom trawl | 29 Jan-23 Feb |
| 5Z+6ABC | USA | Sea scallop survey | 18 Jun-0 Jul |
| 5Z+6ABC | USA | Winter bottom trawl | 4 Feb-2 Mar 2002 |
| 6BC | USA | Apex predators | 23 Apr-8 Jun |
| | | **Other Surveys** | |
| 1A | GRL | Longline and gillnet, inshore Greenland halibut | Jul-Aug |
| 1B | EU-FRG | International hydroacoustic survey off West Greenland | 12 Oct-23 Nov |
| 1B-F | GRL | Gillnets, inshore juvenile cod | Jun-Jul |
| 1D-E | GRL | Snow crab, offshore | Aug-Sep |
| 1F | RUS | International TAS on oceanic redfish | 10 Jun-15 Jul 2002 |
| SA 2+3 | CAN-N | Salmon | 13 Sep-1 Oct |
| SA3 | CAN-N | Hydroacoustic calibrations | 2-4 May |

Table 5. Continued.

| Area/Div. | Country [1] | Type of Survey | Dates |
|---|---|---|---|
| | | **Other Surveys** | |
| 3K | CAN-N | Cod overwintering | 16-25 Jan 2002 |
| 3KLMNO | CAN-N | Oceanography | 13-29 Jul |
| 3LMN | RUS | Trawl selectivity | 20 Mar-10 May |
| 3LMNO | RUS | Ecosystem monitoring | 15 Jun-20 Jul |
| 3LMNO | RUS | Ecosystem monitoring/gear testing | 17 Aug-16 Dec 2002 |
| 4VW | CAN-M | Pollock – Scotian Shelf | 28 Jan-10 Feb 2002 |
| 4VWX+5YZ | USA | Northern right whale | 23 Jul-10 Aug |
| 4X | USA | Ecosystems monitoring | 24 Jan-1 Feb, 2002 |
| 4X+5YZ | USA | Northern right whale | 16 Jul- 31 Aug |
| 4X+5YZ | USA | Herring hydroacoustic | 4 Sep- 12 Oct |
| 4X+5Z | USA | Trawl survey calibration | 15-26 Oct |
| 4X+5YZ | USA | Fishing power | 1-26 Apr 2002 |
| 4X+5YZ+6A | USA | Ecosystems monitoring | 13-31 Aug 2001 |
| 4X+5Z+6A | USA | Trawl survey calibration | 26 Mar-20 Apr |
| 4X+5YZ + 6ABC | USA | Ecosystems monitoring | 29 Oct-16 Nov |
| 5Y | USA | Gear testing | 14-18 May |
| 5Y | USA | Gear testing | 11-15 Jun |
| 5Z | USA | Harbor porpoise and Hydroacoustics | 5-23 Mar |
| 5Z | USA | Benthic habitat | 11-22 Jun |
| 5Z | USA | Benthic habitat | 29 Oct-9 Nov |
| 5Z | USA | AWARE sonar and northern right whale | 11-29 Mar 2002 |
| 5Z+6ABC | USA | Sm. pelagics hydroacoustic | 11 Feb-8 Mar 2002 |
| 5Z+6ABC | USA | Sm. pelagics hydroacoustic | 5 Feb 5-3 Mar 2002 |

[1] Country abbreviations as per Statistical Bulletin.

iii) **Northwest Atlantic survey database**

The Northwest Atlantic Groundfish Research Trawl Survey Data System (NWAGS) was presented by G. Black, Bedford Institute of Oceanography (BIO), Dartmouth, Canada, to STACREC. The data system consists of a common ORACLE data model, Internet web site and data products proposed for NW Atlantic groundfish trawl surveys conducted by Canadian and United States fisheries research laboratories including: Bedford Institute of Oceanography, Gulf Fisheries Centre, Maurice Lamontagne Institute, Northeast Fisheries Science Centre, Northwest Atlantic Fisheries Centre, and the St. Andrews Biological Station. The new system will replace the ECNASAP data system that was developed in 1995. The Maritimes Science Virtual Data Centre (VDC) would be used to provide data products: including up-to-date interactive data tables, maps and graphs for biomass, abundance, size and age composition for 400+ groundfish and invertebrate species ranging from Cape Hatteras, North Carolina, USA, to the Labrador Shelf in Canada starting in 1970. An interactive demonstration showed features of this proposed system using the existing intranet site.

Several aspects of this system require further evaluation before the various data sets collected under many different survey configurations of vessel, gear, tow duration, etc., can be combined for analysis. STACREC considered many of the positive features of a combined Northwest Atlantic Survey Database.

Discussion on this topic included cost estimates, linkages with other on-going initiatives, and the potential for other member countries to contribute to a similar larger virtual assemblage of survey databases with support from the NAFO Secretariat.

STACREC **recommended** that *Contracting Parties should check to see what interest there is to having their national data included in the Northwest Atlantic Survey Database. Assuming there is interest, Contracting Parties should submit an inventory of applicable data, entailing number of records, data type and formats. Once available, the complete inventory of data will be used to evaluate the complexity and costs of conversion to the database format.*

It was felt that the database could be housed and maintained on a server outside NAFO.

5. **Report of the Working Group on Biological Information Database Exchange (Cod in Divisions 3NO)**

There being no further developments in this matter, STACREC concluded that there was no longer any need to continue the efforts of this Working Group.

6. **Report of the *ad hoc* Working Group on NAFO Observer Protocol**

During the 22nd Annual Meeting, September 2000, based on a recommendation by STACTIC, the Fisheries Commission adopted the Scientific Council proposal 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 NAFO 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. STACREC noted that there is a further need for a protocol to ensure printing and distribution of required forms to Contracting Parties and their observer programs.

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*.

STACREC discussed the acquisition of observer data obtained from Contracting Parties and noted that the NAFO Conservation and Enforcement Measures Part VI currently require observers to:

*3 b) "collect catch and effort on a set-by-set basis. This data shall include location (latitude/longitude), depth, time of net on bottom, catch composition and discards; in particular, the observer shall collect the data on discards and retained undersized fish as outlined in the protocol developed by the Scientific Council."*

and that

*3 d) "within 30 days following completion of an assignment on a vessel, provide a report to the Contracting Party of the vessel and to the Executive Secretary, who shall make the report, available to any Contracting Party that requests it. Copies of reports sent to other Contracting Parties shall not include location of catch in latitude and longitude as required under 3 b), but will include daily totals of catch by species and division."*

STACREC noted that the Conservation and Enforcement Measures Part VI, Program for Observers and Satellite Tracking (Section 3 d), is inconsistent with the Scientific Council protocols adopted by the Fisheries Commission in 2000 and therefore **recommended** that *the Chairman of the Scientific Council contact the Chairman of the Fisheries Commission to develop a means of resolving this inconsistency at the 2001 Fisheries Commission meeting*.

Also, in September 2000, STACTIC agreed that a training manual be developed to describe the use of these forms and other observer functions. STACTIC also noted that Canada had produced a training and operation manual for the NAFO Program at its inception and that with modification it could form the basis for a manual reflecting the new forms and protocols.

Therefore, STACREC **recommended** that *the development of a training and operation manual for the collection of scientific data continue, and that the Scientific Council be represented at the September 2001 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 future work of the Scientific Council could be impaired in the absence of timely access to observer data in electronic format.

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 requests the Secretariat to develop cost estimates required to accomplish this task for inclusion in the 2002 budget.

STACREC also reviewed a proposal to collect biological data in the northern shrimp fishery in Div. 3L. After considerable discussion, STACREC concluded that such proposals should be made with respect to modifying the observer program protocols, and that the protocols adopted by the Fisheries Commission in 2000 are sufficient to address most standard sampling requirements. The specific request for observers to determine the maturation stages of shrimp aboard commercial vessels was considered by STACREC to require specialized biological training, and would be better accomplished during research cruises.

## 7. Review of SCR and SCS Documents

STACREC reviewed 10 SCR and SCS documents as summarized below. In addition STACREC deferred SCR Doc. 01/41 and SCR Doc. 01/55 to the September 2001 Meeting, and SCR Doc. 01/46 to the November 2001 meeting.

a) The recruitment dynamics of several stocks in the Northwest Atlantic were analyzed (SCR Doc. 01/6). Significant correlations in year-class strength were evident among several widely separated stocks in Subareas 2, 3 and 4, indicating synchrony in recruitment which may reflect some broad scale environmental influences.

b) Results from the Russian fishery for silver hake on the Scotian Shelf were presented (SCR Doc. 01/12). Between April and August 2000, silver hake aggregations were found between 100 and 250 m. During summer, silver hake migrated eastward towards shallower depths. Highest catches occurred in May and June and most of the catch was composed of mature individuals. In May and June, pre-spawning fish dominated catches while in July post-spawners were observed in the catches.

c) An otolith shape analysis of North Atlantic redfish, comparing sampling areas and species, was presented (SCR Doc. 01/14). While the area comparison of *Sebastes mentella* otolith shapes did not reveal any differences, the species comparison (*S. mentella, S. marinus* and *S. viviparus*) resulted in a considerable grouping of samples by species. The rostrum area of the otoliths was identified as contributing most to the observed shape differences. Reproduced outlines of *S. mentella* otoliths, averaged over sampling areas, did not show any differences between supposed stock units. Effects of different length and age groups on otolith shapes have not been considered and might be confounding the observed shape variation. Ongoing shape analyses of *Sebastes* otoliths will first focus on the comparison of species, including Pacific rockfish, before studying between-stock variation in more detail.

d) A comparative age reading study of *Sebastes marinus* from the Icelandic shelf within an otolith exchange program between Germany, Iceland and Norway was presented (SCR Doc. 01/16). Age reading results were compared between readers and otolith preparation methods (cross-sections, break-and-burn) in terms of bias and precision, using a set of statistical tests and graphical methods. Significant bias was observed for both the comparison between readers and between methods, mainly caused by deviations between age scores in the higher ages (>20 years). Precision estimates, involving the high longevity of redfish, were relatively good compared to previous age reading comparisons using other species. In contrast, the age dependent percent agreement was poor (<30%) for a tolerance level of plus/minus 0 years, particularly for the age range 21-30 years. The fit of age reading scores with the von-Bertalanffy growth curve was relatively good, providing growth parameters comparable to *S. marinus* from the Norwegian shelf. This study will be expanded by age readings on oceanic *S. mentella* otoliths.

e) The United States Research Report (SCS Doc. 01/19) was presented. The status of 19 stocks in Subareas 5 and 6 was updated. Many of the stocks were showing 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 was also provided, including studies on life history/ecology of fishes, invertebrates and marine mammals, food web dynamics, age and growth, habitat relationships, and fishery by-catch.

f) Data relating to by-catches, size composition and distribution by depth of snow crab (Genus *Chionoecetes*), collected by a commercial vessel were presented (SCR Doc. 01/11). Snow crab occurred in depths ranging from 730 m to 1 145 m, with the greatest amount (69.5%) taken between 800-900 m in Div. 3L. No snow crabs were caught on the Flemish Cap (Div. 3M). Of the total number of hauls in Div. 3L, snow crabs occurred in 13.2%. Only male snow crab occurred in the catches, and carapace widths ranged from 72-123 mm. Before the beginning of April all crabs were at molt stage 2. From early-April and until the end of the fishery 2.9% of the snow crabs in catches were found to have molted. The percentage of crabs with damaged legs was 55.6%, apparently due to fishing operations in the area. No ectoparasites were found on snow crabs.

g) Russian data collected on selectivity of bottom trawl (mesh size 98-156 mm) and midwater trawl (mesh size 88-140 mm) in the Northeast Atlantic, Northwest Atlantic and in the Irminger sea were presented (SCR Doc. 01/21). Calculations of benefits and losses in catch of redfish for bottom trawls indicated that any increase of mesh size higher than 100 mm will not generate positive benefits. In the Irminger sea any increase in mesh above120 mm will not generate positive results for at least 15 years. Analogous results were obtained in the calculation of benefits from fishing with midwater trawls with mesh size greater than 90 mm in Div. 3N.

h) Methods for studying redfish (*Sebastes* spp.) in the North Atlantic infested by *Sphyrion lumpi* and having pigmented patches on the body, were described, as well as the methods for examining fish, recording of results in a special format and for primary statistical data processing, etc. (SCR Doc. 01/27). A scale of conventional maturity stages of the copepod *Sphyrion lumpi* was suggested. The method allows for simultaneous registration of both the ichthyological data (length, weight, sex, maturity stages of fish, stomach fullness, food composition) and the data on characteristics of the infestation by *S. lumpi* (alive parasites at different stages of their development, remains of the copepod presence), pigmented patches (colour, size) and their localization. Use of natural (biological, parasitological) tags, such as registration of alive parasites of *S. lumpi* (indicating their stages of development), remains of *S. lumpi* presence and occurrence of pigmented patches, will provide an additional basis for studying the intraspecific structure of redfish in the North Atlantic. Results from the analysis of the data collected by this proposed method will reveal the centers of *S. lumpi* invasion. The occurrence of pigmented patches, in combination with the peculiarities of occurrence and geographical variability of the phenomena studied, will be a pre-condition for studying the routes of migrations and intraspecific structure of redfish.

i) Russian results on the selectivity of trawl bags of 120 and 130 mm in the Greenland halibut fishery in the NAFO Regulatory Area were presented (SCR Doc. 01/30). The analyses of the available data has shown that the currently applied minimum landing size of 30 cm for Greenland halibut may not be consistent with the 25% retention by the trawl bag with the mesh size 130 mm. This size should be in the range 32-34 cm depending on the length of fish in the aggregations harvested. Such an increase of the minimum landing size would reduce fishing pressure on juvenile fish. An increase of mesh size over 130 mm, given the current size composition catches, would result in the escape of individuals of 44 cm which constituted a major part of the aggregations.

j) A report on recent results of gear standardization work between two research vessels used by the Northwest Atlantic Fisheries Center (NAFC) was presented (SCR Doc. 01/26). In 1995, the Northwest Atlantic Fisheries Centre adopted the Campelen 1800 shrimp trawl as the standard bottom trawl gear to replace the Engel 145 High-Lift otter trawl used onboard its research vessels, the CCGS *Wilfred Templeman* and CCGS *Teleost*. Standardization protocols were adopted to minimize the uncertainty in estimates of abundance that could be associated with variations in trawl construction and fishing practices. Trawl performance data were recorded for all fishing sets during the bottom trawl surveys using SCANMAR acoustic trawl instrumentation. The standardization protocols have been effective in minimizing variation in the trawl construction and fishing practices, however, there were differences in trawl geometry between research vessels and between survey years. Differences in survey gear performance between the two research vessels were due to differences in horsepower, displacement, trawl winches and depth fished. The effect on catchability can only be determined by comparative fishing trials.

## 8. Other Matters

### a) Tagging Activities

STACREC reviewed the list of tagging activities carried out in 2000 (SCS Doc. 01/16) compiled by the Secretariat, and requested national representatives to update the list during the meeting.

In 2000 a 5-year tagging program for yellowtail flounder began on the Grand Bank (SCR Doc. 01/53). Five-thousand fish were tagged with a combination of single and double Petersen disc tags and 200 fish were tagged with 'dummy' archival tags in Div. 3NO and released at 25 selected stations. To-date, 3.9% of the Petersen disc tags and 6% of the archival tags have been returned. There was a marginally higher percentage of double tag returns (4.4%) than single tag returns (3.5%). Year two of the tagging program began in June 2001, in which 5 000 or more fish will be tagged with Petersen disc tags and 300 fish will be tagged with real archival tags to measure depth and temperature on a daily basis.

### b) Conversion Factors

STACREC noted that FAO had recently published Fisheries Circular C847 Rev.1 on the factors used by national authorities in converting the landed weight of fishery products to the live weight equivalent and that a program developed by EUROSTAT for interrogating the data-file would shortly be available on the FAO website. It also noted that FAO had started distributing the FISHSTAT CF1 questionnaire requesting national authorities to submit updated lists of conversion factors.

### c) Comparative Fishing Between Canada and EU-Spain

Comparative trials between the Canadian R/V *Wilfred Templeman*, using a Campelen gear, and the Spanish C/V *Playa de Menduiña*, using a Pedreira commercial type gear, were initiated in 2000 and continued in 2001 (SCR Doc. 01/69). The trial in 2001 included 18 simultaneous parallel hauls at daytime. Catches of the C/V *Playa de Menduiña* were several times higher than those of the R/V *Wilfred Templeman* for American plaice, thorny skate and yellowtail flounder. The results seem to confirm that the catch efficiency for flatfish of the Pedreira gear is higher than that of the Campelen gear.

### d) Research Activities

A report of a Canadian/USA age reading workshop held in St. John's Newfoundland was presented (SCR Doc. 01/54). Participants evaluated various structures and methods used to age yellowtail flounder, develop standardized protocols for ageing and training, and for testing consistency. It was determined that ageing based on whole otoliths tended to under-estimate ages compared to scales and thin-sectioned otoliths in older fish. Ageing based on scales also tended to under-estimate ages compared to thin-sectioned otoliths in older fish.

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Application of ages derived from scales and otoliths to derive growth estimates (SCR Doc. 01/52) indicated that for Div. 3LNO yellowtail flounder fish aged with whole otoliths gave a maximum age of 10 years, those aged with scales gave a maximum age of 14 years, and those aged with thin-sectioned otoliths gave a maximum age of 16 years. It was noted that, when ages were based on thin-sectioned otoliths, there was a tendency to have a downward bias in younger ages due to misinterpretation of the first annulus. Von-Bertalanffy growth parameters estimated from age readings based on thin-sectioned otoliths indicated $L_{inf}$ = 53.4 cm (males) and 56.3 cm (females). K was estimated to be 0.17 for both sexes. Compared to the historical perception of Grand Bank yellowtail flounder, this indicates a much slower growth rate.

Age validation techniques were also applied to evaluate the accuracy of Div. 3LNO yellowtail flounder age readings based on scales, whole otoliths and thin-sectioned otoliths (SCR Doc. 01/51). Indirect age validation methods, including length frequency analysis and marginal increment analysis, were applied to evaluate accuracy of ageing of younger fish, while direct methods, including tag-recapture and bomb radiocarbon assay, were applied to evaluate ages from older fish. It was concluded that even thin-sectioned otoliths tended to under-estimate the age of very old fish between 15-20 years as determined from bomb radiocarbon assays. Under-ageing is apparent at age 15, and this will probably be the logical endpoint for constructing the catch-at-age matrix.

e) **Other Business**

The Chairman 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 Chairman closed the June 2001 STACREC Meeting.

## APPENDIX III. REPORT OF STANDING COMMITTEE ON PUBLICATIONS (STACPUB)

Chairman: O. A. Jørgensen Rapporteur: D. Maddock Parsons

The Committee met at the Alderney Landing, 2 Ochterloney Street, Dartmouth, Nova Scotia, Canada, on 31 May to 14 June 2001. In attendance were C. Darby (EU-United Kingdom), O. A. Jørgensen (Chairman) (Denmark in respect of Greenland), D. Maddock Parsons (Canada), V. A. Rikhter (Russian Federation), F. M. Serchuk (USA), M. Stein (EU-Germany), H. Siegstad (Greenland) and the Assistant Executive Secretary (T. Amaratunga).

### 1. Opening

The Chairman welcomed the Committee. The agenda as presented in the Provisional Agenda was modified to include item 4.d) Scientific Council Reports; items 4.d) and 4.e) were renumbered and the agenda was **adopted**. D. Maddock Parsons (Canada) was appointed rapporteur.

### 2. Review of Recommendations in 2000

**Recommendations in June**

i) STACPUB had recommended that *STACREC should consider proceeding with the publication of NAFO Statistical Bulletin for 1994 without the USA data*.

STACPUB noted the Statistical Bulletin had been published.

ii) STACPUB had recommended that *an Executive Committee Meeting be held near the end of the June Meeting to evaluate financial impacts on the NAFO budget, which arise from deliberations and decisions made during the course of that meeting*. STACPUB had further recommended that *costs associated with the preparing historic documents for electronic publication on the website be enumerated and included in the Scientific Council budget request for 2001*.

STACPUB noted that the Executive Committee did meet to discuss these issues and the proposed budget was presented to the General Council in September 2000. The recommendation to include the above costs in the budget request was not supported by General Council, however, money for new scanning equipment was allocated. The scanning equipment was purchased by the Secretariat and scanning of documents for electronic publication is in progress.

iii) STACPUB had recommended that *the Scientific Council Reports and the Reports of the Annual Meeting be included in the contents of the CD-ROM, and the CD-ROM be issued before April of the following year*.

STACPUB noted that the CD-ROM versions of the Reports have been issued.

iv) STACPUB had recommended that *electronic publishing of the Journal begin with the five papers currently awaiting publication in Volume 26*.

Journal Volumes 26 was placed on the web as the first electronic publication. Two further Journal Volumes have subsequently been published electronically.

**Recommendations in September**

v) STACPUB had recommended that *the documents from the "Workshop on Assessment Methods" along with the discussions should be compiled and issued as a Scientific Council Studies publication.*

STACPUB noted that the documentation is currently in progress and will soon be available as a Studies issue.

vi) STACPUB had 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.*

STACPUB noted that this working group had not yet been established. Discussion between the Chairs of Fisheries Commission and Scientific Council did not settle the question as to what documents should be made publicly available. STACPUB suggested that the same method of making documents available in Scientific Council might be appropriate for other Constituent Bodies such that once a document has been accepted it be archived electronically and made available on the website.

3. **Review of STACPUB Membership**

STACPUB noted that the Chairman, O. A. Jørgensen (Greenland), was elected by the Scientific Council in September 1999 Annual Meeting, and his term would end at the end of the 2001 Annual Meeting.

In accordance with the new STACPUB Rules of Procedure, incoming STACPUB members will be designated for a term of three years. STACPUB welcomed D. Maddock Parsons (Canada), who was nominated by Scientific Council to replace M.J. Morgan, and H. Siegstad (Greenland). STACPUB extended its appreciation to M. J. Morgan for her valuable service.

Terms of membership for the present STACPUB members will end at the end of the Annual Meeting in the given years as follows: V. A. Rikhter (Russian Federation), 2001, M. Stein (EU-Germany), 2001, C. Darby (EU-UK), 2002, F. M. Serchuk (USA), 2002, H. Siegstad (Greenland), 2003, and D. Maddock Parsons (Canada), 2003.

4. **Review of Scientific Publications**

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

STACPUB was informed that:

**Volume 26** containing 6 papers and 2 notices (145 pages) was published with a publication date of December 2000 and placed on the NAFO website www.nafo.ca. This was the 1st issue to be published electronically.

**Volume 27** containing 22 papers and 1 note presented at the 1999 Symposium on "Pandalid Shrimp Fisheries – Science and Management at the Millennium", and 2 notices (289 pages), was published with a publication date of December 2000 and placed on the NAFO website www.nafo.ca.

**Volume 28** containing 1 invited paper titled "A Review of the Cod Fisheries at Greenland, 1910-1995" and 2 notices (121 pages) was published with a publication date of December 2000 and placed on the NAFO website www.nafo.ca.

There are presently 8 papers in Secretariat files for future Journal issues.

b) **NAFO Scientific Council Studies**

STACPUB was informed that:

**Studies Number 33** containing 7 miscellaneous papers and 1 notice (135 pages) was published with a publication date of May 2000 and placed on the NAFO website www.nafo.ca.

**Studies Number 34** 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, are in various stages of preparation.

There are presently one scientific paper and one proposed statistical paper in Secretariat files for a future Studies issue.

c) **NAFO Statistical Bulletin**

STACPUB observed catch data by country, species and Division were available on the NAFO website as text files for 1960-99. Information was the most up-to-date available at the Secretariat and will be updated as new information become available.

In accordance with the Scientific Council recommendation of June 2000, the *NAFO Statistical Bulletin*, Vol. 44 for 1994, was published without the USA data with a publication date of December 2000. It was noted this was 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.

STACPUB considered the utility of the hard copy of *NAFO Statistical Bulletin*, given that frequent updates of available data occur. It was noted that although there were frequent requests for electronic versions of the data, paper copies of the documents are still important and they should continue to be provided.

d) **NAFO Scientific Council Reports**

STACPUB noted that, as in recent years (since 1998), the *NAFO Scientific Council Reports* (Redbook) was published on the NAFO website on schedule along with both hardcopy and CD-ROM printed issues. The volume (303 pages) containing reports of the 2000 meetings of the Scientific Council in June, September and November was published and distributed in January 2001.

e) **Index and Lists of Titles**

The provisional index and lists of titles of 88 research documents (SCR Doc.) and 28 summary documents (SCS Doc.) which were presented at the Scientific Council Meetings during 2000 were compiled and presented in SCS Doc. 01/8 for the June 2001 Meeting.

The 5-year compilation "*NAFO Index of Meeting Documents, 1995-99*" (141 pages) was published in December 2000.

STACPUB discussed the suggestion to make the index searchable electronically and it was noted that this is currently being tasked for all documents. It was also mentioned that there are other methods of searching the web published material using currently available web software.

f) **Others**

No other publications were discussed.

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

The Assistant Executive Secretary gave an overview on printing costs for the Journal, the Studies and the Scientific Council Report. STACPUB observed that there is no specific budget for Scientific Council publications to differentiate them from all publications undertaken by the Secretariat. The Assistant Executive Secretary believed the overall allocation for publications in the budget for next year would be sufficient for Scientific Council publications.

STACPUB discussed the possibility of cost recovery on remaining back issues, by advertising them at a discount price on the website. The Secretariat was encouraged to look into this possibility and initiate any possible sales.

STACPUB considered the usefulness of the list of publications printed and associated costs, and it was felt that an annual report of only the number of issues sold would be sufficient. It was agreed that the future STACPUB agenda item on this subject should be changed to reflect this.

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

a) **Invitational Paper**

The invited paper by V. A. Rikhter on silver hake on the Scotian Shelf is in the final editorial process.

STACPUB considered possibility for new invitations and felt it would be appropriate to invite a long-term member of the Council, who might have valuable information to present in a paper. No nominations were presented during this meeting.

b) **Abstracts from Research Documents**

STACPUB noted that all Research Documents now contain abstracts.

c) **NAFO Website**

In June 2000 STACPUB noted there was considerable discussion on additional work to be applied to the Website. It was noted:

1. with respect for mounting a search engine on the Website, keyword searches, usually used for large database sites, were too elaborate. The present website is concise and pages are laid in a logical manner for direct and quick access. However, improvements are ongoing. A new initiative being considered is for a keyword index, primarily for searching scientific articles

2. regarding scanning all Journal and Studies back issues, new scanning equipment was purchased and the project of scanning back-issues is on-going at the Secretariat.

3. with respect to having individual e-mail addresses for each NAFO staff member: A new high-speed internet connection (which only became available to the NAFO Secretariat building this year) was installed at site and the NAFO server was enabled. A new main NAFO address was created info@nafo.ca, with easy (instantaneous) connections within the Secretariat network, however, STACPUB still **recommended** that *each member of the Secretariat be given an individual e-mail address.*

4. with respect to having the information on updates available on the Website, a new page titled "What's New" was placed on the Website homepage. This page provides all updates on a timely basis. Similarly changes and updates are denoted with the upload date so that users can tell if they have the most updated version.

5. with respect to implementation of modern software for designing the website, acquisition of modern software is an ongoing activity at the Secretariat (e.g. Windows 2000). Most suitable software used for the design of the Website, e.g. Microsoft Frontpage, was installed.

In further discussion on website improvements, STACPUB recognized the importance of knowing the effectiveness of the electronic publication method. STACPUB saw the importance of having suitable counters on the web to determine its usage. STACPUB **recommended** that in future, *the Secretariat should routinely submit a report in June on the website usage to STACPUB.* STACPUB **recommended** that *an additional agenda item for future meetings should be introduced to include website use summaries and statistics.*

STACPUB 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.* To facilitate the process, STACPUB proposed presenting a visual demonstration of the NAFO website to representatives at the September Annual Meeting for discussions on improvements.

d) **Scientific Citation Index (SCI)**

The Assistant Executive Secretary has been in communication with the SCI authorities and they have been monitoring the production of the NAFO Journal on the website. There has been no decision from SCI yet. Communications with will continue.

e) **CD-ROM Versions of Reports, Documents**

STACPUB noted that CD-ROM version of reports are being produced at the Secretariat, but that further discussions with other Constituent Bodies were needed for better dissemination of information.

f) **New Initiatives for Publications**

Assistant Executive Secretary raised the issue with respect to immediate electronic publication of Symposium proceedings. Contrary to regular volumes, where independent papers may be electronically numbered and published as they become ready, Symposia papers must be published together to maintain themes and structure of the symposium documents. STACPUB felt that these two methods of electronic publishing are appropriate to deal separately with regular volumes being published immediately and Symposium proceedings being published when the complete volume is ready.

STACPUB reviewed the report from the Working Group on Reproductive Potential prepared by the Chairman. STACPUB **recommended** that *the collection of papers being prepared by the Working Group on Reproductive Potential be edited by the Working Group Chairman, E. A. Trippel (Canada) and compiled into a single issue of the Journal of Northwest Atlantic Fishery Science during 2002.* STACPUB further **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*.

An associate editor proposed that STACPUB consider publishing the report from a 2002 Global Ocean Ecosystem Dynamics (GLOBEC) meeting in the NAFO Journal. Although it was recognized that such inclusion would give the Journal a wider international scope, STACPUB also considered that the Journal's scope has traditionally been to publish work that has been supported and participated in by NAFO membership. STACPUB did not make a decision about the proposal and deferred its considerations to the September Meeting of STACPUB.

STACPUB noted that there is an archive of photographs of members at the Secretariat from previous meetings and that in the interest of conserving these photos, they should be digitized and made available on the server at meetings.

## 7. Editorial Matters Regarding Scientific Publications

### a) Review of Editorial Board

STACPUB was informed that the Associate Editors G. Krause (Biological Oceanography) and A. Richards (Invertebrate Fisheries Biology) stepped down from the Editorial Board in 2000. It was agreed that STACPUB Chairman would continue discussions intersessionally and replacements to the positions of Biological Oceanography and Invertebrate Fisheries Biology were appointed intersessionally. STACPUB welcomed K. Drinkwater (Canada) and V. Siegel (EU-Germany) to the Editorial Board. STACPUB noted that the previous position called Biological Oceanography was retitled as "Physical and Fisheries Oceanography".

STACPUB discussed the process of editorial review of Symposium proceedings and **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.*

### b) Progress Review of Publication of 2000 Workshop Workbook

STACPUB noted that the Workshop Workbook is in the process of being compiled and should be ready for publication in the near future.

### c) Review Process for Publication of Symposium Proceedings

STACPUB noted there are 55 papers and 63 posters expected from 2001 Symposium on "Deep-sea Fisheries". Based on the above recommendation, it is thought that the co-convenors of this Symposium will take the responsibility for editing (or appointing editors) for the resulting proceedings.

Noting that some Symposia may attract large number of papers STACPUB observed that a limit on Journal size might be appropriate. As an initial consideration the Secretariat was requested to consider a maximum number of about 500 pages to an issue.

STACPUB noted that in the event that the proceedings are in excess of 500 pages, two Journal volumes would be produced.

### d) Review of the Journal Editorial Process

STACPUB was informed that an informal meeting with Associate Editors in attendance at this Scientific Council Meeting dealt with problems in relation to some submitted papers. It was agreed by STACPUB that Associate Editors may return submissions to authors, when standards are not met, for correction and resubmission.

STACPUB recognized the importance of making new Journal publications widely known and discussed methods of announcing them. It was proposed that an announcement sent to selected relevant fora on the internet would greatly increase awareness of NAFO publications. It was suggested the announcement could also include details of what types of documents would be suitable for publication in the Journal, applied papers, for example.

## 8. Papers for Possible Publication

### a) Review of Proposals Resulting from 2000 Meetings

#### i) Papers nominated by STACPUB

STACPUB noted that: 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 35.

Consequent disposition of STACPUB nominated papers is as follows:

At its meetings since 1980, STACPUB has nominated a total of 690 research documents. This includes 9 documents nominated at the Workshop on Assessment Methods in September 2000. Since 1980, a total of 616 papers have been published in the Journal (307) and Studies (309).

In addition, 3 papers from outside of the STACPUB nomination process were submitted for the Journal since June 2000.

#### ii) Up-date since June 2000

A total of 37 papers were published or are in their final stage of galley preparation (30 in the Journal and 7 in Studies) since June 2000.

### b) Review of Contributions to the June 2001 Meeting

STACPUB noted that there is one paper outstanding for Studies, which should be published in the next Studies publication.

STACPUB noted that 7 papers from this June 2001 Meeting were proposed for consideration for Studies or Journal issues but review of these was deferred until the September 2001 Meeting.

## 9. Other Matters

### a) Press Release for Scientific Council

STACPUB agreed on a template for "meeting highlights" for Scientific Council, which would summarize information concerning stocks for which advice had changed from the previous year. This template was submitted to Scientific Council for discussion and approval.

Realizing that some issues in this summary might be controversial in terms of the complete meeting report, STACPUB felt that the press release should coincide with the publication of the meeting report on the web.

b) **STACPUB Meeting in Plenum**

STACPUB discussed the change in direction that topics covered in STACPUB had taken. Given that focus moved away from strictly dealing with publication issues, and more with policy related issues (direction of the Journal contents, editorial processes, communication of survey and catch data, etc.), it was suggested that discussions should include a wider group of affected people. The possibility of STACPUB meeting in plenum was brought to the Scientific Council for discussion.

Scientific Council agreed that topics covered by STACPUB include issues that would benefit from participation of a wider audience. While concern was expressed that the Scientific Council meetings are already under time pressures, time (half day) for STACPUB was allocated for meeting in plenum. It was felt that the time allocated for STACPUB should not decrease the time allocated for STACFIS.

c) **Other Business**

There being no other business the Chairman 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 IV. REPORT OF STANDING COMMITTEE ON FISHERIES SCIENCE (STACFIS)

Chairman: H.-J. Rätz Rapporteurs: Various

## I. OPENING

The Committee met at the Alderney Landing, 2 Ochterloney Street, Dartmouth, Nova Scotia, Canada, during 31 May-14 June 2001, to consider and report on matters referred to it by the Scientific Council, particularly those pertaining to the provision of scientific advice on certain finfish and invertebrate marine stocks. Representatives attended from Canada, Cuba, Denmark (in respect of Faroe Islands and Greenland), Estonia, European Union (France, Germany, Portugal, Spain and United Kingdom), Japan, Norway, Russian Federation and United States of America. Various scientists assisted in the preparation of the reports considered by the Committee.

The Chairman, H.-J. Rätz (EU-Germany), opened the meeting by welcoming participants. The agenda was reviewed and a plan of work developed for the meeting. The Chairman noted that there were additional agenda items, *viz* the new fishery and related questions about pelagic redfish in Div. 1F, and the long-term effects of increasing mesh size from 130 to 145 mm in the Greenland halibut fishery and in reducing by-catches of other species. The provisional agenda with these modifications was accordingly **adopted**.

## II. GENERAL REVIEW

### 1. Review of Recommendations in 2000

STACFIS reviewed the recommendations from 2000 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 2000. Estimates of catches from various sources were considered along with catches reported (available to date) in STATLANT 21A forms, in order to derive the most appropriate estimates of catches for the various stocks in Subarea 3. STACFIS also reviewed SCS Doc. 01/5 providing a retrospective comparison between the STATLANT 21A catch data and catch figures as used by STACFIS in the stock assessments. STACFIS noted that recently there have been only minor differences between the officially reported and STACFIS estimated catch figures, up to and including 1999.

Since 1995 there has been a Pilot 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 2000. These provided other sources of catch data.

The Committee encountered significant differences between the catch figures derived from the various sources and was unable to estimate precise catches for some stocks. STACFIS therefore **recommended** that *the tabulation of the STATLANT 21A reported catches against the STACFIS estimates as provided in SCS Doc. 01/5 be updated with the 2000 figures and be made available in advance of the 2002 June Scientific Council meeting*.

The preliminary tabulations including available STATLANT 21A data for 2000, presented on a stock-by-stock basis, are given at Annex 1 of this report. The stocks are in the same sequence as in the present STACFIS report.

***Structure of STACFIS Report***. The present STACFIS report 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. 01/23, 35, 42, 43, 48; SCS Doc. 01/ 11, 13, 15, 21)

#### 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. In 1993 catches decreased to about 11 000 tons and have remained near that level up to 1998 when the catch declined to 8 900 tons. Catches increased to 9 667 tons in 1999 and further to 10 713 tons in 2000. In Subarea 0 catches peaked in 1992 at 12 400 tons, declined to 4 300 tons in 1994 and increased to 6 700 tons in 1996, and decreased gradually to 4 400 in 1998. Catches stayed at that level in 1999 to increase to 5 438 tons in 2000. Catches from offshore in Div. 1A have been low. Catches in Div. 1B-1F have fluctuated between 900 and 1 600 tons during the period 1987-91. After that catches increased to about 5 500 tons where they have remained until 1995. In 1996 catches decreased to 4 600 tons and have since remained at that level until 1998. In 1999 catches increased to 5 100 tons and further to 5 275 tons in 2000 (Fig. 1.1).

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

| | 1992 | 1993 | 1994 | 1995[1] | 1996[1] | 1997[1] | 1998[1] | 1999[1] | 2000[1] | 2001 |
|---|---|---|---|---|---|---|---|---|---|---|
| Recommended TAC[2] | 25 | 25 | 25 | 25 | 11 | 11 | 11 | 11 | 11 | 15[7] |
| SA 0 | 12 | 7 | 4 | 5 | 7 | 6 | 4 | 5 | 5 | |
| SA 1 excluding Div. 1A inshore | 6 | 4 | 6 | 6 | 5 | 5 | 5 | 5 | 5 | |
| Total | 18 | 11 | 10 | 10[3] | 11 | 11[4] | 9 | 10[5] | 11[6] | |

[1] Provisional.
[2] In the period 1991-95 the TAC included Div. 1A inshore.
[3] Including 2 351 tons non-reported.
[4] Including 1 935 tons non-reported.
[5] Including 131 tons non-reported.
[6] Including 259 tons non-reported.
[7] Including a TAC of 4 000 tons allocated specifically to Div. 0A and 1A.

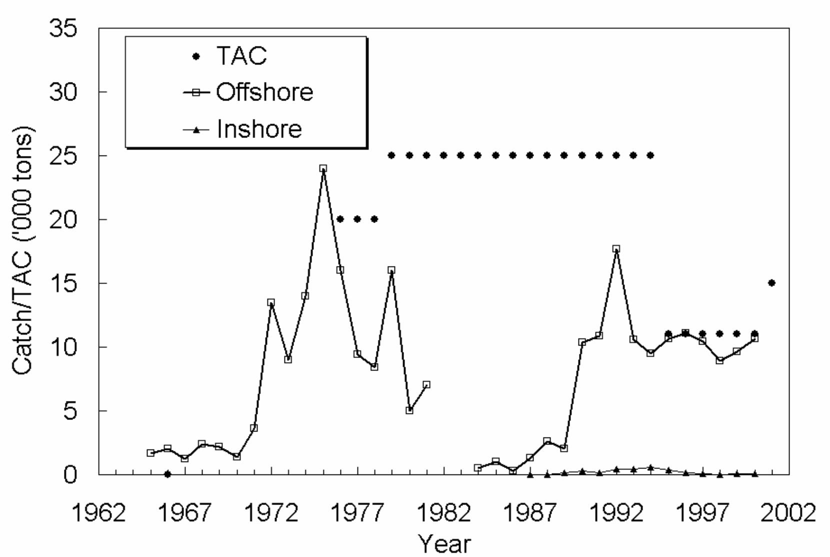


Fig. 1.1. Greenland halibut in Subareas 0+1 (excluding Div. 1A inshore): catches and TACs.

**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 and 1998 only Faroe Islands and Canada conducted a fishery in the area. In the last two years Canada was the only country fishing in the area. In 2000 trawlers took about 2 769 tons while gillnetters and longliners took 1 903 tons and 521 tons, respectively. Catch of 200 tons was not allocated to gear. Almost all the fishery takes place in the second half of the year. Catches were taken mainly in Div. 0B.

In 1987 a longline fishery started inshore in Cumberland Sound. The catches gradually increased to 400 tons in 1992 where they remained until 1994. Catches decreased to 285 tons in 1995. Since then catches have been below 100 tons. The decrease in catches in recent years is due to decrease in effort.

**The fishery in Div. 1A offshore + Div. 1B-1F**. Almost all catches are taken offshore mainly by trawlers from Japan, Greenland, Norway 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. A longline fishery started in 1994 but no longline catches were reported from 2000. In 2000 trawlers from Greenland, Norway, Russia and EU-Germany took 4 243 tons. A new gillnet fishery was started by Greenland and yielded 772 tons. Inshore catches amounted to 1 ton. Further, 259 tons taken by trawlers were not reported. 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 the catch-at-age and weight-at-age from commercial catches in the EU-German fishery for Greenland halibut in Div. 1D in September-November was available for 2000 (SCS Doc. 01/13). Further, length compositions were available from the Greenland trawl fishery in Div. 1D (SCS Doc. 01/21). These were combined with age data from the Greenland deep-sea survey. Catch-at-age and weight-at-age data were available from the trawl, gillnet and longline fishery in SA 0 (SCR Doc. 01/43). Age 7 fish dominated the trawl catches while ages 11 and 9, respectively, dominated gillnet and longline catches (SCR Doc. 01/48).

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-German 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 has remained stable since (Fig. 1.2). Due to the frequency of fleet changes in the fishery both in SA 0 and Div. 1CD, the index of CPUE should, however, be treated with caution.

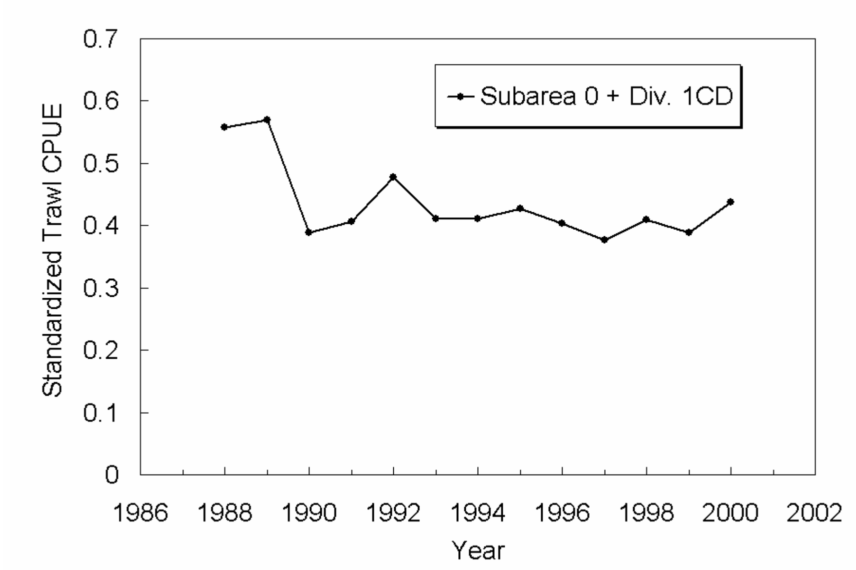


Fig. 1.2. Greenland halibut in Subareas 0+1 (excluding Div. 1A inshore): combined standardized trawl CPUE from SA 0 and Div. 1CD.

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 trawlable biomass in Div. 1CD was estimated to be 59 000 tons in 2000. This is below the estimates from 1998 and 1999 (70 000 and 64 000 tons) but above the estimate in 1997 (56 000 tons) (SCR Doc. 01/23) (Fig. 1.3).

In October 2000 a joint Canada/Greenland survey was carried out in Div. 0B using the same vessel and gear as the survey in Div. 1CD. The survey was conducted as a stratified-random bottom trawl survey covering depths between 400 and 1 500 m. The biomass and abundance was estimated at 56 000 tons and 75 million individuals, respectively. The highest densities were found at 1 000-1 250 m. Length ranged from 7 to 92 cm with modes at 19 cm and 43-45 cm (SCR Doc. 01/23).

Biomass estimates ('000 tons) from USSR (Russia)/GDR(FRG) surveys, Japan/Greenland and Greenland and Canadian surveys for the years 1987-2000 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] | 1CD | 0B+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 | - |

[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.

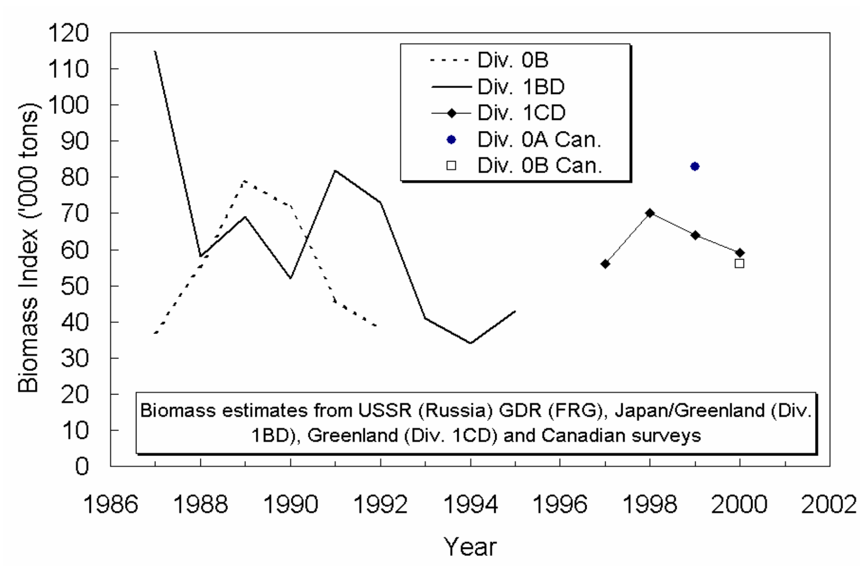


Fig. 1.3. Greenland halibut in Subareas 0+1 (excluding Div. 1A inshore): biomass estimates from surveys.

**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 2000 consisted mainly of one-year-old fish. The number of one-year-old fish in the total survey area including Disko Bay was estimated at 301 million in 2000, which is an increase from 205 million in 1999 and second largest on record. The high index is caused by a combination of above average recruitment in the offshore area and very good recruitment in the Disko Bay. (SCR Doc. 01/35) (Fig. 1.4).

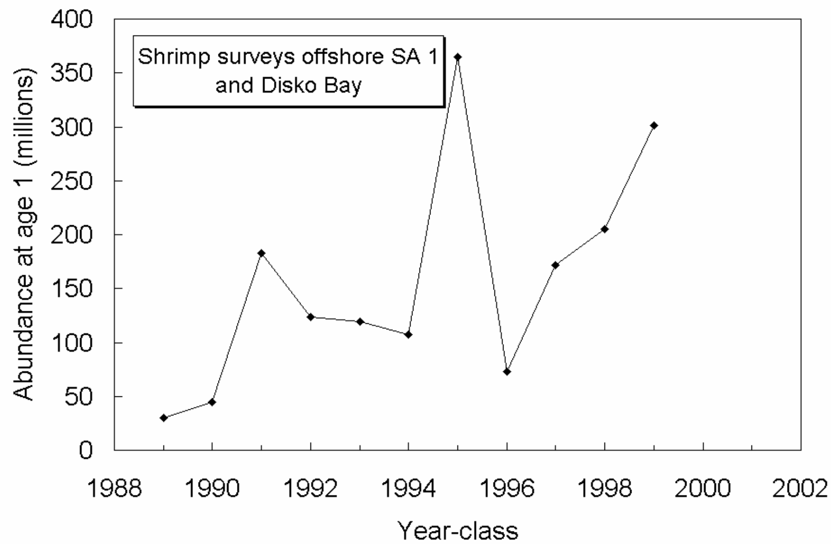


Fig. 1.4. Greenland halibut in Subareas 0+1: recruitment index at age 1 in Subarea 1 derived from the Greenland shrimp trawl surveys. Note that the survey coverage was not complete in 1989 and 1990.

