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Scientific Council Reports 1993

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PREFACE

This fourteenth issue of *NAFO Scientific Council Reports* containing reports of Scientific Council Meetings held in 1993 is compiled in four sections: **Part A** - Report of Scientific Council Meeting during 2-16 June 1993 which addressed requests for scientific advice on fisheries management, **Part B** - Report of the Annual Meeting during 7-10 September 1993. The report of the Special Session on "Gear Selectivity/Technical Interactions in Mixed Species Fisheries" which was held during 13-15 September 1993, is included in the report of the Annual Meeting, **Part C** - Report of the Scientific Council Meeting during 19-23 November 1993 which conducted assessments on shrimp in Subareas 0 and 1, and Denmark Strait, and considerations on mesh size in the redfish fishery, and **Part D** - the Agenda, List of Research and Summary Documents, List of Participants, and List of Recommendations relevant to Part A, B, and C.

The *NAFO Scientific Council Reports* series replaced *ICNAF Redbook* series which terminated with the last issue in 1979. The first issue of this series was published in December 1980.

January 1994

Tissa Amaratunga
Assistant Executive Secretary

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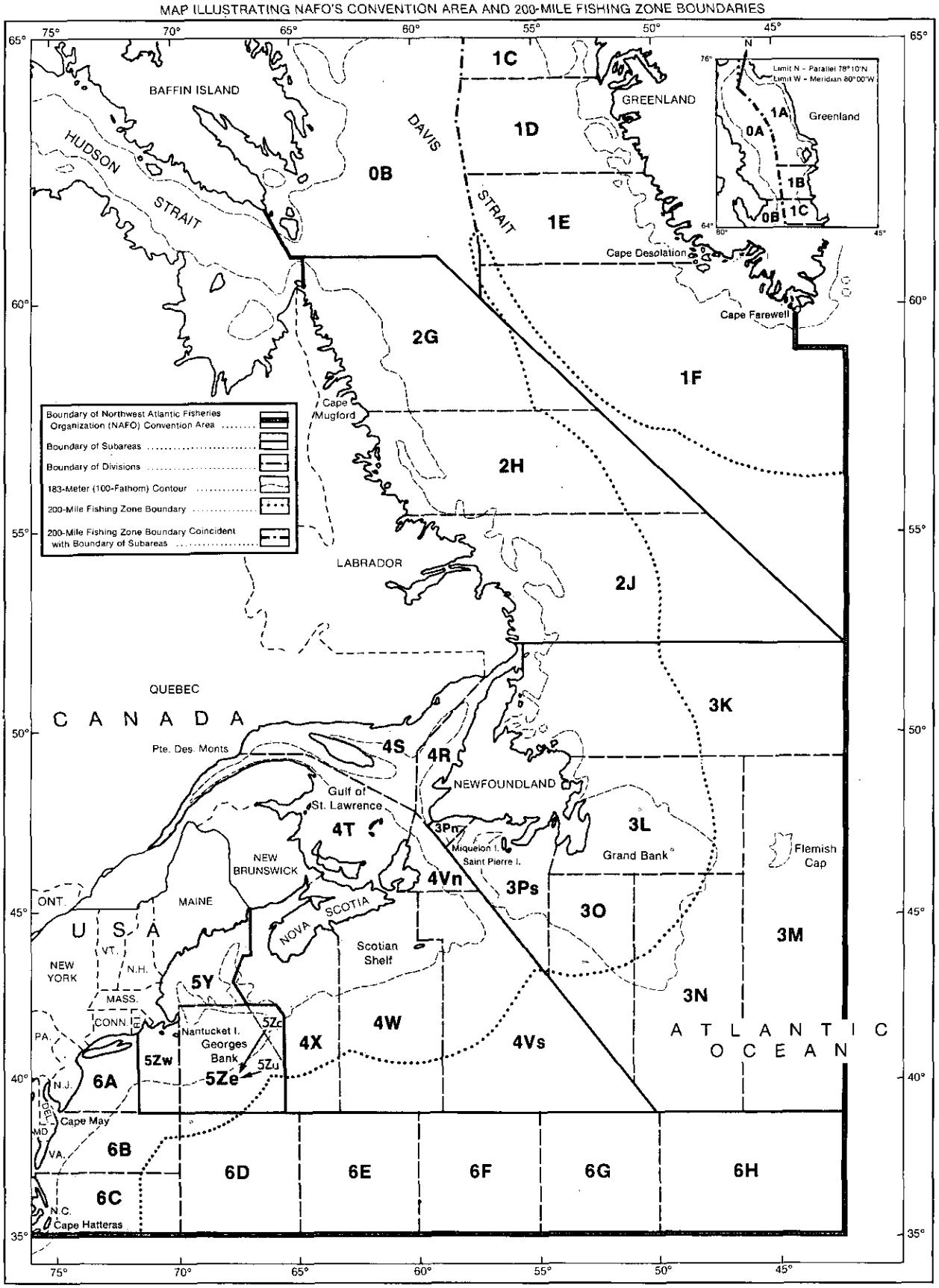
MAP ILLUSTRATING NAFO'S CONVENTION AREA AND 200-MILE FISHING ZONE BOUNDARIES



Participants of June 1993 Scientific Council Meeting

(From left to right)

FRONT ROW - L. Chepel; D. M. Carlsson; S. Kovalev; D. B. Atkinson; V. P. Serebryakov; C. A. Bishop; B. Davis; H. Siegstad; S. Narayanan; U. Skúladóttir; B. Cruikshank

SECOND ROW - H. Champion; M. Stein; A. Avila de Melo; W. R. Bowering; H. P. Cornus; K. V. Gorchinsky; V. A. Rikhter; A. Vazquez; H. J. Rätz; O. A. Jørgensen; M. A. Showell; A. Battaglia; M. L. Godinho; D. Power; T. Amaratunga; H. Lassen; D. Auby

THIRD ROW - E. Murphy; A. Astudillo; D. E. Stansbury; K. Yokawa; E. de Cárdenas; K. F. Drinkwater; P. Kanneworff; L. Motos; K. H. Nygaard; M. Anderson; P. Lyster; G. Glenn

PART A

Scientific Council Meeting, 2-16 June 1993

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REPORT OF SCIENTIFIC COUNCIL

2-16 June 1993

Chairman: V. P. Serebryakov Rapporteur: T. Amaratunga

I. PLENARY SESSIONS

The Scientific Council met at the NAFO Headquarters at 192 Wyse Road, Dartmouth, Nova Scotia, Canada, during 2-16 June 1993, to consider the various matters listed in its agenda (see Agenda I, Part D, this volume).

Representatives attended from Canada, Denmark (in respect of the Faroe Islands and Greenland), European Economic Community (Denmark, France, Federal Republic of Germany, Portugal and Spain), Iceland, Japan, Norway, Russian Federation and an observer from United States of America. The NAFO Executive Secretary and Assistant Executive Secretary were in attendance.

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

The opening session of the Council was called to order at 1005 hr on 2 June 1993.

The Chairman welcomed everyone to the June 1993 Meeting. The Assistant Executive Secretary was appointed rapporteur, as was the usual practice.

The Chairman informed the Council that some minor modifications to the agenda were discussed at the Executive Committee Meeting and presented the proposed changes. In particular, Item 10.f on Proposals for Scientific Tasks of Observers in the Pilot Observer Program and Item 10.g on Development of New Fisheries on Deep Sea Species in the STACFIS Agenda were found to be better suited for the STACREC Agenda. In addition, it was agreed that two new Agenda Items: VI.3. Scientific Council invitations to other international bodies, and X. Request for November Scientific Council Meeting on shrimp, as requested by the Coastal State Denmark (in respect of the Faroe Islands and Greenland) should be inserted. The agenda was **adopted** as given in Part D, Agenda I, this volume.

The Council reiterated its standing invitation to the representative from the USA, noting that an observer for the National Marine Fisheries Service, Woods Hole, Massachusetts, was due to arrive on 4 June 1993.

The Council was informed by the Executive Secretary that in accordance with Rule 2.3 of the Rules of Procedure, he held proxy votes from Bulgaria, Estonia, Latvia, Lithuania, Norway and Poland.

The Session was adjourned at 1045 hr on 2 June 1993.

The Council again met briefly on 4 June 1993 to revise the work plan.

The Council reconvened at 0905 hr on 14 June 1993 to address Agenda Items V to IX. The discussions are reported in Sections V to IX below.

The session was adjourned at 1000 hr.

The Council reconvened at 0930 hr on 16 June 1993 to consider the request for November Scientific Council Meeting on Shrimp (Agenda Item X), and the meeting space requirements and the structure of the Scientific Council.

After a brief adjournment, the concluding session was convened at 1230 hr. The Council then considered and **adopted** the Report of the Standing Committee on Fishery Science (STACFIS). In its consideration of the Report of the Standing Committee on Research Coordination (STACREC), the Council agreed that the items relating to responses to the Fisheries Commission would be reflected in the body of the Council report. The Council **adopted** the STACREC Report having modified the proposed new Rule 4.3 by renumbering it to Rule 4.4. The Council then considered and **adopted** the Report of the Standing Committee on Publications (STACPUB).

Having addressed all outstanding matters, the Council considered and **adopted** the Report of the Scientific Council of the 2-16 June 1993 Meeting.

The meeting was adjourned at 1330 hr on 16 June 1993.

The reports of the Standing Committees are appended as follows: Appendix I, Report of 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 Part D, this volume.

The Council's considerations on the Standing Committee Reports and other matters addressed by the Council follow in Sections II-X.

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

1. General Review

The Council welcomed the STACFIS review of available information on catches for the various stocks, before undertaking the assessments. The Council agreed that this practice should be continued, however, it noted the difficulties of not receiving the scientific papers in advance of the meeting. Accordingly the Council firmly endorsed the **recommendation** that SCR Documents should be announced 15 days before the beginning of the June Meeting, and the announcement should include the title, purpose of the paper and, if available, the abstract.

2. General Fishery Trends

The Council noted that provisional nominal catch data for 1991 and 1992 were not available for EEC-France (Metropolitan) and France (St. Pierre-Miquelon). Also, the 1992 data for Japan were provisional and may change substantially. The following general trends, however, were noted in the absence of those data.

From provisional statistics for 1991 and 1992, the nominal catch of all fish and invertebrate species in the Northwest Atlantic (Subareas 0 to 6) decreased (12%) from 2.82 million tons in 1991 to 2.48 million tons in 1992 (see Appendix I, Table 1). Decreases were noted for all species groups including "groundfish" (24%) from 1.03 million tons in 1991 to 783 000 tons in 1992, "pelagics" (3%) from 631 000 tons in 1991 to 609 000 tons in 1992, "finfish" (31%) 137 000 tons in 1991 to 94 000 tons in 1992, "invertebrates" (4%) from 1.02 million tons in 1991 to 986 000 tons in 1992. With respect to nominal catches by Subarea, increases were noted for Subarea 0 (19 000 tons in 1991 to 20 000 tons in 1992) and decreases were noted for Subarea 2 (33 000 tons in 1991 to 20 000 tons in 1992), Subarea 3 (520 000 tons in 1991 to 348 000 tons in 1992), Subarea 4 (807 000 tons in 1991 to 693 000 tons in 1992), Subarea 5 (460 000 tons in 1991 to 456 000 tons in 1992) and Subarea 6 (897 000 tons in 1991 to 814 000 tons in 1992), and Subarea 1 remained unchanged at 104 000 tons.

3. Review of Recommendations From 1992 Meetings

The Council noted that STACFIS reviewed the general recommendations and observed some serious shortcomings with Contracting Parties not complying with all the recommendations. The Council agreed that it was essential that representatives focus on all recommendations to ensure the work of the Scientific Council is effectively completed, and to ensure that recommendations from previous meetings do not need to be reiterated.

4. Environmental Research

The Council was pleased with the success of the meeting of the Environmental Subcommittee of STACFIS held at the beginning of the Council meeting on 3 June 1993 with M. Stein (EEC-Germany) as Chairman. The Council saw the significant importance of reviewing environmental conditions before the stock assessments were undertaken by STACFIS and providing the opportunity to incorporate those considerations with the conditions of various stocks. The Council was also encouraged by the higher quality of papers

presented to the Subcommittee, with many papers specifically relating environmental conditions to the state of certain stocks.

5. Assessment of Finfish and Invertebrate Stocks

a) Review of Assessment Methods

The Council agreed that a periodical review of the methods for stock assessments, as proposed at the September 1992 Special Session and agreed to by STACFIS at this meeting, would be important for the work of the Scientific Council. The Council endorsed the STACFIS **recommendation** that a workshop on stock assessment methodology should be held, for example, every second or third year.

The Council noted that STACFIS reviewed the status of certain stocks in Subareas 0 to 4, as requested by the Fisheries Commission, Canada and Denmark (in respect of the 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. Details of the stock assessments are given in the Report of STACFIS (Appendix I), while summaries of the assessments are as follows:

Cod in Divisions 2J, 3K and 3L

Source of information: SCR Doc. 93/29, 33, 38, 41, 50, 54, 86; SCS Doc. 93/13, 14. Documents not fully reviewed by STACFIS; SCR Doc. 93/30, 31, 32, 34, 35, 36, 37, 39, 42, 43, 45, 55, 56, 57, 68

Year		1986	1987	1988	1989	1990	1991	1992	1993
TAC		266	256	266	235	199	190	120 [2]	
Catch		252	235	269	253	219 [1]	150 [1]	44 [1]	
Offshore catch		179	156	168	151	106 [1]	90 [1,4]	32 [1,3]	
Fixed gear catch		72	79	101	103	113 [1]	60 [1]	12 [1]	
Sp. stock biomass	ADAPT	287	295	323	280	151	61	22	
Laurec/Shepherd	(L/S)	287	294	323	279	150	59	15	
Recruitment (age 3)	ADAPT	158	130	167	223	238	101	79	
	L/S	158	129	160	185	117	64	68	
Mean F (ages 7-9)	ADAPT	0.52	0.57	0.75	1.00	1.34	2.23	1.17	
	L/S	0.53	0.57	0.75	1.00	1.36	2.51	2.86	

[1] Provisional
[2] Moratorium in effect on Canadian fishing in July 1992
[3] Fishery closed by EEC in June 1992
[4] Canadian surveillance estimate 111

Weights in '000 tons

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. The total Canadian catch in 1992 was approximately 29 000 tons with an additional 14 600 tons being caught in the Regulatory Area during the first half of the year by non-Canadian vessels. The EEC closed their fishery on June 3, 1992.

Data and Assessment: An analytical assessment of catch-at-age data was conducted using Canadian RV survey data included in ADAPT and Laurec-Shepherd (L/S) analyses. The principle index of abundance is the Canadian autumn research vessel survey index.

Fishing Mortality: Total mortality is estimated to be very high (>1.0). Assuming a constant M of 0.2 would imply very high fishing mortality. However, fishing activity has not increased in the Canadian zone to account for such an increase. Natural mortality may have increased as a result of harsh climatic conditions, poor feeding, predation by seals or competition with them, or emigration out of the area.

Recruitment: The 1986 and 1987 year-classes are still dominating the stock although their relative abundance may be closer to the recent average for the stock rather than the previous above average estimate. The 1988 year-class continues to be estimated as below average and based on relationships between recruitment success and environmental variables it is likely that the 1990 and 1991 year-classes will be weak. 0-group survey results indicated that the 1991 and 1992 year-classes may both be much weaker than the 1981 year-class.

State of Stock: The abundance of cod has decreased substantially since 1990. The decline was more pronounced for fish age 6 and older. There is little doubt that the stock is currently at a low level with abundance and biomass at the lowest observed in the time series.

Forecast for 1994: With the low stock size, high mortality rates and the possibility of weak recruiting year-classes, stock recovery in the near future will be unlikely.

Environmental Factors: Climatic and hydrographic conditions in 1991–92 off the Newfoundland shelf have been among the worst recorded for ice coverage, duration of ice, and extent of the cold intermediate layer (CIL) of water less than 0°C.

Multispecies Considerations: Capelin abundance as estimated from acoustic surveys has been very low since 1990 in this area and the biomass of several other groundfish stocks, some very lightly exploited have also declined markedly in recent years. In the absence of a large commercial hunt for harp seals, the abundance has increased and was estimated to be about 3 million in 1990. It has not been possible to fully evaluate the interactions between cod and seals.

Long-term Prospects: At present there are no indications that this stock will begin to recover until a number of at least average year-classes recruit. Because all year-classes from 1988 to 1992 are considered likely to be poor, significant recovery is not anticipated prior to the late-1990s.

Option Basis	Predicted catch (1994)	Predicted SSB (1.1.1995)
$F_{0.1}$ =	No information available	
F_{92} =		
F_{max} =		

Cod in Division 3M

Source of Information: SCR Doc. 93/16, 19, 20, 25, 67, 85; SCS Doc. 93/10, 14, 15

Year	1986	1987	1988	1989	1990	1991	1992	1993
Recommended TAC	0	0	0	0	0	0	0	0
Agreed TAC	13	13	0	0	0	13	13	13
Reported catches	15	11	2	1	2[1]	8[1]	6[1]	
Non-reported catches			-[2]	39	30	3	5	
Total landings	15	11	2	40	32[1]	11[1]	11[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 1992 was estimated to be 11 000 tons. Opportunistic fishery directed at immature fish.

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 EEC since 1988.

Fishing Mortality: Uncertain but assumed to be high.

Recruitment: The 1990 year-class appears stronger than the other year-classes currently in the population.

State of Stock: Surveys conducted by the USSR since 1971 indicated that biomass and abundance had declined to a minimum in 1987. Both USSR and EEC surveys showed an increase in stock biomass from 1988 to 1989 due to a relatively abundant 1986 year-class and a decrease thereafter. Spawning stock biomass is thought to be well below the minimum acceptable level of about 25 000 tons.

Forecast for 1994:

Option Basis	Predicted catch (1994)	Predicted SSB (1.1.1995)
$F_{0.1}$ =		
F_{92} =		No information available
F_{max} =		

Recommendations: No directed fishery on cod be conducted in 1994, to allow stock recovery.

Special Comments: STACFIS is concerned about by-catches of cod in the newly developed shrimp fishery on Flemish Cap. These by-catch rates should be investigated; see also Special Comments on redfish in Div. 3M.

Cod in Divisions 3N and 30

Source of Information: SCR Doc. 93/13, 90; SCS Doc. 93/10, 13, 14

Year	1986	1987	1988	1989	1990	1991	1992	1993
Recommended TAC					Same as agreed			
Agreed TAC	33	33	40	25	18.6	13.6	13.6	10.2
Reported Catches	51	42	43	33	18[1]	17[1]	10.1	
Non-reported Catches	–	–	–	–	11	12	2.5	
Total Landings	51	42	43	33	29[1]	29[1]	12.6[1]	
Sp. stock biomass	139	145	123	102	89	81	59	
Recruitment (age 3)	10	7	14	14	6	8	20[2]	
Mean F (ages 7–10)	0.21	0.25	0.28	0.23	0.24	0.42	0.47	

[1] Provisional
[2] Geometric mean (millions)

Weights in '000 tons

Catches: Catches declined from a peak of 225 000 tons in 1967 to a low of 12 600 tons in 1992. TACs were introduced for this stock in 1973. Until 1978 catches were substantially lower than TACs. From 1981 to 1991, catches exceeded the TAC. However, in 1992, they were slightly below it.

Data and Assessment: An analytical assessment of catch-at-age data was conducted using Canadian and Russian survey indices in a formulation of the Adaptive Framework but using Canadian data only in the Laurec-Shepherd technique since Russia did not conduct a survey in 1992.

Fishing Mortality: Mean fishing mortalities were high in the 1960s and early-1970s and during some years were in excess of 1.0. They decreased in the early-1980s to levels below 0.3 and were stable between 0.2 and 0.4 from 1982 to 1991. The 1992 mean F for ages 7 to 10 was estimated to be 0.47. Fishing mortalities in recent years have been higher than average at younger ages.

Recruitment: Research vessel surveys indicate that the 1983 to 1988 year-classes are extremely weak. The geometric mean recruitment for 1977–90 is approximately 20 million fish. There are indications that the 1989 year-class may be above average.

State of Stock: The SPA, calibrated with research vessel indices, indicates that the stock is near the lowest level in the time series. The biomass increased in the early-1960s and peaked at 470 000 tons in 1967. It declined to 55 000 tons in 1976, but increased again to 220 000 tons in 1984. It also declined in recent years and is currently estimated to be about 74 000 tons.

Forecast for 1994:

Option Basis	Predicted catch (1994)		Predicted SSB (1.1.1995)	
	PR_1	PR_2	PR_1	PR_2
$F_{0.1}$ =	6 000	8 000	22 500	20 900
F_{max} =	9 200	12 100	20 600	18 700
F_{92} =		Not appropriate		

Partial Recruitments, PR_1 = average for 1980-84 PR_2 = average for 1990–92

Recommendation: The 1994 catch should not exceed 6 000 tons.

Special Comments: All necessary steps should be taken to eliminate the catch of small fish from this stock. The SSB is declining and will not begin to rebuild until the 1989 and later year-classes begin to make a contribution. The SSB may never improve beyond current estimates if fisheries on immature cod continue at current high levels. In addition, excessive harvesting of cod from this stock at younger ages will result in considerable loss of yield in the long term.

Redfish in Subarea 1

Source of Information: SCR Doc. 93/26, 52, 58, 89; SCS Doc. 93/12

Year	1986	1987	1988	1989	1990	1991	1992	1993
Recommended TAC				No TAC				
Agreed TAC	18	19	19	19	19	19	19	19
Reported Catches	5	1	1	1	1[1]	0.3[1]	0.3[1]	
Total landings	5	1	1	1	1[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. 1991 and 1992 reported catches are lowest on record. Although unreported, it is believed that substantial numbers of small redfish are taken as by-catch in the shrimp fishery.

Data and Assessment: Stratified-random bottom trawl surveys designed for cod since 1982. Stratified-random shrimp trawl surveys since 1988. Stratified-random bottom trawl surveys designed for Greenland halibut since 1982.

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 considerable decline of stock biomass and abundance in recent years.

Forecast for 1994: No projections.

Option Basis	Predicted catch (1994)	Predicted SSB (1.1.1995)
$F_{0.1}$ =	No information available	
F_{92} =		
F_{max} =		

Recommendations: As long as catches of commercial-sized redfish remain limited to by-catches of fisheries directed to other species, no TAC is advised.

Special Comments: The removal of large numbers of juvenile redfish by the shrimp fishery may adversely affect redfish recruitment.

Redfish in Division 3M

Source of Information: SCR Doc. 93/11, 19, 24, 77; SCS Doc. 93/10, 12, 13, 15

Year	1986	1987	1988	1989	1990	1991	1992	1993
Recommended TAC	20	20	20	20	<50	43	35	<20
Agreed TAC	20	20	20	20	50	50	43	30
Reported catches	29	44	23	48	67[1]	38[1]	29[1]	
Non-reported catches				10	16	17	4	
Total landings	29	44	23	58	83[1]	55[1]	33[1]	
Sp. stock biomass	No information available							
Recruitment (age 2)								
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 again in 1988. In 1989 and 1990 catches of 58 000 and 83 000 tons were the highest in the history of this fishery. Since then catches have declined to 33 000 tons in 1992.

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

Fishing Mortality: No estimate available.

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

State of Stock: Catch rates declined from 1987 to 1991 and increased in 1992 (although based on limited data). Trawlable biomass estimates from EEC bottom-trawl surveys indicate an increase in 1992. Russian trawl-acoustic survey suggest a decline of bottom component and increase of pelagic component in 1992. The stock appears to be stabilized after declining in recent years.

Forecast for 1994:

Option Basis	Predicted catch (1994)	Predicted SSB (1.1.1995)
$F_{0.1}$ = 0.11	No information available	
F_{92} =		
F_{max} = 0.20		

Recommendations: TAC for 1994 be set at 20 000 tons

Special Comments: STACFIS noted that a new fishery for shrimp is developing in Div. 3M. Given that by-catches of juvenile redfish are common in similar fisheries in other areas, STACFIS expresses its concern on the likely negative impact of these shrimp fisheries on recent recruitment of Div. 3M redfish.

Redfish in Divisions 3L and 3N

Source of Information: SCR Doc. 93/73; SCS Doc. 93/13, 15

Year	1986	1987	1988	1989	1990	1991	1992	1993
Recommended TAC	25	25	25	25	25	14	14	14
Agreed TAC	25	25	25	25	25	14	14	14
Reported catches	43	71	45	32	25[1]	22[1]	15[1]	
Non-reported catches		7	8	2	4	4	9	
Total Landings	43	78	53	34	29[1]	26[1]	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 78 000 tons. Since then catches have declined steadily to 24 000 tons in 1992. TAC has been exceeded each year since 1985.

Data and Assessment: Standardized catch rate series, research trawl surveys. Catch rate indices derived for Div. 3L and Div. 3N generally not considered reflective of year-to-year changes in stock abundance although they may be indicative of trends over longer periods of time.

Fishing Mortality: No estimate available.

Recruitment: No estimate available but appears to have been 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 but the strength of this cannot be evaluated.

State of Stock: All indices indicate a general decline since mid-1980s. Bottom trawl surveys by Russia in Div. 3LN and Canada in Div. 3L suggest declines since 1984. Available indices exhibit considerable between-year variability but generally indicate a stock at a low level, especially in Div. 3L.

Forecast for 1994:

Option Basis	Predicted catch (1994)	Predicted SSB (1.1.1995)
$F_{0.1}$ =		
F_{92} =	No information available	
F_{max} =		

Recommendations: Catches be reduced and total catch for 1994 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.

American Plaice in Division 3M

Source of Information: SCR Doc. 93/16, 19, 82; SCS Doc. 93/10, 14, 15

Year	1986	1987	1988	1989	1990	1991	1992	1993
Recommended TAC	2	2	2	2	2	2	2	2
Agreed TAC	2	2	2	2	2	2	2	
Reported catches	3.8	5.6	2.8	3.5	0.8[1]	1.6[1]	0.8[1]	
Non-reported catches				No information available				
Total landings								
Sp. stock biomass								
Recruitment (age 2)				No information available				
Mean F								

[1] Provisional

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 1992 the reported catches had declined to levels below the TAC of 2 000 tons. In 1992 there were no directed fisheries to this stock.

Data and Assessment: Commercial catch-at-age for 1988–92. Information from USSR/Russian surveys (1972–92), and EEC surveys (1988–92) were used to evaluate stock status.

Fishing Mortality: Appears to have been high during the period 1988–90 and seems to have declined in 1992 due to a shift in the target species of the main fleet which previously directed its effort to this species.

Recruitment: 1986 year-class appears to be strong based on information from EEC surveys (1988–92).

State of Stock: EEC surveys show a steady decline in relative abundance and biomass since 1988. Spawning stock biomass follows a similar trend over the same period.

Forecast for 1994:

Option Basis	Predicted catch (1994)	Predicted SSB (1.1.1995)
$F_{0.1}$ =	No information available	
F_{92} =		
F_{max} =		

Recommendations: Catch in 1994 should not exceed 1 000 tons (see Special Comments).

Special Comments: The recommended catch corresponds to the expected by-catches in non-directed fisheries.

American Plaice in Divisions 3L, 3N and 3O

Source of Information: SCR Doc. 93/91; SCS Doc. 93/14, 15

Year		1985	1986	1987	1988	1989	1990	1991	1992	1993
Recommended TAC		49	55	48	28	30.3	24.9	25.8	25.8	10.5
Agreed TAC		49	55	48	40[1]	30.3	24.9	25.8	25.8	10.5
Reported catches		49.5	60.3	55.0	40.7	41.4	24.4[2]	26[2]	10.6[2]	
Non-reported catches		4.7	4.3	0	0.1	2.0	8.1	8	0.5	
Total catch		54.2	64.6	55.0	40.8	43.4	32.5[2]	34[2]	11.1[2]	
Sp. stock biomass[3]	ADAPT	142	132	103	80	66	49	39	27	
	L/S	141	131	101	78	64	46	33	19	
Recruitment	ADAPT	128	96	81	78	73	102	76	27	
(Age 5)	L/S	126	94	71	65	57	57	36	21	
Mean F	ADAPT	0.67	1.04	0.81	0.86	0.82	0.84	0.69	0.66	
(Age 11–15)	L/S	0.68	1.06	0.82	0.88	0.86	0.96	0.86	0.95	

1 Effective TAC was 33 585 tons
2 Provisional
3 Age 9+ knife edge

Weights in '000 tons
Recruitment in millions

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 11 000 tons in 1992, the lowest value since the 1950s.

Data and Assessment: Analytical assessment of catch-at-age data was conducted using Canadian survey results in a formulation of the Adaptive Framework (ADAPT) and the Laurec-Shepherd (L/S) technique. Population estimates derived from the L/S analysis were lower than those from ADAPT.

Fishing Mortality: Both the ADAPT and L/S analyses indicated higher fishing mortalities (0.7–1.0) in recent years (1987–92) compared to those from the mid-1980s (0.5–0.6). Fully recruited F in 1992 is estimated to be decreasing slightly in ADAPT and increasing in L/S.

Recruitment: Both calibration analyses reflect a continued decline in recruitment at age 5 from levels over 250 million fish in the mid-1970s to about 100–150 million fish in the mid-1980s. ADAPT estimates the age 5 population in 1986–89 are at about 75–100 million with the L/S estimates at about 60–90 million. Only ADAPT shows the 1985 year-class to be higher than the preceding 4 year-classes. Both analyses estimate the 1987 year-class at age 5 to be far below any other value in the series.

State of Stock: The stock is at a level far below the historic average, and has declined very rapidly in recent years. The analyses indicate that SSB has declined by 80–85% since 1985. Stock size in 1992 is estimated to be substantially lower than indicated in last year's assessment, at the lowest level ever observed.

Forecast for 1994:

Option Basis	Predicted catch (1994) ('000 tons)	Predicted SSB (1.1.1995) ('000 tons)
ADAPT:		
$F_{0.1}$ = 0.26	9.5	40.0
F_{max} = 0.50	17.0	34.1
F_{92} = 0.65	21.1	31.0
L/S:		
$F_{0.1}$ = 0.26	4.8	13.5
F_{max} = 0.50	8.7	11.4
F_{92} = 0.95	14.9	8.3

Recommendations: Given the extremely low stock size in 1992, concerns about SSB, and expectations of very poor recruitment, STACFIS recommended that the catch in 1994 be kept at the lowest possible level, and should not exceed 4 800 tons.

Special Comments: STACFIS noted that the consistent pattern of apparent overestimation of stock size in the current year continues to be a problem for this stock. This observation, coupled with the fact that virtually all indices of stock size are at their lowest levels ever, warrants a cautious approach in setting the 1994 catch level.

Witch Flounder in Divisions 3N and 3O

Source of Information: SCR Doc. 93/83; SCS Doc. 93/15

Year	1986	1987	1988	1989	1990	1991	1992	1993
Recommended TAC	5	5	5	5	5	5	5	5
Agreed TAC	5	5	5	5	5	5	5	5
Reported catches	9	8	7	4	2.7[1]	3.3[1]	4.8[1]	
Non-reported catches[2]					1.4	1.5	–	
Total landings					4.1[1]	4.8[1]	4.8[1]	
Sp. stock biomass								
Recruitment (age 2)					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 thought to be 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 since that time.

Forecast for 1994:

Option Basis	Predicted catch (1994)	Predicted SSB (1.1.1995)
$F_{0.1}$ =	No information available	
F_{92} =		
F_{max} =		

Recommendations: Catch in 1994 not to exceed 3 000 tons.

Special Comments: More detailed information from the commercial fishery is required to properly evaluate this resource, as research vessel surveys do not cover the total area of distribution.

Recent survey biomass results suggest a TAC for 1994 to be set below 3 000 tons.

Yellowtail flounder in Divisions 3L, 3N and 3O

Source of Information: SCR Doc. 93/10, 76; SCS Doc. 93/14, 15

Year	1985	1986	1987	1988	1989	1990	1991	1992	1993
Recommended TAC	15	15	15	15	5	5	7	7	7
Agreed TAC	15	15	15	15	5	5	7	7	7
Reported catches	24.0	24.5	16.3	16.2	9.1	8.9[1]	11.0[1]	10.7[1]	
Non-reported catches	5.0	5.7	0	0.1	1.1	5.1	5.3	0.1	
Total landings	29.0	30.2	16.3	16.3	10.2	14.0[1]	16.3[1]	10.8[1]	
Sp. stock biomass									
Recruitment (age)				No information available					
Mean F									

[1] Provisional

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 declined to about 10 000 tons in 1989 but increased to 14 000 and 16 000 tons in 1990 and 1991, respectively. Catches declined to about 11 000 tons in 1992, due to decreased effort by EEC and non-Contracting Party fleets in the Regulatory Area. 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.

Recruitment: The 1984–86 year-classes were stronger than the three preceding weak year-classes although they were not as abundant as some year-classes observed in the 1970s. Subsequent year-classes appear to be average to below average.

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 1994:

Option Basis	Predicted catch (1994)	Predicted SSB (1.1.1995)
$F_{0.1}$ =	No information available	
F_{92} =		
F_{max} =		

Recommendations: TAC of 7 000 tons for 1994 (see Special Comments below).

Special Comments: Should the fisheries in the Regulatory Area return to former levels, with high exploitation rates of juveniles as estimated in the past, this stock will likely remain at a low level and perhaps decline further, particularly if predictions of below-average recruitment following the 1986 year-class are true.

