Northwest Atlantic Fisheries Organization

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SCIENTIFIC COUNCIL MEETING - JUNE 1994

Report of Scientific Council, 8-22 June 1994 Meeting

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Participants of June 1994 Scientific Council Meeting

(From left to right)

FRONT ROW – D. Stansbury, A. Avila de Melo, D. Auby, J. Boje, M. Stein, A. Vazquez, F. Serchuk, T. Amaratunga, K. Yokawa, J. Morgan, S. Goddard, M. Godinho, E. Colbourne, D. Power

SECOND ROW – L. Motos, B. Brodie, O. Jørgensen, H. Lassen, F. Rodriguez, K. Drinkwater, H.-J. Rätz, B. Davis, C. Bishop, H. P. Cornus, B. Atkinson, S. Kovalev, V. Rikhter, E. De Cárdenas, A. Battaglia, J. Beckett, G. Glenn

Elected Officers of the Scientific Council
June 1994 Meetings

(From left to right)

Chairman of STACREC:	–	C. A. Bishop (Canada)
Chairman of the Scientific Council:	–	H. Lassen (EU–Denmark)
Chairman of the Environmental Subcommittee:	–	M. Stein (EU–Germany)
Chairman of STACFIS:	–	H. P. Cornus (EU–Germany)
Chairman of STACPUB: (not present)	–	W. R. Bowering (Canada)

REPORT OF SCIENTIFIC COUNCIL

8-22 June 1994

I. PLENARY SESSIONS

Chairman: H. Lassen Rapporteur: T. Amaratunga

The Scientific Council met at the Keddy's Dartmouth Inn, 9 Braemar Drive, Dartmouth, Nova Scotia, Canada during 8-22 June 1994, to consider the various matters listed in its agenda (see Appendix IV).

Representatives attended from Canada, Cuba, Denmark (in respect of Faroe Islands and Greenland), European Union (Denmark, France, Germany, Portugal and Spain), Japan and Russian Federation, and an observer from United States of America. The Executive Secretary and Assistant Executive Secretary were in attendance.

The Executive Committee met prior to the opening session of the Council, and the proposed reorganization of the Scientific Council, the provisional agenda and work plan were discussed.

The Opening Session of the Council was called to order at 1020 hours on 8 June 1994.

The Chairman welcomed everyone to the new venue for this meeting. The Assistant Executive Secretary was appointed rapporteur. The Council reiterated its standing invitation to the USA, welcoming F. M. Serchuk, National Marine Fisheries Service, Woods Hole, as an observer to this meeting. The three Angolan observers who had been invited by the Council (SC-94/79) had conveyed their regrets to the Secretariat indicating they were unable to attend.

The Council was informed by the Executive Secretary that in accordance with Rule 2.3 of the Rules of Procedure with respect to proxy votes, he had received authorization from Norway and Poland to record their abstentions during any voting procedures.

The Council noted that current discussions regarding NAFO fisheries appearing in the Canadian public media were completely independent of the NAFO Scientific Council processes, and that any public releases of the Scientific Council deliberations could only occur when the adopted Scientific Council report of this meeting was available to Contracting Parties.

In introducing the provisional agenda, the Chairman noted that the Council had been requested by Canada and the EU, to further consider the issues of a) the minimum fish landing sizes for witch, redfish and Greenland halibut, and b) the conversion factors to live weight for various fish products, as requested by the Fisheries Commission for the 19-23 November 1993 meeting of the Scientific Council. The Council agreed to include these agenda items.

The Council also agreed that a proposal to have the meeting of ICES/NAFO Working Group on harp and hooded seals should be discussed with the Chairman of the Working Group.

The Chairman then reviewed the proposal to reorganize the Scientific Council. The Council agreed that the Chairman in consultation with the Executive Committee would draft a paper for consideration during this meeting. It was, however, agreed that a new Standing Committee titled the Standing Committee on Fisheries and Environment (STACFEN) would replace the present Environmental Subcommittee of STACFIS.

Recognizing that item 9 on the Provisional Agenda would now be undertaken by STACREC, the Council **adopted** the modified agenda (Appendix IV).

The Chairman's proposal to appoint a Nominating Committee composed of B. Atkinson (Canada) and A. Vazquez (EU-Spain) was accepted for the nomination for the chairmanship of the Standing Committee on Fisheries Science (see Section IX).

The Session was adjourned at 1200 hours on 8 June 1994.

The Council met briefly on 11 June 1994 to consider proposals for the Symposia of 1994, 1995 and 1996. The discussions are reported in Section VII below.

The Council then considered STACPUB membership, and elected K. H. Nygaard (Denmark-Greenland) to replace P. Kanneworff (Denmark-Greenland), extending a note of appreciation for the valuable contributions of P. Kanneworff in STACPUB.

The session was adjourned at 1420 hr on 11 June 1994.

The Council briefly reconvened at 1410 hr on 15 June 1994 to review the proposed changes to the Rules of Procedure for Scientific Council presented by the Executive Committee. It was agreed that the Chairman would prepare a final document with the amendments proposed.

The session was adjourned at 1545 on 15 June 1994.

The Council again met at 1710 on 15 June 1994.

Noting that the Executive Secretary had received two additional proxy votes on 14 June 1994 from Korea and Lithuania, to form a quorum, the Council **adopted** by a unanimous vote the new **Rule 5.1** as reported below in Section V.

The Council agreed that for logistic purposes the **new Rule 5.1** would come into effect on **1 January 1995**.

Recognizing that the Standing Committee on Fisheries and Environment (STACFEN) replaces the Environmental Subcommittee of STACFIS on 1 January 1995, the Chairman called for an election of a Chairman for STACFEN. M. Stein (EU-Germany), the present Chairman of the Environmental Subcommittee, was elected by unanimous consent. The Council extended its welcome to M. Stein and expressed its appreciation to him for his long and valuable contributions as Chairman of the Environmental Subcommittee.

The session was adjourned at 1720 hr on 15 June 1994.

The Council met again at 1510 hr on 17 June 1994.

The Chairman presented a working paper describing a comprehensive proposal for a Symposium titled "What Future for Capture Fisheries in the Northwest Atlantic" for September 1996. Recognizing this should evolve into a meeting of significant international interest, the Council agreed to initiate the planning process (see Section VII.3 below).

The Council was informed it had just received a request for scientific advice on harp and hooded seals from Denmark (Greenland), and agreed to request the ICES/NAFO Working Group on harp and hooded seals (see Section VI.1. below).

The Chairman of STACPUB informed the Council that J. E. Carscadden (Canada) would step down from STACPUB. The Council extended its appreciation to J. E. Carscadden for his valuable contributions to STACPUB, and elected J. Morgan (Canada) as a new member.

The session was adjourned at 1530 hr on 17 June 1994.

The Council met during 2120 to 2300 hrs on 21 June 1994 to consider summary sheets of assessments and the concluding session was convened at 0930 on the 22 June 1994.

The Council considered the *remaining* Summary Sheets, reviewed the texts for the Responses to the Fisheries Commission and Coastal States (Section II.6 and II.7). The Council elected W. B. Brodie as Chairman of STACFIS by unanimous consent to take office at the end of the September 1994 Annual Meeting (Section IX), and welcomed him.

Having addressed all outstanding matters, the Council **adopted** the Report of the Standing Committee on Fishery Science (STACFIS), Report of the Standing Committee on Research Coordination (STACREC), and the Report of the Standing Committee on Publications (STACPUB).

The Council considered and **adopted** the Report of the Scientific Council of the 8-22 June 1994 Meeting.

The meeting was adjourned at 1230 hours on the 22 June 1994.

The reports of the Standing Committees are appended as follows: Appendix 1 - Report of the Standing Committee on Fishery Science (STACFIS), Appendix II - Report of Standing Committee on Research Coordination (STACREC), Appendix III - Report of Standing Committee on Publications (STACPUB).

The agenda, lists of Research (SCR) and Summary (SCS) documents and the list of participants of this meeting are given in Appendix IV, V and VI.

The Council's consideration on the Standing Committee Reports and Other Matters addressed *the Council* follows in Sections II- XII.

II. FISHERY SCIENCE (see STACFIS report, App. I)

1. General Review

The Council welcomed the STACFIS review of stock status and the available data noting that this review enabled the Scientific Council to undertake preliminary assessment before the full Committee met.

Special emphasis was given to Greenland halibut, and Subareas 0-3 was considered a single stock. Noting fishing on one component affects the catch possibilities on other components, it was agreed all components of the Greenland halibut stock should be regulated. This applied particularly to the new fisheries in the Flemish Pass in Div. 3LMN.

The yield taken of the Greenland halibut populations in recent years affects the populations significantly in all Subareas as is seen from declining catch rates and trawlable biomass. The same pattern is seen all *throughout the offshore* range.

There has been a significant amount of information collected which suggests that Greenland halibut in the northern West Greenland fiords (Div. 1A) do not contribute to the spawning stock in the off shore areas in Davis Strait and STACFIS **advised** that a separate TAC be established for the inshore areas of Div. 1A.

2. General Fishery Trends

The Council was disappointed that STATLANT 21A data had not been submitted to allow a general review of fishery trends. It was agreed that this analysis would not be done this year, although this analysis is considered a valuable annual overview of the fisheries in the Northwest Atlantic, Subareas 0-6.

3. Review of Recommendation from the 1993 Meetings

The Council endorsed the STACFIS **recommendation** that Scientific Council Research documents (SCR), excluding the preliminary assessment documents, and the Scientific Council Summary documents (SCS), particularly National Research Reports, be submitted to the Secretariat 15 days before the beginning of the Council meeting. The Council, however, recognized that the deadline for submission of titles and brief

summary set for this June 1994 meeting was not met for several papers and stressed the importance of this deadline for the smooth work of the Council and Secretariat.

4. Environmental Research

The time scheduled for the Environmental Subcommittee at the beginning of the Council meeting had proven to be successful and the Council agreed that this should be continued. The Council recognized the importance of the contributions made by this Subcommittee and this was reflected in the establishment of the new Standing Committee STACFEN. The new STACFEN effective as of 1 January 1995 takes on additional tasks while the Environmental Subcommittee of STACFIS will be discontinued.

5. Assessment of Finfish and Invertebrate Stocks

The Council recognized that as a result of the recent closures of several fisheries in the Northwest Atlantic, important data from the fisheries activities will not be available. The assessments of the stocks will consequently be critically dependent on surveys. The importance of these survey data will therefore be increased, particularly for acoustic survey results since they provide absolute estimates of abundance. The Council agreed with STACFIS that survey studies should be encouraged.

The Council noted that STACFIS reviewed the status of certain stocks in Subareas 0-4 as requested by the Fisheries Commission, Canada and Denmark (in respect of Faroe Islands and Greenland), and had advised on catch levels corresponding to reference levels according to the different requests. Management advice, based on the reference levels, could not be provided for several stocks due to insufficient data. Detailed assessments are given in the report of STACFIS, Appendix I, and the following summaries of the assessments were reviewed and adopted by the Council.

SUMMARY SHEET - Cod in Divisions 2J, 3K and 3L

Source of Information: SCR Doc. 94/12, 40; SCS Doc. 94/13.

Year	1987	1988	1989	1990	1991	1992	1993	1994
TAC	256	266	235	199	190	120[2]	[2]	[2]
Catch	235	269	253	219	150[1]	44[1]	11[1]	
Offshore catch	156	168	151	106	90[1]	32[1]	2[1]	
Fixed gear catch	79	101	103	113	60[1]	12[1]	9[1]	
Sp. stock biomass								
Recruitment (age 3)			N/A					
Mean F (ages 7-9)								

[1] Provisional. Weights in '000 tons

[2] Moratorium in effect on Canadian fishing since July 1992.

Catches: Catches declined from a high of 810 000 tons in 1968 to a low of 139 000 tons in 1978. During 1982-90 catches ranged between 219 000 and 270 000 tons, however, a reduction to approximately 150 000 tons occurred during 1991 and further to 44 000 tons in 1992. A moratorium was imposed on the Canadian fishery in July 1992 and subsequently by the European Union on its fleet. Catches by the recreational, foreign (outside 200 miles), and by-catch fisheries in 1993 totalled approximately 11 000 tons. The moratorium was extended to include the recreational fishery in January 1994.

Data and Assessment: The principle index of abundance is the Canadian autumn research vessel survey index. From 1978 to 1990, the catch-per-tow averaged about 50 cod with the 1990 catch-per-tow equal to the average. The catch-per-tow decreased to 33 fish in 1991. The decline was more pronounced for fish age 6 and older. Despite the *severe reduction in fishing* activity as a result of the moratorium, the catch per tow decreased further during the 1992 and 1993 surveys to 9 and 2 fish respectively.

Fishing Mortality: Although stock size and fishing mortality could not be estimated, analysis incorporating the extremely low RV abundance for 1993 suggest that total mortalities in recent years have been very high and most likely in excess of 1.0 for the fully recruited age groups. The continued drastic decline in survey abundance occurred in the virtual absence of an offshore fishery and with a low 'recreational' fishery.

Recruitment: The 1986 and 1987 year-classes were originally estimated to be strong but subsequent analysis suggest a downward revision of the estimates such that they now appear to have been below average. Survey data would suggest that year-classes since that time are weak. Spawning stock biomass remains low, and based on previous analyses strong recruitment is not anticipated.

State of Stock: There is little doubt that the stock has declined substantially with abundance and biomass probably at an all-time low.

Forecast for 1995: Current data suggest further stock declines. No fisheries should be considered until there is evidence of adequate recovery.

Environmental factors: Temperatures recorded at Station 27 during the 1990s been anomalously low when compared with the mean for years since 1946.

Long term prospects: Before the expansion of the fishery in the 1960s catches had generally been in the 200 000 to 300 000 ton range. During the 1960s, good recruitment along with exploitation rates ranging from 25% to 50% saw catches averaging about 580 000 tons. Given the current depressed state of the stock which continues to decline, the low current spawning stock biomass, and the apparent low recruitment levels of recent years, stock recovery in terms of total and spawning stock biomass is not possible in the next 5-7 years. Stock recovery cannot begin until there is production and survival of significant numbers of new recruits.

Special Comment: Total mortality derived from surveys appeared to have declined between 1992 and 1993 presumably because of the fishery closure, but the level of *mortality is too high to be explained* by a catch of 11 000 tons. Possible reasons for this inconsistency include the following: 1) factors other than fishing are responsible for the observed declines; 2) year effects of the surveys in recent years are hampering calibration of SPA; 3) the 1993 catch has been underestimated. It is not possible to determine which of these or a combination might be correct. It is possible that the recreational fishery in 1993 took fish predominantly originating from supposed inshore stocks. The areas where these fish would occur are not covered during the fall surveys, and no information exists concerning possible trends in inshore 'stock' abundance.

SUMMARY SHEET - Cod in Division 3M

Source of Information: SCR Doc. 94/12, 22, 26, 62; SCS Doc. 94/3, 13, 16

Year	1987	1988	1989	1990	1991	1992	1993	1994
Recommended TAC	0	0	0	0	0	0	0	0
Agreed TAC	13	0	0	0	13	13	13	13
Reported catches	11	2	1	2	8[1]	6[1]	5[1]	
Non-reported catches		-[2]	39	30	3	5	7	
Total landings	11	2	40	32	11[1]	11[1]	13[1]	
Sp. stock biomass								
Recruitment (age)				No information available				
Mean F								

[1] Provisional
[2] No information available

Weights in '000 tons

Catches: Catches ranged from 22 000 to 33 000 tons in late-1970s and were stable around 12 000 tons for 1980-87. Reported nominal catches were less than 2 000 tons from 1988 to 1990. Actual catches were estimated to be around 40 000 tons in 1989 and 31 500 tons in 1990. Total catch in 1993 was estimated to be 12 500 tons.

Data and Assessment: Available data include biological data from the commercial fisheries, catch-rate series from Faroese longline fishery, trawl survey by USSR/Russia since 1971 and by EU since 1988.

Fishing Mortality: Uncertain but assumed to be high.

Recruitment: The 1990 and 1991 year-classes appear stronger than the other year-classes currently in the population.

State of Stock: Surveys conducted by Russia since 1971 indicated that biomass and abundance had declined to a minimum in 1987. Both Russia and EU surveys showed an increase in stock biomass from 1988 to 1989 due to a relatively abundant 1986 year-class, a decrease since then to 1992, and an increase from 1992 to 1993, due to the income of two relatively abundant year-classes, those of 1990 and 1991.

Forecast for 1995: No forecast available.

Option Basis	Predicted catch (1995)	Predicted SSB (1.1.1996)
F_{01} =		
F_{93} =	No information available	
F_{max} =		

Recommendations: No directed fishery on cod be conducted in 1995, to allow stock recovery.

Special Comments: A trawl fishery in 1995 would be based on the 1990 and 1991 year-classes when they were 5 and 4 years old respectively, if the current fishing pattern is maintained. Both year-classes appeared relatively abundant in the Russian and EU surveys when they were of age 2 and 3 in July, 1993, but they would be noticeably reduced at the beginning of 1995, after supporting the fishery in 1994. These two year-classes offered the opportunity to rebuild the spawning stock.

SUMMARY SHEET - Cod in Divisions 3N and 3O

Source of Information: SCR Doc. 94/10, 12, 30, 51; SCS 94/2, 3, 13, 16

Year	1987	1988	1989	1990	1991	1992	1993	1994
Recommended TAC		Same as agreed						
Agreed TAC	33	40	25	18.6	13.6	13.6	10.2	6[2]
Reported catches	42	43	33	18	17[1]	10.1[1]	9[1]	
Non-reported catches	-	-	-	11	12	2.5	0.7	
Total landings	42	43	33	29	29[1]	12.6[1]	9.7[1]	
Sp. stock biomass from maturity ogive:								
Recruitment (age 3)	See SCS 94/2 and Special Comments below.							
Mean F (ages 7-10):								

[1] Provisional.
[2] No fishing

Weights in '000 tons

Catches: There was no new catch information to update the information presented in the February 1994 assessment.

Data and Assessment: Sampling data were available from the Portuguese gill net and otter trawl fishery from 1993. Data were used in the previous formulation of ADAPT and the results indicated that the differences were marginal. *Information was presented relative to the most appropriate partial recruitment (PR) for this stock.* An extension of the statistical model used to estimate abundance from commercial catch-at-age data was formulated to model the fishing mortality on the oldest ages. The analysis presented indicated that no significant difference could be found from that of a flat top PR. Based on this, The Council concluded that this was the most appropriate pattern to use.

Fishing Mortality: *New sampling information from the Portuguese fleet only slightly increased fishing mortalities on most* ages. No further analyses were conducted at this time. The February 1994 assessment indicated that Fs declined in 1992 and 1993 but were particularly high on younger, immature ages.

Recruitment: The February assessment indicated that the 1989 and 1990 year-classes are above the abundance average of the 1974-88 year-classes. The total abundance estimate from the 1994 spring survey was 6% of that in 1993 and suggests that the spring 1993 estimates may have been optimistic.

State of Stock: The stock is comprised mainly of young, immature fish. The number of older mature, fish continues to decline. Rebuilding of the spawning stock biomass in the short term is dependant on the 1989 and the 1990 year-classes surviving to maturity. It will be another one to two years before the majority of these fish are sexually mature.

Forecast for 1995:

Option Basis	Predicted catch (1995)	Predicted SSB (1.1.1996)
$F_{0.1}$ =		
F_{93} =	No information available	
F_{max} =		

Recommendations: The stock must be allowed to rebuild. There should be no fishing for cod in Div. 3N and 3O in 1995.

Special Comments: High variability in the 1993 Canadian and Russian spring RV survey data as well as conflicting evidence between spring and autumn surveys dictate caution in the interpretation of the strength of the 1989 and 1990 year-classes. The low preliminary total biomass and abundance estimates from the 1994 Canadian spring survey reaffirm this caution.

The spawning stock biomass cannot begin to recover unless the 1989 and 1990 year-classes survive to maturity. This will not happen if fisheries on immature ages continue at current high levels. Any harvesting of this stock will reduce the rebuilding potential.

The Council is unable to provide projections of reference level catches in 1995 until all 1994 survey data have been analyzed.

SUMMARY SHEET - Redfish in Subarea 1

Source of Information: SCR Doc. SCR 94/6, 7, 9, 31; SCS Doc. 94/11, 14, 15.

Year	1987	1988	1989	1990	1991	1992	1993	1994
Recommended TAC			No TAC					
Agreed TAC	19	19	19	19	19	19	19	19
Reported Catches	1	1	1	0.4	0.3[1]	0.3[1]	0.3[1]	
Total landings	1	1	1	0.4	0.3[1]	0.3[1]	0.3[1]	
Sp. stock biomass								
Recruitment (age 2)		No information available						
Mean F								

[1] Provisional. Weights in '000 tons

Catches: Mainly by-catches in the cod and shrimp fishery, reported catch in 1977 was 31 000 tons. Recent catches are lowest on record. Substantial numbers of small redfish are discarded as by-catch in the shrimp fishery but not reported.

Data and Assessment: Abundance and biomass estimate from stratified-random bottom trawl surveys designed for cod, shrimp and Greenland halibut. No commercial fishery data were available.

Fishing Mortality: No estimates.

Recruitment: No direct estimates but information from surveys on nursery grounds indicate high abundance of juvenile fish off West Greenland.

State of Stock: Survey estimates indicate decline of biomass and abundance of the adult stock components of both golden and beaked redfish to extremely low level.

Forecast for 1995: No projections.

Option Basis	Predicted catch (1995)	Predicted SSB (1.1.1996)
F_{01} =		
F_{93} =	No information available	
F_{max} =		

Recommendations: Directed catches and by-catches of redfish in Subarea 1 be reduced to the lowest possible level.

Special Comments:

SUMMARY SHEET - Redfish in Division 3M

Source of Information: SCR Doc. 94/13, 22, 60; SCS Doc. 94/3, 13, 14, 16

Year	1987	1988	1989	1990	1991	1992	1993	1994
Recommended TAC	20	20	20	<50	43	35	<20	20
Agreed TAC	20	20	20	50	50	43	30	26
Reported catches	44	23	48	67	41[1]	29[1]	21[1]	
Non-reported catches			10	14	7	14	8	
Total landings	44	23	58	81	48[1]	43[1]	29[1]	
Sp. stock biomass								
Recruitment	No information available							
Mean F								

[1] Provisional. Weights in '000 tons

Catches: Averaged 20 000 tons or less from 1979 to 1985. Increased thereafter to 44 000 tons in 1987, and declined to 23 000 tons in 1988. In 1990 the catch of 81 000 tons was the highest in the history of this fishery. Since then catches have declined to 29 000 tons in 1993. Catches for 1990-92 have been revised based on updated information related to the catches by non-Contracting Parties.

Data and Assessment: Standardized catch-rate series, bottom trawl and acoustic survey indices.

Fishing Mortality: No estimate available.

Recruitment: Both EU and Russian surveys in 1993 indicate proportionately high occurrence of juvenile redfish. However, the abundance of this cannot be quantified.

State of Stock: Biomass has declined at least from 1988 to 1991-92.

Forecast for 1995:

Option Basis	Predicted catch (1995)	Predicted SSB (1.1.1996)
$F_{0.1}$ =		
F_{93} =	No information available	
F_{max} =		

Recommendations: Total catch be reduced to 20 000 tons for 1995.

Special Comments: There continues to be a substantial fishery for shrimp in Div. 3M. The Council expresses its concern on the likely negative impact of these fisheries on future recruitment to the redfish fisheries. While full information for 1993 may be made available when the shrimp resources in this Division will be assessed in September, the Council considers that the annual information should be made available in advance of the June meeting when the status of Div. 3M redfish is to be assessed.

SUMMARY SHEET - Redfish in Divisions 3L and 3N

Source of Information: SCR Doc. 94/13, 54; SCS Doc. 94/13, 16

Year	1987	1988	1989	1990	1991	1992	1993	1994
Recommended TAC	25	25	25	25	14	14	14	14
Agreed TAC	25	25	25	25	14	14	14	14
Reported catches	71	45	32	25	22[1]	15[1]	15[1]	
Non-reported catches	8	8	2	4	4	12	4-9	
Total landings	79	53	34	29	26[1]	27[1]	19-24[1]	
Sp. stock biomass								
Recruitment (age)	No information available							
Mean F								

[1] Provisional. Weights in '000 tons

Catches: Average catch was about 20 000 tons prior to 1985. In 1986, catches doubled to 43 000 tons and increased again in 1987 to 79 000 tons. Since then catches have declined steadily to 26 000 tons in 1991. Cannot precisely determine 1993 catch but likely between 19 000 tons and 24 000 tons. TAC has been exceeded each year since 1985.

Data and Assessment: Catch-rate indices derived for Div. 3L and Div. 3N generally not considered reflective of year-to-year changes in stock abundance. However, all indices indicate a general decline since mid-1980s. Bottom trawl surveys by Russia in Div. 3LN and Canada in Div. 3L suggest decline since 1984.

Fishing Mortality: No estimate available.

Recruitment: No estimate available but appears poor in Div. 3L since the early- 1980s. In Div 3N a mode appeared in Russian and Canadian surveys in 1991 at 12-14 cm. Given the variability in the survey estimates the magnitude of this recruitment cannot be determined. However, there is no sign of any year-classes subsequent to this in the surveys.

State of Stock: Available indices exhibit considerable between-year variability but generally indicate a stock at a low level, especially in Div. 3L.

Forecast for 1995:

Option Basis	Predicted catch (1995)	Predicted SSB (1.1.1996)
$F_{0.1}$ =	No information available	
F_{91} =		
F_{max} =		

Recommendations: Total catch for 1995 not to exceed 14 000 tons.

Special Comments: Catches for non-Contracting Parties in recent years have ranged from 7 000 tons in 1991 to 24 000 tons in 1987.

SUMMARY SHEET - Silver Hake in Divisions 4V, 4W and 4X

Source of Information: SCR Doc. 94/4, 8, 32, 39; SCS Doc. 94/3

Year	1987	1988	1989	1990	1991	1992	1993	1994
Recommended TAC	100	161	235	-	100	105	75	51
Agreed TAC	100	120	135	135	100	105	86[3]	30
Reported catches	62	74	91	69[1]	68[1]	32[1]	29[1]	15[2]
Sp. stock biomass	234	195	183	174	166	147	-	-
Recruitment (age 1)[4]	822	787	1 168	933	943	798	1 200[2]	1 100[2]
Mean F (avg ages 3-5)	0.73	0.76	1.52	0.95	1.40	0.55	0.32	

[1] Provisional. Weights in '000 tons
[2] Estimated.
[3] Catches additional to advised $F_{0.1}$ catch were allocated in the knowledge that not all allocations would be utilized fully.
[4] Numbers in '000 000.

Catches: Peaked in 1973 at 300 000 tons. In recent years catches have dropped from 91 000 tons in 1989 to 29 000 tons in 1993. The 1993 level is the lowest catch in the time series.

Data and Assessment: Catch-at-age from 1977 to 1993 were included in a formulation of ADAPT using research vessel (juvenile and adult) and commercial CPUE indices.

Fishing Mortality: Fully recruited F for ages 3-5 was 0.32 in 1993.

Recruitment: The 1992 year-class is thought to be above average (1972-1992 geometric mean) while the 1993 year-class is estimated to be average.

State of Stock: Commercial standardized catch rates have dropped since 1989, but remained stable over 1992-93 at approximately 40% of the 1989 level. Results of July research vessel surveys showed declining numbers and biomass from 1986-92. The 1993 survey showed a moderate increase in numbers and biomass.

Forecast for 1995: Catch in 1994 was assumed at 15 000 tons. Increase in the size of the fished stock after 1993 results from recruitment of the 1992 year-class which will account for 50% of the catch in 1995.

Option Basis	Predicted catch (1995)	Predicted SSB (1.1.1996)
$F_{0.1}$ = 0.70	79 000	
F_{93} =		
F_{max} =		

Recommendations: The catch at a target fishing level of $F_{0.1}$ in 1995 is 79 000 tons.

Special Comments: Projections based on retrospective analysis suggest that the projected $F_{0.1}$ catch in 1995 of 79 000 tons could be overestimated by as much as 20 000 tons.

SUMMARY SHEET - American Plaice in Division 3M

Source of Information: SCR Doc. 94/22; SCS Doc. 94/3, 13, 16

Year	1987	1988	1989	1990	1991	1992	1993	1994
Recommended TAC	2	2	2	2	2	2	2	1[2]
Agreed TAC	2	2	2	2	2	2	2	
Reported catches	5.6	2.8	3.5	0.8	1.6[1]	0.8[1]	0.3[1]	
Non-reported catches								
Total landings								
Sp. stock biomass								
Recruitment (age)	No information available							
Mean F								

[1] Provisional
[2] No directed fishing allowed

Weights in '000 tons

Catches: Ranged between 600 and 1 900 tons in 1974-85, then increased in 1986-89 to between 2 861 and 5 600 tons. From 1990 to 1993 the reported catches declined to levels below the TAC. Since 1992 there was no fleet which directed its fishery to this stock.

Data and Assessment: Catch-at-age for 1988-93. Information from Russian surveys (1972-93) and EU surveys (1988-93) were used to evaluate stock status.

Fishing Mortality: Appears to have been high during the period 1988-91 and has drastically decreased since 1992, due to a shift in the target species of the main fleet which previously directed its efforts to this species.

Recruitment: The 1990 and 1991 year-classes appears to be weak in 1993 EU survey. 1986 year-class continues to be the strongest in the EU survey.

State of Stock: Both Russian and EU surveys show that relative abundance and biomass are at the lowest level from 1983. SSB increased from 1993 to the level of 1990-91 due to the recruitment of 1986 year-class, but it is still at a low level.

Forecast for 1995:

Option Basis	Predicted catch (1995)	Predicted SSB (1.1.1996)
$F_{0.1}$ =		
F_{93} =	No information available	
F_{max} =		

Recommendations: Catch in 1995 should not exceed 1 000 tons.

Special Comments: The recommended 1 000 tons for 1995 corresponds to the expected by-catch in non-directed fisheries.

SUMMARY SHEET - American Plaice in Divisions 3L, 3N and 3O

Source of Information: SCR Doc. 94/55, 56, 58; SCS Doc. 94/13, 16

Year	1987	1988	1989	1990	1991	1992	1993	1994
Recommended TAC	48	28	30.3	24.9	25.8	25.8	10.5	4.8
Agreed TAC	48	40[1]	30.3	24.9	25.8	25.8	10.5	4.8[4]
Reported catches	55	40.7	41.4	24.4	26[2]	10.6[2]	8.3[2]	
Non-reported catches	0	0.1	2.0	8.1	8	2.0	9.0	
Total landings	55	40.8	43.4	32.5	34[2]	12.6[2]	17.3[2,3]	
Sp. stock biomass								
Recruitment (age)	No information available							
Mean F								

[1] Effective TAC was 33 585 tons.
[2] Provisional.
[3] Catch may be as high as 19.4 thous. tons.
[4] No directed fishing allowed.

Weights in '000 tons

Catches: Highest catches occurred in the late-1960s with a peak catch of 94 000 tons taken in 1967. Catches were stable at about 50 000 tons during the 1970s. Overall catches declined to about 33 000 tons in 1990-91 and to only 12 600 tons in 1992, and 17 300 tons in 1993, the lowest values since the 1950s.

Data and Assessment: Sequential population analyses not possible because age compositions were not available from 50% of the catch in 1993. Stock size indicated by surveys was extremely low in 1993. Canadian CPUE at its lowest level in 1993. Portuguese otter-trawl CPUE increased from 1992 to 1993 in Div. 3N.

Fishing Mortality: Not possible to evaluate, although estimates of total mortality from surveys have increased at most ages.

Recruitment: Recruitment estimated from RV surveys has decreased to very low levels.

State of Stock: The stock is at a level far below the historic average, and has declined very rapidly in recent years. Surveys indicate that SSB has declined by 85% or more since the mid-1980s. Stock size in 1993 is estimated to be at the lowest level ever observed.

Forecast for 1995:

Option Basis	Predicted catch (1995)	Predicted SSB (1.1.1996)
$F_{0.1}$ =		
F_{93} =	No information available	
F_{max} =		

Recommendations: No fishing on American plaice in Div. 3LNO in 1995.

Special Comments: Virtually all indices of stock size are at their lowest levels ever, making stock rebuilding uncertain. Unregulated catches by non-Contracting Parties will continue to hamper the rebuilding of this stock.

SUMMARY SHEET - Witch Flounder in Divisions 3N and 3O

Source of Information: SCR Doc. 94/49; SCS Doc. 94/12; 94/13

Year	1987	1988	1989	1990	1991	1992	1993	1994
Recommended TAC	5	5	5	5	5	5	5	3
Agreed TAC	5	5	5	5	5	5	5	3
Reported catches	8	7	4	2.7	3.3[1]	4.8[1]	4.2[1]	-
Non-reported catches[2]				1.5	1.5	-	0.3	-
Total landings				4.2	4.8[1]	4.8[1]	4.4	-
Sp. stock biomass								
Recruitment (age)	No information available							
Mean F								

[1] Provisional
[2] Data inadequate to estimate misreported catches prior to 1990

Weights in '000 tons

Catches: In the period 1970-84 catches ranged from a low of 2 400 tons in 1980-81 to a high of 9 200 tons in 1972. From 1985 to 1988 catches exceeded the TAC by large margins, but have been stable in recent years near the level of the TAC.

Data and Assessment: Estimates of biomass from surveys and stock trends from Canadian commercial catch rates.

Fishing Mortality: Unknown.

Recruitment: Unknown.

State of Stock: Survey biomass in Div. 3N is at an extremely low level. Biomass in Div. 3O declined slightly during the 1984-90 period with average catches of 2 600 tons but declined more sharply up to 1993. Preliminary estimate for 1994 showed an increase.

Forecast for 1995:

Option Basis	Predicted catch (1995)	Predicted SSB (1.1.1996)
$F_{0.1}$ =		
F_{83} =	No information available	
F_{max} =		

Recommendations: No fishing on witch flounder in 1995 in Div. 3N and 3O, to allow rebuilding to former levels.

Special Comments:

SUMMARY SHEET - Yellowtail flounder in Divisions 3L, 3N and 3O

Source of Information: SCR Doc. 94/44, 46, 58

Year	1987	1988	1989	1990	1991	1992	1993	1994
Recommended TAC	15	15	5	5	7	7	7	7
Agreed TAC	15	15	5	5	7	7	7	7[2]
Reported catches	16.3	16.2	9.1	8.9	11.0[1]	10.7[1]	6.8	
Non-reported catches	0	0.1	1.1	5.1	5.3	0.1	6.8	
Total landings	16.3	16.3	10.2	14.0[1]	16.3[1]	10.8[1]	13.6	
Sp. stock biomass								
Recruitment (age)	No information available.							
Mean F								

[1] Provisional.
[2] No directed fishing allowed.

Weights in '000 tons

Catches: Catches were stable at 10 000-15 000 tons for most of the 1970s and early-1980s. They rose to about 30 000 tons during 1985-86 as effort increased in the Regulatory Area in Div. 3N. Catches ranged from 10 000 to 16 000 since 1986. Considerable uncertainty exists with the catch data for this stock.

Data and Assessment: No analytical assessment possible due mainly to uncertainties with catch and catch-at-age data. Data from Canadian catch rates and Canadian and USSR/Russian RV surveys used to determine trends in stock abundance.

Fishing Mortality: No information available on fishing mortality but total mortality is high at older ages.

Recruitment: The 1989-92 year-classes appear to be average to below average, and appear to be weaker than their immediate predecessors.

State of Stock: The stock remains stable at a low level. Potential growth of the stock from the 1984-86 year-classes has not occurred, likely because of large catches of juveniles from these cohorts by fisheries in the Regulatory Area, and because the TAC has been exceeded each year since 1984.

Forecast for 1995:

Option Basis	Predicted catch (1995)	Predicted SSB (1.1.1996)
$F_{0.1}$ =		
F_{93} =	No information available.	
F_{max} =		

Recommendations: To rebuild this stock as fast as possible, no fishing should be permitted on yellowtail flounder in Div. 3LNO in 1995.

Special Comments: *Status quo* TACs in recent years have resulted in catches well beyond the TAC levels and have not resulted in any growth in stock size.

SUMMARY SHEET - Greenland Halibut in Division 0B and Divisions 1BCDEF (for Div.1A see separate Summary Sheet)

Source of Information: SCR Doc. 94/9, 18, 31, 42, 47, 59 SCS Doc. 94/5, 14, 15 .

Year	1987	1988	1989	1990	1991	1992	1993	1994
Recommended TAC[2]	25	25	25	25	25	25	25	25
Reported catches(Div. 0B+1B-F)	1	3	1	16	11[1]	13[1]	12[1]	
Non-reported catches						1		
Reported catches (Div.1A)[3]	8	7	7	8	10[1]	12[1]	12[1]	
Total landings (Div. 0B+1B-F)	1	3	1	16	11[1]	14[1]	12[1]	
Sp. stock biomass								
Recruitment (age)	No information available							
Mean F								

[1] Provisional. Weights in '000 tons

[2] Until 1994 TAC set for Subareas 0+1.

[3] Only for information, see Summary Sheet on Greenland halibut in Division 1A.

Catches: The catches increased since 1990 mainly in Division 0B due to a new offshore trawl fishery. For catches in Div. 1A, see separate Summary Sheet.

Data and Assessment: Analytical assessment considered inappropriate due to lack of stock indicators and due to uncertainty of migrations in entire distribution area of Greenland halibut. Available survey data do not cover the entire area of distribution in Subareas 0-3. Survey estimates of biomass and abundance and CPUE series available.

Fishing Mortality: Increased in recent years, indication of a high level in 1993, but no exact value available.

Recruitment: No information available.

State of Stock: The survey biomass indices have declined since 1989 and the 1993 estimate for Div. 1BCD is the lowest on record. Abundance estimates also declined in the same period affecting the entire age range except for ages 2 and 3. Catch rates have declined significantly since 1991 in Div. 0B and Div. 1CD.

Forecast for 1995:

Option Basis	Predicted catch (1995)	Predicted SSB (1.1.1996)
$F_{0.1}$ =	No information available	
F_{93} =		
F_{max} =		

Recommendations: A separate TAC be established for the inshore areas of Div. 1A. The catch inshore in Div. 1A is expected to be around 12 000 tons in 1995.

Furthermore a separate TAC to be established combined for all of Div. 0B and Div. 1BCDEF.

The effort and catches throughout Subareas 0-3 in 1995 should be reduced compared to recent years.

For Div. 0B and Div. 1BCDEF combined, the TAC for 1995 be set below the offshore catch level of 11-15 000 tons seen in most recent years. This implies a TAC for 1995 be set below 11 000 tons.

Special Comments: There has been a significant amount of information collected which suggests that Greenland halibut in the Northern West Greenland fjords (Div. 1A) do not contribute to the spawning stock in the offshore areas in Davis Strait. There is very little fishery offshore in Div. 1A (less than 100 tons) and therefore tagging cannot conclusively test a possible link with Greenland halibut occurring inshore and offshore in Div. 1A.

There is no information available suggesting that Greenland halibut in Cumberland Sound and coastal areas of Baffin Island are isolated from the occurrence offshore in Div. 0B.

SUMMARY SHEET - Greenland Halibut in Division 1A (new unit, previously included in Subareas 0+1)

Source of Information: SCR 94/9, 18, 42, 59; SCS 94/5.

Year	1987	1988	1989	1990	1991	1992	1993	1994
Recommended TAC[2]								
Reported catches	8	7	7	8	10[1]	12[1]	12[1]	
Non-reported catches								
Total landings	8	7	7	8	10[1]	12[1]	12[1]	
Sp. stock biomass								
Recruitment (age)	No information available							
Mean F								

[1] Provisional. Weights in '000 tons
[2] Until 1994 TAC for Subareas 0+1.

Catches: Catches increased somewhat 1987-92. The fjord areas account for all catches. The fishery is conducted from small boats and dog sledges using gillnet and longlines.

Data and Assessment: Catch-at-age data are available for some years. Due to the non-migratory behaviour of Greenland halibut in the fjords, assessment will have to be made for each of the three fjord systems: Ilulissat, Ummannaq and Upernavik.

Fishing Mortality: Unknown.

Recruitment: No information available.

State of Stock: Catch compositions suggest stable stock components in the area. Stable catches since 1991.

Forecast for 1995:

Option Basis	*Predicted* catch (1995)	Predicted SSB (1.1.1996)
F_{01} =		
F_{93} =	No information available	
F_{max} =		

Recommendations: A separate TAC be established for the inshore areas of Div. 1A.

Special Comments: There has been a significant amount of information collected which suggests that Greenland halibut in the northern West Greenland fjords (Div. 1A) do not contribute to the spawning stock in the offshore areas in Davis Strait. There is very little fishery offshore in Div. 1A (less than 100 tons) and therefore tagging cannot conclusively test a possible link with Greenland halibut occurring inshore and offshore in Div. 1A. There is ongoing research which will allow a re-evaluation after some few years. The catch inshore in Div. 1A is expected to be around 12 000 tons in 1995.

SUMMARY SHEET - Greenland Halibut in Subarea 2 and Divisions 3K and 3L

Source of Information: SCR Doc. 94/25; 29; 53; 57, SCS Doc. 94/13; 16.

Year	1987	1988	1989	1990	1991	1992	1993	1994
Recommended TAC	100	100	100	50	50	50	50	-
TAC[3]	100	100	100	50	50	50	50	25
Reported catches	31	19	19	27	35[1]	52[1]	53[1]	-
Non-reported catches				20	20-40	11	9	
Total landings	31	19	19	47	55-75[1,2]	63[1]	62[1,2]	
Sp. stock biomass								
Recruitment (age)	No information available							
Mean F								

[1] Provisional
[2] No reliable estimate of total landings
[3] Established by Canada

Weights in '000 tons

Catches: Peaked at 38 500 tons in 1978 then declined to an average of 20 000 tons from 1985-89. Increased sharply in 1990 and 1991 mainly due to a developing fishery in the Regulatory Area of Div. 3LMN and has continued at high levels in 1992-93. Canadian catches were relatively stable from 1988-91 but declined considerably in 1992 and 1993 to their lowest level since the fishery began in the early-1960s.

Data and Assessment: Analytical assessments considered unacceptable until migratory patterns and stock structure are fully understood. Catch-rate data are available, however, research vessel surveys continue to give the more important indices of abundance for the stock distributed in the survey area.

Fishing Mortality: Not known precisely, but believed to be high in recent years.

Recruitment: The 1990 and 1991 year-classes estimated to be better than average in the 1993 survey.

State of Stock: The survey results in 1991 and 1992 suggest that the year-classes of 1984-86 had declined rapidly to very low numbers in the survey area of Div. 2J+3KL.

Most of the indices of abundance for 1993 indicated a continued decline of older fish throughout Subareas 2 and 3.

Forecast for 1995:

Option Basis	Predicted catch (1995)	Predicted SSB (1.1.1996)
$F_{0.1}$ =		
F_{93} =	No information available	
F_{max} =		

Recommendations: The effort and catches throughout Subareas 0-3 in 1995 should be reduced compared to recent years.

Any catch level in Subareas 2-3 above 40 000 tons for 1995 (*status quo* prediction including the catches of non-Contracting Parties) will not be adequate to restrict the fishery. Therefore, a reduction in effort requires a reduction in catch below that figure (see Special Comments below).

Special Comments: Concern was expressed that based on some of the available stock indicators the catch in 1995 should be substantially lower to halt the decreasing biomass trend.

SUMMARY SHEET - Roundnose Grenadier in Subareas 0 and 1

Source of Information: SCR 94/31; SCS 94/15.

Year	1987	1988	1989	1990	1991	1992	1993	1994
Recommended TAC	8	8	8	8	8	8	8	8
Agreed TAC	8	8	8	8	8	8	8	
Reported catches	0.38	0.52	0.08	0.24	0.16[1]	0.19[1]	0.1[1]	
Sp. stock biomass								
Recruitment (age)	No information available.							
Mean F								

[1] Provisional.

Weights in '000 tons

Catches: Since about 1980, landings have been only as by-catch in the Greenland halibut fishery.

Data and Assessment: No catch-at-age data available and no catch and effort data available for the recent period. Assessment is not possible at present.

Fishing Mortality: No estimate available.

Recruitment: No estimate available.

State of Stock: Trawlable biomasses in Div. 1CD estimated from the joint Greenland/Japan surveys have since 1987 fluctuated between 5 900 tons and 45 800 tons. From 1992 to 1993, the estimate decreased from 40 200 tons to 8 200 tons. The surveys did not cover all Divisions and waters deeper than 1 500 m, where roundnose grenadier is known to be distributed. It is, therefore, at present not possible to evaluate the stock.

Forecast for 1995:

Option Basis	*Predicted catch (1995)*	Predicted SSB (1.1.1996)
$F_{0.1}$ =		
F_{93} =	No information available.	
F_{max} =		

Recommendations: TAC for roundnose grenadier in Subareas 0+1 in 1995 to remain at 8 000 tons.

Special Comments:

SUMMARY SHEET - Roundnose Grenadier in Subareas 2 and 3 (with some comments on Roughhead grenadier)

Source of Information: SCR Doc. 94/23, 29, 48; SCS Doc. 94/3, 13.

Year	1987	1988	1989	1990	1991	1992	1993	1994
Recommended TAC	11	11	11	11	11	11	11	5
Agreed TAC	11	11	11	11	11	11	11	3
Reported catches[3]	8	6	5	4	5[1,2]	5[1]	10[1]	
Non-reported catches								
Total landings[3]	8	6	5	4	9-14[1,2]	5[1]	10[1]	
Revised landings[4]	7	5	5	1	5-10[2]	3[1]	4[1]	
Sp. stock biomass								
Recruitment (age)	No information available							
Mean F								

[1] Provisional. Weights in '000 tons

[2] No reliable estimate of total landings.

[3] Original estimates as reported to NAFO.

[4] Revised estimates based on data in SCS 94/13 and SCR Doc. 94/29.

Catches: Prior to 1979, catches averaged about 26 000 tons but based on revised estimates of catches in the Regulatory Area have since declined to an average of about 4 500 tons. In 1991 the Council could not precisely estimate the actual catch but determined it to be within the range of 9 000-14 000 tons. The revised estimates lower this to between 5 000-10 000 tons. Since about 1989, catches from the "traditional" fishery have steadily declined and were zero in 1993. Revised estimates indicate catches from the Regulatory Area began to increase in 1992 due to by-catch by EU-Spain in the Greenland halibut fishery. The catches previously reported by EU-Portugal to be roundnose grenadier have been re-identified as roughhead grenadiers, and about 50% of the catch of EU-Spain previously reported as roundnose is now believed to have been roughhead.