The length distribution from the two deep sea surveys and the shrimp survey is shown in Fig. 1.5. The length distribution from the shrimp survey is for the offshore area not including the Disko Bay.

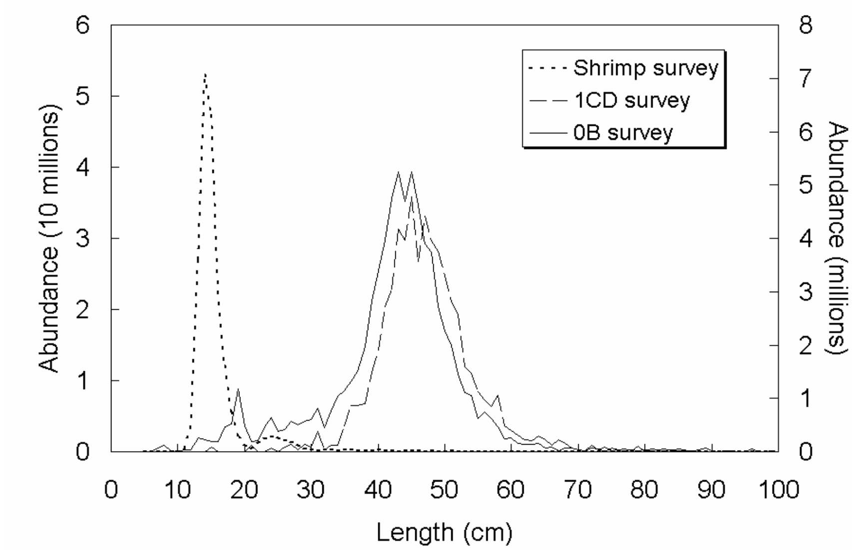


Fig. 1.5. Greenland halibut in Subareas 0+1: length composition from three different surveys in 2000 (Greenland halibut in the Greenland shrimp survey (left y-axis), the Greenland deep-sea survey in Div. 1CD and the Canadian deep-sea survey in Div. 0B (right y-axis).

c) **Estimation of Parameters**

A separable VPA was attempted but the outcome was not considered to be reliable and it was not used (SCR Doc. 01/48).

d) **Assessment Results**

The survey biomass index in Div. 1CD was estimated as 59 000 tons in 2000, which is below the estimate of 70 000 tons in 1998 and 64 000 tons in 1999, but above the estimate from 1997 of 56 000 tons.

Recruitment of the 1999 year-class at age one was the second largest in the time series, but somewhat below the good 1995 year-class. It was noted that the good 1991 and 1995 year-classes have not shown up in the commercial fishery in any significant number.

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

Although the survey series from 1987-95 is not directly comparable with the series from 1997-2000, the decline in the stock observed in Subarea 1 until 1994 has stopped and the stock seems to be back at the level of the late-1980s and early-1990s.

The results of a survey in Div. 0B in 2000 resulted in biomass and abundance estimates of 56 000 tons and 75 million fish, respectively. At present it remains uncertain how the resource in SA 0 and SA 1 is related. Surveys covering SA 0 and Div.1A-1D are planned for 2001. Once these surveys are completed, careful analysis of information from all the offshore area as well as the inshore area of Div. 1A will be necessary in order to better describe the status and distribution of this resource, as well as possible relationships between fish in the different areas.

e) **Precautionary Reference Points**

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

f) **Research Recommendations**

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

2. **Greenland Halibut (*Reinhardtius hippoglossoides*) in Division 1A Inshore** (SCR Doc. 01/35, 48, 68; SCS Doc. 01/23)

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 where the catch was almost 25 000 tons. In 2000 the catch dropped to 18 900 tons (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 are as follows:

| | 1992 | 1993 | 1994 | 1995[1] | 1996[1] | 1997[1] | 1998[1] | 1999[1] | 2000[1] | 2001 |
|---|---|---|---|---|---|---|---|---|---|---|
| Disko Bay[2] | 6.6 | 5.4 | 5.2 | 7.4 | 7.8 | 8.6 | 10.7 | 10.6 | 7.6 | |
| Recommended TAC | | | | | | | | 7.9 | 7.9 | 7.9 |
| Uummannaq | 3.1 | 3.9 | 4.0 | 7.2 | 4.6 | 6.3 | 6.9 | 8.4 | 7.6 | |
| Recommended TAC | | | | | | | | 6.0 | 6.0 | 6.0 |
| Upernavik | 2.2 | 3.8 | 4.8 | 3.3 | 4.8 | 4.9 | 7.0 | 5.3 | 3.8 | |
| Recommended TAC | | | | | | | | 4.3 | 4.3 | 4.3 |
| Unknown[3] | + | 0.1 | - | - | - | - | - | - | 0.2 | |
| Total | 11.9 | 13.1 | 14.0 | 17.9 | 17.3 | 19.8 | 24.6 | 24.3 | 18.9 | |
| Officially reported | 11.9 | 13.1 | 14.0 | 17.9 | 17.3 | 19.8 | 18.8 | - | - | |

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.

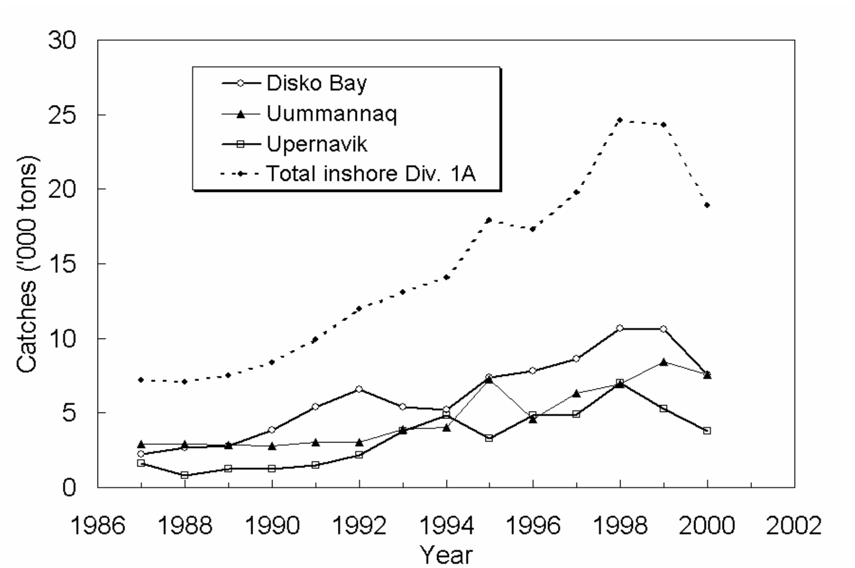


Fig. 2.1. Greenland halibut in Div. 1A: catches by area.

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 below 20 GRT, 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, have caused this fishery to cease in the recent decade. A total ban on gillnets has been in force from 2000, although dispensation presently are given to a gillnet fishery at Ilulissat in Disko Bay. The minimum mesh size allowed is kept at 110 mm (half meshes).

In 2000 an extensive reorganization in the fishing industry has been taking place in Disko Bay, Uummannaq and Upernavik. This is believed to have resulted in a reduction in fishing effort as landing feasibility was reduced.

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°N-70°N), Uummannaq (70°30N-72°N) and Upernavik (72°30N-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 have increased from about 2 300 tons in 1987 to an historic high level of about 10 500 tons in 1998. Landings in 2000 dropped to 7 600 tons. This reduction was believed mainly to be due to reduced fishing effort.

**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. Initially Qarajaq Ice Fjord was the main fishing area but in recent years the fishery has moved further north to Sermilik and Itivilliup Ice Fjords.

Catches have been increasing from a level of 2 000 tons before 1987 to a record high in 1999 of 8 425 tons. The landing in 2000 declined to 7 600 tons. As in Disko Bay the reductions in landings is suggested to be caused by a reduced effort.

**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 have increased steadily from about 1 000 tons in the late-1980s to about 3 000 to 4 000 tons in 1993 to 1995 (Fig. 2.1). The total catch in 1998 was the highest on record, 7 000 tons. In 2000 the catch was 3 800 tons which is at the level in the beginning of the 1990s. As in Disko Bay and Uummannaq the reduction was probably caused by reduced effort.

b) **Input Data**

i) **Commercial fishery data**

Catch data available at the time of the assessment were very preliminary and are likely to have been underestimated by about 2 000 tons. 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 composition have stabilized in recent years.

Length measurements of the commercial longline landings from 1993 to 2000 in Disko Bay, Uummannaq and Upernavik indicated that the fishery was taking place on smaller sub-components of the stock, as size distributions differs substantially between summer and winter.

Disko Bay showed a relatively stable mean length in the summer fishery since 1993 while the trend in the winter fishery was overall increasing except for winter 2000 where weather conditions prevented the traditional fishery. In Uummannaq, a decreasing trend in mean length has been observed for the summer fishery, while mean lengths have been stable in winter fishery. In Upernavik, the mean length has varied but an overall negative trend was observed, especially in the winter fishery where the reduction was significant.

Logbooks are not mandatory. However, in 1999 logbooks were introduced on a voluntary basis. Available logbooks constitute an insignificant part of the fishery (2%), and thus to scarce to be used in the assessment. Earlier attempts to estimate fishing effort has shown a significant correlation between effort (expressed as fishing days) and landings.

Catch curve analyses could not be performed due to the fact that the fishery presumably exploit different age-components in different seasons and localities.

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 2000 the research longline vessel *Adolf Jensen* covered the fjord areas of Upernavik and Disko Bay.

CPUE values (kg/100 hooks) from longline surveys conducted in Div. 1A inshore areas.

| Area | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|---|---|---|---|---|---|---|---|---|
| Disko Bay | 3.1 | 3.1 | - | 3.9 | 4.4 | - | 3.6 | 3.9 |
| Uummannaq | 2.8 | - | 6.6 | 4.5 | - | 6.1 | 8.2 | - |
| Upernavik | - | 5.2 | 3.9 | - | - | 4.2 | - | 2.5 |

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

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

In the standardized surveys from 1993 to 2000 the mean length in Disko Bay has been stable with a stable mode around 60 cm however, the survey in 2000 showed sign of reduction in mean length especially in the Torssukataq icefjord. 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 has decreased since mid-1990s especially with larger fish being less abundant. The survey in 2000 did however indicate a small increase in mean length.

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 2000 were presented as catch-in-numbers per age per hour, for both the offshore and inshore nursery areas (Fig. 2.2). Both offshore and in Disko Bay the numbers of one-year-olds from the 1999 year-class were above average. In Disko Bay it was the second highest on record. The 1997 year-class that was very strong inshore was not above average at age 3. A linkage between the recruitment at age 1-3 and the subsequent recruitment to the inshore fishery at ages 6-7 have however not yet been established due to the short time series.

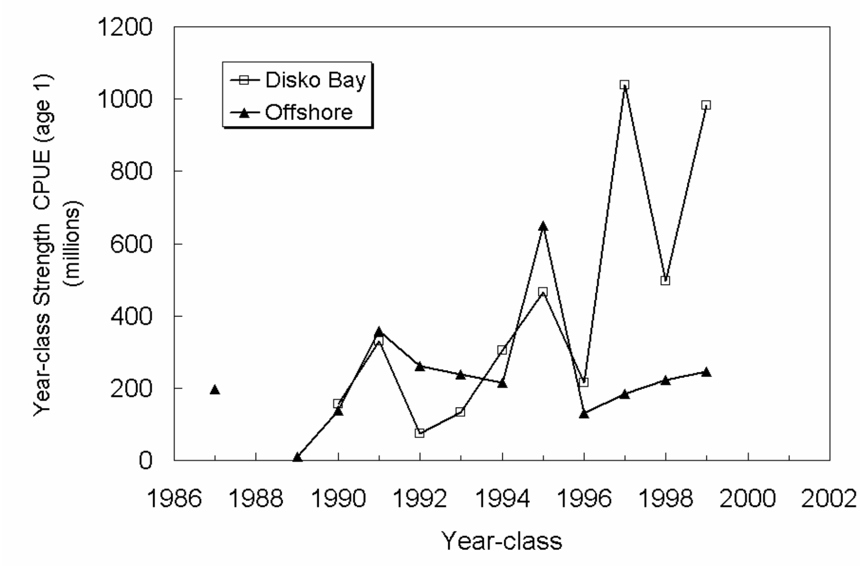


Fig. 2.2. Greenland halibut in Div. 1A: recruitment at age 1 on nursery grounds.

iii) **Biological studies**

A review of the tagging experiments in West Greenland in the period 1986-98 was given in the 1999 assessment. Tagging of inshore Greenland halibut in Div. 1A was continued in 1999 and 2000, but data were not available for review.

Estimation of sexual maturity of Greenland halibut continued in the summer 2000 and confirmed earlier studies. Maturity increased with fish size but maturity was, compared to other known spawning areas, considerably lower for fish of the same size. A study on Greenland halibut collected from the fishery on maturity covering the entire year was initiated in 1998 and may clarify the extent of the inshore spawning.

iv) **Others studies**

A length weight condition index was presented (SCR Doc. 01/68). Condition has been relatively stable throughout the time series without any significant trend in any of the three stock components.

Methodological aspects of the Greenland halibut longline survey was 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**. An exploratory VPA carried out for the Disko Bay population. The VPA was only considered indicative of trends in fishing mortality and stock size. Estimate of fishing mortality has shown a generally increasing trend from late-1980s to present.

Survey results from 1993 onwards do not indicate any major changes in abundance. Mean length composition in the survey has been stable in recent decade. The survey in 2000 did, however, show a decline in mean length in Torssukataq. 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 onwards do not indicate any major changes in abundance. 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 to 1999 have fluctuated without trend but the 2000 survey indicated reduction 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 and the stock components are considered virgin.

d) **Reference Points**

Precautionary reference points could not be given.

e) **Research Recommendations**

The high catch level of Greenland halibut in Div. 1A inshore generates concern, especially because the lack of effort data from the commercial fishery impedes the assessment of the stocks. Voluntary logbooks were introduced in 1999. However, at present they only account for 2% of the landings. STACFIS **recommended** that *for the Greenland halibut commercial fishery in Div. 1A action should be continued to obtain further effort information from the commercial fishery.*

STACFIS **recommended** that *studies of the longline survey in Div. 1A should 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 should 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. 01/23, 01/42, SCS Doc. 01/21)

a) **Interim Monitoring Report**

A total catch of 17 tons, taken as by-catch in the fishery for Greenland halibut, was reported from 2000 compared to 43 tons in 1999 (Fig. 3.1).

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

| | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|---|---|---|---|---|
| Recommended TAC | 8.0 | 8.0 | 8.0 | 8.0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Catch | 0.12 | 0.16 | 0.12 | 0.31[1,2] | 0.12[1,3] | 0.15[1,4] | 0.03[1,5] | 0.04[1] | 0.02[1] | |

[1] Provisional.
[2-5] Includes roughhead grenadier from Div. 1A misreported as roundnose grenadier: [2]: 24 tons, [3]: 30 tons, [4]: 27 tons, [5]: 3 tons.
[4] Also includes 39 tons taken by a longliner and hence must be roughhead grenadier.

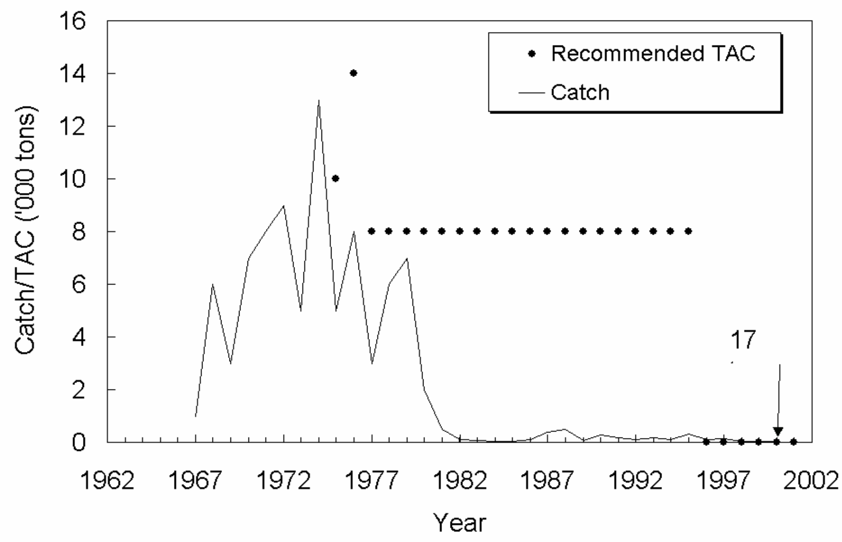


Fig. 3.1. Roundnose grenadier in Subareas 0+1: catches and TACs

In the Greenland survey in 2000 the biomass in Div. 1CD was estimated at 5 594 tons, which is the second lowest on record (Fig. 3.2). In a new survey covering Div. 0B the biomass was estimated at 1 660 tons.

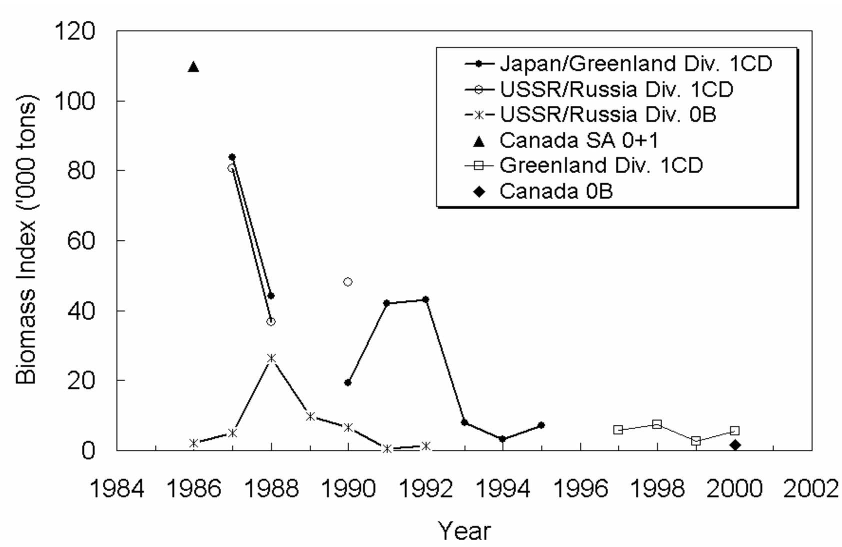


Fig. 3.2. Roundnose grenadier in Subareas 0+1: biomass estimates from USSR/Russian, Japan/Greenland, Greenland and Canadian surveys in Div. 0B and Div. 1CD.

The stock of roundnose grenadier is still at a very low level observed since 1993.

Exploitation level is considered to be low in recent years.

## 4. **Demersal Redfish (*Sebastes* spp.) in Subarea 1** (SCR Doc. 01/15, 23, 35; SCS Doc. 01/13, 21)

### a) **Introduction**

Historically, redfish were taken mainly as by-catch in the trawl fisheries for cod and shrimp. However, occasionally during 1984-86, a directed fishery on redfish was observed for German and Japanese trawlers. With the collapse of the Greenland cod stock during the early-1990s, resulting in a termination of that fishery, catches of commercial sized redfish were taken inshore by long-lining or jigging and offshore by shrimp fisheries only. There are also substantial numbers of juveniles discarded in the shrimp fishery. Since 1 October 2000, however, sorting grids are mandatory, probably reducing the amount of by-catches.

Both redfish species, golden redfish (*Sebastes marinus* L.) and deep-sea redfish (*Sebastes mentella* Travin), are included in the catch statistics since no species specific data are available. Other data suggest that until 1986, landings were composed almost exclusively of golden redfish. Subsequently, the proportion of deep-sea redfish represented in the catches increased, and since 1991, the majority of catches are believed to be deep-sea redfish.

In 1977, total reported catches peaked at 31 000 tons (Fig. 4.1). During the period 1978-83, reported catches of redfish varied between 6 000 and 9 000 tons. From 1984 to 1986, catches declined to an average level of 5 000 tons due to a reduction of effort directed to cod by trawlers of the EU -Germany fleet. With the closure of this offshore fishery in 1987, catches decreased further to 1200 tons, and remained at that low level. The estimated catch figures for 1999 and 2000 are 78 and 164 tons, respectively, representing the lowest on record.

Recent and historical catch figures do not include the weight of substantial numbers of small redfish discarded by the trawl fisheries directed to shrimp.

Recent catches ('000 tons) are as follows:

| | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|---|---|---|---|
| TAC | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 |
| Catch | 0.8 | 1 | 0.9[1] | 0.9[1] | 1[1] | 0.9[1] | 0.1[1,2] | 0.2[1,2] | |

[1] Provisional.
[2] Estimated.

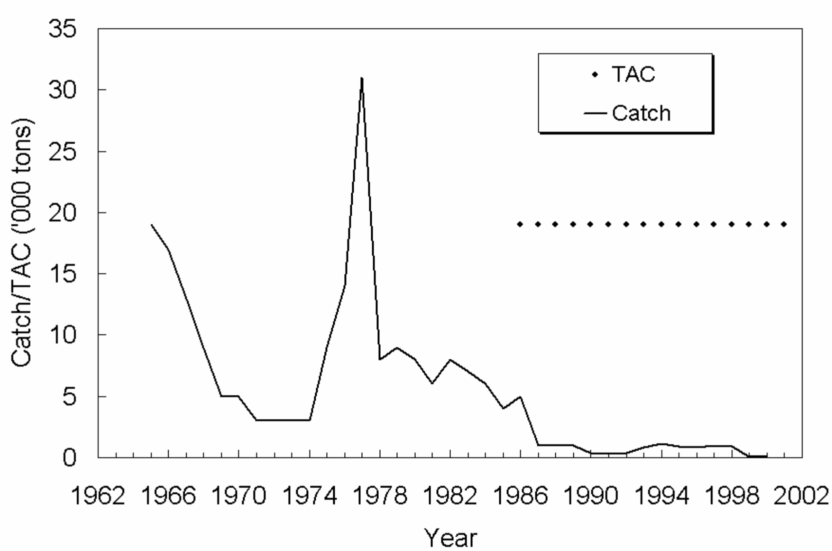


Fig. 4.1. Redfish in Subarea 1: catches and TAC.

b) **Input Data**

i) **Commercial fishery data**

No data on CPUE were available. Information on historical length composition was derived from sampling of German commercial catches of golden redfish during 1962-90 covering fresh fish landings as well as catches taken by freezer trawlers. 118 samples were quarterly aggregated and mean length was calculated. These data revealed significant size reductions of fish caught from 45 to 35 cm, with the biggest reductions occurring during the 1970s. There are no data available to estimate the size composition of historical catches of deep-sea redfish.

There was no information on by-catch in the shrimp fishery available for 2000.

ii) **Research survey data**

**EU-Germany groundfish survey.** Annual abundance and biomass indices were derived from stratified-random bottom trawl surveys commencing in 1982. These surveys covered the areas from the 3-mile limit to the 400 m isobath of Div. 1B to 1F and were primarily designed for cod as target species. Therefore, the high interannual variation in the estimates for redfish could have been caused as a result of the incomplete survey coverage in terms of depth range and pelagic occurrence of redfish. Nonetheless, the survey results indicated that both abundance and biomass estimates of golden redfish (≥17 cm) decreased by more than 90 % until 1990 and remained at that low level since then (Fig. 4.2). Estimates for deep-sea redfish (≥17 cm) varied without a clear trend but have frequently been extremely low since 1989 (Fig. 4.3). However, the 1997 estimate indicated a significant biomass increase due to recruitment. Unspecified redfish <17 cm were found to be very abundant, especially in 1986, 1991, and 1996-98 (Fig. 4.4). In 1999 and 2000, a considerable decrease was observed. Reappearing peaks at 6, 10-12 and 15-16 cm might indicate annual growth increments and represent the age groups 0, 1 and 2 years.

**Greenland-Japan and Greenland deep-sea surveys.** During 1987-95, cooperative trawl surveys directed to Greenland halibut and roundnose grenadier have been conducted on the continental slope in Div. 1A-1D at depths between 400 and 1500 m. This Greenland-Japan deep-sea survey was discontinued in 1996 but conducted again since 1997 by Greenland with another vessel and changed gear. Deep-sea redfish were mainly caught at depths less than 800 m. Despite the technical changes, the increase in stock abundance and biomass from lowest level in 1995 is consistent with other survey information (Fig. 4.3). Length measurements revealed that the size composition of the stock is presently dominated by individuals <30 cm. In 2000, the survey did not cover the shallow areas (<800 m) sufficiently. Therefore, no abundance and biomass indices were calculated.

**Greenland bottom trawl survey using a shrimp gear.** Since 1988, a shrimp survey was conducted by Greenland covering Div. 1A to 1F down to 600 m depth. Due to changes in survey strategy and sampling of fish, determinations of abundance and biomass indices and length composition were considered comparable only since 1992. Redfish was found to be most abundant in the northern Div. 1B. Abundance and biomass indices varied without a clear trend but indicated juvenile redfish to be very abundant, especially in 1994 and 1997 (Fig. 4.4). In 1998, the survey indicated a substantial decrease. In 1999 and 2000, a further decrease was observed. During the entire survey series, catches were composed almost exclusively of redfish being smaller than 20 cm.

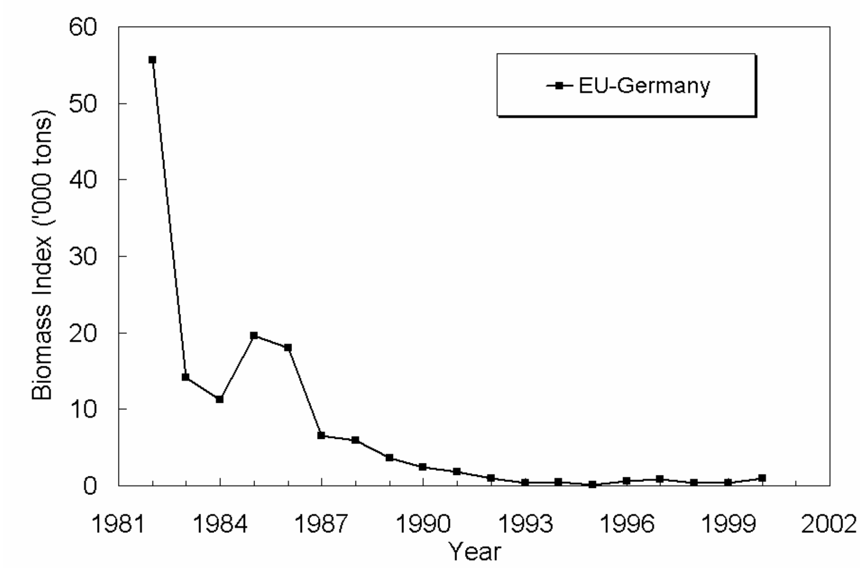


Fig. 4.2. Golden redfish in Subarea 1: survey biomass index.

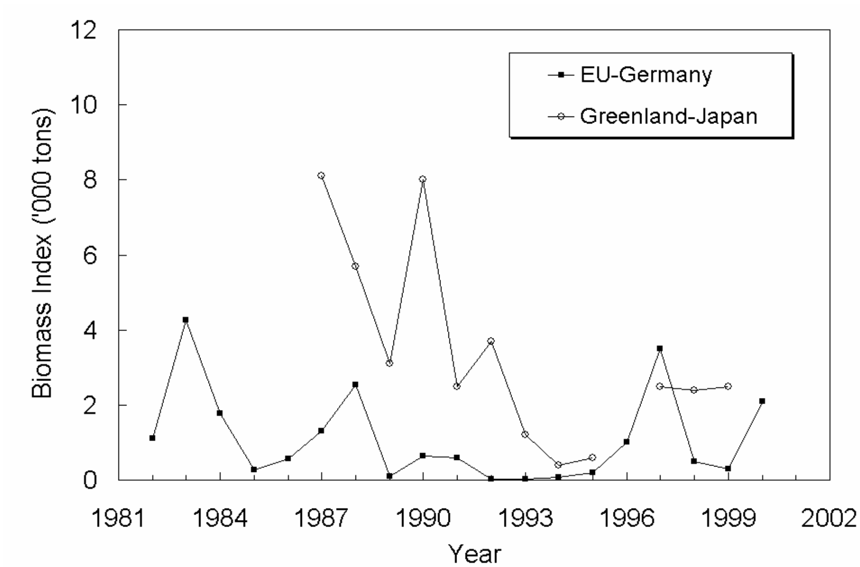


Fig. 4.3. Deep-sea redfish in Subarea 1: survey biomass indices.

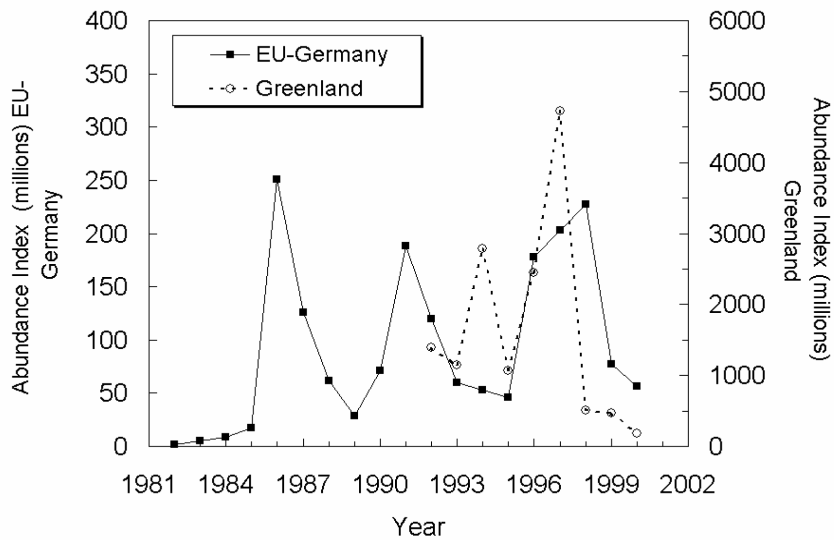


Fig. 4.4. Juvenile redfish (deep-sea redfish and golden redfish combined) in Subarea 1: survey abundance indices.

c) **Estimation of Parameters**

The golden redfish SSB was assessed assuming knife-edge maturity at 35 cm as observed in East Greenland applied to the length disaggregated abundance indices derived from the EU-Germany groundfish survey. The length groups 17-20 cm were chosen as recruitment indices. SSB and recruitment indices decreased drastically from 1982 and have remained significantly below the average level since 1989 (Fig. 4.5). Taking into account the recent very low SSB and the recruitment failure together with the absence of golden redfish in the Greenland surveys, the stock of golden redfish in Subarea 1 are considered to be severely depleted with no signs of recovery. There are indications that the probability of future recruitment is reduced at the current low SSB (Fig. 4.6).

The German survey biomass of fish ≥35 cm and the abundance of length groups 17-20 cm were taken as proxies for deep sea redfish SSB recruitment, respectively. No clear trend can de derived from these estimates but SSB has been below average since 1989 (Fig. 4.7). The recently depleted status of the SSB is confirmed by the lack of adult fish in the Greenland deepwater survey. Recruitment variation is high, and the 1996-97 estimates were above average. While the 1997 estimate represents the maximum of the time series, the 2000 recruitment index reaches about two thirds of this peak.

d) **Assessment Results**

In view of dramatic declines in survey biomass indices of golden and deep sea redfish (≥17 cm) to an extremely low level 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 although pre-recruits (<17 cm) were found to be very abundant as indicated in the surveys.

Substantial numbers of redfish caught are caught and discarded by the shrimp fishery, and concern must be expressed about the continuing failure of the juveniles to rebuild the pre-mature and mature stock components. Considering the depleted SSBs, the recruitment potential of the very abundant early life stages at an age of 0-2 years to the Subarea 1 stocks remains unclear. Recruitment indices for golden redfish have been extremely poor while those for deep-sea redfish indicate some recent increases (1997 and 2000).

The probability of recovery of the redfish stocks in Subarea 1 should increase if the by-catch taken by the shrimp fishery is reduced to the lowest level possible. The application of obligatory sorting grids since 1 October 2000 will hopefully help to reduce by-catches of young redfish.

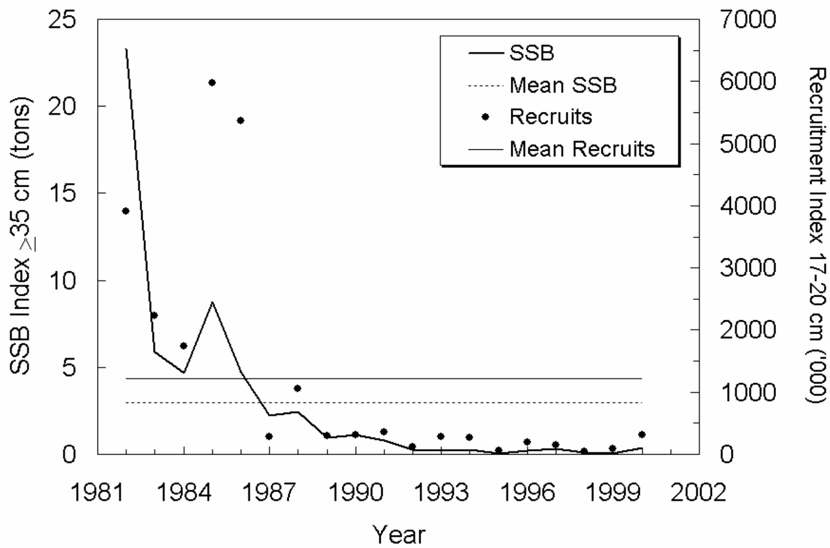


Fig. 4.5. Golden redfish Subarea 1: SSB and recruitment indices as derived from the EU-Germany groundfish survey in the given years.

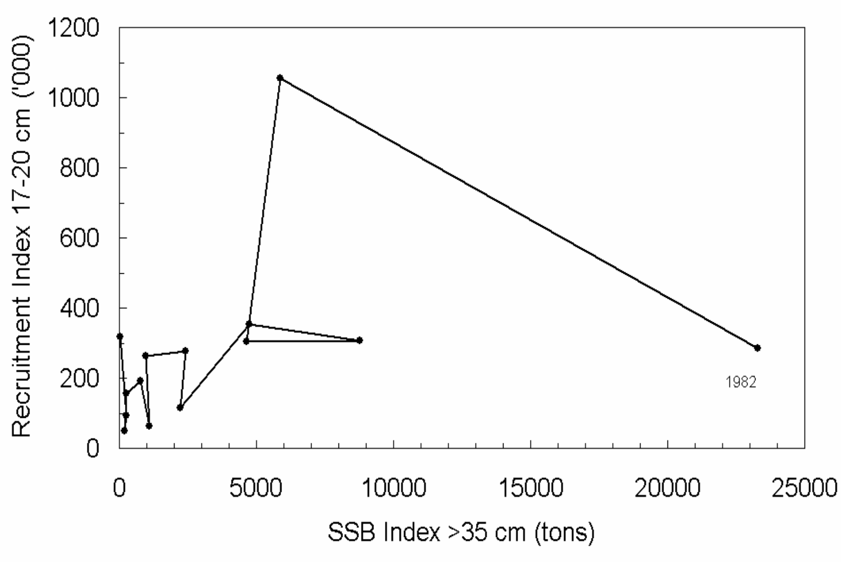


Fig. 4.6. Golden redfish Subarea 1: SSB-recruitment plot as derived from the EU-Germany groundfish survey.

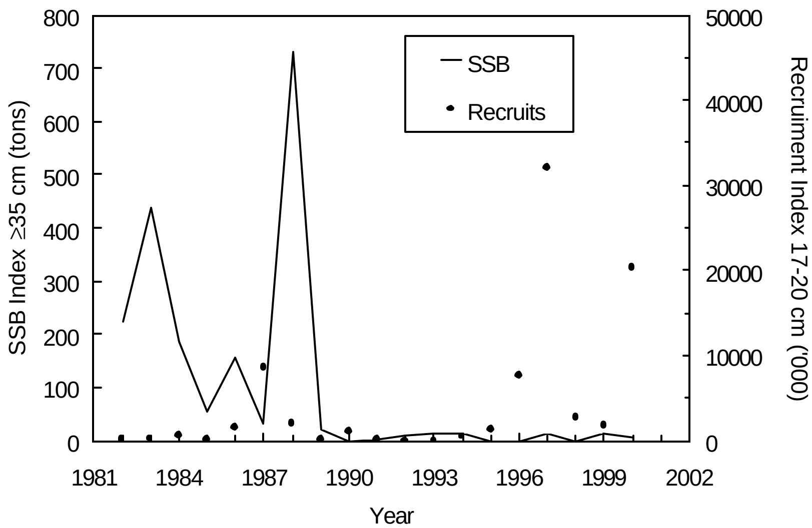


Fig. 4.7. Deep-sea redfish in Subarea 1: SSB and recruitment indices as derived from the EU-Germany groundfish survey in the given years.

e) **Reference Points**

Given the lack of long enough time-series of spawning stock and recruitment data and the uncertainties regarding reproduction and maturation of redfish in this area, STACFIS was unable to propose any limit or target reference points for fishing mortality or spawning stock biomass for the stocks of golden and deep sea redfish stocks in Subarea 1. However, given the relationship observed for golden redfish between adult biomass and recruitment, there appears to be a very high probability of decreased recruitment below biomass levels of 5 000 tons. Recent survey results indicate biomass of golden redfish remains below this level.

f) **Research Recommendation**

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. 01/17, 23, 35; SCS Doc. 01/13, 21)

a) **Introduction**

Historically, catches of Greenland cod (*Gadus ogac*), American plaice (*Hippoglossoides platessoides*), Atlantic wolffish (*Anarhichas lupus*), spotted wolffish (*A. minor*), thorny skate (*Raja radiata*), lumpsucker, Atlantic halibut (*Hippoglossus hippoglossus*) and sharks were mainly taken by offshore trawl fisheries directed to shrimp, cod, redfish and Greenland halibut. Since 1 October 2000, however, sorting grids in the shrimp fisheries are mandatory, probably reducing the amount of by-catches. Fisheries have also been prosecuted by longliners operating both inshore and offshore and by pound net and gillnet fisheries. Estimated catches of other finfish in 2000 amounted to 3 046 tons, representing a decrease of about 2 000 tons compared to the 1999 catch. This was mainly caused by the lack of catch figures for Greenland cod, which has been about 1 700 to 1 900 tons in 1997-99. While the estimated catch for lumpsucker in 2000 (3 000 tons) is of the same order as in 1999 (3 057 tons), catches of wolffish increased by 17% compared to 1999, amounting to 37 tons in 2000. Atlantic halibut catches in 2000 were estimated to be 9 tons, representing a significant increase compared to 1999 (<1 ton), but only amounting to one third to one fourth of the catches recorded in 1993-98.

The catch figures do not include the weight of fish discarded by the trawl fisheries directed to shrimp.

Nominal reported catches (tons) are as follows:

| Species | 1993 | 1994 | 1995[1] | 1996[1] | 1997[1] | 1998[1] | 1999[1] | 2000[1] |
|---|---|---|---|---|---|---|---|---|
| Greenland cod | 1 896 | 1 854 | 2 526 | 2 117 | 1 729 | 1 717 | 1 899 | no data |
| Wolffishes | 157 | 100 | 51 | 47 | 68 | 30 | 26 | 37 |
| Atlantic halibut | 43 | 38 | 23 | 34 | 22 | 22 | <1 | 9 |
| Lumpsucker | 246 | 607 | 447 | 425 | 1 158 | 2 143 | 3 057 | 3 000 |
| Sharks | 10 | 34 | 46 | 135 | | | | |
| Non-specified finfish | 411 | 643 | 618 | 609 | 1 269 | 588 | no data | no data |
| Sum | 2 763 | 3 276 | 3 711 | 3 367 | 4 246 | 4 500 | 4 983 | 3 046 |

[1] Provisional.

b) **Input Data**

i) **Commercial fishery data**

No data on CPUE, length and age composition of the catches were available. Length frequencies derived from the Greenland shrimp survey revealed that the shrimp trawl was capable of catching all predominant fish sizes. There was no information on by-catch in the shrimp fishery available for 2000.

ii) **Research survey data**

**EU-Germany groundfish survey.** Annual abundance and biomass indices were derived from stratified-random bottom trawl surveys commencing in 1982. These surveys covered the areas from the 3-mile limit to the 400 m isobath of Div. 1B to 1F, and were primarily designed for cod as target species. Biomass estimates for American plaice, Atlantic wolffish, spotted wolffish and thorny skates remained severely depleted after severe declines until 1991. Recently, some stocks have shown increased recruitment, which have not yet resulted in a significant increase in the mature biomass, e.g. American plaice, Atlantic wolffish (Fig. 5.1-5.5).

**Greenland-Japan and Greenland deep-sea surveys.** During 1987-95, cooperative trawl surveys directed to Greenland halibut and roundnose grenadier have been conducted on the continental slope in Div. 1A-1D at depths between 400 and 1 500 m. This Greenland-Japan deepwater survey was discontinued in 1996. In 1997, a Greenland survey was initiated with another vessel and changed gear. In 1999, estimates of biomass indices for American plaice were very low and amounted to 135 tons (Fig. 5.1). No data for American plaice for 2000 were available.

**Greenland bottom trawl survey using a shrimp gear.** Since 1988, a shrimp survey has been conducted by Greenland covering Div. 1A to 1F down to 600 m depth. Due to changes in survey strategy and sampling of fish, determinations of abundance and biomass indices and length composition were considered comparable since 1992. Abundance and biomass indices of American plaice, Atlantic wolffish, and spotted wolffish were very low (Fig. 5.1). Thorny skates were mainly distributed in northern strata representing large areas causing higher abundance and biomass estimates. The stocks mentioned were dominated by juveniles as derived from length measurements.

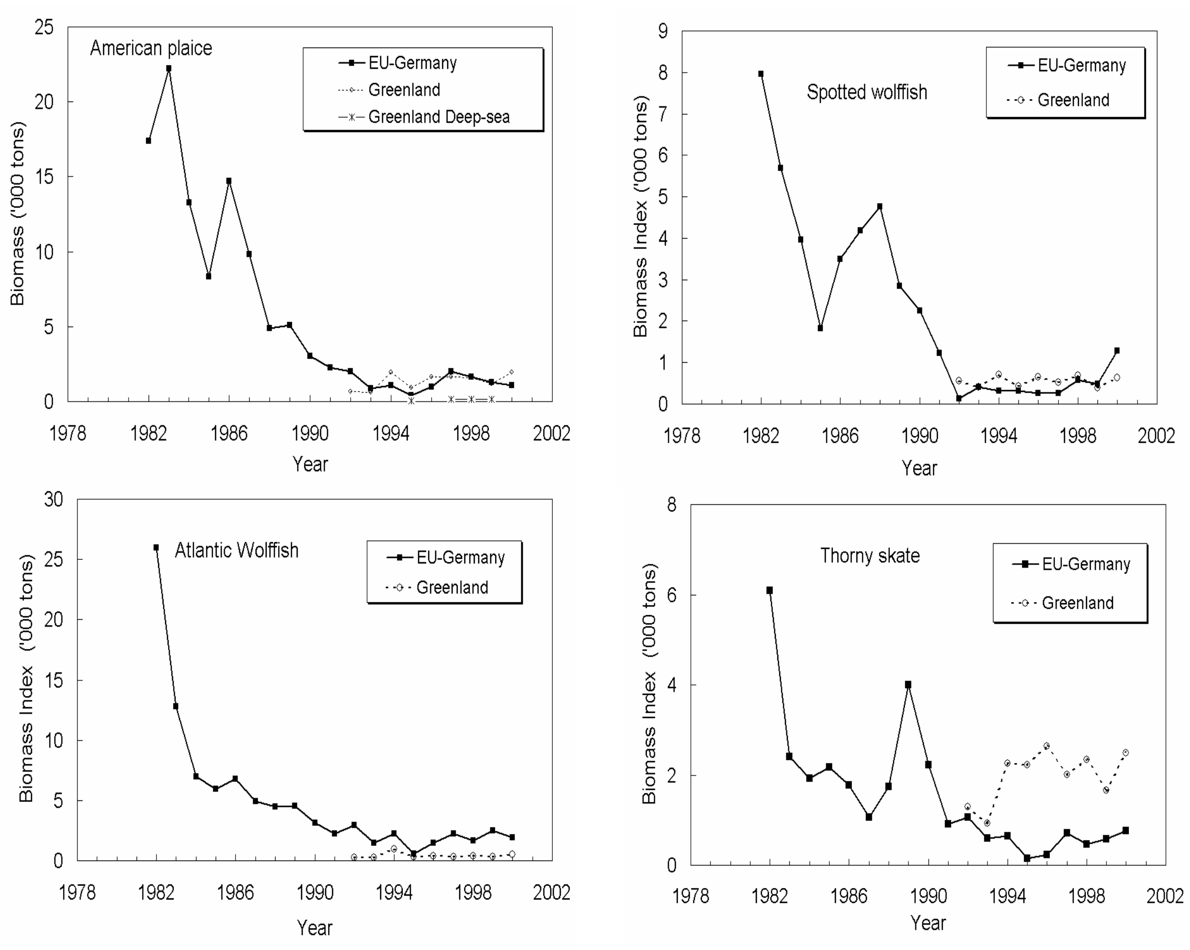


Fig. 5.1. Other finfish in Subarea 1: survey biomass indices of various finfish species.

c) **Estimation of Parameters**

American plaice SSB was derived from EU-Germany length disaggregated abundance indices to which a length-maturity ogive was applied. During 1982-91, the SSB decreased drastically to depletion without a significant increase since then (Fig. 5.2). Recruitment is presented as abundance of small fish 15-20 cm representing age group 5 and is indicated to have increased to the average level in 1997. Recruitment in 1999 and 2000 has been below average. Despite the average recruitment in 1997 and 1998 (1992 and 1993 year-classes), indications for reduced probability of recruitment at low SSB can be derived from the spawning stock and recruitment data (Fig. 5.3).

The estimation of Atlantic wolffish SSB and recruitment was performed in the same manner as for American plaice, i.e. using a length-maturity ogive and fish of 15-20 cm but representing 3-year-old recruits. Since 1982, the SSB decreased drastically and remained severely depleted since the early-1990s (Fig. 5.4). In contrast, recruitment increased almost continuously over the time series but varied considerably since 1995. However, the abundant recruits did not contribute significantly to the SSB (Fig. 5.5).