Greenland Halibut in Subareas 0 and 1

Source of Information: SCR Doc. 93/15, 53, 58, 80; SCS Doc. 93/10, 13, 16

Year	1986	1987	1988	1989	1990	1991	1992	1993
Recommended TAC	25	25	25	25	25	25	25	25
Agreed TAC								
Reported catches	9	10	10	10	20[1]	21[1]	29[1,2]	
Sp. stock biomass								
Recruitment (age 2)				No information available				
Mean F								

[1] Provisional
[2] Including 1 500 tons non-reported

Weights in '000 tons

Catches: The catches have been increasing since 1990. In 1992 the catches increased both in Div. 0B and inshore and offshore in Subarea 1. The offshore fishery in Div. 1CD is now significant.

Data and Assessment: Survey estimates, CPUE series and catch compositions. No analytical assessment.

Fishing Mortality: Has increased in recent years.

Recruitment: No information available.

State of Stock: The survey biomass indices have declined since 1989. However, CPUE and catch length compositions have remained unchanged. The offshore component in Subarea 0B is now exploited slightly above the level experienced before 1980.

Forecast for 1994:

Option Basis	Predicted catch (1994)	Predicted SSB (1.1.1995)
$F_{0.1}$ =		
F_{92} =	No information available	
F_{max} =		

Recommendations: TAC for 1994 be maintained at 25 000 tons.

Special Comments: The offshore fisheries in both Div. 0B and in Div. 1CD are concentrated in small areas. STACFIS considers that intensive fishing effort on localized areas of abundance is imprudent given the lack of scientific information on stock structure and stock size.

Greenland Halibut in Subarea 2 and Divisions 3K and 3L

Source of Information: SCR Doc. 93/75; SCS Doc. 93/10, 14, 15

Year	1986	1987	1988	1989	1990	1991	1992	1993
Recommended TAC	100	100	100	100	50	50	50	50
Agreed TAC	100	100	100	100	50	50	50	50
Reported catches	16	31	19	19	29[1]	35[1]	52[1]	
Non-reported catches					18	20–40	11	
Total landings	16	31	19	19	47[1]	55–75[1,2]	63[1]	
Sp. stock biomass								
Recruitment (age 2)					No information available			
Mean F								

[1] Provisional
[2] STACFIS could not reliably estimate total landings in 1991

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. Canadian catches relatively stable in recent years, with declines in inshore gillnet catches offset by increases in otter trawl catches and offshore gillnet catches in 1992.

Data and Assessment: Analytical assessments considered unacceptable until migratory patterns and stock structure are fully understood. Research vessel surveys continue to give the more important indices of abundance for the stock distributed in the survey area.

Fishing Mortality: Unknown

Recruitment: No new information on recruitment available.

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

Most of the indices of abundance for 1992 indicate a decline from 1991. The number of older fish in the survey areas continues to decline. The decline in some indices may be due, in part, to a redistribution of the stock from northerly areas to the Regulatory Area of Div. 3L, 3M and 3N.

Forecast for 1994:

Option Basis	Predicted catch (1994)	Predicted SSB (1.1.1995)
$F_{0.1}$ =		
F_{92} =	No information available	
F_{max} =		

Recommendations: STACFIS is unable to advise an appropriate catch level for 1994.

Special Comments: The effect on the stock of continued catches in the Regulatory Area at 1990–92 levels is unclear but catches in 1992 were comprised of smaller fish than in 1990 and 1991. Past advice for this stock has been to distribute fishing effort over a wide area if possible. See research recommendations regarding Greenland halibut in Subareas 0 to 3.

Roundnose Grenadier in Subareas 0 and 1

Source of Information: SCR Doc. 93/12, 58; SCS Doc. 93/10, 13, 16

Year	1986	1987	1988	1989	1990	1991	1992	1993
Recommended TAC	8	8	8	8	8	8	8	8
Agreed TAC	8	8	8	8	8	8	8	
Reported catches	0.09	0.38	0.52	0.08	0.16[1]	0.16[1]	0.19[1]	
Sp. stock biomass								
Recruitment (age 2)				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: Not possible to evaluate. Research surveys by Japan and Greenland only fish areas with depths less than 1 500 m and roundnose grenadier occur in deeper waters. As the estimated trawlable biomass in Div. 1CD for 1987, 1988, 1991 and 1992 were about 40 000 tons, the estimates from 1989 and 1990 of 5 900 and 20 300 tons, respectively, were not considered to be realistic. Surveys do not cover the entire stock area.

Forecast for 1994:

Option Basis	Predicted catch (1994)	Predicted SSB (1.1.1995)
$F_{0.1}$ =		
F_{92} =	No information available	
F_{max} =		

Recommendations: TAC for 1994 remain at 8 000 tons.

Special Comments:

Roundnose Grenadier in Subareas 2 and 3

Source of Information: SCR Doc. 93/12, 29, 74; SCS Doc. 93/10, 15

Year	1986	1987	1988	1989	1990	1991	1992	1993
Recommended TAC	11	11	11	11	11	11	11	11
Agreed TAC	11	11	11	11	11	11	11	11
Reported catches	7	8	6	5	4[1]	5[1,2]	5[1]	
Non-reported catches								
Total landings	7	8	6	5	4[1]	9–14[1,2]	5[1]	
Sp. stock biomass								
Recruitment (age)					No information available			
Mean F								

1 Provisional
2 STACFIS could not reliably estimate total landings in 1991

Weights in '000 tons

Catches: Prior to 1979 catches averaged about 26 000 tons but have since declined to an average of about 5 000 tons. In 1991 STACFIS could not precisely estimate the actual catch but determined it to be within the range of 9 000–14 000 tons. Since about 1989, catches from the 'traditional' fishery have steadily declined while catches from the Regulatory Area (mainly Div. 3LM) have increased due to by-catch in the Greenland halibut fishery. There is concern that a portion of the catch reported as roundnose grenadier is actually roughhead.

Data and Assessment: Catch and effort data available for the fisheries in the 'traditional' area but not for the developing fishery in the Regulatory Area. Canadian research vessel data available to 1 000 m and USSR/Russian survey data available to 1 500 m in Div. 2GHJ3K. Potential calibration indices such as survey data and commercial catch rates are of limited value because they do not cover all inhabited depths, and the proportion of roundnose grenadier in deeper waters is unknown.

Fishing Mortality: No estimate available.

Recruitment: No estimate available.

State of Stock: Not possible to evaluate precisely. Based on data collected by Canadian observers, catch rates in the 'traditional' fishing areas have declined steadily since about 1987. Canadian research vessel estimates of biomass show similar declines although they only cover depths to 1 000 m. There are no data available (research or commercial) to enable evaluation of the resource in the Regulatory Area. This latter fishery is restricted to by-catches in the directed Greenland halibut fishery.

Forecast for 1994: No forecast possible.

Option Basis	Predicted catch (1994)	Predicted SSB (1.1.1995)
$F_{0.1}$ =		
F_{92} =	No information available	
Fmax =		

Recommendations: Because of the steady declines in the indices of stock abundance in the 'traditional' fishing areas, the TAC for 1994 be set at a new precautionary level of 3 000 tons. This would apply to the 'traditional' fishing areas within the Canadian zone only. There is insufficient information to provide any advice on appropriate catch levels in the Regulatory Area.

Special Comments: It is not anticipated that data necessary to provide more meaningful advice will be available in the near future. Extensive research information will be required from deepwaters in the Canadian zone and Regulatory Area before any estimate of stock size or status is possible. There is concern that some of the catch reported as roundnose grenadier is actually roughhead grenadier. STACFIS supports the recommendation of STACREC that this be brought to the attention of the Fisheries Commission.

Capelin in Divisions 3N and 30

Source of Information: SCR Doc. 92/84, 93/21, 28, 54; SCS Doc. 93/10

Year	1986	1987	1988	1989	1990	1991	1992	1993
Recommended TAC	0	10	10	28	30	30	30[1]	0
Agreed TAC	0	10	15	28	30	30	30	0
Reported catches	0	1	7	9	25[2]	+[2]	30[2]	
Non-reported catches								
Total landings	0	1	7	9	25[2]	+[2]	0[2]	
Sp. stock biomass[3]	527	273	560	28	–	–	–	–
Recruitment (age 2)				No information available				
Mean F								

1 Scientific Council in March 1992 considered this may exceed 10% exploitation rate
2 Provisional
3 In some years, these are 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. No reliable estimates of the spawning stock after 1989.

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 303 000 tons. Based on parallel patterns of abundance with other spawning stocks, this stock has probably declined to a very low level in 1993.

Forecast for 1994: No projections.

Option Basis	Predicted catch (1994)	Predicted SSB (1.1.1995)
$F_{0.1}$ =	No information available	
F_{92} =		
F_{max} =		

Recommendations: Recommend that no directed capelin fishery be allowed during 1994.

Special Comments: STACFIS is concerned about apparent low abundance levels and their impacts on future recruitment and predator stocks.

Squid in Subareas 3 and 4

Source of Information: SCS Doc. 93/10, 13

Year	1986	1987	1988	1989	1990	1991	1992	1993
Recommended TAC	150	150	–	–	–	–	–	–
Agreed TAC	150	150	150	150	150	150	150	150
Reported catches								
Non-reported catches								
Total landings	+	2	1	7	11[1]	4[1]	2[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 again in 1991 and 1992.

Data and Assessment: No sampling or research data available for 1992.

Fishing Mortality: No information available.

Recruitment: No information available.

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

Forecast for 1994:

Option Basis	Predicted catch (1994)	Predicted SSB (1.1.1995)
$F_{0.1}$ =		
F_{92} =	No information available.	
F_{max} =		

Recommendations: No advice possible.

Special Comments: STACFIS was not able to provide advice without up-to-date information on squid, especially for recruitment. No research is presently being conducted on this stock.

Shrimp in Subareas 0 and 1

Source of Information: SCR Doc. 93/64, 70, 72, 81; SCS Doc. 93/16

Year	1986	1987	1988	1989	1990[1]	1991[1]	1992[1]	1993[1]
Offshore SA 0+1 (south of 71°N)								
Recommended TAC	36	36	36	44	50	50	50	40
Agreed TAC[2]	40.4	40.1	40.1	45.2	45.2	46.2	44.2	40.6[3]
Actual landings	44.6	46.2	43.6	49.9	52.8	57.3	63.0	
Offshore SA 1 (north of 71°N)								
Recommended TAC	–	–	–	–	–	2.5	–	–
Agreed TAC	–	11.6	11.5	8	6.8[4]	6.8[4]	6.4[4]	8.3[5]
Actual landings	11	10.7	6.7	2.5	2.1	1.1	2.6	
SA 0+1 total (including inshore catches in SA 1)								
Actual landings	63.1	63.8	60.5	68.1	69.6	76.3	87.1	

[1] Provisional landings
[2] Not including catches of vessels <75 GRT
[3] SA 1 offshore, south of 68°N + Div. 0A
[4] Including the area from 69°30'N to 71°N, west of 58°W
[5] SA 1 offshore, north of 68°N

Weights in '000 tons

Catches: Increased to about 50 000 tons in 1976, decreased to about 45 000 tons in 1980–84, then gradually increased to 87 000 tons in 1992. Figures include catches outside the TAC area.

Data and Assessment: Catch rates and research survey indices.

Fishing Mortality: No information available.

Recruitment: Recruitment of 1987 and 1989 year-class evident.

State of Stock: Catch-rate indices showed stability in 1989–92. Research survey indices showed stability except that 1991 biomass estimate was low. Last year's concern over the size of spawning stock and future recruitment appears no longer valid.

Forecast for 1994:

Option Basis	Predicted catch (1994)	Predicted SSB (1.1.1995)
$F_{0.1}$ =	No information available.	
F_{92} =		
F_{max} =		

Recommendations: TACs for 1993 and 1994 be set at 50 000 tons for Div. 0A and Subarea 1 offshore south of 71°N.

Special Comments: Concern is expressed over the steady increase in catches in recent years.

Shrimp in Denmark Strait

Source of Information: SCR Doc. 93/51, 60, 63, 65, 66, 84; SCS Doc. 93/16

Year	1986	1987	1988	1989	1990	1991	1992	1993
Recommended TAC	–	–	–	10	10	10	8	5
Agreed TAC[1]	7.5[2]	7.7[2]	8.7[2]	9.0[2]	14.1	14.5	13.0	9.6
Reported catches	11.0	12.2	12.5	10.7	10.3[3]	8.7[3]	7.2[3]	
Sp. stock biomass								
Recruitment				No information available.				
Mean F								

1 On Greenland side of midline only
2 Not including Greenland fishery north of 66°30'N
3 Provisional

Weights in '000 tons

Catches: Increased from less than 400 tons in 1978 to around 12 500 tons in 1988, then decreased gradually to about 8 700 tons in 1991 and further to 7 200 tons in 1992.

Data and Assessment: General biological data, catch and effort data from the fishery, standardized catch rate series.

Fishing Mortality: Not known.

Recruitment: Not known.

State of Stock: The abundance in the recent years has been reduced to a low level, primarily due to a decrease in the abundance of females.

Forecast for 1994:

Option Basis	Predicted catch (1994)	Predicted SSB (1.1.1995)
$F_{0.1}$ =		
F_{92} =	No information available.	
F_{max} =		

Recommendations: Based on the continued depressed condition of the stock, STACFIS advises that the TAC for 1994 should be 5 000 tons.

Special Comments: STACFIS anticipates that this TAC level of 5 000 tons will have to be maintained for several years in an attempt to provide protection for the spawning biomass and rebuild the stock.

6. Response 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. 93/47)

The Scientific Council was again requested (FC Doc. 92/17) 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.

Estimates of the proportion of the cod biomass in Div. 3L in the Regulatory area were updated to include the 1992 research vessel survey data. The results for autumn surveys were similar to those presented previously. 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 and 16.1 % in 1991 and 1992, respectively. The results from the survey series used are as follows:

Season RV survey conducted	Years RV survey conducted	Range of proportions of Div. 3L biomass occurring in the Regulatory Area (1992 value in brackets)	Average proportion percent
Winter	1985-86	23.8-26.8	25.3
Spring	1977-92	0.4-10.8 (16.1)	4.4
Autumn	1981-92	0.5- 7.7 (1.2)	2.8

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 since 1981, continued to 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. The average breakdown of biomass by Division is as follows:

Division	Mean relative proportion of Div. 2J+3KL biomass (%)	1992 Fall %
2J	33	3
3K	34	15
3L	33	82

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, and there were no annual trends. Values presented from recent spring and autumn surveys may be underestimated as there is evidence that there may be a distributional shift of cod to deeper water. These surveys are conducted to depths of 400 fathoms (732 m). Cod have been observed during winter hydroacoustic surveys in depths to 930 m and sampling reported from Portuguese commercial fishery in 1992 show cod catches in Div. 3L to 911 m.

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 combined for Divisions 2J+3KL were similar to those which occurred in Div. 3L inside the 200-mile fishing zone.

b) **Research Activities and Costs in 1992/93**

The Scientific Council was requested (FC Doc. 92/20) to: *describe current research being carried out by relevant Contracting Parties on the stocks under NAFO management, together with the costs of such research, and to determine the optimum volume of scientific work by each division and stock needed for monitoring and for estimation of TACs, as well as work necessary to understand the environmental and ecological factors influencing stock abundance. The Council is requested further to consider options for achieving the desired level of research and to provide estimates of cost.*

The Council reviewed and endorsed the following text as prepared by STACREC:

i) **Review of National Sampling Programs**

The *List of Biological Sampling Data for 1991* was available as SCS Doc. 93/9. The Secretariat reported that because of changes in procedures for data compilation, some of the headings were different from past tabulations but the document was fundamentally the same.

National representatives reported on their sampling programs of commercial fisheries for 1992/93 as follows:

Canada. Sampling data for most Canadian commercial fisheries were collected both at sea and on land for both the inshore and offshore components. Data were collected during 1992 and no major problems have been identified in meeting requirements. Sampling at sea was accomplished by observers.

Denmark (Greenland). Biological samples were obtained in 1992 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) and different sorting of products.

  Approximately 50% of the important fishing areas and periods were covered. Sampling in Subarea 1 covered Div. 1C and 1D in the 2nd and 3rd quarters and Div. 1A in the 4th quarter, whereas sampling in ICES XIV covered the 1st and 2nd quarters.

- **Greenland halibut, inshore (Div. 1A)**. Length measurements were taken from landings, covering the inshore gillnet/longline fishery. Only few samples were taken and sampling was limited to the Ilulissat region in summer.

- **Greenland halibut, offshore (Div. 1C-1D)**. Length measurements were taken from the catch aboard a Japanese trawler covering most of the Japanese trawl fishery in Subarea 1, both in time and distribution.

- **Cod inshore (Div. 1A-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 1992).

EEC-Denmark. No sampling was carried out.

EEC-France. As French catches occurred only inside Canadian waters, length and ageing sampling for cod was done only in Subdiv. 3Ps, on landings.

EEC-Germany. Due to effects of the reunification of EEC-Germany, there was a considerable change during 1992 in the structure of the fishing fleet including changes of the main fishing area, objectives on species, as well as selling of ships of the former GDR fleet. This made the planning of sampling on board the vessels extremely difficult and consequently, there was no sampling activity in the NAFO Area in 1992.

EEC-Portugal. Two OTB6 stern trawlers were sampled from February to August 1992, mainly fishing in Div. 3L, 3M and 3N. Two gillnetters fishing in Div. 3M and 3N were sampled from May to October. Directed effort, catch rates, length and age composition of the catches, as well as mean weights-at-age and in the catch, have been made available for the target species/stocks of both fleets. By-catch rates have also been calculated for the more important Portuguese fisheries.

EEC-Spain. The three components into which the fleet is divided were sampled in 1992 by observers on board.

- Catch of pair trawlers was sampled by only one observer in the 1st quarter, covering three months activity. A previous observer was on board a vessel that sank.

- Catch of small freezers traditionally fishing for flatfish was sampled by one observer in the 1st half of the year. Each vessel had one observer on board in the 2nd half of the year, when the fleet moved to fish Greenland halibut.

- Catch of large freezers fishing for Greenland halibut was sampled by one observer on board each of three vessels.

Japan. Japan did not collect any biological data in 1992 in the Regulatory Area, mainly because of the fact that total fishing by Japan in the Regulatory Area was below 300 days.

Russian Federation. For 1992, no information on length/age compositions of the Russian commercial catches in the Regulatory Area was available, and this situation will probably continue in 1993 and in the near future.

STACREC expressed concern that the level of sampling was continuing to decline and noted that this will have an increasingly important impact on the ability of the Scientific Council to assess the various stocks. The available data from commercial fisheries related to stock assessments for 1992 is given in Table 1. It was noted that there was an ongoing lack of data available from non-Contracting Parties, but these fisheries continued to catch substantial amounts of the various species in the Regulatory Area.

Review of survey activities (Tables 2 and 3)

As in the past, Contracting Parties provided the Secretariat with lists of research survey activities for the past and upcoming year.

STACREC noted with regret that survey activities in the NAFO Area in 1992 had declined from previous years (e.g. no juvenile silver hake survey). The representative of the Russian Federation indicated that a similar situation would probably exist in 1993.

Table 1. Available Data From the Commercial Fisheries Related to Stock Assessment (1992).

				Biological Sampling				
Stock	Country[1]	*Catch*	*CPUE*	Sex	Length	Age	Individual Wt.	Maturity
2J3KL cod	CAN	28 976		X	X	X	X	X
	E/FRA	583						
	E/PRT	3 335	X	X	X	X	X	
	E/ESP	3 823		X	X	X	X	

Table 1. (Continued)

Stock	Country[1]	Catch	CPUE	Biological Sampling				
				Sex	Length	Age	Individual Wt.	Maturity
2J3KL cod	E/FRG	285						
	OTHER	6 857						
3M cod	E/PRT	2 201	X		X	X		
	E/ESP	4 215			X	X		
	RUS	1						
	OTHER	4 500						
3NO cod	CAN	7 684	X	X	X	X	X	
	E/PRT	448	X	X	X	X	X	
	E/ESP	1 984						
	RUS	51						
	OTHER	2 450						
SA 1 redfish	GRL	0.3						
3M redfish	CUB	2 303						
	GRL	1						
	JPN	1 353						
	KOR-S	8 350						
	RUS	2 937						
	LVA	7 741[2]						
	E/FRG	3 350						
	E/ESP	206						
	E/PRT	3 198[2]	X	X	X	X		
	OTHER	3 910						
	TOTAL	33 349						
3LN redfish	CAN	740	X	X	X			
	E/FRG	1 500	X					
	E/PRT	1 900	X	X	X			
	E/ESP	750						
	RUS	3 500						
	CUB	1 300						
	KOR-S	4 900						
	OTHER	9 000						
4VWX silver hake	RUS	14.7 kt	X	X	X	X	X	X
	CAN	4 kt	X	X	X		X	X
	CUB	16.5 kt						
3M American plaice	E/PRT	313		X	X	X	X	
	E/ESP	390			X			
	JPN	49						
	GRL	1						
	KOR-S	10						
	RUS	-						
	TOTAL	763						
3LNO American plaice	CAN	9 542	X	X	X	X	X	
	KOR-S	518						
	E/PRT	140	X	X	X	X	X	
	E/ESP	412		X	X			
	OTHER	500						
3NO witch flounder	CAN	4 296	X	X	X	X	X	
	E/PRT	403	X	X	X			

Table 1. (Continued)

Stock	Country[1]	Catch	CPUE	Biological Sampling: Sex	Length	Age	Individual Wt.	Maturity
3NO witch flounder	E/ESP	182						
	KOR-S	44						
3LNO yellowtail flounder	CAN	6 809	X	X	X	X	X	
	KOR-S	3 825						
	E/PRT	1		X	X	X	X	
	E/ESP	122						
SA 0+1 Greenland halibut	GRL	12 181		X	X			
	JPN	1 864	X	X	X			
	NOR	2 766						
	FRO	689		X	X			
	RUS	6 911						
	CAN	8 185		X	X			
SA 2+3KLMNO Greenland halibut	CAN	6 935	X	X	X	X	X	X
	E/ESP	34 520	X	X	X	X		
	E/FRG	42						
	E/PRT	10 539	X	X	X			
	JPN	1 882						
	FRO	759						
	GRL	10						
	E/GBR	9						
	KOR-S	49						
SA 0+1 roundnose grenadier	GRL	20[3]						
	RUS	22						
	CAN	13						
	JPN	48[3]						
SA 2+3 roundnose grenadier	CAN(M)	12						
	CAN(N)	487						
	SUN	2						
	JPN	4						
	E/PRT	2 000						
	E/ESP	2 860						
SA 0+1 shrimp	GRL	79 260	X		X			
	CAN	7 493	X	X	X	X		X
	FRO	105						
	E/DEU	294						

[1] OTHER refers to estimates of non-Contracting Parties who did not report catches to NAFO.
[2] Data of Canadian surveillance.
[3] The catches are probably a mixture of roundnose and roughhead grenadier.

Table 2. Inventory of biological surveys conducted in the NAFO Area during 1992.

Subarea	Division	Country	Months	Type of survey	No. of sets
				Stratified-random Surveys	
0	B	RUS	11	G. halibut, grenadier temperature, salinity	26

Table 2. (Continued)

Subarea	Division	Country	Months	Type of survey	No. of sets
1	ABCD	JPN	8-9	Bottom trawl survey on groundfish (partially midwater trawl survey on redfish)	202
	CD	JPN	11,12	Bottom trawl survey on groundfish	49
2	G	RUS	11-12	G. halibut, grenadier, temperature, salinity	50
	H	RUS	11-12	G. halibut, grenadier, temperature, salinity	22
	J	CAN-N	10-11	Groundfish	
2+3	JK	CAN-N	11	Groundfish	
	JKL	CAN-N	2	Groundfish	
3	K	RUS	10	G. halibut, grenadier, temperature, salinity	29
	KL	CAN-N	12	Groundfish	
	L	CAN-N	5-6	Groundfish	
			6	Crab (NE St. John's)	
			8	Crab (inshore)	
			9	Juvenile flatfish	
			11	Groundfish	
	LN	CAN-N	5	Groundfish	
			11	Groundfish	
	LNO	CAN-N	8-9	Juvenile flatfish	
	M	E/ESP	7	Groundfish	117
		RUS	4	Groundfish, temperature, salinity	53
	M	E/ESP & E/PRT	6-7	Salinity	125
	NO	CAN-N	4-5	Groundfish	
			8	Juvenile flatfish	
			10	Groundfish	
	P	CAN-N	2	Groundfish	
	Ps	CAN-N	8-9	Scallop	
3+4	Pn+ RSVn	CAN-N	1	Groundfish	
	PRV	CAN-N	8	Redfish	
4	RS	CAN-Q	4	Cod migration	36
			5	Cod juvenile survey	148
			10	Cod juvenile survey	90
	RST	CAN-Q	8	Shrimp,redfish	227
	S	CAN-Q	7	Scallop assessment	261
			9	Scallop acoustic	
	T	CAN-Q	6	Mackerel assessment/larvae	128
			7	Crab assessment	64
			8	Mackerel acoustic	
4	VW	CAN-SF	3	Groundfish survey	80
			7	Groundfish survey	106
4+5	XYZ	CAN-SF	6-7	Groundfish survey	94
5	Z	CAN-SF	2	Groundfish survey	105
				Other Surveys	
1	CD	JPN	9,10,11	Exploratory survey by bottom trawl on G. halibut	227
2	J	CAN-N	7-8	Shrimp	
2+3	JK	CAN-N	4	Cod	
			9-10	Capelin acoustic	
		RUS	11	Capelin, temperature, salinity	7
	JKL	CAN-N	1-2	Cod tagging	

Table 2. (Continued)

Subarea	Division	Country	Months	Type of survey	No. of sets
2+3	JKL	CAN-N	5	Ichthyoplankton	
			5-6	Oceanography	
				Ichthyoplankton	
			7	Oceanography	
			10-11	Oceanography	
3	K	CAN-N	4	Seal sampling	
	KL	CAN-N	2-3	Cod/seals	
			4	Cod	
			5-6	Cod/capelin	
			6	Oceanography	
			6-7	Cod tagging (inshore), groundfish acoustic	
			7	Oceanography	
			9	Oceanography	
			9-10	Cod/capelin	
			11-12	Herring (inshore)	
			12	Juvenile northern cod	
	L	CAN-N	4	Crab (inshore)	
			4-5	Larval fish (NE Nfld Shelf)	
			5	Cod spawning (inshore)	
			5	Capelin acoustic	
			5	Groundfish acoustic	
			6	Larval fish (NE Nfld Shelf)	
			6-7	Capelin tagging (inshore)	
			7	Ichthyoplankton (inshore)	
			8	Crab (inshore)	
			8-9	Oceanography (inshore)	
			9	Gear trials (inshore)	
			9	Crab (inshore)	
			9-10	Cod tagging	
			10	Oceanography (inshore)	
			11	Crab (inshore)	
	LM	RUS	10	G. halibut, grenadier, temperature, salinity	9
	LN	CAN-N	7	Gear trials	
	LP	CAN-N	5	Hydroacoustics	
			9	Hydroacoustics	
	LPs	CAN-N	1-3	Herring, pelagic (inshore)	
			3-4	Crab	
	M	E/ESP	2-3	Tagging for cod	58
	N	CAN-N	6	Flatfish tagging	
			8	Juvenile cod, gear trials	
	NO	CAN-N	6-7	*Capelin* acoustic	
	Ps	CAN-N	5-6	Capelin tagging (inshore)	
4	R	CAN-Q	8	Scallop assessment	82
	S	CAN-Q	2	Crab growth	
			3	Crab migration	
			5	Shrimp larval survey	
			8	Pelagic acoustic	
4	T	CAN-Q	4	Rock crab migration	
			6	Mackerel fecundity	
	V	CAN-Q	5	Mackerel acoustic	
	VWX	CAN-SF	5	Scallop survey	
		CAN-SF	9-10	JGOFS biological oceanography	
	W	CAN-SF	1	Herring acoustic	
	WX	JPN	5-6	Commercial survey on S. hake surimi by bottom trawl	83
	X	CAN-SF	7	Zooplankton survey	
		CAN-SF	10-11	Herring larvae survey	
5	Z	CAN-SF	8	Scallop survey	
		CAN-SF	11	Herring resurgence	

Table 3. Biological surveys planned for the NAFO Area in 1993 and early-1994.

Country	Area	Type of Survey	Dates
		Stratified-radom Surveys - 1993	
CAN-N	2J+3K	Groundfish	Oct 28-Dec 16
	2J+3KL	Capelin acoustics	Sep 1-Oct 21
			Sep 22-Oct 11
			Oct 12-26
	3KL	Herring acoustics	Nov 13-26
			Nov 29-Dec 10
	3L	Crab	May 3-14
			May 25-28
			Aug 2-18
			Oct 11-22
	3LNO	Groundfish	Apr 26-May 7
			May 10-21
			May 24-Jun 11
			Aug 5-23
			Aug 9-20
			Aug 23-Sep 3
			Sep 7-17
			Oct 15-Nov 27
		Juvenile flatfish	Jun 14-23
	3P	Groundfish	Feb 5-25
			Apr 1-9
			Apr 12-21
	3Ps	Scallops	May 21-29
			Jul 23-Aug 3
	3Pn+4RST	Groundfish	Jan 6-30
CAN-SF	4VWX	Groundfish	Mar, Jul
	4X	Groundfish	Jul
	5Z	Groundfish	Feb
CAN-Q	3Pn4RST	Groundfish assessment	Jan
	4R	Cod larval survey	May 3-13
			Jun 18-26
		Stimpson assessment	Jul 16-27
		Cod juvenile survey	Oct 4-12
	4S	Scallop assessment	Jul 1-15
			Aug 27-Sep 7
	4T	Mackerel egg survey	Jun 17-Jul 1
		Crab assessment	Jul 28-Aug 11
		Lobster assessment	Sep 8-18
	4RST	Shrimp - redfish	Aug 13-Sep 11
E/ESP	3M	Groundfish	Jun 15-Jul 18
JPN	1A-D	Bottom trawl survey on groundfish	Sep 5-Oct 7
			Nov 25-Dec 9
RUS	0B+SA2+3K	Trawl survey for G. halibut, grenadiers, capelin temperature, salinity	Oct-Dec
	3LMNO	Bottom trawl survey for groundfish, biomass estimation capelin acoustics, temperature, salinity	May-Jul
	4VWX	Juvenile silver hake	Oct-Dec
		Other Surveys - 1993	
CAN-N	2J+3KL	Cod tagging	Jan 10-27
		Juvenile cod	Nov 29-Dec 19
	3KL	Cod tagging	May 31-Jun 9
		Cod acoustics	Jun 8-30
		Cod tagging	Aug 26-Sep 3

Table 3. (Continued)

Country	Area	Type of Survey	Dates
CAN-N	3KL	Juvenile cod	Sep 20-Oct 13
	3KLP	Hydroacoustics	May 31-Jun 6
			Aug 25-31
	3L	Oceanography	Jan 11-15
		Herring acoustics	Jan 18-27
		Oceanography	Feb 15-19
			Mar 16-17
			May 17-21
		Gear trials	Jun 11
			Jun 14-15
		Oceanography	Jun 21-25
		Inshore cod	Jun 28-Jul 9
		Benthic sampling	Jul 5-13
		Ichthyoplankton	Jul 12-16
			Jul 19-23
			Jul 26-30
		Oceanography	Aug 20-24
		Crab	Sep 6-17
		Gear trials	Sep 20-22
		Oceanography	Sep 29-Oct 1
			Oct 4-8
		Juvenile cod	Oct 25-Nov 10
		Oceanography	Dec 13-17
	3LN	Gear trials	Jan 4-20
CAN-SF	4V	Herring acoustic	Jan
	4VWX	Scallop survey	May
	4W	Zooplankton	Jan
		Sealworm	Mar-Apr
		Silver hake cruise	Oct
	4X	Herring larvae	Oct
	5Z	Scallop survey	Jun
		Herring resurgence	Nov
CAN-Q	4R	Herring acoustic	Oct 25-Nov 15
	4S	Crab, turbot	Apr 20-May 5
		Crab recruitment	Sep 26-Oct 7
	4T	Lobster assessment	May 21-Jun 1
		Crab recruitment	Jun 17-30
		Mackerel acoustic	Aug 12-26
	4Vn	Mackerel acoustic	May 28-Jun 15
JPN	1A-D	Exploratory survey (*bottom trawl*) on G. halibut	Jul 29-Aug 27
		Surveys Planned for Early-1994	
CAN-N	3LPs	Herring acoustics (stratified)	Jan 8-21
			Jan 24-Feb 4
	3L	Cod tagging	Feb 7-16
		Oceanography	Feb 18-22
CAN-Q	4RST	Groundfish (stratified)	Jan 7-31

Coordination of surveys

It was noted that there is a growing interest in the fisheries for Greenland halibut. Although there were a number of different research initiatives taking place in SA 0, 1, 2 and 3, there was little to no co-ordination of those activities. STACREC proposed that the various interested Contracting Parties begin discussions on the possibility of carrying out a coordinated research survey in the entire area, using a number of different vessels working simultaneously with standardized gear and trawling procedures, in order to get a comprehensive picture of the resource and its distribution. STACREC saw the importance of such a coordinated survey and encouraged interested Contracting Parties to continue discussions toward this goal.

ii) **Assessment data needs for 1993/94 and respective budgets**

Regarding the September 1992 Fisheries Commission request to describe the optimum volume and funding of scientific research in the Regulatory Area, Contracting Parties were requested to provide information on current expenditures on research and commercial sampling in the Regulatory Area as well as information of costs for 'optimal' sampling and research. For this meeting, only data on current costs to the EEC were available. These indicated an annual expenditure of about 4.1 million ECU. STACREC requested the necessary information be made available in time for review in September 1993. These should not only indicate current costs, but should also contain information on the cost of at least maintaining base level sampling and research.

c) **Proposals for Scientific Tasks of Observers in the Pilot Observer Program**

The Scientific Council was requested (FC Doc. 92/13) to: *recommend a work plan for fisheries observers that are authorized to obtain biological sampling data for Contracting Party vessels fishing in the Regulatory Area.*

The Council reviewed and endorsed the following text as prepared by STACREC:

STACREC noted Canadian observers collect considerable biological information while at sea. This includes information on fish sizes, sex and maturity, otoliths, by-catches, discards, and catch and effort. It was recognized that appropriate training was essential for other national observers and that experience is also necessary. Similar to the Canadian experience, it was anticipated that data quality from other observers will improve with time. Training must be done on a national basis and in conjunction with research institutes. Similar to Canada, EEC-Spain now provides their observers with a manual. Other Contracting Parties may wish to avail of these manuals for use by their own observers. After discussion, STACREC agreed that having biological data collected during the Pilot Observer Program was a good idea and **recommended** that *the Scientific Council bring forward for the information of and consideration by the Fisheries Commission that observers in the Pilot Observer Program should collect data on set location (latitude and longitude), depth fished, time net on bottom (or fishing), directed species, by-catches, discards, catches and effort. Length sampling of the main species in each set should also be set out.*

7. **Ageing Techniques**

The Council noted that the collaborative ageing work on silver hake between Canada and Russia was continuing and will result in a comprehensive manual prepared jointly by Canada and Russia.