Data and Assessment: Results of the annual Canadian fall stratified-random survey in 1993 once again indicated the area of greatest concentration to be in Div. 3K at about 51° N, coinciding with the area of the 'traditional' fishery. Results of deepwater surveys by Canada in 1991 and 1994 also indicate that the highest catches are in this same area; in depth of 1 000- 1 500 m. Trawlable biomass estimates in Div. 3K did not change from 1991 to 1994, but estimates for Div. 3LM declined somewhat. The lowest estimated biomass was in Div. 3N. The estimated proportion of roundnose grenadier to roughhead grenadier from the survey in Div. 3N (17%) was about the same as the estimated proportion of roundnose to roughhead grenadier in the EU-Spain and EU-Portugal fisheries (20%) in recent years.

Fishing Mortality: No estimate available.

Recruitment: No estimate available.

State of Stock: Not possible to evaluate precisely. Previous assessments have concluded that the resource has declined in the 'traditional' fishing area inside the Canadian zone, although there was no change in the estimated biomass from surveys in Div. 3K in 1991 and 1994. It is not possible to evaluate the status of the resource in the Regulatory Area.

Forecast for 1995: No forecast.

Option Basis	Predicted catch (1995)	Predicted SSB (1.1.1996)
$F_{0.1}$ =	No information available	
F_{sq} =		
F_{max} =		

Recommendations: The current TAC level of 3 000 tons be continued in 1995 as a precautionary measure.

Special Comments: The current TAC for roundnose grenadier in the Canadian zone of SA 2+3 (3 000 tons) is about 15% of the estimated trawlable biomass for Div. 3K alone. If this quota is taken, fishing mortality should not be excessive. In the Regulatory Area, the average catch from 1991 to 1993 represents about 25% of the trawlable biomass for this area. Exploitation has been greater in the Regulatory Area compared to the 'traditional' area in recent years.

Because of efforts by EU-Spain and EU-Portugal it is now possible to determine the proportion of roundnose grenadier and roughhead grenadier in the catches of these countries in the Regulatory Area previously reported as roundnose grenadier. These indicate much lower catches of roundnose grenadier than previously believed. Catches of roughhead grenadier have exceeded those of roundnose since 1990 in the Regulatory Area.

SUMMARY SHEET - Capelin in Divisions 3N and 3O

Source of Information: SCR 94/14, 22; SCS Doc. 94/1.

Year	1987	1988	1989	1990	1991	1992	1993	1994
Recommended TAC	10	10	28	30	30	30[1]	0	0
Agreed TAC	10	15	28	30	30	30	0	0
Reported catches	1	7	9	25	+[1]	+[1]	0	
Non-reported catches								
Total landings	1	7	9	25	+	+	0	
Sp. stock biomass[2]	273	560	28	-	-	-	130	
Recruitment (age 1)	No information available							
Mean F								

[1] Provisional.
[2] In some years, these were averages of USSR and Canadian acoustic surveys and in other years only Canadian estimates were available. These are estimates of mature biomass.

Weights in '000 tons

Catches: Peak catch in 1975 of 132 000 tons. Fishery was closed during 1979-86 and in 1993.

Data and Assessment: Acoustic surveys of the spawning stock through 1981-89 and 1993. Spawning stock estimate expected from summer 1994 survey.

Fishing Mortality: Exploitation considered to be less than 10% of long-term mean spawning biomass.

Recruitment: No estimates of recruitment at age 2.

State of Stock: USSR acoustic survey during 1975-77 indicated mean biomass of 912 000 tons. Mean stock size in 1981-89 was about 300 000 tons. Biomass estimates in 1991 and 1992 were low, but surveys may have been too early. Some signs of improvement in 1993.

Forecast for 1995: No projections.

Option Basis	Predicted catch (1995)	Predicted SSB (1.1.1996)
$F_{0.1}$ =		
F_{93} =	No information available	
F_{max} =		

Recommendations: No directed capelin fishery be allowed during 1995 in Div. 3N and 3O. If results from the Russian survey in 1994 are available for the September 1994 Meeting, the status of the stock should be re-evaluated.

Special Comments: Concern was expressed about apparent low abundance levels and their impacts on future recruitment and predator stocks.

SUMMARY SHEET - Squid in Subareas 3 and 4

Source of Information: SCR 94/37, SCS Doc. 94/1, 12.

Year	1987	1988	1989	1990	1991	1992	1993	1994
Recommended TAC	150	-	-	-	-	-	-	-
Agreed TAC	150	150	150	150	150	150	150	150
Reported catches								
Non-reported catches								
Total landings	2	1	7	11	4[1]	2[1]	3[1]	
Sp. stock biomass								
Recruitment (age)	No information available							
Mean F								

[1] Provisional. Weights in '000 tons

Catches: Increased dramatically during 1970s from under 10 000 tons in first half to 162 000 tons in 1979, after that declined to less than 2 000 tons during 1983-88. Increased in 1989 and 1990 but declined since.

Data and Assessment: Limited sampling data from SA 3.

Fishing Mortality: No information available.

Recruitment: No information available.

State of Stock: Dependent on one year-class only.

Forecast for 1995:

Option Basis	Predicted catch (1995)	Predicted SSB (1.1.1996)
$F_{0.1}$ =		
F_{93} =	No information available	
F_{max} =		

Recommendations: No advice possible.

Special Comments: No advice possible without up-to-date information in relation to assessment on squid, especially for recruitment.

6. **Responses to the Fisheries Commission**

The following responses to the questions by the Fisheries Commission were reviewed and **approved** by the Scientific Council.

a) **Cod in Divisions 2J, 3K and 3L** (SCR Doc. 94/41)

The Scientific Council was again requested (FC Doc. 93/18) to: *provide information, if available, on the stock separation in Div. 2J+3KL and the proportion of the biomass of the cod stock in Div. 3L in the Regulatory area and a projection if possible of the proportion likely to be available in the Regulatory Area in future years. Information was also requested on the age composition of that portion of the stock occurring in the Regulatory Area.*

The stock separation issue has been reviewed previously (NAFO Sci. Coun., Rep. 1986) and it was then concluded that it was appropriate to assess cod in Div. 2J, 3K and 3L as a single stock complex. There is currently no additional information to change this conclusion. The general issue of stock definition is being addressed by research using a suite of genetic techniques (nuclear DNA gene probes). It is hoped these studies will lead to a better understanding of the Div. 2J+3KL stock complex.

Estimates of the proportion of the cod biomass in Div. 3L in the Regulatory area were updated to include the 1993 research vessel survey data. The results for autumn surveys show biomass in the Regulatory Area (6.0%) to be the highest since 1982. The spring survey series continue to show an increasing trend in the percentage of biomass in the Regulatory Area, with consecutive time series highs of 10.1%, 16.1% and 40.1% in 1991, 1992 and 1993 respectively. The results from the survey series used are as follows:

Season RV survey conducted	Years RV survey conducted	Range of % of Div. 3L biomass occurring in the Regulatory Area (1993 values in brackets)	Average
Winter	1985-86	23.8-26.8	25.3
Spring	1977-93	0.4-40.1 (40.1)	6.8
Autumn	1981-93	0.5-7.7 (6.0)	3.1

The proportions observed are estimates for the months in which the surveys were conducted and may not represent distributions in non-surveyed months. Although only two winter surveys have been conducted, the proportion of biomass in the Regulatory Area at that time appeared to be substantially higher than at other times.

Results of the autumn surveys conducted in all three Divisions (2J, 3K and 3L) by Canada from 1981 to 1992, show that the proportion of the cod in the Regulatory Area at that time of year was less than 1%, on average, of the total Div. 2J+3KL biomass. This percentage ranged from 0.1% to a high of 1.5% . In 1993 with the stock at an extremely low level the portion in the Regulatory Area was at a high of 5.2%. The average breakdown of biomass by Division was as follows:

Division	Mean relative proportion of Div. 2J+3KL biomass % 1981-1993	1993 Autumn (%)
2J	31	8
3K	33	23
3L	36	69

Survey data indicated that the proportion of total stock biomass occurring in the Regulatory Area was less than 10% in winter, less than 5% on average in spring and autumn. In recent years there has been a increasing trend in the portion of the biomass in the Regulatory Area.

Age compositions derived from spring and autumn surveys in Div. 3L indicated that for most years there was a higher proportion of younger cod in the Regulatory Area. Estimates for winter surveys showed that age compositions were similar in both areas. Cod age compositions from autumn research vessel surveys for Div. 2J+3KL combined were similar to those which occurred in Div. 3L inside the 200-mile fishing zone.

b) **Mesh Size in the Redfish Fishery**

The Russian mesh size study described in November 1993 (NAFO Sci. Coun. Rep., 1993) had not yet been carried out and there was therefore no information available for consideration by the Council.

c) **Establish minimum sizes for product corresponding to minimum landing sizes**

The Fisheries Commission requested (FC Doc. 93/18) the Scientific Council to investigate:

i) With reasonable levels of variance, are there specific numeric values that can be established for processed fish that would be the equivalent of the current minimum fish sizes (round length).

ii) Is there a reasonable consistent relationship between total body length and head and tail length that could be used by inspectors to establish if vessels are processing fish below current minimum fish sizes. If so, what would these lengths be for gutted, head-off/gutted, head-off, tail-off and split product forms for cod, redfish, American plaice, yellowtail, witch and Greenland halibut.

The Council finds that such information may be more easily obtained through direct contact with the fishing industry or possibly through the observer program, instead of through the fisheries laboratories, since such data are not usually collected by the fisheries research laboratories. The Council further discussed the possible use of the already established conversion factors.

It is noted that conversion factors relate the product weight to the live fresh weight of the fish, and live fresh weight can be related to the length of the fish through a length-weight relationship.

The Council observed that conversion factors have been established for statistical purposes. These factors vary between countries because of, among other things, different production technologies. These factors have been established for different species and different products, and world-wide compilations have been published by FAO (UN). These factors are average values applicable for raising the total production in a country to the corresponding live fresh weight. Within these average values, there are substantial variations with fish size, seasons, fishing grounds, technology and between individual batches. There are also some variation between years.

Also, an average length-weight relationship can usually be established with great precision for a specific species from a specific area in a season. Here too there is individual variance around the mean relationship.

Consequently, the Council observes that individual back calculated live lengths from a product are subject to considerable uncertainty, and the Council doubts that such relationships could be useful for inspection purposes. For example, even a very small head-off tail-off split product cod may be the result of a particular mal-adjusted machine.

If these data need to be obtained, it would require a comprehensive survey involving data for each factory vessel, for different seasons and for fish originating from different fishing grounds. Informal contacts with the industry suggests that such detailed data are considered sensitive information, important to the competitiveness of the enterprise and therefore not easily accessible. The Council does not consider that the compilation of this information will be cost effective in establishing a legal tool for the fishing inspectors.

d) **Minimum Landing Sizes for Greenland Halibut and Flatfishes**

The Fisheries Commission requested (FC Doc. 93/18) the Scientific Council to: *review appropriate minimum landing sizes for Greenland halibut and flatfishes.*

The Council noted it had advised on minimum landing sizes for American plaice (25-28 cm) and yellowtail flounder (25-28 cm) in 1992 (NAFO Sci. Coun. Rep., 1992, p. 71).

It was also noted that available data in laboratories have not yet been analyzed and presented to the Scientific Council. The Council agreed to defer its discussions on this subject to its September 1994 meeting.

7. Responses to Requests by Canada and Denmark (Greenland)

With respect to Greenland halibut in Subareas 0 and 1, subject to concurrence of Denmark (Greenland) as regards to Subarea 1, **Canada** requested the Scientific Council to: *provide an overall assessment of the total stock throughout its range and comment on its management.*

The Scientific Council is not able to provide an analytical assessment of the total stock but the available information indicates that the stock is overexploited, for further comments see the prognosis section for Greenland halibut in the STACFIS Report, Appendix I, Section 15, particularly point 1, 2, 3, 5 and 6.

The two following **recommendations** are relevant in this context:

- Separate TACs be maintained for different areas of the distribution of Greenland halibut.
- The effort and catches throughout Subareas 0-3 in 1995 should be reduced compared to recent years.

With respect to Greenland halibut in Subareas 0 and 1, **Denmark (on behalf of Greenland)** requested that the Scientific Council provide information on:

a) Analysis of the existing information on stock delimitation in Subareas 0, 1, 2 and 3.
b) Allocation of TACs to appropriate Subareas (within Subareas 0 and 1).
c) Allocation of the TAC for Subarea 1 into inshore and offshore areas.

Concerning a) the Council's response is given in the prognosis section for Greenland halibut in the STACFIS Report, Appendix I, Section 15, particularly points 1, 2, 7 and 8.

Concerning b) the Council noted STACFIS updated the available information which may be used in an allocation of the TAC between Subareas 0 and 1. This update confirmed the Council comments of 1993 (NAFO Sci. Coun. Rep., 1993, p. 104).

"Catch and effort information by month and Divisions were available but these were not necessarily indicative of the stock distribution."

"Based on survey information from Subarea 0 and 1 in 1987, 1988 and 1990 the offshore biomass was distributed approximately 50:50 between these two Subareas". The biomass results are presented below:

Biomass estimates (000' tons) from Greenland/Japanese surveys and USSR(RUS)/DDR(FRG) surveys for the years 1987-1993 in Subareas 0+1.

Year	USSR(RUS)/GDR(FRG) Survey 0B	1BCD	Japan/Greenland Survey 1ABCD[d]	1BCD	Total 0B+1ABCD
1987	37	56	58[a]	54[a]	95
1988	55	47	57	53	112
1989	79	-	-	63[c]	-
1990	72	88	56[b]	53[b]	128
1991	46	-	79	77	125
1992	38	-	64	62	102
1993	-	-	-	38	-

- no survey
[a] In 1987 the survey did not cover the depth stratum 1 000-1 500 m.
[b] Average values of two surveys.
[c] Estimate only for Div. 1CD.
[d] Div. 1A south of 70°N.

Concerning c) the Council stated in 1993 (NAFO Sci. Coun. Rep., 1993, p. 104):

"No estimate on the inshore biomass in Subarea 1 was available to STACFIS,..".

Also in 1994 no inshore biomass estimates were provided for this component. The Council is therefore unable to provide an answer. However, further information is given in the prognosis section for Greenland halibut in the STACFIS Report, Appendix I, Section 15, points 7, 8 and 10.

8. **Ageing Techniques**

The Council noted that in accordance with recent recommendations, information on the agreed manual on the methodology on silver hake ageing would be documented for the September 1994 Meeting. It was noted the additional work on the nucleotide method has been discontinued because it was unsuccessful for technical reasons.

The otolith exchange programmes for American plaice and Greenland halibut were continuing while there was no report on new validation studies.

9. **Gear Selectivity**

Investigations on reducing the discard of small shrimp and juvenile fish in the shrimp fishery have been ongoing since 1991 jointly by Denmark, Greenland, Iceland, Faroe Islands, Norway and Sweden. In 1993 a grid device was tested in a commercial shrimp trawl. So far, the device is not adoptable for the fishery due to loss of large shrimps. Additionally, selectivity parameters of a commercial shrimp trawl from Greenland were estimated based on alternate hauls with different cod-end mesh sizes.

The Council noted the ongoing work on prevention of catches of small redfish in the shrimp fisheries in Subarea 1 and noted that the results of this work may be also relevant for other shrimp fisheries.

10. **Relation Between Acoustic Biomass Estimates and Other Methods**

Although no studies were presented, the importance of studies of the relationship between acoustic biomass estimates and other methods for biomass estimation were recognized by the Council. However, the problem of comparability of results based on acoustic surveys and results based on surveys using trawl or longline, etc., has not been resolved yet. Therefore, the Council encourages that research be undertaken.

Concerning surveys combining estimates from trawl fishery and estimation from acoustic measurements, the Council endorsed STACFIS point of view and the **recommendation** that information be provided on bottom trawl and pelagic component, the verticle and horizontal distribution as determined from the trawl-acoustic surveys, and more details on the location or concentration of fish species in combined trawl acoustic surveys.

III. RESEARCH COORDINATION (see STACREC report, App. II)

1. **Fishery Statistics**

a) **Progress Report on Secretariat Activities in 1993/94**

The Council reiterated STACREC concerns on the delays in receipt of national STATLANT 21B reports for 1991 and 1992. These delays continue to affect assessments and cause delays in the publication of Statistical Bulletin.

The Council urged STACREC to pursue the acquisition of data available in reports and working papers of other Standing Committees, namely STACTIC and STACFAC. These data should be distributed to National Representatives and Designated Experts and evaluated annually as to their relevance in the assessment process.

The Council noted that recent volumes of the *NAFO Statistical Bulletins* had been published without data from an important component EU-France (M) and France (SP). The Council agreed with STACREC **recommendation** to publish but that efforts be made to obtain the EU-France data to complete the database and update the bulletins.

The Council was pleased on the progress made regarding the misallocation of catches of roundnose and roughhead grenadier. Documentation was tabled which allow a more accurate partitioning of grenadier catches of EU-Spain and EU-Portugal. It was agreed that these corrected data be confirmed by the Secretariat from the statistical officers of EU-Spain and EU-Portugal.

b) **Deadlines for the Submission of STATLANT 21A and 21B Data**

The Council noted there may have been some uncertainties regarding deadlines for submission of STATLANT data as a result of STACREC discussions and recommendations in 1993. The Council clarified that **Rule 4.4** remains in effect for the submission of STATLANT data, and the deadlines are 15 May and 30 June for STATLANT 21A and 21B, respectively.

c) **Preparation for CWP 16th Session**

The Council noted that the Assistant Executive Secretary had attended, at the invitation of the FAO, an FAO sponsored *ad hoc* consultation of CWP participating agencies in La Jolla, California. The role of CWP in relation to high seas fisheries statistics was discussed. The report of that meeting is available at the Secretariat.

The Council was pleased that the Assistant Executive Secretary had been invited by FAO to investigate discrepancies between the NAFO and FAO databases. It noted that discrepancies had been addressed and a process put in place to ensure the compatibility of the NAFO and FAO databases for the STATLANT 21 area.

The Council noted that an *ad hoc* consultation of CWP participating agencies was being held in place of the Sixteenth Session of CWP in July 1994. The agenda would include discussions on possible revisions to CWP statutes and rules of procedure. The Council noted that consultation with NAFO Contracting Parties indicated that a clear picture of the role of CWP was necessary before discussion were initiated on revision of statutes. The Council felt these issues would be best dealt with by the General Council, as any attending representative would have to have a clear mandate on policy making.

The Council noted that the Assistant Executive Secretary would not attend the July meeting but reconfirmed that attendees (STACREC Chairman, C.A.Bishop; Assistant Executive Secretary, T. Amaratunga, and the representative from Spain, E. de Cardenas) slated to attend the Sixteenth Session of CWP will be **recommended** to attend that meeting, now scheduled for February 1995 in Madrid, Spain.

2. **Biological Sampling**

The Council noted the Provisional List of Biological Sampling for 1992 was prepared by the Secretariat (SCS Doc. 94/8). Also available data from 1993 commercial fisheries for stock assessments were tabulated and the national representatives reported their sampling program for the 1993/94 commercial fisheries, at the STACREC meeting.

3. **Biological Surveys**

a) **Review of Stratification Scheme**

The Council noted that a document was presented (SCR Doc. 94/43) that outlined changes to the stratification used by Canada for stratified-random groundfish surveys in Subareas 2+3. The changes included major revisions to the existing strata by using new, more accurate charts in Div. 2J and 3K, and minor changes to existing strata in Div. 3O and 3P. In addition to these changes, the stratification scheme was extended to 800 fathoms in Div. 3L, 3M, 3N, 3O and 3P, and strata were created in the shoreward area of Placentia Bay.

b) **Coordination of Surveys**

The Council noted that EU-Spain indicated that a survey in Div. 3M, 3L, 3N and 3O in depths between 700 and 2 000 meters would be proposed to EU and Greenland and Japan planned to

conduct a survey for Greenland halibut in Subarea 1 during 1994 in depths from 400 to 1500 meters. The Council hoped these surveys can be coordinated with interested countries.

4. **Data Necessary for Assessments**

The Council was concerned over the lack of biological data from fisheries in the Regulatory Area by non-Contracting Parties, as these fisheries catch significant amounts of various species.

The Council agreed with STACREC that sampling of non-traditional species may become more important as traditional species decline.

5. **Other Matters**

The Council noted STACREC concerns over the lack of an updated document on worldwide conversion factors. It noted that FAO usually updated their compilations periodically, about every three years, but the compilation of the most recent document had been delayed. The Council endorsed the **recommendation** that the Secretariat request documentation detailing any revisions of conversion factors used in STATLANT Area 21.

The Council was informed of the extension of the Pilot Observer Program, and endorsed the STACREC **recommendation** that it be determined if data from this program can be made available in time for annual June assessment meeting of the Council.

The Council noted STACREC concern over the lack of adequate time to review non-assessment documents at this meeting, and hoped that changes to the scheduling and structure of the Scientific Council would alleviate this problem in the future.

IV. PUBLICATIONS (see STACPUB report, App. III)

1. **Review of Scientific Publications**

The Council was pleased to note Journal Vol. 15 containing an invitational paper on "Decapod Crustacean Larvae from Ungava Bay" was published in December 1993. Further it was noted that Journal Vol. 16 containing miscellaneous papers and Vol. 17, containing papers presented at the November 1990 Canada-USSR Meeting on Capelin were in the final stages of preparation and expected to be completed by mid-1994.

The Council also noted Studies No. 19, containing 8 miscellaneous papers was published in October 1993, and Studies No. 20, containing 7 miscellaneous papers was published in February 1994.

The Council was pleased that 8 papers dealing with Northern Cod presented in June 1993 were submitted to the Secretariat to be published in a single issue by the end of 1994.

The Council noted *NAFO Statistical Bulletin*, Vol 40 for 1990 was published in February 1994 without EU-France Metropolitan and France (St. Pierre and Miquelon) data and expressed its regrets that these data are still not available.

The Council was pleased that the *Index of Journal and Studies for 1980-93* had been published in February 1994.

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

a) **Publication Costs and Revenues**

The Council noted that there was no significant departures from previous years production and revenue costs. Further the Council was pleased that the ongoing review of the mailing list and a new billing procedure introduced by the Secretariat had resulted in a decrease in number of copies printed and mailed out.

b) **Print Pages at the Secretariat**

The Council was pleased with the substantial accomplishment in regard to avoiding double printing of documents. It is important that meeting participants are requested to submit finalized documents in advance of the meetings and also participants no longer have to be mailed copies of documents they have received at meetings.

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

The Council noted that initiatives were taken by STACPUB to promote invitational papers. It was also agreed that topics of broad interest should be considered for NAFO Special Sessions and the resulting publication as a possible means to enhance the promotion of the Journal.

4. **Editorial Matters**

The Council was pleased to note that a total of 448 papers had been nominated by STACPUB since 1980 and a total of 357 papers had been published in the Journal (166) and Studies (191). Of the 12 papers nominated at the June 1993 Meeting, 7 papers had been submitted, and in addition, of the 25 papers presented at the NAFO 1993 Special Session, 12 papers had been submitted.

5. **Papers for Possible Publication**

a) **Procedures for STACPUB Review**

The Council noted that concern had been raised regarding procedures of STACPUB review and nomination of papers, and STACPUB had a detailed discussion on this matter. The Council agreed that the introduction of a questionnaire on whether their paper should be considered for publication was useful. The Council further agreed that the role of STACPUB was to act as a preliminary review board with the opportunity to make suggestions for improvements, but that the sole responsibility for the quality of the paper lies with the author.

The Council noted a comment by STACPUB that some authors do not differentiate between Journal and Studies, and stressed that authors need to put more effort into evaluation of the content of the paper and the distinction between Journal and Studies.

b) **Review of Contributions to the 1994 Meetings**

The Council was encouraged by the progress made by STACPUB in the review of SCR documents in consideration of their nomination for publication, particularly the Council welcomed the new approach of providing comments to authors on how to improve their submissions.

The Council noted 13 papers were nominated to invite authors to submit revised papers.

V. RULES OF PROCEDURE

1. **Establishment of a Standing Committee on Environment**

In its considerations of the reorganization of the Scientific Council, it was noted that there has been an increasing awareness of the importance of the information considered by the Environmental Subcommittee of STACFIS, and the relevance of the information to the fisheries considered by the Council. The Council accordingly agreed a new Standing Committee was needed to replace the Environmental Subcommittee.

During the Council meeting on 8 June 1994, the title of "the Standing Committee on Fisheries and Environment", with the acronym STACFEN, as proposed by the Executive Committee was **adopted**.

At its meeting of 15 June 1994, the Council considered the proposed new Rules of Procedure prepared by the Chairman. Noting the Council had a quorum of 10 Contracting Parties (6 present and 4 proxy votes carried by the Executive Secretary), in accordance with Article X.2 of the Convention, the Council **adopted** the new Rules of Procedure for STACFEN by a unanimous vote. It was noted that this **new Rule 5.1d)** for STACFEN was contained in the slate of Rules of Procedure presented in SCS Doc. 94/17, Serial No. N2418 (see Annex 1).

2. **Restructuring Working Arrangements**

In its considerations of the reorganization of the Scientific Council, the Chairman in consultation with the Executive Committee proposed changes to the work arrangements of STACFIS and STACREC while no changes were envisaged to STACPUB. It was recognized that new Rules of Procedure were needed to address changes.

At its meeting of 15 June 1994, the Council considered the proposed new Rules of Procedure prepared by the Chairman. Having agreed to the text as presented in SCS Doc. 94/17, Serial No. 2418 (see Annex 1) for Rule 5.1, the Chairman called for a vote in accordance with Article X.2 of the Convention. The **new Rule 5.1** of the Rules of Procedure of the Scientific Council were **adopted** by a unanimous vote.

VI. COLLABORATION WITH OTHER ORGANIZATIONS

1. **Joint ICES/NAFO Working Group on Harp and Hooded Seals**

At the Council meeting on 17 June 1994, the Chairman announced that a request for scientific advice on harp and hooded seals had just been received from Denmark (on behalf of Faroe Islands and Greenland) (see Annex 2). Noting advice would have to be provided by the Council at the Annual Meeting of September 1995, the Scientific Council agreed a request would be forwarded to the ICES/NAFO Working Group on Harp and Hooded Seals to address this request. The Council proposed that this request should be addressed immediately prior to the 7-21 June 1995 Meeting of the Scientific Council. It is hoped the Working Group would schedule its meeting for 5-7 June 1995, in order that some scientists from the Council may attend the meeting.

2. **Sixteenth Session of CWP and Proposed *Ad Hoc* Consultation**

The Council noted the Sixteenth Session of the CWP had been postponed to early-1995 in Madrid, Spain, and reconfirmed that representatives of the Scientific Council **recommended** during the September 1993 Meeting viz. STACREC Chairman, C. A. Bishop (Canada), Assistant Executive Secretary, T. Amaratunga, and the representative from Spain, E. de Cardenas, would attend the Sixteenth Session.

The Council noted that an *ad hoc* consultation is now scheduled for July 1994 in Madrid, Spain. The agenda of this consultation proposes a discussion of restructuring the CWP, including discussions of statutes and rules of procedure for CWP. The current structure of informal consultations among the international agencies conducted under CWP has worked well and the Council is concerned that a more formal structure could hamper the statistical activities of NAFO. It may therefore be desirable that the views of NAFO are presented at the ad-hoc meeting in Madrid in July 1994. In this light the Council advised the Executive Secretary to discuss this matter with the President with regards to the position of NAFO and possible participation.

VII. ARRANGEMENTS FOR SPECIAL SESSIONS

1. **Special Session of September 1994**

The Council accepted the revised plans proposed by the co-conveners, and the discussions reported by the Environmental Subcommittee. The Council confirmed that the Symposium on "Impact of Anomalous Oceanographic Conditions at the Beginning of the 1990s in the Northwest Atlantic on the Distribution and Behaviour of Marine Life" will be on 15 and 16 September 1994 (not 14-16 September as initially proposed), at NAFO Headquarters, Dartmouth, Nova Scotia. It was noted the papers would include a 10-year review of environmental conditions.

2. **Special Session of September 1995**

The Council was pleased that the first announcement, as reviewed by the Council, will be circulated shortly. Noting special interests expressed by the Contracting Parties Canada and Denmark (Greenland), the Council was hopeful this joint NAFO/ICES Symposium on "The Role of Marine Mammals in the Ecosystem" will attract significant interest and diverse contributions.

3. **Special Session of September 1996**

The Council decided that a symposium should be held in September 1996, and agreed on the working title "What Future for Capture Fisheries in the Northwest Atlantic". The tentative dates and place are 4-6 September 1996, Dartmouth, Nova Scotia, Canada. The Chairman of the Council undertook to form a Steering Committee to prepare for this Symposium, which is likely to be of significant international interest, and report on the progress at the September 1994 meeting.

The objectives of this symposium were stated as:

- Assess the future of Capture fisheries in the Northwest Atlantic on the 25-50 year scale (first half of the 21st century)
- Discuss appropriate management strategies in the same time scale to maintain viable fisheries
- Encourage dialogue between managers (e.g. NAFO Fisheries Commission) and scientists (e.g. NAFO Scientific Council)

It was agreed that the specification of the objectives would be critical to the success of such a symposium. It was recognized that two different approaches could be taken: either aim at a general worldwide rather philosophical discussion or a more area specific discussion.

VIII. FUTURE SCIENTIFIC COUNCIL MEETINGS

1. **Annual Meeting and Special Session in September 1994**

The Scientific Council would next meet at the Annual Meeting of NAFO during 19-23 September 1994 at the Holiday Inn, Dartmouth, Nova Scotia, Canada. At this meeting the Council will address the assessment of shrimp on the Flemish Cap. At this meeting it will also discuss the shrimp fishing activities in Div. 3LN by the Faroese, re-evaluate the capelin stock in Div. 3NO if Russian survey results are available. The Council will also review the computer hardware and software needs for the June assessment meetings.

This meeting would be preceded by the symposium on "Impact of Anomalous Oceanographic Conditions at the Beginning of the 1990s in the Northwest Atlantic on the Distribution and Behaviour of Marine Life", during 15-16 September 1994 (revised from the original 14-16 September) at NAFO Headquarters, Dartmouth, Nova Scotia, Canada.

2. **Special Meeting on Shrimp Assessment in November 1994**

The Council proposed a special meeting to conduct assessments of shrimp in Subareas 0+1 and in Denmark Strait be held at NAFO Headquarters, Dartmouth, Nova Scotia during 17-20 November 1994.

3. **Scientific Council Meeting in June 1995**

The Council agreed this meeting be scheduled for 7-21 June 1995.

4. **Annual Meeting and Special Session in September 1995**

The Council noted it would meet during the Annual Meeting scheduled for 11-15 September 1995. This would be preceded by the Joint NAFO/ICES symposium on "The Role of Marine Mammals in the Ecosystem" during 6-8 September 1995.

IX. NOMINATION AND ELECTION OF OFFICERS

The Chairman's proposal (8 June 1994) to appoint a Nomination Committee composed of D. B. Atkinson (Canada) and A. Vazquez (EU-Spain) was accepted by the Council. On 22 June the Chairman requested the Nominating Committee to present its proposal for the Chairmanship of STACFIS. The Committee reported that after consultations with representatives it was ready to nominate W. B. Brodie (Canada). There being no further nominations, and noting that the appointment is for a two-year term beginning at the end of the September 1994 Annual Meeting, the Chairman called for an election and W. B. Brodie was elected by unanimous consent.

In connection with the establishment of STACFEN, M. Stein (EU-Germany) had been elected on 15 June 1994. The Chairman noted he takes office on the 1st January 1995 for a two-year term ending at the closure of the September 1996 Annual Meeting.

X. OTHER MATTERS

1. Space Requirements for June Meetings

This 8-22 June 1994 Meeting of the Scientific Council was held at Keddy's Dartmouth Inn. The Council considered the space and facilities available were a major improvement compared to those available at NAFO Headquarters. The computer room and extra rooms available for small *ad hoc* meetings were constantly occupied. This permitted the Chairmen to have a better overview of the progress of the work and the scientists better opportunities for individual work and small informal discussions. The Council concluded that the space provided was adequate and necessary for its June meeting. The Council therefore conveys to the General Council that space and facilities of this nature should be considered for future June meetings.

2. Hardware and Software Required for the June Meeting

The hardware made available for the scientists for the June meeting this year included three IBM compatible PCs and one matrix printer. Two of the PCs were equipped with 5.25" diskette units only while all portable PCs brought by many participants only used 3.5" diskettes. The usefulness of these two PCs was therefore limited. The matrix printer was rather slow, and the Council agreed that if it would be possible to make laser printers available, it would speed up the work of the scientists and it would avoid unnecessary disturbances of the work of the Secretariat staff. The software available on the PCs was also limited and many print jobs were made by hooking the portable PC directly to the matrix printer. A modem link via the telephone was established and worked well. The Council felt it could best accomplish its work if 1-2 PCs with some software (WP 5.1 and Spreadsheets programs - as used by most of the assessment scientists) and laser printers could be made available for the June 1995 Meeting. The Council agreed it would further discuss its needs during its meeting in September 1994.

3. By-catch of Redfish in Shrimp Fisheries

The Council expressed its concern of the likely negative impact on future recruitment to the redfish fisheries from the discards of small redfish in trawl fisheries for shrimp in Subarea 1 and in Div. 3M. In Subarea 1 a dramatic decline of adult redfish ($\geq$ = 16 cm) to an extremely low level has been observed. The Council therefore stressed that this mortality component be included in the assessment of the redfish stocks. This requires that estimates of the magnitude of these by-catches and biological sampling data be made available.

It is important that information on by-catches be provided on numbers and sizes of the redfish as well as weight of the by-catch, whether or not sorting mechanisms are employed, because of the size selectivity of these devices.

With respect to the shrimp fishery in Div. 3M, information on by-catches in the shrimp fishery only up to July 1993 was available. The Council stressed that all information for 1993 be made available when the shrimp resources in this Division will be assessed in September 1994. It was also stressed that the annual information should be made available in advance of the June meeting, when the status of Div. 3M redfish is assessed, because of the relevance of this information to the assessment.

4. Documentation of the Work of the Scientific Council

With respect to the reorganization of the work of the Scientific Council, the Council reviewed the documentation of its work and its publications. The Council decided to change the documentation of the assessments. It was agreed the assessments results, after they are adopted by STACFIS, will be printed as an SCS document. The STACFIS report will be reduced to report on internal matters of the Committee and printed as an SCS document. Similarly the STACREC, STACFEN and STACPUB reports will be compiled independently as SCS documents. The Scientific Council report will now additionally deal with those matters which are responses to requests from the Fisheries Commission or Contracting Parties, and a compilation similar to the present Scientific Council Reports will be issued as SCS documents for each meeting. The

Executive Summary will be discontinued. Details on all proposed documentation is given in Annex 3.

It was suggested that the assessment documents which are now issued as SCR documents should be issued as SCS documents, and should be reviewed by STACFIS. The Council agreed that further discussion on the arrangement of this work during the September 1994 Meeting should finalize the disposition of future Scientific Council documents.

XI. ADOPTION OF REPORTS

1. **Standing Committee Reports**

At its concluding Session on 22 June 1994, the Council reviewed and **adopted** the Reports of the Standing Committees, STACFIS, STACREC and STACPUB.

2. **Scientific Council Report, June 1994**

At the concluding Session on 22 June 1994, the Council reviewed and **adopted** the Report of the 8-22 June 1994 Meeting of the Scientific Council.

XII. ADJOURNMENT

There being no other business, the Chairman extended special thanks to the Executive Secretary, the Assistant Executive Secretary and the staff of the Secretariat for exceptional efficiency and support. He thanked all participants for their contributions and the Chairmen of the Standing Committees and Subcommittee for conducting an efficient meeting. He adjourned the meeting wishing everybody a safe trip home and looking forward to seeing the participants again in September at the Annual Meeting.

ANNEX 1

SCIENTIFIC COUNCIL MEETING - JUNE 1994

Changes to Rules of Procedure for the Scientific Council

by

H. Lassen
Chairman of Scientific Council

The Council considered the need to change its Rules of Procedures and based on some proposals from representatives, the Chairman in consultation with the Executive Committee drafted the proposed wording for Rule 5.1 a), 5.1 b), 5.1 c) and a new Rule 5.1 d) for a new Standing Committee. After further review, the Council by unanimous vote, adopted the Rules as presented below in accordance with Article X.2 of the Convention. Rule 5.1 c) shall remain unchanged.

The new **Rule 5.1** shall now read as follows:

5.1 There shall be the following standing committees:

a) The **Standing Committee on Fisheries Science (STACFIS)** which shall:

i) assess the status of fish stocks upon the request of the Scientific Council;
ii) assess the effects on fish stocks of fishing strategies and management upon the request of the Scientific Council; and
iii) evaluate new methods for fish stock assessment.

b) The **Standing Committee on Research Coordination (STACREC)** which shall:

i) develop and recommend to the Scientific Council policies and procedures for the collection, compilation, and dissemination of statistical and sampling information on the living resources and fisheries in the Convention Area;
ii) coordinate the compilation and maintenance of statistics and records and their dissemination, including liaison with coastal states in the Convention Area;
iii) coordinate the planning and execution of international cooperative research in co-operation with coastal states in the Convention Area;
iv) encourage and promote cooperation among the Contracting Parties in scientific research designed to fill gaps in knowledge pertaining to fisheries matters identified by the Scientific Council; and
v) review and evaluate data and information and advise the Scientific Council on advances in knowledge of biology relevant to the Convention Area;

c) The **Standing Committee on Publications (STACPUB)** which shall:

i) develop, coordinate and keep under review the publication and editorial policy and procedures of the Scientific Council and make recommendations thereto on these matters; and
ii) be chaired by the Vice-Chairman, and consist of five other members appointed by the Scientific Council.

d) The **Standing Committee on Fisheries and Environment (STACFEN)** which shall:

i) develop and recommend to the Scientific Council policies and procedures for the collection, compilation and dissemination of environmental information from oceanographic investigations;
ii) provide reviews of environmental conditions and advise the Scientific Council on the effects of the environment on fish stocks and fisheries in the Convention Area; and
iii) encourage and promote cooperation among Contracting Parties in scientific research designed to fill the gaps in knowledge pertaining to the effects of the environment on fish stocks and fisheries as identified by the Scientific Council.

ANNEX 2

SCIENTIFIC ADVICE ON SEALS

1. The following request for advice was received on 17 June 1994. This is presented to the Scientific Council with a view to developing terms of reference for a proposed meeting of the ICES/NAFO Working Group.

"Denmark (on behalf of Faroe Islands and Greenland) request advice from the NAFO Scientific Council (eventually via the Joint ICES/NAFO Working Group on Harp and Hooded Seals) on the following issues:

Harp and hood seals

- assessment of stock sizes, distribution and pup production of harp and hooded seals in the Northwest Atlantic;
- assessment of sustainable yields at present stock sizes and in the long term under varying options of age composition in the catch;
- advise on catch options in the NAFO area;
- assessment of effects of recent environmental changes or changes in the food supply and possible interaction with other living marine resources in the area."

Einar Lemche
Namminersornerullutik Oqartussat
Gronlands Hjemmestyre
Copenhagen, Denmark"

ANNEX 3

PROPOSED PUBLICATIONS RELATED TO THE DOCUMENTATION TO THE SCIENTIFIC COUNCIL STARTING AS OF 1 JANUARY 1995

With regards to the reorganization of the work of the Scientific Council, the following are the publications and the proposed disposition of the documentation related to the Scientific Council, starting as of 1 January 1995.

1. ***Journal of Northwest Atlantic Fishery Science*** (unchanged, peer reviewed)

   Scientific contributions from individual scientists. Aimed at the general scientific community.

2. **NAFO Scientific Council Studies** (unchanged, limited review)

   Scientific contributions from individual scientists. Aimed at the general scientific community, and more specifically at the fishery scientists working in the Northwest Atlantic.

3. **SCR Document** (no review)

   Scientific contributions from individual scientists including Preliminary Assessments by Designated Experts.

   Documentation relevant to the topics discussed at the Scientific Council meetings and preliminary data and analyses may be considered later in a more complete form for publication in Studies or in the Journal.

4. **SCS Document** (no review)

   a) Statistical updates
   b) National research reports
   c) External committee reports (e.g. CWP, harp and hooded seals)
   d) STACFIS accepted assessments
   e) Internal Reports of the Standing Committees (STACFIS, STACREC, STACFEN and STACPUB)
   f) Scientific Council Reports (*each meeting*)
   g) Other summary documents (survey plans, ...)

The papers documenting the STACFIS accepted assessment will be issued as SCS Documents and be made available from the Secretariat upon request.

5. **Statistical Bulletin** (edited by the Assistant Executive Secretary) (unchanged)

Fisheries statistics

6. **Scientific Council Reports** (issued annually) (will contain all Scientific Council Meeting Reports of each year. These will be issued with the usual red cover).

a) Requests for advice
b) Scientific Council Reports
- Records of Scientific Council meetings including lists of SCR and SCS Documents presented, Agenda and list of participants
- Annual overview of the fisheries in the Convention Area
- Annual overview of the environmental conditions in the Convention Area
- Assessment of fish stocks as requested by the Fisheries Commission and by Contracting Parties
- Response to other requests from the Fisheries Commission and Contracting Parties
- Other recommendations

This report is primarily aimed for the Fisheries Commission and Contracting Parties.

The format of the assessments as presented in the Scientific Reports should include:

- Reference to SCS Documents where the accepted assessment can be found
- Reference to SCR Documents drawn upon for the assessment
- Description of the fishery
- Prognosis and management recommendation
- Summary sheet
- Basic graphs:
  i) Catch and TAC *vs* year
  ii) Abundance indices for analytical assessments
  iii) Recruitment and SSB *vs* year
  iv) Fishing mortality *vs* year
  v) Yield and SSB *vs* rel F for the year of projection
  vi) Any other graph deemed essential for understanding the management advice

The accepted STACFIS assessment documents (SCS Doc. mentioned in 4.f above) of a given meeting will be compiled in a single set, with a red cover identifying the set of documents as being the accepted assessments. This package will be issued to participants of the Annual Meeting, and to governments according to an appropriate mail list.

7. **Executive Summary**

Discontinued

8. **Working Papers**

Any information which should be disseminated to Scientific Council and its Committees during session, but which is not relevant for use after the meeting is concluded.

9. **Dumm Documents**

Brightens the life of Scientific Council and Committee members.

APPENDIX I. REPORT OF STANDING COMMITTEE ON FISHERY SCIENCE (STACFIS)

Chairman: H. P. Cornus Rapporteur: Various

The Committee met at the Keddy's Dartmouth Inn, Dartmouth, Nova Scotia, Canada during 8-22 June 1994, 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 from Canada, Cuba, Denmark (in respect of the Faroe Islands and Greenland), European Union (Denmark, France, Germany, Portugal, Spain), Japan and Russian Federation were in attendance, as well as an observer from United States of America.

Various scientists assisted in the preparation of the reports considered by the Committee. The report of the Subcommittee on Environmental Research (M. Stein, Chairman) is summarized in Section III and detailed in Annex 1 below.

I. GENERAL REVIEW

1. **Opening**

The Chairman welcomed the various national representatives to the Keddy's Dartmouth Inn in Dartmouth. The provisional agenda was modified to reduce the workload of STACFIS and in light of the proposed changes in the Rules of Procedure, it was agreed that agenda item 9 would be moved for consideration under STACREC.

2. **Available Assessment Data**

During the first day of the meeting, all available information on catch data for the various stocks were reviewed in order to provide best estimates of catches for the assessments. This procedure proved to be as successful as it was in the previous year. STACFIS agreed to the Chairman's proposal that it would be a valuable investment of time to devote the first two days of the meeting for discussions among the representatives on the available assessment data and the preparation of preliminary assessments before the full Committee discussed them.

Nevertheless, recognizing that for most of the stocks basic catch data were insufficient or recent information was not available, assessments were carried out as was done in previous years. STACFIS recognized because of this the quality of the assessments was not as good as desired.

STACFIS reiterated its **recommendation** that *the Scientific Council bring the problem of availability of assessment related data to the attention of the Fisheries Commission* (NAFO Sci. Coun. Rep., 1992, p. 78).

3. **General Trends for the Northwest Atlantic**

Noting the STACREC observation that there was a large number of countries that had not submitted STATLANT 21A data for 1993, and that it was not possible to prepare a meaningful tabulation to observe trends, STACFIS agreed this study would not be undertaken during this meeting. STACFIS expressed its serious concerns that the basic data (STATLANT 21A) needed for assessments have not been presented by Contracting Parties.

II. REVIEW OF RECOMMENDATIONS FROM 1993 MEETINGS

An improvement was reported on the early provision of assessment-related data to the Designated Experts compared to 1993. However, it was not considered to be sufficient to meet the requirements of Designated Experts. Therefore, STACFIS emphasized the importance of availability of data and again **recommended** that *for the future, national representatives, at the same time as endeavouring to make all necessary data relevant to the assessments available to Designated Experts by May 15 (NAFO Sci. Coun. Rep., 1991, p. 44), should also attempt to provide as much catch/effort data (including preliminary data) as are available.*

STACFIS noted the presentation of estimates derived from surveys (e.g. abundance, biomass) accompanied by associated variances had improved but there were still deficiencies. STACFIS reiterated the **recommendation** that *in future, numbers (e.g. abundance/biomass) derived from research surveys be accompanied by estimates of variance*

associated with these. In addition, information on vessels conducting the surveys, timing of the surveys and the fishing gear used including information as how they may have changed over time should be provided.

Further to the Scientific Council recommendation in June, 1993 that SCR Documents should be announced 15 days before Scientific Council meetings, about 40 papers were announced and of those 11 were submitted before this meeting. STACFIS noted the value of the early submission of papers, and this encouraged the Committee to extend the requirements stated in June 1993 (NAFO Sci. Coun. Rep., 1993, p. 43) and **recommended** that *Scientific Council Research Documents (SCR Doc.), excluding assessment papers, and Scientific Council Summary Documents (SCS Doc.) particularly the National Research Reports, in future be submitted to the Secretariat 15 days before the beginning of the Scientific Council Meeting.*

III. ENVIRONMENTAL RESEARCH

STACFIS received the report of the Subcommittee on Environmental Research, welcoming the opportunity to review environmental conditions before undertaking stock assessments. The following is a summary; the detailed report of the Subcommittee is given in Annex 1.

1. Introduction

The thirteenth meeting of the Subcommittee on Environmental Research was held on 9 June 1994 with M. Stein (EU-Germany) as Chairman. The meeting began with an invited lecture by Dr. Sally Goddard from Memorial University, Newfoundland. She presented results from ongoing research on Antifreeze Protein Production in Cod and described their potential to survive in the extremely cold bottom waters of the Newfoundland Shelf.

The forthcoming NAFO Special Session on "Impact of Anomalous Oceanographic Conditions at the Beginning of the 1990s in the Northwest Atlantic on the Distribution and Behaviour of Marine Life" will be scheduled for 15-16 September 1994, at NAFO Headquarters, Dartmouth, Nova Scotia. A total of 12 papers had been announced by 15 June 1994.