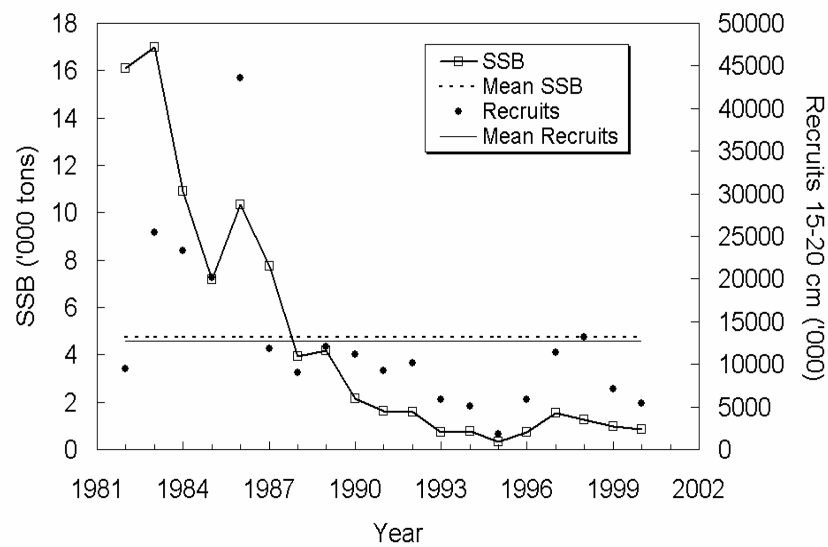


Fig. 5.2. American plaice in Subarea 1: SSB and recruitment indices as derived from the EU -Germany groundfish survey.

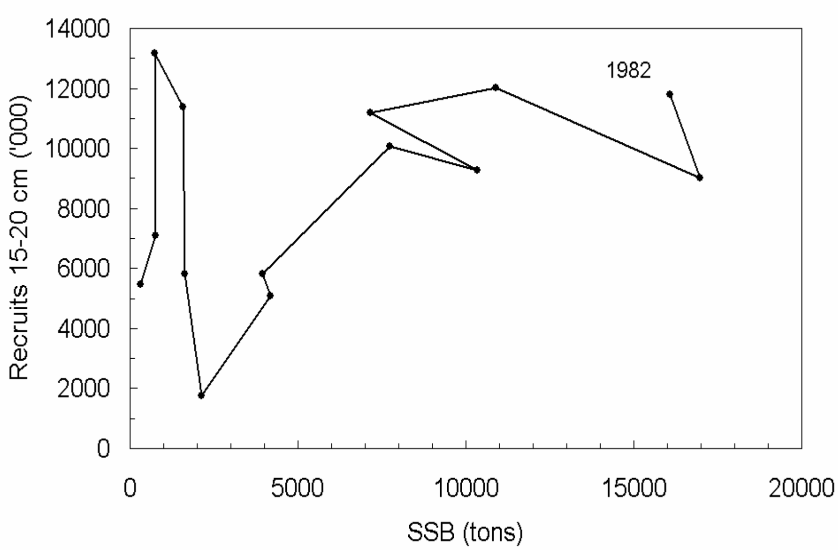


Fig. 5.3. American plaice in Subarea 1. SSB-recruitment plot as derived from the EU-Germany groundfish survey.

d) **Assessment Results**

Despite gradually increasing recruitment since the 1980s no increase in Atlantic wolffish SSB has been observed. The recent increase in recruitment of American plaice did not result in any increase in SSB. Both spotted wolffish and thorny skates have exh ibited 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.

Taking the poor stock status of American plaice, Atlantic wolffish, spotted wolffish and thorny skate into account, even low amounts of fish taken and discarded by the shrimp fishery might be sufficient to retard the recovery potential of these stocks. The continued failure 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 SA1 to the lowest possible level. The application of obligatory sorting grids since 1 October 2000 will hopefully help to reduce these by-catches.

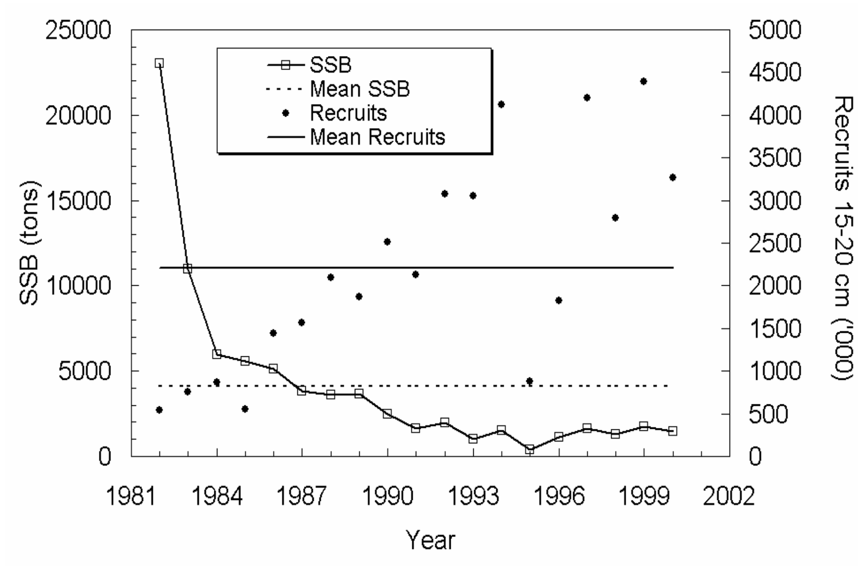


Fig. 5.4. Atlantic wolffish in Subarea 1: SSB and recruitment indices as derived from the EU-Germany groundfish survey.

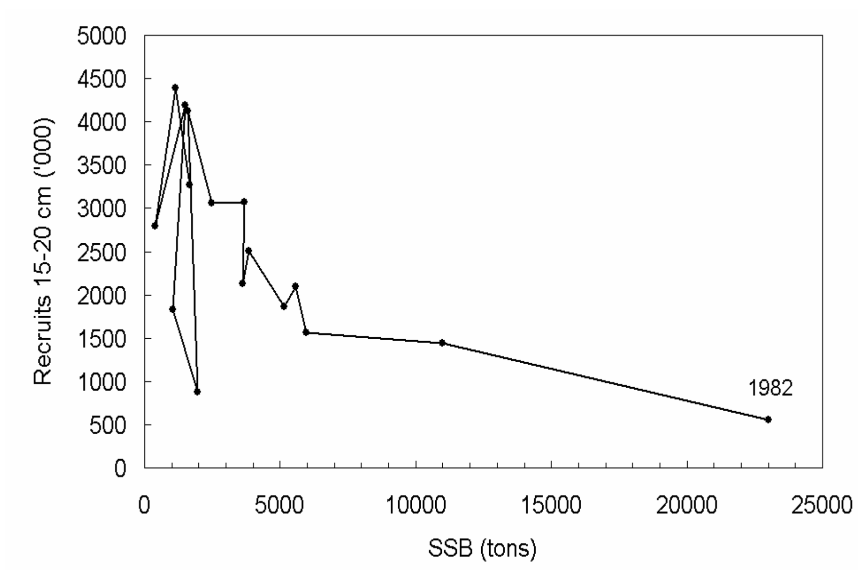


Fig. 5.5. Atlantic wolffish in Subarea 1: SSB-recruitment plot as derived from the EU-Germany groundfish survey.

e) **Reference Points**

Due to a lack of appropriate data, STACFIS was unable to propose any limit or target reference points for fishing mortality or spawning stock biomass for American plaice, Atlantic wolffish, spotted wolffish, and thorny skate in Subarea 1. Nevertheless, the current SSB levels as derived from survey results are considered far below appropriate levels of $B_{lim}$.

f) **Research Recommendation**

STACFIS **recommended** that *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*.

## B. STOCKS ON THE FLEMISH CAP

### 6. Cod (*Gadus morhua*) in Division 3M (SCR Doc. 01/22, 01/56, 01/60; SCS Doc. 01/9)

a) **Interim Monitoring Report**

The 1999 fishery was closed, and catches in that year were estimated as 353 tons, mainly attributed to non-Contracting Parties based on Canadian surveillance reports. Catches in 2000 were estimated to be 55 tons.

Recent TACs and catches ('000 tons) are as follows (see also Fig. 6.1):

| | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|---|---|---|---|---|
| TAC | 13 | 13 | 11 | 11 | 11 | 6 | 2 | 0 | 0 | 0 |
| Catch | 25.1[1] | 15.9[1] | 29.9[1] | 10.3[1,2] | 2.6[1,2] | 2.9[1,2] | 0.7[1,2] | 0.4[1,2] | 0.1[1,2] | |

[1] Includes estimates of misreported catches or catches of non-Contracting Parties.
[2] Provisional.

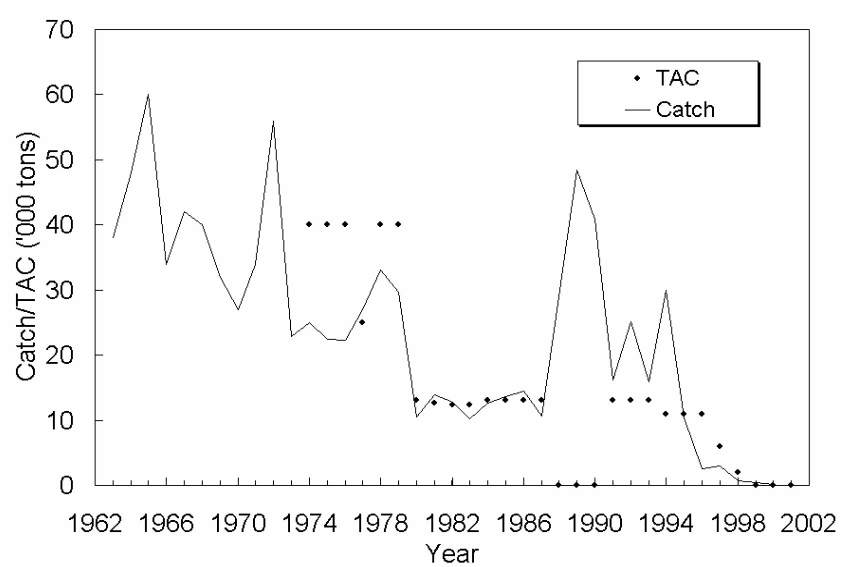


Fig. 6. 1. Cod in Div. 3M: catches and TACs.

Survey results from 2000 indicate that total biomass remain at the same low level than in 1999 (Fig. 6.2), and confirm the weakness of recruitment for the 1992 and subsequent year-classes at all observed ages.

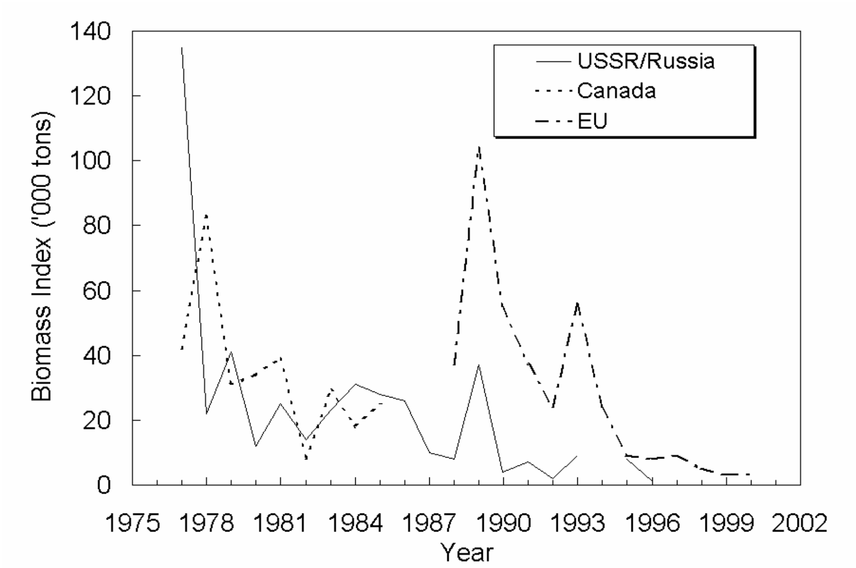


Fig. 6.2. Cod in Div. 3M: total biomass estimates from surveys.

The sequential population analysis (XSA) carried out in 2000 was updated with the new catch and survey data. The new analysis confirms the views in 2000, that stock biomass and spawning stock biomass at the beginning of 2001 remain at the lowest observed level and are mainly composed of fish 7 years old and older. The spawning stock biomass at the low current levels was not able to produce good recruitments in recent years. With the present age structure of the population it is unlikely that there will be a recovery of the stock in a short or medium terms.

7. **Redfish *(Sebastes mentella* and *Sebastes fasciatus)* in Division 3M** (SCR Doc. 01/19, 22, 45; SCS Doc. 01/09, 11, 18)

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 in Div. 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 1 000 tons was recorded mostly as by-catch of the Greenland halibut fishery. Despite low effort by Japanese fleet in 2000 (31 tons against 321 tons in 1999) there is an overall increase of the redfish catches to 3 800 tons in 2000.

The drop in the Div. 3M redfish catches from 1990 onwards 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 in the late-1980s to early-1990s (former USSR, former GDR and Korean crewed non-Contracting Party vessels). The EU (Portugal and Spain) and the Japanese trawlers took the majority of the catch until 1999. The Russian nominal catch increased from 168 tons in 1999 to 1 808 tons in 2000. Estonians vessels joined the fishery in 2000 recording 632 tons, while the EU catches increased from 505 tons in 1999 to 1 349 tons in 2000 due a nominal catch of 916 tons by EU-Portugal.

The rapid expansion, beginning in 1993, of a shrimp fishery on Flemish Cap led to high levels of redfish by-catch in 1993-94. Despite the fact that since 1995 this by-catch fell to lower levels, it is still accounting for an important portion of the catch in numbers for the most recent years. In 1998-2000 the by-catch (ages 1 to 3) represented on average 42% of the total Div. 3M redfish catch in numbers (26% just for age 2).

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

| | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|---|---|---|---|---|
| TAC | 43 | 30 | 26 | 26 | 26 | 26 | 20 | 13 | 5 | 5 |
| Catch | 43.3[1] | 29.0[1] | 11.3[1] | 13.5[1,2] | 5.8[1,2] | 1.3[2] | 1.0[2] | 1.1[2] | 3.8[2] | |
| By-catch[3] | | 11.97 | 5.90 | 0.37 | 0.55 | 0.16 | 0.19 | 0.10 | 0.10 | |
| Total catch | 43.3 | 41.0 | 17.2 | 13.9 | 6.4 | 1.5 | 1.2 | 1.2 | 3.9 | |

[1] Includes estimates of non-reported catches from various sources.
[2] Provisional.
[3] In shrimp fishery (Kulka, D., NWAFC, St. John's, Canada, *pers. comm.* 2000 and 2001).

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.

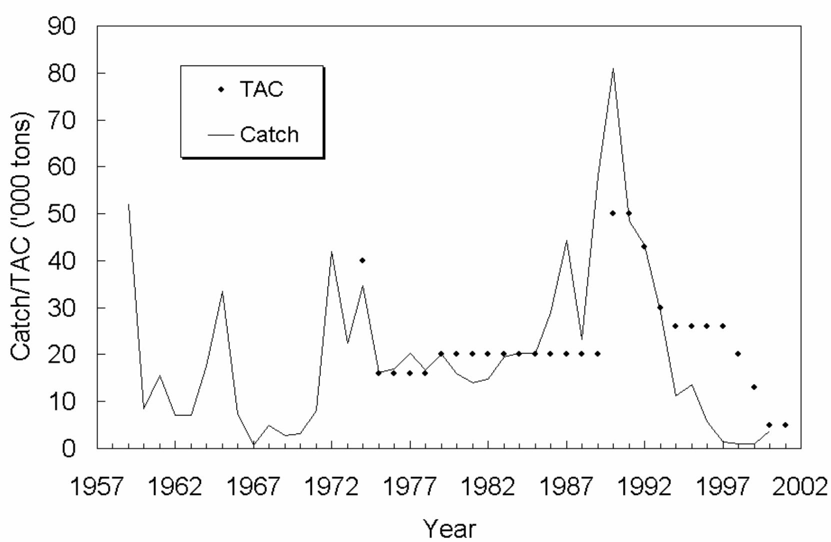


Fig. 7.1. Redfish in Div. 3M: catches and TACs.

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 bank. 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 is from the Portuguese fisheries. Length sampling data from Russia (1989-91, 1995, 1998-2000) and from the Japan (1996 and 1998) were used to estimate the length composition of the commercial catches for those fleets and time periods. The 1989-2000 length composition of the Portuguese trawl catch was applied to the rest of the commercial catches. These length compositions have been coupled with the Div. 3M beaked redfish length-weight relationship from 1989-2000 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 1993-2000 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 and for determination of mean weights-at-age using the *S. mentella* age-length keys from the 1990-2000 EU surveys. The 1990 year-class dominated catches in 2000.

**CPUE data**. A STATLANT 21B CPUE series incorporating catch and effort data for most of the components of the fishery (1959-93) 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 1979-85 and 1988-2000 respectively, and based on the Div. 3M beaked redfish length weight relationship from 1989-2000 EU survey data. Female spawning biomass was calculated applying length maturity ogives derived from data collected during the 1992-94 and 1999 surveys.

Age compositions for Div. 3M beaked redfish EU survey stock and mature female stocks 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 corresponding 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 |

**Total survey biomass and spawning biomass**. During the earlier period (1979-85), covered by the Canadian surveys, both total survey biomass and female spawning biomass of beaked redfish were stable, with female spawning biomass averaging 40% of the total survey biomass (Fig. 7.2).

The more recent period of 1988-2000, 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, then declining further in 1997 and 1998, when the lowest bottom biomass was recorded. It is however difficult to interpret this last apparent decline from 89 000 tons in 1996 to 53 000 tons in 1998 since catches at the time dropped to very low levels. This decline occurred over all age groups in the 1998 EU survey and it was probably a year effect.

Survey biomass increased again in 1999 and 2000 to 102 300 tons. Survey female spawning biomass declined during the EU survey time series until 1998 and increased since then as a result of growth of the 1990 year-class. However the female spawning biomass is still well below its former survey level.

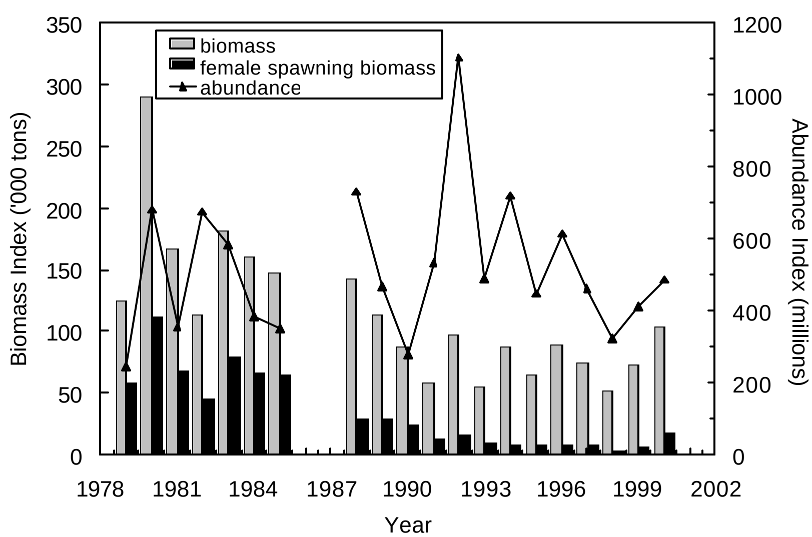


Fig. 7.2. Beaked redfish in Div. 3M: survey biomass, female spawning biomass and abundance from Canadian (1979-85) and EU (1988-2000) surveys.

c) **Estimation of Parameters**

The expected proportion of mature females found at each age (considering both sexes) for Div. 3M beaked redfish was calculated with the mean proportion of mature females found in survey stock abundance-at-age 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.

The ratios between annual STACFIS estimates of Div. 3M redfish catch plus by-catch and EU beaked redfish survey bottom biomass were considered to be an index of the mean fishing mortality during the past 12 years.

An Extended Survival Analysis (XSA) (Shepherd, 1999)[1] for the most recent period of 1989-2000 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 F and M 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 1959-2000 STACFIS catch estimates with the standardized STATLANT commercial catch and effort data (1959-93) 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 the $F_{0.1}$ given 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 1992-2000 period.

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.

From both F index derived from the ratio of commercial catch to survey biomass and XSA average F (ages 6 to 16), fishing mortality was at very high levels until 1995 and then dropped to relatively very low levels since 1997 (Fig. 7.3).

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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.

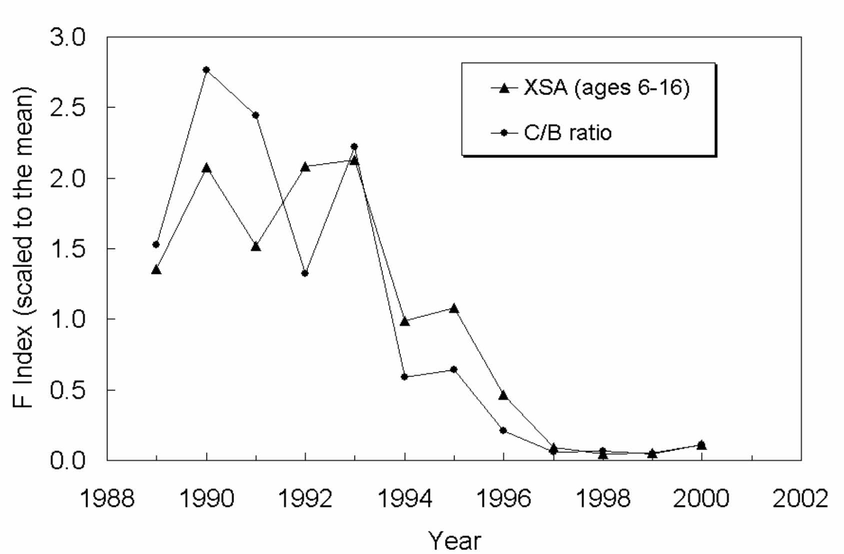



Fig. 7.3. Beaked redfish in Div. 3M: fishing mortality trends: XSA (ages 6 to 16) and catch/biomass EU survey.

Both XSA and ASPIC illustrative analyses indicated that the Div. 3M beaked redfish stock experienced a steep decline from the late-1980s that continued until 1994 (Fig. 7.4). During this former period, fishing mortality is indicated to have been above $F_{msy}$, due to the extremely high catches in the fishery (1989-93) coupled with a very high level of redfish by-catch in numbers (17-19 cm) from the Div. 3M shrimp fishery (1993-94). The observed 1989-95 high level of fishing mortality primarily affected the larger length groups in the *S. mentella* and *S. fasciatus* populations, resulting in a decline of the beaked redfish female spawning biomass to a level much lower than during the late-1970s and early-1980s, when there is evidence, from the Canadian survey bottom biomass series, that the stock experienced a period of relative stability with a proportion of about 40%. From 1997 onwards, fishing mortality has been well below $F_{msy}$.

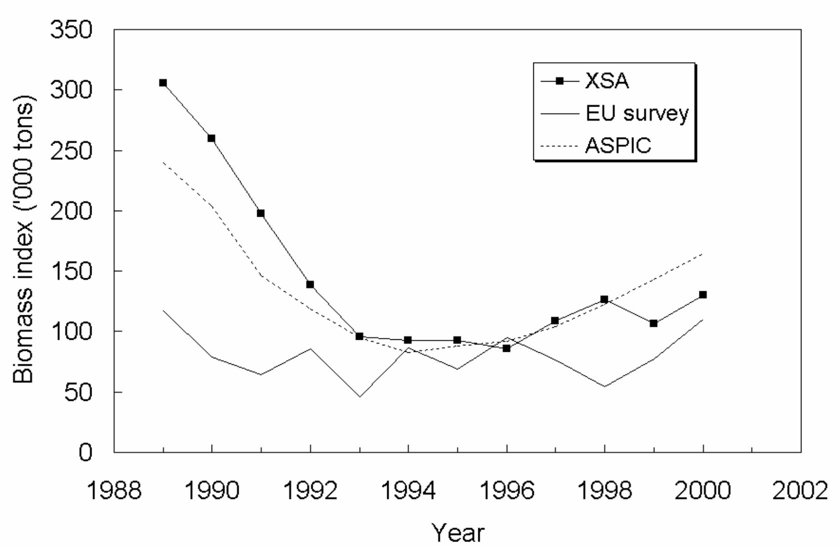



Fig. 7.4. Beaked redfish in Div. 3M: XSA and ASPIC total biomass, and EU survey bottom biomass trends.

Based on XSA, no other pulse of recruitment has occurred since 1990 and abundance at age 4 has been fluctuating over the more recent years at a low level, when compared to the average recruitment of the whole series.

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 mortality level from the most recent years, and with growth of the relatively strong 1990 year-classes, stock and spawning biomass should gradually increase.

STACFIS **recommended** that *an update of the Div. 3M redfish by-catch information be presented on a regular basis during the November assessment of shrimp in Div. 3M, 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. 01/22,38; SCS Doc. 01/09)

a) **Interim Monitoring Report**

A total catch of 133 tons was estimated for 2000 (Fig. 8.1).

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

| | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|---|---|---|---|---|
| TAC | 2 | 2 | 1[1] | 1[1] | 0 | 0 | 0 | 0 | 0 | 0 |
| Catch | 0.8 | 0.3 | 0.7 | 1.3[2] | 0.3[2] | 0.2[2] | 0.3[2] | 0.3[2] | 0.1[2] | |

[1] No directed fishin g.
[2] Provisional.

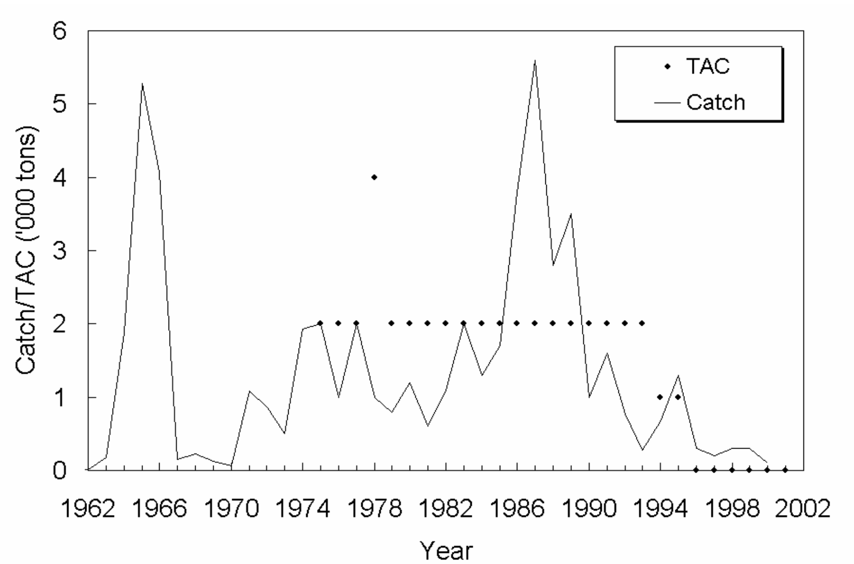



Fig. 8.1. American plaice in Div. 3M: nominal catches and agreed TACs.

The EU bottom trawl survey on Flemish Cap was conducted during 2000. The survey estimates did not alter the perception of the stock status by STACFIS.

Recruitment has been poor since the 1990 year-class. STACFIS noted that this stock continues to be in a very poor condition, with only poor year-classes expected to be recruited to the SSB for at least five years. Although the level of catches and fishing mortality since 1992 appear to be relatively low, survey data indicate that the stock biomass and the SSB are at a very low level (Fig. 8.2) and there is no sign of recovery, due to the consistent year to year recruitment failure since the beginning of the 1990s.

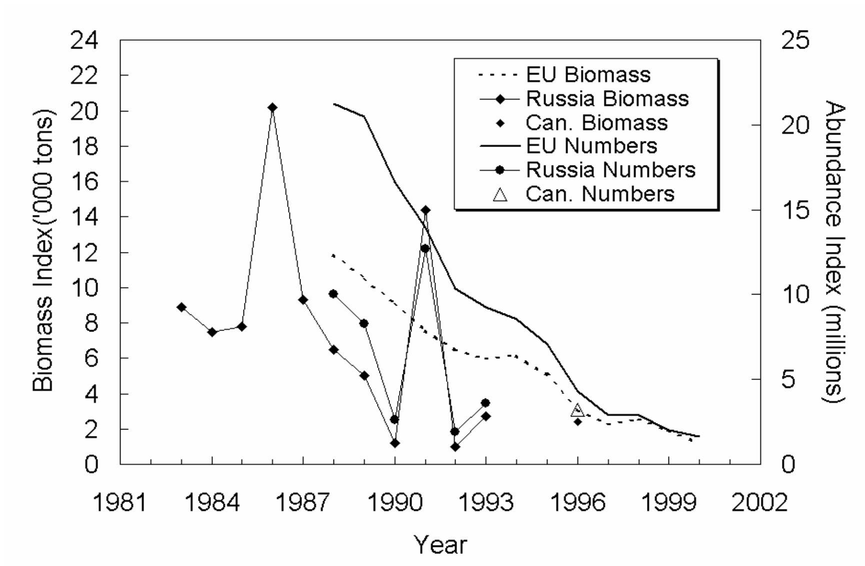



Fig. 8.2. American plaice in Div. 3M: trends in biomass and abundance indices in the surveys.

Recruits ('000) and SSB ('000 tons) EU survey index during the period 1988-2000 are as follows:

| Year | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1988 | 1999 | 2000 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SSB | 9.9 | 7.8 | 6.0 | 5.8 | 5.2 | 5.0 | 6.4 | 4.6 | 2.7 | 2.1 | 2.4 | 1.8 | 1.1 |
| Age 3 recruits | 625 | 6 847 | 775 | 911 | 679 | 1 365 | 40 | 99 | 103 | 96 | 29 | 20 | 6 |

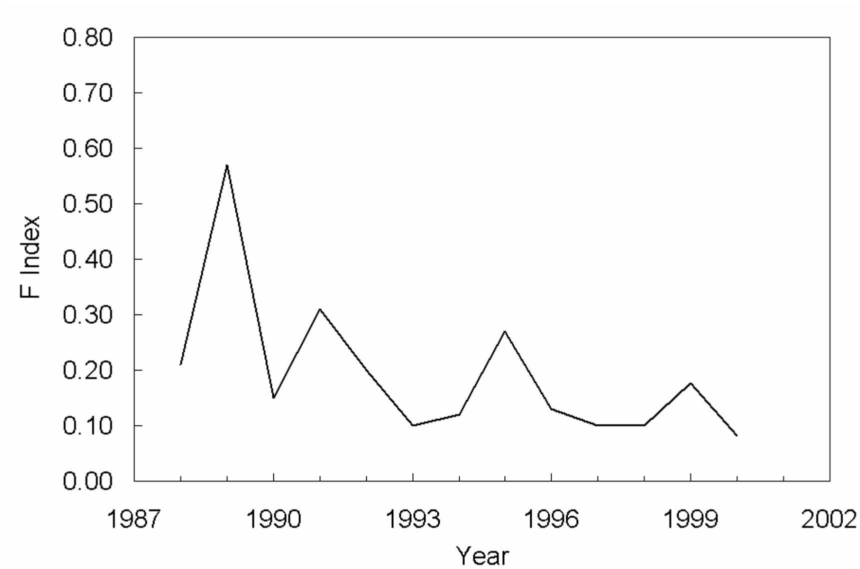



Fig. 8.3. American plaice in Div. 3M: trends in F (catch/biomass ratio).

b) **Future Studies**

Problems related to age determination were presented as a key obstacle to the use of an analytical approach for American plaice in Div. 3M. STACFIS **recommended** that *current initiatives aiming at reconciling age determination from different age readers be continued in an effort to determine the catch-at-age for American plaice in Div. 3M.* Also, efforts should be made to establish historical time series of catch-at-age and other biological information at age so that they can be used in analytical assessments. It was noted that, despite these inconsistencies in age determination, the age disaggregated information available appears to be tracking year-classes as well as the information available for many other stocks. Therefore, STACFIS **recommended** that *analytical assessments be attempted in the next assessment of American plaice in Div. 3M.*

## C. STOCKS ON THE GRAND BANK

### 9. Cod (*Gadus morhua*) in Divisions 3N and 3O (SCR. Doc. 01/67, 72, 78; SCS Doc. 01/9, 11, 18)

a) **Introduction**

Nominal catches increased during the late-1950s and early-1960s, reaching a peak of about 227 000 tons in 1967. During the period from 1979 to 1991, catches ranged from 20 000 to 50 000 tons. The continued reduction in recommended TAC levels contributed to reduced catches in recent years to a level of about 10 000 tons in 1993 (Fig. 9.1). Directed fisheries on this stock ceased about mid-year in 1994. This stock has been under moratorium to all directed fishing both inside and outside the Regulatory Area since February 1994.

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

| | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|---|---|---|---|---|
| Recommended TAC | | | | | Same as agreed | | | | | |
| Agreed TAC | 13.6 | 10.2 | 6 | nf | ndf | ndf | ndf | ndf | ndf | ndf |
| Reported Catches | 10.1 | 9 | 1.9 | 0.17[1] | 0.17[1] | 0.42[1] | 0.50[1] | 0.91[1] | 1.0[1] | |
| Non-reported Catches | 2.5 | 0.7 | 0.8 | 0 | 0 | 0 | 0.05 | 0 | | |
| Total Catches | 12.6 | 9.7 | 2.7 | 0.17[1] | 0.17[1] | 0.42[1] | 0.55[1] | 0.91[1] | 1.0[1] | |

[1] Provisional.
nf No fishing.
ndf No directed fishery and by-catches of cod in fisheries targeting other species should be kept at the lowest possible level.

All reported catches were by-catch. Catches during 2000 totaled approximately 1 050 tons.

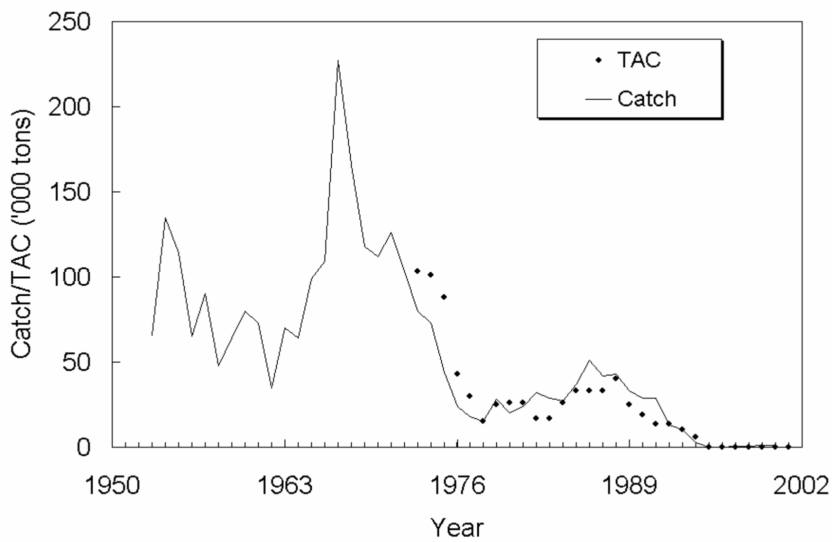



Fig. 9.1. Cod in Div. 3NO: Catches and TACs.

b) **Input Data**

i) **Commercial fishery data**

**Catch rates**. There was no catch rate information in 2000 since there were no directed fisheries for cod.

**Catch-at-age**. There was age sampling of the 1999 and 2000 by-catch in the Canadian and Russian fisheries. There was length sampling only in the Portuguese and Spanish fisheries in 1999 and 2000. In the Portuguese catch in Div. 3NO there was a modal length of 58 cm in 1999 and a mode of 43 cm in 2000. The Spanish catch in 1999 had a mode of 97 cm and a mode of 46 cm in 2000. Catch-at-age from 1999 and 2000 was produced by applying Canadian survey age length keys to length frequencies collected each year by EU-Spain and EU-Portugal. The catch in 1999 was dominated by ages 3 and 5 while in 2000 it was dominated by ages 3 and 4.

ii) **Research survey data**

**Canadian spring surveys**. Stratified-random research vessel surveys have been conducted in spring by Canada in Div. 3N for the 1971-2000 period, with the exception of 1983, and in Div. 3O for the years 1973-2000 with the exception of 1974 and 1983.

A new survey trawl (Campelen 1800) was introduced to the Canadian survey starting with the autumn 1995 survey. The survey time series was converted to Campelen equivalents from 1984 to spring 1995. Consequently, comparisons of data from previous assessments with those in the current assessment should be approached with caution.

A sharp increase in biomass occurred in 1987 but then declined until 1997 when it was the lowest observed since 1982. The biomass has increased slightly since 1997 but the estimates are still at a very low level. Abundance estimates for Div. 3NO suggested similar trends to those observed for biomass (Fig. 9.2).

Estimates-at-age indicated that there has not been a strong year-class since the 1989 and 1990 cohorts. All year-classes were at low levels in the 1999 and 2000 surveys.

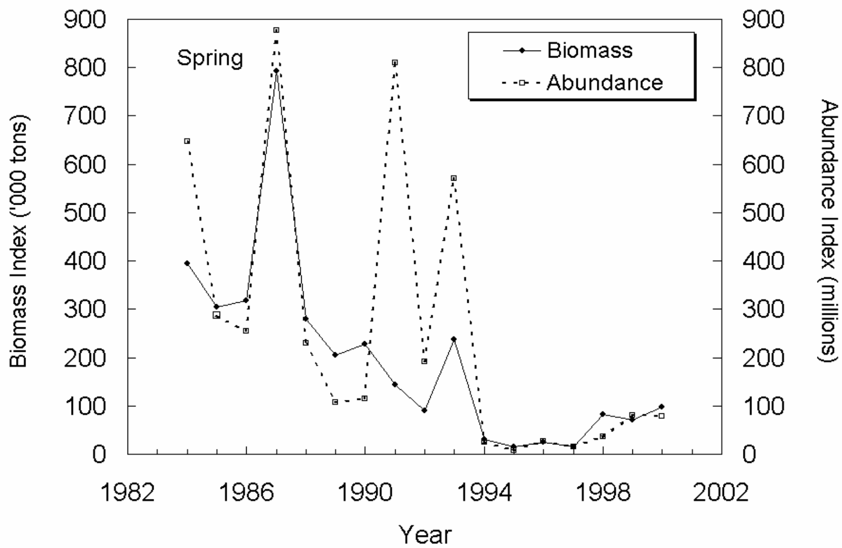



Fig. 9.2. Cod in Div. 3NO: abundance and biomass estimates from Canadian spring surveys.

**Canadian autumn surveys**. Additional stratified-random surveys have been conducted by Canada during autumn since 1990. Biomass and abundance estimates for Div. 3NO declined starting in 1991 and have remained low (Fig 9.3).

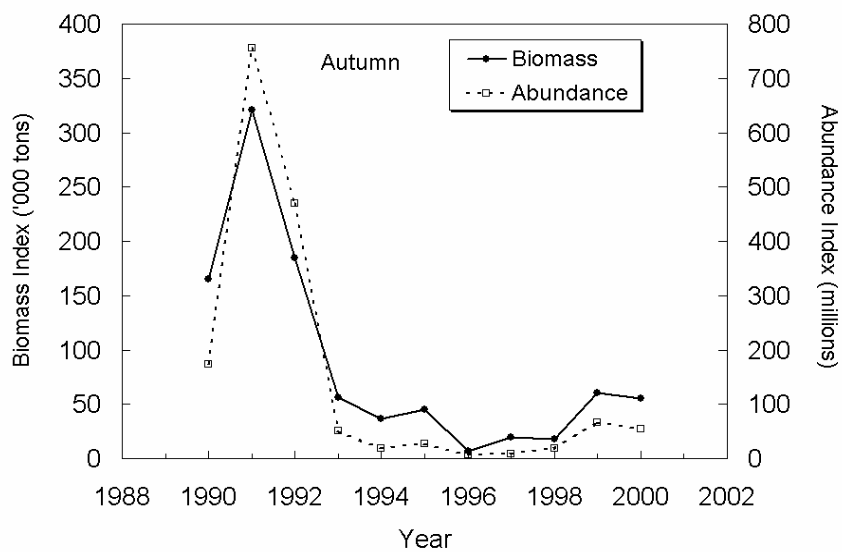



Fig. 9.3. Cod in Div. 3NO: abundance and biomass estimates from Canadian autumn surveys.

**Canadian juvenile surveys**. Canadian autumn juvenile survey data were available for the period 1989-94.

**Spanish surveys**. Stratified random surveys have been conducted by EU-Spain during spring since 1995 in the Regulatory Area of Div. 3NO. No concentrations of cod were observed.

**Russian surveys**. USSR/Russian survey data were available for the period 1977-93 but no new data have been available since that time.

c) **Estimation of Parameters**

i) **Sequential population analysis (SPA)**

An ADAPT was applied to catch-at-age calibrated with the Canadian spring, autumn and juvenile survey data to estimate population numbers in 2001. Spawner biomass estimate for 2001 is 7 500 tons (Fig. 9.4).

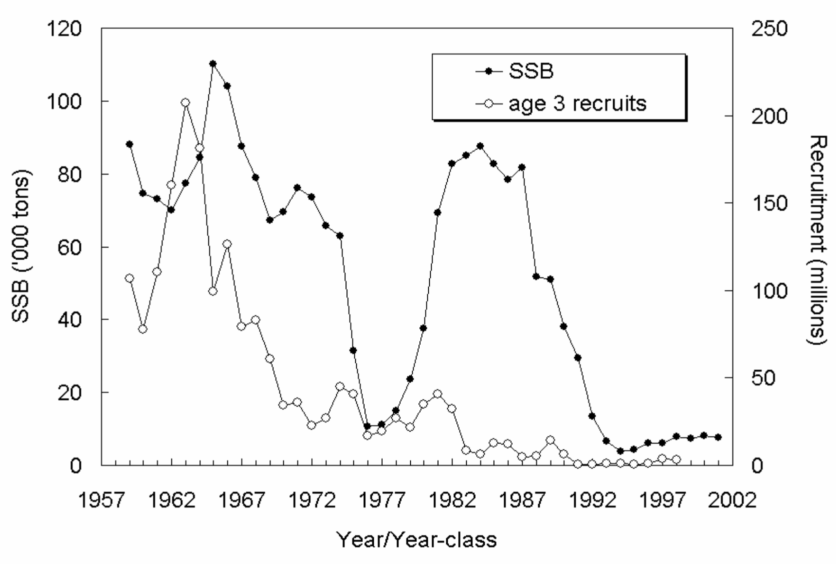



Fig. 9.4. Cod in Div. 3NO: time trend from the SPA of spawner stock biomass (SSB) and corresponding recruitment

d) **Assessment Results**

Historically fishing mortality on the fully recruited age groups (age >5) has been higher than on younger ages. In recent years there has been an increase in fishing mortality on young fish (Fig. 9.5). The fishing mortality averaged over 1999 and 2000 for ages 4 to 6 was $F_{CURRENT}$= 0.29. Estimates of recent year-class size indicates that recruitment has been almost non-existent since the 1990 year-class. Low spawner biomass, low recruitment and high fishing mortality on fish age 4 and 5 point to poor prospects for this stock in the medium term. Recovery will require a number of relatively strong year-classes that survive to maturity, rebuilding the spawner biomass.

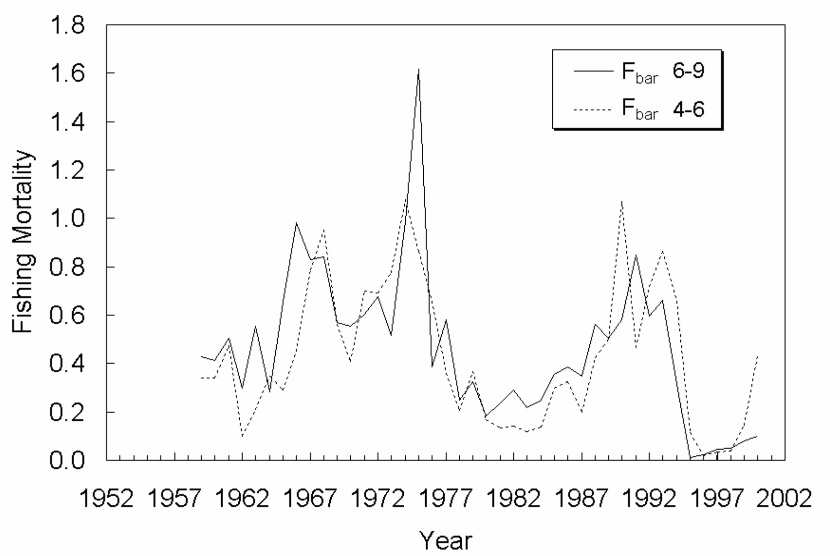



Fig. 9.5. Cod in Div. 3NO: time trend from the SPA of average fishing mortalities.

e) **Reference Points**

In April 1999 the Scientific Council concluded that 60 000 tons is the current best estimate of $B_{lim}$. In the recent period of low productivity (since 1982), there is an indication of even further reduction in recruitment at about half the $B_{lim}$ level. In view of the difficulty in determining if the current low productivity will persist in the immediate future, it was **recommended** that *for cod in Div. 3NO the Scientific Council review in detail the biological reference points in the context of the PA framework when the SSB has reached half the current estimate of $B_{lim}$.*

**Medium-term considerations**. Simulations were carried out to project the SSB for 10 years under various assumptions of spawner recruit regimes and differing levels of fishing mortality. Estimates of SSB were divided into quartiles; simulated recruitment was re-sampled within these quartiles. The simulations take into account the precision of the stock size estimates currently available.

As a result of changing by-catch selection (towards younger ages), the partial recruitment vector applied in the projections (Table 9.1) is much different to that in the 1999 assessment. In particular, the partial recruitment in the current simulation is no longer flat-topped, but domed.

Results suggest that recovery time will largely depend upon which recruitment regime prevails in the future. Fishing mortalities at the same levels observed in recent years (which were associated with by-catch in fisheries for other species) could considerably increase the recovery time of this stock (Fig. 9.6). The yield (Fig 9.7) expected under low recruitment regime is about one-tenth that expected from recruitment levels that existed in the 1960s and 1970s.