The Council was pleased to note the progress on American plaice and Greenland halibut ageing since the workshop of December 1991, and that exchanges were ongoing.

8. **Gear Selectivity**

The Council observed that although no new information was presented to STACFIS, it was probably because scientists involved in gear research were preparing their results for presentation at the September 1992 Symposium being hosted by the Scientific Council.

9. **Relationships Between Acoustic Biomass Estimates and Other Methods**

The Council was concerned that no contributions were received in response to the March 1992 recommendation, and endorsed the reiteration of the **recommendation** by STACFIS for further investigations on the acoustic and other biomass estimation methods.

10. **Review of Scientific Papers**

The Council noted the significant number of SCR documents submitted to the meeting. STACFIS experienced a substantial demand on its time for the assessment discussions and hence had inadequate time to completely review all papers. Although some results from some papers were discussed, the Council supported the STACFIS view that the 28 SCR Documents that did not receive full reviews should be deferred to the September 1993 Meeting.

11. **Other Matters**

a) **Special Session in September 1993**

The Council was pleased with the comprehensive slate of papers proposed for the September 1993 Symposium. The Council extended its support and good wishes to the co-conveners S. Murawski (USA) and P.A.M. Stewart (EEC-UK) for an interesting and successful program.

b) **Special Session in September 1994**

The Council was pleased with the considerable progress made on the preparation for the September 1994 Symposium, and the Council extended its support to the co-conveners E. Buch (EEC-Denmark), M. Sinclair (Canada) and M. Stein (EEC-Germany) as they prepare for this Symposium.

c) **Special Session in September 1995**

The Council was pleased to note STACFIS had reviewed the general theme and specific topics proposed by the co-conveners J. Sigurjonsson (Iceland) and G. Stenson (Canada) for the September 1995 Symposium.

d) **Review of Arrangements for Conducting Stock Assessments**

The Council observed that conducting stock assessments by STACFIS represented a major workload within the scheduled time for the June meetings, and recognized that there was an imbalance of workload among the Standing Committees and the time demands for their work. The Council therefore agreed on the importance of considering a possible restructuring of the Scientific Council, at its meeting in September 1993. For this purpose it was agreed that Designated Experts for various stock assessments prepare working papers describing their specific problems in relation to the current proceedings, demands and schedules, and describing their requirements for a new structure, so that the Council could evaluate potential changes.

e) **Review of Report by the Joint ICES/NAFO Working Group on Harp and Hooded Seals**

The Council noted the report of the Joint Working Group was reviewed by STACFIS which documented current survey methodologies. The Council agreed with and supported the recommendations of the Working Group. The Council supported the view that NAFO publications should be offered as vehicles for scientific papers and extended its continuing interest in the activities of the Working Group.

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

1. Fishery Statistics

a) Progress Report on Secretariat Activities in 1992/93

The Council reiterated the concern expressed by STACREC about the ongoing delays in receipt of national STATLANT 21B reports of statistical information for 1990 and 1991. These delays continue to affect assessment work as well as publication of the Statistical Bulletins. The Council was pleased the Secretariat continues to send reminders to national representatives and hoped the situation would improve soon.

The Council recognized that additional data useful for assessment work concerning catches in the Regulatory Area, particularly those of non-Contracting Parties, are contained in a number of Working Papers of other NAFO Standing Committees. However, it was unclear as to whether these documents of Working Paper status could be used by the Council. The Council agreed to investigate through consultation with the Executive Secretary whether the Scientific Council can use the information they contain.

The Council noted that publication of *NAFO Statistical Bulletin* (Vol. 39) containing 1989 statistics was completed without inclusion of data from EEC-France (M). The Council agreed with the STACREC view of the possibility of publishing the Bulletin Vol. 40 and 41 in the absence of some data, after the Council evaluated the relative importance of the missing data.

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

The Council was pleased that following its recommendation in June 1992, a formal request was made by the Executive Secretary to the Fisheries Commission and General Council, and the General Council at its meeting in September 1992 agreed that the dates proposed by the Scientific Council were reasonable and Contracting Parties would try to comply with the deadlines. Recognizing the support from the General Council, the Council endorsed the **recommendation** to include a new Rule 4.3 as proposed in June 1992 in the Scientific Council Rules of Procedure, to place a legal requirement for Contracting Parties to observe the deadlines for submission of STATLANT data. However, the Council agreed that this new Rule would be more appropriately numbered as Rule 4.4.

Taking into account some concerns expressed by the EEC-EUROSTAT representative in meeting the originally proposed deadlines, the Council endorsed the STACREC **recommendation** that the new Rule 4.4 be: for the purpose of Article VII and VIII, the appropriate preliminary monthly catch and effort information should be furnished to the Scientific Council in advance of meetings. With respect of STATLANT 21A and 21B, they should be submitted not later than on 30 May and 31 August, respectively.

c) Preparation for the CWP 16th Session: Review of the Logbook and STATLANT 21B Forms

The Council was pleased to note that the Assistant Executive Secretary would be attending the *ad hoc Interagency* meeting in Dublin, Ireland, in September 1993, in preparation for the CWP 16th Session, and endorsed the **recommendation** that the Assistant Executive Secretary address issues discussed at this STACREC Meeting, including the questions of ICES and NAFO STATLANT forms.

The Council noted that ICES had decided to discontinue the use of STATLANT 27B forms, however, the Scientific Council has considerable use of the STATLANT 21B data and will continue to request and process them.

The Council was concerned of the increasing problem of double reporting of joint venture catches in recent years but was pleased that the Secretariat had taken action to remind Contracting Parties that separate STATLANT forms must be submitted for joint venture catches.

The Council recognizing the potential usefulness of logbook data agreed with the **recommendation** that the Scientific Council approach the Fisheries Commission about the possibility of requiring logbooks to include tow by tow fishing data.

2. **Fundamental Research Programs for Stock Assessment**

a) **Research Activities and Costs in 1992/93**

The Council reviewed and approved the text as given above (Section III.1.b) in response to the request by the Fisheries Commission.

b) **Assessment Data Needs for 1993/94 and Respective Budgets**

The Council agreed with the STACREC text as given in Section III.1.b above in response to the Fisheries Commission request.

3. **Non-traditional Fisheries Resources in the NAFO Area**

a) **Current Development of the Fisheries**

The Council noted there has been a new fishery for shrimp (*Pandalus borealis*) developing since spring, 1993, on Flemish Cap (Div. 3M), with a total of 27 trawlers from Canada, Denmark, Faroe Islands, Greenland, and Norway reported fishing in the area in early June, achieving catch rates between 8 and 17 tons per day.

By-catches (primarily redfish) were initially low (approximately 5%) but increased over time, to as high as 20% of the total catch.

While endorsing the STACREC **recommendation** that the activities of vessels engaged in this developing shrimp fishery on the Flemish Cap be closely monitored, the Council stressed the need to obtain proper records of fishery and biological data from all countries fishing the resource.

The Council also noted there has been a developing Greenland halibut fishery in the Regulatory Area since about 1990, and associated with this fishery were increased by-catches of roundnose and roughhead grenadier. There also appeared to be an increase in catches of skate in the Regulatory Area.

b) **Available Data and Research Priorities**

The Council was pleased to note there was 100% observer coverage on Canadian vessels licensed to fish shrimp in Div. 3M, collecting data on the fishery, by-catches and length samples.

The Council noted there was good sampling of the Greenland halibut fishery in the Regulatory Area. However, a possible problem of misallocation of the by-catch was recognized in that the roundnose grenadier that are currently reported are probably roughhead. Also noting problems persist with the various flatfish species not being separated but are reported as catches of flounder (unspecified), the Council endorsed the **recommendation** that the matter of misallocation of roundnose and roughhead grenadier, and flatfish species, be brought to the attention of the Fisheries Commission, and request that care be taken to ensure proper identification of species being caught.

The Council noted a STACREC review will evaluate if the reported increases of skate catches are realistic or not.

4. **Proposals for Scientific Tasks of Observers in the Pilot Observer Program**

The Council reviewed and approved the text as given in Section 6.c above in response to the Fisheries Commission request.

5. **Other Matters**

The Council noted the Secretariat had requested updated lists of fishing vessels for the triennial *List of Fishing Vessels* due in 1992.

The Council agreed with STACREC that during the September 1993 Meeting it would be useful to review the current conversion factors being used to convert fish product weights to round weights.

The Council agreed that the protocol adopted in 1984 (NAFO Sci. Coun. Rep., 1984) for the measurement of roundnose and roughhead grenadiers from the tip of the snout to the base of the first anal fin ray, should be conveyed again to national representatives.

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

1. **Review of Scientific Publications**

The Council was pleased to note Journal Vol. 12 containing miscellaneous papers was published in December 1992, and the special issue, Journal Vol. 13, containing papers for the 1989 Special Session was published as proposed by December 1992. The Journal Vol. 13 particularly was noted to be quite popular.

The Council was encouraged that the second invitational paper, a paper on Decapod larvae in Ungava Bay by H. J. Squires, was received for a single issue of the Journal, and is likely to be published late-1993.

The Council noted the rapid turn-around in the publication of Studies. The Council was particularly pleased with the early publication of the Workbook on Sequential Population Analysis containing the tutorial material from the September 1992 Special Session, and was pleased with its popularity.

The Council agreed that the inclusion of a group photograph of the participants of the June 1992 meeting in the *Scientific Council Reports* was a success, and encouraged the practice for future meetings.

The Council agreed that a formal publication of the *Index of Journal and Studies for 1987-93* would be a valuable reference document.

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

a) **Publication costs and revenues**

The Council noted that there were no significant departures from the previous year's production and revenue costs, however, it was noted that the revision of the free mailing list could represent a reasonable saving. The Secretariat was requested to continue to revise the list periodically.

b) **Print pages at the Secretariat**

The Council agreed that attempts to avoid double printing of documents at this meeting was, in general, considered a success. The Council agreed similar attempts should be continued, and endorsed the STACPUB proposal to request authors to submit titles and abstracts of their papers 15 days in advance of the meetings.

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

The Council was pleased with the initiatives being discussed by STACPUB to find means of promoting the Journal. It was particularly noted that the fast turn-around time of publication and encouraging invitational papers would serve the purpose well.

4. **Editorial Matters**

The Council was pleased to note that a total of 411 papers had been nominated by STACPUB since 1980, and a total of 312 papers had been published, and of the 20 papers nominated at the 1992 meeting, 9 have been submitted in addition to the Workbook of the September 1992 Special Session which was published in Studies.

5. **Papers for Possible Publication**

The Council noted that STACPUB had reviewed 30 SCR Documents as requested by the authors, and nominated 12. The Council was pleased to note an additional group of 13 papers dealing with Northern Cod that may be suited for a single NAFO publication.

V. RULES OF PROCEDURE

1. **New Rule on Deadline Dates for STATLANT 21A and 21B**

A new Rule 4.4 as discussed by STACREC was received by the Council. It was noted that the proposed new Rule had revised dates of 30 May and 31 August for STATLANT 21A and 21B, respectively.

2. **Ratification of Addition to Rule 3**

The new Rule 3.7 (as given in Annex 4 of Agenda I, Part D, this volume) which had been proposed by the Council in 1984 but had not been ratified, was reviewed. The Council adopted the new Rule with a slight modification to the proposed wording to read as follows:

Rule 3.7. In the circumstance that both the Chairman and Vice-Chairman of the Scientific Council are absent at the time and place of a scheduled Scientific Council Meeting, a Scientific Council representative shall be appointed as temporary Chairman for that Meeting by consensus among the Scientific Council, representatives, or their alternates, who are present.

VI. COLLABORATION WITH OTHER ORGANIZATIONS

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

The Council noted STACFIS had reviewed the report of the Joint ICES/NAFO Working Group workshop on survey methodology held during 5-12 October 1992 in Archangelsk, Russia. The Council agreed with the conclusions of STACFIS and endorsed the **recommendations**, with full recognition that the Scientific Council continues to be interested in the activities of the Working Group.

2. **Sixteenth Session of CWP 1994**

The Council noted the 16th Session of the CWP was planned for Madrid, Spain, in July 1994. The Council **recommended** that *the Assistant Executive Secretary should attend the 16th Session of CWP.* The Council accordingly requested the General Council approval of an appropriate amount in funds, stating that the Council sees extreme importance of his attendance at the meeting. The Council noted that in addition it is usually represented at the CWP Meeting by the Chairman of STACREC and any representatives from Contracting Parties. It was agreed that these representations would be reviewed at the September 1993 Meeting.

3. **Scientific Council Invitations to Other International Bodies**

The Chairman noted that NAFO routinely receives invitations to participate as observers in many meetings of international bodies such as ICES. The view was expressed that a reciprocal invitation to the June and September Meetings from the Scientific Council to selected international bodies may be appropriate and beneficial for scientific exchange. The Chairman accordingly requested participants to consider this matter and submit their thoughts to the Secretariat, for Scientific Council discussion during the September 1993 Meeting.

VII. ARRANGEMENTS FOR SPECIAL SESSIONS

1. **Special Session of September 1993**

The Council noted comprehensive plans were presented to STACFIS by the co-conveners, and the Secretariat was making arrangements to hold the Symposium at the Holiday Inn, Dartmouth, immediately after the Annual Meeting, during 13-15 September 1993. The Council congratulated the co-conveners S. A. Murawski (USA) and P. A. M. Stewart (EEC-UK) for developing what appears to be a high quality and interesting scientific symposium.

2. **Special Session of September 1994**

The Council was pleased with the progress made with the early announcement of the Symposium to be held during 14-16 September 1994, and was appreciative of the work of the co-conveners E. Buch (EEC-Denmark), M. Sinclair (Canada) and M. Stein (EEC-Germany) and the Secretariat.

3. **Special Session of September 1995**

The Council was pleased that considerable progress was also made on the Symposium to be held during 6-8 September 1995. The Council extended appreciation to the co-conveners J. Sigurjonsson (Iceland) and G. Stenson (Canada) for their work in developing the general theme and specific topics.

Further to STACFIS discussions, the Council considered the possibility of undertaking Special Session Workshops on Assessment Methodology as recommended at the September 1992 Scientific Council Meeting. Recognizing the lead time needed for conveners to prepare for such meetings, and the need for STACFIS to identify requirements to be addressed, the Council agreed that further discussions be undertaken during the September 1993 Meeting.

VIII. FUTURE SCIENTIFIC COUNCIL MEETINGS

1. **Annual Meeting and Special Session in September 1993**

The Council would next meet for the Annual Meeting of NAFO at the Holiday Inn, Dartmouth, Nova Scotia. The Council reaffirmed its decision made in September 1992 that the Council would meet for 4 days during 7-10 September 1993, and the Symposium would be in the week following, during 13-15 September 1993.

2. **Scientific Council Meeting in June 1994**

The Council agreed that the Scientific Council together with its Standing Committees and Subcommittee would meeting during 8 to 22 June 1994. The location of that meeting would be announced during the September 1993 Meeting.

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

The Council noted the proposed dates for the Annual Meeting of 19-23 September 1994. The Council reaffirmed its decision of September 1992 to hold the Special Session (Symposium) during 14-16 September 1994. It was noted that these dates appeared in the first announcement circulated early this year.

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

The Council agreed on the tentative dates of 7-21 June 1995 for its meeting.

IX. NOMINATION AND ELECTION OF OFFICERS

The Chairman's proposal (2 June 1993) to appoint a Nominating Committee composed of C.A. Bishop (Canada) and A. Vazquez (EEC-Spain) was accepted by the Council.

On 14 June 1992 the Chairman requested the Nominating Committee to present its proposal for the nomination of Chairman to the Scientific Council, Vice-Chairman of the Scientific Council who would become the *ex officio* Chairman of STACPUB, and Chairman of STACREC. C. A. Bishop reported that the Committee, after consulting with representatives, was ready to make nominations for the offices of Scientific Council Chairman and Vice-Chairman, while the Chairman himself was advised of a nomination for Chairman of STACREC.

Noting that the appointments were for two-year terms beginning at the end of the September 1993 Annual Meeting of the Scientific Council, the Chairman called for nominations and election.

For the office of Chairman of Scientific Council, the current Vice-Chairman H. Lassen (EEC-Denmark) was nominated by the Committee and the Council elected him by unanimous consent.

For the office of Vice-Chairman of Scientific Council and *ex officio* Chairman of STACPUB, the Committee nominated W. R. Bowering (Canada) and the Council elected him by unanimous consent.

For the office of Chairman of STACREC, the Chairman nominated C. A. Bishop (Canada), and the Council elected him by unanimous consent.

X. REQUEST FOR NOVEMBER MEETING ON SHRIMP

The Council (16 June 1993) noted Denmark/Greenland had submitted on 18 May 1993 a request that the Scientific Council consider in advance of the 1993 Annual Meeting its proposal regarding the reinstatement of a mid-term meeting for assessment of Northern shrimp stocks in Subareas 0 and 1 and Denmark Strait, the first should take place late-November 1993 (see Agenda I, Annex 5, Part D, this volume).

While recognizing Article IX.3 of the Convention, the Chairman requested the views of the Council. It was noted that survey data which constitute a substantial part of the assessment become available by then for a more up-to-date consideration, however, STACFIS had not adequately addressed the possible pros and cons of a mid-term assessment. Concern was expressed that such a mid-term meeting would represent additional costs to the Secretariat and the Contracting Party participants, and limited attendance might weaken the peer review process of the science. Representatives expressed views that this was a request for the Scientific Council to consider this proposal and it did not represent a formal request from a Coastal State in accordance with Article VII.

In view of these uncertainties, the Council agreed a decision should be made during the September 1993 Meeting. In preparation for discussions, representatives were requested to present working papers detailing pros and cons, and also providing an overview of the history of the Scientific Council mid-term shrimp meetings held in the 1980s. The Council also requested the Executive Secretary to obtain clarification from Denmark/Greenland as to the nature of the request.

XI. OTHER MATTERS

1. Space Requirements for June Meetings and on the Structure of the Scientific Council

The Council noted the work of the Scientific Council was again seriously hampered by inadequate space at the Secretariat to conduct its business, with meetings of STACPUB and various working groups being held in staff offices and other make-shift areas. An additional serious short coming was the inadequate space for computer users. The Council also noted there was a disproportionate workload burden on STACFIS, and saw the need to consider the structure and the workload of Scientific Council in general to improve its efficiency.

The Council noted two Working Papers were prepared by representatives for consideration at the September 1993 Meeting. Accordingly, the Council agreed to defer discussions to the September 1993 Meeting with a particular note that Designated Experts should prepare notes on their experiences on where there are problems and identifying any requirements.

XII. ADOPTION OF REPORTS

1. **Standing Committee Reports**

At its concluding session on 16 June 1993, the Council reviewed and **adopted** the reports of STACFIS, STACREC and STACPUB.

The Council was particularly concerned that there were inadequacies in data to adequately respond to requests from the Fisheries Commission. The Council stressed that these inadequacies as identified in the responses to the Fisheries Commission (see Section 6 above) should be rectified and addressed at the September 1993 Meeting prior to the Fisheries Commission Meeting.

2. **Scientific Council Report, June 1993**

At its concluding session on 16 June 1993, the Council reviewed and **adopted** the Report of the 2-16 June 1993 Meeting of the Scientific Council, noting that discussions of the Council's concluding session and editorial modifications will be reflected in the Report.

XIII. ADJOURNMENT

There being no other business, the Chairman extended a special thanks to the Executive Secretary, the Assistant Executive Secretary and to the staff of the Secretariat for exceptional efficiency and support. He thanked Antonio Avila de Melo, Hans Lassen and Manfred Stein for their work as Chairmen of STACREC, STACPUB and Environmental Subcommittee, respectively. The Chairman underlined that the heaviest burden was carried by the STACFIS Chairman and he thanked Hans Peter Cornus for successfully conducting his meetings. Thanks was extended to all participants particulary the Designated Experts for their valuable contributions. He adjourned the meeting, looking forward to seeing most of the participants at the NAFO Annual Meeting in September.

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

Chairman: H. P. Cornus Rapporteur: Various

The Committee met at NAFO Headquarters, Dartmouth, Nova Scotia, Canada during June 2-16, 1993 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 (see Agenda I, Part D, this volume). Representatives from Canada, Denmark (in respect of the Faroe Islands and Greenland), European Economic Community (Denmark, France, Germany, Portugal, Spain), Iceland, Japan, Norway 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 NAFO Headquarters in Dartmouth.

2. Available Assessment Data

It was recommended at the June 1992 Meeting that "during the first day of future June meetings under usual agenda item 'General review of catches and fishing activity' all available information on catches for the various stocks should be reviewed so that best estimates of catches can be determined before commencement of the assessment reviews". This was conducted during the first day of the meeting. Designated Experts reported on available data for the stock assessments. Members felt that this practice was valuable in terms of receiving information at an early stage of the meeting and STACFIS decided to continue this practice at future June meetings.

STACFIS noted the absence of an early announcement of the Scientific Council Research Documents (SCR Doc.) being submitted to the meeting was a disadvantage for the above-mentioned review, and therefore STACFIS **recommended** that *SCR Documents should be announced 15 days before the beginning of the Scientific Council Meetings to the NAFO Secretariat. This announcement should include the title, purpose of the paper and, if available, the abstract.*

3. General Trends for the Northwest Atlantic

While recognizing EEC-France (M) and France (SP) data for 1991 and 1992 were missing, and noting that the data from Japan were preliminary and were likely to change substantially when revised, the following observations from STATLANT 21A reports were noted in the reported catches (Table 1). The provisional overall nominal catch (round fresh weight) of all finfish and invertebrate stocks was 2.48 million tons in 1992, a decrease (13%) from the 1991 catch of 2.82 million tons. The total "groundfish" catch, which represented 32% of the overall catch in 1992 was 24% less than in 1991 (1.03 million tons and 783 000 tons in 1991 and 1992, respectively). Decreases were noted for cod (42%), redfishes (5%), silver hake (58%), American plaice (36%), and increases noted for pollock (22%), Greenland halibut (35%). The total "pelagic" catch, which represented 25% of the overall catch in 1992, decreased (3%) to 609 000 tons in 1992 from 631 000 tons in 1991. Decreases were noted for mackerel (36%) and menhaden (3%) but herring increased (3%). The total "other finfish" catch, which represented 4% of the overall catch in 1992, decreased (31%) from 137 000 tons in 1991 to 94 000 tons in 1992 due mainly to further decreases in capelin (40%). The total catch of "invertebrates", which represented 40% of the overall catch in 1992 decreased (3%) in 1992 to 996 000 tons from 1.02 million tons in 1991. While increases were noted for squids (6%), clams (6%) and shrimp (11%), decreases were noted for scallops (6%), crabs (23%) and lobsters (13%).

Table 1. Provisional nominal catches ('000 tons) by Subarea for 1991 and 1992. (+ indicates less than 50 tons. **N.B.** the 1991 data exclude EEC-France (M) and France (SP); the 1992 data exclude EEC-France (M) and France (SP) and data for Japan preliminary.

Species	SA 0		SA1		SA2		SA 3		SA 4		SA 5		SA 6		Total	
	1991	1992	1991	1992	1991	1992	1991	1992	1991	1992	1991	1992	1991	1992	1991	1992
Cod	+	-	20	6	3	+	203	79	127	112	55	39	+	+	409	237
Haddock	-	-	-	-	-	-	2	1	15	17	7	6	-	-	24	24
Redfishes	+	-	+	+	+	+	86	78	77	76	1	1	+	+	164	155
Silver hake	-	-	-	-	-	-	+	+	122	42	11	11	5	4	139	58
Red hake	-	-	-	-	-	-	1	+	1	1	1	1	1	1	4	3
Pollock	-	-	-	-	-	-	2	1	40	31	10	10	+	+	51	62
American plaice	-	-	+	-	+	+	32	14	8	7	4	7	+	+	44	28
Witch flounder	-	-	-	-	+	+	10	9	3	3	2	2	+	+	14	14
Yellowtail flounder	-	-	-	-	-	-	12	11	2	2	7	5	+	+	21	18
Greenland halibut	11	11	11	15	14	2	27	55	2	3	-	-	-	-	65	88
Other flounders	+	+	+	+	+	+	4	2	10	10	12	10	4	5	30	27
Roundnose grenadier	+	+	+	+	+	+	4	7	-	-	-	-	-	-	5	8
White hake	-	-	-	-	-	-	4	3	9	9	6	10	+	+	19	21
Wolffishes	+	+	+	+	+	+	4	2	1	1	1	1	+	+	5	4
Other groundfish	+	+	1	2	+	+	1	1	5	5	18	20	9	8	34	36
Atlantic herring	-	-	-	-	+	-	19	10	196	205	48	51	1	4	264	271
Atlantic mackerel	-	-	-	-	-	-	1	3	25	23	4	5	29	6	59	38
Atlantic menhaden	-	-	-	-	-	-	-	-	-	-	13	11	283	275	296	286
Other pelagics	-	-	-	-	-	-	1	1	1	2	5	5	5	7	12	14
Capelin	-	-	+	+	+	-	43	20	7	9	-	-	-	-	50	30
Other finfish	+	+	1	+	1	+	35	14	16	12	21	23	14	14	87	64
Squids	-	-	-	+	-	-	2	1	2	1	8	5	24	31	36	38
Clams	-	-	-	2	-	-	7	13	5	5	32	38	354	364	398	421
Scallops	-	-	1	-	+	+	2	6	30	34	133	128	59	41	224	210
Other molluscs	-	-	-	-	-	+	+	+	3	5	21	26	53	22	76	53
Shrimp	8	9	69	79	13	17	2	2	17	15	3	3	-	-	113	125
Crabs	-	-	-	+	1	1	15	13	20	22	3	3	51	30	90	69
Lobsters	-	-	-	-	-	-	2	2	46	40	26	23	3	2	76	66
Other invertebrates	-	-	-	-	-	-	-	-	+	1	10	12	+	+	11	14
Total	19	20	104	104	33	20	520	348	789	693	460	456	897	814	2822	2479

4. Fishery Trends by Subarea

Noting that catches in 1991 and 1992 do not include the French data, and Japanese data for 1992 are preliminary, the following trends were observed:

a) Subarea 0

The overall total nominal catch in 1992 was 20 000 tons, which was a slight increase (5%) over 1991. The catch of Greenland halibut and shrimp remained constant at 11 000 tons and about 9 000 tons, respectively.

b) Subarea 1

The total nominal catch remained at the same level in 1992 as in 1991 (104 000 tons). There was however a decrease in cod (70%) but an increase (36%) for Greenland halibut and shrimp (14%) maintained the total.

c) Subarea 2

The overall nominal catch decreased significantly (39%) to 20 000 tons in 1992 from 33 000 tons in 1991. Decreases were noted for cod (from 3 000 tons in 1991 to <500 tons in 1992) and G. halibut (86%). Shrimp comprised 85% (17 000 tons) of the catch in this Subarea.

d) **Subarea 3**

The overall nominal catch decreased (33%) in 1992 to 348 000 tons from 520 000 tons in 1991. Decreases were noted for cod (61%), redfishes (9%), American plaice (56%), herring (47%), capelin (53%), although increases were noted for Greenland halibut (104%) and clams (86%).

e) **Subarea 4**

The overall total nominal catch decreased (12%) to 693 000 tons in 1992 from 789 000 tons in 1991. Decreases were noted for cod (12%), silver hake (66%) and pollock (28%), although increases were noted for herring (5%) and scallops (13%). Many species remained at a similar level to 1991.

f) **Subarea 5**

The overall total nominal catch decreased slightly (1%) to 456 000 tons in 1992 from 460 000 tons in 1991. Decreases were noted for cod (19%), menhaden (15%), scallops (4%) and lobsters (12%) with increases noted for American plaice (75%), herring (6%) and clams (19%).

g) **Subarea 6**

The overall total nominal catch decreased (9%) in 1992 to 814 000 tons from 897 000 tons in 1991. Most species remained at the same level while decreases were noted for mackerel (79%), menhaden (3%), scallops (31%) and crabs (41%), and increases noted for squids (29%) and clams (3%).

II. REVIEW OF RECOMMENDATIONS FROM 1992 MEETINGS

It was noted that a list of all recommendations was circulated with the provisional agenda. Only recommendations concerning general items were discussed here while recommendations relating to stock assessments were handled in the relevant sections.

Referring to the recommendation 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, page 44), should also attempt to provide as much catch/effort data (including preliminary data) as are available" (NAFO Sci. Coun. Rep., 1992, page 77), it was recognized that there was an improvement, but not sufficient to meet the requirements of Designated Experts. Therefore STACFIS reiterated 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.* The recommendation that "Scientific Council bring the concerns of STACFIS on the potential negative impacts of a reduced annual database on the stock assessments, to the attention of the Fisheries Commission" (NAFO Sci. Coun. Rep., 1992, p. 77) was transmitted to the Fisheries Commission during the Annual Meeting in September 1992. This was also done with the recommendation that "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).

The recommendation to present estimates derived from surveys (e.g. abundance, biomass) accompanied by associated variances (NAFO Sci. Coun. Rep., 1992, page 77) was followed only partly as regards the SCR documents received for assessments at this meeting. Therefore, 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.*

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 twelfth meeting of the Subcommittee on Environmental Research was held on 3 June 1993 with M. Stein (EEC-Germany) as Chairman.

2. **Review of Environmental Studies in 1992**

A total of 13 documents dealing specifically with environmental issues were reviewed.

Below normal air temperatures were observed over the Labrador Sea during most of 1992 continuing the trend of anomalous cold conditions since 1990 and similar to conditions in the early-1970s and early-1980s. In contrast, the air temperature anomalies over most of the Northeast Atlantic were generally above normal. The air temperature anomalies are attributed to the atmospheric circulation pattern. The ice extent in the Labrador Sea was above normal especially in the late winter of 1992. Cold sea temperatures were observed over Fylla Bank comparable in magnitude to the cold periods around 1970 and the early-1980s. At depths below 150 m, where Atlantic waters are found, conditions were near normal.

Sea temperatures collected during the annual fall Canadian groundfish survey in Div. 2J+3KL showed colder-than-normal sea surface temperatures in November 1992, and lower than those in the same month in 1991. In 1992 the areal extent of the cold intermediate layer (CIL) over the Northeast Newfoundland Shelf and off Cape Bonavista was smaller than in 1991 but remained more extensive than normal.

3. **Overview of Environmental Conditions** (SCR Doc. 93/50)

Extremely cold air temperatures were again observed over southern Labrador and Newfoundland especially in winter due in part to an intensification and a westward shift in the position of the Icelandic Low. Similar to 1991, 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.

Deep water temperatures on the Scotian Shelf (Emerald Basin) and in the Laurentian Channel at Cabot Strait rose to above normal temperatures from the extremely cold conditions in 1991. This change was believed to be due to changes in the offshore slope water.

Climatic outlook for 1993 indicated colder-than-normal conditions for the Labrador Sea/Davis Strait area.

IV. STOCK ASSESSMENTS

1. **Review of Assessment Methods to be Used**

STACFIS recalled the experience of the 1992 Special Session, the Tutorial on calibration methods on fish stock assessments, and recognized the value of a periodical review of the methods for stock assessments. STACFIS agreed that this was an important part of the work of the Scientific Council and **recommended** that *a workshop on stock assessment methodology should be held for example every second or third year.* It was agreed that this should be further considered during the September 1993 Meeting.

STACFIS emphasized it was necessary that the description of the estimation of input parameters in all analytical assessments should be made. These should be in sufficient detail in order to ensure the possibility of reproducing the assessments at a later date. STACFIS also agreed that a checklist of data quality and methods used for assessment should be prepared every year.

STACFIS recognized the usefulness of investigating the practicality of providing biological reference points other than $F_{0.1}$ and F_{max} normally requested by the Fisheries Commission. In particular, such points as F_{low}, F_{med} and F_{high} were considered. It was agreed that where appropriate, STACFIS may use these reference points to describe the state of the stock, as well as providing advice based on current reference levels of $F_{0.1}$ and F_{max}.