2. Review of Environmental Studies

Sixteen documents dealing with environmental issues were reviewed.

Extremely cold air temperatures (monthly mean anomalies of up to -8°K)[1] were observed in winter off West Greenland while above normal air temperatures persisted in September and October. This might have affected the upper ocean thermal conditions off West Greenland which indicated for autumn 1993 positive anomalies in the top 200 m.

Extremely cold air temperatures were again observed over southern Labrador and Newfoundland especially in winter, due in part to an intensification of the atmospheric circulation pattern. One index of the latter was the North Atlantic Oscillation (NAO) anomaly, which was strongly positive.

Similar to 1992, ice formed early, spread more rapidly, was of greater concentration and lasted longer than normal off southern Labrador, Newfoundland and in the Gulf of St. Lawrence.

Sea temperatures in Div. 2J+3KL showed colder-than-normal upper layer temperatures in 1993 except near the coast where they were above normal. In the waters below 75 m, temperature anomalies continued to be between -1° and -2°K. Similar to the years 1991, 1992, large areas of the continental shelf had below normal bottom temperatures. The cold intermediate layer (CIL) over the northeast Newfoundland shelf and off Cape Bonavista was more extensive than normal in the autumn of 1993. The area of CIL waters increased over 1992 off Cape Bonavista but decreased along the Seal Island (Hamilton Bank) section.

Environmental conditions in the Newfoundland area during the spring of 1994 indicated that cold air temperatures persisted through the early months of 1994 resulting in more extensive ice cover than normal over the Newfoundland Shelf.

[1] Temperature units in Kelvin.

Studies on otolith ring structures of cod from Flemish Cap indicated a relationship to environmental changes in the area. Feeding and prespawning aggregations of silver hake on the Scotian Shelf were closely linked to warm offshore waters.

Deep water temperatures on the Scotian Shelf (Emerald Basin) and in the Laurentian Channel at Cabot Strait were above normal and increased over the 1992 temperatures.

Cold waters were observed in the 50-100 m depth range over the Scotian Shelf with several regions reaching anomalies equivalent to those recorded in the 1960s. The decline in temperature had begun in the mid- to late-1980s. In contrast, slope waters off the Scotian Shelf appeared to be warm in the upper 200-300 m.

Monthly monitoring of surface and bottom temperatures in the Middle Atlantic Bight and in the Gulf of Maine showed generally cooler-than-normal conditions.

IV. STOCK ASSESSMENTS

1. Review of Assessment Methods Used

There was a proposal to present during the June 1995 Meeting, the Extended Survivor Analysis (XSA) Method which is used in ICES stock assessments. The Committee, however, argued that in the near future it would be confronted with the fact that there will be very little commercial fishery data since there have been closures of fisheries for most Grand Bank fish stocks. The Committee considered instead to encourage reviews and investigations on the problems of comparability and usefulness of survey results. Some discussion on this subject considered the possibility of a special session, however, no special session was proposed for the present.

2. Cod in Divisions 2J, 3K and 3L (SCR Doc. 94/12, 40; SCS Doc. 94/13)

a) Introduction

i) Description of fishery

Nominal catches for this stock increased during the late-1950s and early-1960s and peaked at just over 800 000 tons in 1968 (Fig. 2.1 and 2.2). Catches rapidly declined thereafter and were at a low of 139 000 tons in 1978. From 1980 to 1992 catches ranged from 219 000 to 270 000 tons, but declined to 150 000 tons in 1991 and further to 44 000 tons in 1992 reflecting management actions. In the same period Canadian catches peaked at 242 000 tons in 1988 but subsequently declined to 29 000 tons in 1992.

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Fixed Gear Catch	98	80	72	79	101	103	113	60[1]	12[1]	9[1]	
Offshore Catch	135	151	179	156	168	151	106	90[1,4]	32[1,2]	2[1]	
Total Catch	232	231	252	235	269	253	219	150[1]	44[1]	11[1]	
TAC	266	266	266	256	266	235	199	190	120[3]	[3]	[3]

[1] Provisional.
[2] Fishery closed by EU in June 1992.
[3] Moratorium on Canadian fishing became effective in July, 1992.
[4] Canadian surveillance estimate 111 tons.

The commercial fishery on this stock was closed in mid-1992. At the end of 1993 the recreational fishery was closed. It was estimated that during 1993 this fishery took about 9 000 tons of cod. Most of this catch was taken by handline in Div. 3L, and mainly during the September-October period. Canadian Surveillance has estimated that about 2 500 tons of cod were caught by non-Canadian fleets operating in the NAFO Regulatory Area on or east of the Nose of the Grand Bank in Div. 3L.

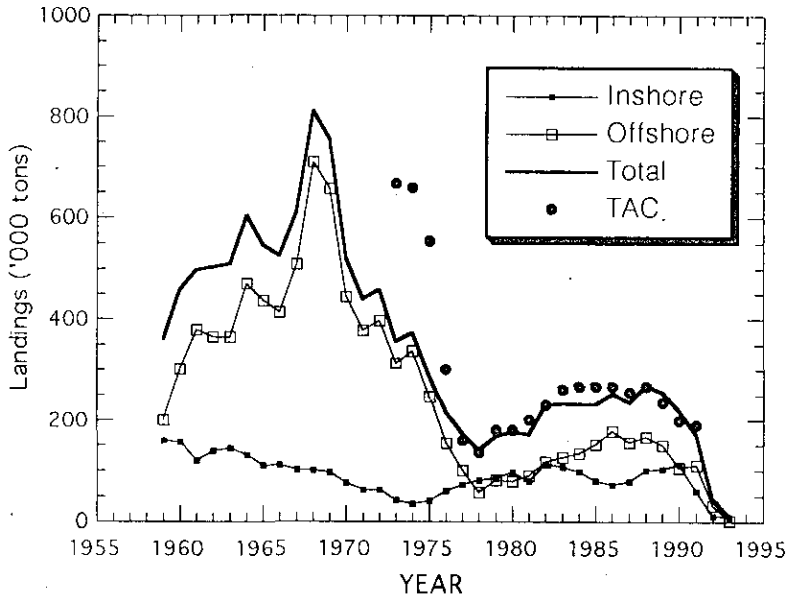

Fig. 2.1. Cod in Div. 2J+3KL: inshore and offshore landings and TACs.

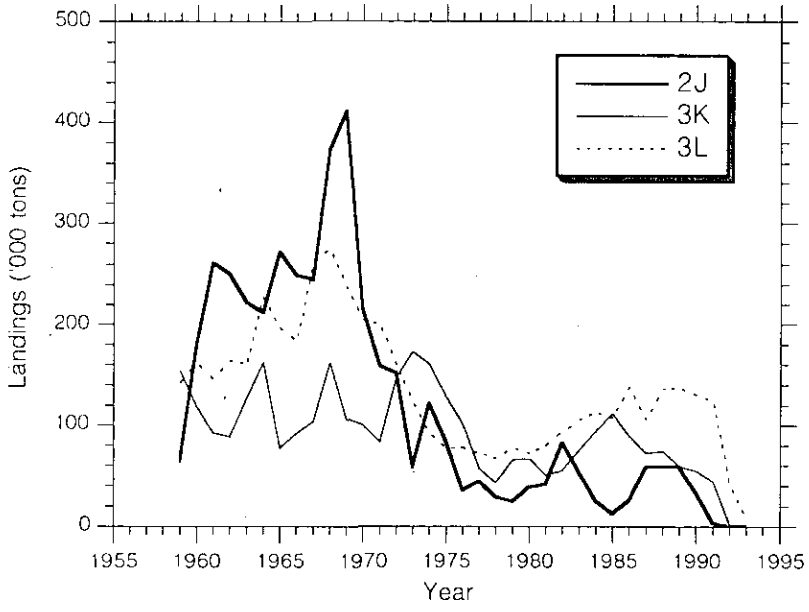

Fig. 2.2. Cod in Div. 2J+3KL: landings by Division.

ii) **Environmental conditions**

Detailed information on environmental conditions in the area is contained in the report of the Environmental Subcommittee (Annex 1). Following the 1960s period of relatively warm oceanic conditions over the shelves of Newfoundland and Labrador, there has been a series of three cold episodes, 1972-73, 1984-85, and 1989 to the present. Temperatures recorded at Station 27 during the 1990s have been anomalously low when compared with the mean for years since 1946. It is not yet possible to evaluate the impacts of these environmental trends on the cod stock.

b) **Input Data**

i) **Commercial fishery data**

Catch- and weight-at-age. The total catch was only approximated in 1993 and therefore catch-at-age could only be roughly estimated. Sampling was available to adequately estimate age and length compositions of the catch from the recreational fishery. A limited amount of data was provided for the non-Canadian 'by-catch' fishery in the Regulatory area. Catch-at-age for the latter was estimated by applying the Canadian Spring Div. 3L research vessel (RV) age-length key. Average weights-at-age increased from the early-1970s to the early-1980s and subsequently declined. The 1992 average weights-at-age for ages 4-7 were the lowest since those of the 1960s and 1970s.

Catch and effort. Prior to the 1993 assessment of this stock, commercial otter trawl catch and effort data were used in the calibration of SPA. The resulting analyses had indicated that the patterns, or year effects, in the residuals were persistent and sufficient to preclude their use as an abundance index. In any case, this information was not available for 1993 as there had been no directed fishery. Adequate catch and effort data from inshore fixed gear fisheries are not available from Canadian Department of Fisheries and Oceans statistics.

ii) **Research survey data**

Canadian trawl surveys. Research vessel surveys have been conducted by Canada during autumn in Div. 2J, 3K,and 3L since 1977, 1978, and 1981, respectively. Since their inception, the surveys in Div. 2J and 3K have experienced difficulties in specific areas with respect to the accuracy of nautical charts and the recorded depths. These charts had formed the basis for stratification charts. The availability of accurate charts in the late-1980s resolved some of these problems but necessitated some adjustment to the original stratification scheme, particularly in Div. 2J. The revised stratification schemes were first used during the 1993 autumn surveys. Some difficulties were encountered in comparisons with previous strata although the total area covered was only slightly different than that of the original stratified area. Estimates of abundance and biomass from autumn surveys have declined sharply in recent years with the 1993 value being extremely low (Fig. 2.3). Similarly the 1993 spring survey conducted in Div. 3L indicated that biomass and abundance in this Division are by far the lowest in the time series.

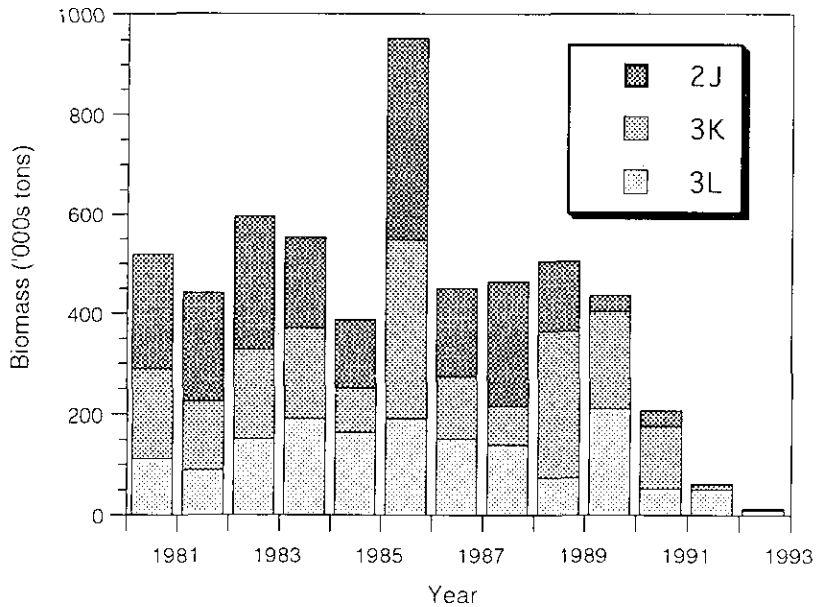

Fig. 2.3. Cod in Div. 2J+3KL: research vessel biomass.

The survey catches-at-age in 1993 were mainly from ages 3 and 4 although, as indicated, total abundance was very low. No cod were caught at ages older than 9 years.

Average weights at age from the 1993 surveys, although represented by small samples, were not substantially different from those observed in the 1992 survey. Recent average weights for all Divisions were substantially lower than those observed in the early- to mid-1980s.

The distribution of cod catches during the autumn surveys from 1981 to 1988 indicated a fairly typical pattern. Catches were spread over the entire survey area and most large catches were in shallower water. Commencing in 1989 fewer cod were found near the coast, particularly in Div. 2J. During 1990 and 1991 most cod were found on the seaward slopes of the offshore Banks and in 1992 and 1993 there were virtually none in Div. 2J and 3K and low abundance in Div. 3L. The only cod located during 1992 and 1993 were in the northern part of Div. 3L bordering with Div. 3K.

Abundance in Div. 2J and 3K generally increased at depths greater than 400 m since 1987 despite the fact that total survey abundance was constant or declining.

Autumn research vessel survey data were used to examine the age distribution of cod in Div. 2J and 3K. The age structure of the Div. 2J cod population collapsed from a wide age distribution (20+) in 1982 to a narrow (up to age 7) age range in 1992. This represented a loss of the majority of the mature fish. The average, modal and median ages of the Div. 2J and 3KL cod stock have ranged between about ages 5 and 6 over the last decade or so but has recently (1990s) decreased to about age 4 with a corresponding decrease in the width of the age distribution (maximum age 8 in 1992). This parallels a decrease in the total numbers of fish estimated for the stock.

Winter hydroacoustic surveys. Winter hydroacoustic surveys conducted since 1987 found large concentrations of cod in southern Div. 2J and northern Div. 3K at depths ranging from 300 to 500 m from 1987 to 1989 with concentrations occurring further south each year. In the 1990 survey, commercial concentrations of cod were found still further south in Div. 3K and mainly at 550 m, about 150 m deeper than in previous years. Survey data from 1991-93 indicated substantial declines in cod densities, particularly in 1993. Significant concentrations were encountered outside the main survey area at depths approximating 930 m on the Nose of the Bank. There was no comparable survey in 1994.

Spring hydroacoustic studies. Studies have been conducted during the 1990-93 period on the distribution and movements of cod in Div. 3K and 3L when they are concentrated in this area for spawning and prior to their migration to inshore areas.

From 1990-92, cod were highly aggregated in the basin south of Funk Island Bank (termed the "Bonavista migration channel"). Aggregation did not occur in this area. The distributions observed suggest that cod had moved along the slope further to the southeast in the winter of 1992/93. The aggregation located in the latter area was only 20-25 miles from an area of concentration located during the winter 1993 acoustic survey.

Cod were concentrated at similar temperatures and salinities in all years. Cod were also aggregated along the northern edge of the Grand Bank in 1991, 1992 and 1993 (no sampling was conducted there in 1990). Fish were located at depths of less than 400 m in 1990 and 1991. In 1992 fish were located up to and likely deeper than average acoustical enumeration limits (ca. 600 m). In 1993 fish were located at depths between 350 and 500 m.

The densities within the aggregations remained relatively stable in the 4 years studied. However, the volume of the aggregations declined sharply from 1990 to 1991, less so from 1991 to 1992, then sharply again from 1992 to 1993. The overall estimates of abundance declined dramatically from 1990 to 1991, then slightly from 1991 to 1992. Abundance estimates in 1993 were less than half those measured in 1992.

iii) **Other biological studies**

Food and feeding. Capelin was the major prey of cod in the offshore area of Div. 2J and 3K during the autumn of most years in the period 1978-89. During the recent decline in cod abundance and reduction in cod distribution, there was also a severe decline between 1989 and 1990 in capelin biomass as estimated from offshore Canadian and Russian acoustic surveys. Nevertheless, many cod had a relatively high content of capelin in their stomachs in 1990-92, in part because capelin changed their distribution and occupied the general area where the remaining cod were concentrated. A preliminary analysis of the average quantity of food in cod stomachs by Division (2J, 3K, 3L) revealed a decline only in Div. 2J (on Hamilton Bank in 1990 and in the whole Division in 1991 and 1992).

Condition factors. Information was available relative to condition factors (gutted weight/length^3) for cod in Div. 2J and 3KL. In both Div. 2J and 3K a declining trend was observed from 1990 to 1992 for all ages although it was less pronounced in Div. 3K. Estimates for 1993 were higher than 1992 in Div. 2J for all ages while those for Div. 3K were similar for 1992 and 1993. No trend was observed in 3L although there was a decline at most ages from 1992 to 1993. The impact of factors such as changes in growth rate over time, migrations between Divisions and aliasing of the condition factors with respect to normal seasonal cycles in cod physiology on the interpretation of the results has not been determined.

c) **Estimation of Parameters**

A formulation of the Adaptive Framework (ADAPT) using Canadian research vessel data was used to estimate stock size. The model formulation was the same as that used previously. A flat topped partial recruitment pattern was assumed as input along with full recruitment as an unweighted average over ages 7 to 9. The patterns of residuals that were produced showed strong year effects reflecting the large interannual variation in the RV index. Residuals for 1993 were all strongly negative while those for 1989 to 1992 were all positive. It was considered that the results from ADAPT and did not adequately represent stock abundance. Consequently, it was not possible to provide an estimate of the size of the current stock biomass.

d) **Assessment Results**

Fishing mortality and stock abundance. Research vessel survey results imply that stock abundance has declined to less than 1/10 of that in the mid-1980s and that the decline persisted from 1992 to 1993 in spite of a moratorium on commercial fishing. It also suggests that the size of the 1986 and 1987 year-classes, which were originally considered to be above average are now well below average, particularly that of 1987. As well, the size of year-classes since that time (1988-90) are also well below average.

Although stock size and fishing mortality could not be estimated, analyses incorporating the extremely low RV abundance estimate for 1993 suggest that total mortalities in recent years have been very high and most likely in excess of 1.0 for the fully recruited age groups. Total mortality derived from surveys appeared to have declined between 1992 and 1993 presumably because of the fishery closure, but the level of mortality is too high to be explained by a catch of 11 000 tons. Possible reasons for this inconsistency include the following: 1) factors other than fishing are responsible for the observed declines; 2) year effects of the surveys in recent years are hampering calibration of SPA; 3) the 1993 catch has been underestimated. It is not possible to determine which of these or a combination might be correct.

It is possible that the recreational fishery in 1993 took fish predominantly originating from supposed inshore stocks. The areas where these fish would occur are not covered during the autumn surveys, and no information exists concerning possible trends in inshore 'stock' abundance.

Recruitment. The results from autumn and spring surveys indicate that the abundance of young cod remains low and consequently recruitment from recent year-classes can be expected to remain low.

A number of different aspects of 0-group and juvenile cod biology have been examined using beach seining, and pelagic and demersal 0-group/juvenile surveys to develop a scientific basis for prerecruit indices for this stock. The predominantly inshore distributions of pelagic (0-group) juvenile cod sampled during 1991-93 differed significantly from the offshore distribution observed in 1981. The different distributions are consistent with what one would expect based on historic and recent spawning distributions, and modelled drift of cod eggs and larvae. Compared to the numbers sampled and the broad offshore distribution in 1981, it would appear that significantly fewer pelagic 0-group cod occurred in recent years, 1991-93. The distribution and abundance of 0-group cod in the near shore environment along the northeast Newfoundland coast in 1992-93 was remarkably similar to the historic distribution and abundance determined from sampling the same site in the early-1960s although abundance in 1992-93 tended to rank toward the lower part of the observed range. The persistence of 0-group cod with the nearshore environment indicates this is a preferred habitat for this age class. However, this continued presence contrasts with offshore observations that there has been a significant southward shift in spawning and significantly lower recruitment during the 1990s. The discrepancy between the distributions of pelagic 0-group cod and that of 0-group cod in the nearshore environment could be explained by maintenance of inshore spawning in the bays along the NE coast of Newfoundland.

The distributions of cod aged 1-3 years observed during the demersal surveys in 1992-93 are consistent with the historical description: age 1 cod predominate inshore while age 3 cod are more predominant offshore. Because directed sampling previously has not been carried out inshore a direct comparison to historical data is not possible. The recent observations emphasize that cod <3 years of age occur predominantly shoreward of the autumn RV survey boundary. As such, the RV survey might be expected to systematically underestimate the abundance of young cod, particularly small cohorts as a greater proportion will be shoreward of the survey boundary.

There was agreement between the capelin trap by-catch and RV ages 2+3 estimates indicating that the combined 1989-90 year-classes are at historically low levels. However, there was disagreement between the by-catch and RV ages 2+3 indices for the combined 1990-91 year-classes, which are ranked as "medium" and "lowest" for the two time series, respectively. Year-class size in 1991 appears to be very low, based on the beach seine, the pelagic 0-group, demersal juvenile and RV ages 2+3 indices. However, the 1992 year-class appears to be moderately good, based on the beach seine, pelagic 0-group and demersal juvenile indices. The 1993 year-class appears to be relatively low, based on the beach seine and demersal juvenile indices, and historic comparison to 1981 for the pelagic 0-group survey.

d) **State of the Stock**

Although it was not possible to provide an adequate determination of absolute stock size, it was possible to describe general trends from the data.

The Div. 2J and 3KL cod stock abundance increased from the mid-1970s to the mid-1980s but has since declined. The stock decline continued in 1993 and the stock is at a record low level. Furthermore, the decline is greater than would be explained by estimated catches in 1992 and 1993 although there are indications that total mortality declined somewhat.

Survey data indicate that recent year-classes are poor and the low recruitment levels will probably persist. Consequently, stock recovery will not occur in the near future.

3. **Cod in Division 3M** (SCR Doc. 94/12, 22, 26, 62; SCS Doc. 94/3, 13, 16)

a) **Introduction**

i) **Description of the fishery**

The cod fishery on Flemish Cap has traditionally been a directed fishery by Portuguese trawlers and gillnetters, Spanish pair-trawlers and Faroese longliners. Cod was also caught as by-catch in flatfish fisheries conducted by Spanish trawlers as well as in the redfish fishery by Portuguese trawlers. Insignificant amounts of cod are taken as by-catch in Russian pelagic fishery for redfish. The fleet currently operating in Div. 3M includes vessels from non-Contracting Parties.

ii) **Nominal catches**

From 1974, when a TAC was first established, to 1979, catches ranged from 22 000 to 33 000 tons. Catches had been at that level or higher for the previous ten years. The TAC was 13 000 tons for 1980-87, while the reported nominal catches were about 12 000 tons.

Recent TACs and catches ('000) tons are as follows (Fig. 3.1):

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
TAC	13	13	13	13	0	0	0	13	13	13	13
Catch	13	14	15	11	2	40[1]	32[1]	11[1,2]	11[1,2]	13[1,2]	

[1] Includes estimates of misreported catches.
[2] Provisional.

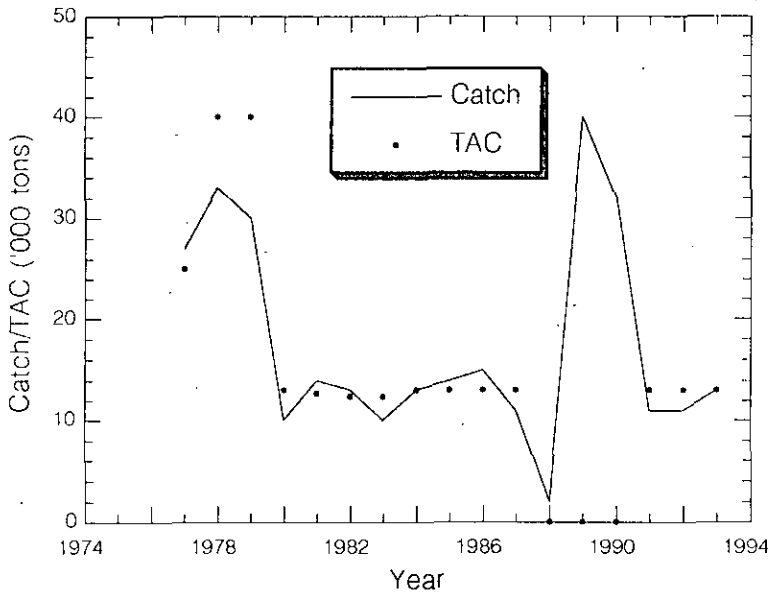

Fig. 3.1. Cod in Div. 3M: catches and TACs.

A moratorium on the Flemish Cap cod fishery was established by the Fisheries Commission for 1988 to 1990. However, catches for 1989 and 1990 have been estimated to be about 40 000 and 32 000 tons, respectively. Reported catches for 1989 and 1990 were about 1 000 and 2 000 tons, respectively. No estimate of unreported catches were available for 1988, but it is believed that actual catches also exceeded those reported for that year.

Catch figure for 1993 is an overall catch estimation, and it includes catch estimates for all fleets, including those from non-Contracting Parties.

b) **Input Data**

i) **Commercial fishery data**

Sampling catch data for 1993 were available for Portuguese trawlers and gillnetters and Spanish pair-trawlers. Samples were selected from the whole catch before it was sorted and discarding occurs. Gillnetter fleet catches were dominated by 1985 and 1986 year-classes, which had been relatively abundant, and its CPUEs had increased somewhat since 1992. Those year-classes were not significant in trawl catches, which were based on

younger age-groups. Trawlers CPUE decreased from the highest value in 1992, when a directed fishery on small size fish concentrations was undertaken. Pair-trawl catches were based on the 1989 and the more abundant 1990 year-classes.

Cod from the 1989 year-class and from the abundant 1990 year-class, aged 4 and 3 years respectively, dominated the catch in 1993. In that year small sized cod of the 1991 year-class was the most abundant cohort in the stock according to surveys, but its occurrence in the catch was low, indicating that catches shifted in 1993 to older age-groups than in 1992.

ii) **Research survey data**

Biomass and abundance estimates were available from research vessel bottom trawl surveys conducted by USSR/Russia from 1977 to 1993 (Fig. 3.2), with a concurrent acoustic survey from 1985. The estimates of trawlable plus acoustic biomass of the pelagic zone decreased from a peak of 78 300 tons in 1989 to 2 500 tons in 1992, and increased to 13 800 tons in 1993.

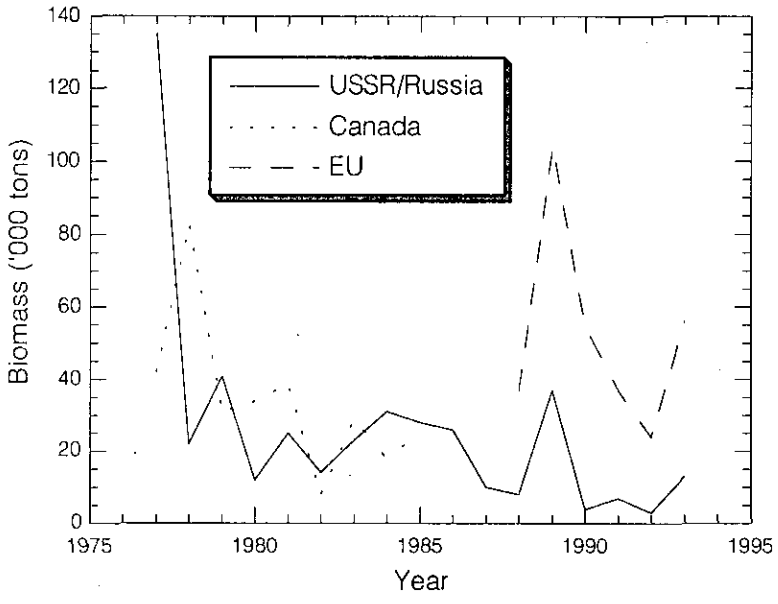

Fig. 3.2: Cod in Div. 3M: total trawlable biomass estimates.

Stratified-random bottom trawl surveys were conducted by the EU from 1988 to 1993. The surveys also showed a decline of trawlable biomass from 103 600 tons in 1989 to 24 300 tons in 1992 and an increase to 55 600 tons in 1993.

The maximum stock biomass in 1989 indicated by surveys was produced by the abundant 1985 and 1986 year-classes when aged 4 and 3 years, respectively. Both surveys also indicated that bottom trawlable biomass in 1993 was at the second highest level since 1988. The increase in biomass from 1992 to 1993 must be attributed to the contribution of two relatively abundant year-classes, those of 1990 and 1991, which constitute 89% of total biomass according to EU survey results.

Abundance decrease of each cohort in EU survey, expressed by its fishing mortality coefficient equivalence, is presented in the following table to illustrate the high level of the fishing mortality exerted on the stock:

mean : unweighted mean over years
F 3+ : weighted by abundance at age
Y 3+ : catch corresponding to F3+ and July to July

Age	1988	1989	1990	1991	1992	1993	Mean
1 :	-1.08	0.37	-2.58	1.11	-0.82		-0.60
2 :	-0.36	0.66	-0.47	1.48	0.06		0.27
3 :	-0.40	1.47	0.69	1.83	1.34		0.99
4 :	-0.74	1.02	0.74	1.56	0.27		0.57
5 :	-0.19	1.35	1.93	1.39	0.46		0.99
6 :	0.18	1.18	2.56	1.91	0.73		1.11
7 :	0.65	-0.06	3.27	3.02	0.54		1.48
8 :		0.21	0.98				0.60
9 :							
10 :			0.90				0.90
11 :							
12 :							
F 3+	-0.47	1.28	1.16	1.69	0.83		
Y 3+	-13338	63039	35216	19272	4437		
Catch(t)		40000	32000	11000	11000	13000	

c) **Estimation of Parameters**

An analytical assessment of the stock has not been conducted since 1984 because of perceived inadequacies in the commercial fishery database.

d) **Prognosis**

The abundance of cod older than 5 years is low on Flemish Cap as a consequence of a very high fishing mortality in recent years. The fishable stock is mainly composed of small fish, which were traditionally overfished. This is an inadequate state for a proper exploitation of the resource, and the situation will remain unchanged at the current fishing intensity. STACFIS reiterates its previous advice that a rational exploited cod fishery on Flemish Cap requires first to impede catches on immature fish, and second to control the exploitation rate through fishing effort or catch. If these two management conditions can not be achieved, the cod fishery will remain as an opportunistic fishery where the catches will follow recruitment fluctuations, but the overall yield of the fishery will be well below its potential level.

A trawl fishery in 1995 would be based on the 1990 and 1991 year-classes when they are 5 and 4 years old respectively, if the current fishing pattern is maintained. Both year-classes appeared relatively abundant in the Russian and EU surveys when they were of ages 2 and 3 in July 1993, but they would be noticeably reduced at the beginning of 1995, after supporting the fishery in 1994. These two year-classes offered the opportunity to rebuild the spawning stock. Therefore STACFIS **advised** that no directed fishery on cod in Div. 3M be conducted in 1995, to allow stock recovery.

4. **Cod in Divisions 3N and 3O** (SCR 94/10, 12, 30, 51; SCS 94/2, 3, 13, 16)

a) **Introduction**

i) **Assessment of February 1994**

The cod stock in Div. 3NO was assessed in February 1994 at a special meeting of the Scientific Council (NAFO SCS Doc. 94/2). The assessment indicated that population abundance had declined from recent highs in the mid-1980s. The stock in 1993 was represented mainly by younger age groups, namely the 1989 and 1990 year- classes. These year-classes were estimated to be more abundant than they had been in the 1993

assessment due to their strong appearance in the Canadian and Russian 1993 spring surveys. However, the Canadian survey found these year-classes in predominantly two strata and both spring survey estimates had large confidence limits. Two new survey indices used in the February 1994 assessment (Canadian autumn and juvenile groundfish surveys) indicated a reduction in the 1989 and 1990 year-classes in 1993. It was suggested that the results from 1993 spring surveys should be treated with some caution until they could be evaluated by further surveys.

During the February 1994 assessment, it was observed that the determination of present stock levels is also greatly influenced by the option of Partial Recruitment (PR) adopted-domed or flat-topped. This choice has also had a major influence on estimates of stock size in the past. The domed pattern (40% of fully recruited fishing mortality) resulted in biomass estimates that were about 80% higher in the mid-1980s than with the flat-topped PR and implied that biomass in the mid-1980s was equal to or larger than in the mid-1960s when landings were consistently in excess of 100 000 tons. The latter appeared to be unrealistic. STACFIS found that the flat-topped pattern better reflected the stock trends but the data and analysis available at that time were considered insufficient to determine the most appropriate PR. Consequently the stock status was considered using population estimates derived from both PR options.

Regardless of the option used in the February 1994 assessment, the analysis indicated that the stock has declined since the mid-1980s to levels at or approaching those in the mid-1970s, which were the lowest observed. Projected stock increases in the near future would be dependent on the size of the 1989 and 1990 year-classes, as the preceding 6 year-classes (1983-88) were well below average.

The current review of stock status uses additional data and presents analyses completed since the February meeting.

ii) **Description of fishery**

No new information was available relative to 1993 catch statistics. The Fisheries Commission during its February 1994 meeting, recommended that there be no directed fishery in 1994.

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

Year	1986	1987	1988	1989	1990	1991	1992	1993	1994
Recommended TAC	Same as agreed								
Agreed TAC	33	33	40	25	18.6	13.6	13.6	10.2	6
Reported Catches	51	42	43	33	18	17[1]	10.1[1]	9[1]	
Non-reported Catches	-	-	-	-	11	12	2.5	0.7	
Total Landings	51	42	43	33	29	29[1]	12.6[1]	9.7[1]	

[1] Provisional

Weights in '000 tons

b) **Input Data**

i) **Commercial fishery data**

Catch-at-age. Since the last assessment sampling data have become available for the Portuguese otter trawl and gillnet fisheries. Catch-at-age for these fisheries was previously derived using Spanish pair trawl and Canadian gillnet sampling. The inclusion of the new data from Portugal increased the estimate of total numbers of cod removed at age, mainly from ages 3 and 4.

ii) **Research survey data**

The 1994 Canadian spring survey in Div. 3NO was completed in late May and preliminary estimates indicated that biomass and abundance had declined substantially (Fig. 4.2).

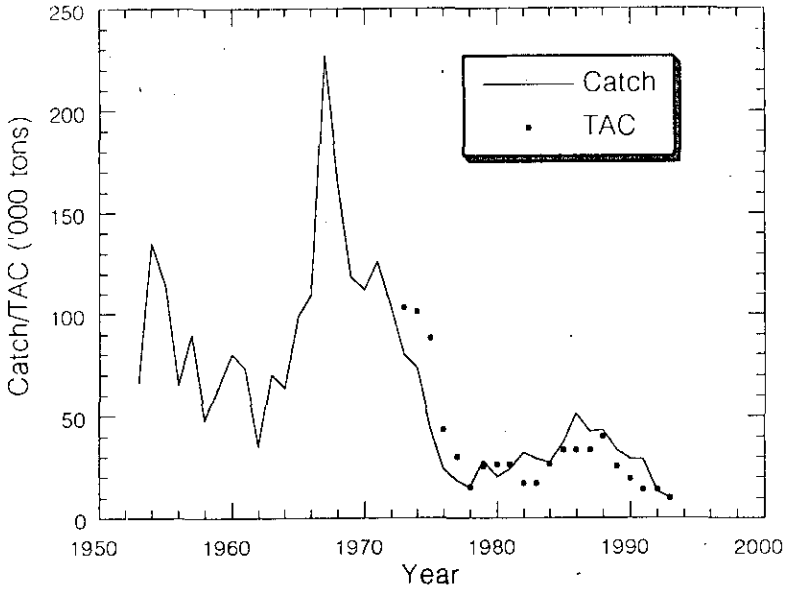

Fig. 4.1. Cod in Div. 3NO: catches and TACs.

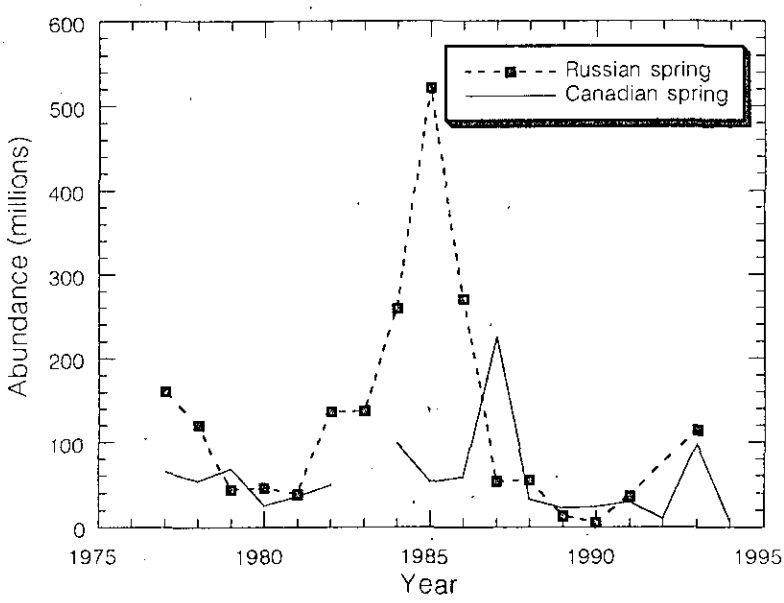

Fig. 4.2. Cod in Div. 3NO: abundance.

c) **Estimation of Partial Recruitment**

The impact of partial recruitment (PR) on estimates of stock status had been described earlier. Information was presented relative to the most appropriate PR pattern for this stock. An extension of the statistical model used to estimate abundance from commercial catch-at-age data was formulated to model the fishing mortality on the oldest ages. The analyses presented indicated that there was no significant difference from that of a flat-top PR. Based on this, STACFIS concluded that the use of a flat-top PR is appropriate for this stock.

d) **Updated Assessment Results**

Inclusion of the additional sampling data in the same formulation of ADAPT used in the February 1994 assessment and with flat-topped PR produced only slight changes in parameter estimates. Fishing mortalities increased slightly for most ages.

e) **Prognosis**

The advice given in February 1994 indicated that the 1994 TAC should not exceed 6 000 tons.

Preliminary results from the 1994 Canadian spring survey indicated a dramatic lower total abundance compared to the 1993 estimate (6%), which corroborates the lower total abundance estimates resulting from the 1993 Canadian autumn and juvenile groundfish surveys. The 1993 Canadian spring survey gave a more optimistic estimate.

STACFIS is unable to provide projections of reference level catches in 1995 because of concerns about the results of the analysis carried out in February 1994. That analysis drew attention to the dependence of the conclusions on the encouraging results of the 1993 spring surveys. The 1993 survey results had an unusually high variability, and conflicted with the evidence from the autumn surveys that the 1989 and 1990 year-classes were not as strong as estimated. At the current meeting, STACFIS learned that the estimates of total biomass for the 1994 Canadian spring survey reinforced the concerns that the equivalent 1993 survey results could be an outlier, and hence the 1989 and 1990 year-class may offer little opportunity for rebuilding. STACFIS **advised** therefore that it would be necessary to analyse all data from 1994 before it would be able to provide information on future trends in stock status and on requested reference catch levels.

Spawning stock biomass is at present at the lowest level on record and furthermore will be entirely dependent on the 1989 and 1990 year-classes. STACFIS **advised** that the stock must be allowed to rebuild. Any harvesting in 1995 will reduce the rebuilding potential. The first chance of a rebuilding is with the 1989 and 1990 year-classes which will only add substantially to the spawning stock in 1995 and 1996, respectively. STACFIS therefore **advised** that there should be no fishing for cod in Div. 3N and 3O in 1995.

5. **Redfish in Subarea 1** (SCR Doc. 94/6, 7, 9, 31; SCS Doc. 94/11, 14, 15)

a) **Introduction**

Historically, redfish were taken mainly as by-catch in the trawl fisheries for cod and shrimp. Landings were considered to be almost exclusively golden redfish (*Sebastes marinus* L.) until 1986. It is believed that subsequently the portion of beaked redfish (*S. mentella* Travin) represented in the catches increased, and since 1991, the majority of the redfish catches are considered to be beaked redfish. In 1977, total reported catches peaked at 31 000 tons (Fig. 5.1). During the period from 1978 to 1983, reported catches of redfish varied among 6 000 tons 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. However, occasionally in this period, a directed fishery on redfish could be observed for this fleet. During the same time, a directed redfish fishery was initiated by Japanese trawlers, but they only partly compensated the reduction in the catches of EU-Germany. With the closure of the offshore fishery in 1987, catches decreased further to 1 200 tons, and remained at that low level in spite of increased effort by trawlers from Greenland and EU-Germany after the reopening of the cod fishery in 1988. Recent fishing effort was directed to shrimp or Greenland halibut only.

Both recent and historical catch figures, especially those reported since 1991 amounting to 300 tons, are believed to disregard substantial numbers of small redfish discarded by the trawl fisheries directed to shrimp and cod.

Recent catches ('000 tons) are as follows:

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Catch	7	6	4	5	1	1	1	0.4	0.3[1]	0.3[1]	0.3[1]

[1] Provisional.

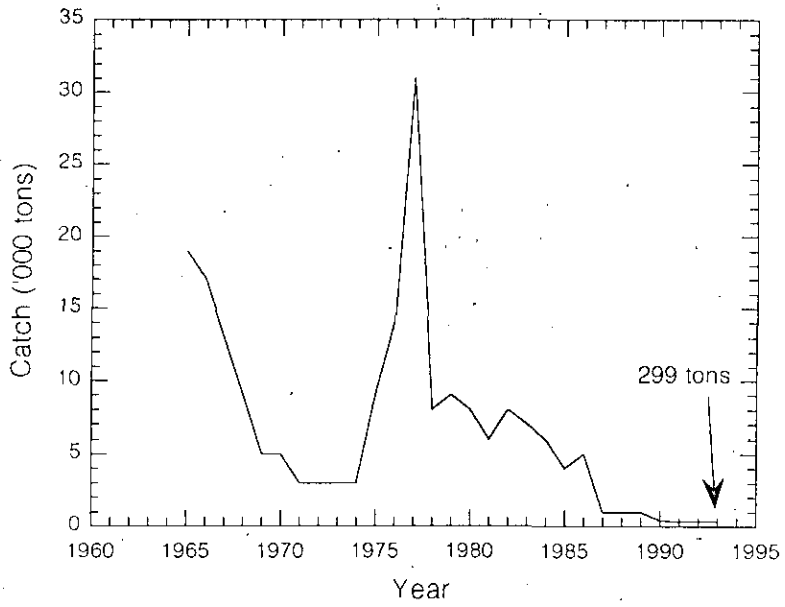

Fig. 5.1. Redfish in Subarea 1: catches.

b) **Input Data**

i) **Commercial fishery data**

No data available.

ii) **Research survey data**

EU-Germany groundfish survey. Annual abundance and biomass indices were derived from stratified-random bottom trawl surveys commenced 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 variation of the estimates for redfish could be caused by the incomplete survey coverage in terms of depth range and pelagic occurrence. The survey indices indicate that the adult component of golden and beaked redfish decreased dramatically during the period 1982-93, and are practically no longer existent in the surveyed area. Juveniles (<16 cm) assessed separately from recruits and adults were very abundant in northern strata (Div. 1B, 1C) and dominated aggregate redfish abundance of the total area since 1986 (88%).

Greenland shrimp survey. Stratified-random shrimp surveys covering depth zones of 0-600 m in Div. 1A to 1D have been conducted since 1988. Abundance, biomass estimates and length frequencies have been used as indicators for the status of the stocks although the catchability of the survey gear for large specimens could be ineffective due to low towing speed (2.5 knots). Abundance and biomass indices declined substantially (36%)

from 1988 to 1990. The surveys were extended to investigate the Disco Bay area and Div. 1E and 1F in 1991 and 1992, respectively. Changes in CPUE data due to a change in the cod end mesh size of the 1993 survey were corrected by length-dependent conversion factors. Abundance and biomass estimates including extended areas decreased from 1991 to 1993 by 80% and 28%, respectively. Length frequencies confirmed the absence of redfish ≥16 cm.

Greenland-Japan groundfish survey. Since 1987, 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 m and 1 500 m. One trawl survey was carried out in August and September 1993. As usual, beaked redfish was mainly caught at depths less than 600 m and the density of small-sized redfish was higher in northern areas (Div. 1B). The trawlable biomass decreased from 3 700 tons in 1992 to 1 200 tons in 1993. This estimate represents the record low for the time series.

c) **Prognosis**

STACFIS noted that no commercial fishery data are available for the stock and that catch figures are believed to disregard discards of small redfish by trawl fisheries directed to shrimp and cod. The number of small redfish discarded is believed to be substantial. In view of dramatic declines of adult redfish (≥16 cm) to an extremely low level, STACFIS concluded that both exploitable stocks of golden and beaked redfish are severely depleted. Given that surveys indicated high abundance of pre-recruits (<16 cm), STACFIS **advised** that directed catches and by-catches of redfish in Subarea 1 be reduced to the lowest possible level.

6. **Redfish in Division 3M** (SCR Doc. 94/13, 22, 60; SCS Doc. 94/3, 13, 14, 16)

a) **Introduction**

The directed redfish fishery was traditionally conducted by Latvia, Lithuania, Estonia, Cuba, EU-Portugal, South Korea and Russia with bottom and midwater trawl as well with gillnets. Because of identification difficulties in commercial catches all the three species of redfish (*Sebastes marinus*, *S. mentella*, *S. fasciatus*) are considered together as a single management unit.

Reported catches in the period 1972-81 were reduced from 41 900 tons to 13 900 tons (Fig. 6.1). Catches began to increase in 1983 and were over double the TAC in 1987 and three times in 1989. The estimated catch for 1990 was the highest on record for this stock (81 000 tons). Since 1990 catches have declined to 29 000 tons in 1993, which includes some estimated catch from surveillance reports. Catches have not exceeded TAC since 1991. Catches for 1990-92 have been revised based on updated information related to catches by non-Contracting Parties.

Recent catches ('000 tons) are as follows:

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
TAC	20	20	20	20	20	20	50	50	43	30	26
Catch	20	20	29	44	23	58[1]	81[1]	48[1,2]	43[1,2]	29[1,2]	

[1] Includes estimates of non-reported catches from various sources.
[2] Provisional.

There continues to be a substantial amount of non-reported catch accounted for by non-Contracting Parties. Since 1989 these catches have been in the range of 3 000 tons to 10 000 tons.