Table 9.1. Cod in Div. 3NO: input used in the projections.

| Age | Population estimate 2001 | CV | Weight, mid-year 1972-97 | Weight, start of year 1972-97 | PR 1999-2000 | Maturity 1975-97 |
|---|---|---|---|---|---|---|
| 3 | 4000 | 0.663 | 0.55 | 0.42 | 0.34 | 0.00 |
| 4 | 3160 | 0.502 | 0.92 | 0.74 | 1.00 | 0.02 |
| 5 | 536 | 0.543 | 1.42 | 1.15 | 1.00 | 0.13 |
| 6 | 98 | 0.555 | 2.15 | 1.79 | 1.00 | 0.46 |
| 7 | 364 | 0.383 | 3.12 | 2.61 | 0.27 | 0.83 |
| 8 | 286 | 0.324 | 4.45 | 3.71 | 0.31 | 0.97 |
| 9 | 104 | 0.31 | 6.42 | 5.75 | 0.22 | 1.00 |
| 10 | 55 | 0.316 | 8.00 | 7.54 | 0.22 | 1.00 |
| 11 | 288 | 0.304 | 8.99 | 8.17 | 0.13 | 1.00 |
| 12 | 466 | 0.322 | 10.90 | 11.09 | 0.17 | 1.00 |
| 13 | | | 10.53 | 10.35 | 0.17 | 1.00 |
| 14 | | | 10.89 | 10.71 | 0.17 | 1.00 |
| 15 | | | 11.28 | 11.08 | 0.17 | 1.00 |
| 16 | | | 11.67 | 11.47 | 0.17 | 1.00 |
| 17 | | | 12.08 | 11.87 | 0.17 | 1.00 |
| 18 | | | 12.50 | 12.29 | 0.17 | 1.00 |
| 19 | | | 12.94 | 12.72 | 0.17 | 1.00 |
| 20 | | | 13.39 | 13.16 | 0.17 | 1.00 |
| 21 | | | 13.86 | 13.62 | 0.17 | 1.00 |
| 22 | | | 14.35 | 14.10 | 0.17 | 1.00 |
| 23 | | | 14.85 | 15.11 | 0.17 | 1.00 |

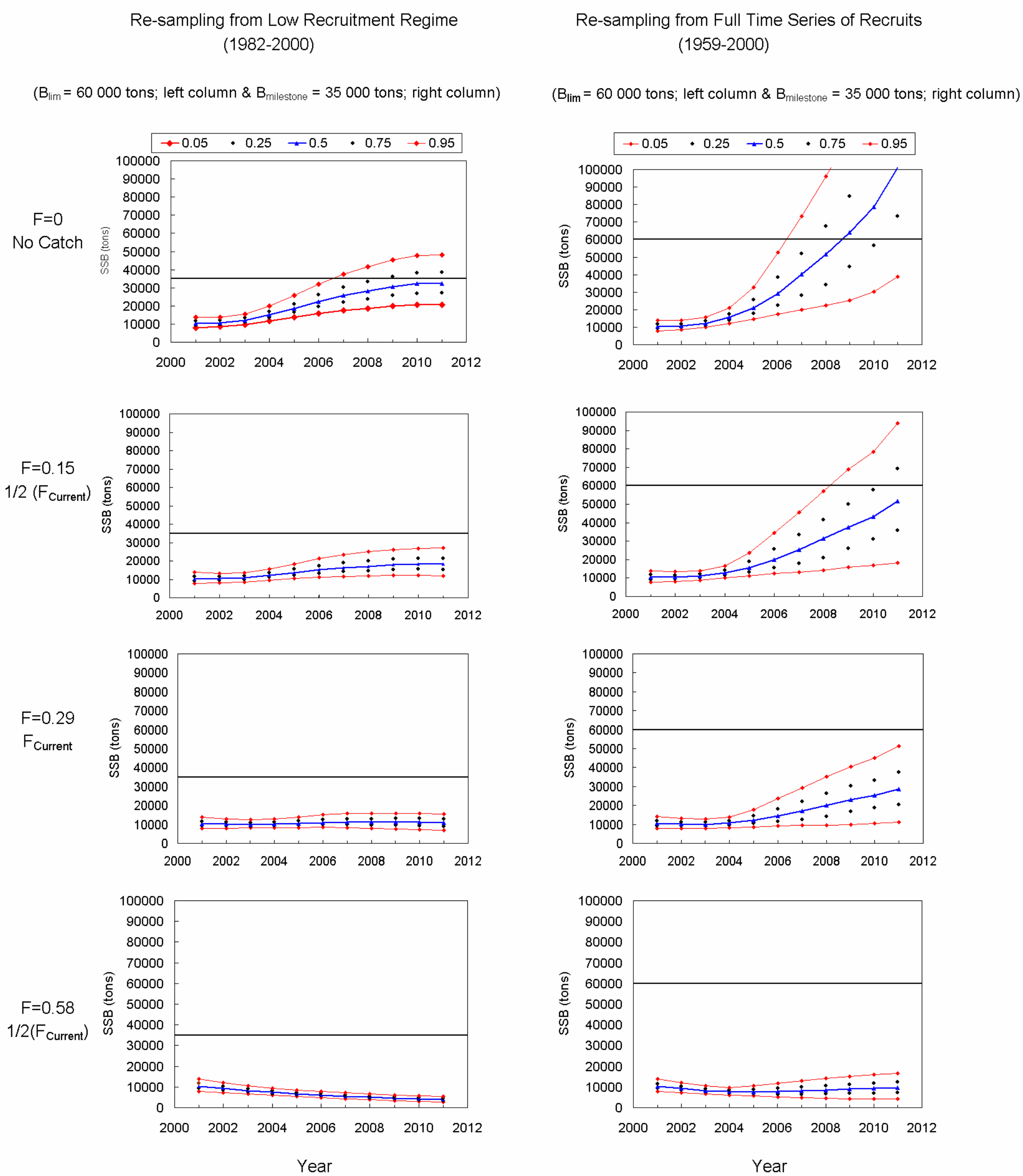



Fig. 9.6. Cod in Div. 3NO: percentiles of SSB projections.

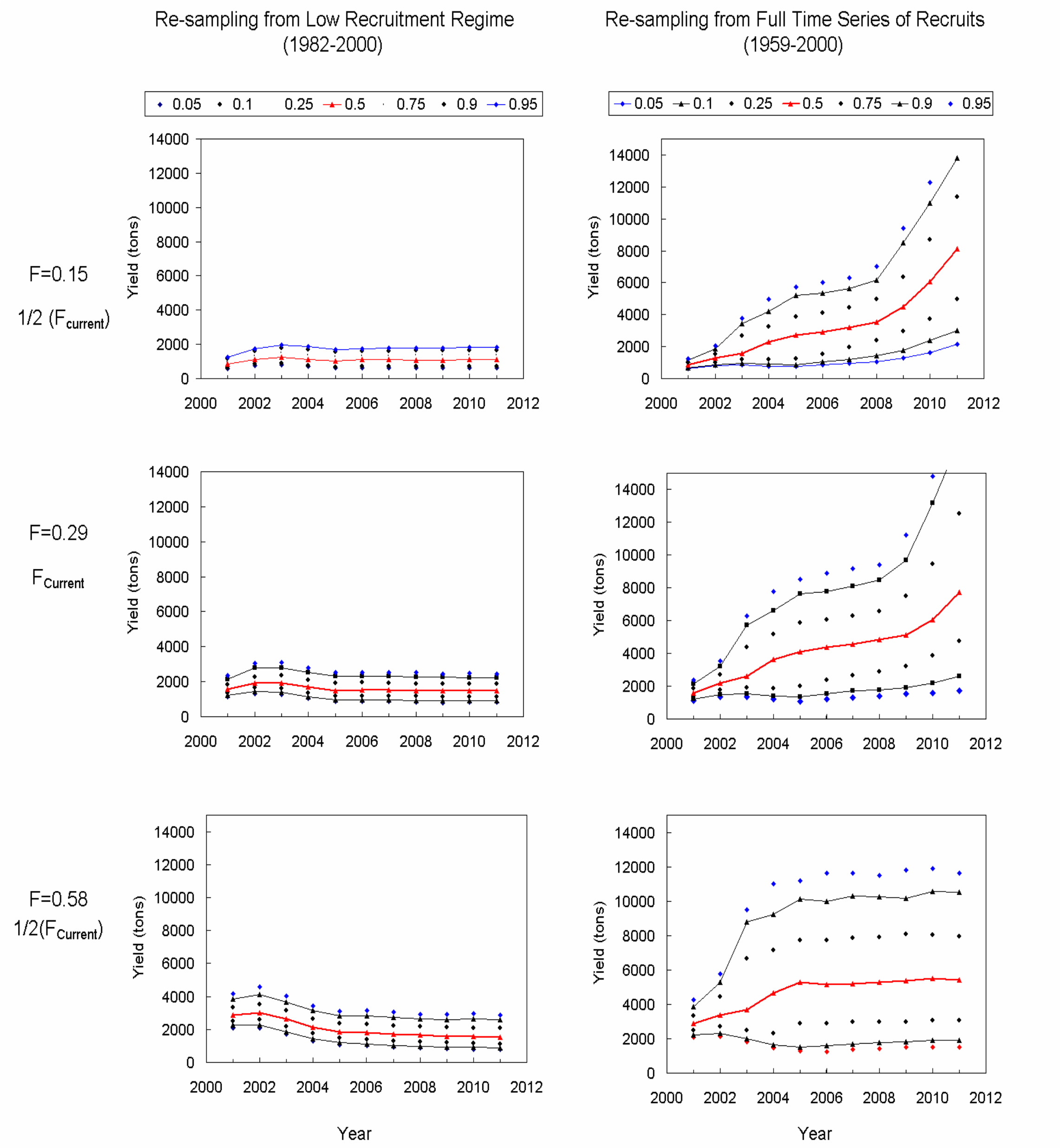



Fig. 9.7. Cod in Div. 3NO: percentiles of projected yields.

10. **Redfish *(Sebastes mentella* and *Sebastes fasciatus* ) in Divisions 3L and 3N** (SCR Doc. 01/62; SCS Doc. 01/9, 11, 18)

a) **Introduction**

There are two species of redfish that have been commercially fished in Div. 3LN; the deep-sea redfish *(Sebastes mentella)* and the Acadian redfish *(Sebastes fasciatus*). The external characteristics are very similar, making them difficult to distinguish, and as a consequence they are reported collectively as "redfish" in the commercial fishery statistics.

Surveillance sources indicate that spatial fishing patterns changed from one that concentrated in the vicinity of the Div. 3N and Div. 3O border and the slope edge in Div. 3L in the early-1980s, to one that predominated in an area southwest of the Flemish Cap at the borders of Div. 3LMN in the 1990s.

The average reported catch from Div. 3LN from 1959 to 1985 was about 22 000 tons ranging between 10 000 tons and 45 000 tons. Catches increased sharply from about 21 000 tons in 1985, peaked at an historical high of 79 000 tons in 1987 then declined steadily to about 500 tons in 1996. Catch increased to 850 tons in 1998 and has been about 2 000 tons for 1999 and 2000.

In the early-1980s the former USSR, Cuba and Canada were the primary fleets directing for redfish. The rapid expansion of the fishery in 1986 and continued high catch in 1987 and 1988 was due to new entrants, primarily EU-Portugal and various non-Contracting Parties (NCP), most notably South Korea, Panama and Cayman Islands. These countries began to fish in the Regulatory Area and accounted for a catch of about 24 000 tons. In the period from 1988 to 1994 NCPs took between 1 000 tons and 19 000 tons annually; however, NCPs have not fished in Div. 3LN since 1994.

In the years prior to the moratorium in 1998, a number of countries had reduced effort substantially on Div. 3LN. The reasons for the reduced effort was varied amongst the fleets involved. Cuba did not fish from 1993 to 1997 because of poor yield with the current regulated mesh size of 130 mm. The Baltic countries reduced their fleet between 1995-97 and directed toward shrimp in Div. 3M. EU-Portugal directed predominantly to Div. 3O redfish since 1994 because of insufficient quota in Div. 3LN and also targeted other species in the NAFO Regulatory Area. Russia, affected by economical problems, reduced its directed effort in 1996. The Canadian fleet has not fished in this area recently because of poor yields.

The directed fishery occurred during the first half of the year in Div. 3L but mostly from April to September in Div. 3N. The bottom trawl was the predominant gear in the fishery in the 1980s. The fleets fishing the Div. 3LMN border on the "Beothuk Knoll" probably accounted for most of the mid-water trawl catch.

From 1980 to 1990 the TAC each year was 25 000 tons. The TAC was reduced to 14 000 tons for 1991 and maintained at that level through 1995. The TAC was reduced again in 1996 at 11 000 tons and maintained at that level in 1997. A moratorium on directed fishing was implemented in 1998. In an 8-year period from 1986 to 1993, TACs were exceeded annually. In some years catch was double (1988) and even triple (1987) the agreed TAC. In the three years prior to the moratorium (1995-97), there was no sustained effort toward redfish.

Nominal catches and TACs ('000 tons) for redfish in the recent period are as follows:

| | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|---|---|---|---|---|
| TAC | 14 | 14 | 14 | 14 | 11 | 11 | 0 | 0 | 0 | 0 |
| Catch[1] | 27 | 21[3] | 6[3] | 2[2] | .5[2] | .6[2] | .9[2] | 2.3[2] | 1.7[2] | |

[1] Includes catch estimated by STACFIS for 1992-94.
[2] Provisional.
[3] STACFIS could not precisely estimate the catch. Figures are midpoint of range of estimates.

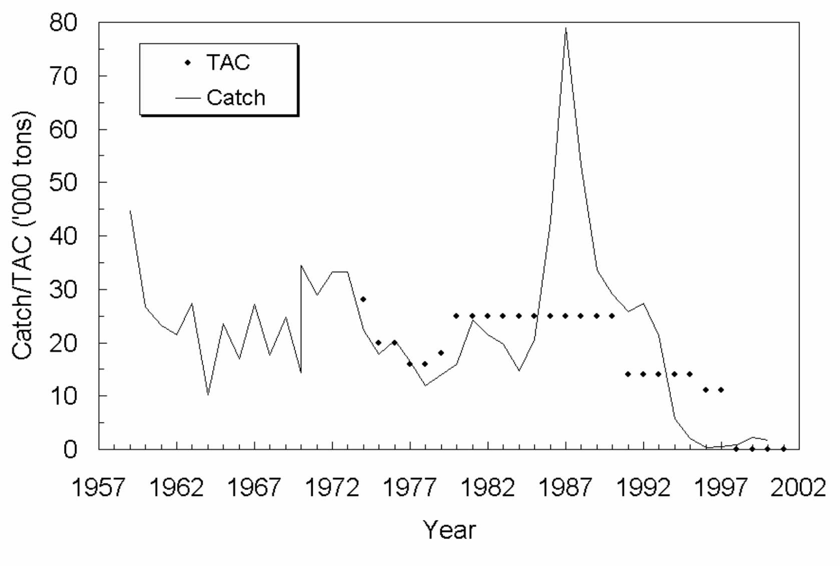



Fig. 10.1. Redfish in Div. 3LN: catches and TACs.

b) **Input Data**

i) **Commercial fishery data**

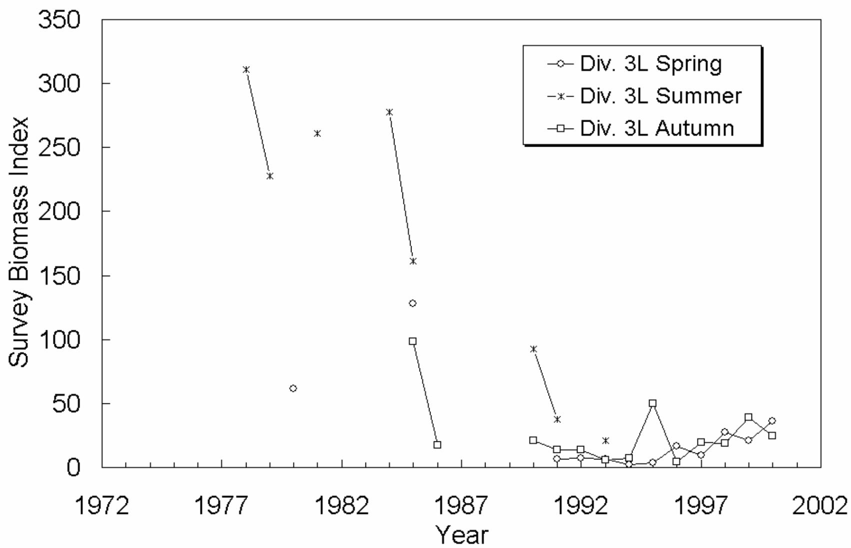
STACFIS reiterated its point of view that the commercial CPUE data are not reflective of year-to-year changes in population abundance *(NAFO Sci. Coun. Rep*., 1996, p. 72), although they may be indicative of trends over longer periods of time. The annual update for the standardized catch-rate series provided little new information because of low catches in recent years prior to the moratorium on directed fishing in 1998. These indices of abundance are of little value in determining current stock status.

Sampling of redfish as by-catch was conducted by EU-Portugal and Russia in Div. 3LN and EU-Spain in Div. 3L from the 2000 trawl fisheries primarily for Greenland halibut. The compilation of annual catch at length suggested similar size distribution for each country in Div. 3L. The catch was dominated by lengths between 26-34 cm with a mode at 28 cm for Portuguese catches, a mode at 29 cm for Spanish catches and a mode at 30 cm for Russian catches. In Div. 3N, the bulk of the Russian catch ranged between 28-34 cm with a mode at 30 cm. The Portuguese fishery sampled *S. mentella* and *S. marinus* separately. The majority of *S. mentella* catch ranged from 27-32 cm with a mode at 30 cm. The bulk of the *S. marinus* catch ranged between 22-28 cm with a mode at 24 cm.

ii) **Research survey data**

Stratified-random surveys have been conducted by Canada in Div. 3L in various years and seasons from 1978 to 2000 during which strata down to a maximum depth of 732 m (400 fathoms) were sampled. Until the autumn of 1995 these surveys were conducted with an Engels 145 high lift otter trawl. Starting in the autumn 1995 survey, a Campelen 1800 survey trawl was used. The Engel data were converted into Campelen equivalent units in the 1998 assessment (*NAFO Sci. Coun. Rep*., 1998, p. 76).

Results of bottom trawl surveys for redfish in Div. 3L indicated a considerable amount of variability. This occurred between both seasons and years. Although it is difficult to interpret year to year changes in the estimates, in general, the spring survey biomass index (Fig. 10.2, upper panel) from 1992 to 1995 suggests the stock was at its lowest level (average 5 000 tons) relative to the time period prior to 1986 for surveys conducted in the first half of the year (winter/spring average 93 000 tons). A similar contrast occurs in the autumn survey biomass index from 1992 to 1995 (average 19 000 tons) relative to a time period prior to 1986 for surveys conducted in the second half of the year (summer/autumn average 248 000 tons). From 1996 to 2000 the spring biomass index has fluctuated around a higher biomass level (average 22 000 tons) than the 1992-95 period (average 5 000 tons). The autumn index also shows a similar increase from 1996 to 2000 (average 21 000 tons) as compared to 1992-95 (average 19 000 tons). The increase is less apparent because of the relatively large 1995 index (50 000 tons) used in the averaging.



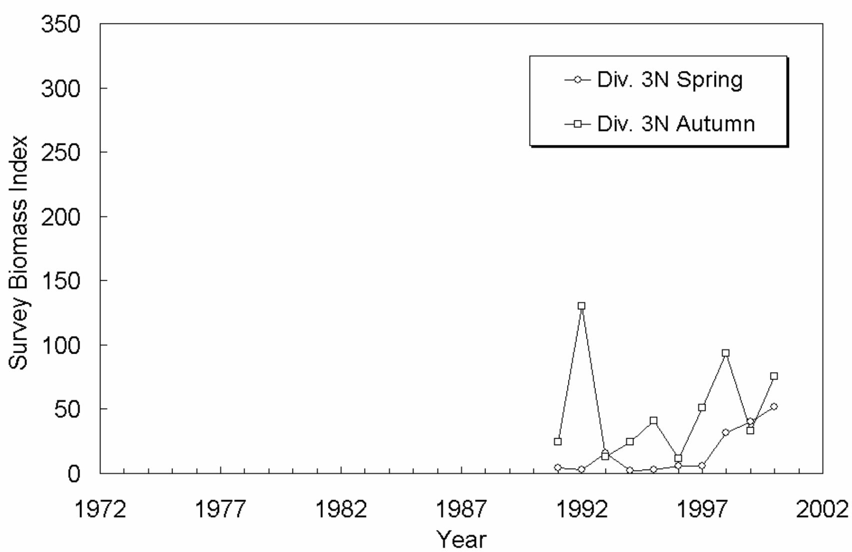




Fig. 10.2. Redfish in Div. 3LN: survey biomass indices from Canadian surveys in Div. 3L and Div. 3N in Campelen equivalent units for surveys prior to autumn 1995.

Canadian surveys have also been conducted in Div. 3N in spring and autumn from 1991-2000 and in summer in 1991 and 1993. These surveys also utilized the Campelen survey trawl beginning in the autumn of 1995. The Engel data prior to autumn 1995 were also converted into Campelen equivalents. Survey biomass and abundance estimates were generally higher in Div. 3N than in Div. 3L, but there was greater between survey variability than in Div. 3L. The source of this variability is unclear but is likely due to availability to the trawl gear or possible migrations between Div. 3N and Div. 3O rather than real changes in population abundance. In any case, abundance in the surveys is higher during the autumn surveys than in the spring.

The average survey biomass index for the spring surveys from 1991-95 is about 6 000 tons (Fig. 10.2, lower panel). The average of the index from 1996-2000 is about 27 000 tons. This average is highly influenced by three or four large sets that have occurred among the 1998-2000 surveys. In spite of this caution, there does appear to be an increase since 1996. For the autumn series the 1991-94 biomass index ranged from 13 000 tons to 123 000 tons (average 46 000 tons) compared to 1995-2000 which ranged from 11 000 tons to 94 000 tons (average 51 000 tons). The autumn series since 1996 is highly variable.

There have been no Russian surveys conducted in Div. 3L since 1994 or in Div. 3N since 1993. A comparison of the Canadian and Russian bottom trawl surveys in Div. 3L indicated a similar decline in biomass estimates from 1984 to 1990 and both indices remained at this relatively low level through 1994. It was noted, however, that the 1994 Russian survey did not cover the entire Div. 3L area. The Canadian spring and autumn indices have shown a gradual increase since 1996 but is still low compared to the pre-1985 period.

In Div. 3N, the Russian surveys indicated a relatively stable biomass from 1989-91 followed by an increase in 1993. This large increase in 1993 relative to 1991 was highly influenced by the trawling conducted in one stratum, which accounted for 70% of the biomass but only represented about 9% of the area surveyed.

iii) **Recruitment**

Length distributions from Canadian surveys in various seasons in Div. 3L indicated there has been relatively poor recruitment since the mid-1970s. There has been no sign of any good recruitment in the recent surveys up to autumn 2000.

Length distributions from spring and autumn Canadian surveys in Div. 3N from 1991-2000 generally showed smaller fish compared with Div. 3L. There was a relatively good pulse of recruitment picked up in the 1991 autumn survey in the range of 12-14 cm (1986-87 year-classes) that could be tracked through to 2000 at about 22-23 cm. There is no sign of any good year-classes subsequent to this in the surveys.

c) **Estimation of Stock Parameters**

i) **Relative exploitation**

Ratios of catch to Canadian survey biomass index were calculated for Div. 3L and Div. 3N separately. Biomass was averaged over all seasonal surveys conducted in any given year. The results (Fig. 10.3) indicate that exploitation in Div. 3L was relatively low from 1978 to 1985. There is no survey information to relate to the period of high catches from 1987 to 1989. Exploitation increased from 1990 to 1991, peaked in 1992 and declined sharply by 1995 and has remained low to 2000.

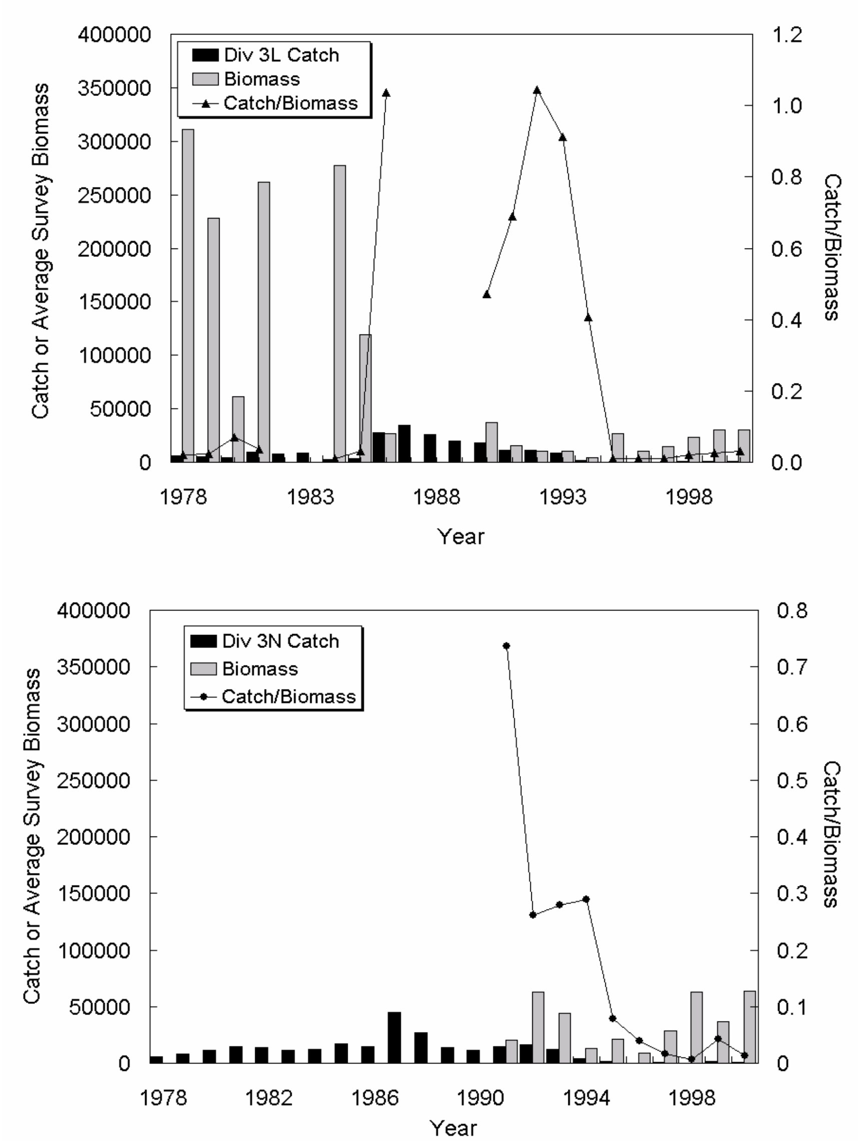



Fig. 10.3. Redfish in Div. 3LN: catch/biomass ratios for Div. 3L and Div. 3N

ii) **Size at maturity**

Maturity ogives were calculated for Div. 3L and Div. 3N separately based on data from 1978-95. The results indicate $L_{50}$ for females in Div. 3L is 30.5 cm and in Div 3N is 30.2 cm. Males mature at a much smaller size than females and there are differences between Div. 3L ($L_{50}$ = 23.9) and Div. 3N ($L_{50}$ = 20.3 cm).

d) **Assessment Results**

Interpretation of available data remains difficult for this stock. The surveys demonstrate considerable inter-annual variability, the changes frequently being the result of single large catches being taken in different years. Nonetheless, estimates from recent surveys are considerably lower than those from the 1980s indicating a reduced and low stock size. The improvement in the stock in both Div. 3L and Div. 3N, particularly since 1996, is due to growth increases from existing year-classes and not through improved recruitment. It is possible that some of the observed increase could be due to migration from Div. 3O to Div. 3N. Exploitation level is indicated to be low in the most recent period since 1995.

Poor recruitment has persisted in Div. 3L since the late-1970s. The last good recruitment in Div. 3N was from the 1986-87 year-classes. Prior to the moratorium on directed fishing in 1998, these year-classes were available to the commercial fleets but did not result in a turn around in catch levels, which remained below the TAC level. This is interpreted as another sign of low overall stock sizes.

Based on the above, STACFIS considers that the stock remains at a very low level and recruitment has been poor for more than a decade.

e) **Reference Points**

Age interpretation difficulties with redfish is a continuing problem and hampers use of age based analyses to develop meaningful reference points. At present however, it is not possible to determine limit or other reference points for either fishing mortality or biomass for redfish in Div. 3LN.

f) **Future Studies**

No new information was available to address an outstanding recommendation concerning the relationship between redfish in Div. 3LN and Div. 3O. STACFIS regards this stock issue to be important as the continuing uncertainties regarding the relationship between redfish in Div. 3LN and Div. 3O have important impacts on interpretations of available data. STACFIS again **recommended** that *(1) redfish data in Div. 3LN and Div. 3O be analyzed further to determine if a relationship exists between Div. 3LN and Div. 3O that may help in the interpretation of the indices of abundance; and (2) data be examined to evaluate the appropriateness of Div. 3LN and Div. 3O as management units for redfish*.

11. **American Plaice (*Hippoglossoides platessoides*) in Divisions 3L, 3N and 3O** (SCR Doc. 01/4, 58, 59, 70; SCS Doc. 01/9, 11, 18)

a) **Introduction**

This fishery was under moratorium in 2000. Total catch in 2000 was 5 176 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 2000 was about 622 tons, and catches by EU-Portugal and EU-Spain were 527 and 3 522 tons, respectively.

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

| | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|---|---|---|---|---|
| TAC | 25.8 | 10.5 | 4.8[1] | ndf | ndf | ndf | ndf | ndf | ndf | ndf |
| Catch | 13[2] | 17[3] | 7 | 0.6[4] | 0.9[4] | 1.4[4] | 1.6[4] | 2.5[4] | 5.2[4] | |

[1] No directed fisheries allowed.
[2] Includes estimates of misreported catches.
[3] Catch may be as high as 19 400 tons.
[4] Provisional.
ndf No directed fishing.

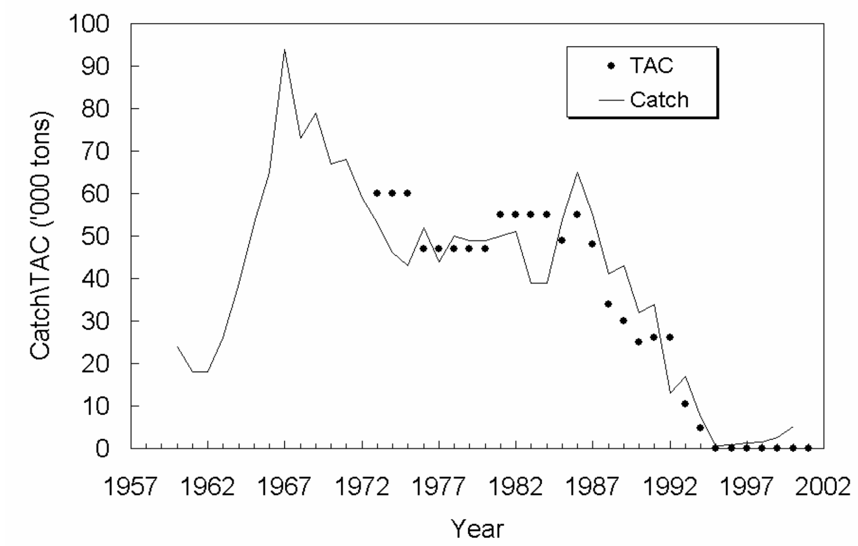



Fig. 11.1. American plaice in Div. 3LNO: catches and TACs.

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 2000 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 8 to 10. For the Spanish pair trawlers the mode in Div. 3L was 34-37 cm while in Div. 3NO in the Spanish trawler by-catch it was 38-45 cm (SCS Doc. 01/18). For the Portuguese trawler fleet most of the by-catch in Div. 3L was 30-44 cm, in Div. 3N 32-44 cm, and in Div. 3O 32-42 cm (SCS Doc. 01/9). In the Russian by-catch the bulk of the catch was made up of fish 34-36 cm in length (SCS Doc. 01/11). Total catch-at-age for 2000 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. Overall, ages 8 to 11 dominated the 2000 catch.

ii) **Research survey data**

**Canadian stratified-random groundfish surveys.** Data from **spring surveys** in Div. 3L, 3N and 3O were available from 1985 to 2000. Surveys prior to 1991 generally had a maximum depth of 366 m. From 1991 to 2000, the depth range has been extended to at least 731 m in each survey.

The 2000 biomass estimates for Div. 3L, 3N and 3O were 37 500, 56 100 and 60 200 tons, respectively. The values for Div. 3L and 3O were down slightly from 1999 while the value for Div. 3N was unchanged from the 1999 estimate. Biomass in Div. 3LNO combined has shown a slight increase since 1996 but is only 25% of that of the mid-1980s (SCR Doc. 01/59; Fig. 11.2).

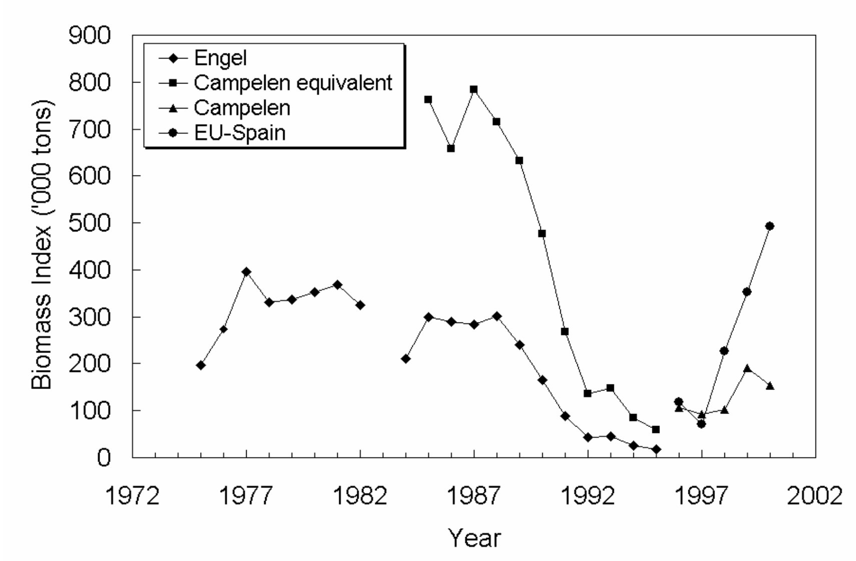



Fig. 11.2. American plaice in Div. 3LNO: biomass from spring surveys.

The total abundance has fluctuated with little trend since 1996. 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. From 1985 to 1990, about 80-85% of the stock was located north of 45 degrees, most of which was in Div. 3L. The proportion north of 45°N declined rapidly after that and since 1993 less than 50% of the biomass has been north of this latitude.

From Canadian **autumn surveys** biomass estimates in 2000 were 27 500, 180 300 and 60 200 tons for Div. 3L, 3N and 3O, respectively. These values were lower than the estimates from the 1999 autumn survey for Div. 3L and Div. 3O and higher for Div. 3N. The large biomass estimate in Div. 3N was heavily influence by a single large set in stratum 360. The overall biomass for Div. 3LNO has shown an increasing trend since 1995 (Fig. 11.3). The biomass index remained well below that of 1990 with the average of the 1999 and 2000 indices representing only 35% of that of 1990.

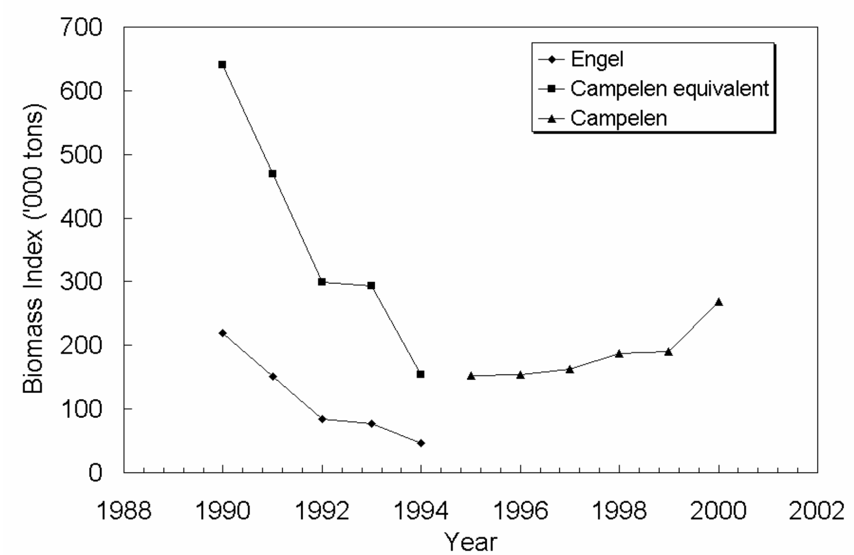



Fig. 11.3. American plaice in Div. 3LNO: biomass from autumn surveys.

**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 and biomass from the surveys have been increasing since 1998 (Fig. 11.2). In 2000, modal size of males was 30-34 cm, and 40-42 cm for females. These are similar to those observed in 1999 (SCR Doc. 01/58). STACFIS noted the progress on presenting the entire time series of survey data in a single document. STACFIS **recommended** that *in future the entire time series of abundance, biomass and length frequencies for American plaice from the surveys conducted by EU-Spain in the Regulatory Area of Div. 3NO continue to be presented in a single document*

**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 5 years (SCR Doc. 01/70).

iii) **Biological studies**

Age ($A_{50}$) and length ($L_{50}$) at 50% maturity were produced from spring RV data. Estimates were produced both by year and by cohort. For males, $A_{50}$ declined and then showed an increase in both the estimates by year and by cohort. For females, when examined by cohort, 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 has been about 8.0 years compared to 11 years for cohorts at the beginning of the time series. $L_{50}$ has been declining for both sexes since the early-1980s but has recovered somewhat in recent years for males. $L_{50}$ calculated by cohort has also declined 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.

Mean weights-at-age were calculated for male and female American plaice for Div. 3LNO using spring survey data from 1990 to 2000. Means were calculated accounting for the length stratified sampling design. There was some indication of a decline in mean weight at some ages from 1996 to 2000.

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 declined over time; the estimates indicated no substantial recruitment since 1989.

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 on older ages (5+) but has remained high on younger ages although the estimates for these ages are highly variable. 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 Z were very high from 1989 through 1996 but decreased substantially after that period.

c) **Estimation of Parameters**

Several formulations of virtual population analyses (VPA) were presented to explore the model for a retrospective pattern and for the effect of a plus group in the catch-at-age. In addition a number of analyses were presented which explored the estimation of M and the effect of an increase in M (SCR Doc. 01/4). There appeared to be no retrospective pattern. A plus group at age 15 in the catch-at-age appeared to give the best fit to the data with the ratio of F on the plus group to F on the last true age set at 1.0. The best estimate of M seemed to 0.2 on all ages except 0.53 on all ages from 1989 to 1996. STACFIS agreed that both the Canadian spring and autumn survey indices should be included in the model. The survey by EU-Spain was not included as it covers only a portion of the stock area.

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 (1995-2000) were much lower, reflecting a period of reduced catches. However, catch/biomass ratios have increased substantially in 2000, indicating an increase in fishing mortality (Fig. 11.4).

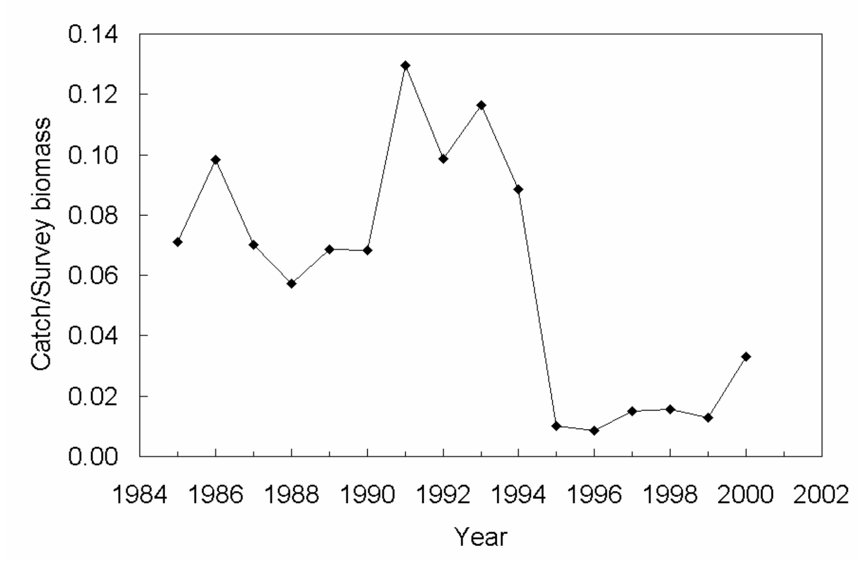



Fig. 11.4. American plaice in Div. 3LNO: catch to survey biomass ratios.

The VPA analyses showed that population abundance and biomass have declined fairly steadily over the 1975 to 1995 time period. Biomass and abundance have been relatively stable over the last number of years (Fig 11.5). Average F on ages 9 to 14 and ages 8 to 12 showed an increasing trend from 1975 to 1992. 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 and 2000 average F on ages 9-14 was above 0.2. In 2000 F on all ages greater than 9 was above 0.2 and in many instances above 0.25 (Fig. 11.6).

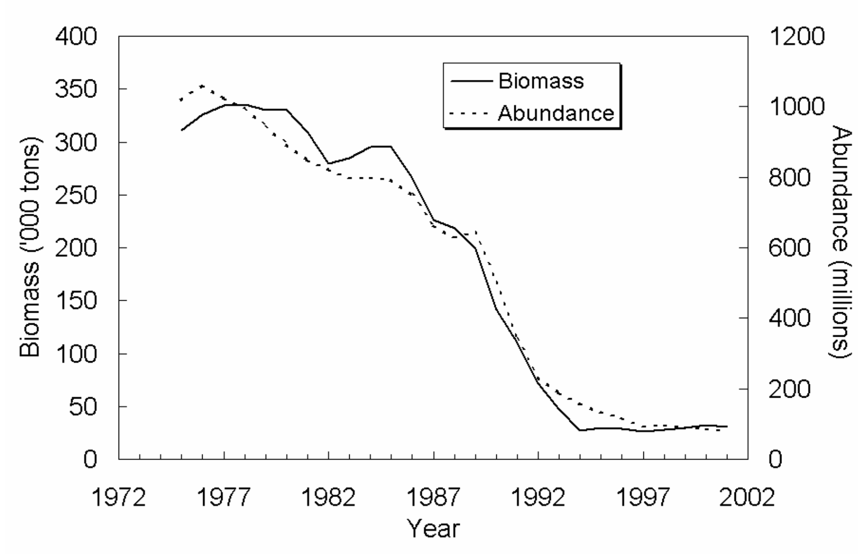



Fig. 11.5. American plaice in Div. 3LNO: Population abundance and biomass from VPA

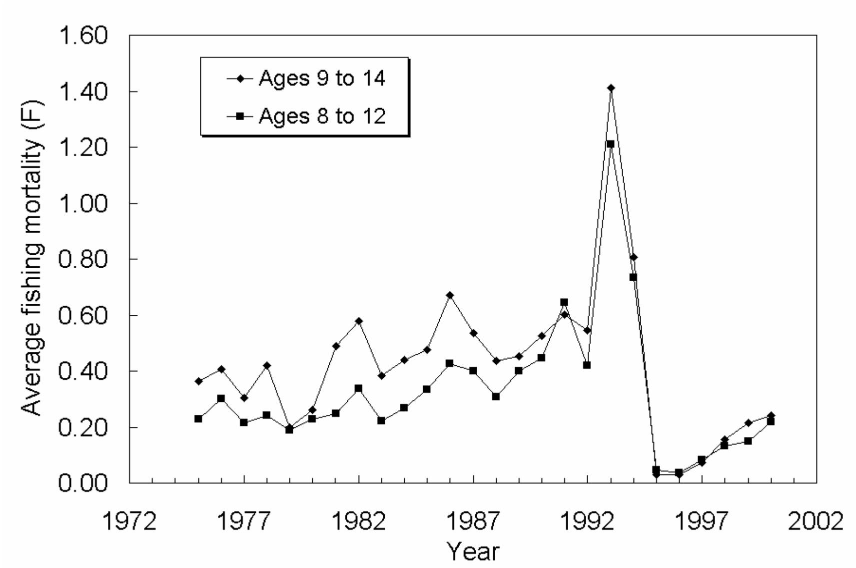



Fig. 11.6. American plaice in Div. 3LNO: Average fishing mortality from VPA.

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 very low level (less than 10 000 tons) in 1994 and 1995 (Fig. 11.7). 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 15% of the level in the mid-1980s. Recruitment has been steadily declining since the 1986 year-class and there have been no good year-classes since then (Fig 11.7). No good recruitment is seen below an SSB of 50 000 tons.

The stock remains low compared to historic levels.

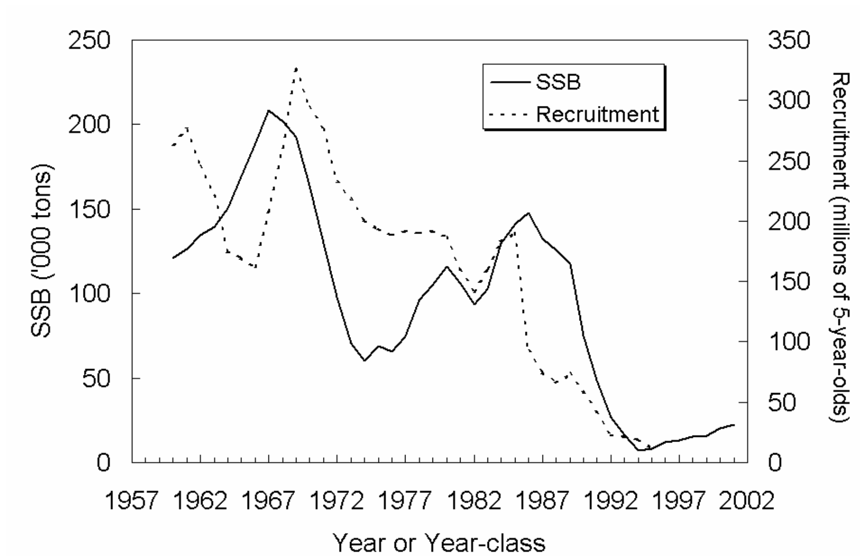



Fig. 11.7. American plaice in Div. 3LNO: Spawning stock biomass and recruitment from VPA.

e) **Reference Points**

In 1999, STACFIS expressed concern about the previously proposed level of $B_{lim}$ for this stock and indicated that it needed to be re-examined. An examination of the stock recruit scatter shows that there has been no good recruitment observed at SSB below 50 000 tons (Fig. 11.8). This 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.