2. **Cod in Divisions 2J, 3K and 3L** (SCR Doc. 93/29, 33, 38, 41, 50, 54, 86; SCS Doc. 93/13, 14. Documents not fully reviewed by STACFIS; SCR Doc. 93/30, 31, 32, 34, 35, 36, 37, 39, 42, 43, 45, 55, 56, 57, 68)

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. 1). Catches rapidly declined thereafter and were at a low of 139 000 tons in 1978. From 1982 to 1990 catches were in the range of 219 000 to 270 000 tons, however, a reduction to approximately 150 000 tons occurred during 1991, and further to 44 000 tons in 1992. The total Canadian catch increased from a low of about 36 000 tons in 1974 to 214 000 tons in 1983. Catches then declined to 190 000 tons in 1986 but increased to a high of 242 000 tons in 1988. Since 1988 catches have again declined and in 1992 the Canadian catch was approximately 29 000 tons including recreational catch.

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Fixed Gear Catch	106	98	80	72	79	101	103	113[1]	60[1]	12[1]	
Offshore Catch	126	135	151	179	156	168	151	106[1]	90[1,2]	32[1,3]	
Total Catch	232	233	231	252	235	269	253	219[1]	150[1]	44[1]	
TAC	260	266	266	266	256	266	235	199	190	120[4]	[4]

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

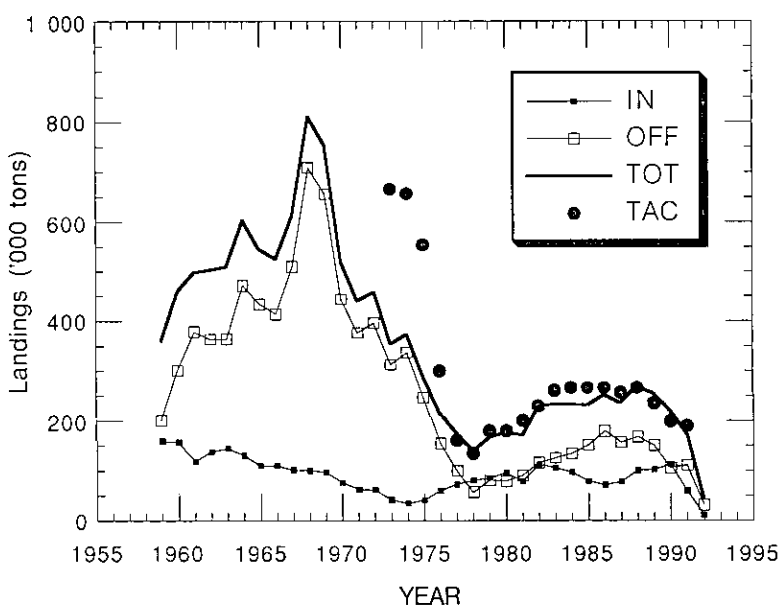

Fig. 1. Cod in Div. 2J+3KL: inshore and offshore landings and TACs.

Estimates of the catch of cod by non-Canadian fleets in the Regulatory Area in Div. 3L were about 14 300 tons in 1992. Of the total, 9 500 tons were reported from EEC vessels

and about 4 800 tons were estimated as non-reported by both Contracting and non-Contracting Parties.

During the 1960s, when the fishery was dominated by non-Canadian fleets, most of the catch occurred in Div. 2J and 3L with Div. 2J generally predominating (Fig. 2). Since that time catches have been mainly from Div. 3K and 3L. No commercial catch was reported from Div. 2J in 1992. Almost all (95%) of the total Canadian catch was taken in Div. 3L over the January to May period. Approximately 30% of the Canadian catch in 1992 was taken by a recreational fishery during the last half of the year using jiggers or baited hooks.

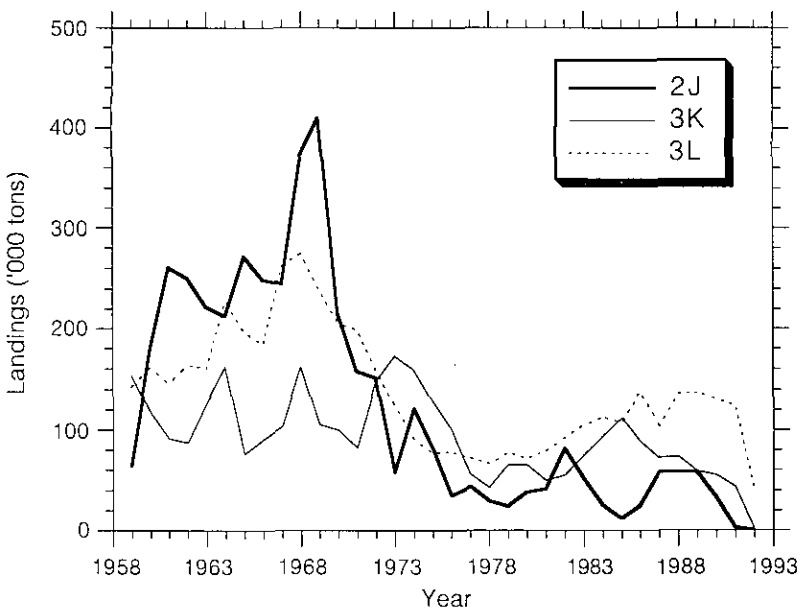

Fig. 2. Cod in Div. 2J+3KL: landings by Division.

ii) **Environmental conditions**

Complete information on environmental conditions in the area is contained in the report of the Environmental Subcommittee. Colder than average conditions continued in 1992, and present prospects are that 1993 will again be a cold year. It is still not possible to evaluate the impacts these environmental trends may have had or have on the cod stock.

Regression analyses have indicated a significant relationship between salinity and recruitment success (age 3) of Div. 2J+3KL cod. A better relationship was derived by including spawning stock biomass (SSB). Both of these relationships predict the 1990 and 1991 year-classes to be poor.

Spawning occurs earlier in the north than the south. Overall, there has been no relationship found between spawning time and water temperature, water column stability, oceanic transport or seasonal cycles of plankton abundance. In Div. 3L, however, it was found that spawning is delayed when water temperatures are colder. It is believed that this is due to the influence of colder temperatures on gonad maturation rates.

iii) **Interrelationships with other species**

Other groundfish species. Based on results of annual Canadian stratified random surveys in Div. 2J+3KL, the abundance and biomass of most other groundfish species have also declined in recent years and most are at or near the lowest observed levels.

These declines were noted for non-commercial species as well as other commercial species. The declines have been most dramatic and occurred earlier in Div. 2J, and were least and later in Div. 3L. Throughout the 1980s, the biomass of cod actually increased relative to the biomass of other groundfish species in Div. 3K and 3L.

Capelin. During the 1980s, capelin were present in two main aggregations; the northern and western portions of Div. 2J and 3K, and northeastern Div. 3L. Acoustic estimates of abundance declined dramatically and unexpectedly beginning in 1990. During this period, stomach content analysis suggested that cod seemed better able to find capelin than the surveys, and overall there was little indication that cod were finding less prey in recent years compared to the past, except in Div. 2J. At the same time, cod taken in large catches appeared to be feeding poorly. The remaining areas of concentration (troughs between Belle Isle Bank and Funk Island Bank, and between Funk Island Bank and Grand Bank) are not areas where cod traditionally found good foraging on capelin. There is evidence, however, from by-catches in bottom trawl surveys and intensive predation by cod outside the large cod concentrations, that capelin moved into these areas in the 1990s. It was noted that a complete picture of the relationships cannot be obtained from the annual fall surveys alone.

Invertebrates. No documentation was provided for review during this meeting, but anecdotal information provided indicated that while fish species are declining in the Div. 2J+3KL area, both the shrimp and crab fisheries are doing extremely well and improving steadily. It is not known if these increases can be attributed to reduced predation on these species, or some environmental factor or some combination of the two.

Seals. The harp seal pup hunt ended in 1983, and only a landsman hunt remains today. The hunt plus by-catch has taken about 100 000 seals annually in recent years. Based on a 1990 survey, the population was estimated to be about 3.1 million seals. This represents an increase from about 1.5-1.75 million animals in 1978. The hooded seal population is estimated to be about 400 000-500 000 animals.

Both species are found in the offshore areas during winter. Hooded seals are generally distributed further east in the slope area, but data from recent years suggest that an area at the Div. 3KL border is important to both. Harp seals were particularly abundant in this area in 1992 and 1993. This distribution overlapped the distribution of cod in 1992, but not in 1993, suggesting that factors other than the presence of cod may influence the seal distribution. At present, it is not possible to estimate the abundance of seals in these offshore areas.

Based on reconstruction of seal stomach contents, there is considerable seasonal, geographical and inter-annual variation in the diet of seals in the Div. 2J+3KL area. Most of the samples presently available are from the inshore areas where a wide variety of prey species have been found including Arctic cod, sculpins, herring, shrimp and squid. Atlantic cod was not identified as a major prey species although caution must be exercised in interpreting this observation because most of the cod are offshore during the period (winter) when these samples were taken. More sampling is required from the offshore areas, but available information suggests that except for seals taken by trawlers during the directed cod fishery, there is presently little evidence that Atlantic cod constitutes a major prey item.

It was agreed that the increase in the seal population in recent years could result in increased interactions between seals and cod, but it is still not possible to fully evaluate the interactions between the two species.

b) **Input Data**

i) **Commercial fishery data**

Catch- and weight-at-age. Catch- and weight-at-age of the Canadian and French fisheries inside the Canadian zone were estimated using sampling spread spatially and temporally

over all gears and areas. Coefficients of variation on the estimated catch were less than 10% for most ages. Sampling was obtained by both EEC-Spain and EEC-Portugal for their fisheries in the Regulatory Area but was not presented in time for inclusion in the analysis. The age composition of catch by non-Canadian fleets fishing in the Regulatory area in 1992 was estimated using the age composition obtained for the Canadian and French otter-trawl catch in Div. 3L. The 1986 to 1987 year-classes were the most abundant in the commercial catch in 1992.

Average weights increased from the early-1970s to the early-1980s and subsequently declined. The 1992 average weights-at-age for ages 4-7 were lowest since those of the 1960s and 1970s.

Commercial catch rates. In previous assessments commercial catch and effort data were analyzed in a multiplicative model and were initially included in calibration models. However, the results indicated a lack of fit based on the occurrence of patterns in the residuals which could not be explained. This problem has been observed in the past and has not been resolved. With this situation and the much reduced otter-trawl fishery in 1992, further analysis of catch and effort data was not conducted at this time.

ii) **Research survey data**

Canadian biomass surveys. Research vessel surveys have been conducted by Canada during autumn in Div. 2J, 3K and 3L since 1977, 1978 and 1981, respectively. Divisional survey estimates of biomass and abundance have shown large fluctuations in recent years. The values observed in 1992 in Div. 2J were the lowest observed in the time series. Biomass estimates have indicated a declining trend since 1988 in Div. 2J and since 1989 in Div. 3K. The 1991 and 1992 estimates for Div. 3L were similar but among the lowest in the time series. Cod abundance and biomass in the autumn surveys were low in the shallow water strata. This was particularly true for Div. 3L where in contrast to previous years, cod catches were small in large strata in the 31-50 fathom range. Indices from the Div. 3L spring surveys have declined substantially since 1990 and in 1992 were the lowest in the time series since 1977.

Percent biomass by Div. (Fig. 3) was fairly stable for a period in the early-1980s and averaged about one third in each of the three Divisions. In recent years the percentages have become quite variable with the highest and lowest percentages for each of the three Divisions occurring since 1987. The average percentages for the 1981-92 period of about 33% for each Division are not reflective of the situation in recent years. In 1992 over 80% of the biomass occurred in Div. 3L.

Mean numbers-per-tow at age for the surveys conducted in all Divisions indicated that in Div. 2J and 3K the 1987 year-class (age 4) was still the most abundant in 1992, but at very much reduced values. A similar pattern was observed for the Div. 3L survey although the 1988 year-class appeared to be slightly stronger in this area.

Average weights-at-age from surveys have shown a decline at ages 4-6 since 1989 in Div. 2J and 3K, and for ages 5-8 since 1990 in Div. 3L, while remaining stable or showing some increase at older ages. 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 1992 indicated a fairly typical pattern from 1981 to 1988. Catches were spread over the entire survey area and most large catches were in shallower water. Commencing in 1989 changes started to occur, in that 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 there were virtually none in Div. 2J and 3K, and low abundance in Div. 3L. This apparent movement to deeper water was also evidenced by the increase in abundance at depths greater than 300 m, mainly since 1989, in spite of decreases in total abundance.

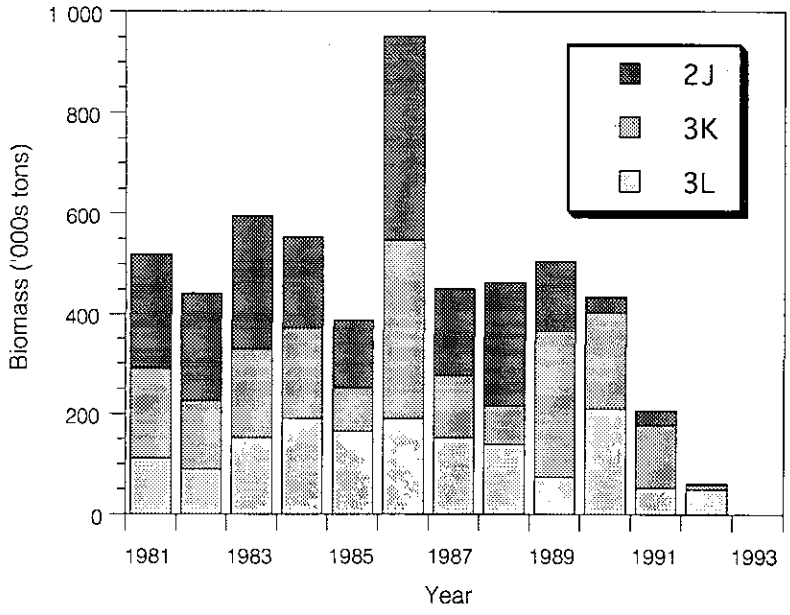

Fig. 3. Cod in Div. 2J+3KL: research vessel biomass.

Canadian surveys for pelagic and demersal 0-group and juveniles. Some data were available from surveys of pelagic 0-group cod in 1981, 1991 and 1992. In 1981 the inshore areas and bays were not surveyed. Considerably higher numbers were found in the offshore areas in 1981 compared to 1991 and 1992. They predominated in the bays in these later years. It was concluded that the data indicated the 1991 and 1992 year-classes were weak compared to that of 1981. Information on the distribution of demersal 0-group cod in 1992 confirmed the geographical distribution suggested by the pelagic survey data.

Cod aged 1 and 2 appear to occupy two distinct areas; one on the inner northeast Newfoundland Shelf off the coasts of southern Labrador and northeast Newfoundland (Div. 2J+3K), and a second on the northern part of the Grand Bank (Div. 3L). Aged 3 and 4 fish were separated from those aged 1, but partially overlapped the distribution of 2 year-olds. Distributions of 1 and 2 year-old cod were associated with colder, shallower water in Div. 2J+3KL, whereas 3 and 4 year-olds were associated with warmer, deeper water in Div. 2J+3K and shallower, cooler water in Div. 3L. Inter-annual variations in the distribution of age 3 fish were not related to bottom temperature.

Winter hydroacoustic surveys. Winter hydroacoustic survey series conducted since 1987 found large concentrations 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 slightly further south in Div. 3K and mainly at 550 m, about 150 m deeper than in previous years. Over the period 1991-93 the surveys indicated substantial declines in cod densities, particularly in 1993. Significant concentrations were encountered outside the survey area in 1993 at depths approximating 930 m on the Nose of the Bank.

Cod tagging survey. The 1993 offshore cod tagging initiative in January along the entire shelf break from Hamilton Bank (Div. 2J) to the Nose of the Bank (Div. 3L) at depths ranging from 150 to 600 m was unable to locate any cod concentrations suitable for tagging.

Spring acoustic studies of cod distribution and abundance (Div. 3KL). Studies have been conducted during the 1990-92 period on the distribution and movements of cod in Div. 3K and 3L when cod are concentrated in this area for spawning and prior to their migration to inshore areas.

In each year, cod were highly aggregated in the basin south of Funk Island Bank (termed the "Bonavista migration corridor"). Cod were also aggregated along the northern edge of the Grand Bank in 1991 and 1992 (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 acoustic enumeration limits (ca. 600 m).

The shoreward passage of migrating cod past the central portion of the migration corridor occurred approximately 2 weeks later in 1991 than in 1990, and 4 weeks later in 1992 than in 1991. The delay in the migration appeared to result from events occurring well offshore and not further inshore at the intersection of the cold intermediate layer (CIL) with the bottom.

The size distribution of the migrating cod differed between years. Large fish (>55 cm) which were numerous in 1990 could not be located in either 1991 or 1992.

Spawning within the migration corridor also occurred progressively later over the study period. In 1990, fish first encountered in early June were virtually all spent. In 1991, it appeared that 50% of the spawning occurred in June. In 1992, spawning was observed continuously for over 2 weeks in mid-June. The maturity data indicate that these fish were still spawning as late as early-July.

Estimates of the densities, volumes and abundances of cod aggregations encountered in the Bonavista corridor were obtained from 1990 to 1992. The densities within the aggregations remained relatively stable in the 3 years studied. However, the volume of the aggregations declined sharply from 1990 to 1991 and less so from 1991 to 1992. The overall estimates of abundance declined dramatically from 1990 to 1991, then slightly from 1991 to 1992.

iii) **Other biological studies**

Spawner biomass and recruitment. Previously, spawning stock biomass (SSB) for cod in Div. 2J+3KL has been approximated as the biomass of fish aged 7+. Length, maturity and age data collected during Canadian surveys were analyzed to determine annual maturity ogives for males and females separately. There was a decline in the proportion mature at ages 5, 6 and 7 in the early-1980s, but this trend has reversed and in recent years the proportion of these ages mature is increasing. In 1992, both the length- and age-of-maturity was the lowest in the time series for both males and females. Year effects explained a significant amount of the variability observed. The age and length-at-maturity was greater for females than males in all Divisions, and males matured at older age in the south; both sexes matured at larger size in the south. The declines in length-at-maturity were more distinct than declines in age-at-maturity.

Based on 1992 SPA results, the SSB was higher when the actual maturity ogives were used instead of ages 7+ (60 000 tons in 1992). There appeared to be temporal differences in the number of recruits per spawner. The number was higher during the late-1970s to late-1980s than now, and recruitment from 1983 onwards appeared to have been below both "annual" and "average" replacement levels. The analyses indicated that recruitment in the late-1980s was so low to be close to the point where the stock will continue to decline even in the absence of any fishing, and the temporal trends in recruits per spawner tend to indicate continued poor recruitment in the near future. Based on a non-parametric analysis, with a SSB of 100 000 tons there is only a 50% chance that recruitment will be 160 000 million at age 3.

Condition factors. Information was available relative to the condition factors for cod in Div. 2J+3KL. These included gutted weights of cod relative to length^3 and liver weight relative

to length[3]. It was determined that there has been a decline in these factors in Div. 2J and 3K since 1989 with the effect being more pronounced in Div. 2J. Liver condition factors have shown an increasing trend in Div. 3L. Some of the decline in Div. 2J may be related to declines in capelin biomass as it is an important food species.

c) **Estimation of Stock Parameters**

Formulations of the Adaptive Framework (ADAPT) and the Laurec-Shepherd (L/S) calibration analyses using research vessel (RV) data were examined in an effort to evaluate the abundance index and for the determination of stock size.

The model formulation used with ADAPT was the same as that used previously (NAFO Sci. Coun. Rep. 1992, p. 39). The CVs on the estimated age 3-12 abundance ranged from 11% to 60% while those on estimated catchabilities slopes were approximately 16%. Patterns of residuals that were observed in a similar analysis for the most recent NAFO assessment of this stock (1992) were similar to those obtained in the current analysis which included the data from the 1992 survey. Residuals for the last year (1992) were all negative while those in preceding years were all positive. This pattern reflects the inclusion in the model of the very low abundance values observed in the 1992 survey.

A formulation of the L/S calibration technique was evaluated using the same structure as for the ADAPT analysis except that the F on the oldest age group was set to 50% of the 5 previous ages. The results indicated that catchability residuals were large and positive for the period 1989-91 and mostly negative in the earlier period.

d) **Assessment Results**

Fishing mortality and stock abundance. The calibrations incorporating the extremely low RV abundance estimates for 1992 indicated that fishing mortalities are very high and that stock size has declined substantially in recent years to levels not previously observed (Fig. 4-6). A summary of some VPA population parameters for 1992 from the two methods are as follows:

Parameter	ADAPT	L/S
Biomass at age 3+ ('000 tons)	210	108
Biomass at age 7+ ('000 tons)	22	15
Population numbers at age 3+ (millions)	335	192
F (ages 7-9)	1.17	2.86

The analysis also suggested that estimates of F and population abundance for 1991 were substantially different from those estimated during the 1992 assessment. For example, the current estimate of F in 1991 from ADAPT was 2.2 as compared with 0.7 from the 1992 assessment. In the 1993 assessment the age 3+ population numbers for 1991 were estimated to be 470 million compared to an estimate of 940 million from the 1992 assessment.

In other respects the results were very similar to those indicated during the 1992 assessment; substantial decline in population biomass and increases in F, as well as differences in results with calibration technique. Part of the reason for the latter relates to differences in the degree of influence each method places on the terminal survey year. The L/S method estimates the current population at the same level as the current catchabilities adjusted RV while the ADAPT considers all RV, estimates of a cohort to determine year-class strength. The RV residual pattern determined in ADAPT, indicating substantial year effects, was also observed previously. In 1992 reasons for this pattern were thought to have resulted from increased natural mortality rather than increased availability. The current analysis indicates that this pattern persists and has not been adequately explained. The apparent reduction in stock size in 1992 occurred despite the very much lower level of fishing effort which would indicate that the large declines in stock abundance were caused by factors other than fishing mortality.

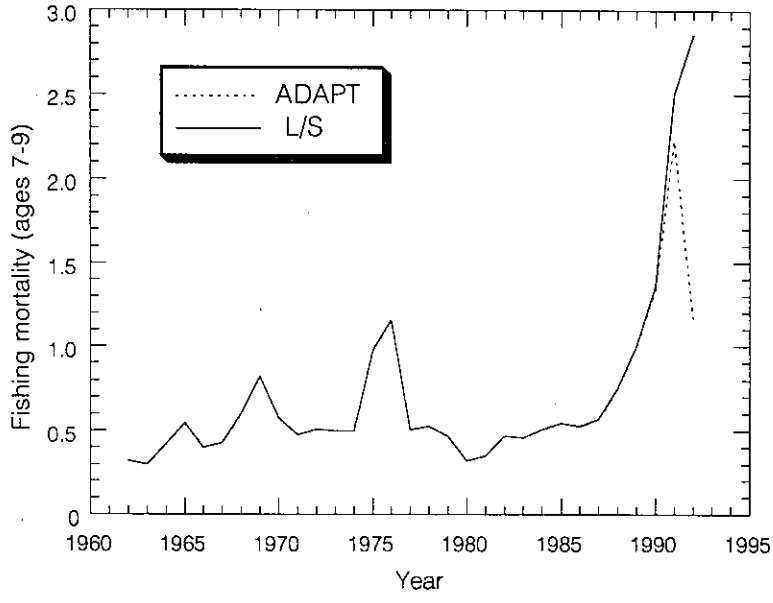

Fig. 4. Cod in Div. 2J+3KL: mean fishing mortality.

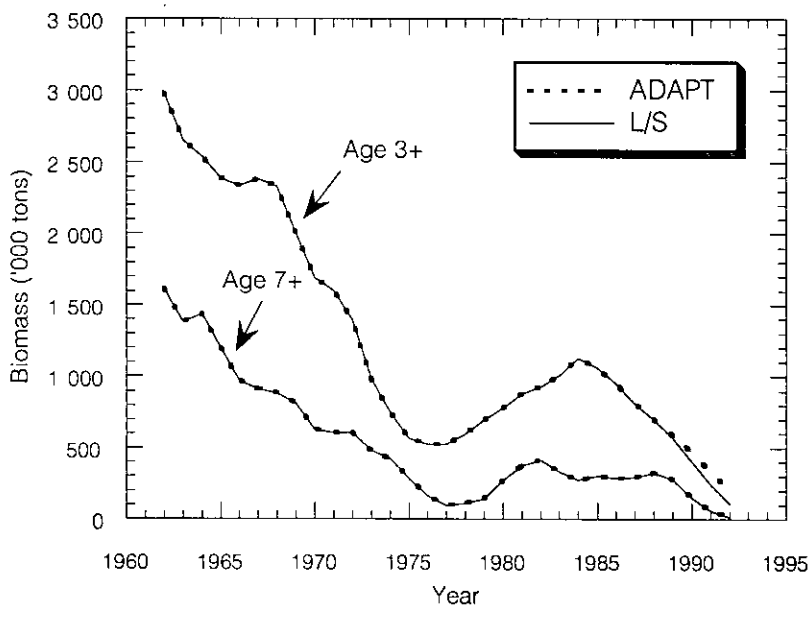

Fig. 5. Cod in Div. 2J+3KL: January 1 population biomass.

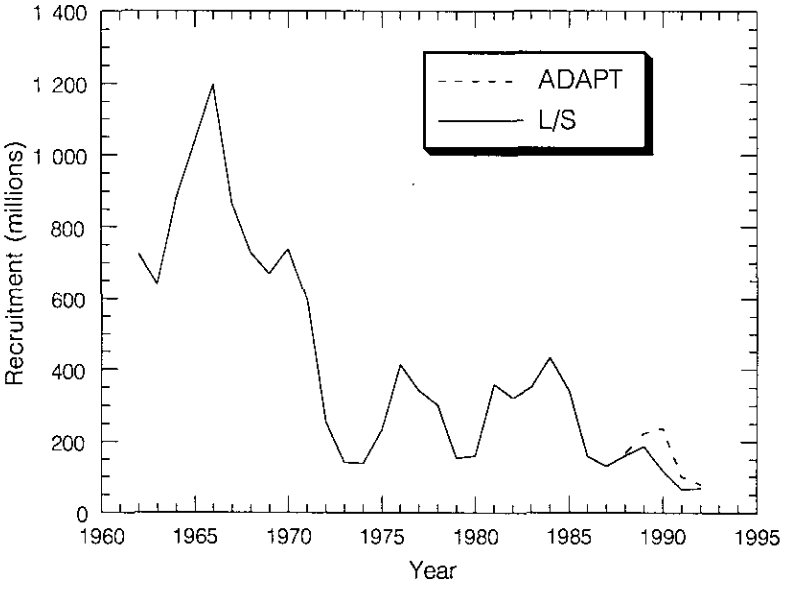

Fig. 6. Cod in Div. 2J+3KL: age 3 population numbers.

Recruitment. The 1986 and 1987 year-classes were previously considered to be well above average. The current analyses estimate these year-classes to be at or above the 1978-91 geometric mean (ADAPT-225 million) or below the mean (L/S-200 million). The 1988 year-class continues to be estimated at below average values. Information available relating recruitment to spawning stock size and environmental variables (salinity and temperature) predict that recruiting year-classes in the near future will probably be small.

Timing of stock decline. The assessment of this stock and events in the fishery have suggested that there has been a substantial stock decline in recent years. Some indications of this decline first became evident from the autumn survey results in 1990, in that the estimates for Div. 2J were considerably reduced. However, those for Div. 3K and 3L were among the highest in the time series and consequently the decline in Div. 2J was felt to be a distributional change. The spring 1991 assessment was consistent with previous assessments and there was some optimism because of strong 1986 and 1987 year-classes. The age 3+ biomass was estimated in excess of 1.0 million tons.

Subsequent events in the fishery along with results from the autumn 1991 surveys did not support this conclusion and led to a downward revision of the estimated stock size. These events included: the failure of the commercial fleet to find cod in Div. 2J and northern Div. 3K in early-1991, apparent distributional shifts further south as well as to deeper water, and reduced catches by the fixed gear fishery, especially gillnet, in the summer of 1991. The autumn 1991 survey results were also much lower (over 50%) than those for 1990, particularly in Div. 3L. This information was considered at a preliminary assessment in January of 1992 and resulted in a recommendation for a reduced catch in 1992.

By mid-1992, after another assessment, the Canadian Atlantic Fisheries Scientific Advisory Committee (CAFSAC) advised that the Div. 2J+3KL cod stock was at an extremely low level with biomass estimates being at or near the lowest observed. The decline in biomass of the stock could not be attributed to fishing alone and it was considered likely that natural mortality in 1991 was higher than usual. The fishery was expected to be dependent on the 1986 and 1987 year-classes with the 1988 year-class being below normal and approximating the low 1983 and 1984 year-classes. Analysis indicated a 1992 $F_{0.1}$ catch of between 50 000 and 79 000 tons. Reported and

projected catches by mid-year would account for approximately 35 000 tons. CAFSAC recommended that the catch in 1992 be restricted to the lowest possible level. Similar advice was provided by the NAFO Scientific Council at a special meeting in June 1992. The Canadian offshore fishery was closed in May 1992, and subsequently the entire Canadian commercial cod fishery in Div. 2J+3KL was closed with the announcement of the cod moratorium in July 1992. The EEC closed its fishery on 3 June 1992.

e) **State of the Stock**

Results from the 1992 assessment of this stock were disturbing in that they indicated a substantial change in stock status as compared with previous assessments. The stock was at a very low level and there were suggestions that the decline was partially related to changes in natural mortality. The results from the current assessment, regardless of the methodology used, substantiates the previously observed declines and indicates that the stock decline has continued in 1992. This has apparently occurred in spite of reduced commercial catch. The reasons for the decline have not been determined. They would not appear to be fishery related although there is no direct evidence to suggest a high natural mortality.

With the low stock size, high mortality rates and the possibility of weak recruiting year-classes, stock rebuilding will be unlikely in the near future.

3. **Cod in Division 3M** (SCR Doc. 93/16, 19, 20, 25, 67, 85; SCS Doc. 93/10, 14, 15)

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 is also caught as by-catch in flatfish fisheries conducted by Spanish trawlers as well as in the redfish fishery by Portuguese trawlers. The fleet currently operating in Div. 3M also includes vessels of 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 level of reported nominal landings were about 12 000 tons in this period.

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 was available for 1988, but it is believed that actual catches also exceeded those reported for that year.

Catch figures for 1992 includes catch estimates for both non- Contracting Parties and non-reported catches. The catch in 1992 was estimated to be equal to that of 1991. It was believed that this was not a consequence of an increase of abundance in Div. 3M but a result of an increase in effort, although it was noted that the Spanish pair-trawl fleet, one of the most important components of the cod fishery in the area, left the area after the first half of the year.

Recent TACs and catches ('000 tons) are as follows (Fig. 7).:

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
TAC	12.4[1]	13	13	13	13	0	0	0	13	13	13
Catch	10	13	14	15	11	2	40[2]	32[2,3]	11[2,3]	11[2,3]	

[1] Excludes expected catches by EEC-Spain.
[2] Includes estimates of misreported catches.
[3] Provisional.

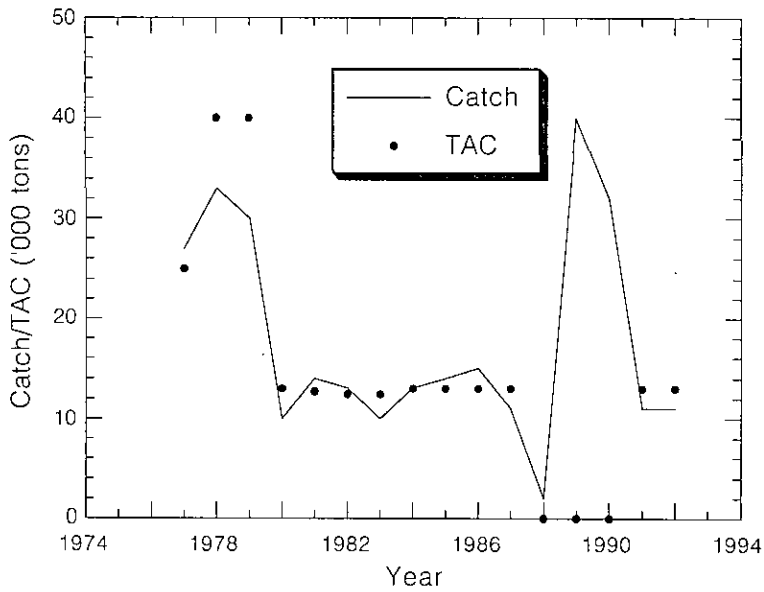

Fig. 7. Cod in Div. 3M: catches and TACs.

b) **Input Data**

i) **Commercial fishery data**

Samples were available from catches by Portuguese stern-trawlers and gillnetters and Spanish pair-trawlers and freezer trawlers. Samples were collected from the entire catch prior to sorting and discarding. Gillnetter catches were dominated by relatively abundant 1985 and 1986 year-classes, but its CPUE was reduced to one half of that of 1991, which indicated a decrease of adult fish stock. The adult year-classes were no longer significant in trawl catches, and were replaced by younger age-groups. The trawler CPUE increased in relation to 1991 as a consequence of a directed fishery on concentrations of small size fish. The age composition of the pair-trawl catches was intermediate between those of the above mentioned fleets.

Cod from the 1989 and the 1990 year-classes, aged 3 and 2 years, respectively, dominated the catch. Their contribution to the catch indicated a directed fishery on these small size fish. Juvenile cod when available in significant numbers and building dense concentrations, may attract fleets.

ii) **Research survey data**

Biomass and abundance estimates were available from research vessel bottom trawl surveys conducted by USSR/Russia from 1977 to 1992 (Fig. 8), with a concurrent acoustic survey from 1985. The estimates of trawlable plus acoustic biomass decreased from a peak of 78 300 tons in 1989 to 2 500 tons in 1992.