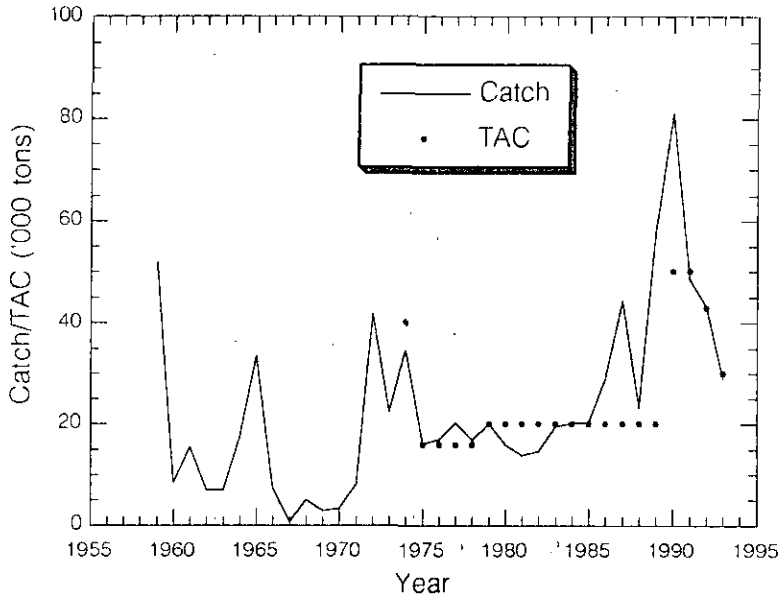

Fig. 6.1 Redfish in Div. 3M: catches and TACs.

b) **Input Data**

i) **Commercial fishery data**

A catch rate database with effort measured in hours fished and another with effort measured in days fished were standardized with a multiplicative model (Fig. 6.2). Information for years prior to 1974 is limited and estimates for these years are considered unreliable. Both indices were consistent in terms of trends since the mid-1970s. Catch rates were fairly stable from 1975 to 1985. The catch rate increased sharply in 1986, peaked in 1987, and declined in 1988 to the level of the 1985 rate. Since 1988 catch rates have declined systematically to 1993, which is the lowest on record and are now only about 40-50% of those in 1986-1987.

Portuguese directed effort for redfish stayed relatively constant between 1992 and 1993 but catch rate dropped from 0.891 tons/h in 1992 to 0.471 tons/h in 1993 and was the lowest one observed since 1989.

Sampling data consisted of *S. mentella* and *S. marinus* length and age composition for Portuguese gillnetters and length composition of redfish by-catch for Spanish pair-trawlers.

Fish in the range of 17-53 cm occurred in pair-trawl catches. Males 30-33 cm and 39-43 cm as well as females 28-34 cm and 38-43 cm dominated the catches. Gillnet catches consisted of *S. mentella* in the range of 18-65 cm and *S. marinus* 16-69 cm long. For both species lengths 35-40 cm dominated the catches. Smaller fish were also well represented in gillnet catches. During this meeting there were no data available on redfish by-catch in the shrimp fishery in Div. 3M.

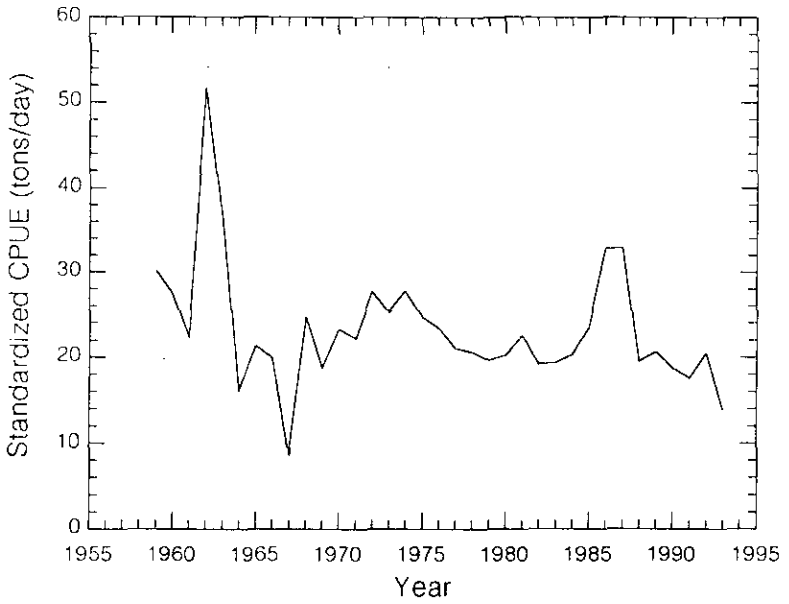

Fig. 6.2. Redfish in Div. 3M: standardized catch rates.

ii) **Research survey data**

Surveys were conducted in June-July 1993 by EU (bottom trawl survey) and by Russia (trawl-acoustic survey). Biomass estimates from the various surveys ('000 tons) are as follows:

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
USSR/Russia										
Trawl	132	52	310	106	47	83	18	45	18	70
Acoustic				350	332	283	229	62	82	77
Total				456	379	366	247	107	100	147
Biomass above bottom trawl (%)				77	88	77	93	58	82	53
EU										
Trawl					158	137	104	64	104	63

Survey results indicate a gradual decrease of the stock since about 1988. Although the annual estimates indicated variability, overall, the decline appeared to be about 50% (Fig. 6.3), similar to that indicated by the standardized commercial catch rates.

Length frequencies from the Russian bottom trawl survey indicated a mode at about 15-16 cm that corresponds to the 1990-91 year-classes. These size groups represented about 20% of the research catch in the 1993 survey. These size groups were also dominant in the EU survey results.

In 1993, STACFIS put forth a recommendation to present results of length and species composition of catches from midwater trawling conducted to verify acoustic signals during the USSR/Russia trawl-acoustic surveys. The information was not provided at this meeting (see Section VII of this report).

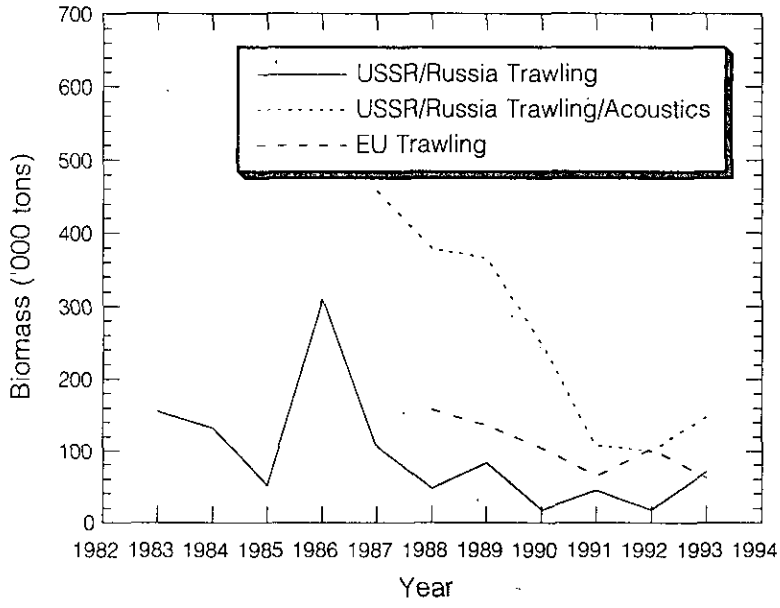

Fig. 6.3. Redfish in Div. 3M: biomass estimates from research vessels (USSR/Russia and EU).

c) **Prognosis**

STACFIS concluded that biomass of this stock has declined at least from 1988 to 1991-1992. Large catches over the past eight years that have likely been well above the stock sustainable production and have resulted in high fishing mortalities. This stock will continue to decline into the future if the present level of catches is maintained. Both Russian and EU surveys indicated a relatively good pulse of recruitment that will start recruiting to the commercial fishery in the late-1990s, however, the abundance of these cannot be precisely determined.

Based on this information, STACFIS **recommended** that *the total catch for redfish in Div. 3M be reduced to 20 000 tons for 1995.* This amount of catch is in the range of catch levels from 1975 to 1985 when stable conditions had been observed in the fishery.

STACFIS noted there continues to be a substantial fishery for shrimp in Div. 3M. Given that significant by-catches of juvenile redfish occur, STACFIS reiterates its concern on the likely negative impact of these shrimp fisheries on future recruitment to the redfish fisheries. STACFIS has only received information on by-catches in the shrimp fishery up to July 1993. While full information for 1993 may be made available when the shrimp resources in this Division will be assessed in September 1994, STACFIS considers that the annual information should be made available in advance of the June meeting when the status of Div. 3M redfish is to be assessed. It is important that information be provided on numbers and sizes of the redfish as well as weight of the by-catch, whether or not sorting mechanisms are employed, because of the size selectivity of these devices.

7. **Redfish in Divisions 3L and 3N** (SCR Doc. 94/13, 54, SCS Doc. 94/13, 16)

a) **Introduction**

The average reported catch from Div. 3LN from 1959 to 1985 was about 21 000 tons ranging between 8 000 tons and 45 000 tons (Fig. 7.1). In 1986 the catch of 43 000 tons was double that taken in 1985. The catch increased again in 1987 to the highest recorded historically at 79 000 tons and has since declined substantially. The 1993 catch could not be estimated precisely because of discrepancies in the information from various sources, however, the likely amount is between 18 600 tons and 24 400 tons.

From 1980 to 1985 the former USSR, Cuba and Canada were the primary fleets in essentially a trawler fishery. Canada accounted for most of the Div. 3L catch while the USSR was the dominant fleet in Div. 3N. Over this period catches averaged 19 000 tons and between 60%-80% was taken from Div. 3N. The rapid expansion of the fishery in 1986 was due primarily to the entry of EU-Portugal, taking about 21 000 tons. In addition, in 1987 various countries who were not Contracting Parties of NAFO, most notably South Korea, Panama and Caymen Islands also began to fish in the Regulatory Area accounting for catches of about 24 000 tons. Since then these countries have taken between 4 000 tons and 13 000 tons annually. Information from surveillance sources indicated that during the 1980s most of the Div. 3LN catch was taken in the vicinity of the Div. 3N and 3O border and from the slopes of the Grand Bank in Div. 3L. Since 1990 a considerable amount of activity has occurred on an area known as the 'Beothuk Knoll' which is at the Div. 3L, Div. 3M and Div. 3N border.

From 1980 to 1990 the TAC each year for this stock has been 25 000 tons. The TAC was reduced to 14 000 tons for 1991 and maintained at that level to 1994. The TAC has been exceeded each year for the past 8 years, and in some years catches have been double (1988) and even triple (1987) the agreed TAC.

The fishery is conducted year round in Div. 3L but mostly in the second half of the year in Div. 3N. The bottom trawl is the predominant gear in the fishery.

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

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
TAC	25	25	25	25	25	25	25	14	14	14	14
Catch	15	21	43	79[1]	53[1]	34[1]	29[1]	26[1,2]	27[1,2]	19-24[1,2,3]	

[1] Includes catch estimated by STACFIS.
[2] Provisional.
[3] STACFIS could not precisely estimate the 1993 catch but is likely within this range.

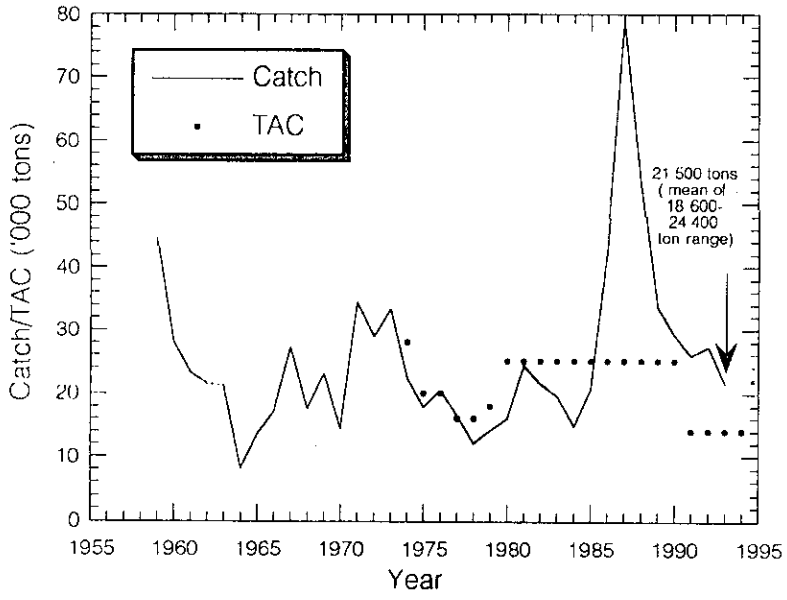

Fig. 7.1. Redfish in Div. 3LN: catches and TACs.

b) **Input Data**

i) **Commercial fishery data**

A catch-rate database with effort measured in hours fished and another with effort measured in days fished were standardized for each Division separately using a multiplicative model. As in the past these indices were not considered reflective of year to year changes in population abundance (see NAFO Sci. Coun. Rep, 1989, p. 70), although they may be indicative of trends over longer periods of time.

Limited sampling of the commercial fishery, based only on Portuguese samples, indicated the dominant size range was 24-28 cm in January in Div. 3L and 28-33 cm in the second quarter in Div. 3N.

ii) **Research survey data**

Results of bottom trawl surveys for redfish demonstrate a considerable amount of variability. This is realized both between consecutive seasons and years, and amongst standard tow by tow catches within a single survey. Nevertheless, Russian bottom trawl surveys conducted from 1984-93 suggested a decline in relative abundance and biomass from 1984 to 1990 Div. 3L and Div. 3N. There was no survey of these Divisions in 1992. The 1993 survey only partially covered Div. 3L but very low densities were encountered. The 1993 survey in Div. 3N indicated an increase in abundance relative to 1991, however, 70% of the biomass occurred in a single stratum which only represents about 9% of the surveyed area. The decline in Div. 3L is also shown by Canadian surveys over this period. Relative abundance estimates from 1993 Canadian surveys in Div. 3L are at their lowest level since 1978. Canadian surveys in Div. 3N from 1991-93 indicated large fluctuations in relative abundance between seasons within each year but with no trend between years. These are not considered reflective of true changes in population size but rather suggest seasonal changes in either catchability or distribution.

Russian acoustic surveys have been conducted concurrent with the bottom trawl surveys since 1987. In 1993, STACFIS was unable to evaluate these surveys and put forth two recommendations to address issues relating to separation of acoustic signals by species and details on vertical and spatial distribution. No information was available at this meeting (see Section VII of this report).

iii) **Recruitment**

Length and age distributions from Canadian surveys in Div. 3L indicated there has been relatively poor recruitment observed since the early-1980s. Despite this, the 1993 spring, summer and autumn survey catches were dominated by 24-30 cm fish corresponding to the year-classes that were born between 1980 and 1985. Length frequencies and age distributions from the Div. 3N Canadian surveys from 1991-93 show different distributions compared with Div. 3L for each corresponding seasonal survey, consistently being composed of size groups that are much smaller. There was a relatively good pulse of recruitment picked up in the 1991 autumn survey in the range of 12-14 cm (1986 and 1987 year-classes) that could be tracked through to the 1993 autumn survey. Given the variability in the survey estimates the magnitude of this recruitment cannot be determined. However, there is no sign of any year-classes subsequent to this in the surveys.

c) **Prognosis**

Russian bottom trawl surveys indicate a decline in relative abundance to low values in recent years for Div. 3L and Div. 3N. The situation in Div. 3L is confirmed in the surveys conducted by Canada. The increase observed in the 1993 Russian survey in Div. 3N occurred in a relatively small area. Canadian surveys in Div. 3N from 1991-93 indicate high seasonal variability. Although a cautious approach should be taken in drawing conclusions about stock status given the inherent variability in bottom trawl surveys, the 1993 Canadian surveys in Div. 3L indicate that relative abundance and biomass are the lowest observed since 1978.

The commercial catch-rate indices derived for Div. 3L and Div. 3N showed much between year variability. Although some of the changes in mean catch rate between some years are too dramatic to be solely the result of year to year changes in population abundance, there are indications of decline since the mid-1980s in all the derived indices. This corresponds to a period when some of the largest catches historically have been taken and have likely generated high fishing mortalities. Although there are increases suggested since 1991 in Div. 3L indices, anecdotal information about the 1994 fishery from Canadian surveillance indicated that most of the Baltic fleets have returned home because of poor catch rates. TACs have been exceeded in each year since 1986 and in some years catches have been double (1988) and even triple (1987) the established TAC. There continues to be a substantial fishery by non-Contracting Parties in the Regulatory Area. Since 1986 catches estimated for these countries have been between 4 000 tons and 24 000 tons.

The information is not sufficient to evaluate where the current TAC (14 000 tons) stands in relation to an appropriate reference catch. Div. 3L appears to be at a relatively low level with the prospect of continuing poor recruitment. Div. 3N shows a year-class of unknown strength that will not be fully available to the fishery until the late-1990s, and there is no sign of good recruitment after this. STACFIS therefore suggests that a cautious approach is warranted in establishing a TAC for 1995. STACFIS considers that this resource to be at a low level and that no improvement could be expected as long as catches exceed recommended TACs. STACFIS therefore **recommended** that *for redfish in Div. 3LN catches be reduced and the total catch not exceed 14 000 tons.*

d) **Future Studies**

STACFIS noted that the information available at this meeting was inadequate to address a previous recommendation regarding the integrity of Div. 3LN as a separate management unit from adjacent Divisions. STACFIS considered this issue important and necessary to resolve, accordingly, **recommended** that *(1) existing data be examined to evaluate the appropriateness of Div. 3LN and Div. 3O management units for redfish*, and (2) *further examination be conducted of the Russian trawl-acoustic survey data to provide more detail on the location of concentrations of redfish both near the bottom and in the water column in Div. 3LNO.*

8. **Silver Hake in Divisions 4V, 4W and 4X** (SCR Doc. 94/4, 8, 32, 39; SCS Doc.94/3)

a) **Introduction**

The fishery is conducted primarily by large Cuban and Russian Federation otter trawlers using small-meshed bottom trawls. Before 1977 the fishery was not restricted by season or area, however, since 1977 the fishery has been restricted to April 1 through November 15 and to the area seaward of the small mesh gear line (SMGL). Since 1990, allocations have been made to Canadian companies which have entered into developmental arrangements with Cuban and Russian Federation fishing companies to harvest silver hake. Despite these realignments, the resultant composition of the fleet actively fishing silver hake has not changed. Nominal catches since 1970 ranged from a maximum of 300 000 tons in 1973 to a minimum of 29 000 tons in 1993. Catches generally increased, with the exception of 1983, from 1977 to 1989, from 37 000 tons in 1977 to 91 000 tons in 1989. Since 1989, catches have shown a continual decline to levels below those reported in the late-1970s. Since 1977 catches for this stock have been below the total allocated. In recent years this trend has been exacerbated through allocations being made to Canadian interests which did not participate in the fishery, and allocations which were made late in the season when commercially viable catch rates could not be achieved.

Recent catches and TACs ('000 tons) are as follows (Fig. 8.1):

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
TAC	100	100	100	100	120	135	135	100	105	86[1]	30
Catch	74	75	83	62	74	91	69	68[2]	32[2]	29[2]	

[1] Projected catch at F_0, was 75 000 tons; 11 000 additional tons were allocated by Canada in the knowledge that not all allocations would be fully harvested.

[2] Provisional.

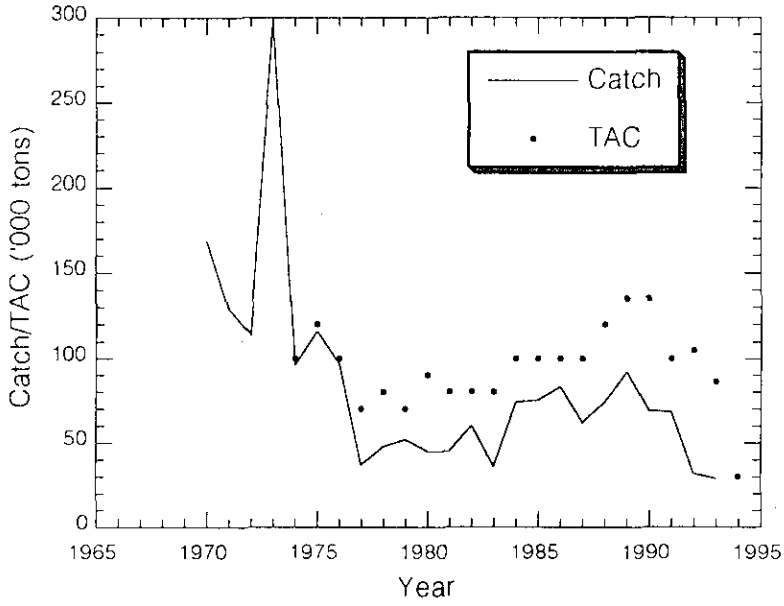

Fig. 8.1. Silver hake in Div. 4VWX: catches and TACs.

The 1993 fishery commenced in the last week of March, and finished in mid-August. Catch rates were generally poor compared to levels seen between 1985-89, and were about the same as in 1992. Unlike the 1992 fishery however, by-catch of other species did not approach regulatory limits, and was not a restraining factor at any time.

b) **Input Data**

i) **Commercial fishery data**

Catch rates. Catch and effort data from the commercial fishery were analyzed using a multiplicative model to derive a standardized catch-rate series from 1977-93. The model used was simplified over that employed in the previous assessment, in that only country, Division, month, and year were considered as factors. The new formulation showed good agreement with that used previously, but explained more of the variation in the data. The standardized catch-rate for this stock has dropped in recent years (Fig. 8.2), from a peak of 5 tons/hr in 1989 to 1.6 tons/hr in 1992 and 1993. The most recent catch rates were similar to those experienced in the late-1970s and early-1980s.

Catch- and weight-at-age. The commercial removals-at-age for 1993 were calculated from Canadian length samples from the commercial fishery and an age-length key constructed from combined Canada/Russia ageing data. Length/weight data from Canadian July research vessel surveys were used in the calculation of weights-at-age. The removals-at-age and weights-at-age for 1977-92 were taken from the previous assessment, to provide estimates for the period 1977-93 inclusive.

ii) **Research survey data**

The survey results indicated a continual decline in total numbers and biomass over the period 1986-92 (Fig. 8.3). Results of the 1993 survey indicated both numbers and biomass had risen moderately.

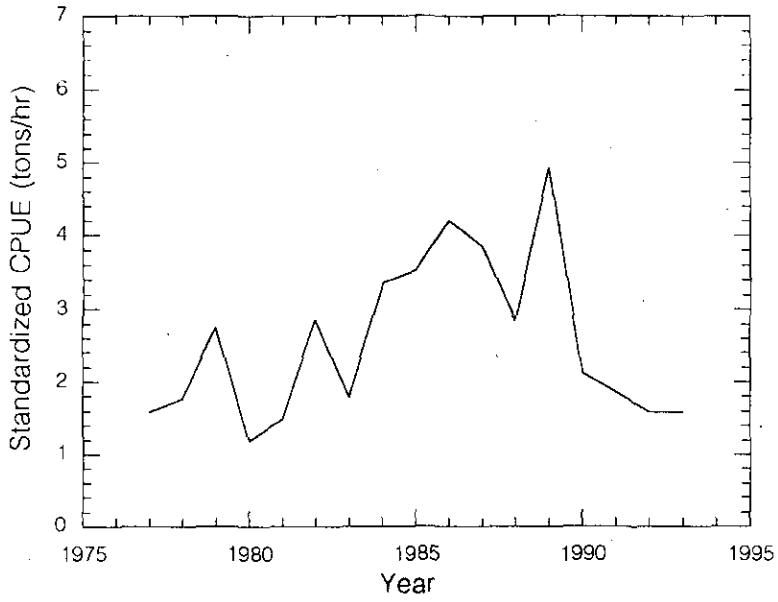

Fig. 8.2. Silver hake in Div. 4VWX: standardized catch rates.

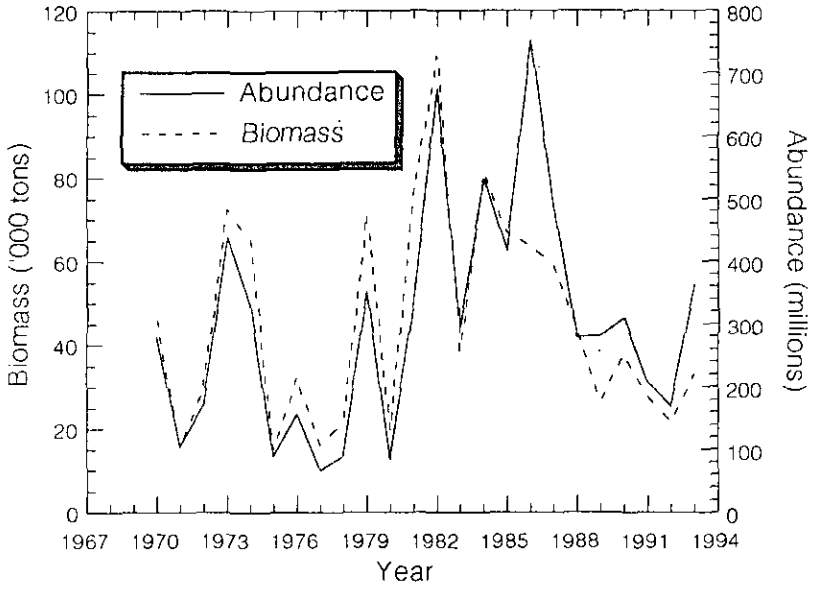

Fig. 8.3. Silver hake in Div. 4VWX: survey biomass estimates.

The July surveys in 1991 and 1992 showed the 1990 and 1991 year-classes to be below average at ages 1 and 2, and age 1, respectively. The 1993 survey shows higher estimates for these year-classes at age 2 and 3. The 1993 survey also indicates the 1992 year-class is above average. The 1993 silver hake 0-group survey shows the 1993 year-class should be about average in size.

iii) **Biological studies**

One paper was presented which investigated the distribution of silver hake and zooplankton with water temperatures on the Scotian Shelf in 1990 (SCR Doc. 94/4). During summer silver hake were found to be aggregated on the warm side of the hydrological front in temperatures between 7° and 10.5°C. While statistical correlations were low, silver hake showed a tendency to be found in association with euphausiids rather than calanoid zooplankton.

c) **Estimation of Parameters**

i) **Sequential population analysis**

Commercial catch-at-age (ages 1-9, 1977-93) age disaggregated standardized CPUE (ages 1-9, 1977-93), Canadian July survey catch-at-age (ages 1-9, 1977-93) and a juvenile index (0-group, 1981-93 except 1992) were used for tuning in the same Adaptive framework (ADAPT) as was employed in the September 1993 assessment. A dome-shaped partial recruitment pattern was used in the analysis, and M was set at 0.4.

An analysis using the Laurec-Shepherd technique was also conducted. The results of the two analyses corresponded closely.

High negative residuals were noted for the 1977, 1978 and 1993 estimates from both July research vessel and CPUE indices. Further, the CPUE estimates for 1989 had high positive residuals. These observations support the conclusion that the data did not fit the model well.

Two papers examined variability trends in population size for this stock. SCR Doc. 94/8 noted the low variability in stock size since 1977, and suggested this may result from a tendency of the ADAPT technique to under-estimate stock size in years of high abundance. Relationships between recruitment indices were examined in SCR Doc. 94/39. The 0-group survey was shown to provide an index of pre-recruitment strength that was well correlated with SPA year-class abundance estimates. However, biases in the relationships between recruitment indices (0-group and age 1) and SPA result in the overestimation of poor year-classes and the under-estimation of large year-classes. This was attributed to mis-assignment of ages in the calculation of annual removals-at-age, resulting in a smoothing of year-class strength estimates. This could also account for the low variability in stock size estimates noted in SCR Doc. 94/8.

A retrospective analysis using the results of the ADAPT formulation on ages 3-5 showed a pattern where F was consistently underestimated (by 40-60%) as a longer time series of data was introduced. This retrospective pattern has been noted in other North Atlantic groundfish stocks, however, the underlying cause remains obscure. The high negative residuals seen from both July research vessel and CPUE indices in 1993 indicate the most recent year did not fit the model well. Under these circumstances, it was reasonable to assume that the 1993 fishing mortality produced by ADAPT was also underestimated.

d) **Prognosis**

The 1993 year-class will make a significant contribution to the catch in 1995 at age 2. Based on the 1993 0-group survey, this cohort was estimated to be average in size at 1.1 billion fish. The size of the 1992 year-class at age 1 was poorly estimated in the SPA, as the estimate is based on a single occurrence in the catch matrix. While it was decided to accept the estimates of the 1991 and earlier year-classes as given by the SPA, the strengths of the 1992 year-class was inferred from July survey data. Year-class estimates from the research vessel survey were regressed against estimates from the SPA for the 1982-91 year-classes at age 1, using the model SPA = a + b(ln RV); $r^2 = 0.72$. Prediction from this relationship for the strength of the 1992 year-class was 1.2 billion fish. An $F_{0.1}$ value of 0.70 was calculated using a Thompson-Bell yield-per-recruit model. The mean weights-at-age and partial recruitment pattern for projection were taken as the average of recent years (1989-93) observed in the fishery and the SPA. Weight and PR-at-age used were as follows:

Age	Avg weight (kg)	PR
1	0.062	0.02
2	0.133	0.30
3	0.182	0.73
4	0.211	1.00
5	0.254	0.96
6	0.308	0.89
7	0.399	0.47
8	0.431	0.34
9	0.717	0.08

Mean weight-at-age from the commercial fishery showed a marked drop in 1993 over previous years. This change was attributed to the length/weight relationship derived from the July RV data. Possible reasons for the low weight-at-length were investigated, and it was judged to be an artifact.

As the 1994 fishery is still in progress, the exact catch cannot be known at this time. Based on preliminary catch rates, level of participation and the late start of the fishery in 1994, the final catch was predicted to be 15 000 tons. A catch of this size will result in a fully recruited fishing mortality of F = 0.13. The catch at a target fishing level of $F_{0.1}$ in 1995 is estimated to be 79 000 tons.

The retrospective analysis indicated a consistent tendency to overestimate the stock size when additional years of data were added. This suggests that the abundance of year-classes estimated by ADAPT for 1993 may have been overestimated. These are the 1991 and older year-classes which will be ages 4 and older in 1995. These ages account for about 43% of the projected catch in 1995. In addition, a review of historical TAC advice indicated that since about 1984, the projected $F_{0.1}$ catches from the assessments have been overestimated. It is expected that the calculated stock size at the beginning of 1994 is also overestimation. Projections suggest that the catch at $F_{0.1}$ in 1995 of 79 000 tons could be an overestimated by as much as 20 000 tons.

e) **Future Studies**

STACFIS continues to support cooperative studies on silver hake. These include continuation of the joint Canada-Russia juvenile survey, which is noted as a critical element in the prediction of incoming year-class size for this stock.

Further investigation into approaches which might explain the retrospective problem is encouraged. This is, of course, not an issue which concerns only silver hake but is central to improvement of many stock assessments.

9. **American Plaice in Division 3M** (SCR Doc. 94/22, 61; SCS Doc. 94/3; 13; 16)

a) **Introduction**

Since 1974, when this stock started to be regulated, reported catches ranged from 600 tons in 1981 to the highest value of 5600 tons in 1987. After that catches declined drastically to 275 tons in 1993. Reported catches for 1993 are 456 tons, but estimated catches from Canadian surveillance and other sources suggested 275 tons as a more realistic value.

The observed reduction in the catches in the last two years was due in part to the shift in the target species to Greenland halibut for the Spanish fleet.

Since 1979 a TAC of 2 000 tons has been agreed for this stock. For 1994 a reduction to 1 000 tons was agreed (Fig. 9:1).

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

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
TAC	2	2	2	2	2	2	2	2	2	2	1
Catch	1.3	1.7	3.8	5.6	2.8	3.5	0.8	1.6[1]	0.8[1]	0.3[1]	

[1] Provisional.

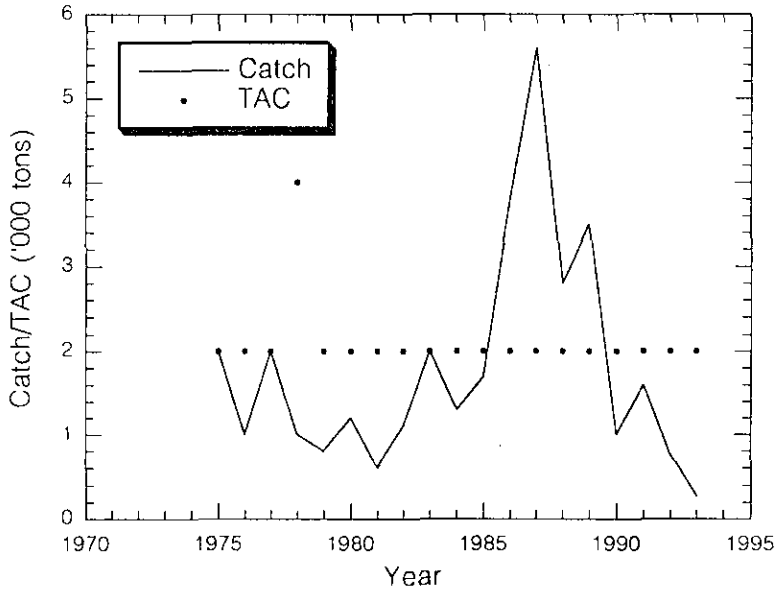

Fig. 9.1. American plaice in Div. 3M: catches and TACs.

b) **Input Data**

i) **Commercial fishery data**

Length compositions of the 1993 catch were available for Spanish small-freezers and pair-trawlers. A limited sample was also available from Portuguese gillnetters. Age-length keys for the commercial fishery were available from EU-Spain.

Small-freezer length frequency ranged between 21-60 cm with a peak at 40 cm. The pair trawler catches were dominated by fish with length between 29 and 62 cm with a main peak at 40 and another at 50 cm. Ages 5 to 7 were dominant in the catches. However, there were discrepancies between catch-at-age from the commercial catches and survey data, where ages 5 and 7 were less represented possibly because the otolith readers were not the same for the survey and for the commercial catches. Mean weights-at-age in the catch showed no trend in the observed period.

ii) **Research survey data**

Research surveys were conducted by the EU and Russia in 1993. From the EU survey, biomass continued to decrease from 6 492 tons in 1992 to 5 949 tons in 1993 (see text Table below; Fig. 9.2) and abundance followed a similar decrease from 10.4 million in 1992 to 9.3 million in 1993. From the Russian surveys, an opposite tendency was observed. Biomass increased from 1 000 tons in 1992 to 2 700 tons in 1993 and abundance also increased from 1.5 million in 1992 to 3.6 million in 1993. Differences in the mean weight per fish in both surveys were detected, but these differences did not follow the same pattern in the series. The Russian survey was more variable but the 3 lowest values were 1990, 1992 and 1993.

The American plaice abundance ('000) and biomass (tons) in the surveys were as follows:

	EU		USSR/Russia	
Year	Number	Biomass	Number	Biomass
1983				8 900
1984				7 500
1985				7 800
1986				20 200
1987				9 300
1988	21 219	11 868	10 000	6 500
1989	20 500	10 533	8 300	5 000
1990	16 631	9 101	2 600	1 200
1991	13 932	7 565	12 700	14 400
1992	10 363	6 492	1 900	1 000
1993	9 268	5 949	3 600	2 700

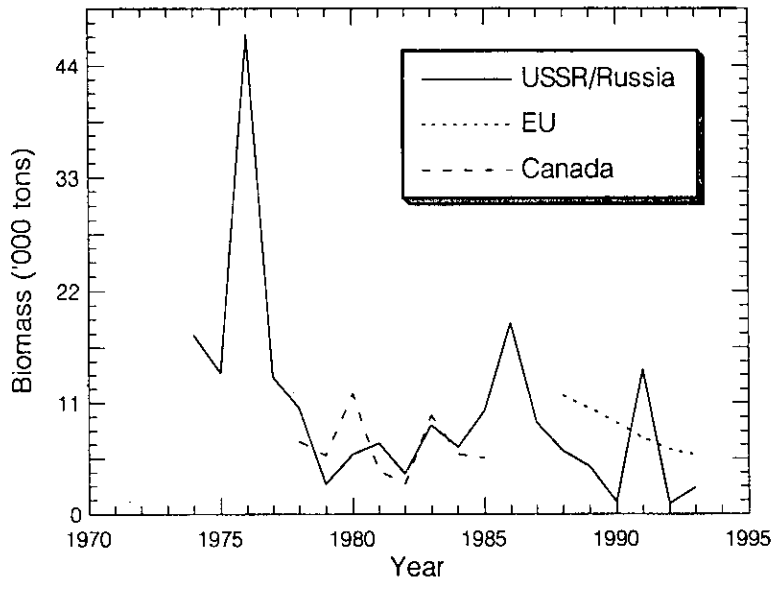

Fig. 9.2: American plaice in Div. 3M: biomass estimates from surveys.

Age composition was dominated by the 1986 year-class at age 7, which should be fully recruited to the fishery in 1994. The 1990 year-class that appeared in 1992 as the second most abundant-at-age 2 since 1988, also appeared in 1993 as the second most dominant-at-age 3. The 1991 year-class appeared to be very weak at age 2. In the 1993 survey there appeared to be an inconsistency compared with previous surveys, with ages 12 and older seeming to be more abundant in 1993. This could possibly be due to the change in the otolith reader.

The spawning stock biomass (50% of age 5 and 100% of age 6+), as estimated from the EU surveys, increased in 1993 to a value close to the 1990-91, due to the recruitment of the 1986 year-class.

c) **Estimation of Parameters**

The catch-at-age matrix was updated with the data of 1993 using the length and age composition available from the commercial catches and the age-length key from the Spanish commercial catches. This matrix was checked by the sum of products and adjusted to the catches.

In order to get an overall view on the situation in the most recent period, last year a catch curve was constructed using 1988-90 age distribution of the catches. In this curve, ages 8 to 11 appeared to be fully recruited to the fishery, and from this catch curve, the partial recruitment vector was estimated. The mean F for this period for these ages was estimated to be 0.53. The partial recruitment vectors are as follows:

Ages	3	4	5	6	7	8	9	10	11	>11
PR	0.03	0.07	0.2	0.4	0.6	0.99	1	1	1	1

The estimation of F was done with the same method used last year. This method provides biased estimates when the catchability of the survey changes with age. However these biases are not very large (SCR 94/61) and the estimates of F are used to indicate an overall trend and general levels. The estimated values are:

Derivation of fishing mortalities estimated from ages 8-11 for the period 1988-90 and annual Fs for the period 1988-93.

	Biomass 8-11			
Year	survey	catch	C/B	F
1988	6 066	1 298	0.21	0.41
1989	2 573	1 470	0.57	1.10
1990	3 262	497	0.15	0.29
1991	2 481	768	0.31	0.60
1992	2 141	435	0.20	0.39
1993	1 075	111	0.10	0.20
1988-90	11 901	3 265	0.27	0.53

q = 0.518830

Although the value of F for 1993 could be an overestimation due to the fact that the distribution of ages 8-11 in the survey appeared to contribute to a wider range of ages in the 1993 survey than in previous surveys, a drastic decrease in F from the high value of 1989 to the value estimated for 1993 was obvious. This was consistent with the shift towards deeper water (toward other species) which occurred in this fishery in 1992. The fishing mortality found in 1993 was approximately equal to the natural mortality.

d) **Prognosis**

STACFIS noted that despite the high variability in the Russian research survey results, it appears that the stock has steadily declined in recent years. It is believed that this decline is due to excessive fishing mortality at least in the period 1988-91. In order to halt the decline of the stock, STACFIS **recommended** that *the catch of American plaice in Div. 3M should not exceed 1 000 tons in 1995.* This corresponds to the expected by-catches in non-directed fisheries.

10. **American Plaice in Divisions 3L, 3N and 3O** (SCR Doc. 94/55, 56, 58; SCS Doc. 94/13, 16)

a) **Introduction**

The catch in 1993 of 17 257 tons is up almost 5 000 tons from the 1992 level, which was the lowest since the 1950s. The increase was due to a rise in catches of non-Contracting Parties to about 9 000 tons in 1993. Catches by non-Canadian fleets in 1993 were similar to 1990 and 1991 values, after declining in 1992. In 1993, the Canadian catch continued its decline from around 23 000 tons in 1990-91 to 7 600 tons in 1993. As in 1992, most of the Canadian catch was taken by otter-trawl in Div. 3O. The Canadian otter-trawl catch in Div. 3L, which ranged from 14 000 tons to 32 000 tons during 1975-89, declined to only 6 tons in 1993.

It was again obvious that catch statistics for this stock are not adequate. In some years, a substantial portion of the catch is estimated or determined from breakdowns of unspecified flounder catches. This situation was worse for 1993 when about 50% of the total catch was based on Canadian surveillance estimates.

Recent nominal catches and TACs ('000 tons) are as follows (Fig. 10.1):

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
TAC	55	49	55	48	40[1]	30.3	24.9	25.8	25.8	10.5	4.8[5]
Catch	39[2,3]	54[2,3]	65[2,3]	55[2]	41[2,3]	44[2,3]	32[2,3]	34[3,4]	13[3,4]	17.3[4,6]	

[1] Although the TAC was set at 40 000 tons, Canada reduced its domestic quota to 33,000 tons, therefore the effective TAC was 33 585 tons.
[2] Includes a percentage of the "flounder non-specified" catch reported to NAFO by South Korea.
[3] Includes estimates of misreported catches.
[4] Provisional.
[5] No directed fisheries allowed.
[6] Catch may be as high as 19 400 tons.

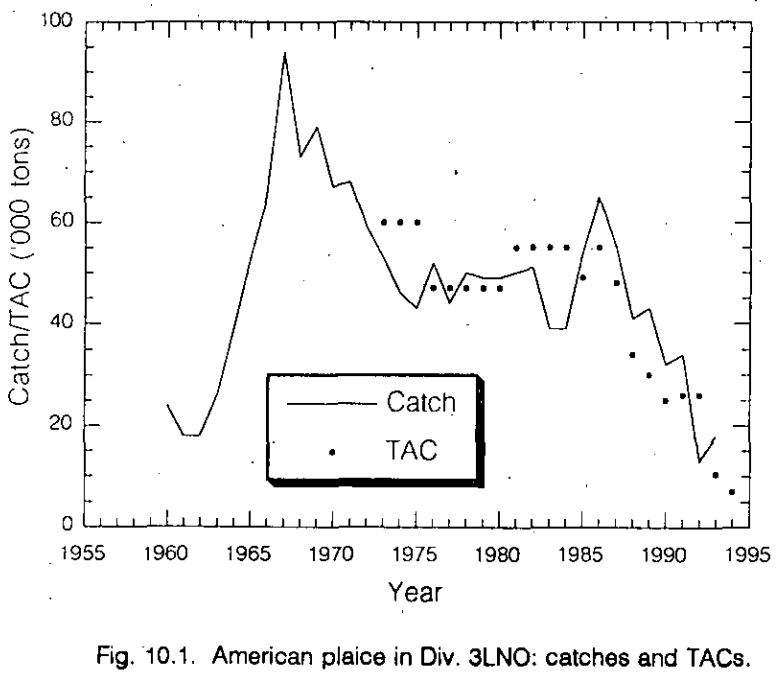

Fig. 10.1. American plaice in Div. 3LNO: catches and TACs.

b) **Input Data**

i) **Commercial fishery data**

Catch and effort. Data from the Canadian commercial fishery in Div. 3LNO from 1956 to 1993 were analyzed using a multiplicative model to obtain a standardized catch-rate series (Fig. 10.2). The data were from Canadian trawlers, tonnage classes 4 and 5, and the same procedure was followed as in the recent assessments of this stock. Catch rates continued the decline which started in 1991 and in 1993 were 75% below the relatively stable level of 1986-90. CPUE in 1993 was the lowest on record. The declines in CPUE in 1991-93 were seen in all three Divisions. Given the major distributional changes in the fishery after 1990, caution should be exercised in evaluating the results of the catch rate analyses. However, it was clear that catch rates of American plaice in the Canadian fishery in all areas of the Grand Bank in 1993 were well below any observed in the 38 year time-series for this fleet.

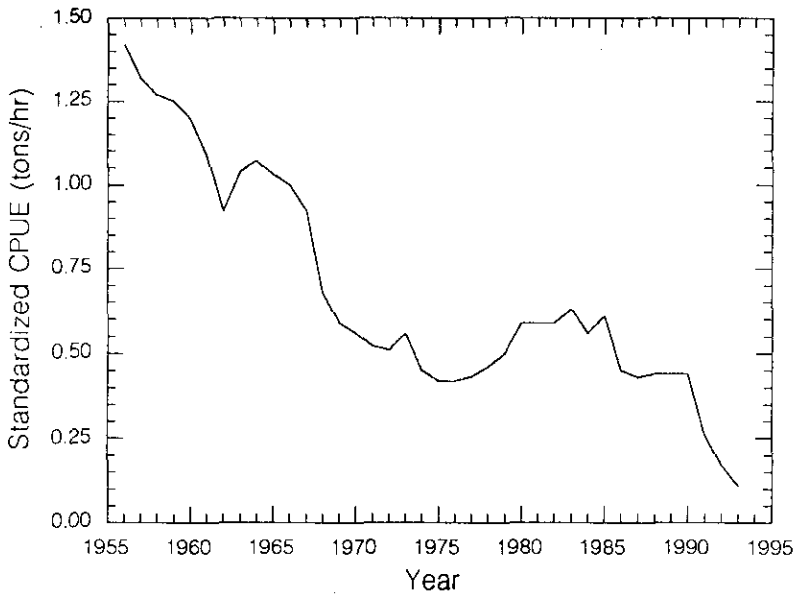

Fig. 10.2. American plaice in Div. 3LNO: standardized catch rates.

Limited data from the Portuguese otter-trawl fishery showed that CPUE in Div. 3N in 1993 was double the 1992 level, and was the highest since 1990.

Catch-at-age and mean weights-at-age. Sampling was available from the Canadian, Spanish, and Portuguese fisheries in 1993. Ages 7-10 comprised the majority of the Canadian catch, with the peak at age 8, compared with a peak of 9. The mean weights were higher at most ages in 1993 compared to 1992, which may reflect the higher proportion of the catch from Div. 3N in 1993.

Length compositions from the Spanish and Portuguese fisheries in Div. 3N were converted to age compositions using age-length keys from the Portuguese fishery and the Canadian research vessel surveys. This catch-at-age indicated that the peak was age 8 in 1993, agreeing with the Canadian fishery. This was also the same cohort which dominated catches in the Regulatory Area from 1989 to 1992. The mean weights-at-age in 1993 were lower than those observed in the Canadian fishery, and lower than those observed in the Spanish and Portuguese fisheries in 1992.

STACFIS noted that it was not possible to calculate an age composition for the total catch in 1993 because catches by non-Contracting Parties, which accounted for 50% of the

catch, did not have sampling data, and are thought to catch a greater proportion of small fish than other fleets in the fishery.

ii) **Research survey data**

Canadian stratified-random groundfish surveys. Data from spring surveys (Fig. 10.3) in Div. 3L, 3N and 3O were available from 1971 to 1993, excluding 1983 in all areas and 1971, 1972 and 1974 in Div. 3O. Age-by-age abundance estimates for Div. 3L, 3N and 3O were available from 1971-93, but only preliminary estimates of biomass were available from the 1994 survey.