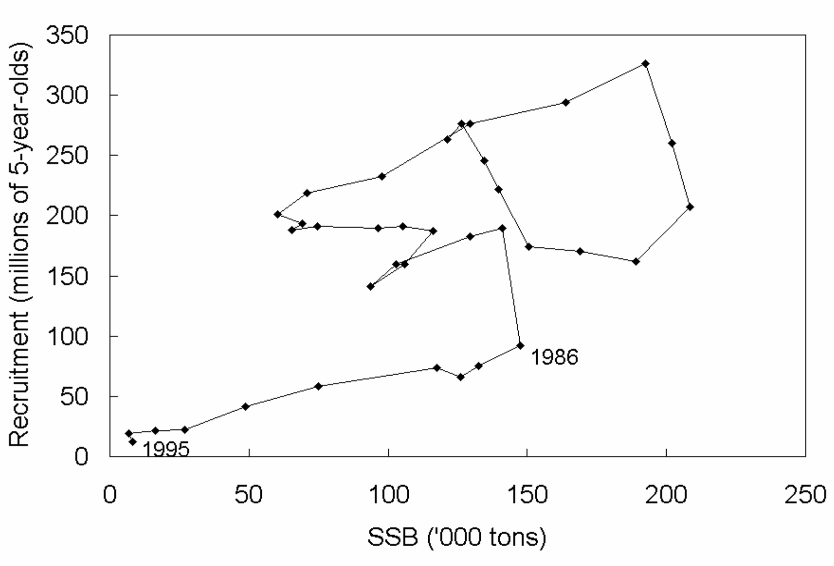



Fig. 11.8. American plaice in Div. 3LNO: spawning stock biomass recruitment relationship from VPA.

f) **Medium term considerations**

Simulations were carried out to examine the trajectory of the stock under 4 scenarios of fishing mortality: $F = 0$, $F = 0.5 \times F_{2000}$, $F = F_{2000}$, and $F = 2 \times F_{2000}$. For these simulations the results of the VPA and the CV on these population estimates were used. The following assumptions were made:

| Age | Estimate of 2001 population numbers ('000) | CV on population estimate | Weight-at-age mid-year (avg. 1975-2000) | Weight-at-age beginning of year (avg. 1975-2000) | Maturity-at-age using data from 1949-93 cohorts | PR calculated over ages 11-14 (avg. 1998-2000) |
|---|---|---|---|---|---|---|
| 5 | 17117 | 0.556 | 0.158 | 0.108 | 0.015 | 0.006 |
| 6 | 11800 | 0.556 | 0.268 | 0.193 | 0.037 | 0.053 |
| 7 | 13100 | 0.331 | 0.348 | 0.303 | 0.090 | 0.161 |
| 8 | 11300 | 0.272 | 0.432 | 0.387 | 0.202 | 0.338 |
| 9 | 8810 | 0.246 | 0.551 | 0.487 | 0.392 | 0.554 |
| 10 | 8620 | 0.235 | 0.677 | 0.610 | 0.622 | 0.781 |
| 11 | 5710 | 0.247 | 0.837 | 0.750 | 0.808 | 1 |
| 12 | 3250 | 0.258 | 1.043 | 0.931 | 0.915 | 1 |
| 13 | 1460 | 0.258 | 1.315 | 1.167 | 0.965 | 1 |
| 14 | 748 | 0.249 | 1.694 | 1.486 | 0.986 | 1 |
| 15 | 437 | 0.201 | 1.980 | 1.821 | 0.994 | 1 |
| 16 | | | 2.358 | 2.155 | 0.998 | 1 |
| 17 | | | 2.717 | 2.531 | 0.999 | 1 |
| 18 | | | 2.86 | 2.86 | 1 | 1 |
| 19 | | | 3.02 | 3.02 | 1 | 1 |
| 20 | | | 3.18 | 3.18 | 1 | 1 |
| 21 | | | 3.34 | 3.34 | 1 | 1 |
| 22 | | | 3.5 | 3.5 | 1 | 1 |
| 23 | | | 3.66 | 3.66 | 1 | 1 |
| 24 | | | 3.82 | 3.82 | 1 | 1 |
| 25 | | | 3.98 | 3.98 | 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 150 000 tons (low and high recruitment), and greater than 150 000 tons (only high recruitment). At $F = F_{2000}$ or $F = 2 \times F_{2000}$ the population is estimated to decline over the 10 year period. At $F = 0.5 \times F_{2000}$ the population is estimated to grow 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. 11.9). Yield is estimated to increase slightly over the 10-year time period under the scenario of $F = 0.5 \times F_{2000}$, but to decline over the time period at $F = F_{2000}$ or $F = 2 \times F_{2000}$

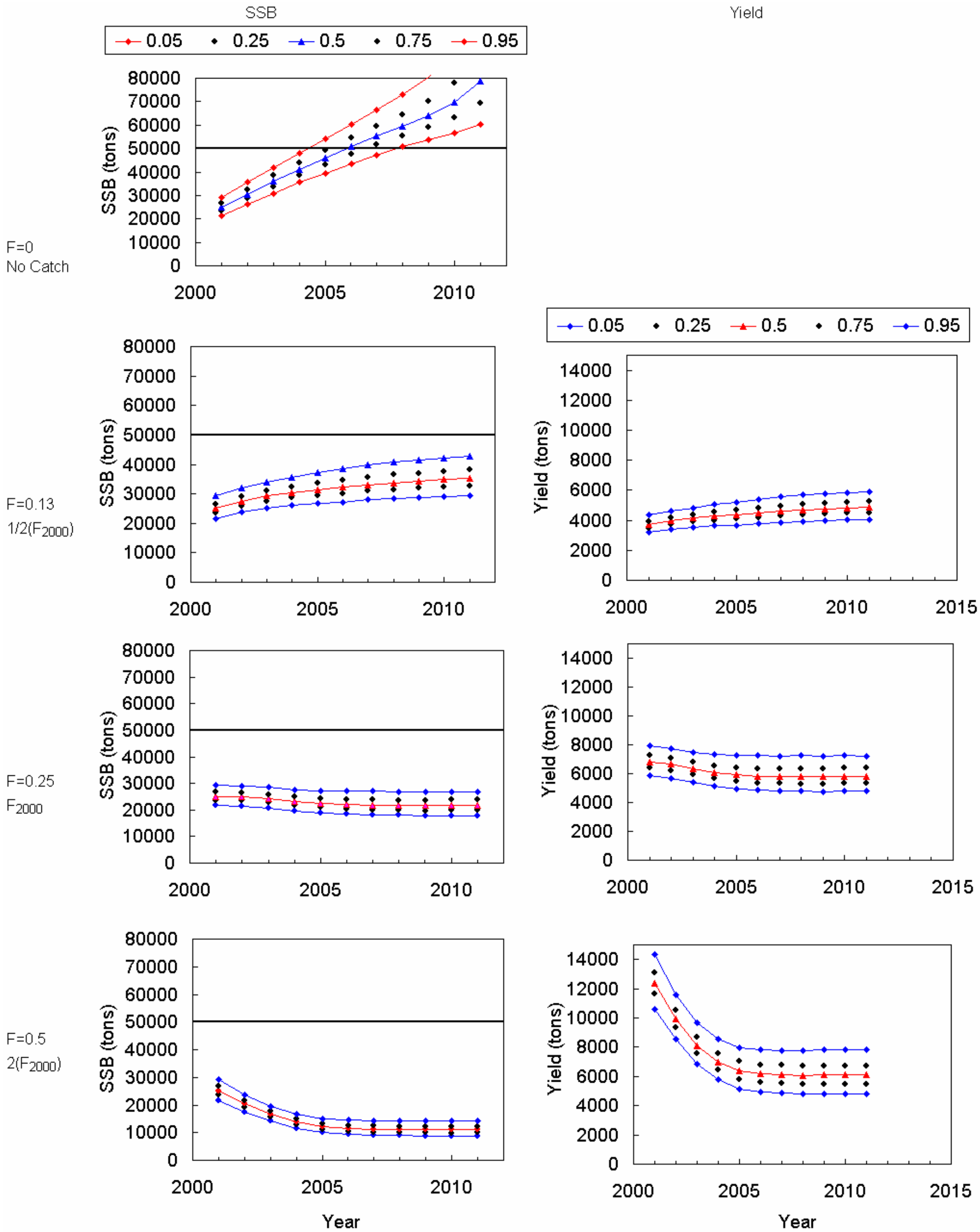



Fig. 11.9. American plaice in Div. 3LNO: median spawning stock biomass and yield from projections along with various percentiles

g) **Research Recommendations**

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 **recommended** 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*.

12. **Yellowtail Flounder (*Limanda ferruginea*) in Divisions 3L, 3N and 3O** (SCR Doc. 01/50, 69, 70, 71,74 76, 78; SCS Doc. 01/9, 11, 18)

a) **Introduction** (SCR Doc. 01/76)

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 11 120 tons in 1999. Catches exceeded the TACs in each year from 1985 to 1993. From 1998-2000, by-catches in the Regulatory Area have led to catches exceeding their respective TACs by as much as 11%. 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 with a categorization of unspecified flounder catches.

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

| | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| TAC | 7 | 7 | 7 | 7[1] | ndf | ndf | ndf | 4 | 6 | 10 | 13 |
| Catch | 16[2] | 11[2] | 14[2] | 2[1] | 0.1[2,3] | 0.3[3] | 0.8[3] | 4[3] | 7[3] | 11[3] | |

[1] No directed fisheries permitted.
[2] Includes estimates of misreported catches.
[3] Provisional.
ndf No directed fishery.

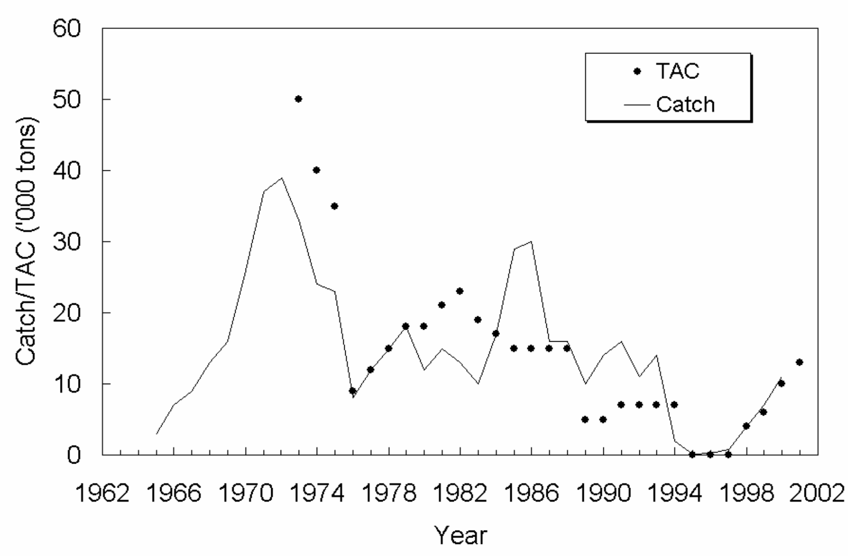



Fig. 12.1. Yellowtail flounder in Div. 3LNO: catches and TACs.

b) **Input Data**

i) **Commercial fishery data** (SCR Doc. 01/71,76; SCS Doc. 01/9, 11, 18)

There were catch and effort data from the Canadian commercial fishery in 2000, which were included in a multiplicative model to analyze the CPUE series from 1965 to 2000. 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 1998-2000 CPUE values are not directly comparable to CPUE indices from previous years because of changes in the 1998-2000 fishing patterns. The 1998-2000 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 2000, this kept the by-catch levels of cod (2.3%) and American plaice (6%) down. The deployment of an excluder grate also contributed to the low by-catch levels, particularly cod. Juvenile catches were reduced by the use of large mesh sizes (145 mm) in the codend. Modal size of yellowtail flounder in the fishery was 36 cm for males and 36 cm for females.

There was limited sampling of yellowtail flounder from by-catches in an EU-Spain skate fishery, EU-Portugal and Russian fisheries in the Regulatory Area of Div. 3NO. The length frequency of yellowtail flounder in the catches ranged in size from 10 to 55 cm, peaking at 32 cm in the Russian catches, 31 cm in the Portuguese catches and 35 cm in the Spanish catches. STACFIS noted that yellowtail flounder were caught in depths to 583 m in Div 3N. However there is no clear explanation of this observation, although small amounts have shown up in the Canadian autumn surveys at similar depths.

ii) **Research survey data**

**Sampling gear studies** (SCR Doc. 01/69, 71). Further analysis of comparative fishing trials on the Grand Banks to derive conversion factors for the new survey trawl, by Canada in 1996, and the 1999-2001 Spanish comparative fishing trials in the Regulatory Area of Div. 3N, to derive conversion factors for their new survey gear, were presented. Based on the analysis of the Canadian 1996 data there was no difference in the selectivity of large American plaice and yellowtail flounder in the catches of the old Engel trawl when compared with the new Campelen trawl. In the 2000 side-by-side fishing trials between Canada and EU-Spain, the catches of the Spanish Pedreira trawl far exceeded that of the Canadian Campelen trawl sometimes by a factor of 10. In the 1999 experiments with the Spanish survey vessel, a direct comparison of the catch rates of the Pedreira and Campelen trawls was made. By rigging the Campelen trawl with the same long sweeps and trawl doors as used with the Pedreira trawl, the differences in the catches between the two gears were much smaller. Although there was an increase in catches at length for American plaice and yellowtail flounder in the Pedreira trawl, when compared to the Campelen, there were minor differences in length selection. In 2001, three ship/three gear side-by-side experimental trials between EU-Spain and Canada were carried out, however, only the catch results of the Canadian Campelen and the Spanish Pedreira were available. Again the catch rates of the Pedreira far exceeded that of the Campelen for most commercial groundfish species.

These large differences in catchability between the two survey trawls were attributed to the increase in herding with long sweep lines (in excess of 260 m Spanish *vs*. 46 m Canadian) and the reduction in escapement underneath the trawl with the use of a smaller footgear (15 cm Spanish *vs* 35 cm Canadian). STACFIS **recommended** that *comparative trials between Canada and EU-Spain be continued and a detailed analysis of the 2001 comparative fishing trails results be presented in June 2002*.

**Canadian stratified-random spring surveys** (SCR Doc. 01/50). These surveys covered depths from 42 to 731 m. In 2000, most of the trawlable biomass of this stock continued to be found in Div. 3N, where the index had declined from 167 700 tons in 1984 to 58 000 tons in 1995. In 1996 the biomass increased to 104 000 tons and continued to rise to a high of 239 000 tons in 1999 followed by a decrease to 197 000 tons in 2000. In Div. 3L, the index of trawlable biomass declined steadily from about 21 000 tons in 1984-85 to zero in 1995; the average biomass in 1996-98 was 700 tons. With the overall increase in stock range as density increases the average biomass in the 1999-2000 surveys was 48 000 tons. In Div. 3O, the biomass index was relatively stable around 26 000 tons from 1984 to 1991, however, the 1992 and 1994-95 values were around 9 000-13 000 tons, compared to 42 000 tons in 1993. After increasing to 71 000 tons in 1996, the biomass continued to increase to 98 700 tons in 1999. In 2000 the estimate decreased to 72 000 tons.

In 1999, the total trawlable biomass index in Div. 3LNO was estimated to be 366 000 tons, a 164 000 tons increase since 1998 (Fig. 12.2). Such a large increase is indicative of a 'year-effect'. In 2000, the biomass had decreased to 287 000 tons

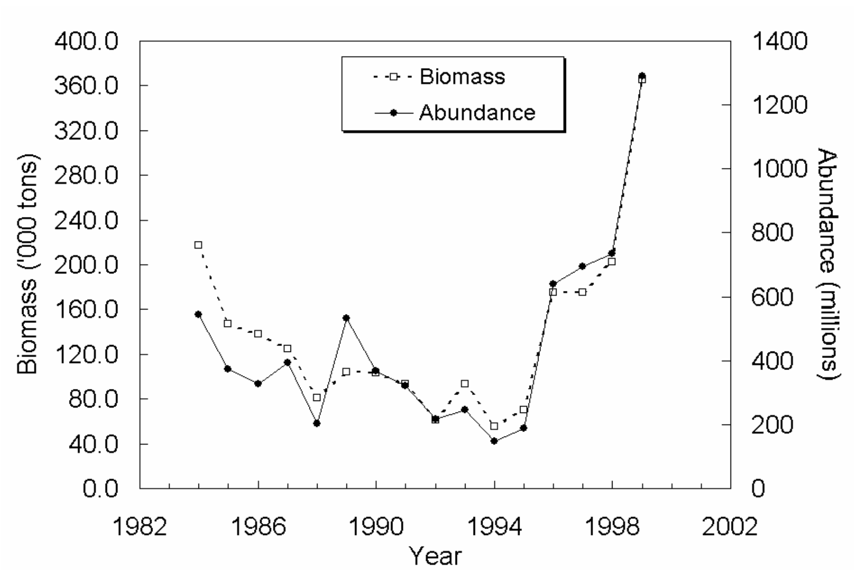



Fig. 12.2. Yellowtail flounder in Div. 3LNO: estimates of biomass and abundance from Canadian spring surveys.

**Canadian stratified-random autumn surveys** (SCR Doc. 01/50). These surveys covered depths from 42 to 1 500 m. The index of trawlable biomass for Div. 3LNO yellowtail flounder has increased steadily from 66 000 tons in 1990 to 335 000 tons in 2000 (Fig. 12.3). Most of this biomass (75%) was found in Div. 3N; Div. 3L had a biomass estimate of 13 000 tons.

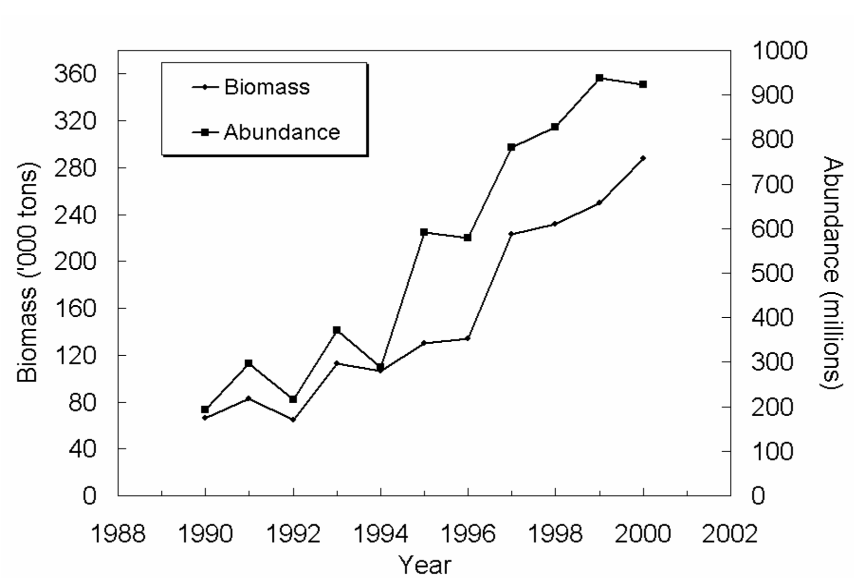



Fig. 12.3. Yellowtail flounder in Div. 3LNO: estimates of biomass and abundance from Canadian autumn surveys.

**Cooperative DFO/fishing industry seasonal surveys** (SCR Doc. 01/70). Cooperative quarterly 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 indicate very low catch rates of yellowtail flounder and other species in March of 1997, 1998 and 1999 compared with surveys at other times of the year which may be due to change in catchability. CPUE observed in the 10 other cooperative surveys was relatively high compared to historic CPUE data from the fishery. The CPUE for the indexed grid blocks for July surveys from 1996-2000 has varied about a mean CPUE of 784 kg/h. In 1999, the seasonal component of these annual surveys concluded in July. In July 2000 the grid was expanded to include a larger area mainly to the north.

Yellowtail flounder in these surveys ranged from 4-57 cm and only 11% of the catch in any one trip was less than 30 cm. These surveys also pointed out the limited area available for conducting a directed fishery for yellowtail flounder within the 5% American plaice by-catch restriction.

**Spanish stratified-random spring surveys in the Regulatory Area of Div. 3NO**. Beginning in 1995 EU-Spain has conducted stratified-random surveys for groundfish in the Regulatory Area of Div. 3NO. These surveys cover a depth range of approximately 45 to 1462 m. The biomass index has shown an increasing trend between 1995 (27 704 tons) and 1999 (589 200 tons). In 2000 biomass decreased to 447 403 tons (Fig. 12.4).

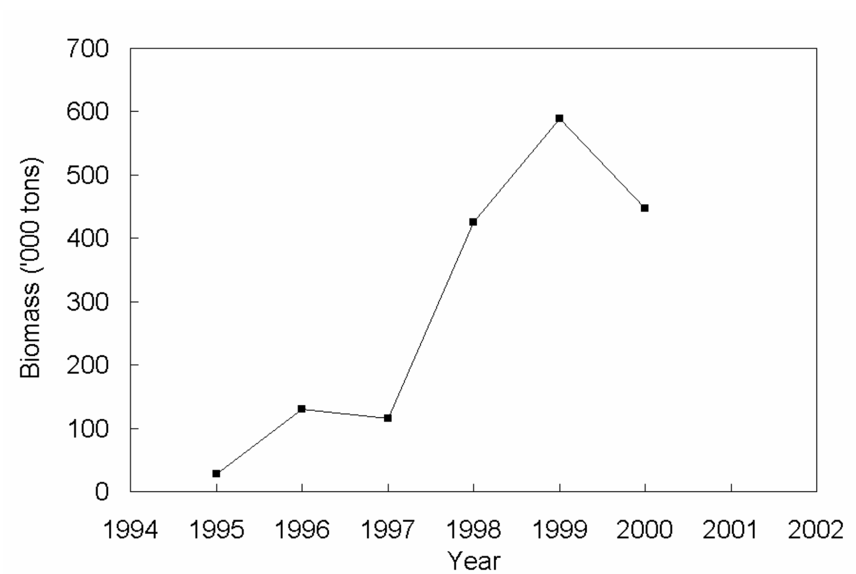



Fig. 12.4. Yellowtail flounder in Div. 3LNO: estimates of biomass from the Spanish spring surveys.

**Stock distribution** (SCR Doc. 01/50). Analysis of 1999 and 2000 spring and autumn surveys confirmed that the stock was more widely distributed in all three Divisions similar to that of the mid-1980s. In the 1999 and 2000 surveys, the majority of the stock was concentrated in Div. 3NO on and to the west of the Southeast Shoal consistent with the distribution in other years. Based on catches during the 1999-2000 surveys, expansion of the range back into Div. 3L has taken place.

iii) **Biological studies** (SCR Doc. 01/76).

Length at 50% maturity ($L_{50}$) was calculated for males and females separately, from samples collected during the 1984-2000 Canadian surveys in the Div. 3LNO. There has been a 6 cm decrease in length at 50% maturity in males from 30 cm to 24 cm, while female length at 50% maturity has remained fairly stable at about 34 cm (Fig. 12.5).

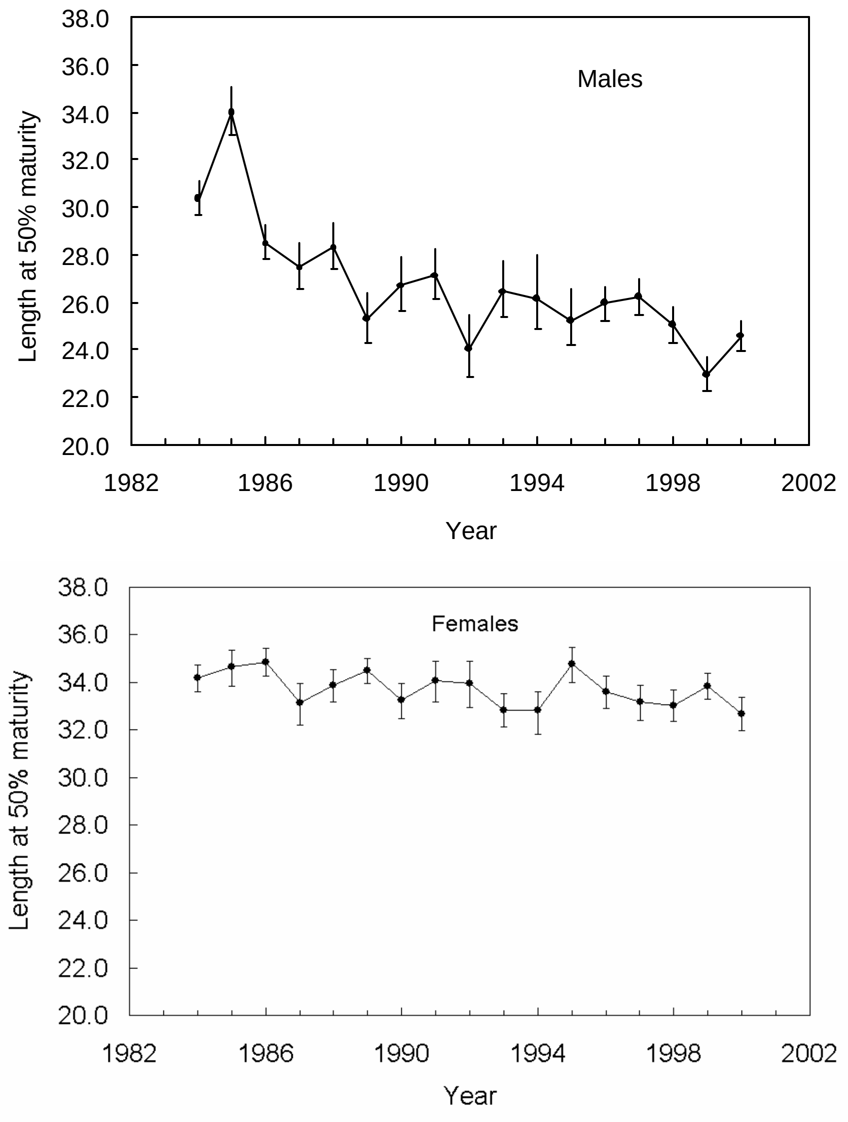



Fig. 12.5. Yellowtail flounder in Div. 3LNO: length at 50% maturity.

A length based female SSB was derived from the 1984-2000 Canadian spring survey data, annual maturity ogives and annual mean weights-at-length. SSB 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 SSB 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, which has been interpreted as a year effect. In 2000 the SSB decreased to 118 000 tons (Fig. 12.6).

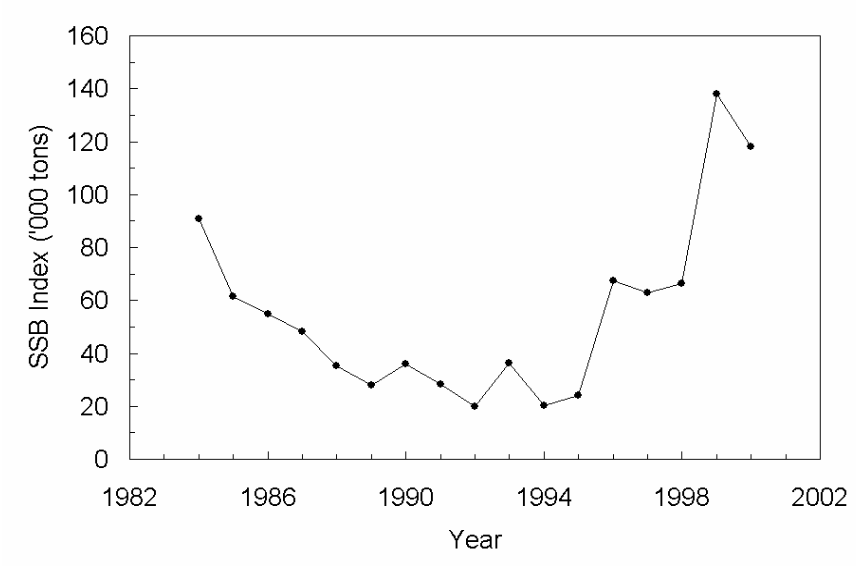



Fig. 12.6. Yellowtail flounder in Div. 3LNO: female spawning stock biomass estimated from 1999 to 2000 annual spring surveys.

Relative year-class strength was estimated from a multiplicative model using information based on abundance of cohorts at ages 3 and 4 from the 1984-2000 spring and 1990-2000 autumn survey time series (Fig. 12.7). Cohort strength reached a minimum in 1990 but has increased since. Based on this analysis, recruitment has been improving since 1992.

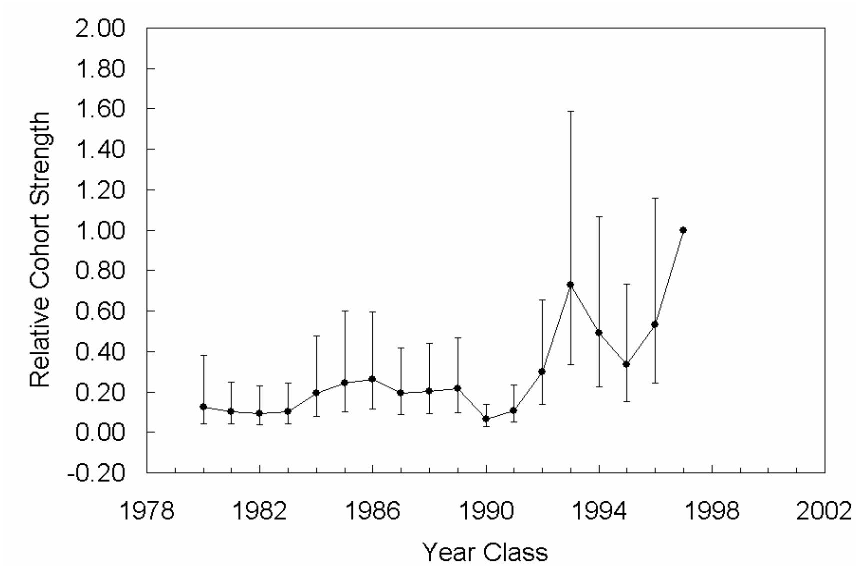



Fig. 12.7. Yellowtail flounder in Div. 3LNO: relative cohort strength with standard errors estimated from a multiplicative model using age 3 and 4 data from annual spring and autumn surveys.

c) **Estimation of Parameters**

Several formulations of a surplus production analysis (ASPIC) were presented. STACFIS agreed that the model that provided the best fit to the data included the catch data (1965-2000), Russian spring surveys (1972-91), Canadian spring surveys (1971-82), Canadian spring (1984-2000) and autumn (1990-2000) surveys and the Spanish spring (1995-2000) surveys. Yield projections assumed that the 14 300 tons (TAC of 13 000 tons + 10% over-run) will be taken in 2001 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.

d) **Assessment Results**

The surplus production model results are consistent with the assessment in 2000. The model suggests that a maximum sustainable yield (MSY) of 17 000 tons can be produced by total stock biomass of 81 000 tons ($B_{msy}$) at a fishing mortality rate of 0.21 ($F_{msy}$). The analysis showed that relative population size ($B_t/B_{msy}$) has been below the level at which MSY can be obtained since 1973 to 1999. Since the rebuilding of the stock biomass ($B_t$) has been above $B_{msy}$ (Fig. 12.8).

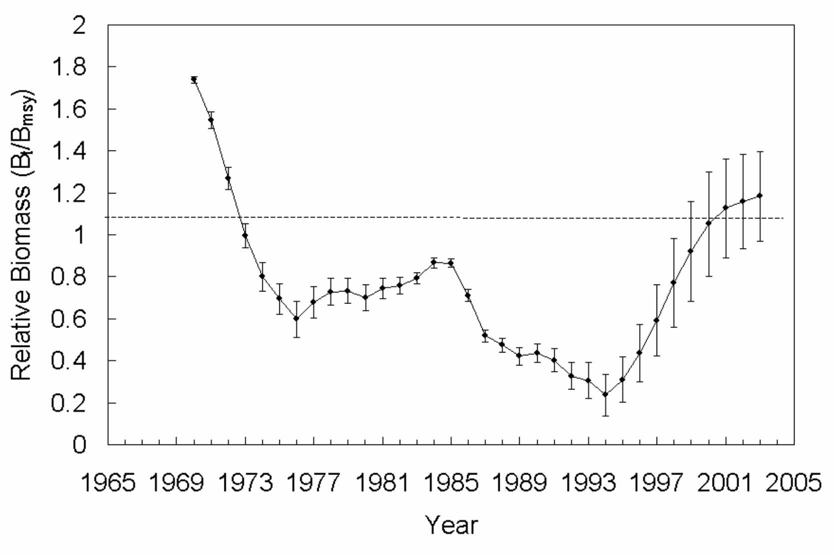



Fig. 12.8. Yellowtail flounder in Div. 3LNO: bias corrected relative biomass trends with 80% confidence intervals.

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 2001, F is projected to be 73% $F_{msy}$ if the TAC of 13 000 tons (+ 10% over-run) is taken in 2001.

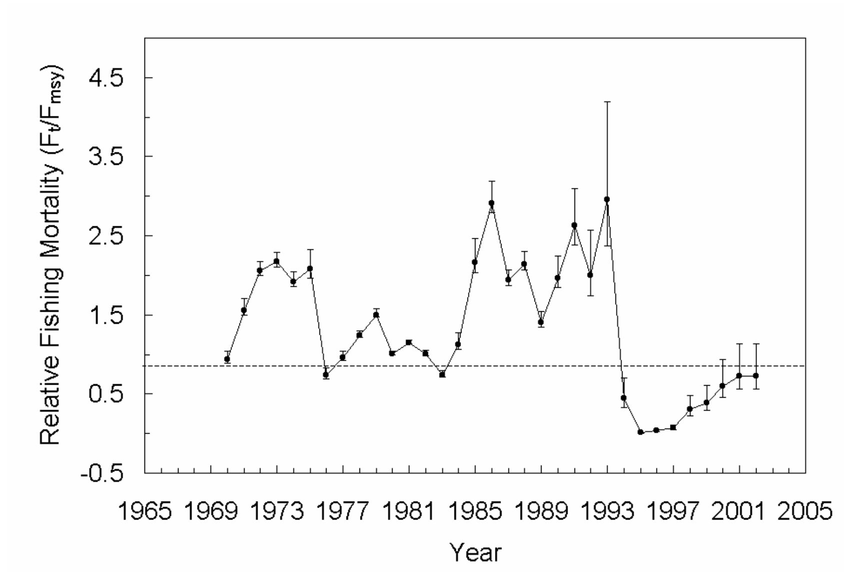



Fig. 12.9. Yellowtail flounder in Div. 3LNO: bias corrected relative fishing mortality trends with 80% confidence intervals.

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

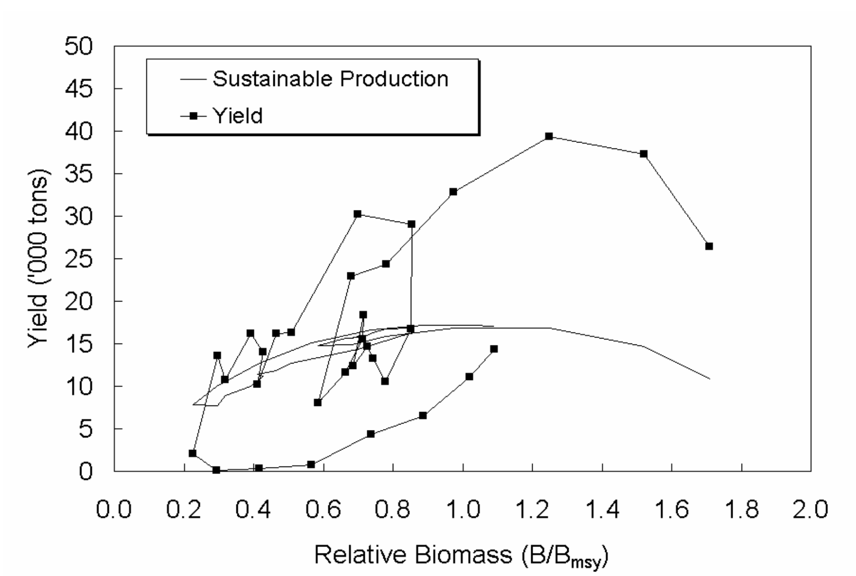



Fig. 12.10. Yellowtail flounder in Div. 3LNO: yield trajectory.

The model was bootstrapped to derive estimates of yield projections for 2002 assuming a *status quo* F ($F_{2001}$=$F_{2002}$) and assuming $F_{2002}$=2/3 $F_{msy}$ . By constraining the catch in 2000 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 2002 and $F_{2002}$=2/3 $F_{msy}$ results in a yield of 13 300 tons in 2002.

Table 12.1 Yellowtail flounder in Div. 3LNO: management options for 2002 and 2003. The percentiles of yield in 2002, and biomass and biomass ratio in 2003 are based on F in 2002 calculated as the product of the F multiplier and F in 2001.

| | | | 2002 F | | |
|---|---|---|---|---|---|
| F multiplier | 5 | 25 | 50 | 75 | 95 |
| 1.0 | 0.133 | 0.146 | 0.158 | 0.172 | 0.206 |
| 0.9 | 0.120 | 0.131 | 0.142 | 0.155 | 0.185 |
| 0.8 | 0.106 | 0.117 | 0.126 | 0.138 | 0.165 |
| 0.6 | 0.080 | 0.087 | 0.095 | 0.103 | 0.124 |
| 0.4 | 0.053 | 0.058 | 0.063 | 0.069 | 0.082 |
| $F_{msy}$ | 0.164 | 0.199 | 0.217 | 0.237 | 0.266 |
| 2/3 $F_{msy}$ | 0.108 | 0.131 | 0.143 | 0.156 | 0.175 |

| | | | 2002 Yield | | |
|---|---|---|---|---|---|
| F multiplier | 5 | 25 | 50 | 75 | 95 |
| 1.0 | 14.43 | 14.60 | 14.69 | 14.78 | 14.91 |
| 0.9 | 13.07 | 13.23 | 13.32 | 13.41 | 13.53 |
| 0.8 | 11.70 | 11.85 | 11.93 | 12.01 | 12.12 |
| 0.6 | 8.88 | 9.01 | 9.08 | 9.15 | 9.25 |
| 0.4 | 6.00 | 6.09 | 6.15 | 6.20 | 6.28 |

| | | | 2003 Biomass / $B_{msy}$ | | |
|---|---|---|---|---|---|
| F multiplier | 5 | 25 | 50 | 75 | 95 |
| 1.0 | 0.788 | 1.015 | 1.156 | 1.285 | 1.418 |
| 0.9 | 0.803 | 1.031 | 1.173 | 1.301 | 1.436 |
| 0.8 | 0.819 | 1.047 | 1.188 | 1.318 | 1.452 |
| 0.6 | 0.845 | 1.080 | 1.223 | 1.351 | 1.486 |
| 0.4 | 0.874 | 1.114 | 1.256 | 1.387 | 1.521 |

The results are derived from an ASPIC bootstrap run (500 iterations) with a catch constraint of 14 300 tons in 2001.

Medium-term projections were carried out by extending the ASPIC bootstrap projections forward to the year 2011 under an assumption of constant fishing mortality at 2/3 $F_{msy}$ . F was constrained to 2/3 $F_{msy}$, i.e. 0.143 and projections were made for a 10-year period. The output shows that yield reaches a maximum at 15 000 tons in the year 2011. The results depicted in Fig. 12.11 show the percentiles of predicted absolute yield and biomass, yield relative to MSY, and biomass relative to $B_{msy}$. The probability of biomass falling below $B_{msy}$ is between 10 and 20% from 2003 onward. The projections are conditional on the estimated values of r, the intrinsic rate of population growth and K, the carrying capacity.

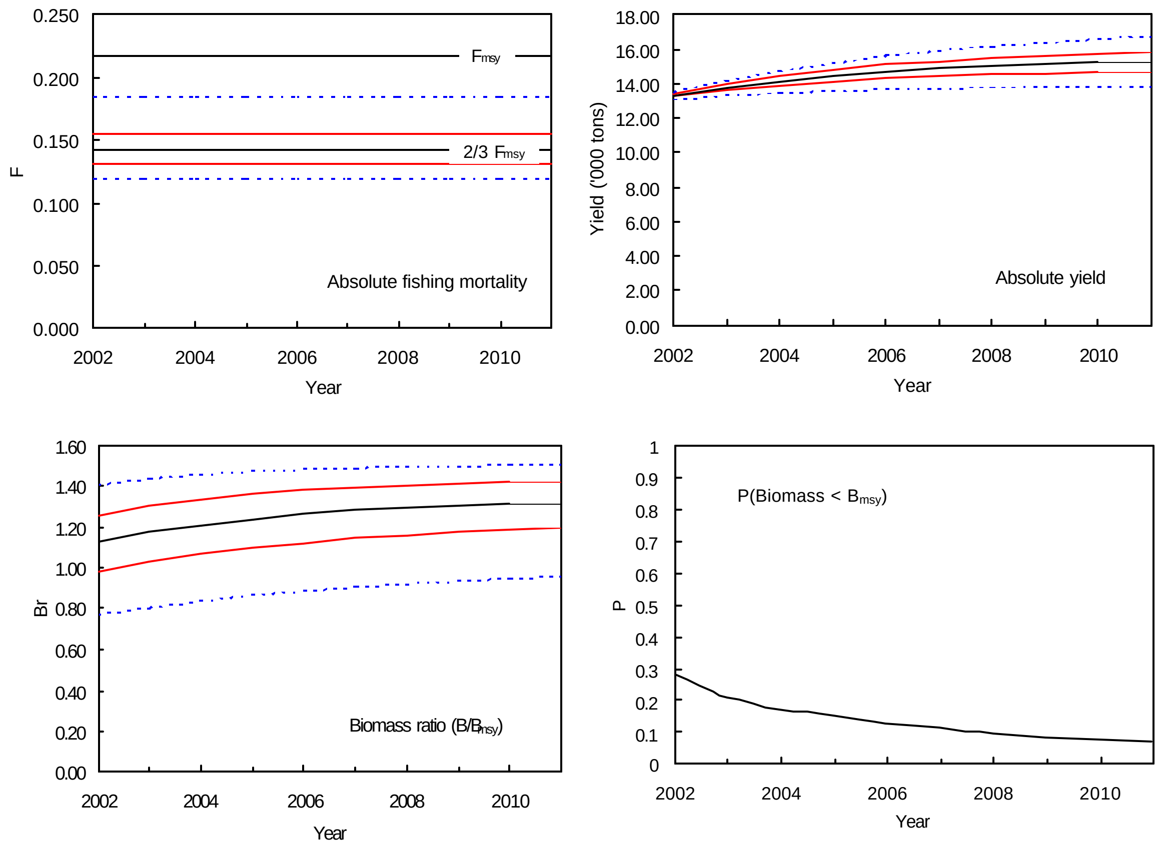



Fig. 12.11 Yellowtail flounder in Div. 3LNO: medium term projections at a constant fishing mortality of 2/3 $F_{msy}$. The figures show the 5$^{th}$, 25$^{th}$, 50$^{th}$, 75$^{th}$ and 95$^{th}$ percentiles of fishing mortality, yield, potential yield/MSY, biomass and biomass/$B_{msy}$. The probability 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 2001.

e) **Reference Points**

**Stock-recruitment relationships** (SCR Doc. 01/76). There is no apparent stock recruitment relationship evident for this stock using a length based SSB derived from Canadian spring surveys (1984-2000) and cohort strength of ages 3 and 4 from Canadian spring (1989-2000) and autumn (1990-2000) surveys (Fig. 12.12).

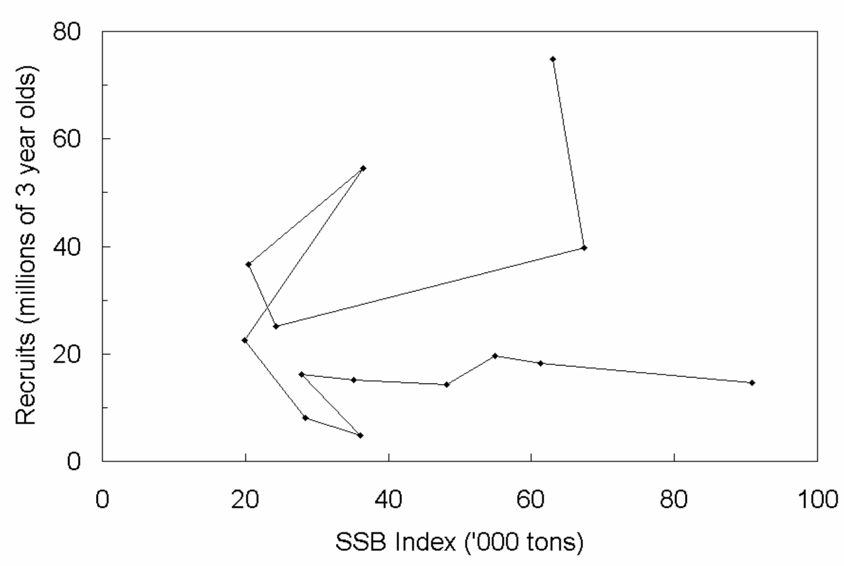



Fig. 12.12. Yellowtail flounder in Div. 3LNO: stock/recruitment plot.

**Precautionary approach**. The stock production model outputs in the current assessment are similar to those reported in the 2000 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).

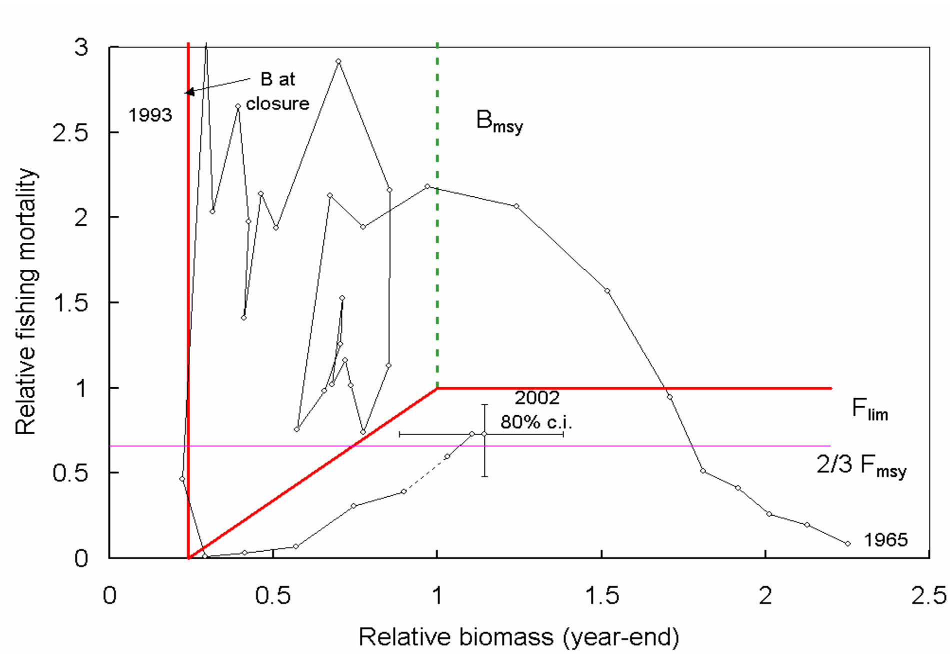



Fig. 12.13. Yellowtail flounder in Div. 3LNO: stock trajectory estimated in the surplus production analysis under precautionary approach framework.

13. **Witch Flounder (*Glyptocephalus cynoglossus*) in Divisions 3N and 3O** (SCR Doc. 01/63; SCS Doc. 01/9, 18)

a) **Interim Monitoring Report**

Although there has been no directed fishing for the stock from 1995 the annual by-catch of witch flounder has ranged between 300 and 800 tons during 1995-2000. The estimated catch in 2000 is about 550 tons, (Fig. 13.1).

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

| | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|---|---|---|---|---|
| TAC | 5 | 5 | 3[1] | ndf | ndf | ndf | ndf | ndf | ndf | ndf |
| Catch | 5 | 4 | 1 | 0.3[2] | 0.3[2] | 0.5[2] | 0.6[2] | 0.8[2] | 0.6[2] | |

[1] No directed catch.
[2] Provisional.
ndf No directed fishery.