Stratified-random bottom trawl surveys were conducted by the EEC from 1988 to 1992. The surveys also showed a decline of trawlable biomass from 103 600 tons in 1989 to 24 300 tons in 1992. The 1990 year-class constituted 40% of the total cod biomass in the 1992 survey. This survey was carried out in July, just after the bulk of the commercial catch was taken. So, survey results roughly correspond to the stock remaining after the 1992 fishery.

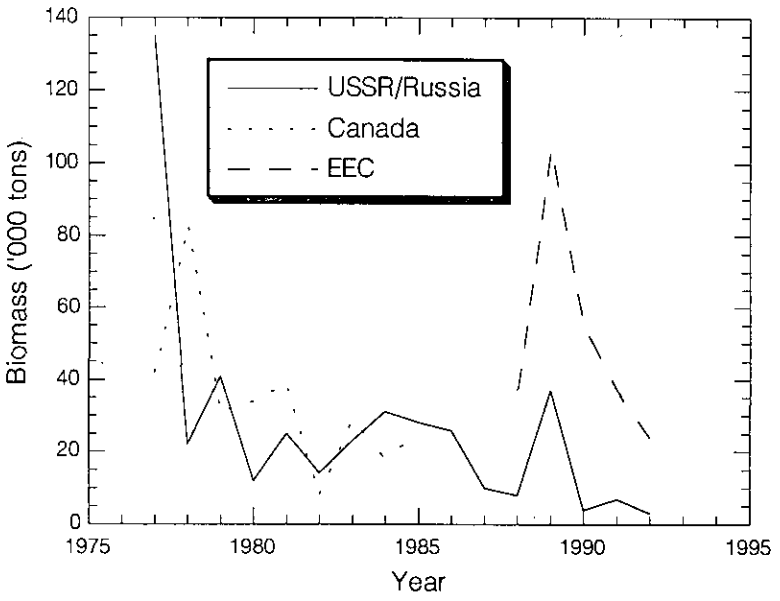

Fig. 8. Cod in Div. 3M: biomass estimates from research vessel data.

Tagging surveys were conducted by EEC in 1991 and 1992. Preliminary results indicated some migration of cod from Flemish Cap to the Grand Bank (2 of 30 returns). Nevertheless, the importance of this migration could not be assessed at present because of differences in level of fishing effort on Flemish Cap and the Grand Bank.

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 1990 year-class was overfished during 1992, when the fish were only two years old. This situation was similar to that in 1989, when the 1986 year-class was also overfished. Fishing strategies of fleets fishing cod on the Flemish Cap appear to be related to the catch rates of young fish (ages 2-3). This fishing strategy is considered uncontrolled exploitation. The situation was worse in 1992 because the exploitation of the 1990 year-class started earlier than on the 1986 year-class in 1989. 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 an opportunistic fishery where the catches will follow recruitment fluctuations, but the overall yield of the fishery will be well below its potential level.

The 1990 year-class, which was first exploited in 1992, will make the bulk of the exploitable stock in 1994. The abundance and biomass expected at that time will be very low. In this view, STACFIS **recommended** that *no directed fishery on cod in Div. 3M be conducted in 1994, to allow stock recovery.*

STACFIS in its 1991 report concluded "if cessation of fishing cannot be achieved, no action can be advised that would result in an improvement of the stock" (NAFO Sci. Coun. Rep., 1991, p. 54) and STACFIS reiterates this point of view. The fisheries by non-Contracting Party fleets is still uncontrolled and a ban on the directed cod fishery implemented only by NAFO member fleets will

not allow stock recovery. Also the potential benefits from a mesh size increase will not be realized, if only implemented by NAFO member fleets.

STACFIS is concerned about by-catches of cod in the newly developed shrimp fishery on Flemish Cap. These by-catch rates should be investigated; see also Special Comments on redfish in Div. 3M.

4. **Cod in Divisions 3N and 3O** (SCR Doc. 93/13, 90; SCS Doc. 93/10, 13, 14)

a) **Introduction**

i) **Description of fishery**

Nominal catches increased during the late-1950s and early-1960s, reaching a peak of about 227 000 tons in 1967, and subsequently declined to a low of 12 561 tons in 1992 (Fig. 9). The previous low had been in 1978. Catches increased after 1978, peaking at 50 000 tons in 1988, but again declined to about 29 000 tons in 1990 and 1991.

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

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
TAC	17[1]	26	33	33	33	40	25	18.6	13.6	13.6	10.2
Catch	29	27	37	51	42	43	33	29[2,3]	29[2,3]	13[2]	

[1] Excludes expected catches by EEC-Spain.
[2] Provisional.
[3] Includes estimates of misreported catches (12 300 tons).

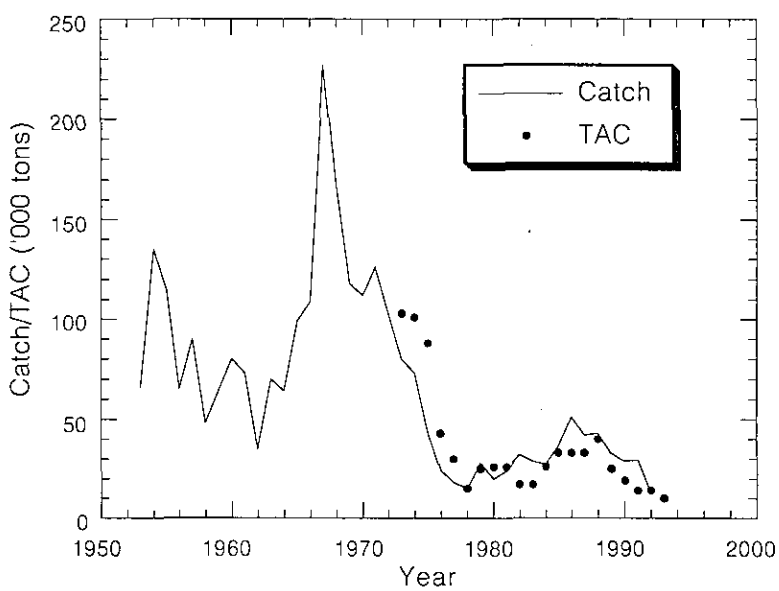

Fig. 9. Cod in Div. 3NO: catches and TACs.

TACs were first introduced for this stock in 1973 at a level of 103 000 tons. Until 1978, catches were substantially lower than the TACs but from 1981-91, they exceeded those recommended. In 1992, the catch was slightly under the recommended TAC.

For the period since 1978, catches have been taken predominantly by Canada and EEC-Spain. All non-Canadian catches in 1992 were from the Regulatory Area. Canadian catches have been taken mainly within the Canadian 200-mile fishery zone by otter-trawlers, with an increasing proportion by other gears, especially gillnet and longline. Canadian catches were stable at approximately 19 000 tons from 1985 to 1988 but have since declined to about 7 700 tons in 1992. Catches by EEC-Spain, mainly by pair-trawlers, averaged approximately 17 000 tons from 1986 to 1989. Since 1989, catches have decreased to a low of approximately 1 900 tons in 1992. Catches by EEC-Portugal decreased from about 7 000 tons in 1986 to 1 000 tons in 1989 but increased to 2 000 tons in 1990 and dropped to 1 100 tons in 1991. The reported catch in 1992 was about 450 tons. The latter was taken by gillnet and otter trawl fleets.

In recent years additional unreported catches have been estimated for countries fishing in the Regulatory Area, and in 1992 this amounted to about 2 450 tons.

b) **Input Data**

i) **Commercial fishery data**

Catch rates. Catch rate indices for Canadian otter-trawl and Spanish pair-trawl fleets have not been incorporated into the assessment calibration models in recent years because they are not considered reflective of stock abundance. They were only considered useful as indicators of general trends. Canadian catch rates increased from 1977 to 1982 but have declined steadily since that time. The 1991 index declined sharply from 1990 to 1991 and fell again in 1992. The 1992 figure is estimated to be the lowest in the time series.

Catch-at-age. Biological sampling data from the Canadian otter-trawl, longline and gillnet fisheries and Portuguese otter-trawl and gillnet fisheries were used to estimate the age composition of the commercial catch in 1992. The 1981 and 1986 year-classes (ages 11 and 6) were most numerous in the Canadian catch and landings. The 1989 year-class (age 3) was the most abundant in the otter-trawl fishery of EEC-Portugal in 1992. Sampling from the Portuguese otter-trawl fleet was used to derive age compositions for all estimated cod catches in the Regulatory Area. This may not be the most appropriate method to derive catch-at-age figures for the Spanish pair-trawler fleet. This indicated that about 4.5 million age 3 cod were caught. Catch and length frequency data indicated that most of these small cod were obtained in the first half of the year and were 30 to 40 cm in length. The catch of such high numbers of cod in this length range would suggest that an effective trawl mesh size considerably smaller than (130 mm) might have been used.

The average weights-at-age for 1992 were lower than the range of values observed in recent years. Average weights estimated for the Portuguese catch were similar to Canadian estimates up to age 6 and then were observed to be lower. Some of the decline may have resulted from catches being obtained earlier in the year in 1992 than in 1991.

The 1981 year-classes (age 11) was dominant in the Portuguese gillnet fishery and Canadian fisheries in 1992. In recent years a considerable portion of the total catch has been estimated. Because sampling was not available for much of this catch, the reliability of catch-at-age estimates has been a persistent concern.

ii) **Research survey data**

Stratified-random research vessel surveys have been conducted by Canada in Div. 3N for the 1971-93 period, with the exception of 1983, and in Div. 3O for the years 1973-93 with the exception of 1974 and 1983. Biomass for Div. 3N and 3O combined, gradually increased from the early-1970s to the early-1980s and increased considerably between 1982 and 1984 (Fig. 10). Another sharp increase occurred in 1987 but survey biomass then declined until 1992 when it was the lowest observed since 1982. The 1993 Div. 3NO biomass increased slightly.

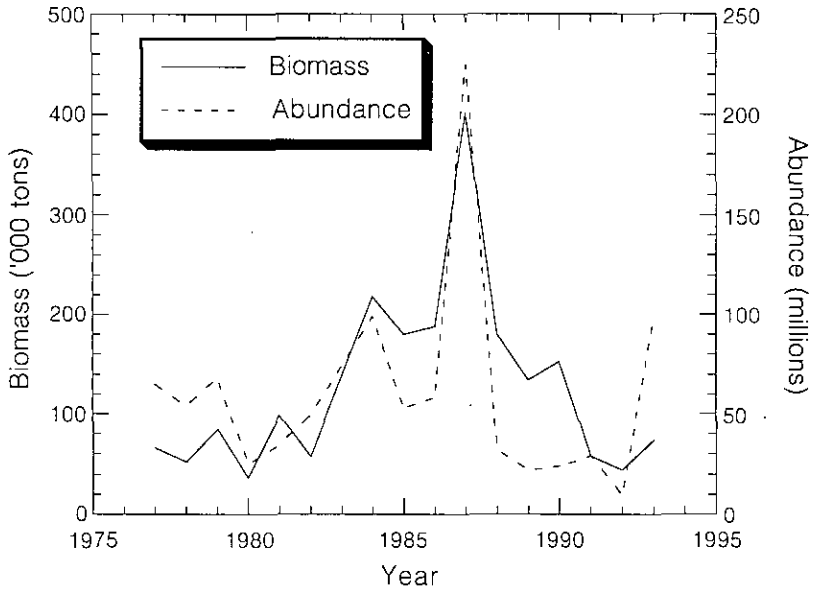

Fig. 10. Cod in Div. 3NO: biomass and abundance from Canadian research vessel data.

Abundance estimates for Div. 3NO suggested similar trends to those observed for biomass with a large value occurring in 1987 resulting mainly from a high estimate for Div. 3O. The abundance estimates for the 1988 to 1991 period were low but stable. The 1992 estimate dropped and was the lowest observed in the time series. The 1993 estimate is higher, reflecting the strength of the 1989 and possibly the 1990 year-classes.

The low levels of biomass and abundance in recent years have been attributed to a succession of very weak year-classes. Abundance estimates-at-age indicated that the 1983 to 1988 year-classes were among the lowest observed in the time series. The dominant age in the 1992 survey was 3 (the 1989 year-class) which comprised about 69% of the total abundance.

As in 1991 and 1992, the 1993 spring survey also covered the deeper water strata (366-732 m) not surveyed in previous years. Biomass in the depth range (366-545 m) was substantial in Div. 3O in 1991 but was considerably lower in 1992 and 1993. Abundance estimates for this depth zone were also low in 1993. Biomass and abundance for these depth zones in Div. 3N were not substantial. Information was not available to determine whether the 1991-93 distributions were similar to previous years when this depth had not been covered.

Additional stratified-random surveys have been conducted by Canada during autumn in 1990, 1991 and 1992. Biomass and abundance estimates were at similar levels in 1990-91 in Div. 3O but were considerably lower in 1992. Biomass estimates in Div. 3N were low in 1992 although abundance was higher than in 1990 or 1991. The age composition from the 1992 survey also indicated that the 1989 year-class was relatively strong.

Russia did not conduct a survey in 1992. However, previous surveys (USSR) were conducted on a random-stratified basis (1983-91), and those for 1977 to 1982 were reanalysed to make both comparable. The abundance and biomass estimates generally increased from 1979 to 1985, but have decreased substantially since that time. The 1990 abundance estimate was the lowest in the time series while biomass was lowest since 1981. In 1991 abundance increased in both Div. 3N and 3O with biomass showing a

decline in 3N but increasing in 3O. The increase in abundance resulted mainly from the appearance of the relatively abundant 1989 year-class although there was a general increase in abundance for most age groups from 1990 to 1991.

c) **Estimation of Parameters**

(i) **Sequential population analysis**

Formulations of the Adaptive Framework (ADAPT) and the Laurec-Shepherd (L/S) technique, including Canadian and Russian RV survey data for the ADAPT analysis, were used for the determination of stock size for 1992. Results from ADAPT indicated that coefficients of variation (CVs) on the population abundance estimates were in the range of 40% to 50%, while that on the age 3 estimate was higher at approximately 91%. All RV age specific catchabilities were estimated with CVs in the range 20% to 30%. Residual patterns showed several year effects, both positive and negative, in both survey series. The mean of the squared residuals for the Canadian survey was about 30% lower than that of the Russian survey, indicating a better fit of the Canadian RV to the estimated SPA. The high CVs on virtually all abundance estimates and the patterns of residuals described above would imply considerable uncertainty with the results of this calibration analysis. Similar comments regarding uncertainty were also made during the previous three assessments of this stock (NAFO Sci. Coun. Rep., 1990; 1991; 1992) and were attributed to large year-to-year variation in survey estimates as well as poorly estimated catch-at-age from some components of the commercial fishery.

An analysis using the L/S technique was also conducted using Canadian RV data only from 1984-92 as a survey was not conducted in 1983. A survey was not conducted by Russia in 1992 and consequently this RV index could not be combined with the Canadian RV index in a L/S calibration. Most of the structure and data were the same as included in the ADAPT analysis except that the oldest age Fs were set to the mean of the previous five ages (7-11) instead of ages 7-10. The age-specific catchabilities did not exhibit any discernable trends. Standard errors on catchabilities were large for most ages suggesting a poor fit of the model to the data.

d) **Assessment Results**

The results of the two analyses indicated that in 1992 fishing mortalities on most ages were high and that the L/S Fs were higher than those for ADAPT.

The L/S analysis was conducted on a shorter data set (Canadian RV 1984-92) and the resulting standard error estimates for q were large. It was concluded that the results from ADAPT, which included data from both RV indices and for a longer time period, provided the better estimate of F and subsequent stock size.

During 1978 to 1981 Fs were less than 0.2 and from 1982 to 1991 were in the range of 0.2 to 0.4. The 1992 mean F for ages 7 to 10 was estimated to be 0.47 although Fs on younger ages (4-6) were higher (Fig. 11).

Beginning of the year population biomass for ages 3 and older increased in the early-1960s and peaked at about 450 000 tons in 1967. A subsequent decline followed and the estimate for 1976 was 70 000 tons. Biomass again increased and reached 290 000 tons in 1984. Another decline occurred in recent years and the age 3+ beginning of the year biomass for 1992 is estimated to be approximately 68 000 tons the lowest estimate since 1977 (Fig. 12).

Age 3 population estimates indicated that the highest recruitment levels occurred during the 1960s when several year-classes were estimated to be above 100 million fish. Recruitment estimates for the early-1970s to the mid-1980s were at a lower level than the 1960s with most being less than 50 million fish (Fig. 13). There has been a recruitment failure in recent years with the age 3 estimates for 1986 to 1991 (the 1983 to 1988 year-classes) the lowest in the time series, averaging below 10 million fish. There appears to be some strength in the 1989 year-class with approximately 35 million fish estimated for this cohort. The geometric mean recruitment for the period of the calibration analyses (1977-93) is about 20 million fish.

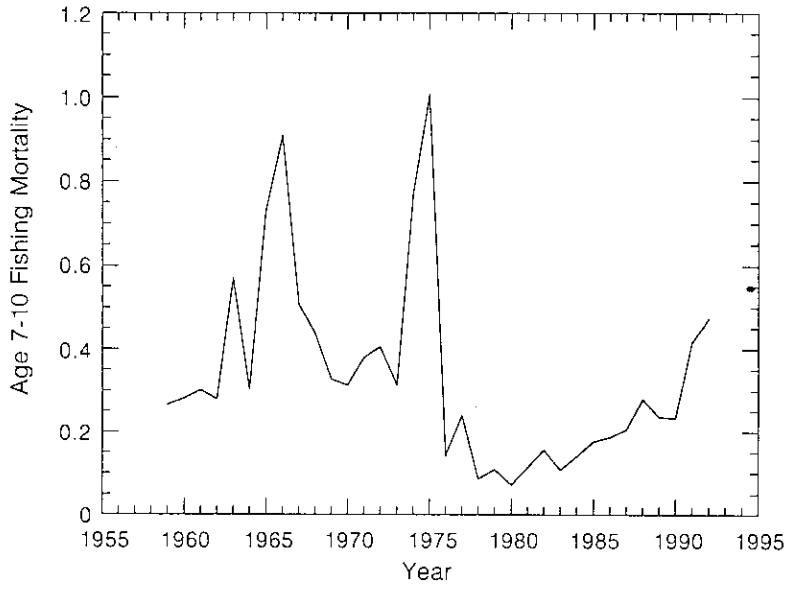

Fig. 11. Cod in Div. 3NO: age 7-10 fishing mortalities from SPA.

The spawning stock biomass (SSB) for this stock was at its highest during the 1960s and peaked at 160 000 tons in 1967, followed by a decline to about 20 000 tons in 1976. SSB was in the range of 175 000 to 200 000 tons from 1982 to 1989 but has been declining in recent years. The 1992 estimate was 59 000 tons. It is expected the recent decline will continue as several weak year-classes recruit to the SSB.

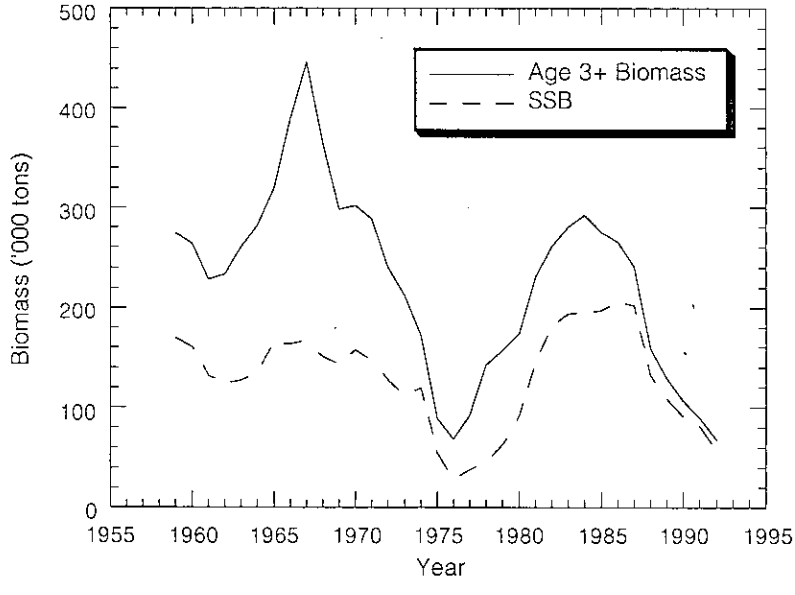

Fig. 12. Cod in Div. 3NO: age 3+ and spawning stock biomass (SSB) from SPA.

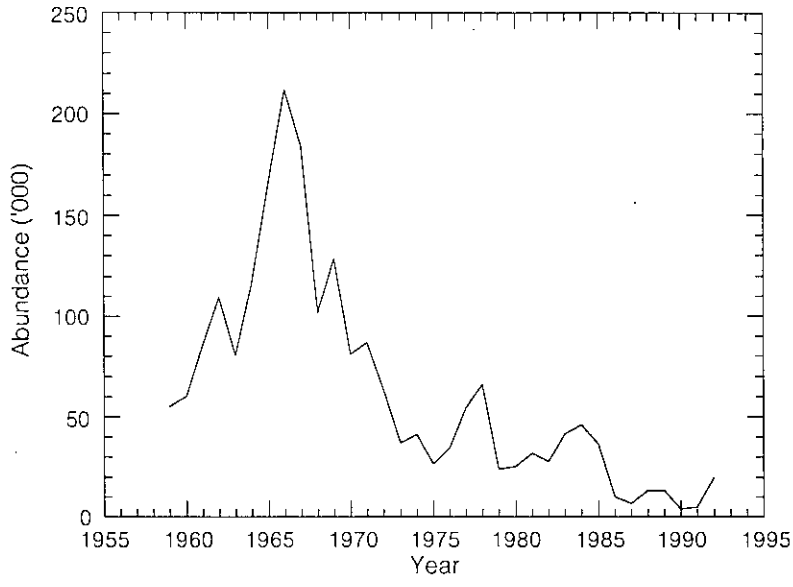

Fig. 13. Cod in Div. 3NO: age 3 recruitment from SPA.

e) **Prognosis**

The parameters which were used to project stock size and SSB are given in Table 2. The age 3 population numbers in 1993 were assumed equal to the geometric mean for the period 1977-91, approximately 20 million. Although this year-class appears to be above average in survey estimates, its size was poorly estimated in the calibration and it has already been subjected to considerable fishing mortality. Using the geometric mean was considered a conservative approach. The pattern of fishing mortality-at-age during recent years has shown considerable variation relative to previous years and was generally higher at younger ages. These partial recruitment (PR) values have most certainly been affected by the catch of small fish in the Regulatory Area. Projections using this recent selection pattern may be inappropriate as a management practice, as it suggests considerable removal of small immature fish. STACFIS considered that a pattern reflective of conditions in the early-1980s might be more appropriate and consequently it was decided to conduct projections using average PR from the 1980-84 and 1990-92 periods to determine their influence. Mean weights-at-age were averages of values from 1989 to 1992.

Table 2. Cod in Div. 3NO: parameters used in projections of catch and stock biomass.

Age	Stock Size 1 Jan 1993 ('000)	Average Weights (kg) Start of year	Mean annual	Percent Mature	Partial Recruitment 1980-84	1990-92
3	20 000	0.37	0.49	0.00	0.06	0.21
4	14 250	0.65	0.87	0.04	0.23	0.73
5	821	1.12	1.43	0.22	0.49	1.00
6	238	1.79	2.23	0.64	0.63	0.67
7	804	2.67	3.19	0.94	0.70	0.67
8	268	3.93	4.83	0.99	0.81	0.58
9	141	5.54	6.36	1.00	0.89	0.55
10	367	7.28	8.33	1.00	1.00	0.55
11	807	9.05	9.84	1.00	0.98	0.70
12	822	10.88	12.03	1.00	0.85	0.62
13	932	12.69	13.28	1.00	0.85	0.62

The two levels of PRs result in two scenarios of projected catch for 1994 and SSB at the beginning of 1995. A catch of 10 200 tons (TAC for 1993) in 1993 implies a mean (ages 7-10) fishing mortality of about 0.3 and SSB at January 1, 1994 of 22 000 tons. Taking the averages of the two PR scenarios, (average PRs for 1980-84 and 1990-92), for 1994 catches results in an $F_{0.1}$ and F_{max} of 7 000 tons and 10 650 tons, respectively.

Table 3. Cod in Div. 3NO: projections of 1994 catch and 1995 spawning stock biomass (SSB) at various reference fishing mortality levels assuming a domed PR in obtaining ADAPT population numbers for 1992.

Reference Fishing Mortality Levels	Catch (1994) tons		SSB (1.1.1995) tons	
	PR_1	PR_2	PR_1	PR_2
$F_{0.1}$	6 000	8 000	22 500	20 900
F_{max}	9 200	12 100	20 600	18 700

Partial Recruitment, PR_1 = average for 1980-84; PR_2 = average for 1990-92.

Other analyses were conducted using different assumptions on exploitation patterns and the results of projections gave similar or even lower values of catch and spawning stock biomass for 1994. All the analyses reflected a pessimistic picture of stock status. The age 3+ population biomass is the lowest level ever observed and the adult population continues to decline as the weak year-classes recruit to the SSB. The 1992 research vessel surveys indicated that the 1989 year-class, at age 3, may be above average. However, the fishery in the Regulatory Area during 1991 and 1992 caught a substantial number of individuals from this year-class. Preliminary results from Canadian spring surveys during 1993 indicate an increase in abundance and to a lesser extent biomass. The age structure is not yet known and it is also possible that the increase is a year affect. All necessary steps should be taken to eliminate the exploitation of small fish from this stock. The SSB is declining and may not begin to rebuild until the 1989 and later year-classes begin to make a contribution. However, the 1989 year-class would be the major contributor to the fishery in 1994 at age 5 when only about 20% would be mature. The SSB may never improve beyond current estimates if fisheries on immature cod continue at the current high levels. In addition, excessive harvesting of cod from this stock at young ages will result in a considerable loss of yield in the long term. Given the extremely low level of the stock, STACFIS **recommended** that *catches of cod in Div. 3NO in 1994 should not exceed 6 000 tons.*

f) **Research Recommendation**

Analyses were presented that indicated different interpretations of stock status parameters depending on the option of partial recruitment that was considered most appropriate. Additional analyses should be conducted to assess the impact of partial recruitment on the interpretation of stock status and determine the most appropriate approach.

5. **Redfish in Subarea 1** (SCR Doc. 93/26, 52, 58, 89; SCS Doc. 93/12)

a) **Introduction**

Redfish were taken mainly as by-catch in the trawl fisheries for cod, Greenland halibut 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* T.) represented in the catches increased, and since 1991, the majority of the redfish catches were considered to be beaked redfish. In 1977, total reported catches peaked at 31 000 tons (Fig. 14). 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 in effort directed to cod by trawlers of the German 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 catches of EEC-Germany.

With the closure of the offshore cod 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 EEC-Germany after the reopening of the cod fishery in 1988. Recent fishing effort was directed to shrimp or Greenland halibut only. Therefore, reported catches in 1991 and 1992 amounting to 300 tons are believed to represent the landings by the inshore fishery while by-catches of small redfish taken by the shrimp and Greenland halibut fisheries are believed to be disregarded in the reported catches.

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	1[1]	0.3[1]	0.3[1]	

[1] Provisional.

b) **Input Data**

i) **Commercial fishery data**

No data available.

ii) **Research survey data**

EEC-Germany groundfish survey. Relative biomass and abundance estimates were derived from stratified-random bottom trawl surveys established in 1982. These surveys were primarily designed for cod as target species in Div. 1B to 1F and did not cover the entire geographic and depth distribution of either golden or beaked redfish. Additionally, the pelagic occurrence of these species caused highly variable estimates. Since 1991, survey coverage changed in that the 400 m to 600 m depth zone was not sampled. Based on analyses of only 0-400 m coverage, biomass indices for both species declined to the lowest on record in 1992. Recently, 0-group and juveniles (≤15 cm) not identified to species level dominated both aggregate redfish abundance (97%) and biomass (37-52%), and were very abundant in northern and shallow strata. Pre-mature and mature individuals (>15 cm) were mainly caught in southern and deeper strata.

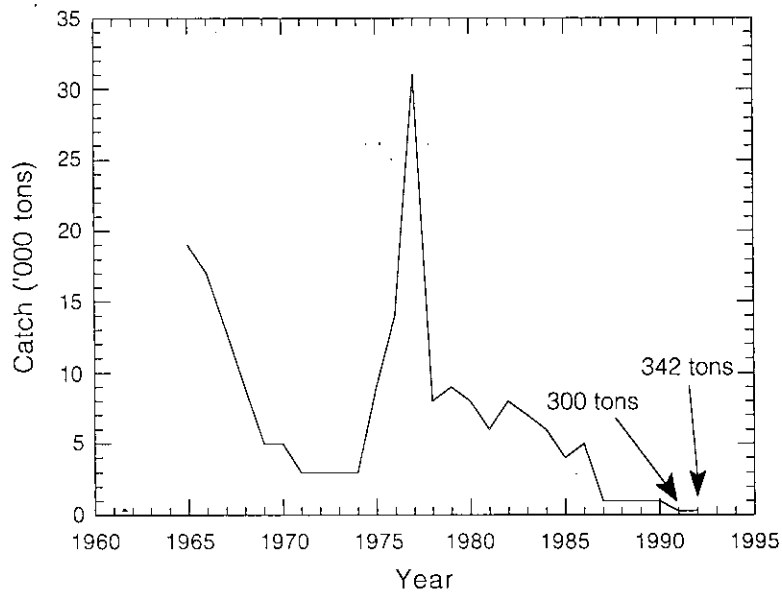

Fig. 14. Redfish in Subarea 1: catches.

Greenland shrimp survey. Stratified-random shrimp surveys covering depth zones of 0-600 m in Div. 1A to 1D have been conducted since 1988. The surveys were extended to investigate the Disko Bay area and Div. 1E and 1F in 1991 and 1992, respectively. Estimates of relative abundance and biomass of redfish declined substantially (36%) from 1988 to 1990. The extended survey coverage in 1991 and 1992 made comparisons of results of these surveys with results of earlier surveys difficult. However, abundance and biomass estimates including extended areas decreased from 1991 to 1992 by 33% and 16%, respectively. Abundance of redfish in the Disko Bay area was found to be negligible as compared with the figure for the total survey area off West Greenland. Length frequencies confirmed the predominance of small redfish (≤15 cm).

Greenland-Japan groundfish survey. Since 1987, cooperative trawl surveys directed to Greenland halibut, redfish and roundnose grenadier have been conducted on the continental slope in Div. 1A-1D at depths between 400 m and 1 500 m. Two trawl surveys were carried out in August and December 1992, respectively. Beaked redfish was mainly caught at depths less than 600 m. Catches were low, especially those of the second survey. Biomass was estimated at 3 700 tons and 600 tons in August and December, respectively. In August, abundance of small-sized redfish was higher in northern Divisions.

c) **Prognosis**

STACFIS noted that no commercial fishery data are available for the stock and that recent catch figures are believed to only represent landings by the inshore fishery. By-catches of 0-group and juveniles by the shrimp fishery are thought to be not reported. It is believed that these by-catches are substantial and may have adversely affected recruitment. In view of low abundance and biomass indices of both golden and beaked redfish, STACFIS concluded that the stock is at a very low level. For commercial-sized redfish no TAC is advised and catches should be restricted to by-catches of fisheries directed to other species. As noted above, there is concern about the impact of the by-catches of small redfish on the future of this resource as such consideration should be given to the implementation of measures where possible to minimize this by-catch.

STACFIS acknowledged the importance of ongoing studies and **recommended** that *studies on distribution and abundance of 0-group redfish in Subarea 1 be continued.*

6. **Redfish in Division 3M** (SCR Doc. 93/11, 19, 24, 77; SCS Doc. 93/10, 12, 13, 15)

a) **Introduction**

There are three species of redfish which are commercially fished on Flemish Cap: beaked redfish (*Sebastes mentella*), golden redfish (*S. marinus*) and American redfish (*S. fasciatus*). The species are not identified in commercial catches and considered together as a single management unit. Only in Spanish surveys have the species been identified separately, starting in 1991.

Reported catches in the period 1972-81 were reduced from 41 900 tons to 13 900 tons (Fig. 15). Catches began to increase in 1983 and were over double the TAC (20 000 tons) in 1987 (44 400 tons) and three times in 1989 (57 900 tons). The estimated catch for 1990 was the highest on record for this stock (82 400 tons), USSR, EEC-Portugal and non-Contracting Parties such as South Korea, Panama and Caymen Islands contributed to this increase. Since 1990 catches have declined to 33 000 tons in 1992, which includes some estimated catch from surveillance reports. Nearly half of the total catch was taken by South Korea (8 400 tons), EEC-Portugal (5 500 tons) and EEC-Germany (3 400 tons).

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

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
TAC	20	20	20	20	20	20	20	50	50	43	30
Catch	20	20	20	29	44	23	58[1]	83[1,2]	55[1,2]	33[1,2]	

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

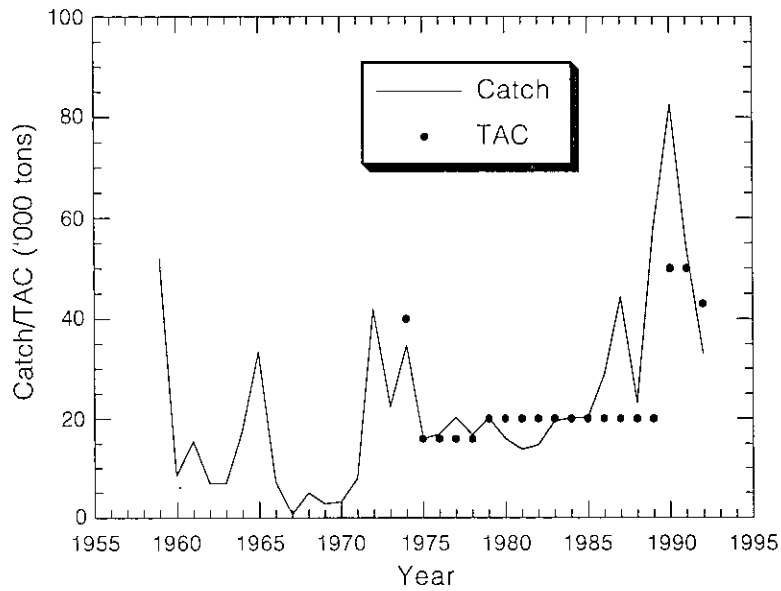

Fig. 15. Redfish in Div. 3M: catches and TACs.