In Div. 3L, the trawlable biomass index was highest from 1978-82, declined to a lower but stable level from 1985 to 1988, then declined by 35% or more in each year from 1989 to 1994, and is currently at a level which is only about 3% of the 1985-88 mean value. In Div. 3N, the trawlable biomass index also showed a decline in recent years, with 1992 and 1994 being the lowest points by far in the series, about 55% lower than the 1993 value. In Div. 3O, the biomass index has shown a consistent decline since 1990, with the 1994 value being the lowest in the series, down 30% from the previous low in 1993.

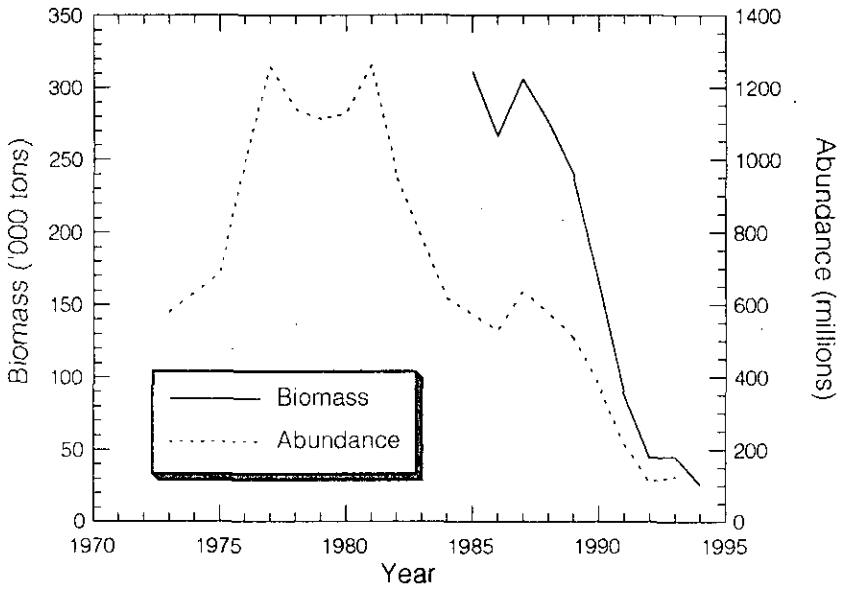

Fig. 10.3. American plaice in Div. 3LNO: biomass estimates from Canadian spring surveys.

In all areas, the trawlable abundance was generally highest in the late-1970s and early-1980s as the strong year-classes of the early-1970s dominated survey catches. Abundance in 1992 was much lower than in any other year, having declined by about 45% in each of 1991 and 1992 to a level which was only 10% of peak estimates in the late-1970s and early-1980s. The total abundance index for 1993 was 13% higher than in 1992 and was the second lowest estimate in the series. In Div. 3L the decline is worse, with abundance in 1992 being only 3% of the peak abundance in the 1977-80 period. In either 1992 or 1993, the abundance in Div. 3LNO at each age over 3 years was the lowest ever observed, in most cases by a wide margin. In the late-1970s, fish aged 9 years and older, which is an approximate measure of spawning stock numbers, made up 35 to 45% of the abundance index. By 1993, fish in these age groups made up only 20% of the index, and the estimates of abundance at these ages had declined by about 95% during this period.

STACFIS noted that from 1975 to 1987, the abundance estimates on a cohort increased each year between ages 7 and 8, indicating that the fish at age 7 were less recruited to the survey trawl than at age 8. Since 1987, the estimates of every cohort have decreased

between ages 7 and 8, which indicates a sudden increase in mortality. An analysis of total mortalities-at-age (Z values) indicated steadily increasing Zs at most ages in Div. 3L in recent years, and that Zs at ages 8+ were often above 1.0. The same increasing trends were not visible at all ages in Div. 3N and 3O, although Zs around 1.0 were not uncommon at the older ages in both datasets.

From Canadian autumn surveys (Fig. 10.4) in Div. 3L, population estimates have shown a sharp downward trend since 1984 to a level in 1993 which is only 8% of the estimates in the early-1980s. Similar to the spring surveys, the 1993 abundance estimates at every age older than 4 years were the lowest in the series.

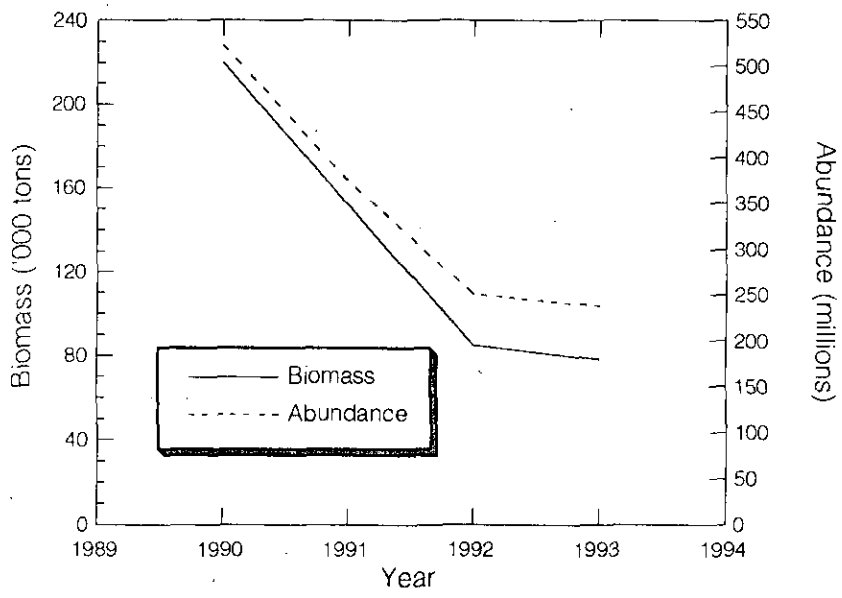

Fig. 10.4. American plaice in Div. 3LNO: biomass estimates from Canadian autumn surveys.

From 1990 to 1993, autumn surveys were also carried out in Div. 3NO. The index of total abundance for Div. 3LNO combined increased between spring and autumn in each year, with the increase ranging from 40 to 125%. This spring to autumn increase has not been observed consistently in Div 3L in other years and cannot be explained. As well, the estimates of total abundance from the autumn surveys in Div. 3L have declined by 30% or more in each of the last 3 years, while there has been no trend in either Div. 3N and 3O. For Div. 3LNO in total, the autumn surveys indicate a decline in abundance of 55% from 1990 to 1993, compared to a decrease of 67% during this period in the spring surveys.

The 1986 and 1987 year-classes made up about 40% of the total abundance index in the both the spring and autumn surveys in 1993.

Canadian juvenile groundfish surveys. Stratified-random surveys of Div. 3LNO were conducted inside the 91 m depth contour from 1985 to 1988 and were extended to 183 m in the 1989 to 1991 surveys and to 273 m in the 1992 and 1993 survey. In 1993, large catches of juveniles were taken in the Regulatory Area in Div. 3NO, consistent with previous surveys. Two other sites were identified as areas of major concentrations of juveniles: the Whale Deep area in Div. 3O, and the north and northeast slope of Div. 3L. Although the areas of concentration of juvenile American plaice were fairly localized, the distribution of adults was more widespread and there was considerable overlap between the distributions of adults and juveniles, similar to other years. American plaice were generally found in deeper and colder water in Div. 3L than in Div. 3NO.

In Div. 3L, the total abundance was relatively stable from 1989 to 1993, however the biomass continued to decline since 1990 and in 1993 was 25% lower than the 1992 estimate. In Div. 3N, total abundance and biomass increased in 1993 by about 50%, however, STACFIS previously noted (NAFO Sci. Coun. Rep., 1993) that the 1992 abundance estimate was likely biased downward as a result of an unusual random allocation of sets in a stratum (360) with historically high abundance. In Div. 3O, total abundance and biomass were similar to the 1992 estimates. No age data were available from the 1993 survey.

USSR/Russian surveys. Results from USSR/Russian surveys in Div. 3LNO were available for 1972-91, but no comparable survey was done in 1992 and the 1993 results were not available at this meeting. STACFIS recognized the importance of the Russian spring survey data in providing an index of abundance for this stock and recommended that the *estimates from the 1993 and 1994 surveys be made available in June 1995 if possible.*

iii) **Biological studies**

Maturity at age was calculated for each Division and sex from 1971 to 1993. Age, maturity and length frequency data collected from Canadian spring research vessel surveys were analyzed. For females, the combined 3LNO estimate of the age at which 50% of the fish are mature (A_{50}) showed a decline from a mean of 10.6 years old in 1975-82 to a mean of 8.4 years old since then. In Div. 3N and 3O, estimates of A_{50} have shown signs of increasing in recent years but there was no similar trend in Div. 3L. For males the combined Div. 3LNO estimates of A_{50} were 6.0 years old in 1975-82 and 4.8 years old in 1984-93, with the largest decline occurring in Div. 3L

Both the male and female Div. 3LNO combined estimates of A_{50} were significantly correlated with the Div. 3LNO age 5+ biomass estimate from the Laurec-Shepherd analysis in the 1993 assessment, using the Spearman rank correlation. The A_{50} estimates for males and females in Div 3L and 3N were significantly correlated with RV abundance estimates but those for Div 3O were not.

Because it was not possible to separate the SPA population numbers at age by sex for this assessment, *the maturity ogives at age could not be applied to the population estimates.* The assumption in recent assessments that age 9+ represented spawning stock is probably reasonable, as this is close to the mean of the female A_{50} estimates. However, the maturity ogives should be used in future calculations of spawning stock biomass if possible, given the trends indicated in these data.

c) **Estimation of Parameters**

i) **Sequential population analysis**

STACFIS concluded that deficiencies in catch-at-age for 1993 as discussed above precluded the use of catch-at-age for 1993 in any SPA-based models. It was also noted that the 1993 assessment pointed out several problems with recent SPA-based assessments for this stock, most noticeably the low level of confidence in the catch and catch-at-age in many years, the lack of fit indicated by the models in recent years, and the severe bias seen in the retrospective pattern in estimates of stock size and fishing mortality in consecutive assessments.

d) **Assessment Results**

STACFIS concluded that the stock had declined rapidly and substantially from the mid-1980s to the present, and it was clear that the stock was at a record low level. Total mortality had been high in recent years, although it was not clear if its recent increases in all areas could be fully attributed to the fishery.

e) **Prognosis**

American plaice in Div. 3LNO is currently at a level far below historic values (Fig. 10.2 and 10.3) The SSB is at an extremely low level and will not improve if exploitation of recruiting year-classes occurs. Given the magnitude of the rapid declines indicated by the survey data, it is not clear if this decline will be halted even in the absence of directed fisheries. Given the extremely low population size in 1993, concerns about the SSB, and the expectation of very poor recruitment, STACFIS **advised** that there be no fishing on American plaice in Div. 3LNO in 1995. Prospects for rebuilding the stock remain unclear, as there are no data to suggest that this stock has ever been at such a low level before.

11. **Witch Flounder in Divisions 3N and 3O** (SCR Doc. 94/49; SCS Doc. 94/12, 13)

a) **Introduction**

Reported catches in the period 1970-84 ranged from a low of about 2 400 tons in 1980 and 1981 to a high of about 9 200 tons in 1972. With increased effort, mainly by EU-Spain and EU-Portugal in 1985 and 1986, catches rose rapidly to 8 800 and 9 100 tons, respectively. This increased effort was concentrated mainly in the Regulatory Area of Div. 3N. Non-Contracting Parties such as South Korea (Contracting Party as of December 1993), Cayman Islands, Panama and USA also contributed to increased catches.

Recent TACs and catches ('000 tons) are as follows (Fig. 11.1):

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
TAC	5	5	5	5	5	5	5	5	5	5	3[2]
Catch	3	9	9	8	7	4	4	5[1]	5[1]	4[1]	

[1] Provisional.
[2] No directed catch.

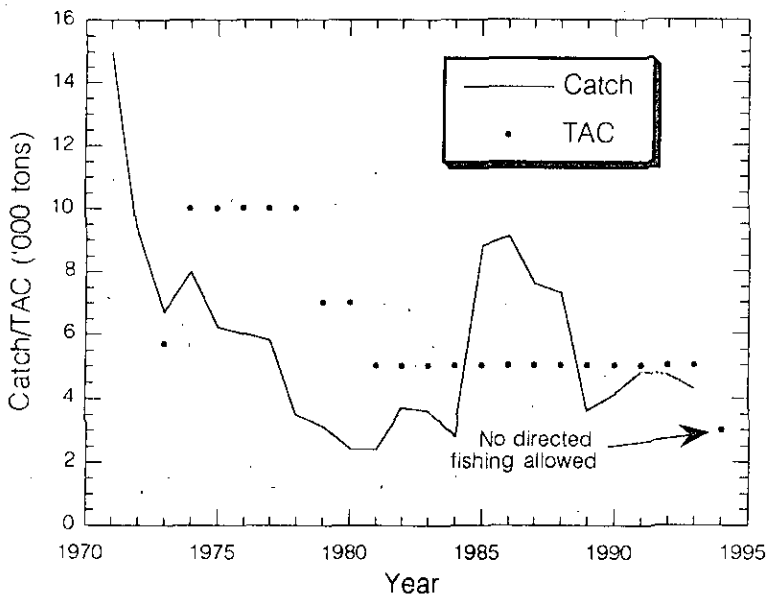

Fig. 11.1 Witch flounder in Div. 3NO: catches and TACs.

In 1987 and 1988, the total catch was about 7 500 tons, declining to between 3 700 and 4 900 tons in 1989 to 1992 with a catch of 4 400 tons estimated for 1993. Catches by Canada ranged from 1 200 tons to 4 900 tons in recent years (about 2 650 tons in 1991 and 4 300 tons in 1992) and were mainly from Div. 3O. Catches by USSR/Russia vessels declined from between 1 000 and 2 000 tons in 1982-88 to less than 100 tons in 1989-90, and to 0 in 1991 to 1993.

Catch statistics are not adequate for this stock, given that there are catches by non-Contracting Parties which are not reported to NAFO (greater than 30% for 1991 and 1992) and are only estimated from surveillance reports. There are also catches which must be estimated from breakdowns of unspecified flounder catches.

b) **Input Data**

i) **Commercial fishery data**

Catch rates. The catch/effort data from the Canadian fleet fishing mainly in Div. 3O were analyzed with a multiplicative model to derive a standardized catch-rate series for hours fished.

The regression was significant ($p < 0.05$), explaining 76% of the variation in catch rates. The analysis indicated very little in the way of trends, however, the most recent three data points were relatively stable at the lowest level in the time series. From the analysis it was evident that the best time of the year for fishing witch flounder is in the late-winter and early-spring. It was recognized, however, that fishing during this period is on prespawning concentrations when fish are highly aggregated and as such these catch rates might be more representative of density rather than stock size. Consequently, when catch rates are at a very low level such as those of recent years it was felt it could be an indication of a seriously depleted stock.

Catch-at-age. Data were available from the Canadian commercial fishery from 1979-93. The age structure in this fishery (almost entirely in Div. 3O) was very stable over the time series ranging from age 5 to age 16 with most of the catch coming from ages 9-12, with some slight increase in the younger ages in the more recent years. It is known, however, that historically the fishery occurred primarily in winter-spring on pre-spawning concentrations comprised of larger fish. Recently, besides fishing pre-spawning concentrations, the fishery was spread to other seasons probably over a wider range of sizes which may explain these differences. Mean weights-at-age data from the commercial fishery in recent years showed a slight increase in the major age groups which might also reflect a change in fishing strategy.

ii) **Research survey data**

Biomass estimates. Estimated biomass from Canadian surveys in Div. 3N has been at very low levels during 1971-94 and in most years was less than 1 000 tons (Fig. 11.2). For Div. 3O estimates of biomass fluctuated annually, on average between 6 000 and 12 000 tons particularly in the late-1980s. It was observed that despite the fact that survey coverage during 1991-93 has been the most complete in the time series, including much deeper water, there was a sharp declining trend since 1989 with the 1993 value (1 500) approximating the lowest observed in the time series. The preliminary estimate from the 1994 Canadian spring survey indicated a biomass of about 6 600 tons. The significance of this increase from 1993 can not be evaluated until distribution of the survey catches can be examined.

Age composition. The age structure for the years from both the spring 1984-93 and autumn (1990-93) surveys in Div. 3O (data from Div. 3N insufficient) indicated that the age structure was quite similar to that from the Canadian commercial fishery.

c) **Prognosis**

The biomass in Div. 3N has been and continues to be quite low and the catch in this Division in 1993 is very low compared to previous years. Most of the stock is located in Div. 3O.

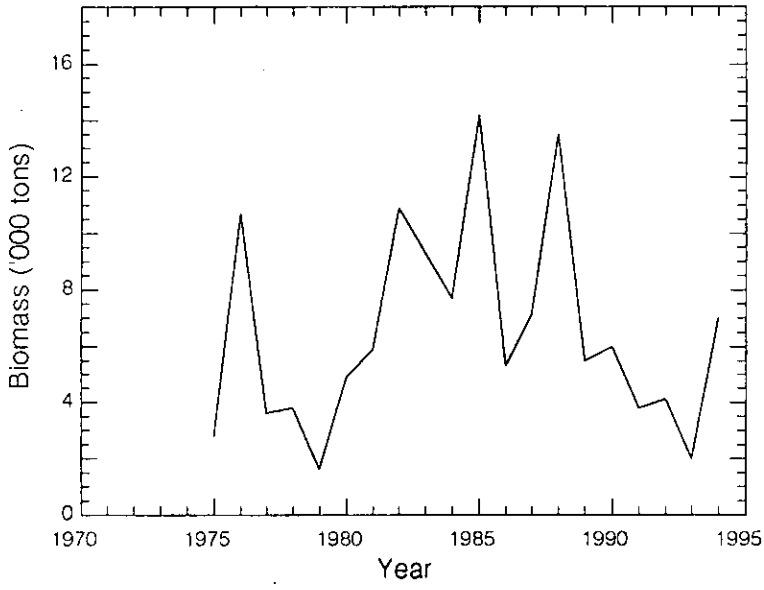

Fig. 11.2. Witch flounder in Div. 3N and 3O: biomass estimates from Canadian surveys.

The estimated trawlable biomass during most of the 1980s in Div. 3O would suggest stability in the range of 6 000 tons assuming that the 1985 and 1988 (and now possibly 1994) points are an artifact of fish moving in over the Bank occupying large strata resulting in estimates that may be biased upwards. In 1992 STACFIS noted that there were some signs to suggest that the stock has declined. Since 1990, there is evidence of a sharp decline in biomass in Div. 3O. This decline has continued and the 1993 values are near the lowest observed in the time series. This is of particular importance since the last four surveys have covered a much more extensive depth range.

Based upon the data presented here, it is considered that the assessment mainly reflects stock status in Div. 3O. If the biomass trajectory of the recent period is correct it indicates that recent catch levels in this Division are too high. Given the current assessment STACFIS **advised** that there should be no fishing on witch flounder in 1995 in Div. 3N and 3O to allow for rebuilding of this stock to former levels.

12. Yellowtail Flounder in Divisions 3L, 3N and 3O (SCR Doc. 94/44, 46, 58)

a) Introduction

Nominal catches increased in 1993 by about 3 000 tons to around 13 600 tons. The main reason for the rise in 1993 was an increase in the catch of non-Contracting Parties. Canadian catches have been stable from 1991 to 1993 at about 6 700 tons per year. Catches by EU vessels were at very low levels in 1992 and 1993, and catches by South Korea declined from 3 800 tons in 1992 to 0 in 1993. Catches exceeded the TACs in each year from 1985 to 1993.

As noted in previous reports of Scientific Council, catch statistics for this stock are not adequate, with as much as 25% of the catch in some years in the mid-1980s coming from surveillance estimates and categorization of unspecified flounder catches. About 33% of the 1991 catch was estimated, but this situation was much worse in 1993, when approximately 50% of the catch was derived from surveillance reports. STACFIS noted that the total catch in 1993 may have been 200 tons higher than the figure of 13 600 tons agreed to.

Recent TACs and catches ('000 tons) are as follows (Fig. 12.1):

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
TAC	17	15	15	15	15	5	5	7	7	7	7[3]
Catch	17[1]	29[1]	30[1]	16	16[1]	10[1]	14[1]	16[1,2]	11[2]	14[1,2]	

[1] Includes estimates of misreported catches.
[2] Provisional.
[3] No directed fishing allowed.

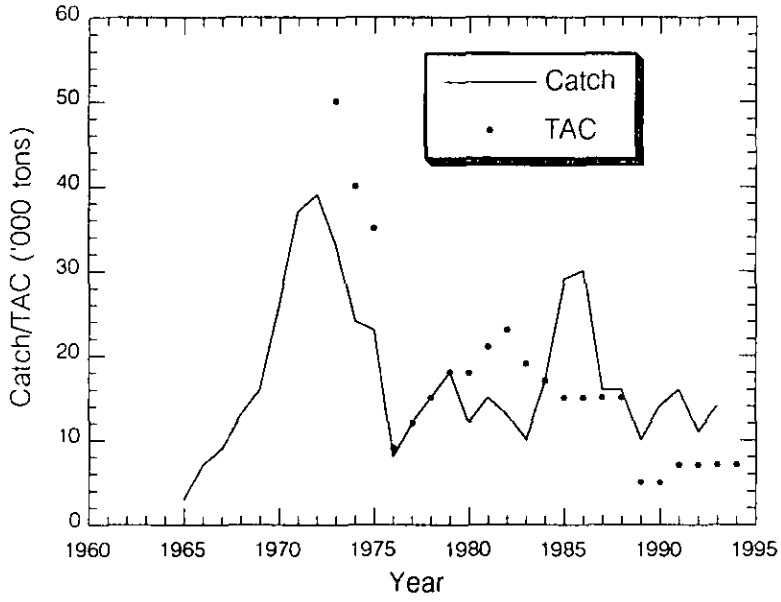

Fig. 12.1. Yellowtail flounder in Div. 3LNO: catches and TACs.

b) **Input Data**

i) **Commercial fishery data**

Catch rates. A multiplicative model was used to analyze the Canadian catch and effort data as in recent assessments. In 1991, the catch rate declined by 45%, to the lowest value in the time series, remained at about this level in 1992, then increased in 1993 (Fig. 12.2). The index in 1991 and 1992 was about one-third lower than the previous minimum value in the mid-1970s, and the 1993 point was still well below that level. The low values from 1991-93 were due in part to a switch in effort by the fleet to Div. 3O where a mixed fishery for American plaice and yellowtail flounder occurred. The CPUE in Div. 3N, where most of the stock was located, had not declined as sharply in recent years as the CPUE in Div. 3O. No series of catch-rate data were available from the fisheries in the Regulatory Area.

Catch-at-age and mean weights-at-age. Catch-at-age was calculated from length frequencies and otolith samples from the Canadian fishery in 1993. As was the case in 1992, no sampling data were available from any fisheries for yellowtail flounder in the Regulatory Area. It was not appropriate to apply the age composition from the Canadian fishery, to most otter-trawl catches in the Regulatory Area, because of differences in selectivity observed previously in these fisheries. Therefore it was not possible to calculate an age composition for about 50% of the catch in 1993, all of which was caught by non-Contracting Parties.

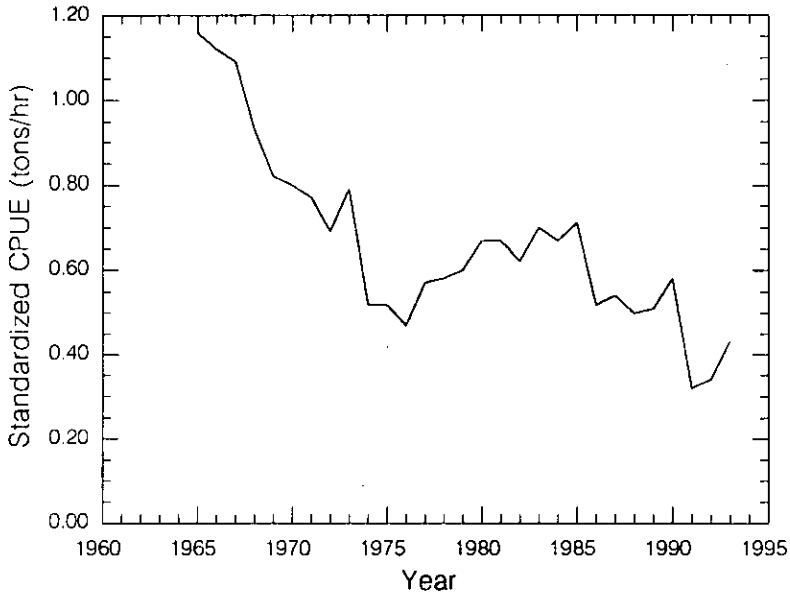

Fig. 12.2. Yellowtail flounder in Div. 3LNO: standardized catch rates.

In the Canadian landings, ages 6-8 dominated in 1992, consistent with other years. The mean weights-at-age from the Canadian catch were lower at ages 5 and 6 than in previous years, but were similar to earlier values at ages 7 to 9.

Given the continuing uncertainties with catch and the lack of sampling data from some fleets and years, no catch-at-age or mean weights-at-age have been calculated for the total removals for many of the years since 1984.

ii) **Research survey data**

Canadian stratified-random spring surveys (Fig. 12.3). Surveys have been carried out by Canadian research vessels in Div. 3LNO each year from 1971 to 1994 with the exception of 1983. The surveys from 1984 to 1994 were comparable in terms of coverage and vessel/gear used. Most of the trawlable biomass of this stock was found in Div. 3N, where the index declined from about 60 000 tons in 1985-86 to between 29 000 and 43 000 tons during 1988-94. In Div. 3L the trawlable biomass has declined steadily from about 15 000 tons in 1984-85 to practically zero in 1992-94. In Div. 3O, the biomass index was relatively stable around 15 000 tons from 1988 to 1991, however, the 1992 and 1994 values were around 6 000-7 000 tons, compared to 27 000 tons in 1993. There was a high degree of variability associated with the 1993 estimate, and the 1992 and 1994 surveys suggest that this 1993 estimate may have been anomalously high.

The total abundance index of this stock was relatively stable, ranging between 240 and 340 million fish from 1975 to 1984, declined steadily until 1988, and has ranged from 85 million to 150 million in the 1988-93 surveys, with the lowest value in the time series occurring in 1992. The Canadian survey catches were usually dominated by yellowtail flounder aged 5-8 years. In 1993, the 1986 and 1987 year-classes, ages 7 and 6 years, respectively, comprised 65% of the total abundance. An analysis of total mortality rates (Zs) from these surveys indicated Z values around 2 at ages 8 and 9, as has been noted in previous analyses. The current analysis also suggested increases in Z at ages 4 to 6 since 1985, although there is considerable variability in the estimates. STACFIS noted that the age-by-age information from the 1994 spring survey was not available at this meeting.

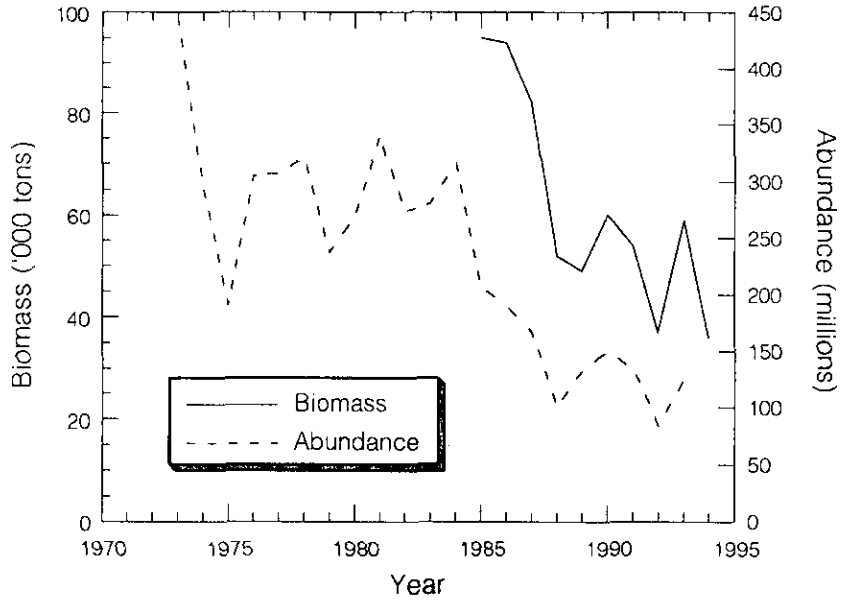

Fig. 12.3. Yellowtail flounder in Div. 3LNO: biomass and abundance estimates from Canadian spring surveys.

USSR/Russian groundfish surveys (1972-91). The trends in stock size in the USSR/Russian surveys were similar to those in Canadian surveys. However, there was no comparable survey in 1992 and data from the 1993 survey were not available at this meeting. STACFIS recognized the importance of the Russian survey data in providing an index of abundance for this stock and **recommended** that *the estimates from the 1993 and 1994 USSR/Russian groundfish surveys be presented in June 1995, if possible.*

Canadian stratified-random autumn surveys (1990-93) (Fig. 12.4). The trawlable biomass estimates from the autumn surveys in Div. 3LNO from 1990 to 1992 ranged from 38 000 to 48 000 tons, although the 1992 estimate was biased downward by the omission of one stratum and part of another which historically had relatively high yellowtail flounder abundance. The 1993 estimate of trawlable biomass was 67 000 tons, with all the increase occurring in Div. 3N, unlike the increase in the spring 1993 survey, which was in Div. 3O.

Canadian juvenile groundfish surveys. From 1985 to 1993, annual stratified-random surveys have been conducted in Div. 3LNO, directed at juvenile American plaice and yellowtail flounder. In Div. 3L, the biomass has declined steadily since 1985 to the lowest level in the series in 1993. The biomass estimate for Div. 3N which had shown a steady increase since 1988, and which declined in 1992, showed an increase in 1993. In Div. 3O, the 1993 biomass estimate remained at the same level as seen in 1992, both of which were 20% higher than in 1991.

In 1993 the total abundance at age showed a 25% increase from the 1992 estimate. This was due mainly to an increase in abundance of yellowtail flounder of ages 1 to 6 years. The abundance of ages 1-4 yellowtail flounder in 1993 increased by 14% but was the third lowest in the 8 year time series, while the abundance of age 7+ was the highest in the time series due mainly to the contribution of the 1986 cohort. The 1986 year-class, which was the second strongest in the time series at almost every age, next to the 1985 year-class, contributed 61% to the total estimate of age 7+ fish in 1993.

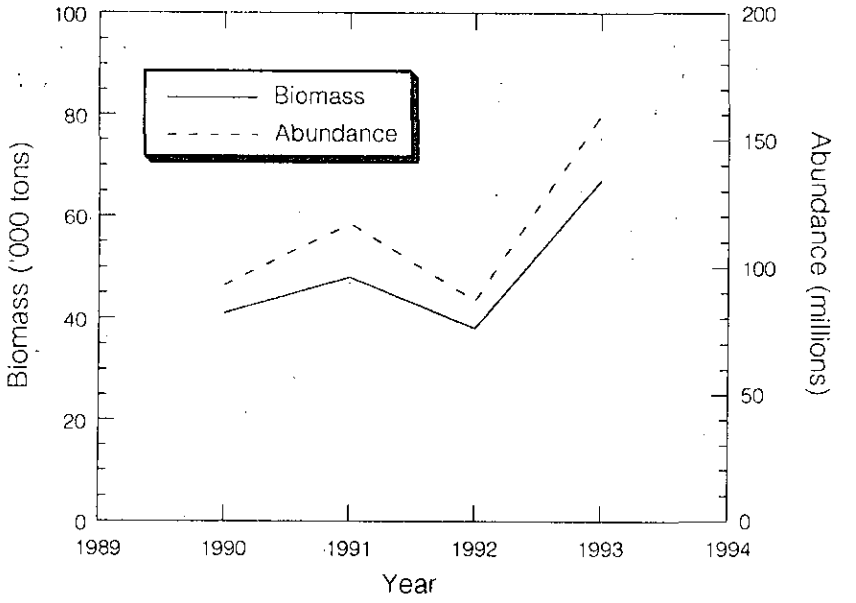

Fig. 12.4. Yellowtail flounder in Div. 3LNO: biomass and abundance from Canadian autumn surveys.

The 1992 year-class, at age 1, was the third lowest in the 8-year time series of age 1 abundance estimates, and well below the long-term average.

The 1991 year-class, at age 2, was the third highest in the time series, but only slightly above the long-term average.

The 1990 year-class, at age 3, was the fourth lowest in the time series, and well below the long-term average.

The 1989 year-class, at age 4, was the third highest in the time series, but was only slightly above the long-term average.

In the 1993 survey the majority of the 1988-92 year-classes, ages 1 to 5 years, were found in the Regulatory Area, which agrees with the usual pattern for juvenile yellowtail flounder in Div. 3NO.

In general, there was good agreement between the year-class estimates from the spring surveys and those from the juvenile surveys. However, some caution is advised in interpreting these correlations due to the shortness of the time series of juvenile surveys.

Stock distribution. Three series of Canadian research vessel surveys of Div. 3LNO: spring groundfish surveys, 1971-94; autumn groundfish surveys, 1983-93; and late summer juvenile groundfish surveys, 1985-93, were examined in order to detect changes in distribution of yellowtail flounder. The decline in the northern range of concentrations occurred during a sustained cold period, 1983-93, on the Grand Bank, and at a time when the stock has been at or near its lowest level for a number of years. Contraction of the distribution from the northern part of the bank to the area on and to the west of the Southeast Shoal may simply reflect movement of parts of the population from marginal habitats but the cause is unknown at present. However, this contraction of the stock to a smaller geographical area makes it very vulnerable to over exploitation.

c) **Assessment Results**

Sequential population analysis (SPA) has been used in the past to assess this stock but has not been used since 1984 as the basis of advice. Since then, it has been concluded that the very high values of mortality at the older ages could not be fully explained and that the SPA models attempted were not appropriate. In 1990, the previously noted difficulties with the catch-at-age were raised, with the conclusion being that catch-at-age based models, such as SPA, were not suitable for this stock. Confidence in the catch and catch-at-age data for this stock remains at a low level, especially with the lack of sampling from fisheries in the Regulatory Area in both 1992 and 1993. Thus, evaluation of stock status continues to rely heavily on the interpretation of the available indices of abundance.

As in the recent assessments, there are 5 indices used to evaluate this stock (Canadian spring and autumn groundfish surveys, USSR groundfish surveys, Canadian juvenile flatfish surveys, and C/E from the Canadian commercial fleet) and most indicate that the stock is still at a low level compared to historic values. The decline in stock size in the mid- to late-1980s was caused by poor recruitment from the year-classes of the early-1980s and a rapid increase in catches to about 30 000 tons in 1985-86 from 10 000-15 000 tons in 1980-83. The year-classes of 1984-86 were stronger than their immediate predecessors and supported increased catches from 1989 to 1991. Available data suggest that there has likely been increased fishing mortality at ages 5 and younger in the late-1980s and early-1990s than in earlier years. Given the continuing inadequacies with the catch and sampling data, and still unresolved questions about the natural mortality-at-age for this stock, it remains impossible to estimate the level of fishing mortality in recent years.

d) **Prognosis**

The 1993 assessment concluded that the stock has remained at a low level, but that "a catch of 7 000 tons (current TAC) in 1994 should not be detrimental to the stock". It was then further reported that if total catches continue to exceed the TAC, the opportunity for this stock to rebuild to historic levels will likely not be achieved. Little has changed in this assessment. It should be noted that if the fisheries in the Regulatory Area continue at the 1993 level, with suspected high exploitation rates of juveniles, then this stock will likely remain low and perhaps decline further, particularly if predictions of reduced recruitment are accurate. Surveys prior to 1993 suggested that the 1987 and 1988 year-classes were average at best, although they are estimated to be somewhat higher in 1993. However, the juvenile surveys also indicate that the 1989 to 1992 year-classes may be average to well below average, and the 1994 spring survey showed a return of the biomass to the 1992 level.

It is important to note that even though most indices showed an increase in 1993, stock size is still well below that observed for most of the 1970s and early- to mid- 1980s, and that recent stability at this level should not be viewed as a sign that recent catch levels and exploitation patterns have been appropriate. There are also concerns, because the stock distribution has contracted to a relatively small area west of the Southeast Shoal, and since the bottom temperatures over most of the Bank have been below average for a number of years, that the stock at present is very vulnerable. It is also difficult to ignore the fact that many groundfish fisheries on the Grand Bank have either collapsed or been reduced to very low levels, which leads to the question as to how long yellowtail flounder will be able to maintain stability at its current low level.

The stock has remained at a low level for several years with catches around 10 000-16 000 tons (*versus* TACs of 5 000-7 000 tons) so further reductions in the total catch will be needed to allow some growth in stock size. Although there is an agreement that there will be no directed fishing on this stock in 1994, the actual reduction in catches will depend upon by-catch taken in other fisheries and catches by non-Contracting Parties. STACFIS **advised** that this stock should be rebuilt, and to rebuild this stock as fast as possible, no fishing should be permitted on yellowtail flounder in Div. 3LNO in 1995. A catch of 7 000 tons may allow some rebuilding, depending on the age composition of the catch and the strength of recruiting year-classes. Catches above the TAC level of 7 000 tons have not resulted in any growth in stock size in recent years. It should also be noted that continuing unregulated catches will hinder stock rebuilding, particularly if these catches consist mainly of juvenile yellowtail flounder.

13. **Greenland halibut in Subareas 0 and 1** (SCR Doc. 94/9, 10, 17, 18, 31, 42, 47; SCS Doc 94/3, 5, 10, 14, 15)

a) **Introduction**

The annual catches in Subareas 1 and 0 were around 9 000 tons in the period 1984-89 with more than 80% taken in Subarea 1, where most catches were taken inshore in the West Greenland fjords (Div. 1A). Before that time catches were low with Div. 0B contributing about 45% of the annual catches. In Subarea 1 a small offshore fishery for Greenland halibut began in 1987, mainly conducted by Japan and Norway. It has since then increased slowly to 4 300 tons in 1993. In Div. 0B catches increased considerably in 1990 due to development of a new trawl fishery.

Recent catches are 26 627 tons in 1992 and 24 038 tons in 1993 with 62% taken in Subarea 1 (Fig. 13.1).

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

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Recommended TAC	-	25	25	25	25	25	25	25	25	25	25
Effective TAC	-	25	25	25	25	25	25	25	25	25	25
Div. 0B	+	1	+	+	1	1	15[3]	11[1]	11[1]	8[1]	
Div. 1BCDEF (offshore)	+	+	0	1	2	1	1	1[1]	3[1,2]	4[1]	
Div. 1A (inshore)	7	9	8	8	7	7	8	10[1]	12[1,2]	12[1]	
Total	7	10	9	10	10	10	24	22[1]	27[1,2]	24[1]	

[1] Provisional
[2] Including 1 457 tons non-reported
[3] Catches under revision

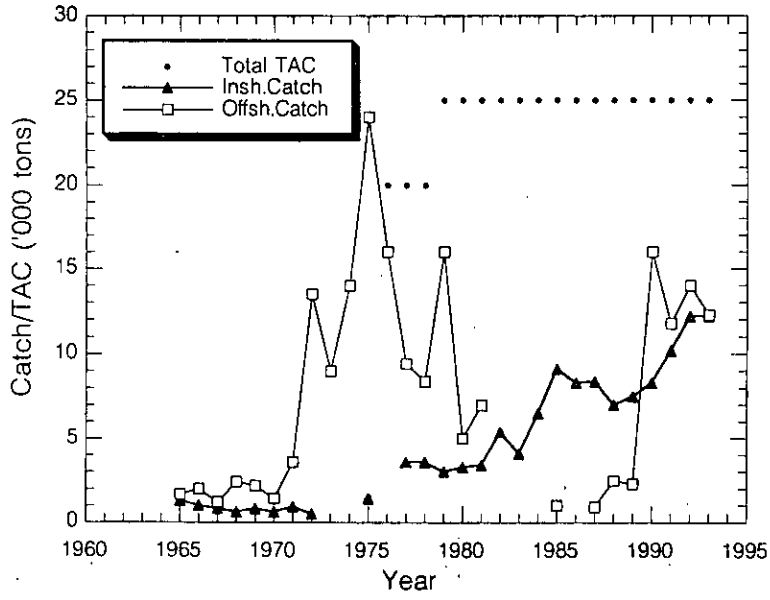

Fig. 13.1: Greenland halibut in Subareas 0 and 1: catches and TACs.

The fishery in Subarea 0. Prior to 1984, USSR and GDR conducted a trawl fishery in the offshore part of Div. 0B. Also Faroese longliners have regularly taken minor catches in this area. In 1990 and in 1991 the Faroese longline catches were about 2 500 tons, but they dropped to a low level in 1992 and no catches were recorded from Faroe Islands in 1993. Since 1990 the trawl fisheries in Div. 0B have increased significantly. Catches in Div. 0B jumped from 907 tons in 1989 to about 14 500 tons in 1990 but decreased to 7 613 tons in 1993. The fishery in Div: 0B was restricted by the ice coverage and in 1993 most of the fishing took place during August-December.

No catches were reported from Div. 0A.

The offshore fisheries in Subarea 1. The offshore fishery in Subarea 1 (Div. 1C+1D) increased from about 900 tons in 1987 to 4 289 tons in 1993. Japanese trawl catches amounted to 1 434 tons in 1993. The Norwegian trawl fishery contributed with 1 775 tons and minor catches derived from the longline fishery by Faroe Islands (113 tons).

The inshore fisheries in Subarea 1. Most of the total catches in Subarea 1 were taken in the fjords of Subarea 1 by Greenland (74%), almost entirely in Div. 1A. Three areas comprise the fishery: Ilulissat (69°N), Ummannaq (71°N) and Upernavik (74°N) of which Ilulissat makes up about 40% of the catches. In Ilulissat and Ummannaq the fishery has been regulated due to concern on the stock status, and fishing effort is diverted to northern areas in Upernavik. Catches maintained a level of 12 200 tons from 1992 to 1993. The inshore Greenland fishery is carried out by gillnet and longline, either by boats below 20 GRT or by means of dog sledges, typically in the inner parts of the fjords at depths of 500-800 m. Since the mid-1980s gillnets became more common and in the period 1986-89 gillnets and longlines accounted equally for the catches in Div. 1A. Since then the annual proportion of catches from each gear has varied considerably, but in 1993 longline catches comprised about 76% of the total inshore catches, due to regulations in use of fishing gear. In recent years the inshore catches have been evenly distributed throughout the year.

b) **Input Data**

i) **Commercial fishery data**

Length frequency data were obtained both from a Norwegian factory trawler from offshore fishery in Div. 1CD, from catches taken deeper than 600 m by the Japanese vessel '*Shinkai Maru*' in Div. 1CD and from a trial fishery by a Norwegian longliner in Div. 1A.

For 1993 catch-at-age and weight-at-age data in Subarea 1 were available from the offshore fishery in Subarea 1. Catch-at-age data for Div. 0B from the period 1988-93 were this year provided by Canada. No maturity data were available.

From data collected by observers of the otter-trawl fisheries in Div. 0B 1988-93, standardized catch-rate series were calculated. From 1990 to 1991 standardized catch rates were fairly constant, but they declined significantly from 1991 to 1993. Catch rates for a Japanese trawler for the period 1987-92 showed a drop in 1991 but a 1992 value similar to the average of the years 1987-90. No catch rates were available for 1993 from the Japanese fleet. Average catch rates from the Norwegian trawl fishery in Div. 0B and 1CD and from Russian trawl fishery in Div. 0B were provided by the two nations for the period 1990-93. Catch rates in all Divisions decreased by about half during the period 1991-93.

Catch-at-age for the inshore areas in Subarea 1 were based on sampling from the commercial fishery with gillnets and longlines. Length samples were available for the entire period 1988-93, however, due to insufficient sampling from the fishery in 1991 and 1992, length samples for these years were pooled. Mean weight-at-age and the age-length data were pooled for the period 1986-88 and used to calculate catch-at-age for the period 1988-92. Catch-at-age for the period 1988-93 were rather stable, but the insufficient sampling makes it difficult to interpret.

ii) **Research survey data**

Since 1987 bottom-trawl surveys have been conducted in Subarea 1 jointly by Japan and Greenland. In 1993 a survey was conducted in August/September. The survey covered Div. 1B to 1D at depths between 400 and 1 500 m. The trawlable biomass was estimated to be 37 700 tons, which was remarkably lower than in 1992 (62 000 tons) and 1991 (77 000 tons). Abundance estimates for Div. 1CD for the period 1988-92 fluctuated in the range 35-53 million but declined since 1991 to 30 million in 1993. Apart from ages 2 and 3, the decline was seen for all age groups from 1991 to 1993.

In the period 1990-92 the total biomass has shown a declining trend (see text table below). In the same period offshore catches were in the range 11 000-15 000 tons, compared to catches of about 2 000 tons or less in the period 1984-89.

Biomass estimates ('000 tons) from Greenland/Japanese surveys and German/USSR (GDR until 1989, EU-Federal Republic of Germany since 1990-91 and USSR until 1991, Russia since 1992) surveys for the years 1987-93 in Subareas 0 and 1 are as follows:

Year	USSR(RUS)/GDR(FRG) Survey		Japan/Greenland Survey		Total
	0B	1BCD	1BCD	1ABCD[d]	0B+1ABCD[e]
1987	37	56	54[a]	58[a]	95
1988	55	47	53	57	112
1989	79	-	63[c]	-	-
1990	72	88	53[b]	56[b]	128
1991	46	-	77	79	125
1992	38	-	62	64	102
1993	-	-	38	-	-

- no survey
[a] In 1987 the survey did not cover the depth stratum 1 000-1 500 m.
[b] Average values of two surveys.
[c] Estimate only for Div. 1CD.
[d] Div. 1A south of 70°N.
[e] USSR(RUS)/GDR(FRG) Survey Div. 0B + Japan/Greenland Survey Div. 1ABCD.

Since 1991 annual trawl surveys were conducted with a commercial shrimp trawler off West Greenland between 59°N and 72°30'N from the 3-mile limit to the 600 m depth contour line. Estimated trawlable biomass increased from 1991 to 1992 and has remained stable until 1993, where it was estimated to 9 600 tons. Abundance index increased from 84 mill. in 1991 to 283 mill. in 1992 and remained stable to 1993 (239 mill.). The increase from 1991 to 1992 in biomass and abundance is supposedly due to a strong 1991 year-class. The same strong year-class appears in the inshore area Disko Bay in Div. 1A, which was surveyed in August/September. The biomass of Greenland halibut from this area was estimated at 2 100 tons, 4 000 tons and 2 400 tons for 1991 to 1993, respectively. Abundance estimates fell from 69 million in 1992 to 30 million in 1993.