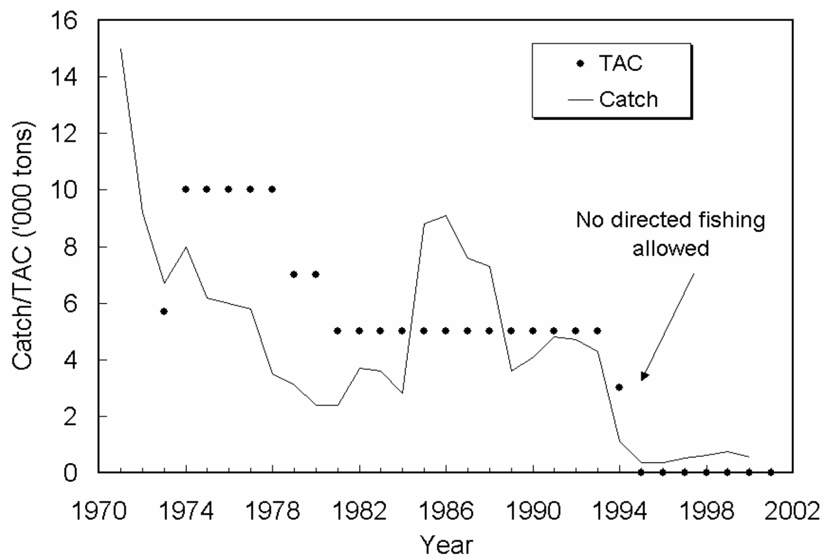



Fig. 13.1. Witch flounder in Div. 3NO: catches and TACs.

Survey biomass indices show that the stock has been declining since the early-1980s and by 1998 had reached the lowest level observed (Fig. 13.2). Little improvement in the stock has been observed since then.

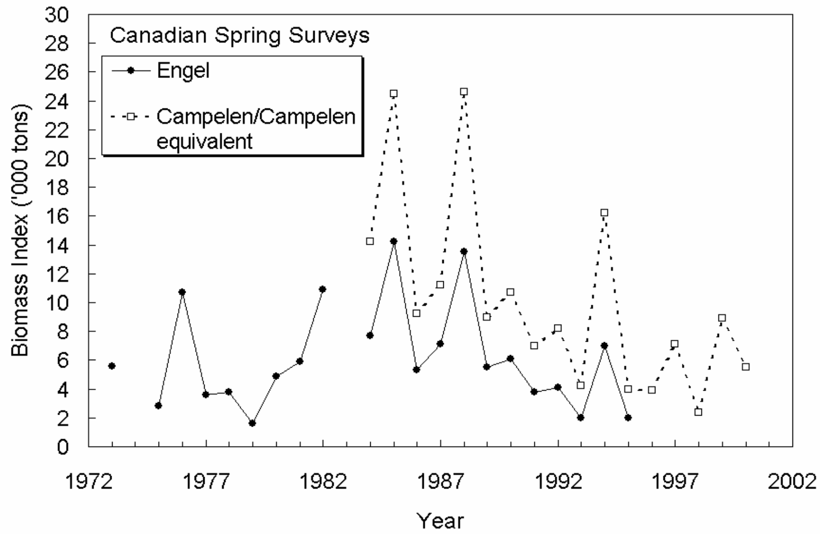



Fig. 13.2. Witch flounder in Div. 3NO: estimates of biomass.

## 14. Capelin (*Mallotus villosus*) in Divisions 3N and 3O

### a) Introduction

Directed fishery was closed in 1992 and the closure has continued through 2001 (Fig. 14.1).

Nominal catches and TACs ('000 tons) for the recent period are as follows:

| | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|---|---|---|---|---|
| Advised TAC | 30 | ndf | ndf | ndf | ndf | na | na | na | na | na |
| TAC | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Catch | + | + | 0 | 0[1] | 0[1] | 0[1] | 0[1] | 0[1] | 0[1] | |

[1] Provisional.
ndf No directed fishery.
na No advice possible.

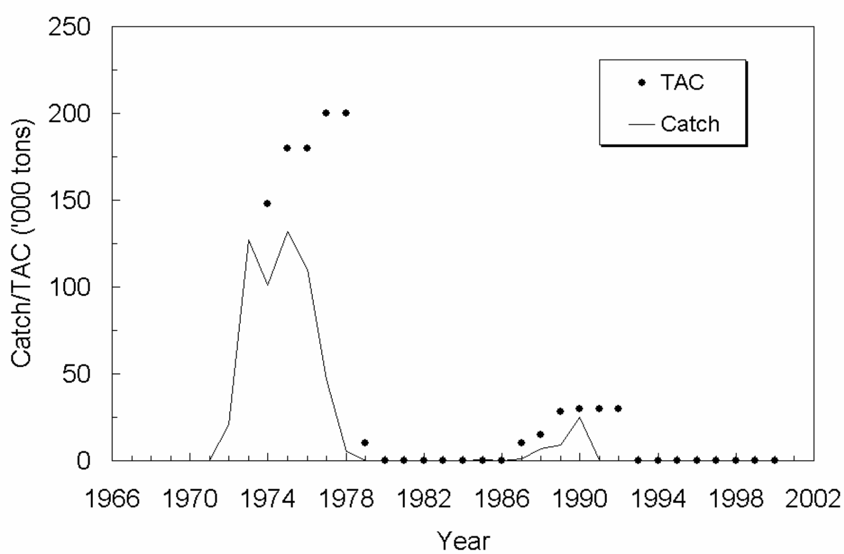



Fig. 14.1. Capelin in Div. 3N and 3O: catches and TACs.

b) **Input Data**

There were no data available to allow STACFIS make an evaluation of the current status of that stock.

c) **Potential Reference Points**

It is quite difficult to determine precautionary reference points for capelin in Div. 3NO. The historical database (both biological and fisheries statistics) began in the early-1970s but has not been compiled and reviewed since 1992. The main problems are related to the biological peculiarities of capelin, such as short life span, the high post-spawning mortality and its importance in ecosystem as a prey for many other species.

There are currently neither surveys nor fishery directed to capelin in Div. 3NO.

In the absence of information it is not possible to evaluate the status of the stock.

STACFIS reiterated its 2000 **recommendation** that *all data available related to capelin in Div. 3NO to be compiled for the June 2002 Scientific Council Meeting.*

## D. WIDELY DISTRIBUTED STOCKS

15. **Roughhead Grenadier (*Macrourus berglax*) in Subareas 2 and 3** (SCR Doc. 01/10, 29, 75; SCS Doc. 01/9, 11, 18)

a) **Interim Monitoring Report**

It has been recognized that a substantial part of the recent grenadier catches in Subarea 3, previously reported as roundnose grenadier, correspond to roughhead grenadier. The misreporting has not yet been resolved in the official statistics before 1996, but the species have been reported correctly since 1997. Roughhead grenadier is taken as by-catch in the Greenland halibut fishery, mainly in Div. 3LMN Regulatory Area (Fig. 15.1).

The revised catches ('000 tons) since 1991 are as follow:

| | 1991 | 1992 | 1993 | 1994 | 1995[1] | 1996[1] | 1997[1] | 1998[1] | 1999[1] | 2000[1] |
|---|---|---|---|---|---|---|---|---|---|---|
| Catch | 4.3 | 6.7 | 4.4 | 4.0 | 3.9 | 4.1 | 4.7 | 7.2 | 7.2 | 4.7 |

[1] Provisional.

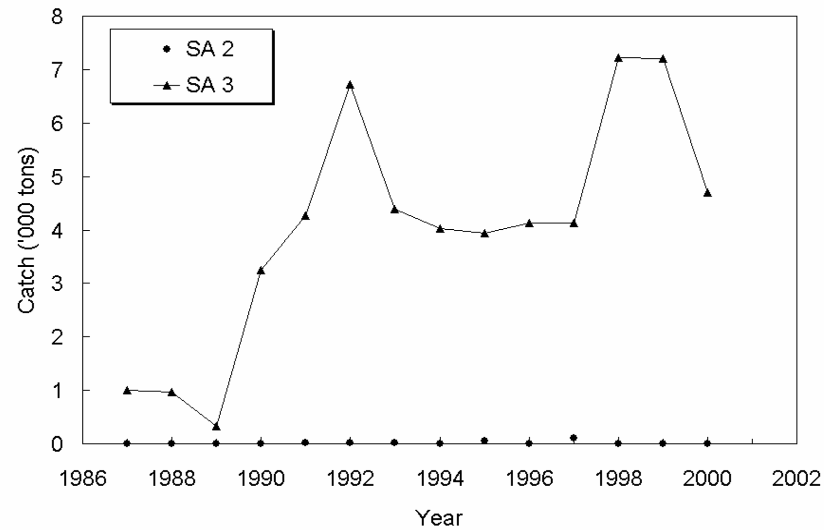



Fig. 15.1. Roughhead grenadier in Subareas 2+3: catches in Subarea 2 and Div. 3LMNO.

The biomass indices from the Canadian autumn, Canadian spring, Canadian deep-water, EU summer in Div. 3M and Spanish spring in Div. 3NO survey series are presented in Fig. 15.2.

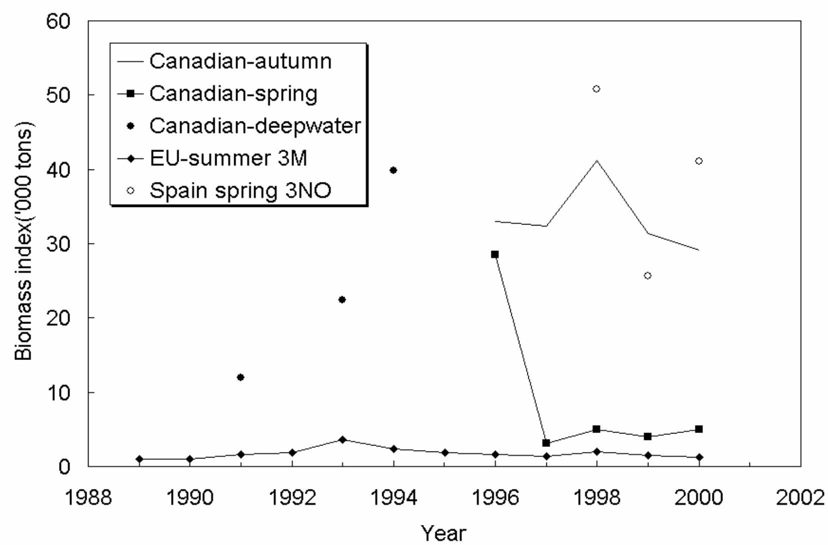



Fig. 15.2. Roughhead grenadier in Subareas 2+3: biomass indices from surveys.

The state of the stock is not known.

Based on commercial catch-at-age data, full recruitment to the fishery occurs at age 8. Estimates of Z by sex for a synthetic catch curve for the pair-trawl fleet catches is available. Z for males was 0.6, while that for females was 0.4. The catch/biomass (C/B) index obtained using the Canadian autumn survey data was 0.16 ($C/B_{1999}$ = 0.27).

A decrease in the mean lengths in the catches has been observed in 2000 relative to the previous period since 1995. The available time series of catches at age is too short to analyse trends in the SSB, however, it was noted that only 12% of the 2000 catches (18% in 1999), were above the female age at maturity (15 years). Information is scarce to assess an appropriate exploitation level.

STACFIS is not in the position to provide references points at this time.

## 16. **Cod (*Gadus morhua*) in Divisions 2J, 3K and 3L** (SCR Doc. 01/33, SCS 01/9, 11, 15)

### a) **Introduction**

Catches by non-Canadian fleets increased rapidly in the late-1950s and 1960s, with the total catch peaking at 800 000 tons in 1968 (Fig. 16.1). Catches both offshore and inshore declined during the 1970s. The stock declined to a low biomass by 1977. Following extension of jurisdiction the stock began to recover as a consequence of smaller catches, entry of the strong 1973-75 year-classes, and an increase in individual growth rate. However, recovery of the spawner biomass stopped after about 1982 as a result of higher fishing mortality, entry of the weak 1976-77 year-classes and a decline in individual growth rate. The 1978-82 year-classes were moderate to strong but experienced slow growth rates. Catches during the mid- to late-1980s were relatively stable but fishing mortality was high and increasing. The 1986-87 year-classes appeared strong at an early age but, in concert with older year-classes, appeared to decline very rapidly in the early-1990s. Fishing mortality was very high during this period but reported landings including documented discards are insufficient to account for the decline observed in the research vessel indices. A moratorium on directed commercial fishing was imposed in July 1992.

Reported catches in 1993-97 came from by-catch, sentinel surveys (1995-97) and estimates of catches during recreational fisheries (1994, 1996). The reported catch of about 4 500 tons in 1998 came from sentinel surveys, a recreational fishery, and an inshore commercial index fishery. In 1999, the commercial fishery was re-opened with a TAC of 9 000 tons in the inshore for vessels under 65 feet. Reported landings were approximately 8 000 tons from the commercial fishery and 200 tons from the sentinel surveys, which together with the estimate of 235 tons for a recreational fishery totaled approximately 8 500 tons.

In 2000, a TAC of 7 000 tons was established for sentinel surveys and a commercial index fishery in the inshore for vessels under 65 feet. Reported landings were approximately 4 700 tons from the commercial index fishery and 200 tons from the sentinel surveys, which together with the estimate of 500 tons for the recreational fishery totaled approximately 5 400 tons. The reported landings include a small by-catch in the large vessel trawler fishery for yellowtail flounder on the plateau of Grand Bank in Div. 3L.

The catch came mainly (72%) from Div. 3L, with 27% taken in Div. 3K and less than 1% taken in Div. 2J.

A total of 29 tons were reported in the Regulatory Area in Div. 3L in 2000 by EU-Portugal.

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

| | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|---|---|---|---|---|
| TAC | 120 | 0 | 0 | 0 | 0 | 0 | 0 | 9[1] | 7[1] | |
| Fixed Gear Catch | 12 | 9 | 1.3 | 0.3[2,3] | 1.5[2] | 0.5[2] | 4.5[2] | 8.5[2] | 5.4[2] | |
| Mobile Gear Catch | 29[3,4] | 2[3] | 0.5[3] | 0[2] | 0[2] | 0[2] | 0[2] | 0[2] | 0[2] | |
| Total Catch[5] | 41 | 11 | 1.4 | 0.3[2] | 1.5[2] | 0.5[2] | 4.5[2] | 8.5[2] | 5.4[2] | |

1 Inshore fixed gear only.
2 Provisional.
3 Includes reported landings and Canadian surveillance estimates.
4 Fishery closed by EU in June 1992.
5 Moratorium on Canadian fishing became effective in July 1992.

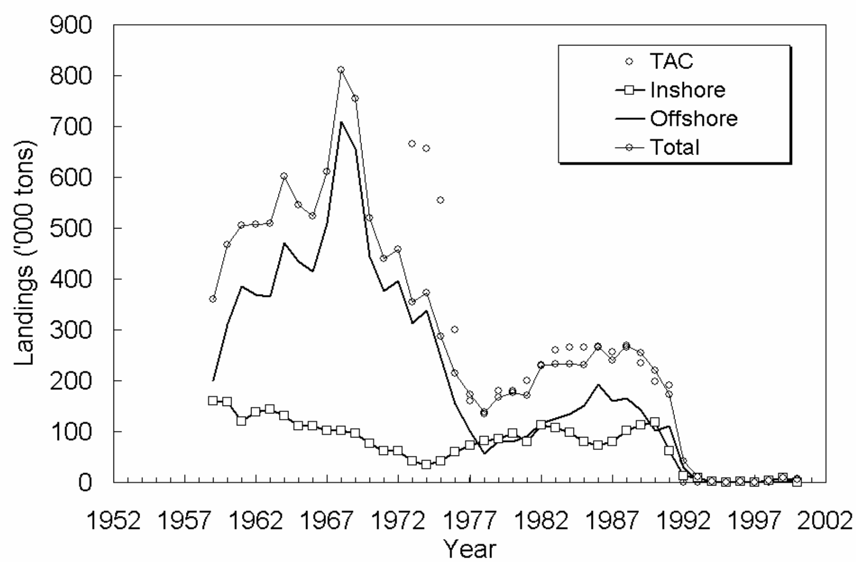



Fig. 16.1. Cod in Div. 2J+3KL: landings from fixed and mobile gears and TACs.

b) **Input Data**

i) **Commercial fishery data**

**Catch and effort**. Catch rates for the commercial index fishery were calculated from catch and effort data recorded in logbooks maintained by participants in the index fisheries in 1998 and 2000 and the commercial fishery in 1999. The spatial pattern since fishing re-commenced in 1998 has been similar among years. Catch rates were very low in Div. 2J and northern Div. 3K, increased towards the south in Div. 3K, were highest in northern Div. 3L and decreased in southern Div. 3L except at the border with Subdiv. 3Ps where catch rates were again higher. Catch rates throughout southern Div. 3L are thought to be influenced by fish migrating seasonally into the area from Subdiv. 3Ps. This migration was much reduced in 2000. The data for the three years suggests a progressive shrinkage of the area of highest concentration to a restricted portion of northern Div. 3L. The gillnet catch rates showed a significant decline over the three year period.

Catch rates in the sentinel gillnet fishery increased from 1995 to 1998 but declined from 1998 to 1999 and decreased further in 2000. Sentinel line trawl catch rates showed relatively little change from 1995 to 1996, increased in 1997, and declined again in 1998, 1999 and 2000. The catch rates at age indicated that the 1990 and 1992 year-classes were relatively strong and that all subsequent year-classes are weaker. The pattern in age-aggregated gillnet catch rates is consistent with the 1990 and 1992 year-classes entering and then passing through the fishery and being replaced by the weaker year-classes.

**Catch-at-age**. The sentinel fishery was intensively sampled for lengths and ages and the commercial index fishery was adequately sampled as well, but the recreational fishery and cod caught as by-catch were poorly sampled. The total catch-at-age in 2000 comprised a range of ages, with ages 3 to 10 each contributing at least 5% by number and ages 5 and 6 most prominent. The 1992 year-class was considerably less prominent in 2000 than it had been in 1999.

The total catch-at-age in 2000 strongly reflects the selectivity of the gillnets, the dominant gear, which tend to select ages 6 and 7 but caught roughly equal numbers of ages 5 to 8 in 2000. Only 2% (by number) of the total catch in 2000 was older than age 10.

ii) **Research survey data**

The biomass index from the autumn survey in 2000 remained extremely low at only 2.5% of the average in the period 1983-88 (excluding 1986) (Fig. 16.2). The index increased a little from 1995 to 1997, remained unchanged in 1998, increased 70% from 1998 to 1999, and increased slightly in 2000.

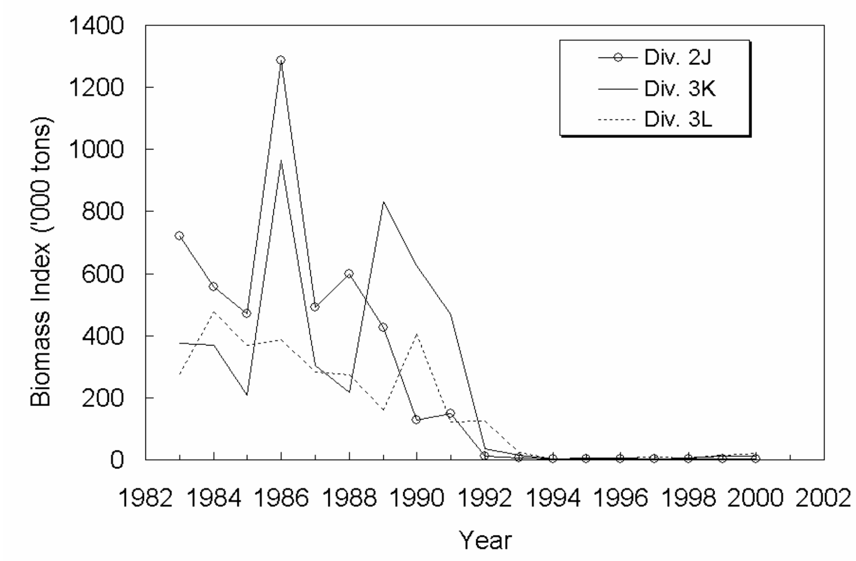



Fig. 16.2. Cod in Div. 2J+3KL: biomass indices from autumn surveys.

The biomass index from the spring research bottom-trawl survey in Div. 3L increased from 1998 to 1999 and declined in 2000. The biomass index for 2000 was only 1.5% of the average in the period 1986-1989.

Analysis of mark-recapture data using a simple migration model resulted in estimates of exploitable biomass in the inshore of Div. 3K and northern Div. 3L from 1998 to 2000 that are relatively stable at about 40 000 tons. A more detailed model, but one which did not include migration (and which therefore will result in positively biased estimates), gave a biomass of no more than 77 000 tons in Div. 3KL in 2000. Fish in southern Div. 3L were found to comprise mostly seasonal migrants for Subdiv. 3Ps.

Acoustic surveys in a small inlet in northern Div. 3L, Smith Sound, carried out in January in each year provided average indices of biomass of about 15 000 tons in 1999, 22 000 tons in 2000 and 31 000 tons 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 the two hypothesis: a) the inshore constitutes a separate inshore subpopulation that is functionally separate from the offshore; and b) inshore and offshore fish together constitute a single functional population. Prior to the collapse 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. 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. This migration was much reduced in 2000. Slightly elevated abundances of fish were detected in 1999-2000 in acoustic surveys and bottom trawl surveys on the shelf near the boundary between southern Div. 3K and northern Div. 3L.

**Size-at-age and maturity**. Size-at-age has increased in recent years but is still below peak values observed in the late-1970s. Much of the variability in growth is related to variability in water temperature. The age of 50% maturity of females fluctuated between 6.0 and 6.5 during the 1980s, declined during the late-1980s and early-1990s, and fluctuated considerably at about 5.0 to 5.5 in recent years. Much of the recent year-to-year variability may be caused by small sample sizes, particularly for older fish.

**Recruitment trends**. A recruitment index (Fig. 16.3) was derived from catch rates of juvenile (ages 0-3) cod from a variety of studies, which together provide 12 indices. The 1998 to 2000 year-classes are higher than earlier year-classes in the time series but are imprecisely estimated and all year-classes are extremely low compared with those that occurred prior to the collapse.

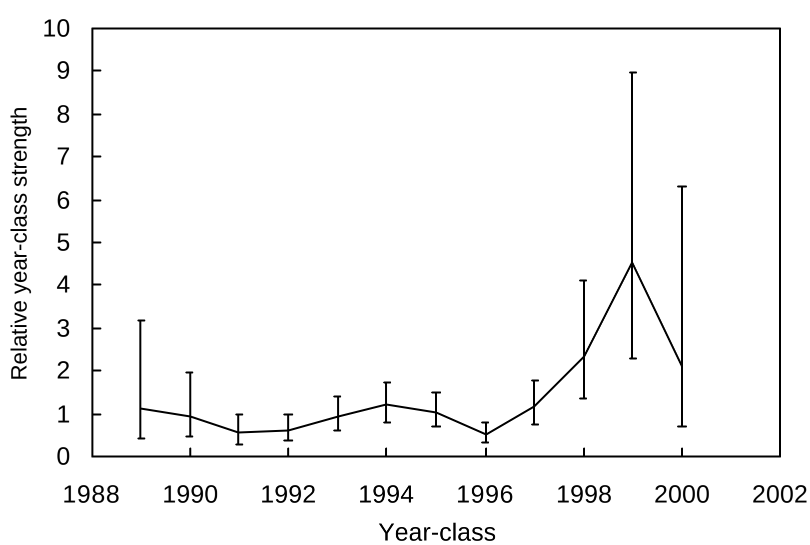



Fig. 16.3. Cod in Div. 2J+3KL: standardized year-class strength.

**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 4 are provided as an illustration (Fig. 16.4). In general, the estimates increased up until 1992, coinciding with the beginning of the moratorium. The rates then declined until 1995, and since then have remained constant at levels similar to or higher than those observed in the late-1980s when there was a substantial fishery.

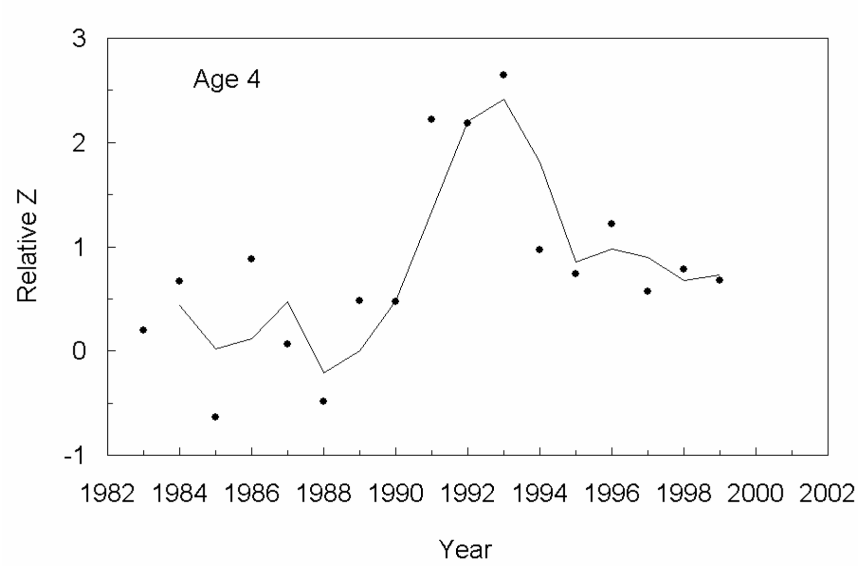



Fig. 16.4. Cod in Div. 2J+3KL: mortality rate (Z) for age 4 fish calculated from the autumn research vessel bottom-trawl data for 1983-2000.

**Predation by harp seals**. Based on the average diet data over the period 1982-98, it is calculated that harp seals consumed 37 000 tons of cod in 2000 (with a 95% confidence interval of 14 000-62 000 tons). Diet data from the inshore show that the per capita consumption of cod by harp seals has not declined with the collapse of the cod stock. In 1998 there was an increase in per capita consumption in the inshore, especially in the winter. The estimates of cod consumption may be biased upwards relative to other species because stomach content analysis relies on the presence and identification of hard parts (such as cod otoliths) and diet contributions from soft-bodied animals or species with small otoliths may be missed. The estimates of cod may be biased downwards because incidences of belly feeding will go undetected.

c) **Assessment Results**

*Hypothesis of a functionally separate inshore component*

There is considerable uncertainty regarding stock structure. Stock status can be evaluated under the hypothesis that cod currently in the inshore constitute a functionally separate stock from those in the offshore. However, there is not information on what levels of biomass could be supported in the inshore, or on what would constitute an undesirably low spawner biomass under a precautionary approach. Indices of exploitable biomass from commercial and sentinel catch rates and the autumn bottom-trawl survey in inshore strata show downward trends over the recent period but are inconsistent with estimates from tagging which indicate a stable biomass and an acoustic index for Smith Sound which shows an increase. Therefore, it cannot be said whether recent levels of exploitation have been sustainable. The fact that only about 70% of the TAC was taken in the 2000 commercial index fishery is cause for concern.

*Hypothesis of a single functional stock*

An analytical assessment of the Div. 2J and 3KL cod stock was attempted but changes in the distribution of fish relative to the survey area since the collapse, the change in the survey trawl in 1995, and the unaccounted for fish from the 1986 and 1987 year-classes, precluded obtaining an acceptable calibration of a sequential population analysis model. Overall, there is no doubt that the Div. 2J+3KL cod spawner biomass remains at an extremely low level and there is no evidence of a recovery. The offshore research bottom-trawl survey results show extremely low abundance levels, although the remaining fish are widely dispersed. Mortality rate of fish in the offshore is estimated to be as high as levels in the 1980s when a substantial commercial fishery existed. Slightly elevated abundances of fish have been detected in 1999-2000 in acoustic surveys and bottom trawl surveys on the shelf near the boundary between southern Div. 3K and northern Div. 3L. This overlaps the areas in which the Greenland halibut and shrimp directed fisheries are being carried out. Although reported by-catches on observed vessels are low (less than 40 tons in 2000), there is concern that by-catch mortality could delay or impede the recovery of the stock.

There has been no good recruitment at spawning stock biomass levels below 200 000 tons. Although it is difficult to define a $B_{lim}$ at this stage, it would clearly be desirable to have the spawning stock above 200 000 tons. Under the precautionary approach put forward by Scientific Council, there would be no fishing on a stock that is below $B_{lim}$. Any fishery on the remnant in the inshore will delay recovery of the stock.

The estimates of removals of cod by harp seals, based on reconstructed diets, are high (37 000 tons in 2000) and do not incorporate the mortality caused by seals feeding on cod bellies alone. It appears that predation by seals has been an important source of mortality of cod since the start of the moratorium. There is also the possibility that predation by seals is preventing the recovery of the cod stock, not simply because considerable numbers of cod are being consumed but also because some of those cod eaten are mature fish.

## 17. Witch Flounder (*Glyptocephalus cynoglossus*) in Divisions 2J, 3K and 3L (SCR Doc. 01/64; SCS Doc. 01/9, 11, 18)

### a) Introduction

The fishery for witch in this area began in the early-1960s and increased steadily from about 1 000 tons in 1963 to a peak of over 24 000 tons in 1973 (Fig. 17.1). Catches declined rapidly to 2 800 tons by 1980 and subsequently fluctuated between 3 000 and 4 500 tons to 1991. The catch in 1992 declined to about 2 700 tons, the lowest since 1964, and further declined to around 400 tons by 1993. Until the late-1980s, the fishery was conducted by Poland, USSR and Canada mainly in Div. 3K. Since then, the regulated fishery had been mainly Canadian although EU (Portugal and Spain) has taken increased catches in the NAFO Regulatory Area of Div. 3L since the mid-1980's. Although only 12 tons were reported for 1994, a catch of 491 tons was indicated for EU-Spain in the Spanish Research Report (SCS Doc. 95/15) for the Regulatory Area of Div. 3L. Although a moratorium on directed fishing was implemented in 1995, the catches in 1995 and 1996 were estimated to be about 780 and 1 370 tons, respectively. However, it is believed that these catches could be overestimated by 15-20% because of misreported Greenland halibut. The catches in 1997 and 1998 were estimated to be about 850 and 1 100 tons, respectively, most of which was reported from the NAFO Regulatory Area of Div. 3L. The 1999 and 2000 catches were estimated to be about 300 and 700 tons, respectively.

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

| | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|---|---|---|---|---|
| TAC | 4 | 3.5 | 1 | 0 | 0 | 0 | 0 | 0 | 0[1] | 0[1] |
| Catch | 3 | 0.4 | 0.5 | 0.7[2] | 1.4[2] | 0.8[2] | 1.1[2] | 0.3[2] | 0.7[2] | |

[1] No directed catch.
[2] Provisional.

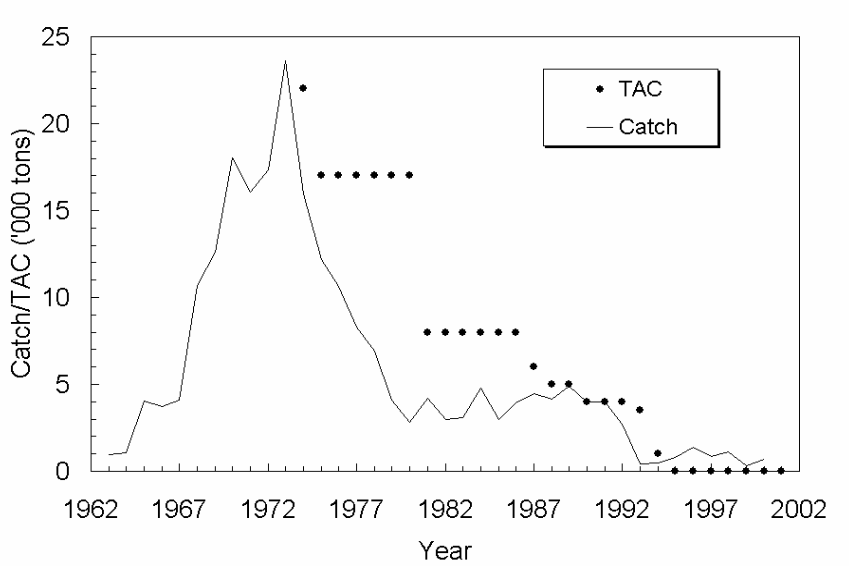



Fig. 17.1. Witch flounder in Div. 2J, 3K and 3L: catches and TAC

b) **Input Data**

i) **Research survey data**

**Biomass estimates**. For Div. 2J, biomass estimates ranged from as high as 5 900 tons in 1986 to a low of less than 300 tons in 1995 with only marginal increases since then and with the 2000 estimate still only 500 tons (Fig 17.2). In Div. 3K, during 1979-85, there was a period of relative stability where most annual biomass estimates were near 50 000 tons. Since that time estimates have declined considerably to less than 200 tons in 1995, the lowest in the time series. Estimates increased slightly after 1995 ranging from 900-1 300 tons between 1996-2000. For Div. 3L, biomass estimates varied generally between 7 000 and 10 000 tons from 1983 to 1990 but declined rapidly since then to a low of less than 400 tons in 1995. Little appreciable change has occurred since then.

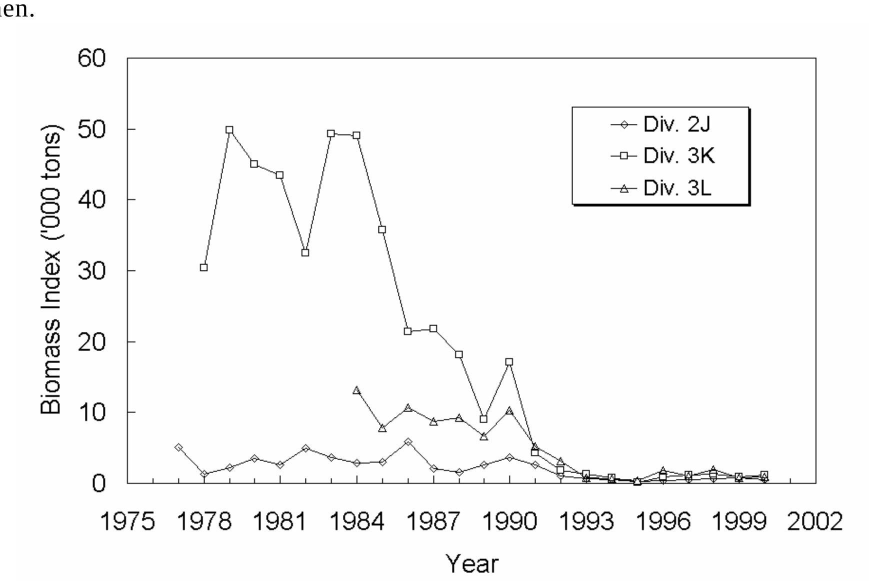



Fig. 17.2. Witch flounder in Div. 2J, 3K and 3L: biomass indices from Canadian autumn surveys.

**Distribution.** Survey distribution data from the late-1970s and early-1980s indicated that witch flounder were widely distributed throughout the shelf area in deeper channels around the fishing banks primarily in Div. 3K. By the mid-1980s, however, they were rapidly disappearing and by the early-1990s had virtually disappeared from the area entirely except for some very small catches along the slope and more to the southern area. They now appear to be located only along the deep continental slope area, especially in Div. 3L both inside and outside the Canadian 200-mile fishery zone (Fig. 17.3).

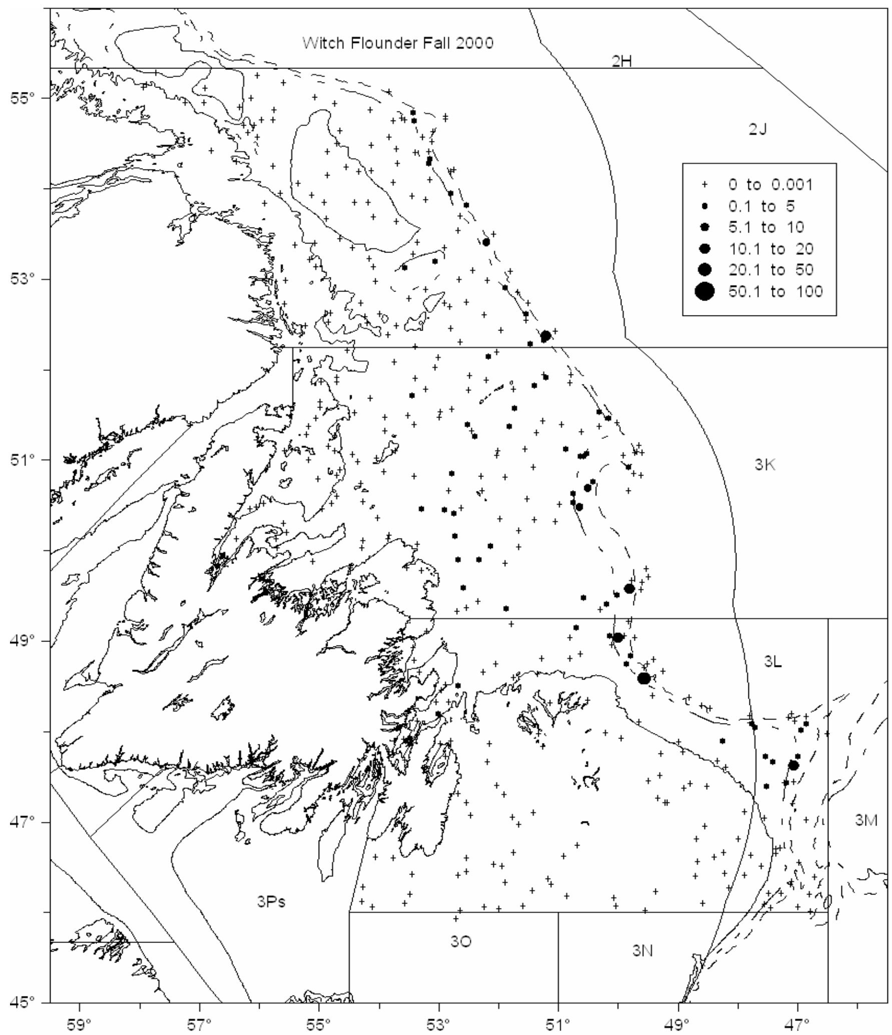



Fig. 17.3. Witch flounder in Div. 2J, 3K and 3L: Weight (kg) per set from Canadian surveys during autumn 2000.

c) **Assessment Results**

Based on the most recent data, STACFIS considers that the overall stock remains at a low level.

18. **Greenland Halibut (*Reinhardtius hippoglossoides*) in Subarea 2 and Divisions 3KLMNO** (SCR Doc. 01/10, 13, 22, 39, 44, 49, 79, 80; SCS Doc. 01/9, 11, 18)

a) **Introduction**

Catches increased from low levels in the early-1960s to over 36 000 tons in 1969, and ranged from 24 000 tons to 39 000 tons over the next 15 years. From 1986 to 1989, catches exceeded 20 000 tons only in 1987 (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 has been around 20 000 tons per year, with an increase to 24 000 tons in 1999 and 34 000 tons in 2000. The major participants in the fishery in the Regulatory Area in 2000 were EU-Spain (11 200 tons), EU-Portugal (4 700 tons), Russia (3 300 tons) and Japan (2 500 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 were 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 and increased to 10 600 tons in 2000. Most of the Canadian catch in recent years is taken by gillnets.

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

| | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|---|---|---|---|---|
| TAC[1] | 50 | 50 | 25 | 27 | 27 | 27 | 27 | 33 | 35 | 40 |
| Catch[2] | 63 | 42-62 | 51 | 15[3] | 19[3] | 20[3] | 20[3] | 24[3] | 34[3] | |

[1] Set autonomously by Canada 1985-94 and by the Fisheries Commission since 1995.
[2] Includes estimated unreported catches in 1991-96 and 2000.
[3] Provisional.

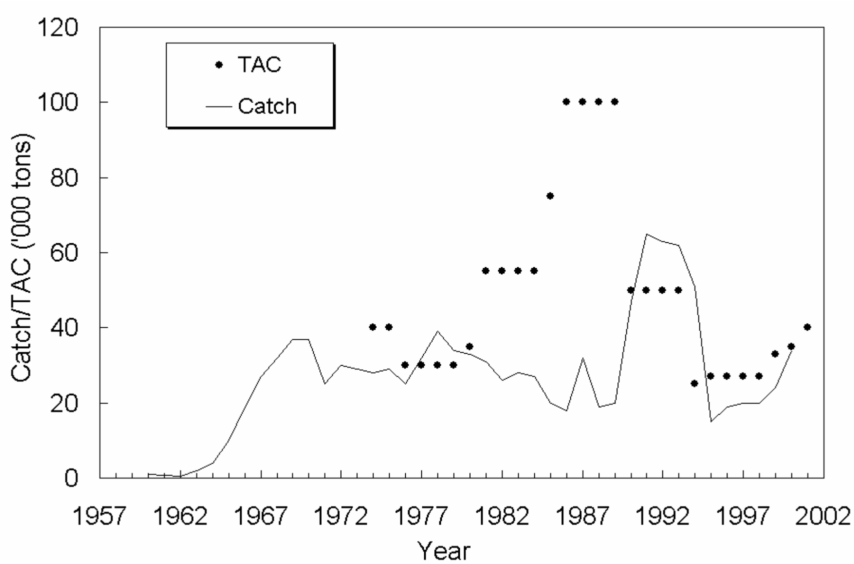



Fig. 18.1. Greenland halibut in Subarea 2 + Div. 3KLMNO: catches and TACs.

b) **Input Data**

i) **Commercial fishery data**

**Catch and effort**. Analyses of otter trawl catch rates from many fleets, 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 1997-2000 in the hours fished analysis and 1998-2000 in the days fished analysis (SCR Doc. 01/79).

Catch-rates of Portuguese otter trawlers fishing in the NAFO Regulatory Area (NRA) of Div. 3LMN from 1988-2000 declined sharply from 1989 to 1991, and remained around this low level until 1994 (SCS Doc. 01/09). CPUE has gradually increased since then, and in 1999-2000 it was almost double the low values in 1991-94, but still below the CPUE in 1988-90. Directed effort on Greenland halibut was present in Div. 3L in all years from 1988-2000, in Div. 3N since 1990 but only since 1995 in Div. 3M.

**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.

At the current STACFIS meeting the Canadian catch-at-age data for 2000 were provided as calculated in the usual fashion (SCR Doc. 01/65). In addition, the total international catch-at-age from 2000 was calculated and presented to STACFIS. These calculations were carried out by applying a Canadian annual commercial age-length key from the Canadian fishery in 2000 to length frequency data provided in national research reports by countries fishing in the NRA. The resultant age compositions were then adjusted to the agreed best estimates of total catch. 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. The Canadian age-length key was used for consistency in age interpretation (SCR Doc. 01/13).

Ages 6-8 dominated the catch throughout the entire time period with ages 12+ contributing about 10-15% on average to the 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. For older fish they were rather variable but with little appreciable trend (SCR Doc. 01/80).

ii) **Research survey data**

STACFIS reiterated that most research vessel survey series providing information on the abundance of Greenland halibut were 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. Nevertheless, the extent of coverage varied from year to year in all Divisions except for Div. 2H, 2J and 3K (SCR Doc. 00/12). During 1995, a new survey trawl (Campelen 1800 shrimp trawl) was introduced to the Canadian survey series. Conversions from the old trawl (Engel 145) to Campelen equivalents have been used for the data in Subarea 2 and Div. 3K, from 1978 to 1994, as described in previous STACFIS reports.

Although EU (Spain) has conducted surveys during spring in the NRA portion of Div. 3NO since 1995 no new data were available for review at the present meeting.

**Canadian stratified-random surveys in Div. 2J and 3K** (SCR Doc. 01/39) (Fig. 18.2). These surveys are conducted in the autumn. Length-weight relationships were applied to estimate biomass 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 declined again in 2000 to 55 000 tons, the lowest value since 1995. In Div. 3K there was a rather long period of apparent stability from 1978-89 at an average annual biomass estimate 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 it reached an estimate of 176 000 tons, the highest in the time series. As with Div. 2J the index declined again in 2000 to about 143 000 tons, which is about the same as the 1998 value.

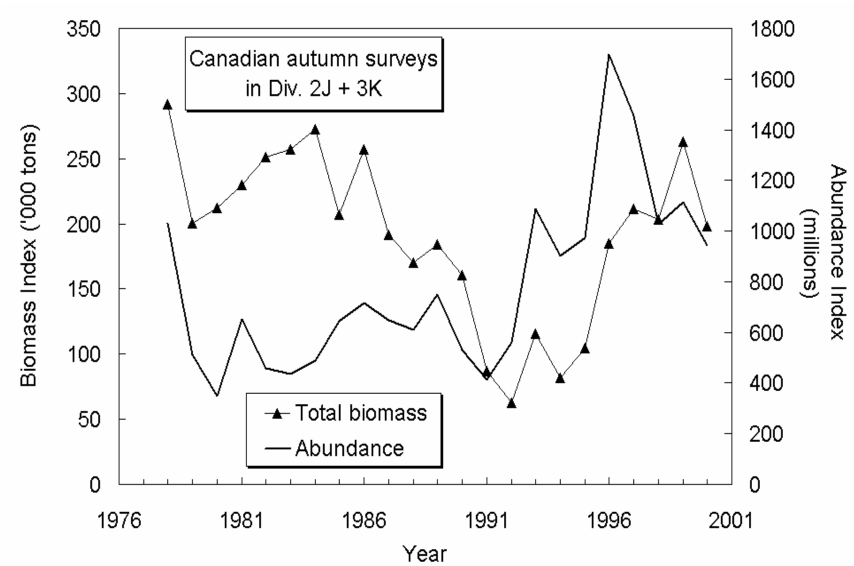



Fig. 18.2 Greenland halibut in Subarea 2 + Div. 3KLMNO: estimates of biomass and abundance from Canadian autumn surveys.

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. 01/39). While the index declined in 2000 it still remained at a high level. During the late-1970s and early-1980s Greenland halibut greater than 70 cm (approximate length at $M_{50}$) contributed near 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.18.3). Since then, the contribution to stock biomass from this size group has remained extremely low (SCR Doc. 01/39).

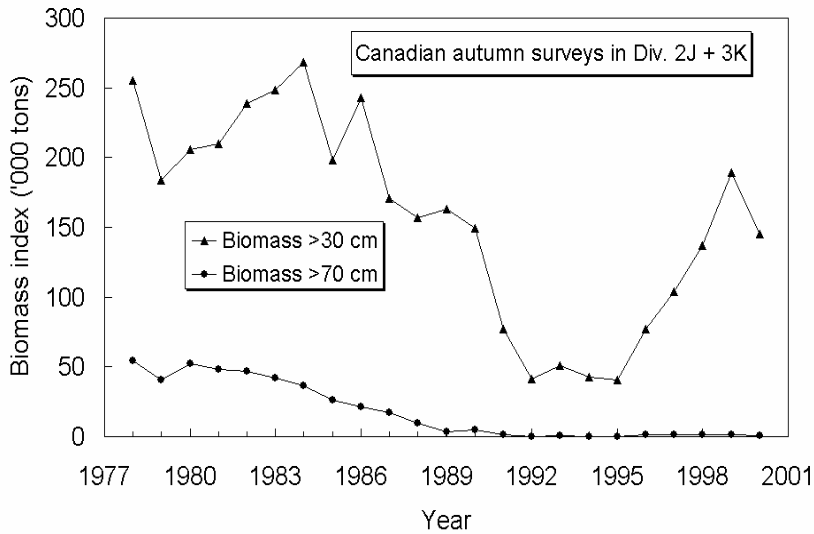



Fig. 18.3 Greenland halibut in Subarea 2 + Div. 3KLMNO: estimates of biomass for fish >30 cm and >70 cm from Canadian surveys.