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. The 1992 data consisted of catch rate information only from the Portuguese fleet. Information for years prior to 1974 is limited and estimates for these years are considered unreliable. Both indices were consistent in terms of trends. Catch rates showed no obvious trend from 1974 to 1984 (Fig. 16). The rate increased to 1987 and subsequently declined to 1991. The limited 1992 data suggested an increase from 1991 to 1992 but there was a large variability associated with this estimate.

There were 1992 sampling data available from the commercial fisheries of South Korea, EEC-Germany and Russia. Length frequencies from the Portuguese trawl fishery in 1992 indicated the majority of the catch was composed of 25-30 cm fish. Length 33-39 cm predominated in the Portuguese gillnet catches. The main Portuguese fishery is carried out in depths below 400 m.

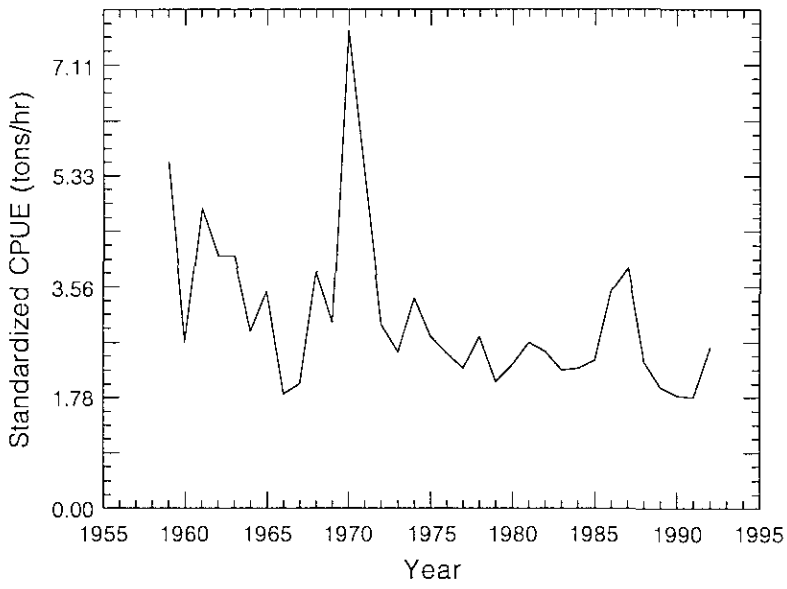

Fig. 16. Redfish in Div. 3M: standardized catch rates.

ii) **Research survey data**

The results from the 1992 EEC trawl survey indicated an increase in biomass of redfish. The increase was due primarily to increases in biomass of *S. mentella* and juvenile redfish (<15 cm). The EEC-Spain trawl survey estimation of redfish biomass in Div. 3M for 1988-92 (SCR Doc. 93/24) are as follows:

	Redfish Biomass Estimates (tons)				
	S. marinus	*S. mentella*	*S. fasciatus*	Juvenile	Total
1988	15 289	142 933			158 222
1989	22 918	113 675			136 633
1990	14 690	72 893		16 601	104 193
1991	4 093	48 554	7 198	4 001	63 846
1992	4 130	71 810	5 308	23 229	104 477

The results of the Russian trawl/acoustic survey indicated an increase of pelagic component of the total biomass and a decrease of the bottom component in 1992 (Fig. 17). The total biomass decreased marginally. Information was available to clarify that no double counting of the bottom-layer had occurred and that this was also the case for previous years trawl-acoustic estimates. STACFIS **recommended** that *results of acoustic estimates of biomass in the 4-meter bottom layer as well as length and species composition of catches from midwater trawl conducted to verify acoustic signals during the USSR/Russia surveys should be presented in 1994.*

Biomass estimates from the various surveys ('000 tons) are as follows:

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

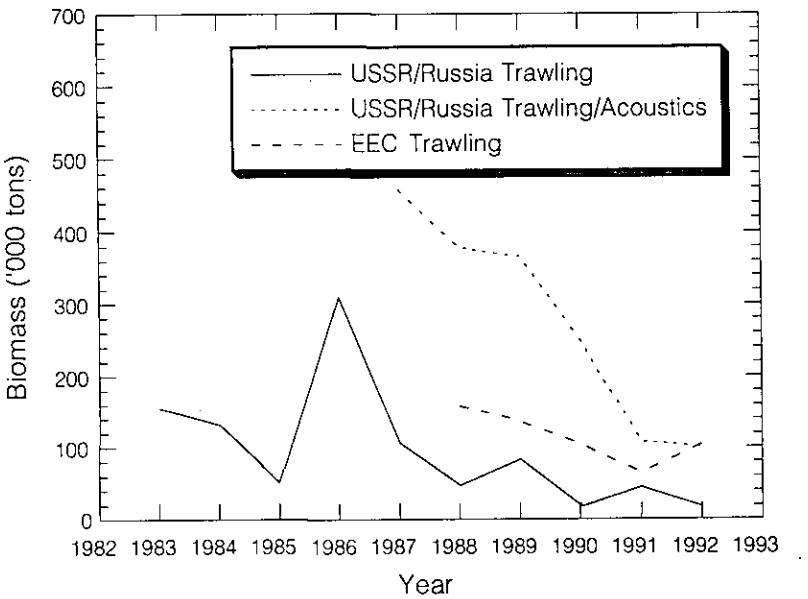

Fig. 17. Redfish in Div. 3M: biomass estimates from research vessels (USSR/Russia and EEC).

Both EEC and USSR/Russia surveys suggest that recruitment (1989-1990 year-classes) appears to be proportionately abundant.

c) **Prognosis**

STACFIS noted that catches in the order of 20 000 tons in 1975-85 corresponded to a period of stability in the Div. 3M redfish fishery. Catches ranging between 55 000-83 000 tons (average 66 000 tons) in 1989-91 led to a rapid depletion of the stock biomass, despite the strong recruitment of the 1984 year-class as evidenced by the trends of the research survey estimates. The change in biomass between 1991 and 1992 is uncertain. EEC surveys and one fleet sectors catch rate increased in 1992, but the combined Russian trawl/acoustic estimate decreased. In view of the above and in order to allow recruiting year-classes to achieve their growth potential, STACFIS **recommended** that *the catch of redfish in Div. 3M in 1994 be maintained at a level conducive to a more stable fishery.* STACFIS notes that the catch advised for 1993, i.e. 20 000 tons is in a range of catch levels when stable conditions have been observed, and, in absence of a firm basis for making catch projections **recommended** that *the TAC for redfish in Div. 3M be 20 000 tons for 1994.*

STACFIS noted that a new fishery for shrimp is developing in Div. 3M. Given that by-catches of juvenile redfish are common in similar fisheries in other areas, STACFIS expresses its concern on the likely negative impact of these shrimp fisheries on recent recruitment of Div. 3M redfish.

7. **Redfish in Divisions 3L and 3N** (SCR Doc. 93/73, SCS Doc. 93/13, 15)

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. 18). 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 78 000 tons. Since 1987 catches have declined substantially. The 1992 catch of 24 000 tons is about the same amount taken in 1991.

From 1980 to 1985 the USSR, Cuba and Canada were the primary fleets in essentially a trawl 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 EEC-Portugal, taking 13 000 tons in Div. 3L and 8 000 tons in Div. 3N. The USSR, which had taken the majority of its catch from Div. 3N since 1980, also diverted the major portion of its fishery to Div. 3L in 1986. In 1987 various non-Contracting Parties, most notably South Korea, Panama and Caymen Islands began to fish in the Regulatory Area accounting for a catch of about 24 000 tons. Since then these countries have taken between 7 000 tons and 12 000 tons annually.

From 1980 to 1990 the TAC had been 25 000 tons. The TAC was reduced to 14 000 tons for 1991 and maintained at that level to 1993. Since 1986 the TAC has been exceeded each year, and in some years catches have been double (1988) and even triple (1987).

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

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

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
TAC	25	25	25	25	25	25	25	25	14	14	14
Catch	20	15	21	43	78[1]	53[1]	34[1]	29[1,2]	26[1,2]	24[1,2]	

[1] Includes catch estimated by STACFIS.
[2] Provisional.

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. The indices were not considered reflective of year to year changes in population abundance, although they may be indicative of trends over longer periods of time.

Sampling of the commercial fishery, based only on Portuguese and Canadian samples, indicated the dominant size range was 24-30 cm in Div. 3L and 20-31 cm in Div. 3N.

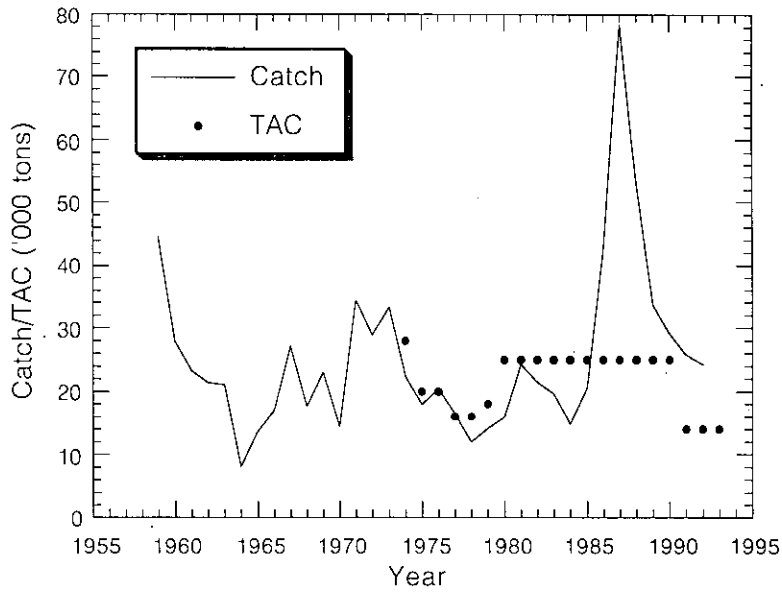

Fig. 18. Redfish in Div. 3LN: catches and TACs.

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, USSR/Russian bottom trawl surveys conducted from 1984-1991 suggest a decline in relative abundance and biomass since 1984 in both Div. 3L and Div. 3N. There was no survey of these Divisions in 1992. The trend in Div. 3L is confirmed by comparable Canadian surveys over this period. Relative abundance estimates from 1992 Canadian surveys in Div. 3L are at their lowest level since 1978. Canadian surveys in Div. 3N in 1991 and 1992 indicate large differences in relative abundance between seasons within each year. These are not considered reflective of true changes in population size but rather suggest seasonal changes in either catchability or distribution.

USSR/Russian acoustic surveys have been conducted concurrent with the bottom trawl surveys since 1987. In 1992, STACFIS was unable to evaluate these surveys and put forth two recommendations that were expected to help clarify the results. No information was available at this meeting to address these recommendations. It was noted that Russian surveys were being conducted in 1993 and that presentation of information to address the outstanding issues would be necessary to evaluate the results of these surveys. Accordingly, STACFIS reiterates these requirements and **recommended** that (1) *details be provided to clarify how acoustic signals are separated between redfish and other species, and, that more detailed information be presented describing the vertical distribution as determined from the trawl-acoustic surveys*, and that (2) *further examination be conducted of the trawl-acoustic survey data to provide more detail on the location of concentrations of fish both near the bottom and in the water column in Div. 3LNO.*

iii) **Recruitment**

Length and age distributions from Canadian surveys in Div. 3L indicate there has been relatively poor recruitment observed since the early-1980s. The 1992 spring and fall survey

catches were dominated by 25-30 cm fish corresponding to the year-classes of the early-1980s. Length and age distributions from Div. 3N Canadian surveys in 1991 and 1992 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 pulse of recruitment that first appeared in the 1991 autumn survey in the range of 12-14 cm (1986-1987 year-classes). The relative proportion of this recruitment appears to vary between successive surveys. This may occur if they are not present in high numbers.

c) **Prognosis**

USSR/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 was confirmed in the surveys conducted by Canada. Although a cautious approach should be taken in drawing conclusions about stock status given the inherent variability in bottom trawl surveys, the 1992 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 show 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 which likely generated high fishing mortalities.

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.

The information is not sufficient to evaluate where the current TAC (14 000 tons) stands in relation to an appropriate reference catch. With the prospect of continuing poor recruitment in Div. 3L, and given that the unknown strength of the recruitment detected in Div. 3N would not be available to the fishery until the late-1990s, a cautious approach is warranted in establishing a TAC for 1994. 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 7 000 and 24 000 tons. STACFIS previously considered this resource to be at a low level and the more recent information indicates the stock is still low. No improvement can be expected as long as catches exceed the current TAC. 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 also noted there was no information available to address an outstanding recommendation regarding the integrity of Div. 3LN as a separate management unit from adjacent Divisions and, accordingly, **recommended** that *existing data be examined to evaluate the current separation of Div. 3LN and Div. 3O in relation to adjacent Divisions for the purpose of determining whether these management units are appropriate.*

8. **Silver Hake in Divisions 4V, 4W and 4X**

Due to a lack of Canadian research and commercial ageing data, and a 1992 juvenile survey, STACFIS was unable to adequately assess the size of the 1990-1992 year-classes in June 1993. Since these will be the most important for the 1994 fishery, STACFIS deferred advice until the September 1993 Meeting. At that time a more complete data set is expected to be available. This data set should include the 1992 Canadian July survey and commercial catch-at-age, the 1993 commercial standardized CPUE, the abundance and biomass from the 1993 Canadian July survey. STACFIS encouraged the appropriate experts to age otolith samples from the 1993 commercial vessels and July research vessels. STACFIS agreed that all papers presented at the June 1993 Meeting will be reviewed again during the September 1993 Meeting.

9. **American Plaice in Division 3M** (SCR Doc. 93/16, 19, 82; SCS Doc. 93/10, 14, 15)

a) **Introduction**

Since 1974, when this stock started to be regulated, reported catches ranged from 600 tons in 1981 to the highest value of 5 600 tons in 1987. After that they declined drastically to the level of 800 tons in 1992.

Since 1979 a TAC of 2 000 tons has been agreed for this stock (Fig. 19).

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

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
TAC	2	2	2	2	2	2	2	2	2	2	2
Catch	1.9	1.3	1.7	3.8	5.6	2.8	3.5	0.8[1]	1.6[1]	0.8[1]	

[1] Provisional.

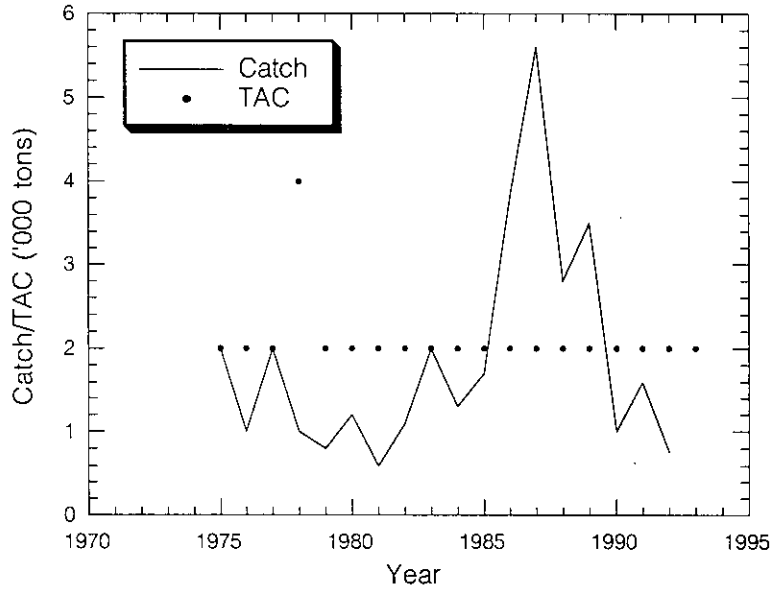

Fig. 19. American plaice in Div. 3M: catches and TACs.

b) **Input Data**

i) **Commercial fishery data**

There was no directed fishery for American plaice in Div. 3M during 1992.

By-catch length composition for Spanish freezers, and by-catch age compositions for Portuguese trawlers and gillnetters were available for 1992. Ages 6 and 8 were dominant in the catches.

ii) **Research survey data**

Research surveys are conducted by EEC in July and USSR/Russia in April. Both indicated a declining trend in abundance and biomass from 1988. However, the USSR/Russian series showed higher variability than the EEC ones (Table 4).

The 1986 year-class still appeared as the most abundant in the EEC survey, and that was consistent with the age composition of the catches.

A maturity ogive was available for 1992 with a L_{50} estimated to be 41.6 cm.

Table 4. American plaice in Div. 3M: total biomass and abundance estimated from EEC surveys and USSR/Russia surveys.

Year	Biomass (tons) EEC[1]	Biomass (tons) USSR/Russia[2]	Abundance ('000) EEC[1]	Abundance ('000) USSR/Russia[2]
1983		8 900		-
1984		7 500		26 500
1985		7 800		15 800
1986		20 200		33 400
1987		9 300		16 500
1988	11 868	6 500	21 200	10 000
1989	10 533	5 000	20 500	8 300
1990	9 101	1 200	16 600	2 600
1991	7 565	14 400	13 900	12 700
1992	6 492	1 000	10 400	1 900

[1] Vazquez, SCR Doc. 93/19.
[2] Rikhter *et al.*, SCS Doc 91/5; Borovkov *et al.*, SCS Doc. 92/12, 93/10.

The spawning stock biomass (50% of age 5 and 100% of age 6+), which showed a slight increase from 1990 to 1991, continued its overall decreasing trend in 1992.

Trends in biomass of all the surveys conducted in the area are shown in Fig. 20. Trends in abundance and biomass of the EEC survey are presented in Fig. 21.

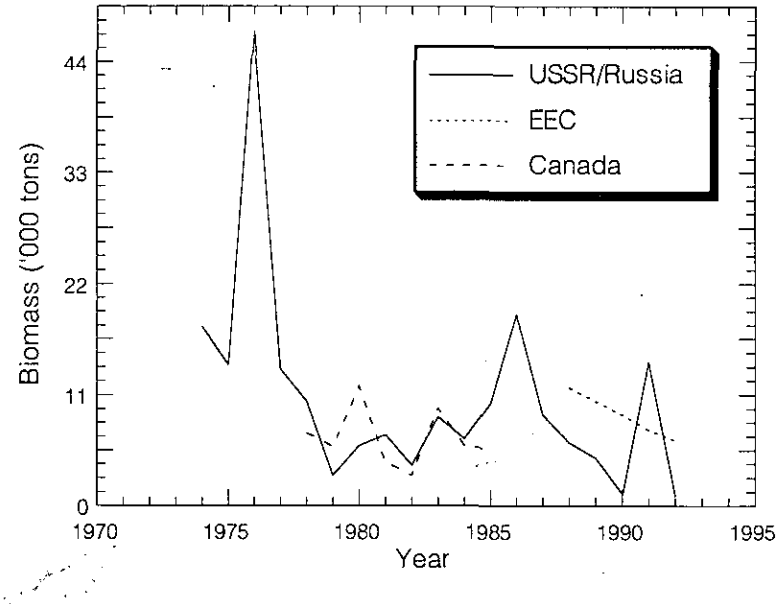

Fig. 20. American plaice in Div. 3M: biomass estimates for research vessel data.

c) **Estimation of Parameters**

A catch-at-age matrix was constructed for the period 1988-92 using the length and age composition available from the commercial catches and the age-length key from the EEC research survey.

An analytical assessment was intended using Laurec-Shepherd (L/S) method to estimate the mortality level for the last year, but was rejected because standard errors of the catchability coefficients (q) were bigger than q for all the ages, indicating a probable shift in exploitation pattern.

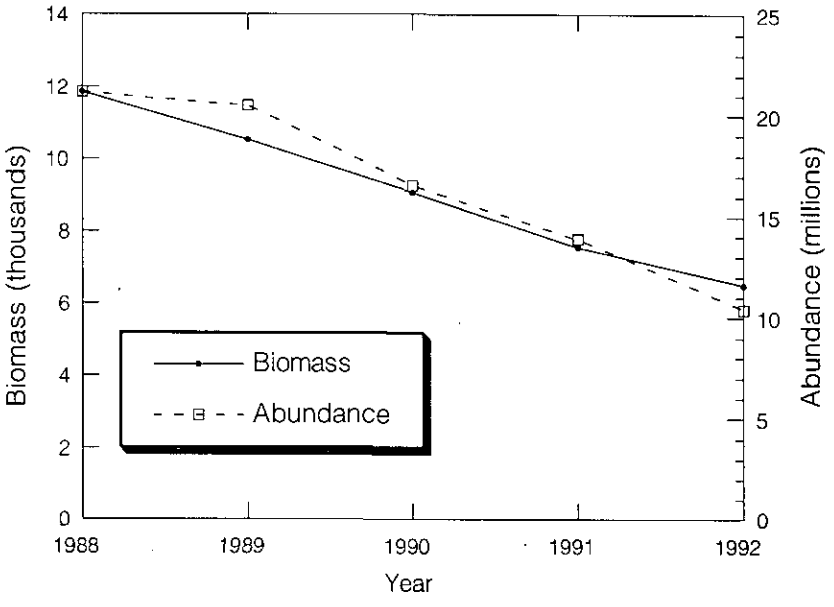

Fig. 21. American plaice in Div. 3M: biomass and abundance estimated from the EEC bottom trawl surveys for 1988-92 (SCR Doc. 93/19).

A separable VPA was used to estimate the exploitation pattern but it showed trends in the residuals from the last 2 years.

In order to get an overall view on the situation in the most recent period, a catch curve was constructed using 1988-90 age distribution of the catches (Fig. 22). The F for this period for ages 8-11 was estimated to be 0.53. The fully recruited age was estimated to be age 8, which was consistent with the result obtained by the separable analysis.

Taking into account that the EEC survey was conducted in July, the q of the survey has been estimated by dividing the catches for ages 8-11 by the biomass index for the same ages for the period 1988-90, and dividing the obtained results by F estimated in the catch curve.

The value for q was estimated to be 0.56 and F for the last year was estimated to be below 0.1, which was similar to the value obtained in the L/S, and is consistent with the information that the main effort directed to this species has shifted to Greenland halibut during 1992.

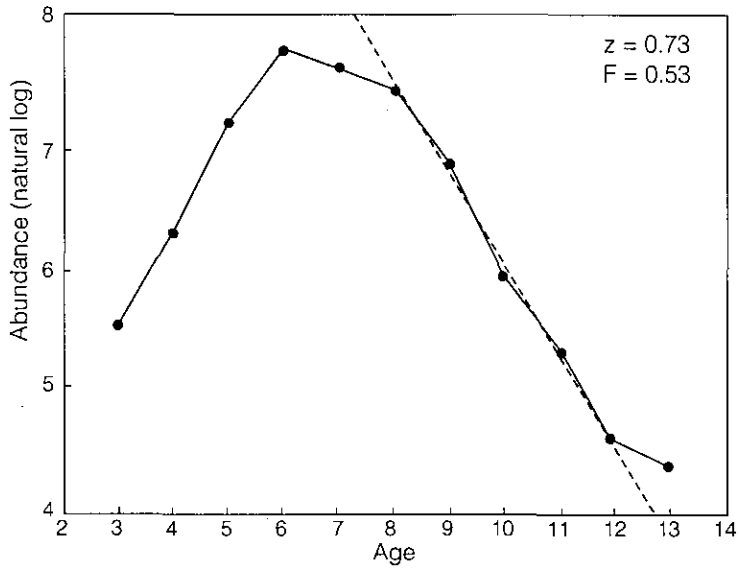

Fig. 22. American plaice in Div. 3M: catch curve for the period 1988-90.

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 was due to excessive fishing mortality at least in the period 1988-90. In order to halt the decline of the stock, STACFIS **advised** that the catch in 1994 should not exceed 1 000 tons. This corresponds to the expected by-catches in non-directed fisheries.

10. **American Plaice in Divisions 3L, 3N and 3O** (SCR Doc. 91; SCS Doc. 93/14,15)

a) **Introduction**

Catches increased from about 20 000 tons in the early-1960s to a peak of 94 000 tons in 1967, were relatively stable around 45 000 to 50 000 tons in 1973-82, then declined to 39 000 tons in 1984-85 (Fig. 23). Catches then increased to 65 000 tons in 1986 and have subsequently declined to about 33 000 tons in 1990-91. The revised catch figure of 33 817 tons in 1991 is about 5 400 tons lower than the estimate used in the 1992 assessment, due mainly to a revision in the South Korean catch. The catch in 1992 of 11 112 tons is the lowest since the 1950s. This was due to reduced effort by Canada inside the 200-mile zone and by EEC and South Korean fleets in the Regulatory Area. Catches by non-Canadian fleets in 1992 were at their lowest level since 1982.

In 1992, the Canadian catch totalled about 9 500 tons which is almost 60 percent lower than the catch in each of 1990 and 1991. About two-thirds of the 1992 catch was taken by otter-trawl, mainly from 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 675 tons in 1992. In 1991 and again in 1992, the directed fishery by Canada was higher in Div. 3O than in either Div. 3L or 3N, these being the only years in which that has occurred. Some of the Canadian fishery in this area was actually a mixed fishery for American plaice and yellowtail flounder. This represents a substantial change from earlier years, when most of the directed American plaice fishery occurred in Div. 3L and most of the fishery for yellowtail flounder was in Div. 3N.

It was 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. However, the situation was much improved in 1992 when no estimates of catch were necessary.

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

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
TAC	55	55	49	55	48	40[1]	30.3	24.9	25.8	25.8	10.5
Catch	39[2]	39[2,3]	54[2,3]	65[2,3]	55[2]	41[2,3]	44[2,3]	32[2,3,4]	34[3,4]	11[3,4]	

[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.

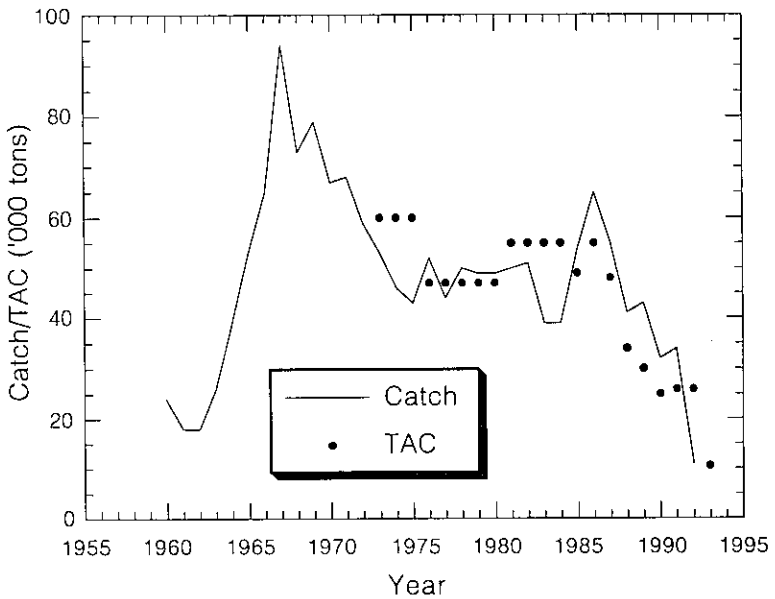

Fig. 23. American plaice in Div. 3LNO: catches and TACs.

b) **Input Data**

i) **Commercial fishery data**

Catch and effort. Data from the Canadian commercial fishery in Div. 3LNO from 1956 to 1992 were analyzed using a multiplicative model to obtain a standardized catch-rate series (Fig. 24). 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. In 1991 the catch rate declined by about one-third from the relatively stable level of the previous 4 years. This was followed by a similar decline in 1992 to a level far below any ever seen in this fishery. The declines in CPUE in 1991-92 were seen in all three Divisions. Standardized effort exerted by the Canadian fleet in 1992 was at the lowest level since the early-1960s. Analysis of the same data from only the years 1981-92 showed the same patterns in CPUE. These years were chosen because the Canadian fleet switched to a larger mesh size in 1981. Given the major distributional changes in the fishery in 1991 and 1992, caution should be exercised in evaluating the results of the catch rate analyses. Nonetheless, it was clear that catch rates of American plaice in the Canadian fishery in all areas of the Grand Bank in 1992 were well below any observed in the 37 year time-series for this fleet.

STACFIS noted that the CPUE from the Canadian fleet had declined sharply three times in the last seven years, twice following periods of relative stability. To examine the reasons for these patterns in the CPUE, STACFIS **recommended** that *area fished by the*

commercial fleet be incorporated in future analyses of catch rates.

Limited data from the Portuguese fishery showed an increase in CPUE in Div. 3L from 1991 to 1992 and a decrease in Div. 3N.

Catch-at-age and mean weights-at-age. Sampling was available from the Canadian, Spanish, and Portuguese fisheries in 1992. As in 1991, ages 7-11 comprised the majority of the Canadian catch, with the peak at age 9. The mean weights were lower at most ages in 1992 compared to 1991.

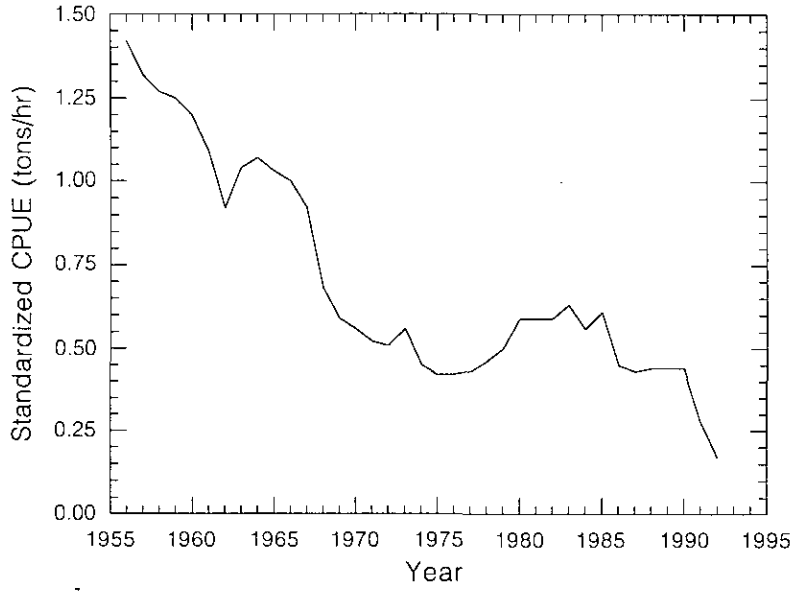

Fig. 24. American plaice in Div. 3LNO: standardized catch rates.

Length compositions from the Spanish and Portuguese otter-trawl fisheries in Div. 3N were similar, so it was decided to apply the Portuguese age composition (based on the 140 ton catch by EEC-Portugal) to the total catch in the Regulatory Area of 1 570 tons. This includes catches by EEC-Spain, South Korea, and catches by other non-Contracting Parties estimated from surveillance data. This catch-at-age indicated that the peak was age 7 in 1992, compared to age 6 in 1991. The mean weights-at-ages 6 to 10 agreed generally with those in the Canadian fishery, but were lower at ages 11+. This may have been due to sampling variability at older ages in the Portuguese fishery, so it was decided to use the mean weights-at-age from the Canadian fishery to represent the overall means in 1992.

The total catch-at-age for 1992 did not show the same bimodal pattern as in 1989 and 1990. In 1991 and 1992 there was less difference in the modal ages in the catch in the Regulatory Area *versus* the catch inside the Canadian 200-mile zone, compared to earlier years. It should be noted that there was a substantial number of fish in the catch-at-ages younger than age 5 from 1989 to 1991, but not in 1992. In fact there were substantial reductions in the catch of all ages in 1992 compared to recent years, due to the overall decline in the catch. The mean weights-at-age in 1992 were generally lower than in 1991.It should also be noted that the 1991 catch-at-age was adjusted to account for the difference in the South Korean catch estimate used last year, resulting in downward revisions at all ages.

ii) **Research survey data**

Canadian stratified-random surveys. Data from spring surveys 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 to 1992, but not from 1993.

In Div. 3L, the biomass index was highest from 1978 to 1982, declined to a lower but stable level from 1985 to 1988, then declined sharply in 1991 and again in 1992 to a level which is only about 7% of the 1985-88 mean value. Data from the 1993 spring survey were not available at this meeting. In Div. 3N, the biomass index also showed a decline in recent years, with 1992 being the lowest point by far in the series. Preliminary analysis of the 1993 survey data indicated that the biomass was similar to the value observed in 1991, and was still well below average. In Div. 3O, the biomass index has shown a consistent decline since 1990, with the 1993 value being the lowest in the series. In all 3 Divisions, most of the biomass continues to be found in the shallower strata. There was no evidence from these surveys that American plaice changed their distribution by moving to deeper water, at least in the spring time.

In all areas, 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 (Fig. 25), 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. In Div. 3L the decline was worse, with abundance in 1992 being only 5% of the peak abundance in the 1977-80 period. In 1992, the abundance in Div. 3LNO at each age over 3 years was the lowest ever observed, in most cases by a wide margin.