A trial longline fishery was conducted offshore in Div. 1AB between 66°N and 73°N in August 1993 by a Norwegian vessel. The fishery was directed towards resources down to 1 400 m, which never have been investigated at these depths in these Divisions. Highest CPUE values of Greenland halibut was obtained at depths between 800-1 200 m. Mean length of Greenland halibut increased with depth. Length distributions of the catches ranged between 35 cm and 100 cm, with the majority being between 45 cm and 75 cm.

iii) **Biological studies**

Tagging experiments were carried out 1986-1992 in Greenland waters, inshore and offshore, in West and East Greenland. Recapture records indicate that Greenland halibut in the northwest Greenland fjords (Div. 1A), were stationary in these fjords and do not contribute to the spawning stock complex in the Davis Strait. Recapture records from offshore tagging in Div. 1CD suggest that the adult offshore component of Greenland

halibut in Subareas 0, 1, 2 and 3 do intermingle to some extent. Recapture records west of Iceland from releases in the southwest Greenland fjords and East Greenland fjords indicate that the Greenland halibut components in these Greenland fjord areas do have a connection with the Icelandic spawning stock and possibly originate from that to some extent.

Investigations on sexual maturity of Greenland halibut inshore and offshore in Subarea 1, indicated that spawning in the offshore areas peaked in the first quarter of the year, although a significant proportion of the larger fish were not maturing. For the inshore areas spawning seem to occur sporadically and vary from one fjord to another, as well as between the years. Age compositions of the catch from the inshore fishery are very stable throughout the year, and this would also suggest that the inshore component in Div. 1A does not contribute to the spawning in the Davis Strait.

c) **The Biological Status of the Inshore Stock Component in Subarea 1**

With respect to a recommendation by STACFIS on the suballocation of a possible total TAC by geographical areas within Subareas 0, 1, 2 and 3 (NAFO Sci. Coun. Rep. 1993), and to a 1994 request by Denmark (on behalf of Greenland) on the allocation of the TAC for Subarea 1 into inshore and offshore areas, the biological status of the inshore stock component in Subarea 1 was reviewed.

In its 1990 report (NAFO Sci. Coun. Rep., 1990, p. 87) the Scientific Council presented a review of the biological information on Greenland halibut in the Northwest Atlantic. Studies on stock delimitation in the area suggested that the Greenland halibut stock component in the fjords of West Greenland was mainly recruited from the spawning component in the Davis Strait area. However, it appeared that the fjord component (in Div. 1A) was not suggested to contribute to the spawning component in the Davis Strait area, as adult fish seemed to be very stationary in the fjords. The information presented at that time were not considered conclusive and the management status of the stock component was unchanged.

Since then other studies on the population dynamics of Greenland halibut have been carried out. Extensive tagging experiments are newly reported. Migration of adult fish have never been recorded between the fjords and the offshore areas in West Greenland, despite the significant increase in offshore fishing effort, and although considerable numbers of Greenland halibut have been released both inshore and offshore. Recaptures of Greenland halibut released offshore have been reported from a trawl fishery developed offshore in Subareas 0 and 1. Studies on sexual maturity suggest that Greenland halibut in the fjords do only spawn there sporadically. As catch compositions are shown to be unchanged during the year it implies that the mature component is stationary.

Thus the recent information support the information provided by the Scientific Council in 1990, that the Greenland halibut stock component in the northern fjords of Subarea 1 is mainly recruited from the Davis Strait spawning component and that Greenland halibut after entering the fjords are stationary. There is very little fishery offshore in Div. 1A (less than 100 tons) and therefore tagging cannot conclusively test a possible link with Greenland halibut occurring inshore and offshore in Div. 1A. However, STACFIS **advised** that a separate assessment be carried out for the inshore areas of Div. 1A. There is ongoing research which will allow STACFIS to review its opinion after some years.

d) **Estimation of Parameters**

Mean estimates of Z-at-age based on abundance estimates from surveys of Greenland halibut in Div. 1CD in 1988-93, suggested an emigration of age groups 8-11 from the area surveyed. This suggestion is however based on assumptions on constant catchability, so an absolute level could not be estimated.

A sequential population analysis was attempted on the Greenland halibut offshore component in Subareas 0 and 1, but due to difficulties in the data set it was unsuccessful.

e) **Prognosis**

A combined prognosis for Greenland halibut in Subareas 0, 1, 2 and 3 is given in Section 15 below.

14. **Greenland Halibut in Subarea 2 and Divisions 3K and 3L** (SCR Doc. 94/22, 25, 29, 53, 57; SCS Doc. 94/13, 16)

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. 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 where it has continued.. The total catch estimated by STACFIS for 1990-93 was 47 000 in 1990, 55 000-75 000 in 1991 and about 63 000 tons in both 1992 and 1993. The major participants in the fishery in the Regulatory Area were EU-Spain and EU-Portugal, as well as some non-Contracting Parties such as Panama. STACFIS in its 1991-93 reports considered that catches from the Regulatory Area were from the Subarea 2 and Div. 3KL stock, and should therefore be included in the assessment of this resource.

Canadian catches peaked in 1980 at just over 31 000 tons, while the largest non-Canadian catches before 1990 occurred in 1969-70. USSR, Denmark (Faroe Islands), Poland and EU-Germany (GDR up to 1989) have taken catches from this stock in most years, but catches by the latter two countries were negligible in 1991. USSR/Russian catches increased from about 1 100 tons in 1988-90 to 8 200 tons in 1991, the largest catch by this fleet since 1975. EU-Portugal and Japan have taken catches from this stock each year since 1984. Canadian catches have ranged from 8 200 and 13 500 tons from 1985-91. The Canadian catch declined in 1992 to 6 900 tons and further declined to 4 700 tons in 1993.

In most years, the majority of the catch has come from Div. 3K and 3L, with catches from Div. 2G and 2H usually being relatively low. Canadian gillnet catches were taken mainly in inshore areas, and except for 1992-93 had been around 7 000 to 10 000 tons in most recent years, down from a high of 28 000 tons in 1980. The gillnet catch in 1992-93 of 3 200 tons were the lowest since the fishery started in the 1960s. In 1991 and 1992 most of the gillnet effort had shifted from inshore to the deep slopes of the continental shelf in Div. 3K and northern Div. 3L at depths in excess of 800-1 000 m and by 1993 some of the effort had moved to the more northerly Div. 2G and 2H.

Canadian otter-trawl catches peaked at about 8 000 tons in 1982, declined to less than 1 000 tons in 1988 and increased to about 7 400 tons in 1990, which is the highest level since 1982. By 1992, the catch had declined again to a level of 2 800 tons and 1 500 tons in 1993.

Recent TACs and catches('000 tons) are as follows (Fig. 14.1):

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
TAC	55	75	100	100	100	50	50	50	50	
Catch	19	16	31	19	19[1]	47[1,2]	55-75[2,3]	63[1,2]	62[2,3,4]	

[1] Provisional
[2] Includes estimates of misreported catches
[3] STACFIS could not reliably estimate total landings.
[4] Catch estimate may be as low as 42 000 tons.

b) **Input Data**

i) **Commercial fishery data**

Catch and effort. Catch and effort data from the directed fishery for the period 1975 to 1990 were obtained from ICNAF/NAFO Statistical Bulletins and were combined with provisional 1991-92 NAFO data and preliminary Canadian data for 1992-93. Data from the Spanish fishery in the Regulatory Area for 1992 were included in this analysis.

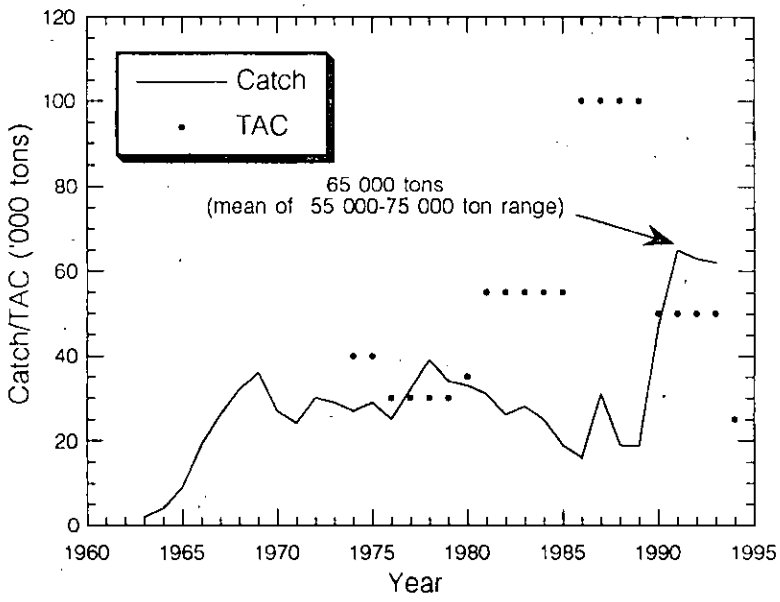

Fig. 14.1 Greenland halibut in Subarea 2 and Div. 3K and 3L: catches and TACs.

The catch/effort data were analyzed with a multiplicative model to derive a standardized catch-rate series for hours fished.

The standardized catch-rate series showed high within year variability, especially in the late-1970s to mid-1980s. There was an increasing trend from the mid-1970s to about 1981, then declined to the lowest observed by 1986. The standardized catch rate showed stability for the next several years but declined further to very low levels during 1991-93. There appeared to be little in the way of significant seasonal trends, however, it would seem that catch rates improved as the fishery moved progressively northward.

A preliminary analysis of unstandardized catch-rate data from the Spanish fishery for Greenland halibut in the Regulatory Area of Div. 3L, 3M and 3N from 1990-93 was also reviewed. This analysis also indicated a decline in catch rates in recent years but of a lesser magnitude than that of the analysis described above. It was difficult, however, to fully evaluate the significance of the decline in these data without a more thorough investigation.

Catch-at-age. Length sampling data from the catches of Canada, EU-Portugal, and EU-Spain were available at this meeting, however, mainly Canadian ageing data were used. Ages 6-8 dominated the catch in all years from 1988-91, which was typical of the Canadian catch in virtually all years. In 1992 and 1993, the catch-at-age for older ages increased because of the deepwater gillnet fishery at the continental slope of Div. 3K and northern Div. 3L as well as Div. 2G and 2H.

An examination of age frequency data from both EU-Spain and EU-Portugal indicated that most of the fishery in the Regulatory Area in 1992 was dominated by age 7 (35%) with 78% of the catch comprised of ages 6-8. Length frequency data in 1993 from Spanish freezer trawlers fishing to depths of 1 700 m for large vessels and 1 500 m for smaller vessels indicated that more than 90% of the catch was less than 60 cm. This suggests that very little of the catch was age 9 or older.

Data from the Portuguese otter-trawl fishery in Div. 3L indicated a decline in the mean and modal lengths in the catch from 1990 to 1991 and a further decline in 1992 and 1993. Few fish larger than 46 cm (about age 7) were sampled in the 1993 catches. In Div. 3N the size distribution in the Portuguese fishery indicates an increase in the mean lengths in the catch from 1992 to 1993 (males from 43.9 to 46.2 cm and females from 45.2 to 49.4 cm).

ii) **Research survey data**

Canadian stratified-random groundfish surveys in autumn. Biomass indices of Greenland halibut have been declining in Div. 2J (to depths of 1 000 m) since 1982 from a level of over 100 000 tons to less than 9 000 tons by 1992. There was a slight increase in 1993 to near that of 1991 but still the index was at a very low level. The biomass index in Div. 3K (to depths of 1 000 m) peaked at 112 000 tons in 1984 but by 1987 biomass in this Division also declined similar to Div. 2J and reached a low of just over 20 000 tons in 1992. In 1993 there was a similar proportional increase in biomass in Div. 3K as with Div. 2J to a level slightly higher than that of 1991. Estimates for Div. 3L to a depth of 366 m were relatively stable from 1981 to 1990 at about 15 000 tons. Between 1990 and 1991, the biomass index fell from nearly 17 000 tons to 7 300 tons and further to 6 700 tons in 1992 although complete survey coverage in 1991-92 was down to depths of 732 m. Unlike Div. 2J and Div. 3K, the biomass index for Div. 3L in 1993 continued to decline to a level of about half of the 1991-92 estimates. The cumulative biomass index for all three Divisions has rather steadily declined from a high of about 225 000 tons in 1984 to 37 000 tons in 1992 which is by far the lowest in the time series (Fig. 14.2). The cumulative estimate for 1993 increased from 1992 to 49 000 tons. STACFIS recognized that these estimates reflect biomass in the depths surveyed and that Greenland halibut are also found beyond these depths.

Since declines in biomass are not consistent across all age classes, decreases in age specific abundance are less apparent than in total biomass. An examination of the age structure indicated that the ages 6+ abundance has been declining since the mid-1980s and by 1993 the age 6+ abundance is far below anything ever observed, at a level of about one third of that estimated in 1992. Age 10+ has been declining since the early-1980s and by 1993 did not even appear incidently in the survey catches. On the other hand, ages 3-5 were slowly increasing from the early 1980's to about 1989. From 1989 to 1992, however, these age groups also declined very sharply to a level less than half the 1988 estimate. A sudden increase in abundance was observed in 1993 and was due to a significant increase in the estimated abundance of ages 2 and 3 in the 1993 survey.

Canadian deepwater surveys. The results of deepwater surveys conducted in the summer of 1991 (Fig. 14.3) and the winter of 1994 (Fig. 14.4) in Div. 3K, 3L,3M (1991 and 1994) and Div. 3N (1994) were reviewed. Both surveys were conducted using 30 min. hauls with the same bottom trawls in a range of depths between 750-1 500 m. The results indicated a reduction in biomass, in Div. 3K, from 32 000 tons in 1991 to 10 000 tons in 1994; in Div. 3L, from 13 000 tons to 10 000 tons; and, in Div. 3M from 24 000 tons to 10 000 tons. There was an overall reduction in biomass of about 60%, for all Divisions combined. The results of these 2 surveys should be viewed with caution because they were conducted at different times of the year, by different ships, with different sampling designs. However, it should be noted that although there was a reduction in biomass, fish were distributed in a similar pattern in Div. 3KLM, in both years. The abundance at age 7+ was greater in all three Divisions in 1991, than in 1994, however, there was a considerably higher abundance of ages 3-5 in the 1994 survey than in the 1991 survey. There were very few fish older than age 9 observed in 1994. Biomass of age 9+ showed a reduction in all three Divisions, between 1991 and 1994. In 1991, age 9+ comprised 62% of the biomass in Div. 3K, 68% in Div. 3L and 70% in Div. 3M. In 1994, age 9+ fish comprised 34%, 14% and 31 % in Div. 3K, 3L and 3M, respectively.

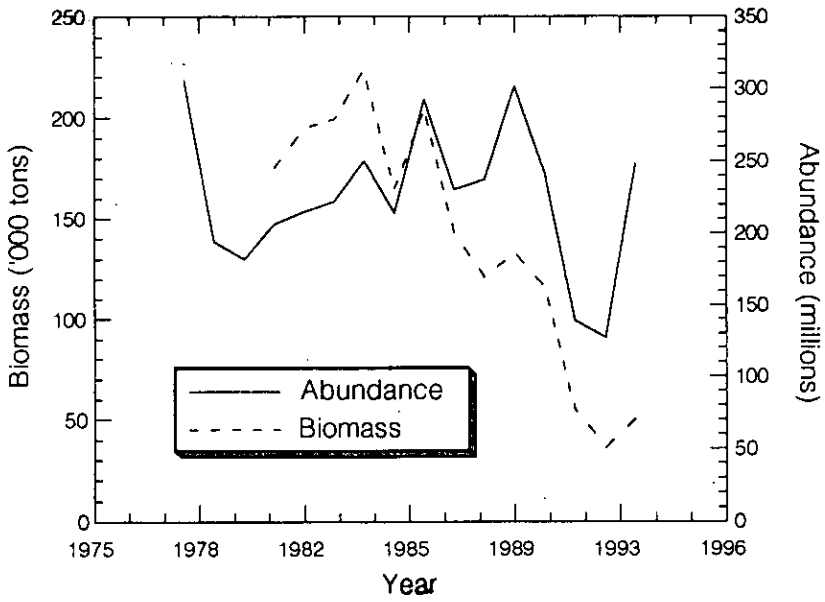

Fig. 14.2. Greenland halibut in Subarea 2 and Div. 3K and 3L: abundance and biomass estimates from Canadian surveys.

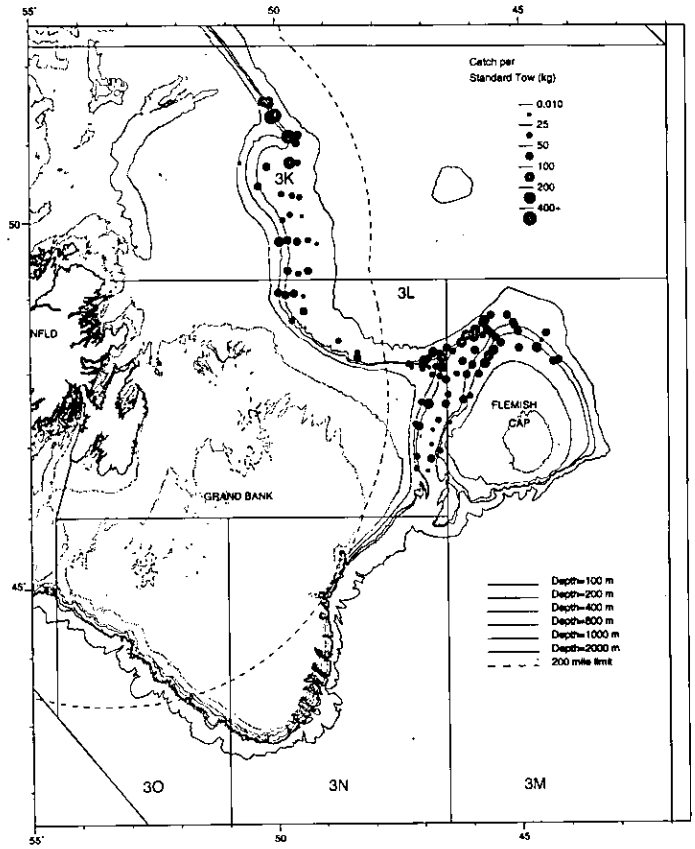

Fig. 14.3. Greenland halibut in Subarea 2 and Div. 3K and 3L: Canadian survey catches, summer 1991.

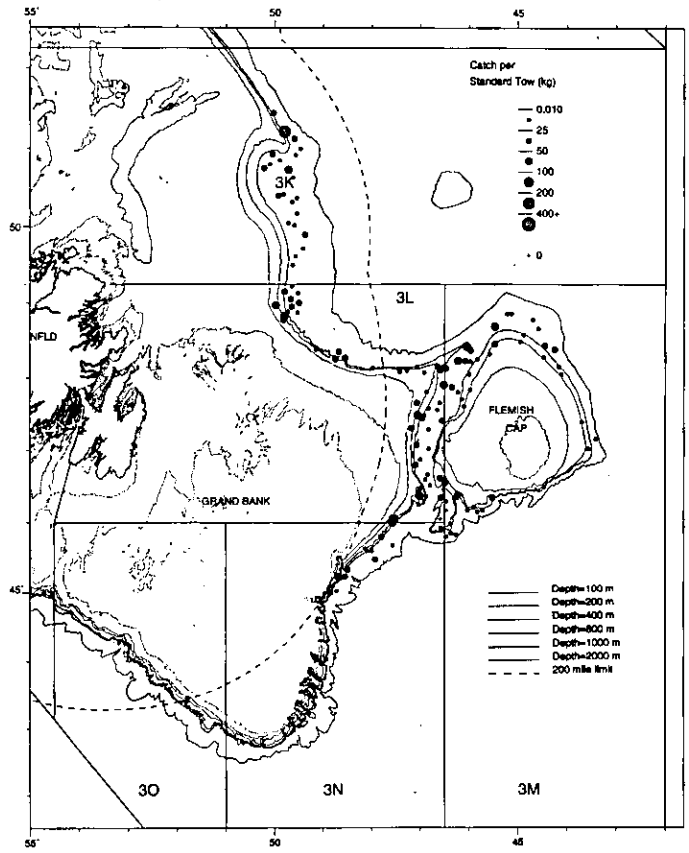

Fig. 14.4. Greenland halibut in Subarea 2 and Div. 3K and 3L: Canadian survey catches, winter 1994.

USSR/Russian stratified-random groundfish surveys. The results of the Russian stratified-random survey conducted in Div. 2GH in 1992 (down to 1 500 m) showed that the abundance and biomass of Greenland halibut in this area were greatly reduced from levels observed in the early-1980s (down to 1 250 m). Since 1985, the biomass indices fluctuated around a very low level compared to the period of the early-1980s. No survey was conducted in this area in 1993. Some information on fishing sets in Flemish Pass to depths of 800 m during 1989-93 were provided and indicated that Greenland halibut comprised a very small part of the catch within these depth zones.

EU stratified-random surveys - Div. 3M. These surveys indicated that Greenland halibut biomass on Flemish Cap in depths to 730 m ranged from 4 300 tons in 1989 to 8 500 tons in 1992. The survey estimate in 1992 was similar to the value estimated in 1991 at 8 000 tons. The estimated biomass from this survey series in 1993 indicated a decline from 1992 to 7 200 tons. The estimates from these surveys were not indicative of the total biomass in Div. 3M and could only be interpreted as an index of the population in depths to 730 m. The age-composition data indicated that the abundance in 1992 was dominated by the ages 5-7 or the 1985-87 year-classes and that the 1993 survey was also dominated by the same year-classes in 1993 at ages 6-8. This survey did not show the same predominance of young fish as observed in the Canadian surveys.

iii) **Biological studies**

STACFIS examined length samples from the Canadian deepwater gillnet fishery in Div. 3K and northward to Div. 0B. It indicated that while there were mature fish in all samples, the size at 50% maturity increased from north to south suggesting a northward migration of maturing fish. There was evidence, nevertheless, of some spawning throughout the range. Studies conducted by EU-Spain in the Regulatory area also indicated that spawning takes place in this area as well. Both studies observed peculiarities in spawning stages and

timing of spawning. The observations are consistent with the belief that Greenland halibut may not spawn annually. It was agreed that these types of studies are essential as the reproductive strategy of this species is very unclear but yet critically important in making appropriate decisions on harvesting strategy, and as such STACFIS **recommended** that *collection of maturity samples from deepwater fisheries on Greenland halibut be encouraged.*

c) **Estimation of Parameters**

STACFIS again noted that an analytical assessment of this stock was not possible. Although the available indices of abundance derived from surveys and CPUE series do not apply to the entire stock, STACFIS believes they can be used as indicators for evaluation of stock status.

d) **Prognosis**

A combined prognosis for Greenland halibut in Subareas 0, 1, 2, and 3 is given in Section 15 below.

15. **Greenland Halibut in Subareas 0, 1, 2 and 3**

a) **Prognosis**

Subareas 0 to 3

1. The Greenland halibut in Subareas 0-3 is considered a single stock as discussed in NAFO Sci. Coun. Rep., 1990. Fishing on one component affects the catch possibilities on other components and therefore all components of the Greenland halibut stock should be regulated. This applies particularly to the new fisheries in the Flemish Pass Div. 3LMN.

2. The yield taken of the Greenland halibut populations in recent years affects the populations significantly in all Subareas as is seen from declining catch rates and trawlable biomass. The same pattern is seen all throughout the offshore range.

3. There is concern about the impact of the present fishery on the stock, Greenland halibut being a deep water slow growing species is likely unable to sustain high exploitation levels.

4. The length of first maturity of Greenland halibut is around 60 cm and the trawl fisheries in all Subareas mainly catch fish below this size, hence the trawl fisheries exploit mainly immature Greenland halibut.

5. STACFIS maintains (Sci. Coun. Report, 1993, p. 104) that a single TAC for the entire stock area without consideration of effort distribution could lead to excessive effort being concentrated in different areas of distribution and this could lead to the collapse of important fisheries. STACFIS therefore **advised** that separate TACs be maintained for different areas of the distribution of Greenland halibut.

6. Because of uncertainty in evaluating the magnitude of declines in survey results and CPUE series STACFIS is not able accurately to calculate appropriate TAC levels. This applies to all Subareas. However STACFIS considers that the offshore effort levels in all Subareas are in excess of what the Greenland halibut stocks can sustain and STACFIS **advised** that the effort and catches throughout Subareas 0 to 3 in 1995 should be reduced compared to recent years. This is further discussed below under the headings of the Subareas 0 and 1 and 2 and 3.

Subareas 0 and 1

7. There has been a significant amount of information collected which suggests that Greenland halibut in the northern West Greenland fiords (Div. 1A) do not contribute to the spawning stock in the offshore areas in Davis Strait. There is very little fishery offshore in Div. 1A (less than 100 tons) and therefore tagging cannot conclusively test a possible link with Greenland halibut occurring inshore and offshore in Div. 1A. STACFIS **advised** that a separate TAC be established for the inshore areas of Div. 1A. There is ongoing research which will allow STACFIS to review this position after a few years.

8. There is no information available suggesting that Greenland halibut in Cumberland Sound and coastal areas of Baffin Island are isolated from the occurrence offshore in Div. 0B. STACFIS **advised** that a TAC to be established combined for all of Div. 0B and Div. 1BCDEF.

9. Catch rates and survey trawlable biomass have decreased since 1991 and both the commercial and survey catch-at-age estimates showed a shift towards younger fish. Trawlable biomass estimates for Div. 1BCD decreased from 62 000 tons in 1992 to 38 000 tons in 1993. The decline was seen over the entire age range. This decline is much larger than the actual catch which occurred between these two surveys.

10. After 1989 the offshore fishery in Subareas 0 and 1 has expanded considerably. This increased exploitation is expected to cause a change in the stock composition in the area towards younger fish and with a lower total biomass. The decline both in the commercial catch rates and in the survey biomass are however marked and suggests a high exploitation level. STACFIS therefore **advised** that the TAC for 1995 be set below the offshore catch level of 11 000-15 000 tons seen in most recent years. This implies a TAC for 1995 for the total area of Div. 0B and Div. 1BCDEF combined be set below 11 000 tons. The catch inshore in Div. 1A is expected to be around 12 000 tons in 1995.

Subareas 2 and 3

11. The major fishing grounds at present in Subareas 2+3 are in Div. 3LMN in the NAFO Regulatory Area.

12. The survey in 1993 in Div. 2J and 3KL suggests that recruitment of ages 2 and 3 are above average. These fish will however under the present exploitation pattern not recruit to the fishery before they reach age 6-8 years. Recent surveys and the fishery indicate that the population in Div. 2J is at its lowest level on record. The 1993 survey also showed an absence of age 10+ fish compared with previous years. The winter deep water survey in Div. 3KLMN in 1994 compared with deep water survey in summer 1991 also showed a sharp decline of age 10+ fish.

13. STACFIS considers that the present fishery exploits this component well above sustained levels and that current effort levels must be reduced. Because of the decrease in catch rates, present catch levels are not likely to be maintained in 1995 unless more effort is introduced in these areas. A reduction in fishing effort requires TAC set well below present catch levels.

14. All available stock indicators (survey results and catch rates in the commercial fisheries) suggests a significant decline of abundance. STACFIS is unable to determine appropriate TAC levels since this partly depends on the uncertain state of the stock prior to the increased exploitation after 1989. STACFIS considers that any catch level above 40 000 tons for 1995 (*status quo* prediction including the catches by non-Contracting Parties) will not be adequate to restrict the fishery. Concern was expressed that based on some of the available stock indicators the catch in 1995 should be substantially lower to halt the decreasing biomass trend.

b) **Responses to Requests by Canada and Denmark (Greenland)**

Canada has requested that *the Scientific Council provide an overall assessment of the total stock throughout its range and comment on its management.*

STACFIS is not able to provide an analytical assessment of the total stock but the available information indicates that the stock is overexploited; for further comments see the prognosis section for Greenland halibut above, particularly points 1, 2, 3, 5 and 6.

The two following recommendations are relevant in this context:

STACFIS **advised** that separate TACs be maintained for different areas of the distribution of Greenland halibut.

STACFIS **advised** that the effort and catches throughout Subareas 0-3 in 1995 should be reduced compared to recent years.

Denmark (on behalf of Greenland) has requested that the Scientific Council *report on*

a) Analysis of the existing information on stock delimitation in Subareas 0, 1, 2 and 3.
b) Allocation of TACs to appropriate Subareas (within Subareas 0 and 1).
c) Allocation of the TAC for Subarea 1 into inshore and offshore areas.

Concerning a), see 1, 2, 7 and 8 in the prognosis section on Greenland halibut above.

Concerning b), STACFIS updated the available information which may be used in an allocation of the TAC between Subareas 0 and 1. This update confirmed the STACFIS comments of 1993 (NAFO Sci. Coun., 1993, p. 104):

> "Catch and effort information by month and Divisions were available but these were not necessarily indicative of the stock distribution."
>
> "Based on survey information from Subareas 0 and 1 in 1987, 1988 and 1990 the offshore biomass was distributed approximately 50:50 between these two Subareas". The biomass results are presented below.

Biomass estimates (000' tons) from Greenland/Japanese surveys and USSR(RUS)/GDR(FRG) surveys for the years 1987-93 in Subareas 0 and 1.

Year	USSR(RUS)/GDR(FRG) Survey 0B	1BCD	Japan/Greenland Survey 1ABCD[d]	1BCD	Total 0B+1ABCD
1987	37	56	58[a]	54[a]	95
1988	55	47	57	53	112
1989	79	-	-	63[c]	-
1990	72	88	56[b]	53[b]	128
1991	46	-	79	77	125
1992	38	-	64	62	102
1993	-	-	-	38	-

- no survey
[a] In 1987 the survey did not cover the depth stratum 1 000-1 500 m.
[b] Average values of two surveys.
[c] Estimate only for Div. 1CD.
[d] Div. 1A south of 70°N.

Concerning c), STACFIS stated in 1993 that "No estimate on the inshore biomass in Subarea 1 was available to STACFIS,..".

Also in 1994 no inshore biomass estimates were provided for this component. STACFIS is therefore unable to provide an answer. However, see 7, 8 and 10 in the prognosis section for Greenland halibut above.

16. **Roundnose Grenadier in Subareas 0 and 1** (SCR Doc. 94/31; SCS Doc. 94/15)

a) **Introduction**

A total catch of 98 tons has been reported to date for 1993 compared to 152 tons for 1992.

Recent catches and TACs ('000 tons) are as follows (Fig. 16.1):

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
TAC	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Catch	0.1	0.1	0.4	0.5	0.08	0.24	0.16[1]	0.19	0.1[1]	

[1] Provisional.

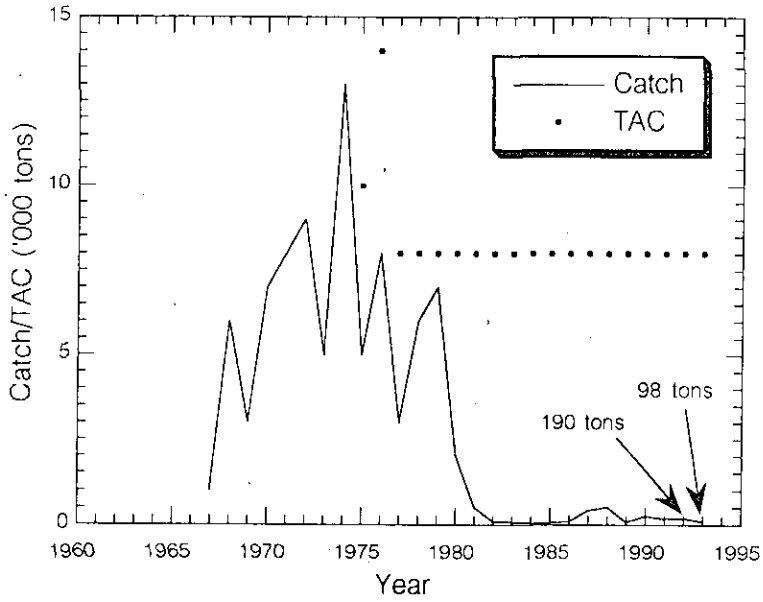

Fig. 16.1. Roundnose grenadier in Subareas 0 and 1: catches and TACs.

b) **Input Data**

i) **Commercial fishery data**

There has been no directed fishery for roundnose grenadier in Subareas 0 and 1 since 1978. Present catches are by-catch in the fishery for Greenland halibut. No update of the catch effort analysis presented in NAFO Sci. Coun. Rep., 1985, p. 72 was possible.

ii) **Research survey data**

Since 1987 Japan in cooperation with Greenland has conducted bottom trawl research surveys in Subarea 1. The trawlable biomass in Div. 1CD for the depth range 400-1 500 m were estimated as follows:

Year	1987	1988	1989	1990	1991	1992	1993
Biomass	45 800[1]	44 000[2]	5 900[3]	20 300[4]	41 700[4]	40 200[4]	8 200[4]

[1] June/July depth 400-1 000 m
[2] September/October
[3] April/May
[4] August/September

The 1993 estimate is the lowest recorded in the August/September surveys. As usual, only a few roundnose grenadier were taken at depths less than 600 m. Eighty-five percent (85%) of the biomass was found in Div. 1D below 1 000 m.

c) **Prognosis**

The surveys do not cover the entire stock area as roundnose grenadier occur deeper than 1 500 m and also in Subarea 0. Hence the trawlable biomass is an underestimate. The surveys, being the only stock indicator available, suggest that the stock is declining even though the commercial catches are very small. Since 1977, a value of 8 000 tons has been used as a precautionary TAC but STACFIS is not able to evaluate whether this value is appropriate under present conditions.

17. **Roundnose Grenadier in Subareas 2 and 3** (SCR Doc. 94/23, 29, 48; SCS Doc. 94/3, 13) (with some comments on Roughhead Grenadier)

a) **Introduction**

Prior to 1979, catches averaged about 26 000 tons but since then have only averaged about 4 500 tons. Previously, the Scientific Council had commented on the possible misidentification of the species actually caught, with roughhead grenadier being reported as roundnose grenadier. Information was made available this year to quantify this misidentification. Based on this information, catch estimates were revised downwards based on detailed examination of catches in the Regulatory Area by EU-Spain and EU-Portugal.

Nominal catches, revised catches, and TACs ('000 tons) for roundnose grenadier in the recent period are as follows (Fig. 17.1):

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
TAC	11	11	11	11	11	11	11	11	11	11	3[5]
Catch[3]	4	5	7	7	5	5	1	5-10[2]	3[1]	4[1]	
Catch[4]	4	5	7	8	6	5	4	9-14[2]	8[1]	11[1]	

[1] Provisional data.
[2] Includes estimates of misreported catches which could not be determined precisely.
[3] Includes adjustments reported in SCS Doc. 94/13, and SCR Doc. 94/29.
[4] Original as reported to NAFO
[5] Inside Canadian zone only.

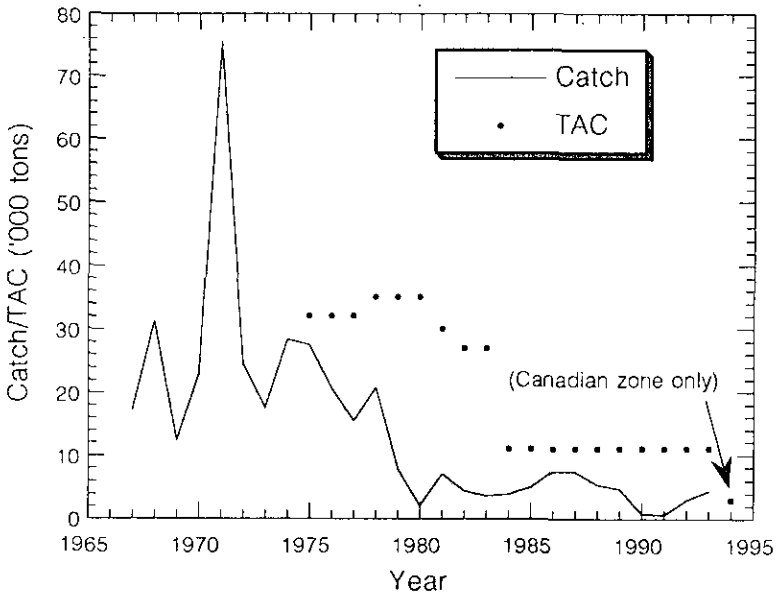

Fig. 17.1. Roundnose grenadier in Subareas 2 and 3: catches and TACs.

The provisional 1993 catch was 4 408 tons, up from about 3 000 tons in 1992. Revised estimates suggest that the catches may have been less than 1 000 tons in 1990 and 1991, although some estimates placed the 1991 catch as high as 10 000 tons. There has been no fishing effort by the EU-Germany/GDR or USSR/Russian Federation since 1990. Their fisheries traditionally took place in the Canadian zone, primarily in Div. 3K. In 1993 there were no allocations to non-Canadian vessels. Prior to the increase in fishing effort in the Regulatory Area in the early-1990s directed for Greenland halibut, the traditional fishery took place primarily during the second half of the year when

the fish moved up the slope into shallower water. Because revised estimates of catches in the Regulatory Area by EU-Spain and EU-Portugal were only recently available, it was not possible to determine the pattern of catches by area and season.

Canadian industry has not shown any significant interest in pursuing this fishery.

Based on revised calculations, catches of roughhead grenadier in the Regulatory Area ('000 tons) have been estimated to be as follows:

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Catch	0	0	3	1	1	+	3	4[1]	5[1]	6[1]

[1] Provisional.

b) **Input Data**

i) **Commercial fishery data**

Because there was no fishery in the 'traditional' area inside the Canadian zone in 1993, there were no new commercial catch or effort data available for examination. As was the case in 1993, similar data for the by-catch fisheries in the Regulatory Area were not available.

ii) **Research survey data**

Information on catch distribution from 1993 Canadian autumn stratified-random trawl survey was presented. Similar to results from previous years, the highest catches were taken in Div. 3K at about 51°N, an area corresponding to the location of most of the commercial effort in earlier years. It was recognised that since the surveys only cover depths to 1 000 m, the information they provide is limited because the distribution of roundnose grenadier extends deeper than this. This was confirmed through examination of results from deepwater (750-1 500 m) surveys conducted by Canada in 1991 and 1994 which, while showing the largest concentrations to be at about 51°N in Div. 3K, also indicated that the best catches were taken between 1 000 and 1 500 m.

Based on the results from these surveys, concentrations in the Sackville Spur area of Div. 3L, across the north of Flemish Cap, and in Flemish Pass were not as great as those in Div. 3K. Estimates of trawlable biomass from these two surveys indicated no change in Div. 3K, but declines in both 3L and 3M from 1991 to 1994. Based on the 1994 survey results, the biomass is lowest in Div. 3N of all surveyed Divisions.

Estimates of biomass for roughhead grenadier were lower than for roundnose grenadier in Div. 3K, but higher in Div. 3L, and about the same as roundnose grenadier in Div. 3M. The increased estimates for Div. 3L and 3M in 1994 were probably the result of increased survey area. There were no very large concentrations of roughhead grenadier found, although the 1994 results suggest somewhat higher biomass of roughhead grenadier in southern 3L and 3N. The biomass in Div. 3N in 1994 was the lowest of the 3 Divisions, but was about 6 times higher than the estimate for roundnose grenadier. This ratio of the two species corresponded closely with the ratio of the two species reported in catches in this area by both EU-Spain and EU-Portugal.

c) **Prognosis**

In 1991, STACFIS concluded (NAFO Sci. Coun. Rep., 1992, page 127) that there are insufficient data upon which to base an assessment of roundnose grenadier. This situation has not changed because Canadian industry has not pursued this resource, and there has been a gradual decline in allocations to non-Canadian fleets inside the zone, culminating in a complete elimination of these allocations in 1993. Deepwater surveys in Div. 3K in 1991 and 1994 suggest no change in status in Div. 3K during this time period. The current TAC for all of Subareas 2 and 3 inside the Canadian zone (3 000 tons) is about 15% of the estimated biomass for Div. 3K, where the traditional fishery

was primarily prosecuted, and does not appear to be excessive.

The estimated biomass of roundnose grenadier in Div. 3LM was slightly less than that in Div. 3K in 1991, and declined to only about 50% of the estimate for Div. 3K in 1994. The average annual catch based on revised breakdowns of the species for 1991-93 was only about 2 200 tons. This represents about 25% of the estimated biomass in 1994, but it is probable that there was substantial discarding. Although exploitation cannot be quantified, it has been greater in the Regulatory Area compared to the 'traditional' area in recent years. It is not possible to determine the effects of this, but catches have increased significantly between 1991 and 1993 in the Regulatory Area. STACFIS noted that the effort exerted on Greenland halibut in this region in recent years has been extensive, and the relatively low by-catch of roundnose grenadier may indicate a limited resource in the area.

There have been previous concerns about possible species misallocation of grenadier catches in the developing fishery in the Regulatory Area (roughhead grenadier being reported as roundnose grenadier). Information presented this year indicated that these concerns were well founded. STACFIS was pleased that this information was provided this year by both EU-Spain and EU-Portugal, and encourages all Contracting Parties with similar information to make it available in the future.

18. **Capelin in Divisions 3N and 3O** (SCR Doc. 94/14, 22; SCS Doc. 94/1)

a) **Introduction**

Nominal catches in the Divisions increased from about 750 tons in 1971 to 132 000 tons in 1975 and declined to 5 000 tons in 1978. During this period, most of the catch was taken by USSR trawlers and Norwegian purse seiners. The fishery was closed during 1979-86, was opened under quota regulation during 1987-92, and closed in 1993.

Recent catches and TACs ('000 tons) are as follows (Fig. 18.1):

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Advised TAC	0	0	0	10	10	28	30	30	30	0	0
TAC	0	0	0	10	15	28	30	30	30	0	0
Catch	0	0	0	1	7	9	25	+[1]	+[1]	0[1]	

[1] Provisional.

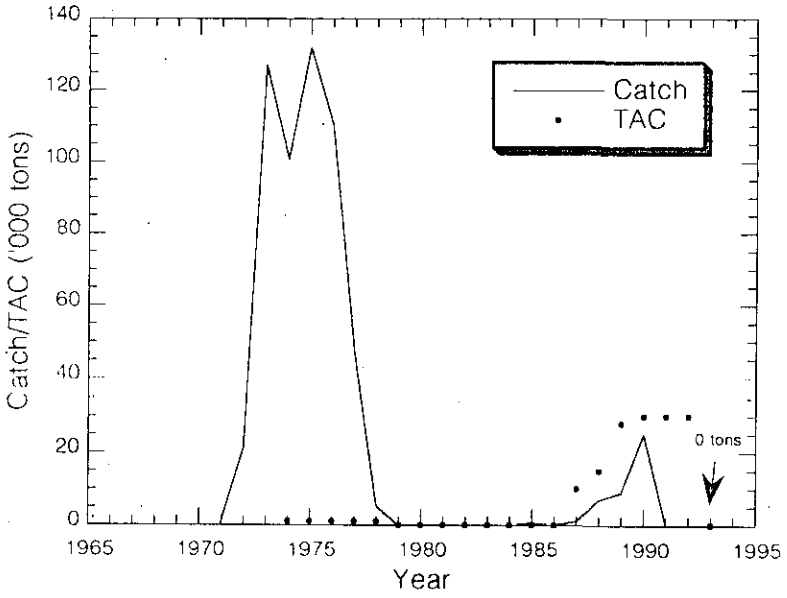

Fig. 18.1. Capelin in Div. 3N and 3O: catches and TACs.

b) **Input Data**

i) **Research survey data**

USSR acoustic surveys during 1975-77 indicated a mean biomass of 900 000 tons. Based on USSR and Canadian acoustic surveys, the mean biomass from 1981-88 was about 300 000 tons. These historical biomass estimates ('000 tons) for capelin in Div. 3NO are as follows:

	1975	1976	1977	1978	1979	1980	1981	1982	1983
USSR	1 050	687	1 000				109		269
Canadian							223	419	219

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
USSR			559	315						191
Canadian	88	212	495	230	560	28			4	

Due to stocks mixing prior to spawning, STACFIS was unable to quantify what portion of the 991 000 tons estimated from the USSR acoustic survey in May 1990 in Div. 30 would spawn in Div. 3L and in Div. 3N0. A USSR acoustic survey conducted in June 1991 in Div. 3N did not detect capelin and a Canadian acoustic survey in June 1992 resulted in a biomass estimate of 4 000 tons.

STACFIS concluded that both the 1991 and 1992 surveys had been conducted prior to the arrival of capelin on the spawning grounds.

A Russian acoustic survey conducted during June 1993 in Div. 3LN0 resulted in a biomass estimate of 315 000 tons. Of this total biomass estimate, 191 000 tons occurred in Div. 3NO and of this Div. 3NO total, 130 000 tons were mature. Capelin of the 1990 year-class accounted for 73% of the catches by numbers over the entire survey area. Capelin of the 1992 year-class were observed in large numbers during the acoustic survey but their biomass could not be quantified because of lack of reliable target strength estimates.

ii) **Capelin in adjacent areas**

During the Russian acoustic survey in June 1993, 126 000 tons of capelin were estimated in Div. 3L, compared to a 1991 estimate of 118 000 tons. Capelin of the 1990 year-class dominated (82%) during the 1993 survey.

Capelin were reported as by-catch during Spanish groundfish surveys in Div. 3M during 1992 and 1993 but had not been caught during similar surveys during 1988-91. Based on historical records, capelin are considered a rare species in Div. 3M.

b) **Prognosis**

Based on historical patterns, ages 3 and 4 (1992 and 1991 year-classes) would be expected to dominate in the spawning stock in Div. 3N0 during 1995. Although STACFIS was encouraged by the qualitative observations that the 1992 year-class was abundant, no estimates were available and consequently, no projections could be made. STACFIS noted that the 1993 acoustic estimate is the highest since 1988 and is about 43% of the 1981-89 and 14% of the 1975-77 average biomasses. STACFIS reiterates its previous concerns regarding relatively low biomass levels in the Div. 3N0 stock because of the implications for future recruitment and because of the importance of capelin as a forage species. A Russian survey is planned for June 1994 and if the results of this survey are available during the September 1994 meeting, STACFIS would re-evaluate the status of the stock at that time. If the stock is not re-evaluated at that time, STACFIS **advised** that no capelin fishing be allowed in Div. 3NO during 1995.

19. **Squid in Subareas 3 and 4** (SCR Doc. 94/37, SCS Doc. 94/1, 94/12)

a) **Introduction**

Catches of squid (*Illex illecebrosus*) in Subareas 3 and 4 started showing an upward trend in 1989 with a total of 7 000 tons and an additional 6 800 tons in Subareas 5 and 6. In Subareas 3 and 4, catches increased to 11 000 tons in 1990 and subsequently declined to 3 000 tons in 1993 while in Subareas 5 and 6 catches increased to 18 000 tons in 1993. Catches of 300 tons in Subarea 3 during 1993 were directed but the remainder of the catch occurred as directed catch and by-catch in the Subarea 4 silver hake fishery.