An examination of the age structure indicated that the ages 6+ abundance declined by over 80% from the peak values of the mid-1980s to the lowest point observed in 1994 (SCR Doc. 01/39). Abundance increased steadily at these ages from 1994 to 1997 and stabilized in 1998. The 1999 value was about double the 1997 and 1998 estimates but declined again somewhat in 2000. Ages 10+ declined from the early-1980s to very low levels in 1994-95 when they virtually disappeared from the surveys. Little or no improvement has occurred since then. On the other hand, the abundance index of ages 3-5 slowly increased from the early-1980s to about 1989. The index for ages 3-5 generally remained above the long-term average since 1989 and reached a maximum in 1993. The index remained relatively high in 1996-99 but declined to below the 1996 value in 2000.

**Canadian stratified-random surveys in Div. 3LMNO** (SCR Doc. 01/39). As part of the annual Canadian autumn survey (September to December), coverage in 1996-2000 was extended to Div. 3M (only Flemish Pass and Sackville Spur, deeper than 731 m in 1997-2000), 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 again in 2000. Survey coverage was most complete in 1998 and 2000 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 25% of the total biomass estimated from the Canadian autumn surveys in 1998, although deep strata in Div. 2G and 3O were not fully surveyed. This compares to about 19% in 1996-97 and 12% in 1999, when deepwater coverage in Div. 3NO was not as extensive as in 1998.

**EU stratified-random surveys in Div. 3M** (SCR Doc. 01/22). 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. The estimated biomass has increased in each year since then, to reach a maximum value of 24 000 tons in 1998, which was slightly more than double the 1996 estimate. The biomass declined to about 21 000 tons and 17 000 tons in the 1999 and 2000 surveys, respectively. The age composition data indicated that the abundance in 1997 and 1998 was dominated by ages 3-7, compared to ages 4-7 in the 1999 survey indicating that an increase in recruitment was mainly responsible for the relatively high biomass in those years. The 1993, 1994 and 1995 year-classes were represented by relatively high values at all ages thus far with the estimate of the 1994 year-class at age 6 in 2000 the 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.

**Russian stratified-random survey in Div. 3LM** (SCR Doc. 01/10). A Greenland halibut directed survey was carried out in depths of 732-1280 m during the spring of 2000. Estimated abundance and biomass of Greenland halibut constituted 37 million fish and 24 000 tons, respectively. Most fish were in the length range of 30-50 cm with mean lengths of 41 cm for males and 43 cm for females.

iii) **Recruitment indices**

A mixed linear (multiplicative) model was used to calculate an index of year class strength from available research vessel survey datasets (SCR Doc. 01/44). 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.

Six independent data series were used in the analysis: (i) the Canadian autumn Div. 2GH series (Campelen trawl; 1996-99), (ii) the Canadian autumn Div. 2J and 3KLMNO series (Campelen trawl; 1996-2000), (iii) the Canadian autumn Div. 2J and 3KL series (Engel trawl; 1981-94), (iv) the Canadian spring Div. 3L series (Yankee 41.5 trawl 1977-82; Engel trawl; 1984-95), (v) the Canadian spring Div. 3LNO series (Campelen trawl; 1996-99), and (vi) the EU July Div. 3M series (1992-2000). Abundance estimates (in thousands) 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. 18.4). The 1990-92 year-classes appeared to be nearly the same as 1984-85. The 1993-95 year-classes were estimated to be well above average despite wide confidence intervals. The subsequent year-classes (1996-98) are about the same in strength as those of the earlier period.

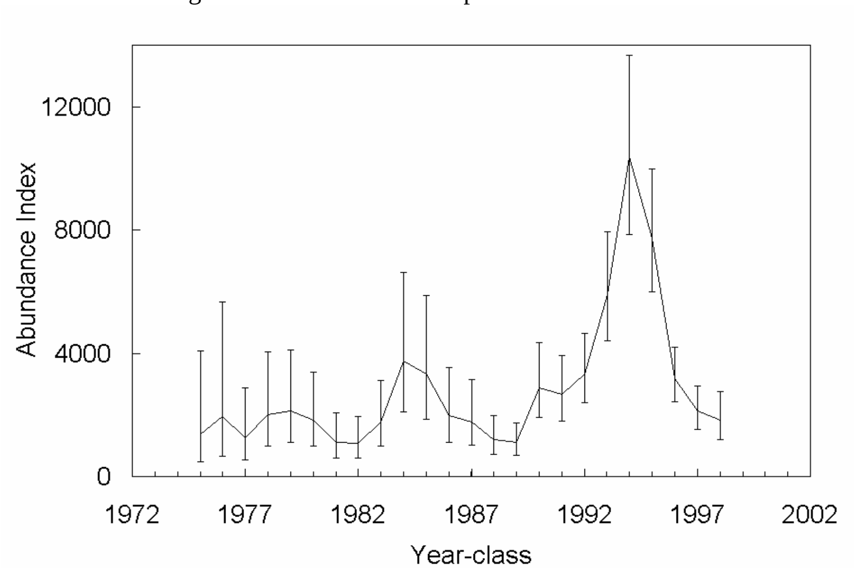



Fig. 18.4 Greenland halibut in Subarea 2 + Div. 3KLMNO: recruitment index from six research vessel survey series

c) **Biological Studies**

Maturity at age and size were examined for male and female Greenland halibut (SCR Doc. 01/49). Estimates were produced from Canadian survey data for a portion of the stock area (Div. 2J and 3K) from 1978-2000 and from 'synoptic' surveys covering the stock area from Div. 2GH in the north to Div. 3NO in the south from 1996 to 1999. The estimates from the Div. 2J and 3K area were similar to those of the wider area but were extremely variable, particularly since the late-1980s. However, there was no apparent trend over time in the estimates for the Div. 2J and 3K area and the best estimates for the entire time period may be those produced from the synoptic surveys of 1996-99. Estimated age at 50% maturity for females from these surveys is 13.6 years.

d) **Assessment Methodologies**

A complete catch-at-age matrix from the commercial fishery was available from 1975-2000. Using fishery independent abundance indices i.e. the Canadian autumn surveys in Div. 2J and 3K from 1978-2000 and the EU surveys in Div. 3M from 1991-2000 for calibration, an age-structured model, Extended Survivors Analysis (XSA) was engaged to investigate the current population abundance at age. STACFIS reviewed the results of this analysis (SCR Doc. 01/80).

e) **Assessment Results**

Based on the results of the XSA, the resource has been increasing since the mid-1990s. This trend during this period is consistent with the Canadian and EU surveys and is the result of better than average recruitment during the first half of the 1990s particularly the 1993-95 year-classes. However, the overall historical trajectory of the resource, as indicated by the XSA, suggested that the current stock size is the largest in the time period from 1975 to the present. This did not fit the trend as suggested by the longest series of research data, those for Div. 2J and 3K (Fig. 18.5), nor did it fit overall perceptions of this resource over time.

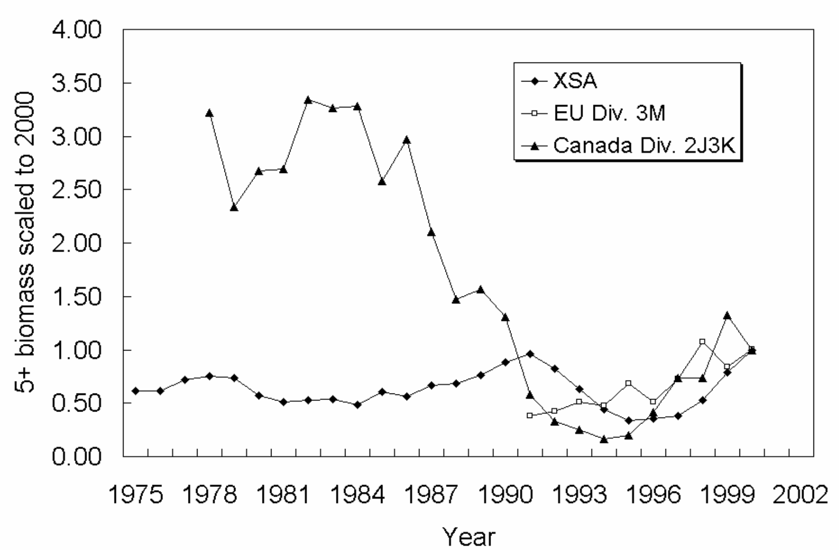



Fig. 18.5. Greenland halibut in Subarea 2 + Div. 3KLMNO: comparison between the age 5+ biomass index from the Canadian and EU surveys and the age 5+ biomass obtained from the Extended Survivors Analysis (XSA).

As the dynamics of the underlying population model are still uncertain, it is difficult to determine an absolute estimate of fishing mortality. Accordingly, projections were made under scenarios of *status quo* fishing mortality, assuming a catch of 40 000 tons in 2001, instead of scenarios using traditional reference points. The *status quo* projections, using the XSA results are presented here.

There was considerable uncertainty as to the strengths of the 1994-96 year-classes. Therefore, for projections, these year-classes were set at a more conservative level defined as the average of the XSA estimates and the long-term geometric mean. Probability profiles of catch predictions in 2002, 2003 and 2004 at 3 levels of fishing mortality: F *status quo*, $F_{sq}$ - 30% and $F_{sq}$ + 30% are shown in Fig 18.6. Trends in exploitable (ages 5+) and spawning stock biomass (represented by ages 10+), and the corresponding confidence intervals, are given in and Fig. 18.7 for the 3 levels of fishing mortality with the input parameters shown in Table 18.1.

Table 18.1 Greenland halibut in Subarea 2 and Div. 3KLMNO: input parameters for the short and medium-term predictions and risk analysis.

Input data

| Age | $N_{2001}$ | Catch Wt. (kg) | Stock Wt. (kg) | M | PR |
|---|---|---|---|---|---|
| 1 | Bootstrapped | 0.000 | 0.000 | 0.2 | 0.000 |
| 2 | 193074 | 0.000 | 0.000 | 0.2 | 0.000 |
| 3 | 36927 | 0.000 | 0.000 | 0.2 | 0.000 |
| 4 | 65671 | 0.245 | 0.000 | 0.2 | 0.002 |
| 5* | 66938 | 0.359 | 0.359 | 0.2 | 0.019 |
| 6* | 78550 | 0.533 | 0.533 | 0.2 | 0.093 |
| 7* | 70120 | 0.807 | 0.807 | 0.2 | 0.347 |
| 8 | 34847 | 1.216 | 1.216 | 0.2 | 0.316 |
| 9 | 12394 | 1.734 | 1.734 | 0.2 | 0.286 |
| 10 | 5123 | 2.306 | 2.306 | 0.2 | 0.261 |
| 11 | 1698 | 2.959 | 2.959 | 0.2 | 0.293 |
| 12 | 992 | 3.721 | 3.721 | 0.2 | 0.342 |
| 13 | 395 | 4.691 | 4.691 | 0.2 | 0.305 |
| 14 | 462 | 5.815 | 5.815 | 0.2 | 0.305 |

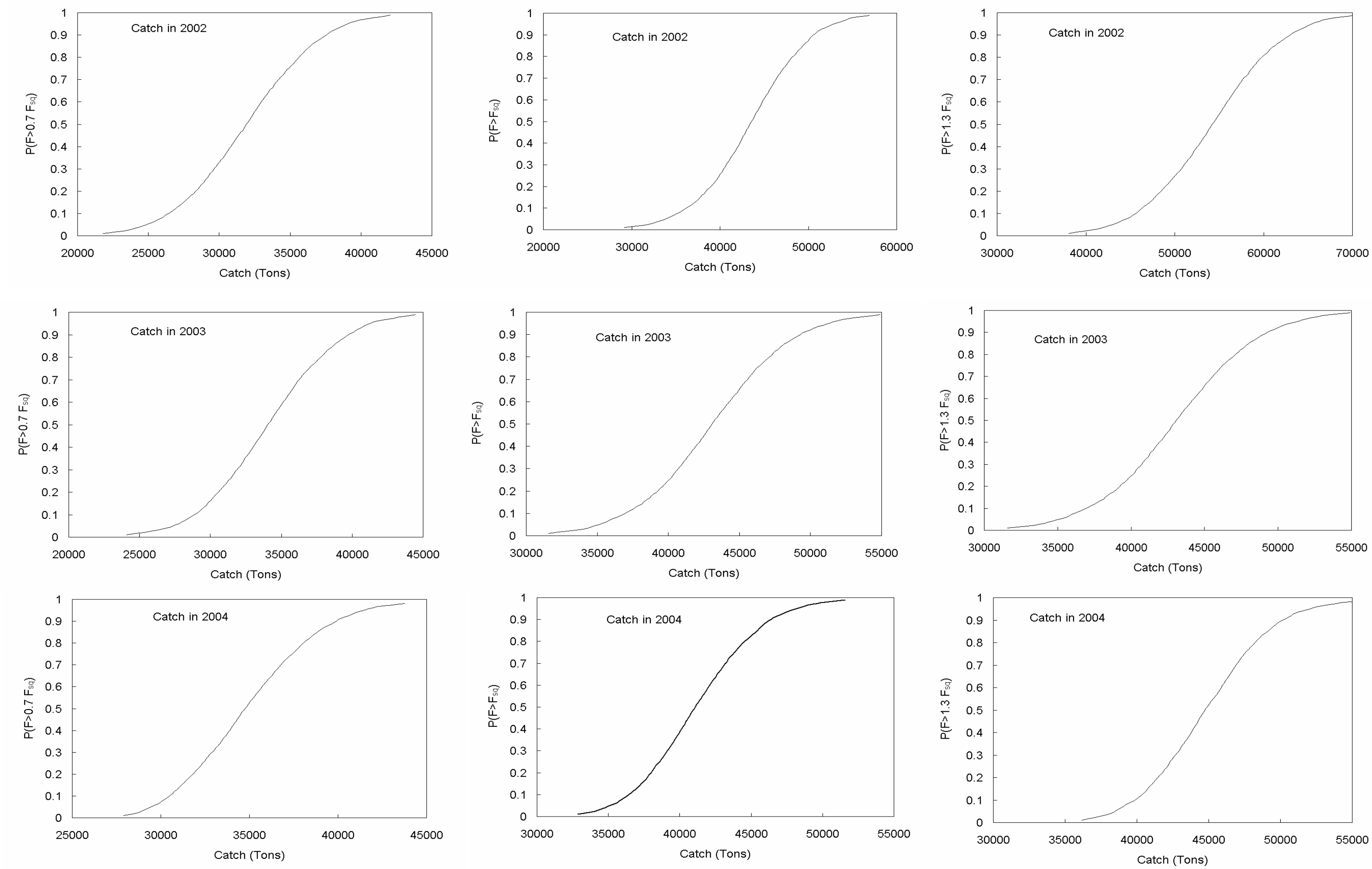
Source N = From XSA output except *
N* = 0.5NXSA+0.5NGM(1975-1998)
PR = F 98-2000 scaled to F2001 for a 40000 tons catch,
PR CV from average PR 1998-2000 scaled to 1
R= Bootstrapped in 1975-1999 time series

CVs

| Source<br>Error<br>model | Average<br>VPA<br>Lognormal | Average<br>1996-99<br>Normal | Average<br>1996-99<br>Normal | Assumed<br>Normal | Average PR<br>(1998-2000)<br>Normal |
|---|---|---|---|---|---|
| Age | | | | | |
| 1 | Bootstrapped | 0.000 | 0.000 | 0.15 | 0.000 |
| 2 | 0.45 | 0.000 | 0.000 | 0.15 | 0.000 |
| 3 | 0.40 | 0.000 | 0.000 | 0.15 | 0.000 |
| 4 | 0.26 | 0.060 | 0.000 | 0.15 | 0.291 |
| 5 | 0.19 | 0.038 | 0.038 | 0.15 | 0.471 |
| 6 | 0.17 | 0.018 | 0.018 | 0.15 | 0.239 |
| 7 | 0.16 | 0.024 | 0.024 | 0.15 | 0.260 |
| 8 | 0.15 | 0.027 | 0.027 | 0.15 | 0.284 |
| 9 | 0.15 | 0.030 | 0.030 | 0.15 | 0.564 |
| 10 | 0.16 | 0.017 | 0.017 | 0.15 | 0.055 |
| 11 | 0.18 | 0.040 | 0.040 | 0.15 | 0.130 |
| 12 | 0.20 | 0.070 | 0.070 | 0.15 | 0.297 |
| 13 | 0.23 | 0.081 | 0.081 | 0.15 | 0.311 |
| 14 | 0.25 | 0.051 | 0.051 | 0.15 | 0.311 |

b) **Reference points**

The current assessment results are not considered sufficiently reliable to allow estimation of formal reference points in quantitative terms.




Greenland Halibut in Subarea 2+3 Short-term catch projection at 0.7 $F_{sq}$

| Year | 2002 | 2003 | 2004 |
|---|---|---|---|
| Deterministic | 32265 | 34577 | 35137 |
| P=0.05 X< | 24936 | 27458 | 29299 |
| P=0.50 X≤ | 31997 | 34431 | 34959 |
| P=0.95 X< | 39150 | 41542 | 41658 |

Greenland Halibut in Subarea 2+3 Short-term catch projection at $F_{sq}$

| Year | 2002 | 2003 | 2004 |
|---|---|---|---|
| Deterministic | 43945 | 43434 | 41343 |
| P=0.05 X< | 33829 | 35156 | 35136 |
| P=0.50 X≤ | 43562 | 43071 | 41084 |
| P=0.95 X< | 52904 | 51317 | 48153 |

Greenland Halibut in Subarea 2+3 Short-term catch projection at 1.3 $F_{sq}$

| Year | 2002 | 2003 | 2004 |
|---|---|---|---|
| Deterministic | 54845 | 50261 | 44881 |
| P=0.05 X< | 43054 | 41726 | 38492 |
| P=0.50 X≤ | 54232 | 49877 | 44742 |
| P=0.95 X< | 65491 | 59015 | 52082 |

Fig. 18.6. Greenland halibut in Subarea 2 + Div. 3KLMNO – probability profiles of catch predictions in 2002, 2003 and 2004 at 3 levels of fishing mortality: F *status quo*, $F_{sq}$ - 30% and $F_{sq}$ + 30%.

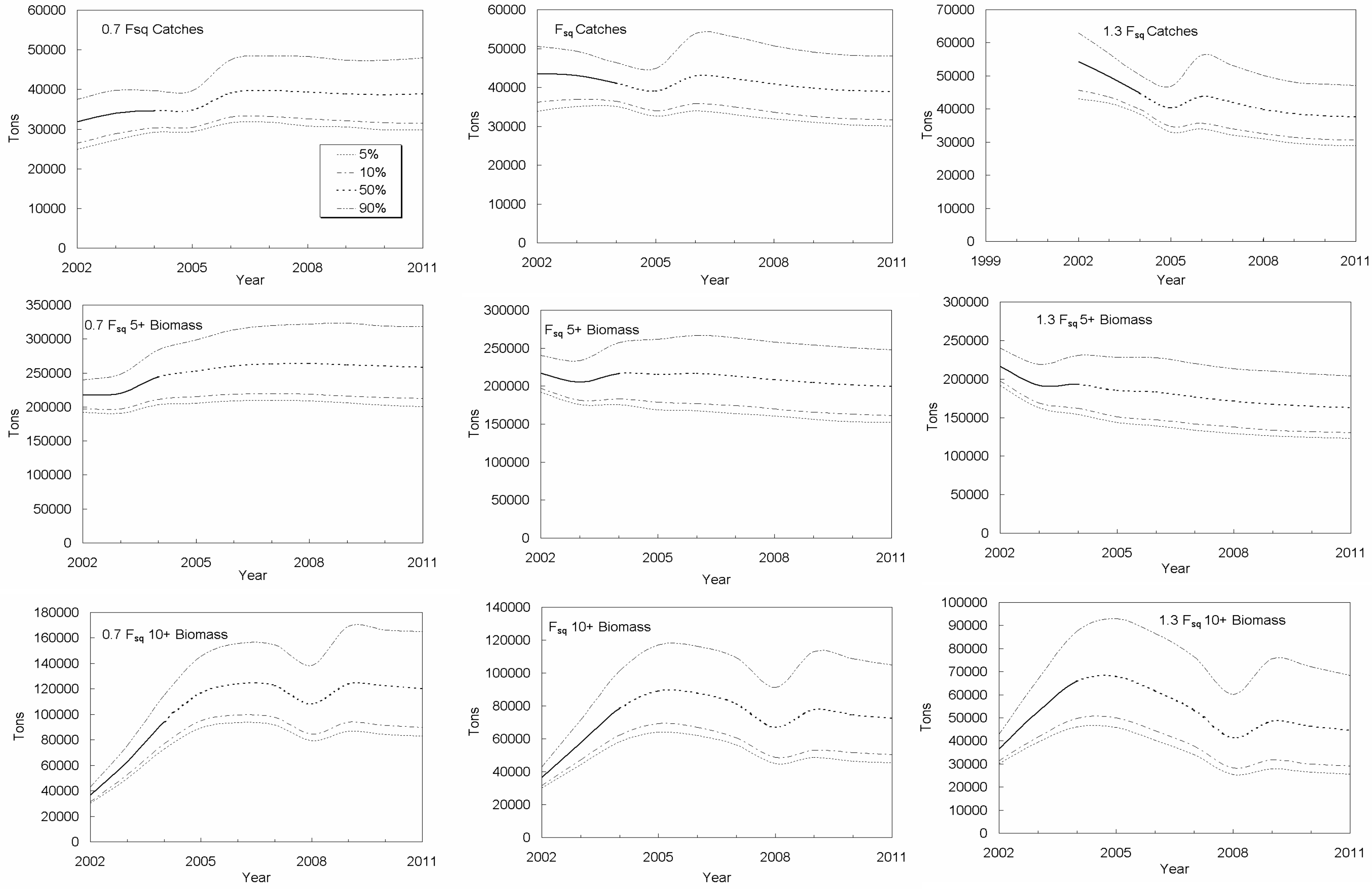



Fig. 18.7. Greenland halibut in Subarea 2 + Div. 3KLMNO – Medium term projections at 3 levels of fishing mortality: F *status quo*, $F_{sq}$ – 30% and $F_{sq}$ + 30%.

19. **Short-finned Squid (*Illex illecebrosus*) in Subareas 3 and 4** (SCR Doc. 98/75, 01/57, 61; SCS Doc. 01/11, 12, 17)

a) **Introduction**

i) **Description of the fisheries**

In Subareas 3+4, a TAC of 150 000 tons was in place during 1980-98. It was set at 75 000 tons for 1999 and 34 000 tons for 2000. Occasionally, very low catches from Subarea 2 occur; these have been included with Subarea 3 for convenience. Subareas 3+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 1991-95, then increased to 16 000 tons in 1997. Catches declined to 2 000 tons in 1998 and 300 tons in 1999 and 2000 (SCR Doc. 01/61).

Since this annual species is considered to constitute a single stock throughout Subareas 2-6, trends in Subareas 3+4 must be considered in relation to those in Subareas 5+6. Subareas 5+6 catches have ranged between 2 000 tons and 25 000 tons during 1970-2000 (Fig. 19.1).

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

| | 1992 | 1993 | 1994 | 1995[1] | 1996[1] | 1997[1] | 1998[1] | 1999[1] | 2000[1] | 2001 |
|---|---|---|---|---|---|---|---|---|---|---|
| TAC SA 3+4 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 75 | 34 | 34 |
| Catch SA 3+4 | 1.6 | 2.7 | 5.9 | 1.0 | 8.7 | 15.6 | 1.9 | 0.3 | 0.3 | |
| Catch SA 5+6 | 17.8 | 18.0 | 18.3[1] | 14.0 | 17.0 | 13.6 | 23.6 | 7.4 | 9.0 | |
| Catch SA 3-6 | 19.4 | 20.7 | 24.2[1] | 15.0 | 25.7 | 29.2 | 25.5 | 7.7 | 9.3 | |

[1] Provisional catches.

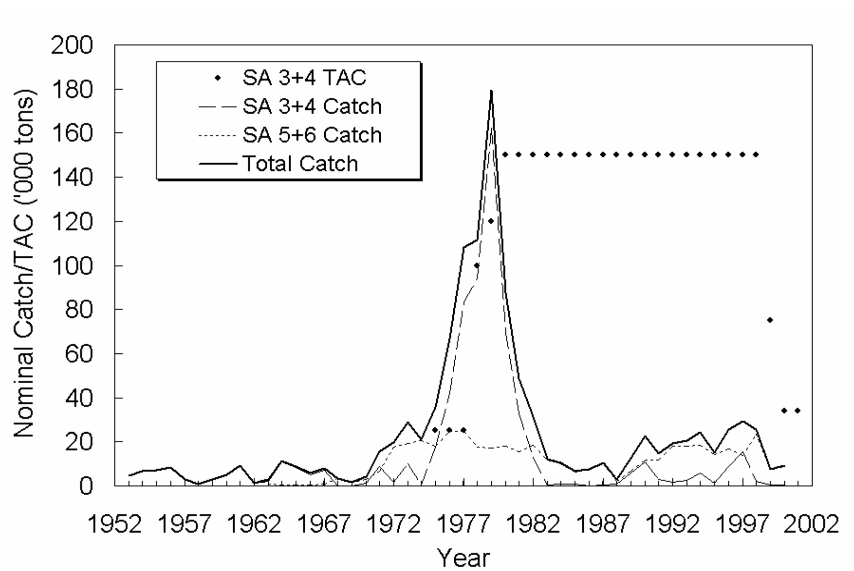



Fig. 19.1. Short-finned squid in Subareas 3+4: nominal catches and TACs in relation to Subareas 5+6 and total stock catches.

b) **Input Data**

i) **Commercial fishery data**

Estimates of nominal catches were available for Subareas 3+4, during 1953-2000, and for Subareas 5+6 during 1963-2000. 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 Subarea 3+4, is unknown. Subarea 4 catches were updated to reflect the by-catch of squid in the Scotian Shelf silver hake fishery, during 1987-2000, a period of 100% fishery coverage by the Canadian Observer Program.

ii) **Research survey data**

Stratified, random bottom trawl surveys were conducted in Subarea 4 on the Scotian Shelf (Div. 4VWX) during July of 1970-2000, in the southern Gulf of St. Lawrence (Div. 4T) during September of 1971-2000, and in Subareas 5+6 during autumn of 1967-2000. 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 all Subareas.

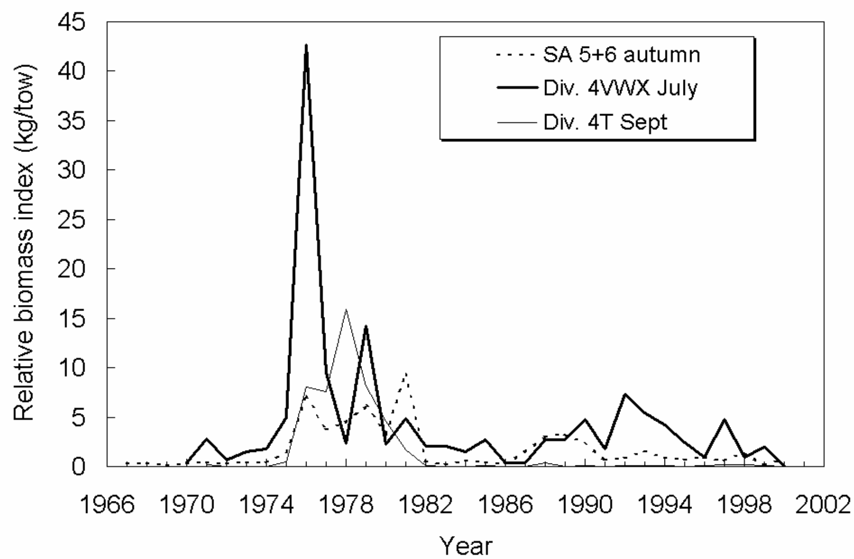



Fig. 19.2. Short-finned squid in Subareas 3+4: research survey biomass indices for Subarea 4, during July in Div. 4VWX and September in Div. 4T, and during autumn in Subareas 5+6.

iii) **Biological studies**

Biological samples from the Subarea 3 inshore jig fishery indicated a smaller mean size and slower maturation of males, during 2000, relative to individuals sampled during 1976-98 (SCR Doc. 01/57). No squid samples were obtained from the Subarea 4 silver hake fishery in 2000 (SCS Doc. 01/12).

Annual mean body weights of squid from the July survey in Div. 4VWX declined dramatically during 1982-83, following much higher mean weights during 1976-1981 (Fig. 19.3). Mean body weight increased gradually in subsequent years, to 1999 when it achieved the highest value since

1981. It then declined to a record low in 2000. Similar trends were evident in Subareas 5+6, with higher mean body weights during 1976-81 than in recent years.

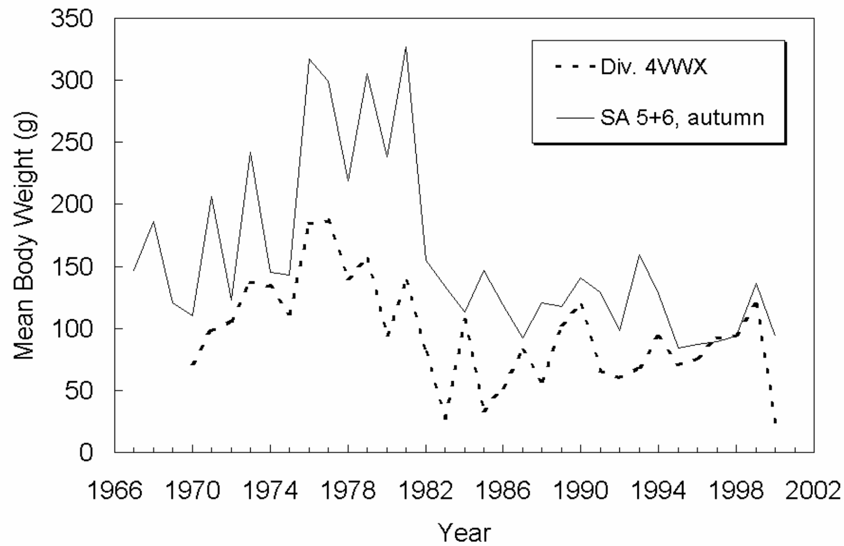



Fig. 19.3. Short-finned squid in Subareas 3+4: mean body weight in the July Div. 4VWX and the autumn Subareas 5+6 bottom trawl surveys.

iv) **Fishing mortality indices**

Fishing mortality indices (Subarea 3+4 nominal catch/July Div. 4VWX survey biomass index) in Subareas 3+4 were highest during 1978-80, within the 1976-81 period of highest catch (Fig. 19.4).

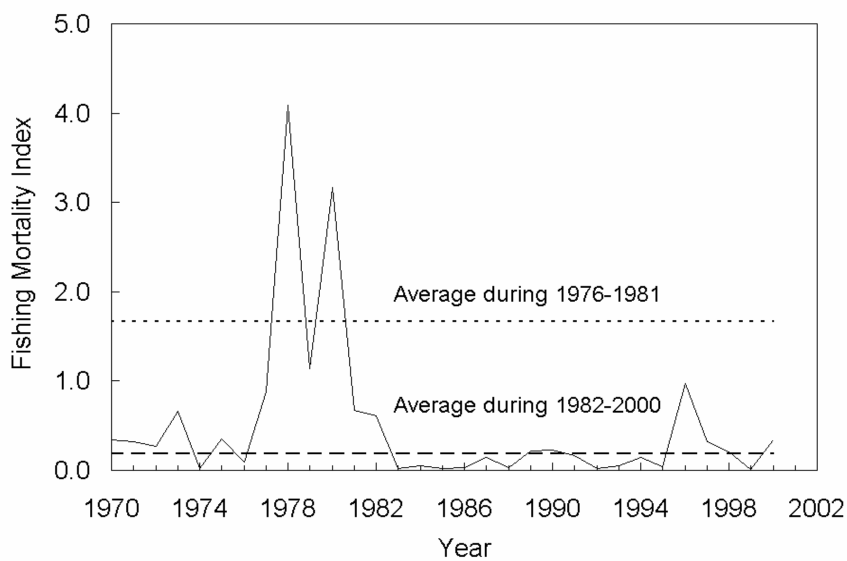



Fig. 19.4. Short-finned squid in Subareas 3+4: fishing mortality indices.

c) **Assessment Results**

Trends in fishery and research vessel survey data indicate that a period of high productivity occurred during 1976-81, followed by a period of much lower productivity during 1982-2000. It appears that the high productivity period was associated with larger body size than in the more recent low productivity period.

Relative abundance and biomass, as well as mean body weight, of squid caught in the Div. 4VWX survey, were the lowest on record in 2000. Survey trends were similar in Subareas 5+6. Catches in Subareas 3+4 remained low and the mean length of squid in the Subarea 3 jig fishery was very small in 2000. These data suggest that productivity continued to be low in 2000.

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 Recommendations**

STACFIS **recommended** that *for short-finned squid in Subareas 3+4 survey abundance and biomass indices be developed for Subarea 3.*

## E. MISCELLANEOUS TASKS

20. **Pelagic Redfish in the NAFO Convention Area** (SCR Doc. 01/01, 20, 34; SCS Doc. 01/11, 13; (see also meeting reports (FC Doc. 01/03, 07))

STACFIS noted that information had been provided by Scientific Council to Fisheries Commission during the September 2000 Annual Meeting (*NAFO Sci. Coun. Rep*., 2000, p. 182-183) indicating that since the initiation of systematic surveys in the early-1990s, the stock had been shown to be distributed in the ICES Sub-area XII, parts of SA Va and XIV. During the 1999 international survey, the stock was found distributed to a great extent inside the NAFO Convention Area (Div. 1F). Scientific Council also indicated that it considered the oceanic redfish distributed in NAFO Div. 1F as part of the oceanic stock previously distributed in the NEAFC Convention Area.

Additional information was provided to the NAFO/NEAFC Working Group meeting during 13-14 February 2001, and to the Special Fisheries Commission meeting of 28-30 March 2001. This same information was reviewed by STACFIS during this June 2001 Meeting.

In 2000, significant fishing activity took place in the NAFO Convention Area (Div. 1F) compared to previous years. Preliminary information suggested 10 944 tons were taken there. The majority of these fish were sexually mature, similar to the catches in the NEAFC Area.

Based on the international and Russian trawl-acoustic surveys, during the 1990s prior to 1999, the main concentrations were found east of the NAFO Convention Area in the NEAFC Area but they also demonstrated that the resource distribution did extend into the NAFO Convention Area. The more westward distribution found in 1999 has been hypothesized to result from a redistribution of water masses but information was not available to allow STACFIS to consider this in detail. The 1999 survey data indicated that 31% of the overall estimated biomass was in Div. 1F with this distributed at about 50:50 between the Greenland EEZ and the NAFO Convention Area.

These summer distributions are considered by ICES to represent feeding aggregations. It is believed that the fish migrate back eastward in the autumn for mating, and larvae are extruded in the spring in the ICES area. The eastward migration in the autumn is supported by fishery data that show a gradual reduction in the fishable concentrations in the west in the fourth quarter.

The information indicates that while the presence of commercial concentrations of oceanic redfish in the NAFO Convention Area appears, based on fishing activity, to be a relatively recent phenomenon, there are data that indicate the biological extension of the resource into the NAFO Area is not new. In 1980, the USSR found aggregations of oceanic redfish in Div. 1F, and they conducted 23 comprehensive scouting and research cruises into the Div. 1F area subsequently. They fished aggregations in Div. 1F during 1990, 1991 and 1999. During the 1990s, three international and four Russian trawl-acoustic surveys showed that the distribution, during the time of the survey, extended into the NAFO Convention Area but only at relatively low densities.

Published information from the 1960s also indicates the presence of these pelagic fish in the NAFO Convention Area and even extending into the Canadian EEZ although the abundance in the western-most areas is not known.

Overall, STACFIS concluded that the redfish found in NAFO Div. 1F do constitute a part of the oceanic redfish in the NEAFC Area, and **recommended** that *the oceanic S. mentella resource should be managed in a compatible manner between NAFO and NEAFC*. STACFIS noted that Fisheries Commission has done this for the 2001 fishing year, but **recommended** that *longer- term arrangements be made.*

STACFIS was unable, based on available information, to evaluate the overall extent of distribution within the NAFO Convention Area, the relative amounts present in the NAFO Convention Area and NEAFC area, nor how this may change over time. STACFIS did note that the international trawl-acoustic survey planned for the summer of 2001 will cover more western areas than previous surveys and that the results of this survey should be available for review during the Annual Meeting in September 2001.

STACFIS was unable to evaluate the possible relationships between the oceanic redfish and the shelf stocks in the NAFO Convention Area. It was noted that ICES has also been unable to agree on the relationship of the oceanic redfish with those in the shelf areas of Iceland, and that results from genetic studies to date have been inconclusive. Further, it has been hypothesized by Iceland that the oceanic redfish appear to be comprised of two components, oceanic *S. mentella* down to about 500 m, and the deepwater pelagic *S. mentella* found deeper than 500 m. ICES in 2001 advised that management measures are required to ensure that the possible stock components in the pelagic fishery in the Irminger Sea will not be overexploited. (see paper from ICES, ACFM, 2001).

STACFIS **recommended** that *this resource in the NAFO Convention Area not be referred to as "redfish in Div. 1" but more specifically as "pelagic S. mentella in the NAFO Convention Area".*

STACFIS noted that it is important to have close, ongoing interaction between NAFO Scientific Council and ICES on the issue of pelagic *S. mentella*.

Nonetheless, STACFIS advises against the establishment of a Joint NAFO/ICES Working Group to examine this resource. The resource is assessed annually by the North-Western Working Group of ICES, and members of Scientific Council normally participate in these activities.

STACFIS **recommended** that *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 at the subsequent meeting of Scientific Council*.

Additionally, all documentation pertaining to pelagic *S. mentella* provided to the North-Western Working Group of ICES should be made available to the Scientific Council.

Further, it is **recommended** that *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 Scientific Council for consideration as necessary.*

21. **Long-term Effects of Increasing Mesh Size from 130 to 145 mm on Greenland Halibut Fishery and in Reducing By-catch of Other Species**

The Fisheries Commission had requested the Scientific Council to *provide*: *information on the long-term effects of increasing mesh size from 130 mm to 145 mm in yield-per-recruit and stock spawning biomass-per recruit for Greenland halibut in SA 2 + Div. 3KLMNO and in reducing by-catch of other species in that fishery.* The Scientific Council had also been requested to: *evaluate the medium term consequences in terms of yield and stock size of any such changes in mesh size.*

The species that are taken as by-catch within the SA 2 + Div. 3KLMNO Greenland halibut fishery are American plaice, cod, yellowtail flounder, roughhead grenadier, roundnose grenadier, thorny skate, hake, monkfish, spotted wolfish, striped wolfish, redfish and witch flounder (SCR Doc. 01/40). For some of these species, Scientific Council has provided advice on this subject in earlier reports (*NAFO Sci. Coun. Rep*., 1995, 1997 and 1998) as follows:

*Greenland halibut*

In 1995, 1997 and 1998 (*NAFO Sci. Coun. Rep*., 1995, 1997 and 1998), the Scientific Council examined the effects on the Greenland halibut fishery in Subareas 2 and 3 of:

1) an increase in the length of first capture to 60 cm
2) separate natural mortality-at-age by sex
3) a dome-shaped selection pattern,
4) a mesh change from 130 mm to 155 mm.

Relatively small increases in mesh size were shown to have only marginal effects on yield and spawning stock biomass.

In 1995 (*NAFO Sci. Coun. Rep*., 1995), the Council concluded that it would be difficult to generate an exploitation pattern for trawlers that would be optimal for Greenland halibut. Also that "substantial improvements in the exploitation pattern could be achieved by adoption of alternative fishing methods such as, long lining and gill netting with 205 mm mesh". Also that "restricting fishing for Greenland halibut to 1 200 m should decrease the proportion of small fish in the catch, since larger individuals are found in deeper water".

*American plaice*

In 1996 (*NAFO Sci. Coun. Rep*., 1996), the Council concluded that significant gains in yield-per-recruit could not be realized by increasing the age of first capture, but that significant gains in SSB could. Scientific Council concluded that, due to the uncertainty in important parameters, namely natural mortality and different growth rates by sex, it was unable to specify an optimal minimum size for American plaice in Div. 3LNO (and by implication the optimal mesh size).

*Redfish*

In 1995 (*NAFO Sci. Coun. Rep*., 1995), the Council noted that 130 mm mesh allowed escapement of 90%, by weight, of the catch of redfish relative to 90 mm mesh, in mid-water trawl experiments. The results were conditional on the length structure of the stock, in the area of the fishery.

*Multi-species*

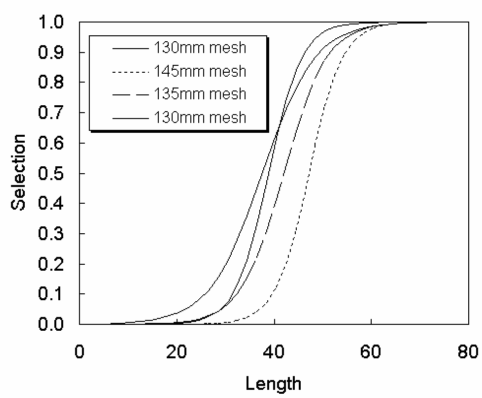
In 1995 (*NAFO Sci. Coun. Rep*., 1995), with reference to minimum landing sizes, the Council stated that if a single net rule were to be introduced for trawling in the NAFO region, then a 130 mm mesh size is a compromise corresponding to the optimum yield-per-recruit fishery for the traditional species – American plaice, yellowtail flounder, witch flounder and cod.

*Further studies*

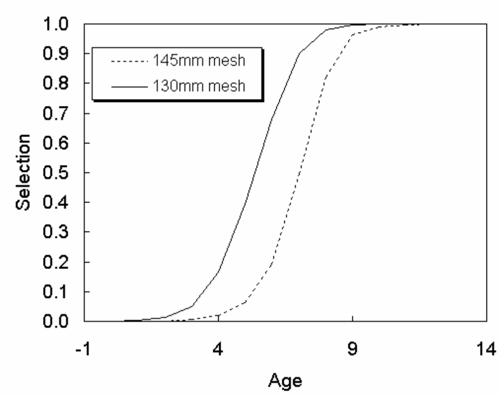
The effects of a change in mesh selection on the yield and SSB per recruit of Greenland halibut in SA 2 + Div. 3KLMNO, American plaice in Div. 3LNO and cod in Div. 3NO were examined in SCR Doc. 01/81. For each species, trawl selection at length for 130 mm and 145 mm nets was calculated using mesh retention parameters estimated by mesh selection experiments. Selection at length was converted to selection at age using an age length key. For each stock, the relative change in selection at age between the 130 mm and 145 mm mesh was used to scale the average partial recruitment at age, estimated within an age based assessment model. It was assumed that trawlers using 130 mm mesh have landed all of the recent catches from which the fishing mortality at age was estimated. Yield-per-recruit analysis was carried out using the 130 mm and 145 mm partial recruitment vectors.

Parameters were available for two parametric mesh selection curves, the logistic and generalized logistic functions. Separate analyses using the two functional forms established that the results are not sensitive to the choice of selection function. The results using the logistic function are presented, as the parameters of this curve were available for all of the species.

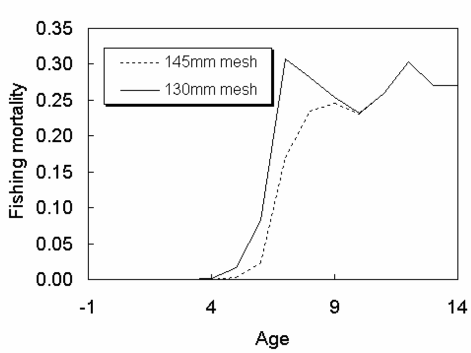
The results of the analyses are presented in Fig. 21.1 to 21.3 and Table 21.1. The figures for each species illustrated in panel (a), the selection at length curves (selection parameters were also available for a range of mesh sizes similar to 130 and 145 mm, the selection at length curves are plotted for comparison), panel (b), the selection at age curve, panel (c), the fishing mortality at age estimated by the age based assessment (130 mm) and the transformed fishing mortality at age calculated for a 145 mm mesh, and panel (d), the results of the yield and SSB per recruit calculations for each species and mesh size.



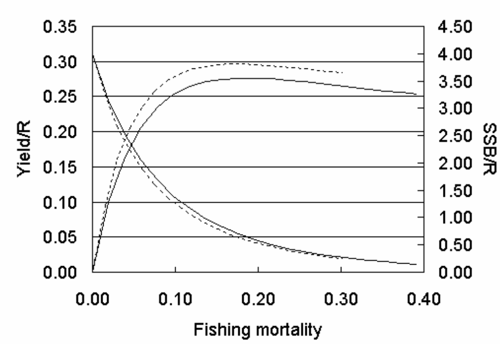

(a) The logistic selection at length curves




(b) The logistic selection at age curves




( c) The logistic selection, fishing motality at age curves




(d) The logistic selection yield and SSB per recruit curves

Fig. 21.1. An investigation of the equilibrium yield and combined sex SSB for Greenland halibut in Subarea 2 and Div. 3KLMNO resulting from fishing with 130 and 145 mm mesh trawls.