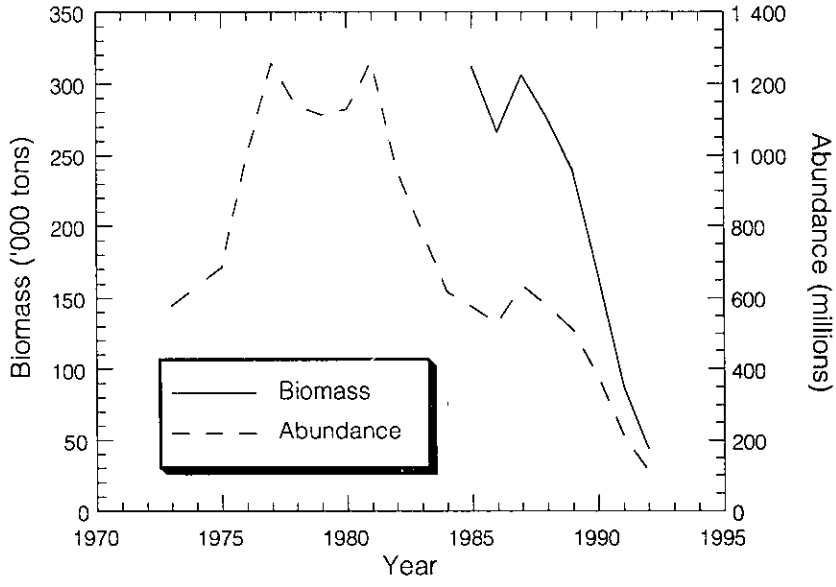

Fig. 25. American plaice in Div. 3LNO: biomass and abundance estimates from Canadian spring surveys.

Examination of the distribution of survey catches clearly shows the drastic change in abundance and highlights the virtual disappearance of American plaice from many former areas of high abundance on the Grand Bank (Fig. 26).

There was some evidence, from the 1989 and 1990 surveys, of improved recruitment to the stock, notably the 1985 and 1986 year-classes. However, the 1991 and 1992 surveys now estimate these year-classes to be well below average, although the 1985 year-class was the dominant one in the 1991 and 1992 surveys. STACFIS noted that 1991 was the only year in the series of spring surveys where the dominant age was less than 7 and 1992 was

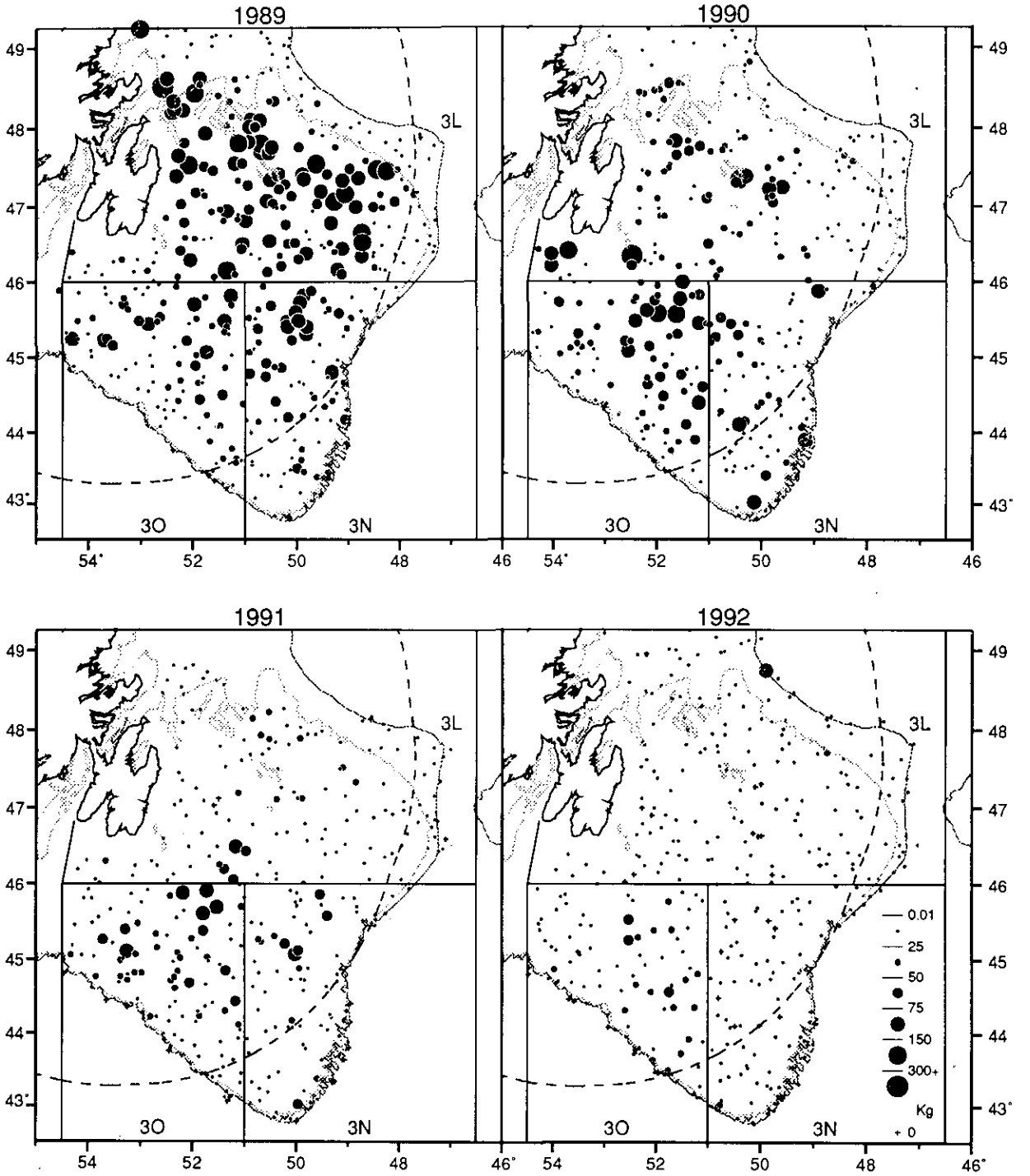

Fig. 26. American plaice in Div. 3LNO: distribution of catches (kg per standard tow) from 1989 to 1992 Canadian spring surveys. Dashed line represents division between the Canadian economic zone and the NAFO Regulatory Area. Depth contours are shown at 200 m (light) and 400 m (dark).

only the second year where the dominant age was 7. Another cause for concern is that from 1990 to 1991 and again from 1991 to 1992, the abundance estimates decreased between ages 5 and 6. In all previous years (except 1978-79 when the decrease was 1%), the abundance at these ages increased anywhere from 12 to 355% (mean = 131%), indicating that the fish at age 5 were less recruited to the survey trawl than at age 6. The change in the last two surveys is an indication of a very unusual increase in mortality. Similarly large declines were observed over almost all ages in the 1991 and 1992 surveys.

From Canadian autumn surveys in Div. 3L, population estimates have shown a sharp downward trend since 1984 to a level in 1992 which is about one-eighth as large as those observed in the early-1980s. The 1986 year-class was the dominant one in 1992, but its value was the lowest in the series at age 6. Similar to the spring surveys, the 1992 abundance estimates at every age older than 4 years were the lowest in the series.

From 1990 to 1992, 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 (40% in 1990, 75% in 1991, and 125% in 1992). 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 spring surveys showed declines of 55% or more in each Division from 1990 to 1992. However, the autumn surveys did not show this pattern in Div. 3N and 3O, but only in Div. 3L. For Div. 3LNO in total, the autumn surveys indicated a decline in abundance of 52% from 1990 to 1992 (Fig. 27), compared to a decrease of 71% during this period in the spring surveys.

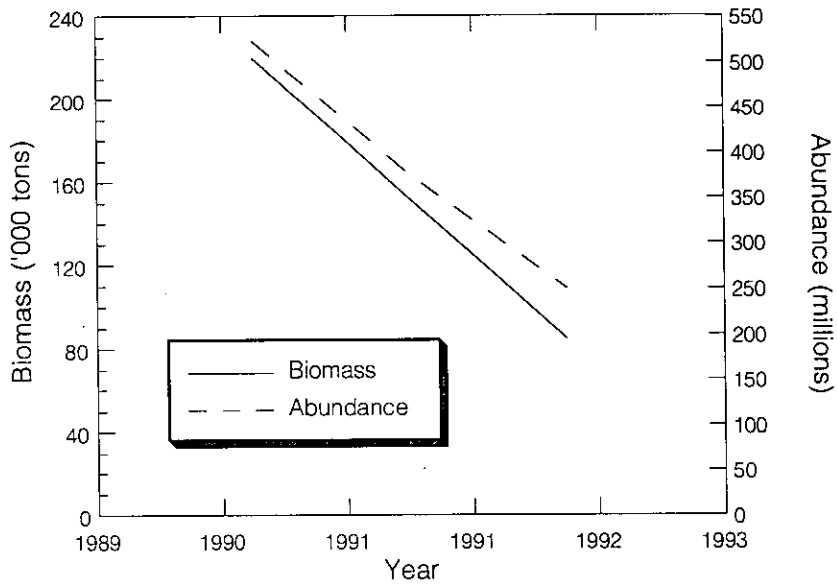

Fig. 27. American plaice in Div. 3LNO: biomass and abundance estimates from Canada autumn surveys.

The 1985 and 1986 year-classes were prominent in the catches in Div. 3N in all three surveys, particularly in 1990. These year-classes were not as dominant in Div. 3O. In Div. 3LNO combined, the 1985 year-class was the dominant one in both 1991 and 1992.

Like the spring surveys, autumn surveys did not show a trend of American plaice moving to deeper waters in recent years. The declines observed in the biomass over most strata on the Grand Bank were not countered by increases in the deeper areas.

In addition to the declines in abundance noted for American plaice in Div. 3LNO, reductions in the numbers of this species in adjacent areas have also been observed. In

Div. 2J+3K, the biomass index from surveys has decreased at virtually the same rate as the biomass in Div. 3L, to estimates in 1992 which are less than 10% of peak levels in the early-1980s. It is highly unlikely that the fishery played a major role, with catches in this area averaging around 1 500 tons per year from 1983 to 1992. In Subdiv. 3Ps, the biomass of American plaice has shown a similar rapid decline since the mid-1980s.

This suggests that other factors, possibly environmental, may be contributing to reduced abundance of American plaice.

USSR/Russian stratified-random surveys (Fig. 28). Results from USSR/Russian surveys in Div. 3LNO were available for 1972-91, but no comparable survey was done in 1992. Abundance and biomass were at relatively high levels from 1977-84, then declined to the lowest levels in the time series from 1987-91. This decline was present in all three Divisions. Age compositions indicated the 1985 and 1986 year-classes to be dominant in the catches in most recent surveys.

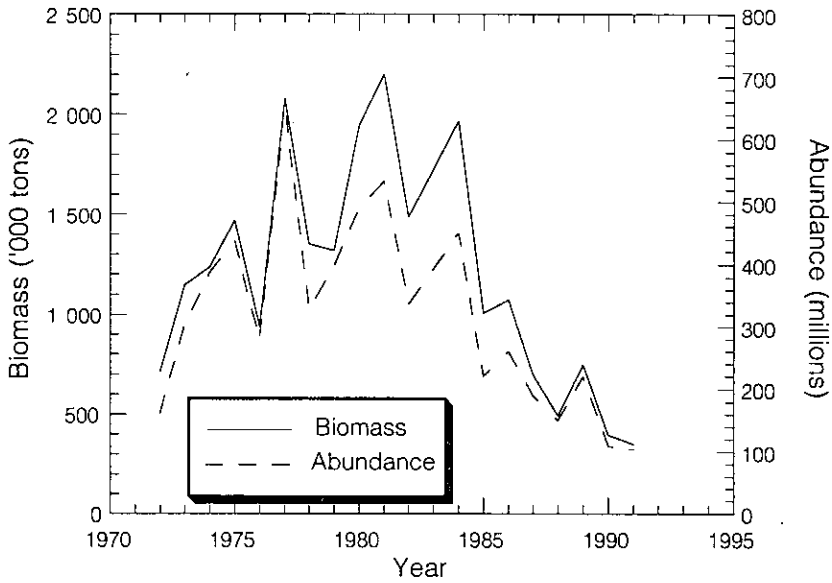

Fig. 28. American plaice in Div. 3LNO: biomass and abundance estimates from USSR/Russian surveys.

Canadian juvenile flatfish 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 survey. Large catches of juveniles aged 1-4 years 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 in depths up to 183 m. 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. American plaice were generally found in deeper water in Div. 3L than in Div. 3NO.

In Div. 3L, the total abundance was relatively stable from 1989 to 1992, with a decline in the numbers of age 7+ fish being offset by an increase in the numbers of younger fish. The 1987 and 1988 year-classes were dominant in the 1992 survey. The 1986 year-class, which was dominant in the 1991 survey, declined by about 60% in 1992. In Div. 3N, total abundance declined in 1992 by about half, although it was concluded that there was likely to be a downward bias in 1992. This was caused by an unusual random allocation of sets in a stratum with historically high abundance, such that the portion of the stratum where

juveniles are usually concentrated was poorly sampled in 1992. The 1989 and 1988 year-classes were predominant in Div. 3N in both the 1991 and 1992 surveys. In Div. 3O, total abundance increased by about 60% in 1992, due to large increases in the estimates of abundance of the 1988-1990 year-classes, which dominated the survey catches. The estimate of age 7+ fish was relatively constant from 1990 to 1992.

Other biological studies. Maturity-at-age was calculated for each Division and sex from 1971 to 1992. Age, maturity and length frequency data collected from Canadian spring research vessel surveys were analyzed. An approach was used which corrected for the length stratified sampling scheme and for the different abundance levels in each Division. Age at 50% maturity (A_{50}) was produced for each sex and year, for each Division separately and for Div. 3LNO combined using probit analysis, assuming a normal distribution. Model estimates for the probability of being mature-at-age were also produced using probit analysis for each sex and year for Div. 3LNO combined.

For females, the combined 3LNO estimate of A_{50} showed a decline from a range of 10-11 years old in 1975-82 to between 8 and 9 years old since then. A comparison of the ogives of 1975 and 1992 for the combined 3LNO estimate for females showed a marked shift to the left, with the females maturing at a younger age in 1992 than 1975. In Div. 3L and 3N, estimates of A_{50} have generally been lower since the mid-1980s. In Div. 3O the estimates were more variable but were also generally lower since the mid-1980s. For males the combined Div. 3LNO estimates of A_{50} and the 3L estimates have been lower since the mid-1980s. The estimates for the age at 50% maturity for males in Div. 3N showed some increase from 1971 to 1982 and have declined slightly since then, while in Div. 3O the estimates have been variable showing no clear trend.

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 1992 assessment, using the Spearman rank correlation. The A_{50} estimates for males and females in Div. 3L and 3N were significantly correlated with research vessel abundance estimates. The A_{50} estimates for males and females in Div 3O were not correlated with abundance estimates from research vessel surveys.

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 was probably reasonable, as this was about the mean of the female A_{50} estimates. However, the maturity ogives should be used in future if possible, given the trends indicated in these data.

c) **Estimation of Parameters**

i) **Sequential population analysis**

The catch-at-age (ages 5-17, 1975-92), and the abundance-at-age from the Canadian groundfish surveys (ages 5-14, 1975-92 except 1983) were used in one of the same formulations of the Adaptive Framework (ADAPT) that was completed in the 1992 assessment of this stock. The Laurec/Shepherd (L/S) calibration technique was also employed with the same data, except that the survey data were for 1984 onward (there are no data for 1983). Given the problems encountered with the calibrations using C/E data in 1992, as well as the interpretation of the C/E data in the last 2 years, it was decided to exclude these data from SPA calibrations in this assessment. STACFIS again noted the problems in the catch-at-age for recent years, including the fact that younger than age 5 were not present in the catch matrix despite relatively large catches at these ages in some recent years, but concluded that these data were adequate to use in an SPA.

The results of both analyses indicated a lack of fit to the model, with severe year effects present in both residual matrices. Most residuals in recent years in the L/S analysis were positive, and all the values in 1984-86 were negative. In the ADAPT model, all ages in 1992 had negative residuals, with most of the values in 1988 to 1991 showing a positive sign.

d) **Assessment Results**

Compared with ADAPT, L/S estimated age 5+ population numbers in 1992 to be about 50% lower. Both analyses indicated stock size to be much reduced; ADAPT indicated a 75% decline in age 5+ numbers from 1984 to 1991 and L/S a decline of 85%. Both analyses indicated similar severe declines in SSB, assumed to be age 9+, from the early-1980s to the lowest level observed in 1992 (Fig. 29). Both showed higher F in recent years compared to the mid-1980s, with fully recruited Fs (ages 11-15) in most recent years around 0.7 to 0.8 in ADAPT and 0.8 or higher in the L/S. Fully recruited F in 1992 was estimated to have decreased to about 0.65 in ADAPT and increased to about 1.0 in the L/S (Fig. 30)

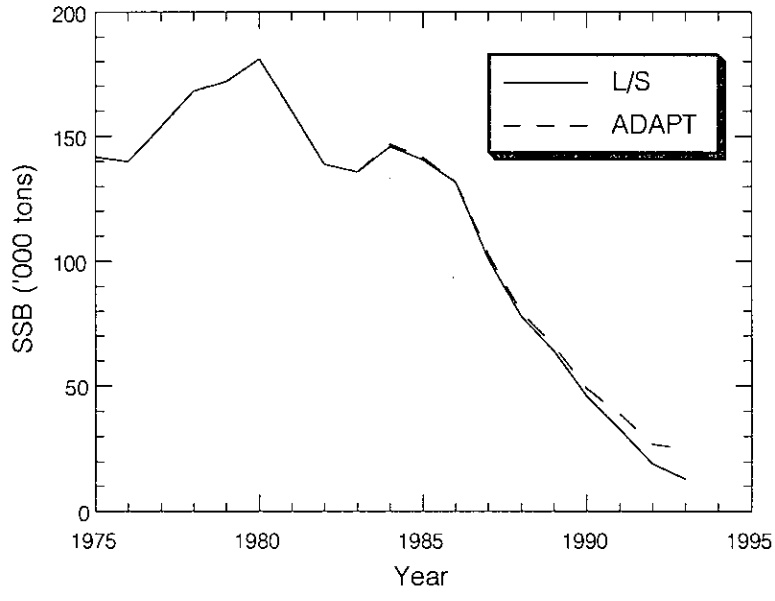

Fig. 29. American plaice in Div. 3LNO: trends in SSB from the L/S and ADAPT calibrations.

Both ADAPT and L/S indicated a continued decline in recruitment at age 5 from over 250 million in the mid-1970s, to about 100-150 million in the mid-1980s (Fig. 31). ADAPT estimated the age 5 population in 1990 at about 100 million, roughly double the L/S estimate. ADAPT showed this year-class (1985) to be larger than the preceding 4, while the L/S showed it to be the same size or smaller than the preceding 4. Each method indicated the size of the 1987 year-class at age 5 to be well below any other in the time series, although the precision of these estimates was rather low.

STACFIS concluded that neither model used fits the data very well, probably because of the rapid declines in the survey index in recent years. Regardless of the analysis used however, the conclusions must be basically the same - that the stock has declined rapidly and substantially from the mid-1980s to the present. Concern must be expressed with the state of the spawning stock and the lower levels of recruitment in recent years. Whether or not there has been a coincidental increase in natural mortality is not clear, although evidence from the adjacent northern area indicates that it is possible for an American plaice stock to decline rapidly in the absence of a sustained fishery. It is also not clear what effect, if any, this may have had on the SPA.

Both analyses displayed the severe retrospective pattern which has been documented in assessments of this stock in the past. The current ADAPT estimated the age 5+ population in 1991 to be 256 million fish, compared to 425 million in the 1992 assessment, a decrease of 40%. The L/S analysis in the 1992 assessment gave a population estimate in 1991 of 281 million, which means that the current analysis estimated the population in 1991 to be 46% lower. As with many stocks, the reasons for this retrospective pattern are not well understood.

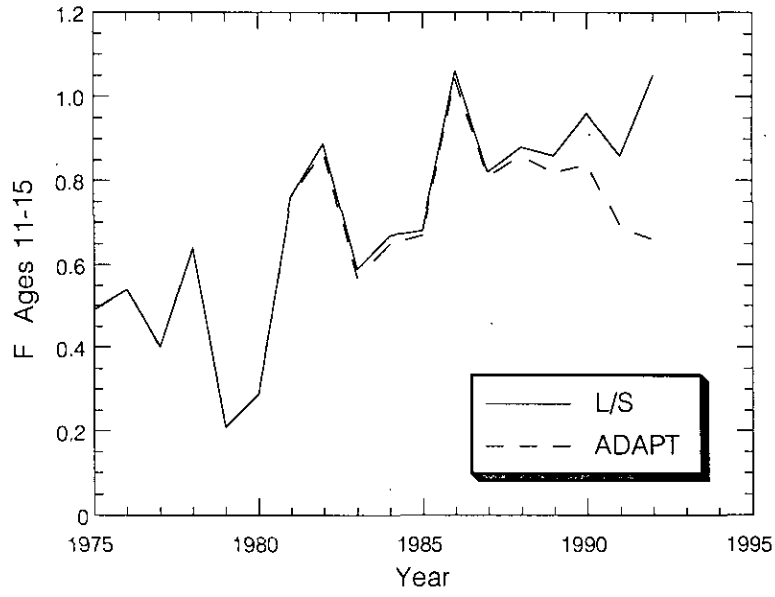

Fig. 30. American plaice in Div. 3LNO: trends in mean F (ages 11-15).

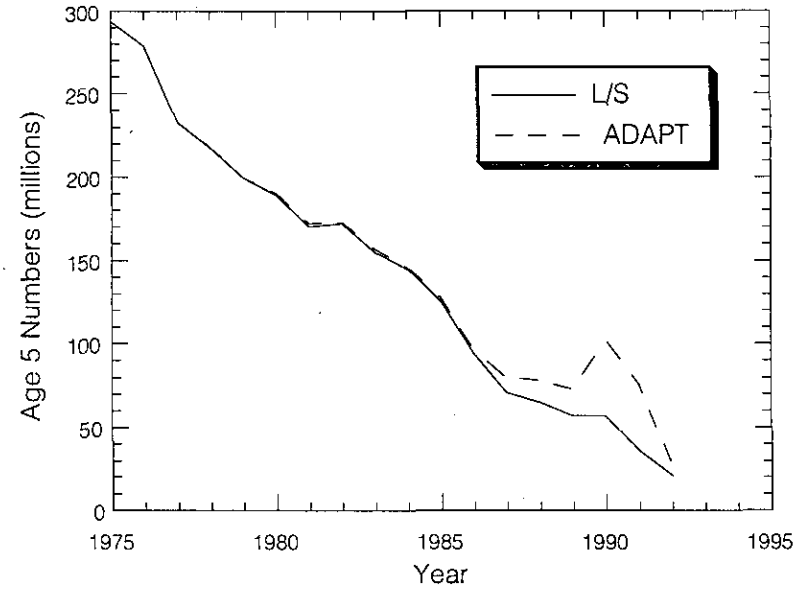

Fig. 31. American plaice in Div. 3LNO: trends in age 5 population numbers from the L/S and ADAPT calibrations.

e) **Catch Projections and Prognosis**

STACFIS agreed to do catch projections for 1994 based on both the L/S and ADAPT results, given the difference between the two. The population sizes in 1992 and mean partial recruitment for 1990-92 from each analysis along with mean weights-at-age from 1990-92, were used in catch projections at various levels of F in 1994. The 1984-90 geometric mean estimate of 98 million was used for the

estimate of age 5 population in 1993 in the ADAPT-based projections and 82 million was used in the L/S-based projections. The shorter time series was used to calculate the geometric mean (1978-89 was used in 1992) because it was felt that this time period was more indicative of recent reduced recruitment levels than the longer time frame. A catch of 10 500 tons (TAC) was assumed for 1993. The catch in 1993 generates an F of 0.34 in the projection from ADAPT and 0.67 in the projection from L/S. The following table contains results of the catch projections (see also Fig. 32 and 33):

Reference F		SSB 1.1.1994	Catch 1994	SSB 1.1.1995
ADAPT	$F_{0.1}$ = .26	32 300	9 500	40 000
	F_{max} = .5		17 000	34 100
	F_{92} = .65		21 000	31 100
L/S	$F_{0.1}$		4 800	13 500
	F_{max}	10 700	8 700	11 400
	F_{91} = .95		14 900	8 300

(For comparison, the $F_{0.1}$ projection for 1993 is 4 600 tons for L/S).

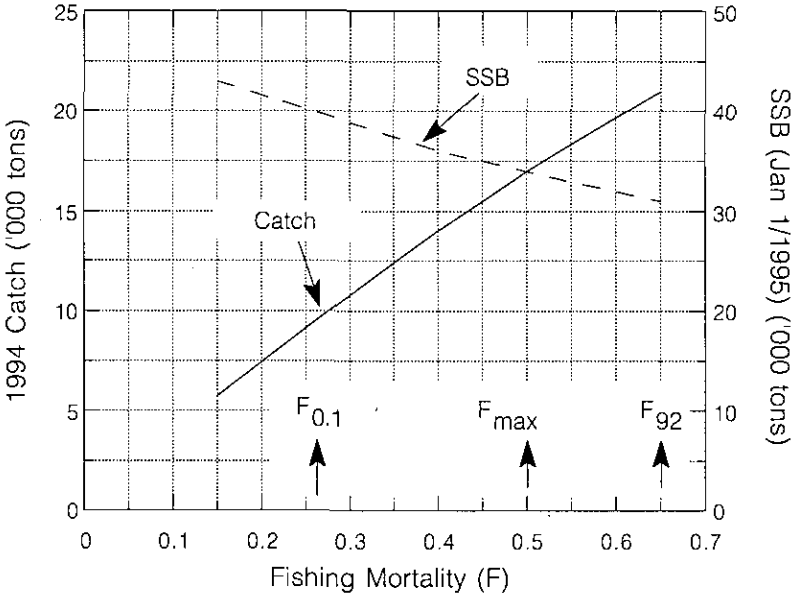

Fig. 32. American plaice in Div. 3LNO: projection of catch for 1994 and SSB at 1 January 1995, using the results from ADAPT.

This stock is currently at a level far below historic values. The SSB is at an extremely low level and may not improve if exploitation of recruiting year-classes continues at current levels. 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 a fishery. The L/S analysis indicated that catches around F_{max} in 1994 will be only slightly smaller than the remaining SSB. Fishing mortality should be substantially reduced in 1994 to allow the 1985 and 1986 year-classes to contribute to the growth of the SSB. Catches at the $F_{0.1}$ level in 1993 are well below the comparable $F_{0.1}$ catches projected for 1993 in last years assessment (e.g. 4 600 tons from the L/S analysis in 1993 *versus* 10 500 tons from the L/S analysis in 1992). This highlights the previously discussed problem with retrospectively lower stock sizes, and indicates that if the same pattern persists, the projected catch levels for 1994 should perhaps be 40% lower, which is about the magnitude of the retrospective error.

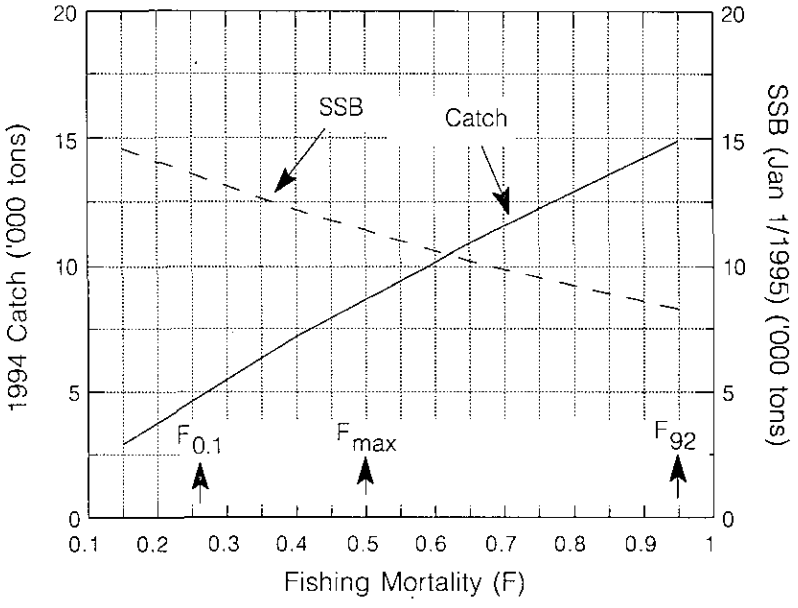

Fig. 33. American plaice in Div. 3LNO: projection of catch for 1994 and SSB at 1 January 1995, using the results from L/S.

These analyses suggest that the $F_{0.1}$ catch for 1994 is less than 5 000 tons. This is also about 10% of the average catch from 1978 to 1991, corresponding to the ratio of the abundance from surveys in 1992 to that from surveys in the late-1970s. Given the extremely low population size in 1992, concerns about the SSB, and the expectation of very poor recruitment, STACFIS concluded that a cautious approach was warranted and **recommended** that *the American plaice catch in Div. 3LNO in 1994 should be kept at the lowest possible level, and should not exceed a maximum of 4 800 tons.* Prospects for rebuilding the stock are unknown, 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. 93/83; SCS Doc. 93/15)

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 (Fig. 34). With increased effort, mainly by EEC-Spain and EEC-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, USA, Cayman Islands and Panama also contributed to increased catches.

Recent TACs and catches ('000 tons) are as follows (Fig. 34).:

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
TAC	5	5	5	5	5	5	5	5	5	5	5
Catch	4	3	9	9	8	7	4	4[1]	5[1]	5[1]	

[1] Provisional.

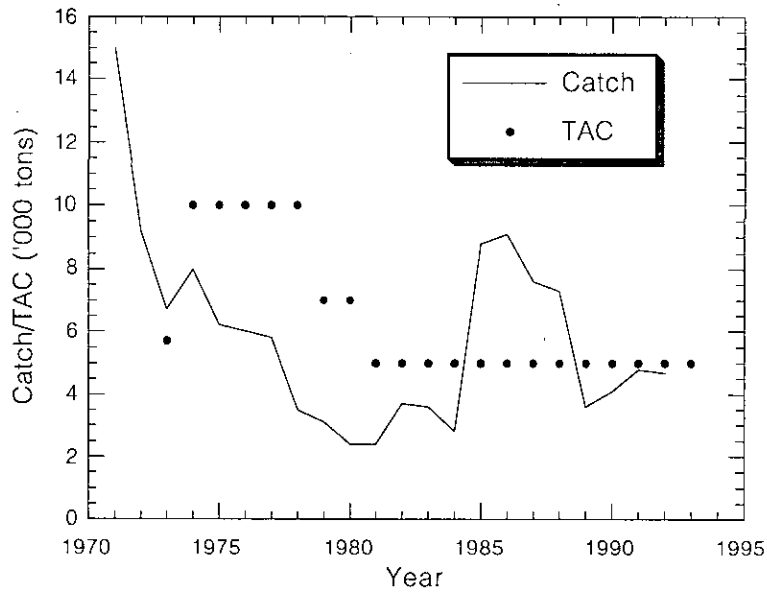

Fig. 34. Witch flounder in Div. 3NO: catches and TACs.

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. Catches by Canada ranged from 1 200 tons to 4 900 tons in recent years (about 2 650 tons in 1991 and 4 900 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 and 1992.

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 66% of the variation in catch rates. The standardized catch rate series indicated that the 1991 value was the lowest in the series followed by a slight increase in 1992. The 1982 and 1990 values appeared to be anomalously high. The reasons for this are unknown. However, without those values there was an increasing trend from about 1978-85 followed by a declining trend since that time. It was recognized, however, that most data pertain to fishing on aggregations (pre-spawning) and significant changes in stock size may not be easily detected until substantial reductions have occurred.

Catch-at-age. Data were available from the Canadian commercial fishery from 1979-92.

The age structure from the Canadian 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. There was some slight increase in the younger ages in the more recent years,

however, the reason for this was not readily apparent. 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 is 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 did not indicate any change in growth patterns that would suggest changes in selectivity-at-age.

ii) **Research survey data**

Biomass estimates. Estimated biomass from Canadian surveys in Div. 3N has been at very low levels during 1971-93 and in most years was less than 1 000 tons (Fig. 35). 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 approximating the lowest observed in the time series.

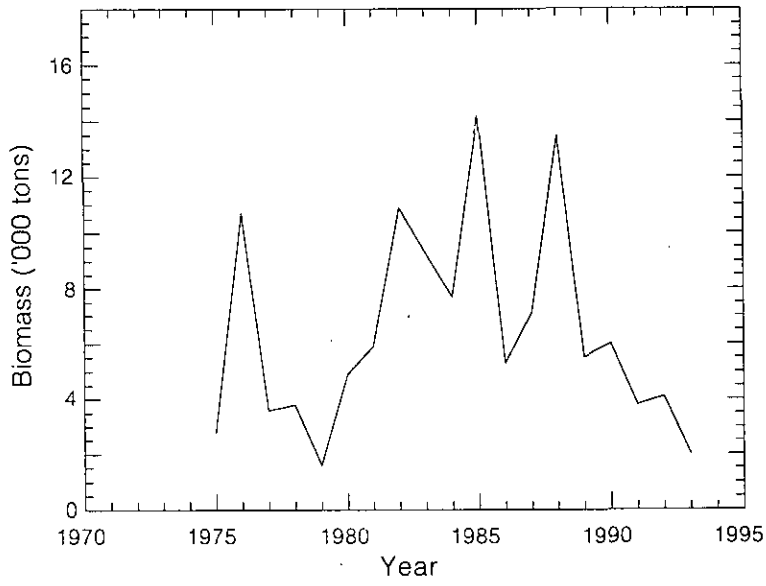

Fig. 35. Witch flounder in Div. 3NO: biomass estimates from Canadian RV data.