Recent TACs and catches ('000 tons) are as follow (Fig. 19.1):

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
TAC	150	150	150	150	150	150	150	150	150	150
Catch	1	+	2	1	7	11	4[1]	2[1]	3[1]	

[1] Provisional.

In comparison, the following statistics ('000 tons) are recorded in Subareas 5 and 6 for the last 5 years:

	1989	1990	1991	1992	1993
Catches	7	12	12[1]	18[1]	18[1]

[1] Provisional.

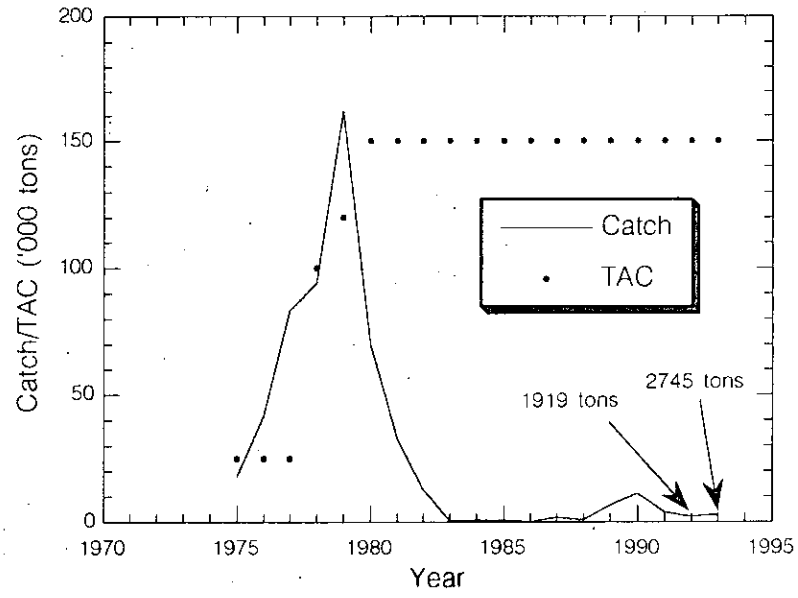

Fig. 19.1. Squid in Subareas 3 and 4: catches and TACs.

b) **Input Data**

i) **Commercial fishery data**

In the Cuban silver hake fishery, March-August 1993, squid by-catches were not recorded until the middle of June. The overall catch rate was 0.1 tons of squid per hour or 0.3 tons per tow. The squid by-catch was about 10% of the silver hake catch.

ii) **Research survey data**

Squid sampled in Div. 3P during October 1993 were larger and males in more advanced stages of sexual maturation than those sampled later in Div. 3L. This may be related to warmer water conditions or different feeding regimes.

The eleven year low (1983-93) of squid abundance in Subarea 3 is the longest period of low abundance on record. Previous periods of low squid abundance have usually coincided with cold water temperatures.

Survey abundance indices in Subareas 5 and 6 indicate that the squid stock is at a medium biomass level.

c) **Estimation of Parameters**

There were no data available on which to base an assessment.

The most important characteristic of this stock is that there is only a single age group present at any time. Although the relationship between spawning biomass and recruitment is believed to be most important for current management, this relationship is poorly known. The basis for management was discussed extensively by ICNAF and was changed after 1973, when it was concluded that fishing levels were having no harmful effect on subsequent recruitment. In 1979, from a theoretical point of view, effort regulation was considered to allow more effective management, but some practical difficulties hampered its enforcement. In 1980, it was concluded that a TAC of 150 000 tons for Subareas 3 and 4 in conjunction with effort constraints remained the most satisfactory means of preventing over-exploitation in years of moderate or high abundance. In years of low abundance the fishery would be self-regulated.

d) **Prognosis**

There was a small-scale directed fishery for squid in 1989-91 but since then most of the catch has been by-catch in the silver hake fishery. Without up-to-date information on the squid stock, especially for recruitment, STACFIS is not able to provide updated advice and this situation will remain as long as there is no research effort.

20. **Other Finfishes Subarea 1** (SCR Doc. 94/7, 10, 31; SCS Doc. 94/11, 14, 15)

a) **Introduction**

Catches of American plaice, wolffishes, starry skate and Greenland cod in Subarea 1 are taken by offshore trawl fisheries directed to shrimp, cod, redfish and Greenland halibut, by longliners operating both inshore and offshore and by pound net and gillnet fisheries in inshore areas only. The statistics of these by-catches seem to be poorly reported in general. In 1993, catches of these species amount to 2 500 tons representing 12% of the total finfish catch reported. Landings of Greenland cod (1 892 tons) dominated the catch of other finfishes by 75%.

b) **Input Data**

i) **Research survey and trial fishery data**

EU-Germany groundfish survey. Annual abundance and biomass indices were derived from stratified-random bottom trawl surveys which commenced 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. During the periods 1982-84 and 1988-93, pronounced negative trends in aggregate fish abundance and biomass were observed. Since 1988, overall decrease in aggregate abundance and biomass amounted to 88% and 99%, respectively. The fish species Atlantic cod, American plaice, golden and beaked redfish, Atlantic and spotted wolffish and starry skate contributed to the dramatic decline in total fish abundance and biomass. Length distributions revealed that at present very small individuals dominate demersal stocks in this area. A production model based on a multiple regression explains 87% of the observed variability in annual aggregate fish production with cod recruitment and fishing effort as explanatory factors. On the basis of low fishing effort and poor recruitment, the model prognosticates stagnant fish biomass at lowest level for 1994.

Greenland-Japan groundfish survey. Since 1987, cooperative trawl surveys directed to Greenland halibut and roundnose grenadier have been conducted on the continental slope in Div. 1A to 1D at depths between 400 m and 1 500 m. In August and September 1993, biomass indices of these species amounted to 5% of the total finfish biomass, which was dominated by Greenland halibut (76%) and grenadiers (20%). In comparison to the results of a similar survey in 1992, the estimated biomass indices of almost all the species decreased.

Greenland and Norway trial longline fishery. In August 1993, a trial longline fishery for Greenland halibut was conducted in the northern Davis Strait (Div. 1A and 1B). During 13 fishing days 154 328 hooks in 44 longline settings at depth ranging from 400-1 400 m were hauled. A total of 16 465 fish were caught. The by-catch of other finfish in numbers amounted to 37% and was dominated by arctic skates (95%) while other species rarely occurred.

c) **Prognosis**

Based on information derived from survey data STACFIS considered that American plaice, wolffishes and starry skate off West Greenland are at a very low level, and any catches of these species will reduce the probability of recovery.

V. RESPONSES TO FISHERIES COMMISSION REQUESTS

STACFIS considered the request from the Fisheries Commission with regards to cod in Div. 2J, 3K and 3L, and the report was submitted to the Scientific Council for review and adoption (see Section II.6 of the Council report).

Mesh size in the redfish fishery in Div. 3LN, minimum fish size and minimum sizes of products corresponding to minimum landing sizes were dealt with by the Scientific Council (see Section II.6 of the Council report).

VI. AGEING TECHNIQUES AND VALIDATION STUDIES

1. Report on Methods of Ageing Silver Hake Otoliths

In 1992 a decision was made to move Canadian silver hake age reading from the St. Andrews Biological Station, New Brunswick, to the Bedford Institute of Oceanography, Nova Scotia. Training of the new age reader was completed in July 1993. The overall agreement between old and new readers was in excess of 70% and while there was an indication of bias in one of the two comparisons, there was only a small difference in estimated catch-at-age. Using glycerin-stored otoliths appeared to reduce age reader subjectivity and the need to minimize time between collection, and the transfer to glycerin was recognized as an important factor in the process. Estimated ages for 1993 were therefore considered to be based on criteria consistent with those used in the past and precision of ages of the new reader were similar to those for historical samples.

In response to the 1991 and 1992 recommendation of the Scientific Council regarding publication of a comprehensive manual on silver hake ageing, STACFIS was informed that the work on the silver hake radio-nucleotide study was unsuccessful because of technical reasons. Consequently, the status of the initially proposed report on ageing techniques must now be reviewed in light of the lack of results from this study,

as well as the change in responsibilities for the Canadian research group conducting ageing studies. The results of this review will be reported to STACFIS at its September 1994 Meeting.

2. **Reports on the Otolith Exchanges of *American Plaice and Greenland* Halibut**

STACFIS noted that the exchange of otoliths of American plaice from various areas in the Northwest Atlantic has been completed for some time and the results have not yet been tabulated. It was agreed these should be presented to STACFIS no later than June, 1995.

The exchange of otoliths and scales from Greenland halibut from different areas in the Northwest Atlantic has not been completed. STACFIS agreed it will be necessary to determine the status of the exchange and to ensure its completion, and then to tabulate and present results from this exchange to STACFIS as soon as possible.

3. **Other Ageing and Validation Studies**

There were no reports of other ageing and validation studies presented at this meeting.

VII. GEAR AND SELECTIVITY STUDIES

1. **Reports on Gear and Selectivity Studies**

Investigations on reducing the discard of small shrimp and juvenile fish in the shrimp fishery have been ongoing since 1991 jointly by Greenland, Iceland, Faroe Islands, Norway, Sweden and Denmark. In 1993 a grid device was tested in a commercial shrimp trawl. So far, the device is not adoptable for the fishery due to loss of large shrimps. Additionally, selectivity parameters of a commercial shrimp trawl from Greenland were estimated based on alternate hauls with different cod-end mesh sizes. A report on this investigation is expected next year.

2. **Proposals for Gear and Selectivity Studies**

STACFIS noted that the gear and selectivity studies on prevention of catches of small redfish in the shrimp fisheries in Subarea 1 were ongoing and encouraged the continuation of this work.

VIII. RELATIONSHIPS BETWEEN ACOUSTIC BIOMASS ESTIMATES AND OTHER METHODS

Considering management measures recently adopted by the Fisheries Commission and Coastal States, i.e. closing of fisheries, the Committee faces the situation that no fishery based data will be available in future for a lot of stocks. Consequently, analytical assessment cannot be conducted in those cases. Stock assessments then will be based mostly on fishery independent data like surveys. In this context the importance of acoustic survey data will be increased. However, the problem of comparability of results based on acoustic surveys and results based on surveys using trawl or longline, etc., has not been resolved yet. Therefore, STACFIS encourages that research be undertaken.

Concerning surveys combining estimates from trawl fishery and estimation from acoustic measurements, STACFIS **recommended** that:

1. *Information be provided to compare size distributions from the trawl component and the pelagic component at the same stations, and more detailed information be presented describing the vertical and horizontal distribution as determined from the trawl-acoustic surveys, and*

2. *further examination be conducted of trawl acoustic survey data to provide more details on the location or concentration of fish species, both near the bottom and in the water column, in all areas in which combined trawl acoustic survey are carried out.*

IX. OTHER MATTERS

1. **Progress Report on the Special Session in 1994**

STACFIS was informed that due to many other symposia scheduled around September 1994, including the ICES Statutory meeting in Newfoundland, only a limited number of papers had been submitted for the NAFO Symposium on "Impact of Anomalous Oceanographic Conditions at the Beginning of the 1990s in the Northwest Atlantic on the Distribution and Behaviour of Marine Life" to be co-convened by E. Buch, A. Sinclair and M. Stein. Consequently it would be more suited for a 2-day meeting. STACFIS, agreed with the discussion on this matter at the Environmental Subcommittee Meeting (see Annex 1), and proposed that the meeting should be re-scheduled to 15 and 16 September 1994, and be held at NAFO headquarters. It is anticipated that the Symposium will include the 10-year review of the environmental conditions in the Northwest Atlantic.

2. **Progress Report on the September 1995 Special Session**

The proposed NAFO/ICES joint symposium on "The Role of Marine Mammals in the Ecosystem" was observed to progress well with the draft of the first announcement submitted by the co-conveners for consideration at this meeting. STACFIS was pleased with the proposed structure of the meeting and confirmed that the Symposium will be held in Dartmouth in conjunction with the NAFO Annual Meeting.

3. **Progress Report on the September 1996 Special Session**

This topic was addressed at the Scientific Council Meeting.

4. **Review of Arrangements for Conducting Stock Assessments and Documentation of Assessments**

STACFIS welcomed the changes to the terms of reference of the Standing Committees of the Scientific Council, as adopted by the Council during this meeting. STACFIS observed that the new Rules of Procedure for STACFIS will come into effect on 1 January 1995.

5. **Review of Report by the Joint ICES/NAFO Working Group on Harp and Hooded Seals**

STACFIS noted there was no meeting of this Working Group since October 1992. STACFIS also noted a request for advice on harp and hooded seals had been received from Denmark (Greenland) during this meeting and that the Scientific Council will request the Working Group to consider this matter in conjunction with the June 1995 Meeting.

X. ADJOURNMENT

In closing the meeting, the Chairman thanked all participants for their efforts and contributions to this meeting. He thanked the Assistant Executive Secretary and the staff of the Secretariat for the help and efforts in running an efficient meeting. Noting his term was coming to an end on September 1994, and that he may not have the opportunity to see several of the participants in September, he thanked all participants for their help and support during his term of office.

ANNEX 1. REPORT OF THE SUBCOMMITTEE ON ENVIRONMENTAL RESEARCH

Chairman: M. Stein Rapporteur: K. Drinkwater

The Subcommittee met at the Keddy's Dartmouth Inn at 9 Braemar Dr., Dartmouth, Nova Scotia, Canada, on 9 and 15 June 1994, to consider environment-related topics and report on various matters referred to it by STACFIS. Scientists attended from Canada, Cuba, Denmark (in respect of Faroe Islands and Greenland), European Union, Japan, Russia and the United States.

The Subcommittee reviewed the following documents: SCR Doc. 94/4, 10, 15, 16, 17, 19, 20, 21, 27, 28, 33, 36; SCS Doc. 94/3, 10, 11 and 12.

1. Chairman's Report

The Chairman welcomed everyone and reflected on his chairmanship over the last 10 years. He felt that during this time there had been increasing interest in climate issues, and while future environmental conditions are not predictable, progress has been made in describing climate trends. He looked forward to a continued discussion and cooperation between physical oceanographers and fisheries scientists in an attempt to solve some of the outstanding and important issues in fisheries today.

It was noted that beginning 1994, this Subcommittee under STACFIS will be discontinued and replaced by a Standing Committee of the Science Council. It will be called the "Standing Committee on Fisheries and Environment" (STACFEN).

The Chairman was pleased to note a reasonable number of papers this year, in spite of the lack of a reminder to submit papers to the Environmental Subcommittee.

2. Invited Lecture by Dr. S. Goddard on Production of Antifreeze Proteins in Cod

The Chairman introduced the invited speaker Dr. Sally Goddard from the Marine Science Research Laboratory, Ocean Sciences Centre, Memorial University of Newfoundland, to the Subcommittee. He had invited her to speak after hearing her presentation at the Cod and Climate Symposium in Iceland last year.

Dr. Goddard began her talk by providing a brief history of the discovery of antifreeze in fish during the 1950s. Four different types of antifreeze proteins have since been found which inhibit the formation and growth of ice crystals in the blood of fish. This allows an increased tolerance to low water temperatures. Previous work by Dr. Gareth Fletcher and his co-workers in St. John's, Newfoundland, demonstrated that the antifreeze level in fish changes seasonally. Adults begin to produce antifreeze when water temperatures generally decrease below 0°C, reach maximum levels at the time of minimum temperature and production shuts off when the temperatures again rise above 0°C. Juveniles, on the other hand, begin production at higher temperatures and attain higher levels of antifreeze compared to adults. The difference between adults and juveniles is believed to be related to their migration patterns, as most adults migrate into warmer offshore waters in winter while juveniles overwinter in cold waters on the shelf. Studies on cod eggs show that they can withstand very cold temperatures (less than -5°C) unless the outer casing of the egg is damaged. Larvae can only withstand temperatures down to -1.3°C and therefore larvae may have high mortality under extreme cold water conditions and heavy ice.

Stress in fish is found to increase with exposure time to cold waters. Studies of cod in Trinity Bay, Newfoundland, in winter have shown that some fish will remain all winter, whereas most of the fish migrate offshore into warm waters. Those that stay, move to the bottom and begin in the autumn to produce antifreeze. They reach maximum levels of antifreeze by spring when they start to ascend towards the warmer surface waters.

She also reported that comparisons of ocean pout from waters off New Brunswick, Nova Scotia and Newfoundland have shown differences in antifreeze levels when exposed to the same water temperatures. These differences appeared to be due to genetic differences between fish from different regions. Differences in antifreeze levels were also found between cod at different latitudes, the higher values are found in the north.

Observations during the winters of 1991/92 and 1992/93 showed that the cod taken along the Avalon Peninsula have produced significantly higher levels of antifreeze proteins than during the previous 10 years although no significant change in water temperature was found. Dr. Goddard suggested that these fish may have immigrated in from regions further north.

3. **NAFO Special Session**

The Chairman noted that the Co-conveners of the Special Symposium on *Impact of Anomalous Oceanographic Conditions at the Beginning of the 1990s in the Northwest Atlantic on the Distribution and Behaviour of Marine Life* scheduled for 14-16 September 1994 had only received a total of 10-12 requests to present papers. As a result a proposal being considered was to change the symposium to a one day meeting. He speculated that the much lower response than anticipated was most likely due to a combination of financial constraints and the large number of conferences and symposia that are scheduled around the same time, e.g. ICES Annual Meeting, Coastal Zone Canada Conference, etc. However, it was anticipated that some valuable information would be presented, particularly in respect of the 10-year summary of environmental conditions and the patterns of the fisheries in the Convention Area.

4. **Marine Environmental Data Service (MEDS) Report for 1993** (SCR Doc. 94/16)

During 1993-94, MEDS had been busy processing their backlog of data and improving their quality control (QC) procedures. A brief summary of the QC procedures was presented.

a) **Data Collected in 1993**

Data from 4 561 oceanographic stations collected in the NAFO area were sent directly to MEDS in 1993. An additional 4 629 stations were received through Integrated Global Ocean Service System (IGOSS). The exact number of stations occupied was not certain because all the data had not been received by MEDS.

The number of stations received directly by MEDS was an increase of about 50% of that obtained during 1992-93, while the number of stations obtained through IGOSS increased by nearly 1 000.

b) **Historical Data Holdings**

Data from 26 217 oceanographic stations collected prior to 1993 were obtained during 1993-94, an increase by a factor of approximately 6.

c) **Drift-buoy Data**

A total of 86 drift-buoy tracks were received by MEDS during 1993 representing 79 buoy months. This amounted to an increase of over 20% in both buoy releases and buoy months compared to 1992-93. Plots of the buoy tracks by season were presented.

d) **Wave Data**

During 1993-94, 84 864 wave spectra were again processed, due mostly to the permanent network of moored wave buoys in the area. This represented a 7% drop as compared to 1992.

f) **Environmental Conditions**

Investigations showed that the Levitus climatology for the NAFO region was inadequate to provide meaningful anomalies for an overview of environmental conditions. MEDS efforts have been directed instead to providing data in a timely fashion to other agencies such as the Bedford Institute of Oceanography for their reviews.

5. **Review of Environmental Studies in 1993**

a) **Subareas 0 and 1** (SCR Doc 94/10, 17, 19; SCS Doc. 94/11)

During the annual EU-German groundfish survey (SCS Doc. 94/11) CTD measurements were taken at 55 fishing stations and along the NAFO standard sections off West Greenland (Fylla Bank and

Cape Desolation). An additional 54 XBT stations down to 750 m were taken in the eastern North Atlantic during trips to and from Greenland.

Monthly air temperature anomalies and changes in the ice cover in the northern North Atlantic were described (SCR Doc. 94/19). Extremely cold air temperatures (monthly mean anomalies of up to -8°K)[1] were observed in winter off West Greenland while above normal air temperatures persisted in September and October. Similar cold conditions in winter were observed in 1992 and during most of the previous decade. The cold winter was responsible for below normal annual mean temperatures in the region and continued the cooling trend at Nuuk on West Greenland which began in the late-1960s. The cold air lead to more extensive ice cover than normal, with ice appearing off the southwestern tip of Greenland. Ice did not leave the Cape Farewell region until August and returned again by December. Ocean temperatures at Fylla Bank in autumn were above normal (by 1°K in the top averaged over the top 50 m and 0.4°K over 0-200 m). Warmer conditions were observed further to the south along the Cape Desolation transect. Slightly above normal temperatures in the top 200 m were also observed off East Greenland in the autumn of 1993.

Temperature measurements taken during studies of Greenland halibut (*Reinhardtius hippoglossoides*) off West Greenland were briefly described. As part of a trial fishery for Greenland halibut (SCR Doc. 94/10) several CTD stations were taken in Div. 1A and 1B. Summer data showed the typical structure of a cold intermediate layer (<-1°C) with a slightly warmer surface layer and warmer deeper water. Bottom temperatures taken during halibut studies in Div. 1A-1D for the years 1988 to 1993 were also provided (SCR Doc. 94/17).

b) **Subareas 2 and 3** (SCR Doc. 94/21, 27, 28 33, 36; SCS Doc. 94/3, 10)

Sea temperatures collected during the annual fall Canadian groundfish survey in Div. 2J+3KL showed colder-than-normal upper layer temperatures in 1993 except near the coast where they were above normal (SCR Doc. 94/28). In the waters below 75 m, temperature anomalies continued to be between -1° and -2°K. Similar to the years 1991, 1992, large areas of the continental shelf had below normal bottom temperatures. The cold intermediate layer (CIL) over the northeast Newfoundland shelf and off Cape Bonavista was more extensive than normal in the fall of 1993. The area of CIL waters increased over 1992 off Cape Bonavista but decreased along the Seal Island (Hamilton Bank) section. At Station 27 off St. John's, Newfoundland, negative temperature anomalies were observed at mid-depths and near bottom. In contrast, the near surface waters were slightly warmer-than-normal. Oxygen levels in the waters covering the Newfoundland shelves were generally above normal in the autumn of 1993.

Environmental conditions in the Newfoundland area during the spring of 1994 were described (SCR Doc. 94/27), including data taken during an oceanographic survey in May 1994. As in recent years, cold air temperatures persisted through the early months of 1994 resulting in more extensive ice cover than normal over the Newfoundland shelf. Temperature anomalies at Station 27 in the first 4 months of 1994 were colder-than-normal throughout the water column except late in April when slightly warmer-than-normal values were observed over most of the top 100 m. Along the Flemish Cap section and the northern Grand Bank temperature anomalies varied with depth and horizontal position. Negative anomalies were observed along the Flemish Cap section in the surface layers over most of the transect, below about 90 m and along the edge of the Bank in the core of the Labrador Current. Positive temperature anomalies were recorded near the coast down to 100 m and over most of the Grand Bank at depths of approximately 30-90 m. Salinities were higher than the long-term mean near the coast and in the surface layers but lower in the bottom half of the water column and offshore. On the northern Grand Bank temperatures were primarily below normal with the maximum value (below -1°C) near the bottom at the edge of the bank in the Labrador Current. Positive temperature anomalies were observed nearshore and at mid-depths over the shallow regions of the Bank. Salinity anomalies were positive in the surface layers over the Bank and throughout the water column nearshore and offshore, but negative in the lower half of the water column and near the bottom at the Bank edge. The position of the offshore and inshore branches of the Labrador Current were clearly shown from acoustic doppler current measurements.

[1] Temperatures referred to as °C/K denote **measured** values/**derived** anomalies in Kelvin units.

Temperature and salinity data obtained from moored current meters on the NE Newfoundland Shelf and off southern Labrador (SCR Doc. 94/36) showed an annual cycle with a very peaked maximum. At 75 m the maximum occurred in November or December. At deeper depths the maximum, if any, typically occurs slightly later. The precise timing of the maximum also varied year-to-year. At many locations the amplitude of the high frequency variability was of the same order as the annual cycle, especially near the shelf edge and in the saddles. Therefore, ship measurements taken in those locations approximately at the same date each year had the potential to be biased.

An analysis of the influence of geostrophic current patterns on cod egg distributions on the Flemish Cap was presented (SCR Doc. 94/33). Earlier studies based upon oceanographic surveys between 1978 to 1984 had identified four circulation types; Cap-wide anticyclonic circulation, anticyclonic circulation with several centres of rotation, meanders across the Cap with an eastward flow, and a mixture of anticyclonic and eastward flow. It had further been suggested that the anticyclonic flow regimes favoured egg and larval retention while the eastward flow tended to sweep ichthyoplankton off the Cap. In the paper the authors suggested that eastward circulation may transport eggs onto the Cap, and this may have occurred in March of 1980 and 1981. High recruitment in 1986, when the circulation pattern was again generally eastward, was also suggested as possibly having arisen due to a transport of eggs from the Flemish Pass area onto the Cap.

Studies of otoliths from Flemish Cap cod (SCR Doc. 94/21) were used to assess the possibility of immigration of adult cod onto Flemish Cap between 1980 and 1989. The otolith rings showed similarities in size between different fish of different ages suggesting they were subject to the same environmental conditions of certain years (i.e. 1990). The authors concluded that the ring structures were related to environmental changes on Flemish Cap.

Results of an oceanographic survey in April to July on the Grand Banks and Flemish Cap (SCS Doc. 94/3) showed that bottom waters over the Grand Banks were typically colder and fresher than normal, the major exception occurring along the southern edge of the Bank and the Tail of the Bank, where conditions were warm and salty due to influence of slope waters.

The Canadian research report (SCS Doc. 94/10) noted that the time series of moored current meters on Hamilton Bank was continued in 1993 and that several clusters of satellite-tracked surface drifters were deployed.

c) **Subareas 4, 5 and 6** (SCR Doc. 94/4, 15; SCS 94/3, 10, 12)

Near bottom temperature data along the continental break of the Scotian Shelf were presented as part of a study on the distribution of silver hake (SCR Doc. 94/4). Feeding and prespawning aggregations of silver hake were observed in warm offshore waters in temperatures of 7-10.5°C. On the eastern half of the Scotian Shelf a near bottom front occurred between the cold intermediate waters on the banks and the warm offshore slope waters. Silver hake were not found in the colder shelf waters.

Analysis of sea surface temperatures in the region showed an increase from 1992 over the Scotian Shelf, in the slope waters off the Scotian Shelf and in the Labrador Sea north of the Grand Banks (SCS Doc. 94/3). Negative temperature anomalies were observed on the Grand Banks.

The Canadian research report indicated that circulation models are being used to investigate egg and larval drift with emphasis presently on Georges Bank (SCS Doc. 94/10). Long-term monitoring of zooplankton populations on the Scotian Shelf and in the Gulf of Maine was continued in 1993.

Monthly monitoring of surface and bottom temperatures on a transect across the Middle Atlantic Bight showed generally cooler-than-normal conditions, by upwards of 1.4°K at the surface (SCR Doc. 94/15). Below normal temperatures were also found in the Gulf of Maine but of lower magnitude. Bottom temperatures in Crowell Basin were, however, warmer than normal. Surface salinities were below average for 1993 in both the Middle- Atlantic Bight and in the Gulf.

Hydrographic surveys were conducted by U.S. scientists on Georges Bank as part of a herring study in January, November and December 1993 and over the entire shelf from Cape Hatteras to the Gulf of Maine in the spring and autumn 1993 in conjunction with bottom trawl surveys (SCS Doc. 94/12).

6. **Overview of Environmental Conditions in 1993** (SCR Doc. 94/20)

A review paper was presented based on several long-term oceanographic and meteorological data sets as well as summarized results from available research documents. Highlights for 1993 not covered in Section 3 are listed below.

a) Extremely cold air temperatures were again observed over southern Labrador and Newfoundland especially in winter, due in part to an intensification of the atmospheric circulation pattern. One index of the latter was the North Atlantic Oscillation (NAO) anomaly, which was strongly positive.

b) Similar to 1992, ice formed early, spread more rapidly, was of greater concentration and lasted longer than normal off southern Labrador, Newfoundland and in the Gulf of St. Lawrence.

c) The number of icebergs to reach south of 48°N during 1993 rose compared to 1992 but was slightly less than the recent maximum in 1991. It was the second highest number of bergs detected since the introduction of side-looking airborne radar 8 years ago.

d) Below normal temperatures were observed throughout most of the water column at Station 27. For the near bottom waters this continues a trend that has lasted ten years.

e) The areal extent of the CIL water in summer was greater than normal and had increased slightly or remained the same as in 1992.

f) In offshore waters, cold sea surface temperatures were found off Cape Farewell in Greenland, on the eastern Grand Banks and Flemish Cap, in the Gulf of Maine and on Georges Bank. Warm conditions were recorded in the Labrador Sea, on the Labrador Shelf, the Scotian Shelf and the Middle Atlantic Bight. The warmest conditions were observed in the slope waters off the Scotian Shelf.

g) Annual coastal sea temperatures at Halifax and St. Andrews were slightly below normal and about normal at Boothbay Harbor in 1993.

h) Deep water temperatures on the Scotian Shelf (Emerald Basin) and in the Laurentian Channel at Cabot Strait were above normal and increased over the 1992 temperatures.

i) Cold waters were observed in the 50-100 m depth range over the Scotian Shelf with several regions reaching anomalies equivalent to that recorded in the 1960s. The decline in temperature had begun in the mid- to late-1980s. In contrast, slope waters off the Scotian Shelf appear to be warm in the upper 200-300 m.

j) The Shelf/Slope front and the Gulf Stream were both north of their long-term mean locations.

7. **National Representatives**

No changes were reported to the national representatives responsible for submitting oceanographic data to MEDS. The representatives are:

G. Glenn (Canada), R. Dominguez (Cuba), E. Buch (Denmark), A. Battaglia (France), R. Leinebo (Norway), A.J. Paciorkowski (Poland), F. Troyanovsky (Russia) and G. Withee (USA). The representative for the United Kingdom is unknown.

8. **Joint Russian/German data evaluation (ICNAF/NAFO data, status report)**

At last year's meeting it was noted that a cooperative program between Russia and EU-Germany was being explored to retrieve hydrographic data from the Russian central archives. The Chairman reported that a 3-year program might get funding from 1995 onwards, that will allow German and Russian scientists and technicians to obtain and evaluate the historical hydrographic data collected by the former USSR.

9. **Other Matters**

Dr. Goddard was again thanked for her presentation. It was **recommended** that *similar invited talks on topics related to environmental influences on fisheries should be an ongoing annual feature.* This was generally agreed to by the Subcommittee and the Chairman offered to arrange such for next year's meeting and to discuss with the Secretariat the possibility of obtaining funds to help offset costs of such lecturers, if required.

10. **Acknowledgements**

The Chairman closed the meeting by thanking the participants for their contributions and cooperation.

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

Chairman: C. A. Bishop Rapporteur: E. F. Murphy

The Committee met at the Keddy's Dartmouth Inn, 9 Braemar Drive, Dartmouth, Nova Scotia, Canada on 15 and 17 June 1994, to discuss various matters pertaining to statistics and fisheries research in the Regulatory Area. Representatives from Canada, Cuba, Denmark (in respect of Faroe Islands and Greenland), European Union, Japan and Russian Federation and an observer from the United States of America were present.

1. Fisheries Statistics

a) Progress Report on Secretariat Activities in 1993/94

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

STACREC remains concerned about the ongoing delays in receipt of national statistical reports. A list of STATLANT 21A AND 21B reports that have not yet been received for 1991 and 1992 are shown in Table 1. The 1993 STATLANT 21A reports have not been received for many components and this meant that the update of fisheries trends could not be produced for this June meeting. STACREC was seriously concerned that a major component of NAFO statistics are not available since 1988 from EU-France and **recommended** that *the Scientific Council take steps to obtain these data to complete the database and update statistical bulletins.*

Table 1. List of STATLANT 21A and 21B reports which have not been submitted for 1991 and 1992.

STATLANT 21A		STATLANT 21B	
1991	1992	1991	1992
EU-France (M)	EU-France (M)	EU-Denmark	Canada-M
France (SP)	France (SP)	France (SP)	Canada-N
	Lithuania	Norway (Partial)	EU-Denmark
		USA	EU-France (M)
			France (SP)
			Lithuania
			USA

ii) Acquisition of statistical information from other NAFO Standing Committees

STACREC has been informed (September 1993) that there was no problem in using data contained in Working Papers produced by other Standing Committees, namely STACTIC and STACFAC. Data contained in these papers could be requested directly from the Secretariat for use in stock assessments.

STACREC noted that the reports from these Committees should be reviewed and the reports and/or lists of Working Papers should be distributed to national representatives and designated experts prior to assessment meetings to evaluate their usefulness. It was noted that the documents from NAFO Constituent Bodies and Standing Committees are routinely made available for reference at the Scientific Council Meeting by the Secretariat.

iii) Publication of statistical information

STACREC again noted that late submission of STATLANT reports (Table 1) continues to affect timely production of Statistical bulletins. *NAFO Statistical Bulletin* (40) containing the 1990 data was published in February 1994 without data from EU-France (M) and France (SP).

The problem of misallocation of roundnose and roughhead grenadier catches was discussed by STACREC in June 1993, particularly with regards to Portuguese and Spanish

catches. Data were presented at this meeting suggesting that this problem has been resolved. STACREC suggests that the corrected data should be forwarded by the Secretariat to statistical offices of EU-Spain and EU-Portugal so that they may be confirmed as official statistics.

STACREC reviewed the Secretariat's decadal catch summary (SCS Doc. 94/1) and indicated that the document receives considerable use. Some changes and/or additions to the present format were suggested. These included that catch be reported by NAFO Div. rather than Stock area, as well as some streamlining of the tables to exclude those countries perpetually reporting zero catches. It was suggested that representatives consider the matter and prepare proposals for consideration by STACREC.

b) **Deadlines for Submission of STATLANT 21A and 21B Data**

The Chairman noted that there may have been some uncertainties regarding the deadlines for submission of STATLANT 21A and 21B data. The issue was discussed to provide clarification of the current status. Although STACREC recommended in 1993 that Rule 4.4 be changed to May 30 and August 31, respectively, in response to EU-EUROSTAT concerns, STACREC confirmed that NAFO requirements as stated in the Scientific Council Rules of Procedures, Rule 4.4, are May 15 for STATLANT 21A and June 30 for STATLANT 21B. This Rule 4.4 remains in effect for NAFO submissions as this was ratified by the General Council in September 1992.

c) **Preparation for the CWP 16th Session**

i) STACREC was informed that an *ad hoc* Inter-Agency Consultation meeting sponsored by FAO was held in La Jolla, California in December 1993 on the role of regional fishing agencies in relation to high seas fishing statistics. The Assistant Executive Secretary attended this meeting upon the invitation of FAO. Items addressed included the requirements for statistics on high sea fisheries for research and management purposes, the type of statistics to be collected, collated and disseminated by FAO, arrangements for reporting statistics, and arrangements for exchanging information. The issue of extending the brief of the CWP on Atlantic Fisheries Statistics to areas outside the Atlantic Ocean was also addressed. STACREC was informed that the report of this meeting was available at the Secretariat.

ii) STACREC noted that the Assistant Executive Secretary was invited to FAO to investigate discrepancies between the NAFO database and the FAO database. The Assistant Executive Secretary reported that the majority of the discrepancies were resolved and a process devised to ensure that the NAFO database is compatible to the FAO database for the STATLANT 21 area.

iii) STACREC noted that an *ad hoc* Consultation of the CWP participating regional fisheries agencies was scheduled for July 1994 in place of the Sixteenth Session of the CWP as discussed by STACREC in 1993. This *ad hoc* Consultation has been primarily designed to discuss possible revisions to CWP statutes and rules of procedure. Consultation with NAFO Contracting Parties indicated that a clear picture of the role of CWP was necessary before discussions are made on revising statutes. Any attendee would require a clear mandate on policy making. It was considered that the matter be dealt with at General Council with possible participation by a General Council representative. STACREC noted that CWP has been a productive Working Party and maintaining the informal nature of its functions should be a primary consideration.

NAFO has indicated that the Assistant Executive Secretary would not be attending this *ad hoc* consultation, but would attend the 16th Session of the CWP, as originally intended.

STACREC noted it maintains its full interests in the work of the CWP, and reconfirmed that attendees (STACREC Chairman, C. A. Bishop; Assistant Executive Secretary and the representative from Spain, E. de Cardenas) slated to attend the 16th Session of the CWP will be **recommended** to attend that meeting now scheduled for February 1995 in Madrid, Spain.

2. **Biological Sampling**

a) **Report on Activities in 1993/94**

The Provisional List of Biological sampling for 1992 was tabled (SCS Doc. 94/8).

It was noted the Inventory of Sampling Data for the period 1985-89 was published in March 1993. The next issue of the 5-year publication would be considered by STACREC at its meeting in June 1995.

b) **Report by National Representatives**

National representatives reported on their sampling programs of commercial fisheries for 1993/94 as follows:

Cuba.. No sampling.

Canada. Canadian commercial fisheries in 1993 were reduced because of a moratorium and reduced TACs. Data relative to length and age were collected for most commercial catches as required from Subareas 2 and 3. Sampling at sea was accomplished by observers and additional sampling was conducted on the Div. 2J+3KL non-commercial cod fishery.

Denmark-Greenland: Biological samples were obtained in 1993 from the commercial fishery in Subarea 1 and Denmark Strait (ICES XIV).

- **Shrimp, offshore (Div. 1A-1F, ICES XIV)**. Shrimp were sexed and carapace length measurements were collected from catch (directly from trawl).

  The most important fishing areas and periods were covered. Sampling in Subarea 1 covered Div. 1B, 1C, 1D and 1E in the 1st quarter and Div. 1B, 1C and 1D in the 3rd and 4th quarter, whereas sampling in ICES XIV covered the 1st and 2nd quarter.

- **Greenland halibut, inshore (Div. 1A)**. Length measurements and otoliths were taken from landings, covering the inshore gillnet/longline fishery. Sampling were extended in 1993 and covered the three important fishery areas, summer and winter.

- **Greenland halibut, offshore (Div. 1B-1D)**. Length measurements were taken from the catch aboard a Norwegian trawler.

- **Cod inshore (Div. 1B-1F)**. Length measurements and otoliths were taken from landings, covering the inshore poundnet fishery from May to September (the main part of the cod fishery in 1993).

EU-Denmark. No sampling.

EU-France. No. sampling, no fishing.

EU-Germany. No sampling, no fishing.

EU-Portugal. During 1993 biological sampling was obtained from one stern trawl fishing in all Divisions from January to June and two gillnetters operating between April and August, one mainly in Div. 3M and the other in Div. 3N/30. Catch and effort data were also obtained from these vessels through direct consultation of the captain's logbook records, as in previous years. In addition to this, statistical information on catch and effort from one trawler and one gillnetter fishing in the NAFO area was also made available by the respective captains, on a trawl by trawl basis.

Biological sampling was conducted for the most abundant species in each haul following the NAFO sampling recommendations. Cod, redfish (*S. mentella*), American plaice and Greenland halibut were the main species sampled in three trawl vessel sampled. For the gillnet ones besides cod, redfish (both *S. mentella* and *S. marinus*) and American plaice, red hake was also sampled.

In order to assess the impact of the redfish trawl fishery on the cod stocks, cod by-catch rates were also estimated in 1993, below and above the 400 depth line. Also by-catches of cod on direct fishing for Greenland halibut was assessed by month and Division.

EU-Spain. During 1993 sampling for the catches by Spanish fleet was obtained by observers on board. Length and age samples were obtained for Greenland halibut, American plaice and cod. Coverage included 10 pair trawler units (3 observers - 3 months each), 12 small freezer trawlers, and 22 large freezer trawlers (1/3 of total year covered).

Japan. No sampling.

Russian Federation. Data were obtained relative to length and age for silver hake in Subarea 4.

c) **Data Necessary for Stock Assessments**

The available data from commercial fisheries by stock relative to the assessment is given in Table 2.

Table 2. Available Data From the Commercial Fisheries Related to Stock Assessment (1993).

				Biological Sampling				
Stock	Country[1]	Catch	CPUE	Sex	Length	Age	Individual Wt.	Maturity
2J3KL cod	CAN	9 000		X	X	X	X	X
	E/ESP	2 200			X			
	OTHER	225						
3M cod	E/PRT	3 130	X		X	X		
	E/ESP	2 249			X	X		
	OTHER	7 000						
3NO cod	CAN	5 326		X	X	X	X	X
	E/PRT	521	X	X	X	X	X	
	E/ESP	3 031		X	X	X	X	
	RUS	150						
	OTHER	700						
SA 1 redfish	GRL	299[3]						
3M redfish	CUB	945	X					
	EST	2 188[2]						
	JPN	967						
	LAT	6 875[2]						
	LTU	2 190[2]						
	NOR	37[2]						
	RUS	2 035	X					
	E/ESP	100		X	X			
	E/PRT	4 781	X	X	X	X	X	
	OTHER	4 138[1,2]						
	TOTAL	24 256[1,2]						
3LN redfish	CAN	45	X	X	X	X		
	E/PRT	253	X	X	X			
	E/ESP	36			X			
	EST	1 926						
	LAT	3 403						
	LTU	1 790						
	JPN	36						
	RUS	5 619	X		X			
	KOR-S	708						
	OTHER[5]	3 627-9 427						

Table 2. Continued.

Stock	Country[1]	Catch	CPUE	Biological Sampling				
				Sex	Length	Age	Individual Wt.	Maturity
4VWX silver hake	RUS	7 139	X	X	X	X	X	X
	CAN	73	X	X	X			X
	CUB	22 018	X	X	X	X	X	X
3M American plaice	E/PRT	75[2]		X	X		X	
	E/ESP	100[2]		X	X	X	X	
	OTHERS	100[2]						
3LNO American plaice[6]	CAN	7 585	X	X	X	X		
	KOR-S	13						
	E/PRT	50[2]	X	X	X	X		
	E/ESP	525[2]		X	X			
	USA	84						
	OTHER	9 000						
3NO witch flounder	CAN	4 337	X	X	X	X		
	E/PRT	245						
	E/ESP	7						
	RUS	3						
	USA	12						
3LNO yellowtail flounder[7]	CAN	6 697	X	X	X	X		
	USA	68						
	OTHER	6 800						
SA 1 Greenland halibut	GRL	918						
	JPN	1 434		X	X	X	X	X
	NOR	1 775	X		X			
	FRO	113						
	E/DEU	49						
SA 0 G. halibut	CAN	7 613	X		X	X	X	
SA 2+3 Greenland halibut	CAN	5 128	X	X	X	X		X
	E/ESP	35 640	X	X	X	X		
	E/PRT	8 808	X	X	X			
	JPN	2 919						
SA 2+3 roundnose grenadier	E/ESP	4 281						
	JPN	127						
Div. 3NO Capelin				Fishery closed. No catches reported.				
SA 3+4 Squid	CAN-N	261		X	X			X
	CAN-M	34						
	CUB[4]	2 358	X[4]					
	RUS[4]	92						

1 OTHER refers to estimates of non-Contracting Parties who did not report catches to NAFO.
2 Data of Canadian surveillance.
3 By-catch of small redfish taken by the shrimp fishery is believed to be substantial in number and not reported.
4 By-catch in silver hake fishery. Effort is directed for silver hake.
5 OTHER - Non-reported catch could not be precisely estimated but is considered to be in this range.
6 Actual total catch may be 2 100 tons higher.
7 Actual total catch may be 200 tons higher.

d) **Assessment Data Needs in Relation to Research in the Regulatory Area**

There were some concerns expressed relative to the identification of specific assessment data needs in the Regulatory Area. There is still a lack of data from non-Contracting Parties who continue to catch substantial amounts of various species in the Regulatory Area.

3. **Biological Surveys**

a) **Report on the Activities in 1993**

An inventory of biological surveys conducted in 1993 as submitted by National Representatives and Designated Experts was presented by the Secretariat (Table 3). Designated experts also provided a more detailed account of the survey data available for 1993 relative to their stocks.

Table 3. Inventory of biological surveys conducted in the NAFO Area during 1993.

Subarea	Division	Country	Months	Type of survey	No. of sets
				Stratified-random Surveys	
1	A-F	GRL	7-9	Shrimp and groundfish	187
	B-D	GRL/JPN	8-9	Greenland halibut	87
	B-F	DEU	10	Groundfish, Oceanography	
2+3	JK	CAN-N	10-12	Groundfish	
3	L	CAN-N	5,8,10	Crab	
	L	RUS	5-6	Groundfish, temperature, salinity	74
	LNO	CAN-N	4-6	Groundfish	
			8	Redfish	
			8-9	Juvenile flatfish	
	M	E/ESP	6-7	Groundfish	101
		RUS	4-7	Groundfish, temperature salinity	69
		CAN-N	10-12	Groundfish	
	N	RUS	5	Groundfish, temperature, salinity	80
	O	RUS	5	Groundfish, temperature, salinity	78
	P	CAN-N	4	Groundfish	
	Ps		5	Scallops	
			7-8		
				Other Surveys	
1	A	GRL	7-9	Greenland halibut longline inshore	52
	A-D	GRL/NOR	5-8	Greenland halibut longline offshore	44
	B-F	GRL	6-7	Juvenile cod, inshore gillnets	170
2+3	HJKL	CAN-N	7	Oceanography	
	JKL		8-10	Capelin acoustic	
			12-1	Juvenile cod	
	JKLPs		10-11	Oceanography	
3	KL	CAN-N	4-5,5-6,9-10	Oceanography	
			5-6	Cod tagging	
			6	Cod acoustics	
			9-10	Juvenile cod and capelin	
			11-12	Herring acoustics	
	KLP	CAN-N	5-6,10	Acoustic calibration	

Table 3. Continued.

Subarea	Division	Country	Months	Type of survey	No. of sets
3	L	CAN-N	5,6, 8-9,9, 10,12	Oceanography	
			6	Trawling impact on cod spawning	
			6	Cod and capelin acoustics	
			6-7	Cod acoustics	
			7	Ichthyoplankton	
			7	Trawling impact on benthos	
			9,9-10	Gear trials	
			9	Crab	
			10-11	Juvenile cod	
	LNO	CAN-N	6	Flatfish tagging	
		RUS	6	Capelin, temperature,	~316
3+4	OVW	CAN-SF	6,9	Trawling impacts	
4	VWX	CAN-SF	5	Scallop	
	W		1	Herring acoustic	
			10	Juvenile silver hake	
	X		5	Globec plankton cruise	
			10	Globec Moorings	
			10-11	Herring larvae	
5	Z	CAN-SF	8	Scallop	
			11	Herring resurgence	

b) **Surveys Planned for 1994 and Early-1995**

An inventory of biological surveys planned for 1994 as submitted by National Representatives and Designated Experts was presented by the Secretariat (Table 4).

Table 4. Biological surveys planned for the NAFO Area in 1994 and early-1995.