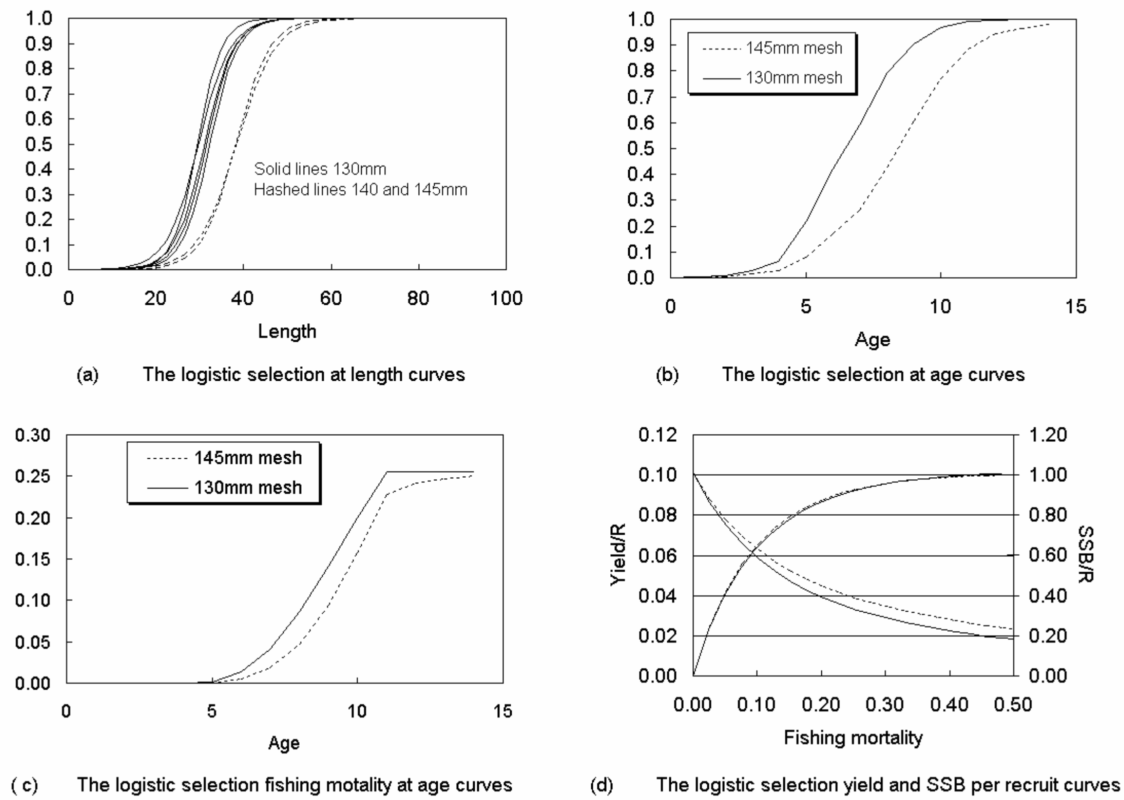
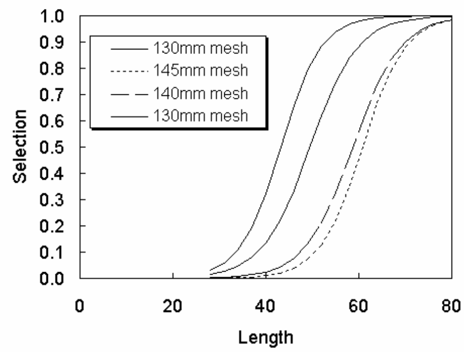
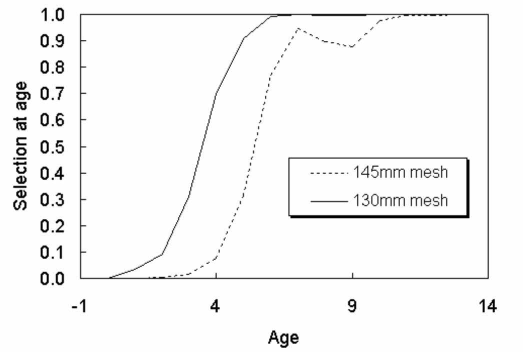


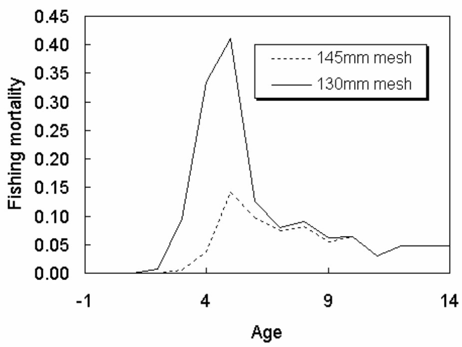

Fig. 21.2. An investigation of the equilibrium yield and combined sex SSB for American plaice in Div. 3LMNO resulting from fishing with 130 and 145 mm mesh trawls.



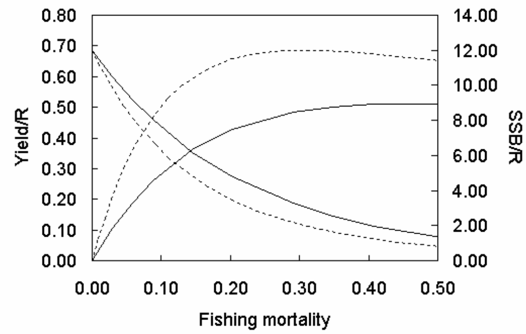

(a) The generalized logistic selection at length curves



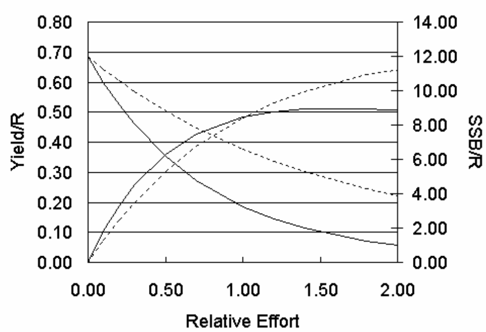

(b) The logistic selection at age curves




( c) The logistic selection fishing motality at age curves




(d) The logistic yield and SSB per recruit curves




(e) The logistic yield and SSB per recruit curves for relative effort

Fig. 21.3. An investigation of the equilibrium yield and combined sex SSB for cod in Div. 3NO resulting from fishing with 130 and 145 mm mesh trawls.

Table 22.1. The yield and SSB per recruit values derived from analyses utilizing partial recruitment at age estimated for two trawl mesh sizes.

Greenland halibut in Subarea 2 and Div. 3KLMNO

| Mesh | $F_{0.1}$ | $F_{max}$ | SSB E=1 | YE=1 | SSB $F_{0.1}$ | Y $F_{0.1}$ | SSB $F_{max}$ | Y $F_{max}$ |
|---|---|---|---|---|---|---|---|---|
| 130 | 0.105 | 0.185 | 600 | 276 | 1 278 | 259 | 763 | 276 |
| 145 | 0.090 | 0.174 | 783 | 295 | 1 370 | 273 | 650 | 296 |

American plaice in Div. 3LNO

| Mesh | $F_{0.1}$ | $F_{max}$ | SSB E=1 | YE=1 | SSB $F_{0.1}$ | Y $F_{0.1}$ | SSB $F_{max}$ | Y $F_{max}$ |
|---|---|---|---|---|---|---|---|---|
| 130 | 0.214 | 0.621 | 329 | 93 | 373 | 90 | 145 | 100 |
| 145 | 0.224 | 0.700 | 386 | 91 | 405 | 89 | 171 | 102 |

Cod in Div. 3NO

| Mesh | $F_{0.1}$ | $F_{max}$ | SSB E=1 | YE=1 | SSB $F_{0.1}$ | Y $F_{0.1}$ | SSB $F_{max}$ | Y $F_{max}$ |
|---|---|---|---|---|---|---|---|---|
| 130 | 0.297 | 0.465 | 3 260 | 484 | 3 067 | 489 | 1 544 | 513 |
| 145 | 0.188 | 0.306 | 66 000 | 481 | 3 752 | 646 | 2 006 | 686 |

From Table 21.1 it can be determined that only a slight increase in equilibrium yield (5% at $F_{0.1}$) and SSB (7% at $F_{0.1}$) result from changing from 130 mm to 145 mm mesh in the Greenland halibut fishery in SA 2 + Div. 3KLMNO (Fig. 21.1). For American plaice in Div. 3L, 3N and 3O (Fig. 21.2) there would be no increase in yield and a relatively small increase in SSB (8% at $F_{0.1}$). For cod in Div. 3N and 3O (Fig. 21.3) the analysis indicates that the benefits gained from the mesh change are dependent on the response by management. If effort is increased to compensate for the reduced catches resulting from the mesh change, by a factor of 3, then there is only a limited benefit from increasing the mesh size (Fig. 21.3(d)). If effort is held constant there is a 200% increase in equilibrium SSB (Fig. 21.3(e)).

The results for Greenland halibut and American plaice are consistent with previous advice from Scientific Council. They indicate that there would be only marginal benefits to changing the mesh size from 130 mm to 145 mm, in the Greenland halibut fishery, on yield and SSB of the Greenland halibut and American plaice. For cod there would be large increases in SSB and yield if effort were constrained. The analyses are conditional on the estimated mesh selection parameters and the partial recruitment vectors from the assessment models.

The analyses presented here do not consider the effects on species for which age based assessments were not available.

## IV. OTHER MATTERS

### 1. Temperature Effect on Catchability

A review paper on temperature and fish catchability was presented (SCR Doc. 01/73). There is no direct empirical evidence in the literature to show that temperature actually affects trawl catchability. Indirect evidence from laboratory tank studies suggests that temperature affects the swimming endurance in some groundfish species but not in others.

### 2. Other Business

There being no other business, the Chairman thanked the participants for their valuable contributions, and in particular the Designated Experts and the Secretariat for their work during the meeting.

## ANNEX 1. STATLANT 21 REPORTED CATCHES BY STOCK TABULATED AGAINST STACFIS ESTIMATES, 1985-2000

In the preparation of the following stock-by-stock tables, annual STATLANT 21A data reported by Division to the Secretariat were collated to obtain the most recent annual catches by stock area. Data for 1995-2000 are listed as provisional. However it is noted that STATLANT 21A data for 1985-99 are complete except for the unavailability of USA data from 1994 to 1999. Note: data for 2000 are missing reports from Canada (N), Greenland, Portugal and USA.

The following tables provide the STATLANT data available on a current year (i.e. year n) basis.

In the presentation of the annual STACFIS estimates on a stock-by-stock basis, the compilations were subject to availability of information. It is noted that in general STACFIS estimates were done in the first year following (i.e. year n + 1) the reported STATLANT data. These estimates were often revised by STACFIS in the next year (i.e. year n + 2) and then again in the following year (i.e. n + 3), and after. Tables in this document indicate only the 3 most recent years.

It is noted that STACFIS did not undertake assessments of certain stocks in certain years. Such lapses are indicated in the Tables as "no report".

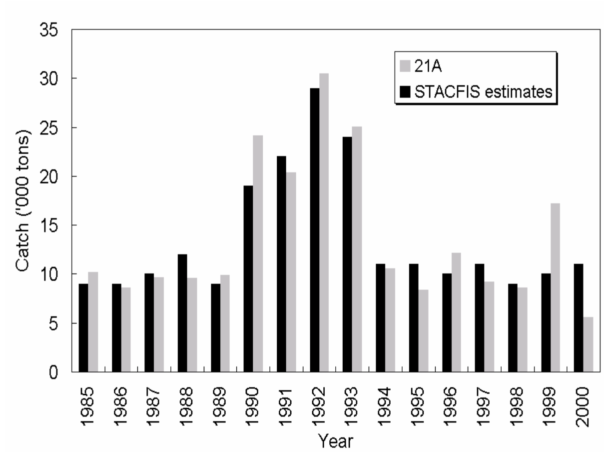
Bar graphs provide a comparison of the STATLANT 21A data and the STACFIS estimated catch used for that year in the stock assessment carried out in the following year (n + 1).

1. **Greenland Halibut in Subareas 0+1**

1985-1993 SA 0+1
1994-2000 SA0 + Div. 1A offshore + 1B-F

| Year (n) | STATLANT[1] 21A ('000 tons) | STACFIS REPORTED ('000 tons) n+1 | n+2 | n+3 |
|---|---|---|---|---|
| 2000 | 5.600[3] | 11 | | |
| 1999 | 17.073[2] | 10 | 9 | |
| 1998 | 8.388[2] | 9 | 9 | 9 |
| 1997 | 8.583[2] | 11 | 11 | 11 |
| 1996 | 11.277[2] | 10 | 10 | 10 |
| 1995 | 8.114[2] | 11 | 11 | 11 |
| 1994 | 10.144[2] | 11 | 11 | 10 |
| 1993 | 24.627 | 24 | 13 | 13 |
| 1992 | 30.007 | 29 | 27 | 18 |
| 1991 | 20.226 | 22 | 21 | 22 |
| 1990 | 23.907 | 19 | 20 | 20 |
| 1989 | 9.699 | 9 | 9 | 10 |
| 1988 | 9.608 | 12 | 9 | 10 |
| 1987 | 9.680 | 10 | 10 | 8 |
| 1986 | 8.605 | 9 | 9 | 9 |
| 1985 | 10.171 | 9 | 9 | 10 |

[1] 1995-2000 Provisional.
[2] Does not include any catch from Div. 1A.
[3] Some STATLANT data have not been submitted.

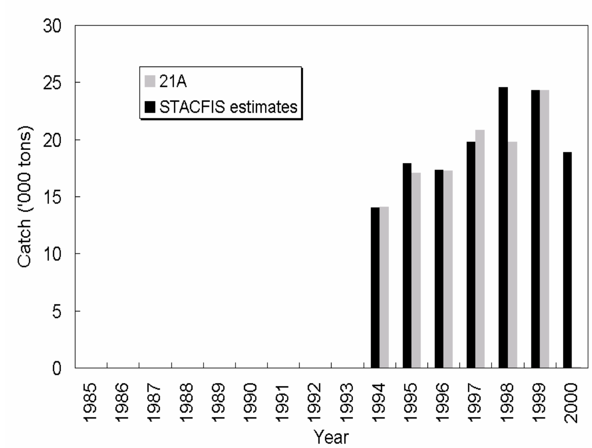



2. **Greenland Halibut in Division 1A**

(Inshore)

| Year (n) | STATLANT[1] 21A ('000 tons) | STACFIS REPORTED ('000 tons) n+1 | n+2 | n+3 |
|---|---|---|---|---|
| 2000 | 0.096[3] | 18.9 | | |
| 1999 | 24.332[2] | 24.3 | 24.3 | |
| 1998 | 19.669[2] | 24.6 | 24.6 | 24.6 |
| 1997 | 20.835[2] | 19.8 | 19.8 | 19.8 |
| 1996 | 17.271[2] | 17.3 | 17.3 | 17.3 |
| 1995 | 17.059[2] | 17.9 | 17.9 | 17.9 |
| 1994 | 14.067[2] | 14.0 | 14.0 | 14.0 |
| 1993 | | | | |
| 1992 | | | | |
| 1991 | | | | |
| 1990 | | | | |
| 1989 | | | | |
| 1988 | | | | |
| 1987 | | | | |
| 1986 | | | | |
| 1985 | | | | |

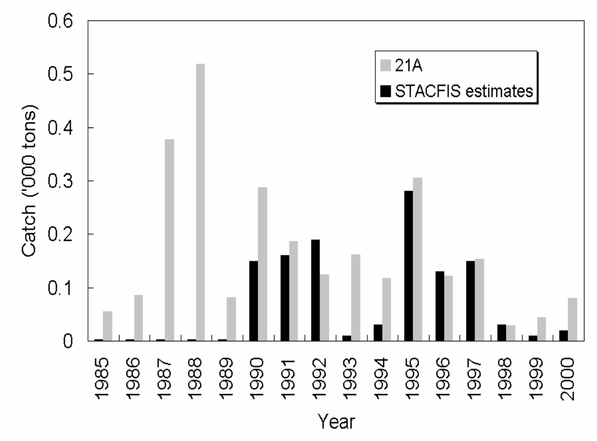
[1] 1995-2000 Provisional.
[2] Total Div. 1A catch.
[3] Some STATLANT data have not been submitted.



## 3. Roundnose Grenadier in Subareas 0+1

| Year (n) | STATLANT[1] 21A ('000 tons) | STACFIS REPORTED ('000 tons) n+1 | n+2 | n+3 |
|---|---|---|---|---|
| 2000 | 0.080[2] | 0.02 | | |
| 1999 | 0.043 | 0.01 | 0.04 | |
| 1998 | 0.029 | 0.03 | 0.03 | 0.03 |
| 1997 | 0.153 | 0.15 | 0.15 | 0.15 |
| 1996 | 0.122 | 0.13 | 0.13 | 0.12 |
| 1995 | 0.306 | 0.28 | 0.31 | 0.31 |
| 1994 | 0.118 | 0.03 | 0.03 | 0.12 |
| 1993 | 0.162 | 0.1 | 0.2 | 0.2 |
| 1992 | 0.124 | 0.19 | 0.11 | 0.12 |
| 1991 | 0.186 | 0.16 | 0.16 | 0.19 |
| 1990 | 0.287 | 0.15 | 0.16 | 0.16 |
| 1989 | 0.082 | + | 0.05 | 0.05 |
| 1988 | 0.518 | + | 0.5 | 0.5 |
| 1987 | 0.377 | + | + | 0.4 |
| 1986 | 0.086 | + | + | + |
| 1985 | 0.055 | + | + | + |

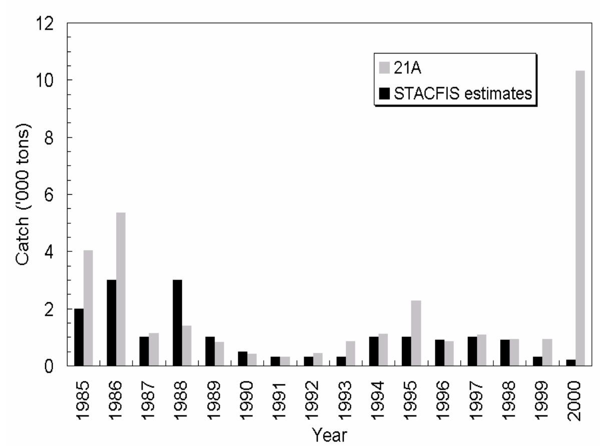
1 1995-2000 Provisional.
2 Some STATLANT data have not been submitted.




## 4. Redfish in Subarea 1

| Year (n) | STATLANT[1] 21A ('000 tons) | STACFIS REPORTED ('000 tons) n+1 | n+2 | n+3 |
|---|---|---|---|---|
| 2000 | 10.321[2] | 0.2 | | |
| 1999 | 0.938 | 0.3 | 0.1 | |
| 1998 | 0.927 | 0.9 | 0.9 | 0.9 |
| 1997 | 1.083 | 1.0 | 1.0 | 1.0 |
| 1996 | 0.859 | 0.9 | 0.9 | 0.9 |
| 1995 | 2.267 | 1 | 0.9 | 0.9 |
| 1994 | 1.109 | 1 | 1 | 0.9 |
| 1993 | 0.852 | 0.3 | 0.8 | 0.8 |
| 1992 | 0.445 | 0.3 | 0.3 | 0.3 |
| 1991 | 0.303 | 0.3 | 0.3 | 0.3 |
| 1990 | 0.414 | 0.5 | 0.5 | 1 |
| 1989 | 0.840 | 1 | 1 | 1 |
| 1988 | 1.401 | 3 | 1 | 1 |
| 1987 | 1.142 | 1 | 1 | 1 |
| 1986 | 5.344 | 3 | 5 | 5 |
| 1985 | 4.040 | 2 | 3 | 4 |

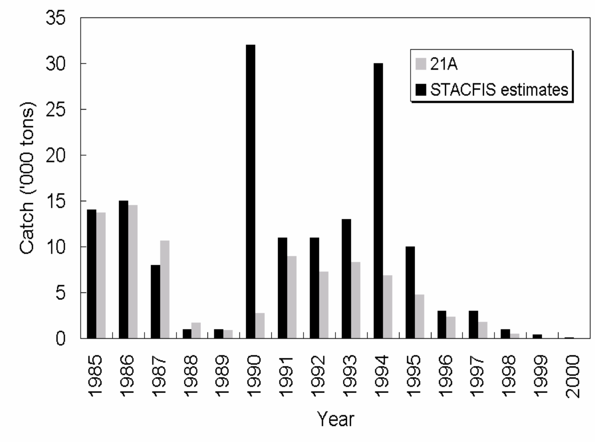
1 1995-2000 Provisional.
2 Some STATLANT data have not been submitted.



## 5. Cod in Division 3M

| Year (n) | STATLANT[1] 21A ('000 tons) | STACFIS REPORTED ('000 tons) n+1 | n+2 | n+3 |
|---|---|---|---|---|
| 2000 | 0.036[2] | 0.1 | | |
| 1999 | 0.003 | 0.4 | 0.4 | |
| 1998 | 0.456 | 1 | 0.7 | 0.7 |
| 1997 | 1.802 | 3 | 3 | 2.9 |
| 1996 | 1.611 | 3 | 3 | 3 |
| 1995 | 3.732 | 10 | 10 | 10 |
| 1994 | 6.883 | 30 | 30 | 30 |
| 1993 | 8.316 | 13 | 16 | 16 |
| 1992 | 7.226 | 11 | 11 | 25 |
| 1991 | 8.989 | 11 | 11 | 11 |
| 1990 | 2.762 | 32 | 32 | 32 |
| 1989 | 0.917 | 1 | 40 | 40 |
| 1988 | 1.718 | 1 | 1 | 2 |
| 1987 | 10.632 | 8 | 8 | 8 |
| 1986 | 14.518 | 15 | 15 | 15 |
| 1985 | 13.675 | 14 | 14 | 14 |

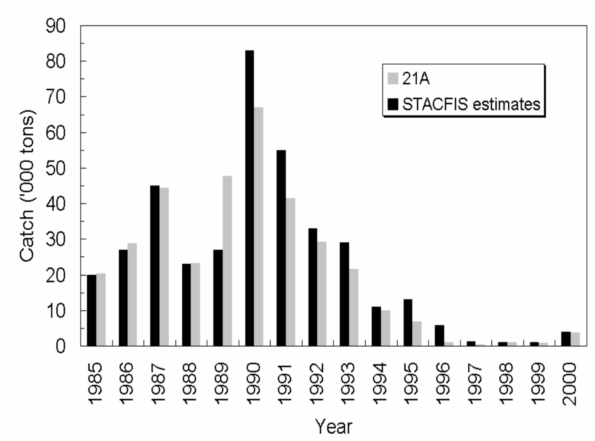
[1] 1995-2000 Provisional.
[2] Some STATLANT data have not been submitted.




## 6. Redfish in Division 3M

| Year (n) | STATLANT[1] 21A ('000 tons) | STACFIS REPORTED ('000 tons) n+1 | n+2 | n+3 |
|---|---|---|---|---|
| 2000 | 3.765[2] | 3.9 | | |
| 1999 | 0.862 | 1.1 | 1.2 | |
| 1998 | 0.972 | 0.97 | 1.1 | 1.2 |
| 1997 | 0.424 | 1.3 | 1.3 | 1.2 |
| 1996 | 1.139 | 5.8 | 5.8 | 5.8 |
| 1995 | 6.736 | 13 | 13.5 | 13.5 |
| 1994 | 9.893 | 11 | 11 | 11.3 |
| 1993 | 21.611 | 29 | 29 | 29 |
| 1992 | 29.321 | 33 | 43 | 43 |
| 1991 | 41.406 | 55 | 55 | 48 |
| 1990 | 66.887 | 83 | 83 | 83 |
| 1989 | 47.697 | 27 | 58 | 58 |
| 1988 | 23.189 | 23 | 23 | 23 |
| 1987 | 44.411 | 45 | 44 | 44 |
| 1986 | 28.873 | 27 | 29 | 29 |
| 1985 | 20.282 | 20 | 20 | 20 |

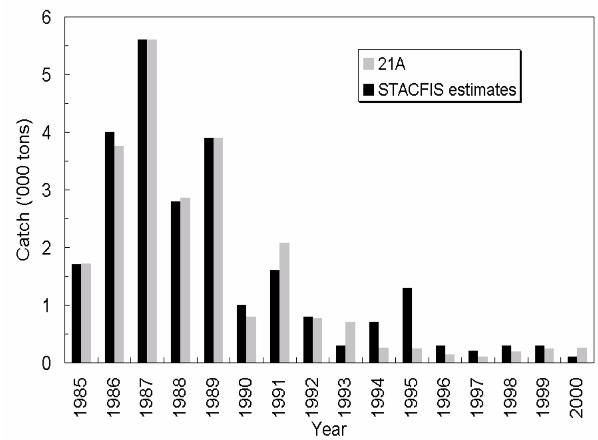
[1] 1995-2000 Provisional
[2] Some STATLANT data have not been submitted.



## 7. American Plaice in Division 3M

| Year (n) | STATLANT[1] 21A ('000 tons) | STACFIS REPORTED ('000 tons) n+1 | n+2 | n+3 |
|---|---|---|---|---|
| 2000 | 0.251[2] | 0.1 | | |
| 1999 | 0.243 | 0.3 | 0.3 | |
| 1998 | 0.188 | 0.3 | 0.3 | 0.3 |
| 1997 | 0.108 | 0.2 | 0.2 | 0.2 |
| 1996 | 0.136 | 0.3 | 0.3 | 0.3 |
| 1995 | 0.244 | 1.3 | 1.3 | 1.3 |
| 1994 | 0.253 | 0.7 | 0.7 | 0.7 |
| 1993 | 0.705 | 0.3 | 0.3 | 0.3 |
| 1992 | 0.765 | 0.8 | 0.8 | 0.8 |
| 1991 | 2.082 | 1.6 | 1.6 | 1.6 |
| 1990 | 0.790 | 1.0 | 0.8 | 0.8 |
| 1989 | 3.894 | 3.9 | 3.5 | 3.5 |
| 1988 | 2.861 | 2.8 | 2.8 | 2.8 |
| 1987 | 5.607 | 5.6 | 5.6 | 5.6 |
| 1986 | 3.754 | 4 | 3.8 | 3.8 |
| 1985 | 1.720 | 2 | 2 | 1.7 |

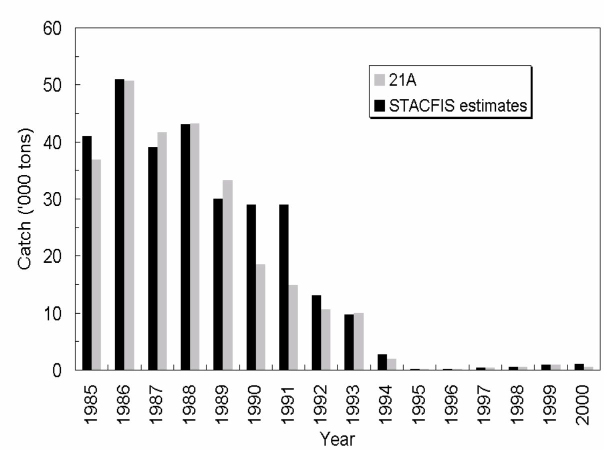
1 1995-2000 Provisional.
2 Some STATLANT data have not been submitted.




## 8. Cod in Divisions 3NO

| Year (n) | STATLANT[1] 21A ('000 tons) | STACFIS REPORTED ('000 tons) n+1 | n+2 | n+3 |
|---|---|---|---|---|
| 2000 | 0.482[2] | 1.0 | | |
| 1999 | 0.919 | 0.91 | 0.91 | |
| 1998 | 0.504 | 0.55 | 0.55 | 0.55 |
| 1997 | 0.443 | 0.42 | 0.42 | 0.42 |
| 1996 | 0.146 | 0.17 | 0.17 | 0.17 |
| 1995 | 0.103 | 0.17 | 0.17 | 0.17 |
| 1994 | 1.879 | 2.7 | 2.7 | 2.7 |
| 1993 | 9.952 | 9.7 | 9.7 | 9.7 |
| 1992 | 10.653 | 13 | 12.6 | 12.6 |
| 1991 | 14.935 | 29 | 29 | 29 |
| 1990 | 18.551 | 29 | 29 | 29 |
| 1989 | 33.215 | 30 | 33 | 33 |
| 1988 | 43.150 | 43 | 43 | 43 |
| 1987 | 41.619 | 39 | 39 | 42 |
| 1986 | 50.645 | 51 | 50 | 51 |
| 1985 | 36.899 | 41 | 39 | 37 |

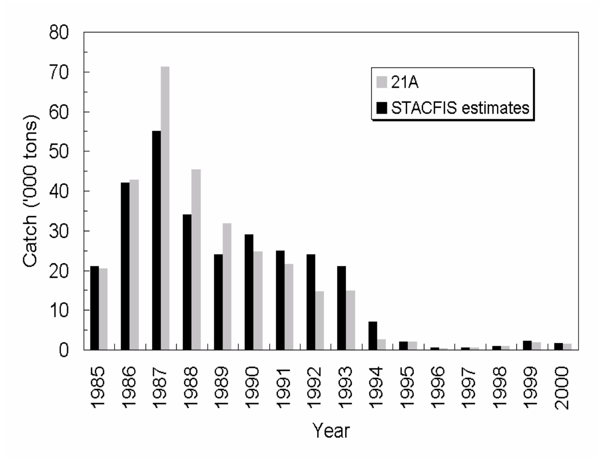
1 1995-2000 Provisional.
2 Some STATLANT data have not been submitted.



9. **Redfish in Divisions 3LN**

| Year (n) | STATLANT[1] 21A ('000 tons) | STACFIS REPORTED ('000 tons) n+1 | n+2 | n+3 |
|---|---|---|---|---|
| 2000 | 1.444[2] | 1.7 | | |
| 1999 | 1.832 | 2.3 | 2.3 | |
| 1998 | 0.899 | 0.9 | 0.9 | 0.9 |
| 1997 | 0.629 | 0.6 | 0.6 | 0.6 |
| 1996 | 0.453 | 0.5 | 0.5 | 0.5 |
| 1995 | 1.988 | 2 | 2 | 2 |
| 1994 | 2.652 | 7 | 6 | 6 |
| 1993 | 14.974 | 19-24 | 23 | 23 |
| 1992 | 14.783 | 24 | 27 | 27 |
| 1991 | 21.615 | 25 | 26 | 26 |
| 1990 | 24.755 | 29 | 29 | 29 |
| 1989 | 31.848 | 24 | 34 | 34 |
| 1988 | 45.366 | 34 | 45 | 53 |
| 1987 | 71.291 | 55 | 71 | 71 |
| 1986 | 42.805 | 42 | 42 | 43 |
| 1985 | 20.557 | 21 | 20 | 21 |

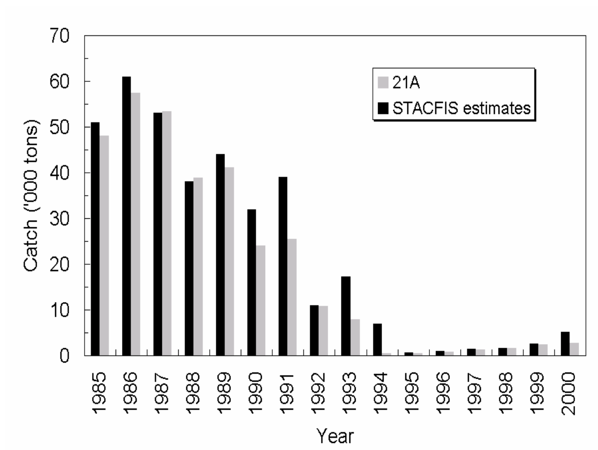
[1] 1995-2000 Provisional.
[2] Some STATLANT data have not been submitted.




10. **American Plaice in Divisions 3LNO**

| Year (n) | STATLANT[1] 21A ('000 tons) | STACFIS REPORTED ('000 tons) n+1 | n+2 | n+3 |
|---|---|---|---|---|
| 2000 | 2.690[2] | 5.2 | | |
| 1999 | 2.424 | 2.6 | 2.5 | |
| 1998 | 1.560 | 1.6 | 1.6 | 1.6 |
| 1997 | 1.363 | 1.4 | 1.4 | 1.4 |
| 1996 | 0.886 | 0.9 | 0.9 | 0.9 |
| 1995 | 0.547 | 0.6 | 0.6 | 0.6 |
| 1994 | 0.560 | 7 | 7 | 7 |
| 1993 | 7.916 | 17.3 | 17 | 17 |
| 1992 | 10.870 | 11 | 13 | 13 |
| 1991 | 25.503 | 39 | 34 | 34 |
| 1990 | 24.006 | 32 | 32 | 32 |
| 1989 | 41.206 | 44 | 44 | 44 |
| 1988 | 38.928 | 38 | 42 | 41 |
| 1987 | 53.457 | 53 | 53 | 55 |
| 1986 | 57.449 | 61 | 61 | 61 |
| 1985 | 48.081 | 51 | 55 | 54 |

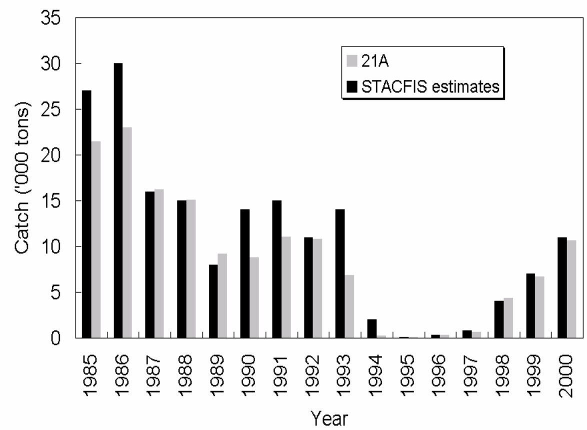
[1] 1995-2000 Provisional.
[2] Some STATLANT data have not been submitted



## 11. Yellowtail Flounder in Divisions 3LNO

| Year (n) | STATLANT[1] 21A ('000 tons) | STACFIS REPORTED ('000 tons) n+1 | n+2 | n+3 |
|---|---|---|---|---|
| 2000 | 10.646[2] | 11 | | |
| 1999 | 6.687 | 7 | 7 | |
| 1998 | 4.386 | 4 | 4 | 4 |
| 1997 | 0.657 | 0.8 | 0.8 | 0.8 |
| 1996 | 0.287 | 0.3 | 0.3 | 0.3 |
| 1995 | 0.067 | 0.1 | 0.1 | 0.1 |
| 1994 | 0.231 | 2 | 2 | 2 |
| 1993 | 6.850 | 14 | 14 | 14 |
| 1992 | 10.796 | 11 | 11 | 11 |
| 1991 | 11.015 | 15 | 16 | 16 |
| 1990 | 8.762 | 14 | 14 | 14 |
| 1989 | 9.166 | 8 | 10 | 10 |
| 1988 | 15.054 | 15 | 16 | 16 |
| 1987 | 16.234 | 16 | 16 | 16 |
| 1986 | 22.957 | 30 | 31 | 31 |
| 1985 | 21.468 | 27 | 29 | 29 |

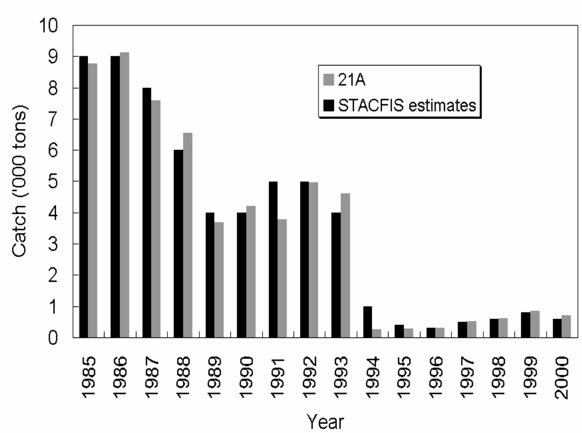
[1] 1995-2000 Provisional
[2] Some STATLANT data have not been submitted.




## 12. Witch Flounder in Divisions 3N and 3O

| Year (n) | STATLANT[1] 21A ('000 tons) | STACFIS REPORTED ('000 tons) n+1 | n+2 | n+3 |
|---|---|---|---|---|
| 2000 | 0.716[2] | 0.6 | | |
| 1999 | 0.859 | 0.8 | 0.8 | |
| 1998 | 0.620 | 0.6 | 0.6 | 0.6 |
| 1997 | 0.513 | 0.5 | 0.5 | 0.5 |
| 1996 | 0.315 | 0.3 | 0.4 | 0.3 |
| 1995 | 0.279 | 0.4 | 0.3 | 0.3 |
| 1994 | 0.263 | 1 | 1 | 1 |
| 1993 | 4.604 | 4 | 4 | 4 |
| 1992 | 4.961 | 5 | 5 | 5 |
| 1991 | 3.777 | 5 | 5 | 5 |
| 1990 | 4.210 | 4 | 4 | 4 |
| 1989 | 3.688 | 4 | 4 | 4 |
| 1988 | 6.538 | 6 | 6 | 6 |
| 1987 | 7.596 | 8 | 8 | 8 |
| 1986 | 9.131 | 9 | 9 | 9 |
| 1985 | 8.771 | 9 | 9 | 9 |

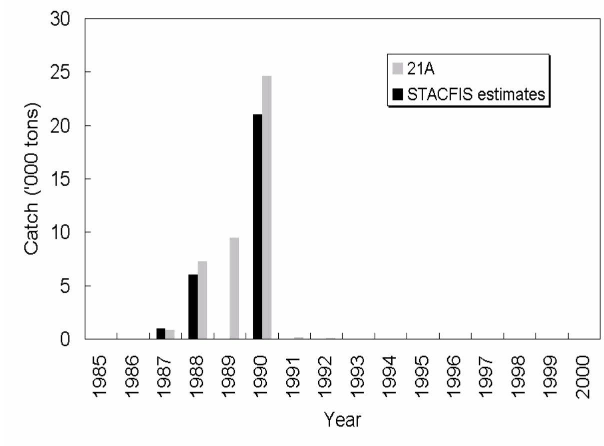
[1] 1995-2000 Provisional
2 Some STATLANT data have not been submitted.



## 13. Capelin in Divisions 3NO

| Year (n) | STATLANT[1] 21A ('000 tons) | STACFIS REPORTED ('000 tons) n+1 | n+2 | n+3 |
|---|---|---|---|---|
| 2000 | - | - | | |
| 1999 | - | - | - | |
| 1998 | - | - | - | - |
| 1997 | - | - | - | - |
| 1996 | - | - | - | - |
| 1995 | - | - | - | - |
| 1994 | - | - | - | - |
| 1993 | 0.003 | 0 | + | + |
| 1992 | 0.065 | 0 | + | + |
| 1991 | 0.118 | + | + | + |
| 1990 | 24.630 | 21 | 21 | 25 |
| 1989 | 9.496 | nr | 5 | 5 |
| 1988 | 7.227 | 6 | nr | 7 |
| 1987 | 0.807 | 1 | 1 | nr |
| 1986 | - | nr | 0 | 0 |
| 1985 | 0.003 | nr | nr | + |

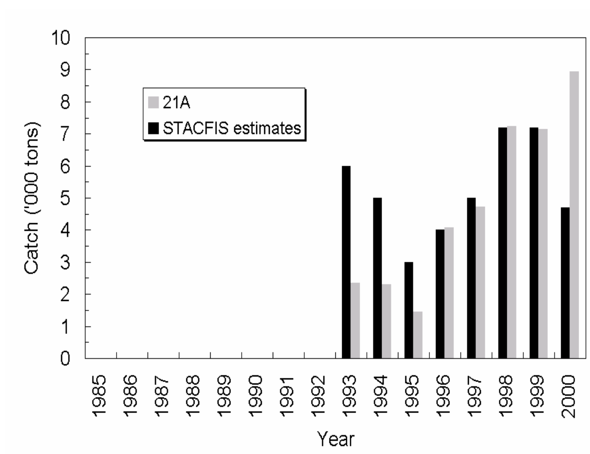
[1] 1995-2000 Provisional.
nr = no report.




## 14. Roughhead Grenadier in Subareas 2 + 3

| Year (n) | STATLANT[1] 21A ('000 tons) | | STACFIS REPORTED ('000 tons) n+1 | n+2 | n+3 |
|---|---|---|---|---|---|
| 2000 | 8.939[2] | 4.7 | | | |
| 1999 | 7.150 | 7.2 | 7.2 | | |
| 1998 | 7.228 | 7.2 | 7.2 | 7.2 | |
| 1997 | 4.720 | 5 | 4.7 | 4.7 | |
| 1996 | 4.076 | 4 | 4 | 4.1 | |
| 1995 | 1.461 | 3 | 3 | 4 | |
| 1994 | 2.303 | 5 | 5 | 5 | |
| 1993 | 2.341 | 6 | 6 | 6 | |
| 1992 | | | | | |
| 1991 | | | | | |
| 1990 | | | | | |
| 1989 | | | | | |
| 1988 | | | | | |
| 1987 | | | | | |
| 1986 | | | | | |
| 1985 | | | | | |

[1] 1995-2000 Provisional
[2] Some STATLANT data have not been submitted.

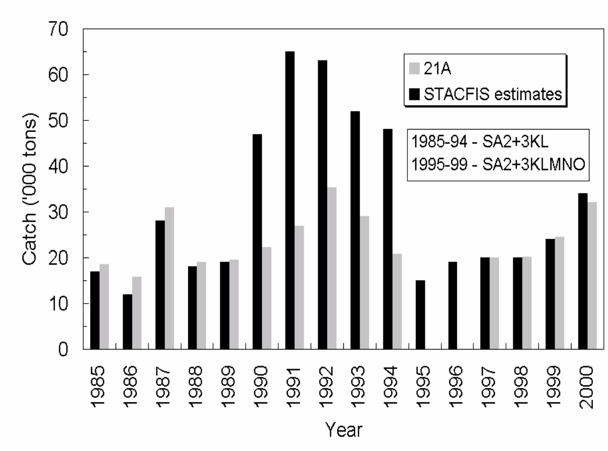


15. **Greenland Halibut in Subareas 2+3**

1985-1994 – Subarea 2 + Div. 3KL
1995-1999 – Subarea 2 + Div. 3KLMNO

| Year (n) | STATLANT[1] 21A ('000 tons) | STACFIS REPORTED ('000 tons) n+1 | n+2 | n+3 |
|---|---|---|---|---|
| 2000 | 32.131[2] | 34 | | |
| 1999 | 23.812 | 24 | 24 | |
| 1998 | 20.139 | 20 | 20 | 20 |
| 1997 | 20.075 | 20 | 20 | 20 |
| 1996 | 18.999 | 19 | 19 | 19 |
| 1995 | 15.867 | 15 | 15 | 15 |
| 1994 | 20.748 | 48 | 48 | 48 |
| 1993 | 29.072 | 42-62 | 42-62 | 42-62 |
| 1992 | 35.363 | 63 | 63 | 63 |
| 1991 | 26.886 | 55-75 | 55-75 | 55-75 |
| 1990 | 22.238 | 47 | 47 | 47 |
| 1989 | 19.496 | 19 | 19 | 19 |
| 1988 | 19.086 | 18 | 19 | 19 |
| 1987 | 30.938 | 28 | 27 | 31 |
| 1986 | 15.878 | 12 | 15 | 16 |
| 1985 | 18.610 | 17 | 17 | 19 |

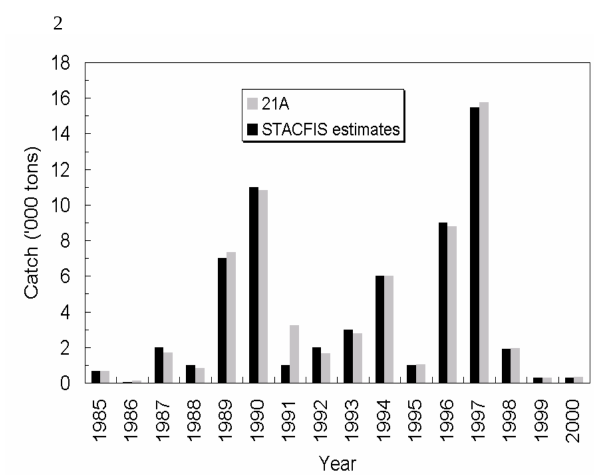
[1] 1995-2000 Provisional.
[2] Some STATLANT data have not been submitted.




16. **Squid in Subareas 3 + 4**

| Year (n) | STATLANT[1] 21A ('000 tons) | STACFIS REPORTED ('000 tons) n+1 | n+2 | n+3 |
|---|---|---|---|---|
| 2000 | 0.347[2] | 0.3 | | |
| 1999 | 0.310 | 0.31 | 0.3 | |
| 1998 | 1.937 | 1.92 | 1.93 | 1.9 |
| 1997 | 15.758 | 15.5 | 14.5 | 15.8 |
| 1996 | 8.811 | 9 | 8.7 | 8.7 |
| 1995 | 1.055 | 1 | 1 | 1 |
| 1994 | 6.031 | 6 | 6 | 6 |
| 1993 | 2.791 | 3 | 3 | 3 |
| 1992 | 1.664 | 2 | 2 | 2 |
| 1991 | 3.227 | 1 | 4 | 4 |
| 1990 | 10.843 | 11 | 11 | 11 |
| 1989 | 7.327 | 7 | 7 | 7 |
| 1988 | 0.846 | 1 | 1 | 1 |
| 1987 | 1.718 | 2 | 2 | 2 |
| 1986 | 0.111 | + | + | + |
| 1985 | 0.673 | 0.67 | 1 | 1 |

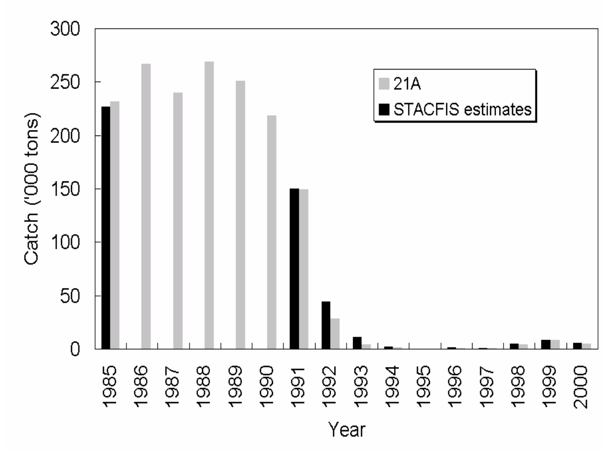
[1] 1995-2000 Provisional
[2] Some STATLANT data have not been submitted.



## 17. Cod in Divisions 2J + 3KL

| Year (n) | STATLANT[1] 21A ('000 tons) | STACFIS REPORTED ('000 tons) n+1 | n+2 | n+3 |
|---|---|---|---|---|
| 2000 | 4.690[2] | 5.4 | | |
| 1999 | 8.139 | 8.5 | 8.5 | |
| 1998 | 3.834 | 4.5 | 4.5 | 4.5 |
| 1997 | 0.538 | 0.5 | 0.5 | 0.5 |
| 1996 | 0.427 | 1.7 | 1.7 | 1.5 |
| 1995 | 0.248 | 0.3 | 0.3 | 0.3 |
| 1994 | 1.314 | 1.8 | 1.8 | 1.8 |
| 1993 | 4.075 | 11 | 11 | 11 |
| 1992 | 28.621 | 44 | 44 | 44 |
| 1991 | 149.578 | 150 | 150 | 150 |
| 1990 | 218.636 | nr | 219 | 219 |
| 1989 | 250.943 | nr | nr | 253 |
| 1988 | 268.677 | nr | nr | nr |
| 1987 | 239.924 | nr | nr | nr |
| 1986 | 266.713 | nr | nr | nr |
| 1985 | 231.293 | 227 | nr | nr |

1 1995-2000 Provisional.
2 Some STATLANT data have not been submitted.
nr = no report




## 18. Witch Flounder in Divisions 2J + 3KL

| Year (n) | STATLANT[1] 21A ('000 tons) | STACFIS REPORTED ('000 tons) n+1 | n+2 | n+3 |
|---|---|---|---|---|
| 2000 | 0.475[2] | 0.7 | | |
| 1999 | 0.359 | 0.3 | 1.1 | |
| 1998 | 0.434 | nr | nr | nr |
| 1997 | 0.854 | nr | nr | nr |
| 1996 | 1.371 | nr | nr | nr |
| 1995 | 0.779 | nr | nr | nr |
| 1994 | 0.137 | nr | nr | nr |
| 1993 | 0.402 | nr | nr | nr |
| 1992 | 2.702 | nr | nr | nr |
| 1991 | 4.015 | nr | nr | nr |
| 1990 | 3.967 | nr | nr | nr |
| 1989 | 4.906 | nr | nr | nr |
| 1988 | 4.154 | nr | nr | nr |
| 1987 | 4.475 | nr | nr | nr |
| 1986 | 3.916 | nr | nr | nr |
| 1985 | 3.003 | nr | nr | nr |

1 1995-2000 Provisional.
2 Some STATLANT data have not been submitted.
nr = no report