Country	Area	Type of Survey	Dates
		Stratified-random Surveys - 1993	
CAN-N	2J+3K	Groundfish	Nov-Dec
	3L	Crab	May, Aug, Sep-Oct
		Scallops	Jul
	3LNO	Groundfish	Apr-Jun, Oct-Dec
		Juvenile flatfish	Sep-Oct
	3P	Groundfish	Apr
	3Ps	Scallops	May
	3P+4V	Redfish	Aug
CAN-SF	4VW	Groundfish	Feb, Jul
	4X	Groundfish	Jul
	5Z	Groundfish	Feb
EU	3M	Groundfish	Jul
E/DEU	1B-F	Groundfish, oceanography	Oct-Nov
GRL	1A-F	Shrimp and groundfish	Jul 9- Oct 10

Table 4. Continued.

Country	Area	Type of Survey	Dates
GRL+ JPN	1A-D	Greenland halibut	Aug 1-21
JPN	1NK	Bottom trawl survey on G. halibut	
RUS	3L	Groundfish,temperature, salinity	Jun - Jul
	3M	Groundfish,temperature, salinity	Jul
	3N	Groundfish, temperature, salinity	Jun
	3O	Groundfish, temperature, salinity	Jun
		Other Surveys - 1994	
CAN-N	2J+3KL	Cod acoustics	Jun
		Oceanography	Jun
		Juvenile cod and capelin	Aug-Sep, Dec-Jan
		Capelin acoustics	Sep-Oct
	3K	Herring acoustics	Nov-Dec
	3KL	Seals	Feb
	3KLMN	Greenland halibut	Feb
	3KLP	Acoustic calibration	May-Jun, Oct-Nov
	3L	Oceanography	Jan, Feb, May, May-Jun, Jul, Sep, Nov
		Cod tagging	Feb, May-Jul
		Trawling impact on benthos	Jun-Jul
		Capelin acoustics	Jul
		Ichthyoplankton	Jul-Aug
		Crab	Aug, Sep
		Cod acoustics and tagging	Oct
		Gear trials	Oct-Nov
	3LN	Gear trials	Jan-Feb, Jul
	3LPs	Herring acoustics	Jan-Feb
CAN-SF	3O	Trawling impacts	Jul
	4VWX	Scallop survey	May
	4W	Fish sampling	May
		Zooplankton	Jun
		Gear trials	Jun
		IYGPT trawl survey	Nov
	4X	Herring larvae	Oct
	5Z	Acoustic, trawling, tagging	Mar
		Scallop research	Aug
		Herring resurgence	Nov
GRL	1A	Greenland halibut inshore, longline	Aug - Sep
		Snow crab	Aug
	1B-F	Juvenile cod inshore, gillnets	Jun- Jul
	1E-F	Snow crab	Jun
RUS	3LNO	Capelin, temperature, salinity	Jun

Table 4. Continued.

Country	Area	Type of Survey	Dates
		Surveys Planned for Early-1995	
CAN-N	2J3KL	Cod acoustics	Jan
		Cod tagging	Jan-Feb
	3L	Oceanography	Jan-Feb
	3Ps	Herring acoustics	Jan
GRL+ NOR	1D	Greenland halibut, longline offshore	Jan

c) **Review of Stratification Schemes**

A document (SCR Doc. 94/43) was presented describing revisions and additions to the stratification scheme used for stratified-random groundfish surveys in Subareas 2 and 3. Charts in Div. 2G and 2H were completed (strata units added) while those in Div. 2J and part of Div. 3K were revised because of the availability of revised and more accurate charts which indicated that those originally used contained many errors. Stratification charts for Div. 3L, 3M, 3N, 3O, and 3P were extended to include depth zones from 400 to 800 fathoms. Those for Div. 3O and Div. 3P also had minor revisions to several strata on the edge of the banks because of errors in the charts originally used. The stratification scheme in Div. 3P was also extended to some inshore areas in Placentia Bay.

STACREC noted that the revised stratification is currently being used by Canada and is available for use by other Contracting Parties.

d) **Coordination of Surveys**

In June 1993 the Scientific Council proposed that consideration be given to implementation of a joint multinational trawl survey, particularly noting there were a number of different initiatives taking place in Subareas 2-3 for Greenland halibut. Information provided by EU-Spain indicated that they will propose to the EU to conduct a survey (1995) in Div. 3M, 3L, 3N and 3O in depths from 700 to 2 000 m. Greenland with Japan will conduct a survey for Greenland halibut in Subarea 1 during 1994 at depths from 400 to 1 500 m. STACREC **recommended** that *this initiative be discussed and coordinated with other interested countries.*

4. **Non-traditional Fishery Resources in the NAFO Area**

a) **Statistics and Sampling**

It was noted in the 1993 STACREC report that the shrimp fishery that developed in 1993 in the Flemish Cap area could take significant numbers of finfish as by-catch. STACREC advised that information on the levels and species of this by-catch needs to be monitored to determine impacts on assessed stocks.

b) **Survey Data**

i) **Species encountered in surveys**

STACREC observed there has been a need in the past for information on some non-traditional species (e.g. skate). This information would be best obtained from research surveys. STACREC suggested that there is a need to give additional consideration to determining abundance and distribution of non-traditional species. The status of these species could change as traditional species decline.

ii) **Feasibility of having set-by-set data on non-traditional species**

STACREC was presented with a proposal that basic survey data from traditional stratified-random surveys be provided to the Secretariat, to facilitate *ad hoc* determination of distribution and abundance of non-traditional species as might be required. STACREC did not discuss this topic to any extent but proposed that representatives address this for future consideration.

5. **Other Matters**

a) **List of Fishing Vessels for 1992**

The Secretariat could not provide a list of fishing vessels for 1992 because reports were still outstanding for 11 countries. STACREC requested the representatives ensure the data are submitted.

b) **List of Tagging Activities**

The Secretariat compiled a list of tagging activities in 1993 (SCS Doc. 94/7). Representatives were requested to check the list and report any errors or omissions.

c) **Update of Information on Conversion Factors**

At its meeting in September 1993, STACREC reported that FAO was in the process of revising their previously published document on conversion factors and the information should be obtained from that update before further work on compilation of conversion factors was attempted. The Secretariat has since been informed that the information is not yet available. The 1993 report of CWP also indicated that the Working Party had made a similar request to FAO. STACREC **recommended** that *further work on conversion factors would not be required at the Scientific Council level until the status of the FAO report was determined.* It also suggested that the Secretariat obtain further information on the progress from FAO.

d) **Other Papers**

STACREC tabled for review, eight papers not related to stock assessments, which were traditionally considered in STACFIS (SCR Doc. 94/4, 11, 24, 26, 29, 34, 35, and 38). Sufficient time for adequate review was not available at this particular meeting and STACREC deferred the review to the September 1994 Annual Meeting. STACREC hoped that such reviews in future would be done in June to ensure adequate peer-review.

e) **Pilot Observer Program**

Contracting Parties, through STACTIC, set up a Pilot Observer Program in 1993 which has been extended into 1994. Information from this program has not been made available to STACREC for review. STACREC noted that this information may be quite useful with regards to stock assessments and **recommended** that *the Scientific Council determine if the data from the Pilot Observer Program can be made available for assessment purposes.*

6. **Acknowledgements**

The Chairman thanked the Secretariat for their assistance in compiling all the pertinent information for the meeting.

As there was no further business the meeting was adjourned.

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

Chairman: W. R. Bowering Rapporteur: K. H. Nygaard

The Committee met at the Keddy's Dartmouth Inn, 9 Braemar Drive, Dartmouth, Nova Scotia, Canada on 13 and 18 June, 1994. In attendance were W. R. Bowering (Canada, Chairman), J. M. Morgan (Canada), V. A. Rikhter (Russian Federation), M. Stein (EU-Germany), A. Vazquez (EU-Spain), K. H. Nygaard (Greenland) and the Assistant Executive Secretary (T. Amaratunga).

1. Review of STACPUB Membership

The Scientific Council at its meeting in September 1993 agreed to undertake its review of northern shrimp at Special Meetings in November. As a result P. Kanneworff (Greenland) informed STACPUB he would no longer attend the June Meetings. Accordingly, he had been replaced by K. H. Nygaard (Greenland) by the Scientific Council. While extending its appreciation to P. Kanneworff for his services in STACPUB, K. H. Nygaard was welcomed to the Committee. Further J. M. Morgan (Canada) substituted for J. E. Carscadden (Canada) for this meeting. The Scientific Council on 17 June 1994 had been informed by J. E. Carscadden (Canada) that he was not likely to attend the June Meetings in the foreseeable future, and the Council replaced him by J. M. Morgan (Canada). STACPUB extended its appreciation to J. E. Carscadden for his services and welcomed J. M. Morgan.

2. Review of Scientific Publications Since June 1993

a) Journal of Northwest Atlantic Fishery Science

STACPUB noted Volume 15, containing the paper on "Decapod Crustacean Larvae from Ungava Bay" by Hubert J. Squires, and 3 notices (169 pages) was published with the publication date of December 1993.

Volume 16 containing 6 miscellaneous papers is in the final stages of preparation. This issue is expected to be completed by mid-1994.

Volume 17, containing papers presented at the November 1990 Canada-USSR Meeting on Capelin, has 5 papers in the final stages of preparation. This issue is expected to be completed by mid-1994.

STACPUB also noted the special issue of the Journal containing papers presented at the NAFO 1993 Symposium was also in progress after a short delay in the editorial process.

b) NAFO Scientific Council Studies

Studies Number 19, containing 8 miscellaneous papers and 3 notices (97 pages) was published with the publication date of October 1993.

Studies Number 20, containing 7 miscellaneous papers was published with the publication date of February 1994.

STACPUB noted a group of 13 papers (SCR Documents) dealing with Northern Cod presented in June 1993 had appeared suitable for a single issue of Studies. STACPUB was pleased that of those 13 papers, 8 papers plus 1 abstract were submitted by the coordinator J. S. Campbell (Canada) to the Secretariat on 25 May 1994 to be published. The publication of this issue is expected to be completed by the end of 1994.

There are presently 3 miscellaneous papers in hand at the Secretariat which are in the process of being edited.

c) **NAFO Statistical Bulletin**

NAFO Statistical Bulletin, Vol 40 for 1990 was published without EU-France Metropolitan and France (St. Pierre and Miquelon) data, in February 1994 (309 pages). These data were still not available.

STACPUB noted that the delay in the acquisition of final data has delayed the timely publications of Bulletin, Vol. 41 and Vol. 42.

d) **NAFO Scientific Council Reports**

The volume (234 pages) containing reports of the 1993 meetings of the Scientific Council in June, September and November was published and distributed in January 1994, instead of the usual publication month of December. The Secretariat had found it more appropriate to wait until the year ended before the Scientific Council Reports for each year was published.

e) **List of Fishing Vessels**

This triennial publication with data for 1992 was due to be published last year but data were still outstanding from many countries. STACPUB noted this matter was being addressed by STACREC.

f) **Inventory of Sampling Data**

Inventory of Sampling Data, 1985-89 was published in March 1993. The next issue for 1990-94 is targeted for 1996.

g) **Index of Journal and Studies**

STACPUB was pleased that in accordance with the Scientific Council decision, the Index of Journal of Northwest Atlantic Fishery Science and NAFO Scientific Council Studies, 1980-93 (62 pages) (since NAFO replaced ICNAF) was completed and published by the Secretariat in February 1994.

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

a) **Publication Costs and Revenues**

The production costs and the revenues for the various publications related to the activities of the Scientific Council were reviewed by STACPUB. No significant departures from those of previous years were observed. However, a new billing procedure which requires advance payment from recipients, and the ongoing review of the Secretariat mailing list had resulted in a decrease of copies sent out.

b) **Microfiche Project**

STACPUB noted that there was no new information on this subject and that the project is now considered to be concluded.

c) **Print Pages at the Secretariat**

STACPUB noted that a lot has been accomplished in regard to avoiding double printing of documents, as no second print is now made for the majority of SCR and SCS Documents. As participants at the meetings are requested to submit finalized documents, and participants no longer get another copy by mail, there has been further decreases in the costs connected with publications.

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

a) **Publicity and Response Regarding the Journal**

The inclusion of the Journal in Allen Press Subscription Catalog has been suspended due to costs involved and because it has been difficult to evaluate its effectiveness. STACPUB was informed that the Journal is included in a number of relevant scientific citation indices.

STACPUB found that topics of broad interests considered at NAFO Special Sessions and published in the Journal, could be a possible avenue to enhance the propagation of the Journal.

b) **Invitational Papers for the Journal**

As requested the Secretariat had contacted V. K. Zilanov (Russian Federation) about the prospects for a possible submission of scientific papers from various Russian research institutes. The response from V. K. Zilanov had been very positive, but as of this meeting there had been no further progress.

As a result of the forthcoming Russian/German Data Evaluation Project on historic ICNAF/NAFO oceanographic data, STACPUB welcomed an invitational paper on results of this bilateral project. This paper would be available after the completion of the 3-year project starting during 1995 when funds are allocated.

STACPUB agreed that further invitational papers should be considered by STACPUB members, and proposals be brought to the September 1994 Meeting.

5. **Editorial Matters Regarding Scientific Publications**

a) **Editorial Activities**

At its meetings since 1980, STACPUB has nominated a total of 448 research documents as potential for publication in the NAFO Journal or Studies. This includes 12 documents nominated at the June 1993 Meeting and 25 documents at the September 1993 Meeting. Since 1980, a total of 357 papers have been published in the Journal (166) and Studies (191). Some of the papers have been submitted independent of the research documents series.

b) **Progress Report of Publication on West Greenland Cod**

Papers for the single issue publication on West Greenland cod is being compiled by the coordinator (H. Lassen). Three to four papers have progressed considerably, while others have not been received. A very early submission has already been published in the Journal, and hence it was necessary for the plan to have all papers in one single issue to be amended somewhat.

c) **Review of General Editorial Process**

STACPUB noted that the general editorial process had improved and seemed to run smoothly.

d) **Review of the Editorial Board**

STACPUB welcomed S. Murawski (USA) as the newly appointed Associate Editor for Vertebrate Biology in replacement of R. G. Halliday, who stepped down from the Editorial Board in September 1993.

6. **Papers for Possible Publication**

a) **Procedures for STACPUB Review**

A detailed discussion was carried out regarding the procedures for STACPUB review of papers. It was agreed that the questionnaire requesting authors to state whether or not a paper should be considered for publication was an improvement and had considerably lowered the workload of STACPUB. The inclusion of boxes to indicate whether a paper should be considered for Journal or Studies was also found useful.

Concern had been raised that papers passing STACPUB review had often been heavily criticised by Associate Editors and referees and that a number had been rejected for publication. This often leading to an extensive workload for editors and referees and disappointment for the authors.

STACPUB found that time constraints at the meetings could be a limitation to a fair review of papers, but on the other hand agreed that the role of STACPUB was to act as a preliminary review board with the opportunity to encourage authors to upgrade papers and offer constructive comments. The sole responsibility for the quality of the paper however lies with the author. It was agreed that in the letter to the author it should be clearly stated that a nomination does not necessarily mean approval for publication.

STACPUB noted that some authors do not differentiate between Journal and Studies and stressed that authors need to put more effort into evaluation of the content of the paper and the distinction between Journal and Studies.

b) **Review of Proposals Resulting from the 1993 Meetings**

Of the 12 papers nominated at the June 1993 Meeting, 7 papers have been submitted. In addition, of the 25 papers presented at the NAFO 1993 Special Session, 12 papers have been submitted and are in various stages of preparation for a single issue of the Journal.

In addition, 5 papers from outside of the STACPUB nomination process were submitted since June 1993.

c) **Review of Contributions to the 1994 Meetings**

STACPUB was pleased with the inclusion in the questionnaire to authors of SCR Documents, boxes to indicate the preferred publication (i.e. either the Journal or Studies). As a result, STACPUB members were able to focus on those papers requested by the authors. Members were also able to offer comments as to how each document could be improved.

STACPUB considered 16 SCR Documents and nominated the following 13 including the standard papers on overview of environmental conditions: SCR Doc. 94/4, 7, 18, 19, 20, 24, 26, 27, 28, 30, 33, 35 and 58. The Assistant Executive Secretary was requested to invite the authors to submit them in a suitable form for consideration for publications, with a clear note as discussed above in Section 6.a).

7. **Publication of 10-year Environmental Perspective**

STACPUB suggested this to be discussed with the conveners at the September 1994 Symposium on environmental conditions.

8. **Other Matters**

No other matters were discussed.

9. **Acknowledgement**

The Chairman closed the meeting and thanked the members for their contributions. He also thanked the Assistant Executive Secretary for his support and organization of most of the documentation for review and asked that he convey the Committee's appreciation to the staff of the Secretariat for their efforts in support of the NAFO publications.

A special thanks was afforded to K. H. Nygaard for his assistance as rapporteur while making a full contribution to the meeting as a member.

APPENDIX IV. AGENDA SCIENTIFIC COUNCIL MEETING - 8-22 JUNE 1994

I. Opening (Chairman: H. Lassen)

1. Appointment of rapporteur
2. Adoption of agenda
3. Attendance of observers
4. Plan of work
5. Report of proxy votes (by Executive Secretary)

II. Fishery Science (STACFIS Chairman: H. P. Cornus)

1. General review of catches and fishing activity in 1993

2. Review of recommendations from 1993 meetings

3. Environmental research (Subcommittee Chairman: M. Stein)

   a) Chairman's report
   b) Invited Lecture (Dr. S. Goddard, Northern Cod Project)
   c) Special Session September 1994
   d) Marine Environmental Data Service (MEDS) Report for 1993
   e) Review of environmental studies in 1993
   f) Overview of environmental conditions in 1993
   g) National representatives
   h) Joint Russian/German data evaluation (ICNAF/NAFO data, status report)
   i) Other matters

4. Stock assessments

   a) Review of assessment methods to be used

   b) Stocks within or partly within the Regulatory Area, as requested by the Fisheries Commission with the concurrence of the Coastal State (Annex 1)(Shrimp in Div. 3M will be undertaken during the Annual Meeting in September 1994.):

      - Cod (Div. 3NO; Div. 3M)
      - Redfish (Div. 3LN; Div. 3M)
      - American plaice (Div. 3LNO; Div. 3M)
      - Witch flounder (Div. 3NO)
      - Yellowtail flounder (Div. 3LNO)
      - Capelin (Div. 3NO)
      - Squid (Subareas 3 and 4)
      - [**Note** also Annex 1, Item 3 concerning cod in Div. 2J+3KL]

   c) Stocks within the 200-mile fishery zone in Subareas 2, 3 and 4, as requested by Canada (Annex 2):

      - Greenland halibut (Subarea 2 and Div. 3KL)
      - Roundnose grenadier (Subareas 2 and 3)
      - Silver hake (Div. 4VWX)
      - [**Note** also Annex 2, Item 3 concerning cod in Div. 2J+3KL]

   d) Stocks within the 200-mile fishery zone in Subarea 1 and at East Greenland as requested by Denmark on behalf of Greenland (Annex 3)(Northern shrimp in Denmark Strait and off East Greenland will be undertaken during a special meeting in November 1994.):

      - Redfish (Subarea 1) (if possible, by species)
      - Other finfish and invertebrates (Subarea 1)

   e) Stocks overlapping the fishery zones in Subareas 0 and 1, as requested by Canada and by Denmark on behalf of Greenland (Annexes 2 and 3) (Northern shrimp in Subareas 0 and 1 will be undertaken during a special meeting in November 1994):

      - Greenland halibut (Subareas 0 and 1)
      - Roundnose grenadier (Subareas 0 and 1)

5. Fisheries Commission requests (see Annex 1 with specific reference to items 4, 5 and 6)

6. Ageing techniques and validation studies

   a) Report on methods of ageing silver hake otoliths
   b) Reports on the otolith exchanges of American plaice and Greenland halibut
   c) Other ageing and validation studies reported

7. Gear and selectivity studies

   a) Reports on gear and selectivity studies
   b) Proposals for gear and selectivity studies

8. Investigations on the relationship between acoustic biomass estimates and biomass estimates based on other methods

9. Other matters

   a) Progress report on the Special Session in 1994; Symposium on "Impact of Anomalous Oceanographic Conditions at the Beginning of the 1990s in the Northwest Atlantic on the Distribution and Behaviour of Marine Life" (co-conveners: E. Buch (Denmark), M. Sinclair (Canada) and M. Stein (EEC-Germany))
   b) Progress report on the Special Session in 1995: joint NAFO/ICES Symposium on "The Role of Marine Mammals in the Ecosystem" (co-conveners: J. Sigurjonsson (Iceland) and G. B. Stenson (Canada))
   c) Topic for Special Session in 1996.
   d) Review of arrangements for conducting stock assessments and documentation of assessments
   e) Review of report by the Joint ICES/NAFO working group on harp and hooded seals
   f) Other business

III. Research Coordination (STACREC Chairman: C. A. Bishop)

1. Fishery statistics

   a) Progress report on Secretariat activities in 1993/94

      i) Acquisition of STATLANT 21A for 1993 and of STATLANT reports for recent years
      ii) Acquisition of statistical information from other NAFO Standing Committees
      iii) Publication of statistical information

   b) Deadlines for submission of STATLANT 21A and 21B data

      i) Clarification of status of Rule 4.4.

   c) Preparation for the CWP 16th Session: review of the logbook and STATLANT 21B forms

      i) Report on *Ad hoc* Consultation, La Jolla, California, December 1993
      ii) STATLANT data and discrepancies in databases
      iii) Proposals for *Ad hoc* Consultations and 16th Session

2. Biological sampling

   a) Report on activities in 1993/94
   b) Report by National Representatives on sampling conducted
   c) Report relative to status of data necessary for assessments (by Designated Experts)
   d) Assessment data needs in relation to research in the Regulatory Area

3. Biological surveys

   a) Review of survey activities in 1993 (by National Representatives and Designated Experts)
   b) Surveys planned for 1994
   c) Review of stratification schemes (new stratifications and changes)
   d) Coordination of survey (Greenland halibut or other surveys - see Annex 1)

4. Non-traditional fishery resources in the NAFO Area

   a) Statistics and sampling
   b) Survey data

      i) Species encountered in surveys
      ii) Feasibility of having set-by-set data on non-traditional species

5. Other matters

   a) List of fishing vessels for 1992
   b) Tagging activities
   c) Update of information on conversion factors
   d) Review of SCR and SCS documents not considered by STACFIS
   e) Pilot Observer Program
   f) Other business

IV. Publications (STACPUB Chairman: W. R. Bowering)

1. Review of STACPUB membership

2. Review of scientific publications since June 1993

3. Production costs and revenues for Scientific Council publications

   a) Publication costs and revenues
   b) Microfiche project
   c) Limiting the number of pages printed at the Secretariat

4. Promotion and distribution of scientific publications

   a) Publicity and response regarding the Journal
   b) Invitational papers for the Journal

5. Editorial matters regarding scientific publications

   a) Editorial activities
   b) Progress report of publication on western Atlantic cod
   c) Progress report of publication on West Greenland cod
   d) Progress review of Journal issue of 1993 Special Session
   e) Review of general editorial process
   f) Review of Editorial Board

6. Papers for possible publication

   a) Procedures for STACPUB review
   b) Review of proposals resulting from the 1993 meetings
   c) Review of contributions to the 1994 meetings

7. Publication of 10-year environmental perspective

8. Other matters

V. Rules of Procedure

1. Establishment of a Standing Committee on Environment under the Scientific Council in accordance with Rule 5.4.
2. Restructuring the working arrangements of STACFIS and modification of Rule 5.1.

VI. Collaboration with other Organizations

1. Joint ICES/NAFO Working Group on harp and hooded seals (see also Annex 2[1])
2. Sixteenth Session of CWP and proposed *Ad hoc* Consultation

VII. Arrangements for Special Sessions

[See under Fishery Science, Section 9(a), 9(b) and 9(c)]

VIII. Future Scientific Council Meetings, 1994 and 1995

1. Annual Meeting in September 1994 (including assessment of Flemish Cap shrimp)
2. Special Meeting in November 1994 (assessment of Northern Shrimp in Subareas 0+1 and off East Greenland)
3. Other Scientific Council Meetings

IX. Nomination and election of STACFIS Chairman

X. Other Matters

XI. Adoption of Reports

1. Committee reports from this meeting (STACFIS, STACREC, STACPUB)
2. Scientific Council Report, June 1994

XII. Adjournment

[1] A request was received from Denmark (Greenland) during the Scientific Council Meeting on 17 June 1994, and is given in Annex 4.

ANNEX 1. FISHERIES COMMISSION'S REQUEST FOR SCIENTIFIC ADVICE ON MANAGEMENT IN 1995 OF CERTAIN STOCKS IN SUBAREAS 3 AND 4

1. The Fisheries Commission with the concurrence of the Coastal State as regards the stocks below which occur within its jurisdiction, requests that the Scientific Council, at a meeting in advance of the 1994 Annual Meeting, provide advice on the scientific basis for the management of the following fish and invertebrate stocks or groups of stocks in 1995:

   Cod (Div. 3NO; Div. 3M)
   Redfish (Div. 3LN; Div. 3M)
   American plaice (Div. 3LNO; Div. 3M)
   Witch flounder (Div. 3NO)
   Yellowtail flounder (Div. 3LNO)
   Capelin (Div. 3NO)
   Squid (Subareas 3 and 4)
   Shrimp (Div. 3M)

2. The Commission and the Coastal State request the Scientific Council to consider the following options in assessing and projecting future stock levels for those stocks listed above:

   a) For those stocks subject to analytical dynamic-pool type assessments, the status of the stock should be reviewed and management options evaluated in terms of their implications for fishable stock size in both the short and long term. As general reference points the implications of fishing at $F_{0.1}$, F_{1993} and F_{max} in 1995 and subsequent years should be evaluated. The present stock size and spawning stock size should be described in relation to those observed historically and those expected in the longer term under this range of options.

      Opinions of the Scientific council should be expressed in regard to stock size, spawning stock sizes, recruitment prospects, catch rates and TACs implied by these management strategies for 1995 and the long term. Values of F corresponding to the reference points should be given and their accuracy assessed.

   b) For those stocks subject to general production-type assessments, the time series of data should be updated, the status of the stock should be reviewed and management options evaluated in the way described above to the extent possible. In this case, the general reference points should be the level of fishing effort or fishing mortality (F) which is calculated to be required to take the MSY catch in the long term and two-thirds of that effort level.

   c) For those resources of which only general biological and/or catch data are available, no standard criteria on which to base advice can be established. The evidence of stock status should, however, be weighed against a strategy of optimum yield management and maintenance of stock biomass at levels of about two-thirds of the virgin stock.

   d) Spawning stock biomass levels that might be considered necessary for maintenance of sustained recruitment should be recommended for each stock. In those cases where present spawning stock size is a matter of scientific concern in relation to the continuing productive potential of the stock, management options should be offered that specifically respond to such concerns.

   e) Presentation of the result should include the following:

      i) for stocks for which analytical dynamic-pool type assessments are possible:

         - a graph of yield and fishing mortality for at least the past 10 years.
         - a graph of spawning stock biomass and recruitment levels for at least the past 10 years.
         - a graph of catch options for the year 1995 over a range of fishing mortality rates (F) at least from $F_{0.1}$ to F_{max}.
         - a graph showing spawning stock biomass at 1.1.1996 corresponding to each catch option.
         - graphs showing the yield-per-recruit and spawning stock per-recruit values for a range of fishing mortality.

      ii) for stocks for which advice is based on general production models, the relevant graph of production on fishing mortality rate or fishing effort.

      In all cases the three reference points, actual F, F_{max} and $F_{0.1}$ should be shown.

3. The Fisheries Commission with the concurrence of the Coastal State requests that the Scientific Council continue to provide information, if available, on the stock separation in Div. 2J+3KL and the proportion of the biomass of the cod stock in Div. 3L in the Regulatory Area and a projection if possible of the proportion likely to be available in the Regulatory Area in future years. Information is also requested on the age composition of that portion of the stock occurring in the Regulatory Area.

4. The Scientific Council is asked to review all data available on the implications of using 90 mm minimum mesh size in mid-water trawls when fishing for redfish in Div. 3LN, in comparison to 130 mm. This should include consideration of fish lost during haulbacks.

5. Noting that the Scientific Council has scheduled a Symposium on Seals in the Ecosystem for September 1995, the Fisheries Commission requests a report in 1994 on the nature and extent of analyses that are expected to be tabled at the Symposium with respect to the interrelation between seals and commercial fish stocks.

6. Noting the Scientific Council's recommendations for coordinated research on Greenland halibut, the Fisheries Commission and the two Coastal States emphasize the urgency of acquiring information on the distribution and stock status. The Scientific Council is requested to pursue its coordinated efforts and member countries are urged to commit the necessary resources to the research.

ANNEX 2. CANADIAN REQUEST FOR SCIENTIFIC ADVICE ON MANAGEMENT IN 1995 OF CERTAIN STOCKS IN SUBAREAS 0 TO 4

1. Canada requests that the Scientific Council, at its meeting in advance of the 1994 Annual Meeting, provide advice on the scientific basis for the management of the following fish and invertebrate stocks in 1995:

   Greenland halibut (Subarea 2 and Div. 3K and 3L)
   Roundnose grenadier (Subareas 2 and 3)
   Silver hake (Div. 4V, 4W and 4X)

   It is also suggested that, subject to the concurrence of Denmark (Greenland), the Scientific Council, prior to the 1994 Annual Meeting of NAFO, provide advice on the scientific basis for management in 1995 of the following stocks:

   Shrimp (Subareas 0 and 1)
   Greenland halibut (Subareas 0 and 1)
   Roundnose grenadier (Subareas 0 and 1)

   The Scientific Council has noted previously there was no biological basis for making two separate assessments for the Greenland halibut throughout Subareas 0-3. The Council is therefore asked, subject to concurrence of Denmark (Greenland) as regards Subarea 1, to provide an overall assessment of the total stock throughout its range and comment on its management, including any expansion of the responses to the questions asked in June 1993.

   With respect to shrimp, it is recognised that the Council may, at its discretion, delay providing advice until later in the year, taking into account data availability, predictive capability, and the logistics of additional meetings.

2. Canada requests the Scientific Council to consider the following options in assessing and projecting future stock levels for those stocks listed above:

   a) *For those stocks subject to analytical dynamic-pool type assessments,* the status of the stock should be reviewed and implications of continuing to fish at $F_{0.1}$ in 1995 and subsequent years should be evaluated. The present stock size should be described in relation to those observed historically and those to be expected at the $F_{0.1}$ level in both the short and long term. In those cases where present spawning stock size is a matter of scientific concern in relation to the continuing productive potential of the stock, management options should be considered to rebuild the spawning stock. All results should be expressed in terms of stock sizes, catch rates and TACs implied for 1995 and the long term.

   b) For those stocks subject to general production-type assessments, the status of the stock should be reviewed and management options evaluated in the way described above to the extent possible. In this case, the general reference point should be the level of fishing effort (F) which is two-thirds that calculated to be required to take the MSY catch in the long term.

   c) For those resources on which only general biological and/or catch data are available, no standard criteria on which to base advice can be established. The evidence on stock status should, however, be weighed against a strategy of optimum yield management and maintenance of stock biomass at levels of about two-thirds that of the virgin stocks.

3. The Scientific Council is requested to review the status of the cod stock in Divisions 2J+3KL and to provide estimates of the current size of the total and spawning biomass, together with a description of recent trends. The Council is asked further to provide estimates of the immediate and long-term outlook for the abundance of this stock, including both total and spawning biomass.

4. With respect to *scientific advice on seals, Canada has no specific request* at this time. As I noted in my letter to Dr. Chepel dated February 24, 1994, we will have important inputs to the Scientific Council's symposium on "Seals in the Ecosystem" scheduled for September 1995.

B. Rawson
Deputy Minister
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Ottawa, Canada

ANNEX 3. DENMARK (GREENLAND) REQUEST FOR SCIENTIFIC ADVICE ON MANAGEMENT OF CERTAIN STOCKS IN 1995

1. Denmark, on behalf of Greenland, requests the Scientific Council of NAFO in advance of the 1994 Annual Meeting, provide advice on the scientific basis for management of the following stocks in Subarea 1 in 1995 and as many years forward as data allow:

   i) Redfish (by species, if possible)
   ii) Any other stock of invertebrates and finfish of commercial interest, for which data allow a status report

   It is also suggested that, subject to the concurrence of Canada, advice be given for the following stocks overlapping Subareas 0 and 1:

   i) Greenland halibut
   ii) Roundnose grenadier
   iii) Northern shrimp (*Pandalus borealis*)

   Further, in cooperation with ICES, the Scientific Council is requested to advise on the scientific basis for management of the following stock in the Denmark Strait and off East Greenland:

   i) Northern shrimp (*Pandalus borealis*)

2. In the analyses on which management advice will be based, the following should be included:

   In its 1993 report, the Scientific Council has noted that the offshore component of **Greenland halibut**, in Subareas 0 and 1 was distributed equally between these Subareas, and further that the biomass of the inshore component in Subarea 1 was unknown. The Council is therefore asked to provide information on the following questions asked in June 1993.

   a) Analysis of existing information on stock delimitation in Subareas 0, 1, 2 and 3.

   b) Allocation of TACs to appropriate Subareas (within Subareas 0 and 1).

   c) Allocation of the TAC for Subarea 1 into inshore and offshore areas.

   For **Northern shrimp in Subareas 0 and 1** the biological and practical implications of combining all areas of stock distribution for stock assessment purposes should be considered. Specifically, the Council is asked to provide a TAC for areas not included in the 1994 advice (i.e. Subarea 1 north of 71°N and Subarea 1 inshore).

3. The Scientific Council should feel free to report on such other invertebrates and finfish stocks in Subarea 1 and on such other scientifically based management options for the above-mentioned Subarea 1 stocks, as it feels applicable.

Henrik Leth
Aalisarnermut Piniarnermut
Nunalerinermullu Pisortaqarfik
Direktoratet for Fangst, Fiskeri og Landbrug

ANNEX 4. SCIENTIFIC ADVICE ON SEALS

1. The following request for advice was received on 17 June 1994. This is presented to the Scientific Council with a view to developing terms of reference for a proposed meeting of the ICES/NAFO Working Group.

"Denmark (on behalf of Faroe Islands and Greenland) request advice from the NAFO Scientific Council (eventually via the Joint ICES/NAFO Working Group on Harp and Hooded Seals) on the following issues

Harp and hood seals

- assessment of stock sizes, distribution and pup production of harp and hooded seals in the Northwest Atlantic;
- assessment of sustainable yields at present stock sizes and in the long term under varying options of age composition in the catch;
- advise on catch options in the NAFO area;
- assessment of effects of recent environmental changes or changes in the food supply and possible interaction with other living marine resources in the area.

Einar Lemche
Namminersornerullutik Oqartussat
Gronlands Hjemmestyre
Copenhagen, Denmark"

The Scientific Council advice would be presented to the Fisheries Commission in September 1995. Recognizing the Scientific Council needs to review the Working Group report and prepare its advice, it is hoped the ICES/NAFO Working Group would schedule its meeting for 5-7 June 1995, immediately prior to the Scientific Council meeting.

APPENDIX V. LIST OF RESEARCH AND SUMMARY DOCUMENTS - JUNE 1994

RESEARCH DOCUMENTS (SCR)

SCR #	Ser. #	Author(s) and Title
94/4	N2360	SIGAEV, I. K. Distribution of silver hake, water temperatures and zooplankton on the Scotian Shelf in May-July 1993.
94/5	N2361	RIKHTER, V. A. On the problem of the commercial fish populations abundance control in the Northwest Atlantic since 200-miles economic zone enforcement.
94/6	N2362	RÄTZ, H. J. Redfish Subarea 1 (0-400 m) stock abundance indices, species and length composition, 1982-92.
94/7	N2363	RÄTZ, H. J. Status of the demersal fish assemblage off West Greenland and a simple production model, 1982-93 (Divisions 1B-1F, 0-400 m).
94/8	N2364	RIKHTER, V. A. On variability of silver hake commercial catches and stocks within the shelf prior to introduction of the 200-mile zone. (Revised)
94/9	N2367	BECH, G. Biomass and abundance of Greenland halibut (*Reinhardtius hippoglossoides*) and redfish (*Sebastes* spp.) from a bottom trawl survey in NAFO Subarea 1 in 1993.
94/10	N2373	GUNDERSEN, A. C., N.-R. HAREIDE, V. BERG, and S. A. PEDERSEN. A Trial Longline Fishery for Greenland Halibut (*Reinhardtius hippoglossoides*) in the Northern Davis Strait, August 1993.
94/11	N2374	MAHÉ, J. C. Median length at 50% maturity of Atlantic cod in Subdivision 3Ps: year to year variations and comparison of samples from Burgeo Bank, St. Pierre Bank and South Slope.
94/12	N2375	KISELEVA, V. M., and A. A. VASKOV. Status of cod stock in NAFO Subarea 3 from 1993 trawl-acoustic survey data. (Revised)
94/13	N2376	VASKOV, A. A. Assessment of redfish stocks in Divisions 3LN and 3M from trawl-acoustic survey data, 1993.
94/14	N2377	BAKANEV, V. S., and T. M. SORGEEVA. Results of acoustic survey for capelin (*Mallotus villosus*) in NAFO Divisions 3LNO in 1993.
94/15	N2380	BENWAY, R. L., and J. W. JOSSI. Surface and bottom temperatures, and surface salinities: New York to the Gulf Stream, Massachusetts to Cape Sable, N.S., 1993.
94/16	N2381	GLENN, G. F. Marine Environmental Data Service Report for 1993
94/17	N2382	JØRGENSEN, O. A. Offshore distribution pattern of Greenland halibut, *Reinhardtius hippoglossoides* (Walb.), at West Greenland.
94/18	N2383	BOJE, J. Migrations of Greenland halibut in the Northwest Atlantic based on tagging experiments in Greenland waters, 1986-1992.
94/19	N2384	STEIN, M. Climatic conditions around Greenland - 1993.
94/20	N2385	DRINKWATER, K. F. Overview of environmental conditions in the Northwest Atlantic in 1993.
94/21	N2387	PEREZ-GANDARAS, G., and J. M. CASAS. Migration environmental changes and otolith ring typing in Flemish Cap cod.

94/22	N2388	VAZQUEZ, A. Results from bottom trawl survey of Flemish Cap in July 1993.
94/23	N2389	PAZ, J., and S. IGLESIAS. Grenadiers in the Spanish fishery of Greenland halibut, NAFO Divisions 3LM and 3N, 1991-1993.
94/24	N2390	CASAS, J. M., and J. PAZ. Diet of Flemish Cap cod with particular reference to predation on redfish: 1988-93.
94/25	N2391	JUNQUERA, S. Analysis of the variations in the spacial distribution and spawning of the Greenland halibut in Divisions 3LMN (1990-93).
94/26	N2392	GONZÁLEZ, M., and M. G. LARRAÑETA. Length and age of first maturation of Flemish Cap cod in 1993 with an histologic study.
94/27	N2393	COLBOURNE, E. Environmental conditions in Atlantic Canada, spring 1994, with comparisons to the long-term average.
94/28	N2394	COLBOURNE, E. Environmental conditions during the fall of 1993 in NAFO Divisions 2J+3KL.
94/29	N2395	GORCHINSKY, K. V., and P. I. SAVVATIMSKY. Composition of bottom trawl catches at different depths off the Flemish Pass in 1989-1993.
94/30	N2396	AVILA DE MELO, A. M., and R. ALPOIM. Portuguese cod fisheries in NAFO Divisions 3N and 3O in 1989-1993.
94/31	N2399	OGAWA, M., K. YOKAWA, and O. JØRGENSEN, Results of a stratified random bottom trawl survey off West Greenland in 1993.
94/32	N2400	SHOWELL, M. A., and M. C. BOURBONNAIS. Status of the Scotian Shelf Hake Population in 1993 with Projections to 1995.
94/33	N2401	DE CARDENAS, E., and J. GIL. Geostrophic circulation on cod egg distribution in Flemish Cap.
94/34	N2402	HUNT, J. J., and M. C. BOURBONNAIS. Summary of age training for silver hake.
94/35	N2403	RODRIGUEZ-MARÍN, E., A. PUNZÓN, J. PAZ, and I. OLASO. Feeding of Most Abundant Fish Species in Flemish Cap in Summer 1993.
94/36	N2404	NARAYANAN, S. Monthly T/S from NE Newfoundland and S. Labrador Shelves.
94/37	N2405	BECH, P. C., E. G. DAWE, and J. DREW. An update of the fishery for short-finned squid (*Illex illecebrosus*) in the Newfoundland area during 1989-93 with descriptions of some biological characteristics and temperature trends.
94/38	N2407	HORSTED, SV. AA. A review with some proposals for amendments of the catch statistics for the cod fisheries in Greenland waters since 1991.
94/39	N2409	HALLIDAY, R. G. Year-class strength in the Scotian Shelf silver hake stock.
94/40	N2410	BISHOP, C. A., J. ANDERSON, E. DALLEY, M. B. DAVIS, E. F. MURPHY, G. A. ROSE, D. E. STANSBURY, C. TAGGART, G. WINTERS, and D. METHVEN. An assessment of the cod stock in NAFO Divisions 2J+3KL. (+ Corrigendum)
94/41	N2411	MURPHY, E. F., and C. A. BISHOP. Cod in Divisions 2J+3KL - estimates of biomass and age composition for the portion of the stock in the NAFO Regulatory Area for Canadian research vessels surveys.
94/42	N2412	JØRGENSEN, O., and J. BOJE. Sexual maturity of Greenland halibut in NAFO Subarea 1.

94/43	N2413	BISHOP, C. A. Revisions and additions to stratification schemes used during research vessel surveys in NAFO Subareas 2 and 3.
94/44	N2414	BRODIE, W. B., S. J. WALSH, D. POWER, and M. J. MORGAN. An assessment of yellowtail flounder stock in Divisions 3LNO.
94/45	N2415	DE CÁRDENAS, E., and M. L. GODINHO. An assessment of American plaice in Division 3M (1994). (2nd Revision)
94/46	N2416	BRODIE, W. B., and S. J. WALSH. Changes in distribution of yellowtail flounder on the Grand Bank during the late-1980s and early-1990s.
94/47	N2417	ATKINSON, D. B., W. R. BOWERING, and W. BRODIE. Analysis of data collected by observers during the Greenland halibut otter trawl fisheries in Subarea 0 during 1988-1993.
94/48	N2419	ATKINSON, D. B., D. POWER, and J. MORGAN. Roundnose grenadier (*Coryphaenoides rupestris*) and roughhead grenadier (*Macrourus berglax*) in NAFO Subareas 2+3.
94/49	N2420	BOWERING, W. R., D. POWER, and W. B. BRODIE. Stock status of witch flounder in NAFO Divisions 3NO.
94/50	N2421	MYERS, R. A., and N. G. CADIGAN. Correlated error model results for 2J3KL cod in 1993.
94/51	N2422	MYERS, R. A., and N. G. CADIGAN. The statistical analysis of catch-at-age data with correlated errors.
94/52	N2423	MYERS, R. A., and N. G. CADIGAN. Was an increase in natural mortality responsible for the collapse of northern cod?
94/53	N2424	MORGAN, J. M., W. R. BOWERING, and W. B. BRODIE. A comparison of results from Canadian deepwater surveys in 1991 and 1994, with emphasis on Greenland halibut.
94/54	N2425	POWER, D. The status of Divisions 3LN redfish resource.
94/55	N2426	BRODIE, W. B., M. J. MORGAN, and D. POWER. An assessment of the American plaice stock in Divisions 3LNO.
94/56	N2427	WALSH, S. J. Distribution, abundance and biomass of juvenile and adult American plaice populations on the Grands Banks, NAFO Divisions 3LNO.
94/57	N2428	BOWERING, W. R., W. B. BRODIE, and D. POWER. Greenland halibut in NAFO Subarea 2 and Divisions 3KLM: a rapidly declining resource with a rapidly increasing fishery.
94/58	N2429	MYERS, R. A. Analysis of mortality from research vessel surveys for cod and flatfish in the Northwest Atlantic.
94/59	N2430	BOJE, J., O. A. JORGENSEN and G. BECH. A preliminary assessment of the Greenland halibut stock component in NAFO Subareas 0+1.
94/60	N2431	GORCHINSKY, K., and D. POWER. An assessment of the redfish stock in NAFO Division 3M.
94/61	N2432	LASSEN, H. The catch-trawlable biomass model used in assessment of the American plaice in Division 3M.
94/62	N2433	VAZQUEZ, A. An assessment of the cod stock in NAFO Division 3M.

SUMMARY DOCUMENTS (SCS)

SCS #	Ser. #	Author(s) and Title
94/1	N2351	NAFO SECRETARIAT. Historical catches of selected species by stock area and country for the period 1982-92.
94/2	N2352	NAFO. Report of Scientific Council, Special Meeting, 13-15 February 1994.
94/3	N2352	V. A. RIKHTER, and I. K. SIGAEV. Russian national research report, 1993 (Part 1).
94/4	N2365	RAWSON, B. Canadian request for scientific advice on management in 1995 of certain stocks in Subareas 0 to 4.
94/5	N2366	LETH, H. Denmark (Greenland) request for scientific advice on management of certain stocks in 1995.
94/6	N2368	NAFO SECRETARIAT. Provisional Index and List of Titles of Research and Summary Documents of 1993.
94/7	N2370	NAFO SECRETARIAT. Tagging activities reported for the Northwest Atlantic in 1993.
94/8	N2371	NAFO SECRETARIAT. List of biological sampling data for 1992.
94/9	N2372	NAFO SECRETARIAT. Notes on statistical activities and publications since June 1993.
94/10	N2378	BOUDREAU, P., and M. M. ROBERGE. Canadian research report for 1993.
94/11	N2379	CORNUS, P., H.-J. RÄTZ, and M. STEIN. German research report for 1993.
94/12	N2386	SERCHUK, F. M., and M. D. GROSSLEIN. United States research report for 1993.
94/13	N2397	ALPOIM, R., A. M. AVILA DE MELO, M. L. GODINHO, and E. SANTOS. Portuguese research report for 1993.
94/14	N2398	YOKAWA, K. Japanese research report for 1993.
94/15	N2406	ANDERSEN, M. Denmark/Greenland research report for 1993.
94/16	N2408	VAZQUEZ, A., S. JUNQUERA, J. PAZ, and L. MOTOS. Spanish research report for 1993.
94/17	N2418	LASSEN, H. Rule 5.1 of Rules of Procedures for the Scientific Council.
94/18	N2434	NAFO SECRETARIAT. Compilation of research vessel surveys on a stock-by-stock basis.
94/19	N2435	NAFO. Report of Scientific Council, 8-22 June 1994.

APPENDIX VI. LIST OF PARTICIPANTS - JUNE 1994

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