A comparison of biomass and abundance of spring *versus* autumn surveys for 1990-92 indicated that for 1990 the autumn estimate was higher than in spring, whereas for 1991 and 1992 the reverse was true. The differences between spring and autumn estimates, however, especially for the 1991-92 surveys were relatively small. Both the spring and autumn surveys showed a considerable decline in abundance between 1990 and 1991 but little change between 1991 and 1992.

Age composition. The age structure for the years 1984-92 from both the spring and autumn surveys in Div. 3O (data from Div. 3N insufficient) indicated that the age structure was quite similar to that from the Canadian commercial fishery.

Distribution. Distribution data from the spring surveys indicated that witch flounder was most abundant along the southwest side of the Grand Bank, primarily in Div. 3O. For most years the only significant abundance outside the Canadian fishery zone was located in Div. 3O, although there are some witch flounder caught along the eastern edge of Div. 3N. In some years the higher catches are more frequent over the more shallow areas of the Grand Bank, especially in 1985 and 1988. This could explain the unusually high biomass in those

years as these high catches were associated with large strata. The 1991 and 1992 catches were concentrated along the deeper slope area of Div. 3O with little caught on the shallower parts of the bank or in Div. 3N. Autumn surveys showed that witch flounder were more widely distributed compared to spring over the southwestern half of the Grand Bank, almost entirely in Div. 3O.

c) **Prognosis**

The biomass in Div. 3N has been and continues to be quite low with most of the stock located in Div. 3O.

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 points are an artifact of fish moving in over the Bank occupying large strata resulting in biased estimates. 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 value is near the lowest observed in the time series. This is of particular importance since the last three surveys have covered a much more extensive depth range than any previously conducted.

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 would suggest that recent catch levels in this Division are too high. Catches of about an average of 2 600 tons in this Division taken during the 1984-90 period indicated a decline in survey biomass. STACFIS therefore **advised** that catches of this stock should not exceed 3 000 tons in 1994. STACFIS is not able to calculate an appropriate lower value as indicated by the survey results.

12. **Yellowtail Flounder in Divisions 3L, 3N and 3O** (SCR Doc. 93/10, 76; SCS Doc. 93/14, 15)

a) **Introduction**

Nominal catches declined in 1992 to about 10 800 tons, which was similar to the 1989 level, after increasing in each of 1990 and 1991 (Fig. 36). The main reason for the decline in 1992 was a shift in effort of the Spanish and Portuguese freezer fleets to fisheries in deeper water. Canadian and South Korean catches were stable in 1991 and 1992 at about 6 700 and 4 000 tons, respectively. Catches exceeded the TACs in each year from 1985 to 1992.

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 1985-86 coming from surveillance estimates and breakdowns of unspecified flounder catches. About 33% of the 1991 catch was estimated although this situation was much improved in 1992, when no catch estimates were required.

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

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
TAC	19	17	15	15	15	15	5	5	7	7	7
Catch	10	17[1]	29[1]	30[1]	16	16[1]	10[1]	14[1,2]	16[1,2]	11[2]	

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

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, and remained at about this level in 1992 (Fig. 37). The index in 1991 and 1992 was about one-third lower than the previous minimum value in the mid-1970s. Analysis of the data from only the years 1981 to 1992, which was done to eliminate possible effects of a change in mesh size in 1981, showed the same declines in 1991 and 1992. The low values in both indices in 1991 and 1992 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 is located, did decline in 1991 and 1992, but only to approximately the levels observed in 1988-89 and 1975-76. No series of catch-rate data are available from the fisheries in the Regulatory Area.

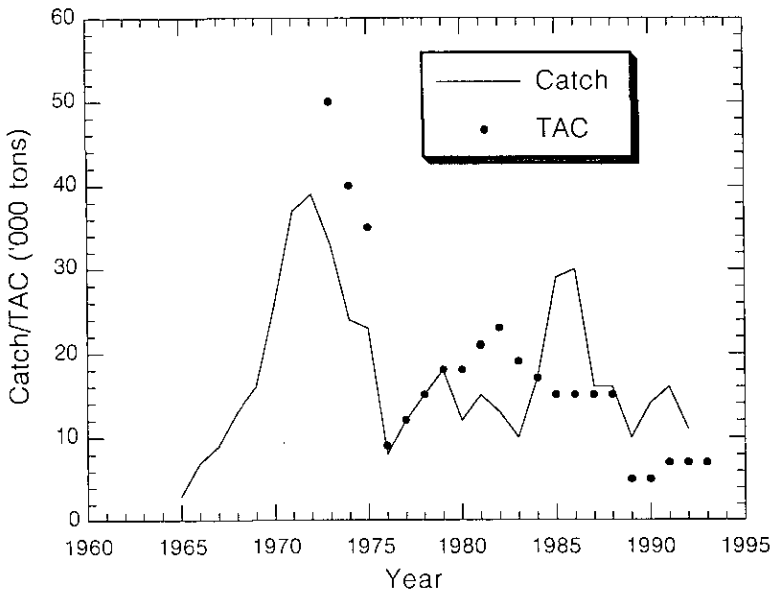

Fig. 36. Yellowtail flounder in Div. 3LNO: catches and TACs.

Catch-at-age and mean weights-at-age. Catch-at-age was calculated from length frequencies and otolith samples from the Canadian fishery in 1992. No sampling data were available from any otter-trawl fisheries for yellowtail flounder in the Regulatory Area. It was not appropriate to apply the age composition from the Portuguese gillnet fishery, or the age composition from the Canadian fishery, to otter-trawl catches in the Regulatory Area, based on differences in selectivity observed in these fisheries. Therefore it was not possible to calculate an age composition for about 37% of the catch in 1992, almost all of which was caught by South Korea.

In the Canadian landings, ages 6-8 dominated in 1992, consistent with other years. These same ages were also the predominant ones in the small fishery by EEC-Portugal gillnetters in 1992. The mean weights-at-age from the Canadian catch have shown no trends in recent years.

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

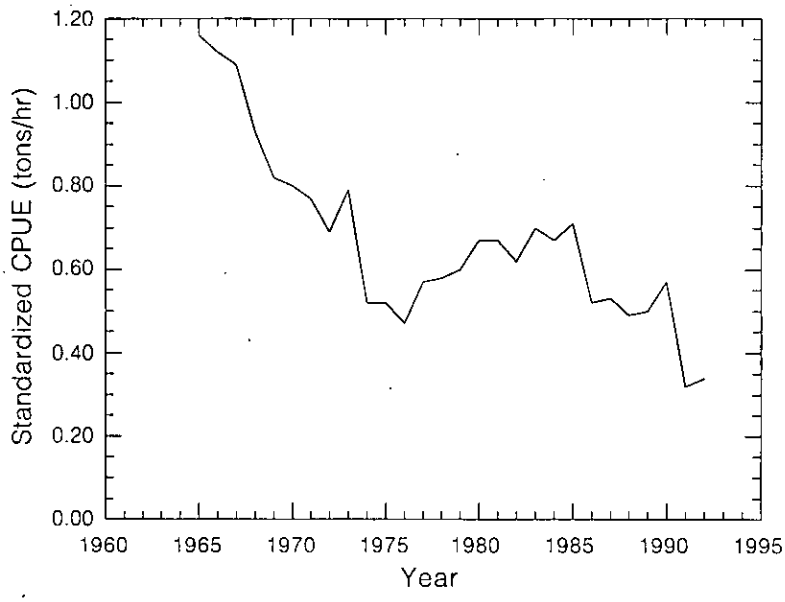

Fig. 37. Yellowtail flounder in Div. 3LNO: standardized catch rates.

ii) **Research survey data**

Canadian stratified-random spring surveys (Fig. 3-8). Surveys have been carried out by Canadian research vessels in Div. 3LNO each year from 1971 to 1993 with the exception of 1983. The surveys from 1984 to 1992 were comparable in terms of coverage and vessel/gear used. Most of the biomass of this stock was found in Div. 3N, where it declined from about 60 000 tons in 1985-86 to a stable but lower level around 35 000 tons from 1988-93. In Div. 3L the biomass has declined steadily from about 15 000 tons in 1984-85 to practically zero in 1992. In Div. 3O, the biomass index was relatively stable around 15 000 tons from 1988 to 1991, declined to about half that level in 1992, then increased to 27 000 tons in 1993.

Plots of yellowtail flounder distribution from these surveys show the center of distribution to be around the western side of the Southeast Shoal in Div. 3N. As the stock declined from the mid-1980s to the present, the distribution of the stock contracted towards this area. In 1991 and 1992, there were few yellowtail flounder caught on the Grand Bank north of 45°N.

The total abundance index of this stock was relatively stable, ranging between 240 and 340 million fish from 1975 to 1984, after which time it declined steadily, ranging from 85 million to 150 million in the 1988-92 surveys which were the lowest in the time series. The Canadian survey catches are usually dominated by yellowtail flounder aged 5-8 years. In 1991, the 1985 and 1986 year-classes, ages 6 and 5 years respectively, appeared to be larger than any year-classes at these ages in the most recent 5 or 6 years, but were still lower than those observed for this stock during the 1970s and early-1980s. These year-classes were the dominant ones in the 1992 survey, but their abundance relative to previous year-classes was lower than in 1991. STACFIS noted that the age by age information from the 1993 spring survey was not available at this meeting.

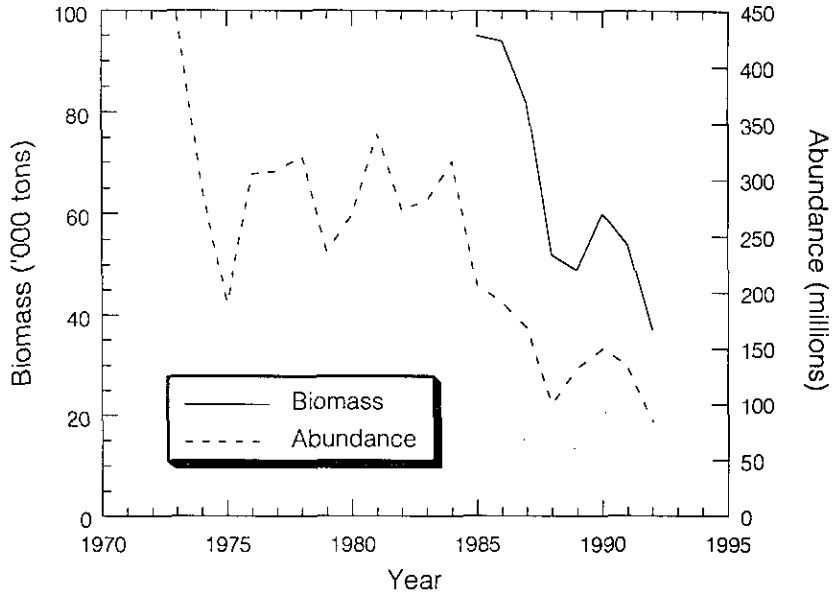

Fig. 38. Yellowtail flounder in Div. 3LNO: biomass and abundance estimates from Canadian spring surveys.

USSR/Russian stratified-random groundfish surveys (1972-91) (Fig. 39). The trends in stock size in the USSR/Russian surveys were identical to those in Canadian surveys, showing a sharp drop in abundance in 1985, and a continued decline to very low levels in 1988-91. There was no comparable survey in 1992. Data on distribution of yellowtail flounder from these surveys also agreed with Canadian surveys indicating few fish in Div. 3L in recent years, despite relatively high abundance in the 1970s and early-1980s. Information on bottom temperature, and on the abundance and distribution of juveniles indicated that the extent of yellowtail flounder distribution on the Grand Bank may be more related to population abundance than bottom temperature.

Canadian stratified-random autumn surveys (1990-92). The biomass estimates ('000 tons) from the autumn surveys in Div. 3LNO in 1990, 1991 and 1992 were 41, 48 and 38, respectively, although the 1992 estimate was biased downward by the omission of one stratum and part of another which had relatively high yellowtail flounder abundance in 1990 and 1991. These data indicate that the stock size was stable at a relatively low level in 1990-92.

Canadian juvenile flatfish surveys. From 1985 to 1992, annual stratified-random surveys have been conducted in Div. 3LNO, directed at juvenile American plaice and yellowtail flounder. The biomass estimate for Div. 3N which had shown a steady increase since 1988, declined in 1992 to about the level observed in 1989. In Div. 3L, the biomass has declined steadily since 1985 to the lowest level in the series in 1992. In Div. 3O, the biomass estimate was about 20% higher in 1992 compared to the relatively stable level observed from 1989 to 1991.

In 1992 the total abundance at age showed a 37% decrease from the 1991 estimate. This was due mainly to a 53% decrease in juveniles aged 1 to 4 years and a moderate decrease in the abundance of the 1985 and 1986 cohorts. The abundance of ages 1-4 yellowtail flounder in 1992 was the third lowest in the 7 year time series, while the abundance of age 7+ was close to the 1991 estimate and was the third highest in the time series. The 1985 year-class, which was the strongest in the time series at almost every age, contributed 63% to the total estimate of age 7+ fish in 1992.

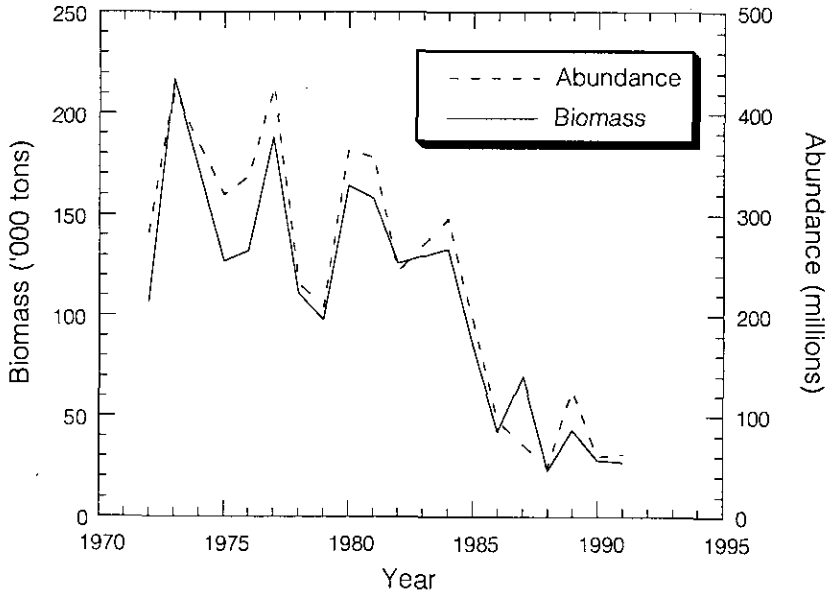

Fig. 39. Yellowtail flounder in Div. 3LNO: biomass and abundance estimates from USSR/Russian surveys.

The 1991 year-class, at age 1, was the second lowest in the time series of age 1 abundance estimates. The 1990 year-class, at age 2, is the lowest in the time series, well below the long term average. The 1989 year-class, at age 3, was slightly below the long term average and appears to be a moderate year-class. The 1988 year-class which appeared to be strong at age 2 in the 1990 survey and extremely strong at age 3 in the 1991 survey, was found to be of moderate size in the 1992 survey, being slightly above the long-term average. The 1987 year-class at age 5 was about average. The 1986 year-class, at age 6, which has been consistently the second highest year-class (behind 1985) during the time series, maintained this ranking again in 1992, and was well above the long term average. In the 1992 survey the majority of the 1987-91 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.

c) **Assessment Results**

Catch-at-age could not be used in a sequential population analysis based model for this stock, and the use of a yield-per-recruit model was also not possible, so STACFIS again decided that the information contained in the indices of abundance (research vessel surveys and catch rate) would be evaluated to determine stock status. Given the inadequacies with the catch and sampling data, and questions about the natural mortality-at-age for this stock, it remains impossible to estimate the level of fishing mortality in recent years.

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 less than 15 000 tons in 1980-83. The year-classes of 1984-86 and possibly the 1988 year-class, clearly are not as strong as most of the 1970s year-classes at ages 4 and 5, but were stronger than those of the early-1980s. However, comparisons with the earlier period are somewhat difficult, given that the juvenile surveys did not begin until 1985, and that relatively large numbers

of the recent year-classes have been caught at younger ages compared to earlier cohorts. The year-classes from 1989-91 appear to be below average, although the amount of data for some of these year-classes is limited.

d) **Prognosis**

In 1992, the prognosis was that the stock remained at a low level, although improved recruitment appeared likely. Based on the 1993 assessment, the first part of that statement remains true, although there is some doubt about the latter part. While there is little doubt that the 1985 and 1986 year-classes were more abundant than those of the early-1980s, these will have essentially passed through the fishery after 1994. The spring and juvenile surveys suggest that subsequent year-classes are anywhere from average to well below average. The relatively small increase in biomass in the 1993 spring survey is a positive sign although little can be concluded from this until analysis of the age composition is completed.

The stock has remained relatively stable at a low level in recent years with catches around 10 000-16 000 tons (*versus* TACs of 5 000-7 000 tons) so it is apparent that reductions in the total catch to around the TAC level will be needed to allow some growth in stock size. As in 1992, it appears that additional reductions in fishing effort on this stock in 1993 and 1994 may be forthcoming. EEC fleets moved out of this fishery almost entirely in 1992 and South Korean vessels withdrew part-way through 1993. If these actions are permanent in 1993, catches in the Regulatory Area are expected to be reduced substantially, assuming fishing effort by other non-Contracting Parties remains near current levels.

Given the current estimated biomass level, a catch of 7 000 tons (current TAC) in 1994 should not be detrimental to the stock. STACFIS therefore **advised** that the TAC for 1994 be 7 000 tons. If total catches continue to exceed the TAC, the chance for this stock to rebuild to former levels, when catches averaged over 14 000 tons for an extended period of time with no adverse effects on stock size, will be reduced. Should the fisheries in the Regulatory Area return to former levels, with high exploitation rates of juveniles as estimated in the past, this stock will likely remain at a low level and perhaps decline further, particularly if predictions of below-average recruitment following the 1986 year-class are true.

13. **Greenland Halibut in Subareas 0 and 1** (SCR Doc. 93/15, 53, 58, 80; SCS Doc 92/10, 13, 16)

a) **Introduction**

Between 1984 and 1989 most catches of Greenland halibut in Subareas 0+1 were taken inshore in the West Greenland fjords (Subarea 1). This fishery in Subarea 1 has been increasing during the 1980s. Also in Subarea 1 a small offshore fishery for Greenland halibut has been executed since 1987, and has now increased from 700 tons in 1991 to 4 600 tons in 1992. In 1990, 1991 and 1992 Faroese longliners, USSR/Russian and (from 1991) Canadian trawlers fishing in offshore areas in Div. 0B have caught significant amounts, and the catches increased slightly from 10 000 tons in 1991 to 11 706 tons in 1992.

The annual catches in Div. 0B and Subarea 1 in the period 1984-89 were around 9 000 tons with more than 80% of the yield coming from Subarea 1. Before that time catches were low with Div. 0B contributing about 45% of the annual catches. Recent catches are 21 424 tons in 1991 and 28 501 in 1992 with 59% taken in Subarea 1. (Fig. 40).

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

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Recommended TAC	-	-	25	25	25	25	25	25	25	25	25
Effective TAC	-	-	25	25	25	25	25	25	25	25	25
Div. 0B	5	+	1	+	+	1	1	11[1]	10[1]	12[1]	
Subarea 1	4	7	9	9	10	9	9	9[1]	11[1]	17[1,2]	
Total	9	7	10	9	10	10	10	20[1]	21[1]	29[1,2]	

[1] Provisional.
[2] Including 1 457 tons non-reported.

The fishery in Subarea 0. The USSR prior to 1984, and in some years the GDR, had in Div. 0B a trawl fishery offshore. 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 again to a low level (500 tons) in 1992. Since 1990 the trawl fisheries in Div. 0B have increased significantly. Catches in Div. 0B jumped from 727 tons in 1989 to about 10 500 tons in 1990 and 1991 and increased further to 11 700 tons in 1992. Most of the fishing took place during June-December in 1992.

No catches were reported from Div. 0A.

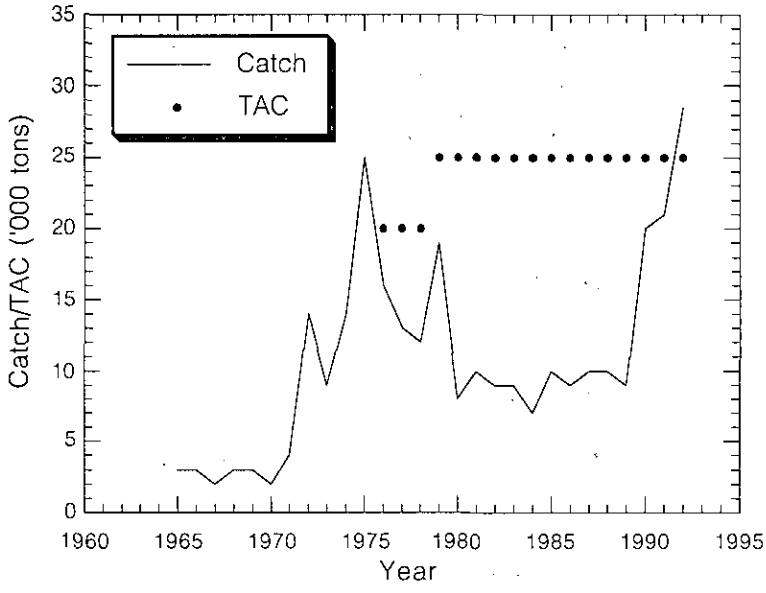

Fig. 40. Greenland halibut in Subareas 0 and 1: catches and TACs.

The offshore fisheries in Subarea 1. The offshore fishery in Subarea 1 (Div. 1C+1D) increased from about 700 tons in 1991 to 4 614 tons (including 1 457 tons non-reported) in 1992. Japanese trawl catches amounted to 1 629 tons in 1992, which is an increase compared to 1991 (600 tons). Norway contributed with 1 309 tons and minor catches derived from trawl fishery by Russia (6 tons) and longline fishery by Faroe Islands (213 tons).

The fjord fisheries in Subarea 1. Most of the total catches in Subarea 1 were taken in the fjords of Div. 1A by Greenland (73%). Three areas comprise the fishery: Ilulissat, Uummannaq and Upernavik, of which Ilulissat makes up about 50% of the catches. Catches increased from 10 200 tons in 1991 to 12 200 tons in 1992. The inshore Greenland fishery is a gillnet and longline fishery carried out 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 have become more common, and in the period 1986-89 gillnets and longlines accounted equally for the catches in Div. 1A. In 1990 and 1991 longlines dominated again and comprised about 83% of catches in 1991. In 1992 gillnet catches comprised about 60% of the catches. In recent years the inshore catches have been evenly distributed throughout the year.

b) **Input Data**

i) **Commercial fishery data**

Only a few samples from the inshore fishery in 1992 were available, not allowing an estimate of catch-at-age in numbers. Length frequencies were obtained from offshore

fisheries and Div. 1CD. The length compositions in the trawl catches appear almost identical both between years and between Divisions, suggesting a stable age composition. The peak length group in both 0B and 1CD was 50 cm. Using age-length keys from 1CD (1987-89), assuming no change in growth rate and recruitment, age compositions were determined. The 7-10 years age groups dominated the catches in the offshore trawl fisheries. Catch/effort data were obtained from the Japanese trawl fisheries in Subarea 1. Their CPUE was stable in the period 1987-92 except for 1991.

ii) **Research survey data**

Bottom trawl surveys have been conducted jointly by Japan and Greenland in Subarea 1 since 1987. In 1992 two surveys were conducted in August and November/December, respectively. In the first survey the trawlable biomass was estimated to be 64 500 tons in Div. 1A to 1D at depths between 400 and 1 500 m, which is somewhat lower than in 1991 (79 500 tons), but back at the level recorded in the period 1987-90. The second survey covered Div. 1CD and the biomass was estimated to be 50 600 tons, which was at the same level as in the comparable area in the first survey (51 820 tons).

A bottom trawl survey was carried out by Russia in Div. 0B in November, covering depths between 500 and 1 500 m. The trawlable biomass was estimated to be 38 100 tons, in comparison to the level found in 1991 (46 000 tons).

In 1987, 1988 and 1990 both surveys covered Div. 1BCD and a first comparison suggested that the two research vessels trawlable biomass estimates were comparable and hence that estimate for 0B and Div. 1ABCD may be summed.

In the period 1989 to 1992 the total biomass has shown a declining trend. In the same period the offshore fisheries has increased from less than 1 000 tons to around 16 000 tons.

Biomass estimates ('000 tons) from Greenland/Japanese surveys and Germany/USSR (GDR until 1989, EEC-Federal Republic of Germany since 1990-91 and USSR until 1991, Russia in 1992) surveys for the years 1987-92 in Subareas 0+1 are as follows:

	Germany/USSR			Greenland/Japan	
Year	Div. 0B	1BCD	1ABCD	1BCD	0B+1ABCD
1987	37	56	54[a]	54[a]	81
1988	55	47	63	53	118
1989	79	no survey	63	63	142
1990	72	88	56[b]	53[b]	128
1991	46	no survey	79	77	125
1992	38	no survey	64	62	102

[a] In 1987 the survey did not cover the depth stratum 1 000-1 500 m.
[b] Average values of two surveys.

During July to August 1992, a trawl survey with a commercial shrimp trawler was conducted off West Greenland between 59°N and 72°N from the 3-mile line to the 600 m depth contour line. Biomass and abundance indices were estimated to be 8 800 tons and 290 million individuals, respectively. The length distributions of the catches in NAFO Div. 1A and 1B showed peaks at 11-12 cm and 17-18 cm, supposedly representing age groups 1 and 2. The inshore area Disko Bay in West Greenland was surveyed during August to September at the depth range 150-500 m. The length distributions showed peaks at 12 and 18 cm, respectively, and the biomass of Greenland halibut was estimated to be 3 960 tons while the abundance was estimated to be 69 million individuals.

A trial longline fishery was conducted in Div. 1D+1E in May-June 1992 by a Norwegian commercial vessel. The fishery was directed towards deepwater resources down to

2 200 m. Mean CPUE of Greenland halibut increased with depth. The overall mean CPUE was 122 kg Greenland halibut/1 000 hooks, including some fishing directed at cusk on less deep waters on the slopes. Length distributions in the catches ranged between 40 cm and 120 cm, with peaks at 60 cm and 85 cm, representing two unimodal distributions for males and females, respectively. The length distributions were very similar to previous longline fisheries in 1989-91, but different from the length distributions found in the trawl catches.

c) **Prognosis**

Greenland halibut seemed to be rather evenly distributed in the area, possibly with a component at depths beyond 2 200 m.

For the fjord areas in Subarea 1, catches increased from 10 200 tons in 1991 to 12 200 tons in 1992 probably due to an increase in effort, especially around Ilulissat in Div. 1A. In this area catches have increased from about 2 500 tons in 1989 to about 6 000 tons in 1992. The increase resulted in a dramatic change in the catch composition, where large fish were almost absent (90% <70 cm in 1992; 50% <70 cm in 1988). The changes in catch compositions were restricted to this area. A reduction in the catch level in the Ilulissat area from 6 000 tons to 3 500 tons has been proposed by the Greenland Fisheries Research Institute based on their estimate of the sustainable yield for this area. The fishing level at about 7 000 tons in the other inshore areas of Div. 1A combined does not seem to affect the size composition.

For the offshore areas of Subareas 0+1, biomass estimates from the Germany/USSR (EEC-Federal Republic of Germany since 1990; Russia since 1992) and Greenland/Japan surveys have shown a declining trend since 1989, from 142 000 tons to 102 000 tons in 1992. In the same period the offshore fishery has increased from less than 1 000 tons to around 16 000 tons. However, there is no indication of a change in catch composition or in CPUE in the offshore fishery in Subarea 1.

It is not known to what extent the trawl surveys cover the stock area, in particular there is no information from Div. 0A and from depths beyond 1 500 m. The considerable difference in the size distribution from trawl and longline fishing, indicates that the trawl survey data may not represent the length composition of the stock. An analytical assessment is not possible at this point in time due to the short time series available, the low fishing mortalities in 1987-89 in the offshore fishery and problems in stock separation.

The CPUE data series and the length compositions in the catches have remained stable between 1987 and 1992, however, STACFIS is concerned over the declining trend in the biomass estimates seen since 1989. The surveys did not cover the entire distribution area and the variance of estimates makes interpretation of this decline difficult. Faced with this conflicting information, STACFIS is not at present able to change its previous advice. STACFIS **advised** that the present TAC level of 25 000 tons be maintained for 1994.

The offshore fisheries in both Div. 0B and Div. 1CD are concentrated in small areas. STACFIS considers that intensive fishing effort on localized areas of abundance is imprudent, given the lack of scientific information on stock structure and stock size.

14. **Greenland Halibut in Subarea 2 and Divisions 3K and 3L** (SCR Doc. 93/75; SCS Doc. 93/10, 14, 15)

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 (Fig. 41). From 1985 to 1989, catches exceeded 20 000 tons only in 1987. In 1990, an extensive fishery developed in the deep water (down to 1 500 m) in the Regulatory Area, around the boundary of Div. 3L and 3M and by 1991 extended into Div. 3N. The total catch estimated by STACFIS for 1990-92 was 47 000 in 1990, up to 75 000 in 1991 and 63 000 tons in 1992. The major participants in the fishery in the Regulatory Area were EEC-Spain and EEC-Portugal, as well as some non-Contracting Parties such as Panama. STACFIS in 1991 and 1992 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 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. EEC-Portugal and Japan have taken catches from this stock each year since 1984. Canadian catches have been between 8 200 and 13 500 tons in each year from 1985-91. The Canadian catch in 1992 was 6 900 tons.

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 are taken mainly in inshore areas, and have 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 of 3 200 tons was 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.

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.

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

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
TAC[1]	55	55	75	100	100	100	100	50	50	50
Catch	25	19	16	31	19	19[2]	47[2,3]	55-75[3,4]	63[2,3]	

[1] TAC for Div. 2J+3KL only for 1977-84.
[2] Provisional.
[3] Includes estimates of misreported catches.
[4] STACFIS could not reliably estimate total landings.

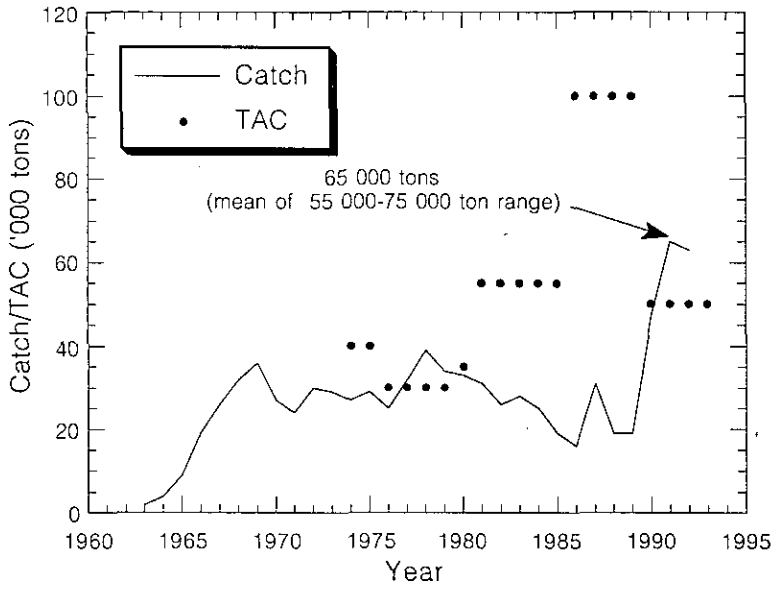

Fig. 41. Greenland halibut in Subarea 2 and Div. 3KL: catches and TACs.

b) **Input Data**

i) **Commercial fishery data**

Catch and effort. Catch and effort data from the directed fishery for the period 1975 to 1989 were obtained from ICNAF/NAFO Statistical Bulletins and were combined with provisional 1990-91 NAFO data and preliminary Canadian data for 1991-92. No data from the fishery in the Regulatory Area were included in this analysis.

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 1991-92. 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 multiplicative analysis of 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. However, due to the short time series and paucity of data in 1993, firm conclusions on stock trends were difficult to reach. Nevertheless, STACFIS observed that there was a clear seasonal trend with January being the month of the highest catch rate. In addition, catch rates declined slightly as the fishery moved into deeper water. There were also differences seen among the three Divisions but the reasons for these differences were too confounding to fully evaluate.

Information from the Portuguese fishery indicated from unstandardized catch rates that there was an increase in catch rate between 1991 and 1992 for Div. 3N and declined for Div. 3L.

Catch-at-age. Length sampling data from the catches of Canada, EEC-Portugal, and EEC-Spain were available at this meeting, however, only Canadian aging data were reviewed. 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, 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.

An examination of length frequency data from both EEC-Spain and EEC-Portugal indicated that most of the fishery in the Regulatory Area in 1992 was dominated by the 1986 year-class.

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. Data from the Spanish fishery in Div. 3LM also indicated a similar decline in the size of fish in the catch in 1992, with modes between 40-50 cm compared to 50-60 cm in 1990 and 1991.

ii) **Research survey data**

Canadian stratified-random groundfish surveys in autumn. Biomass indices of Greenland halibut have been declining in Div. 2J (down to 1 000 m) since 1982 from a level of over 100 000 tons to less than 9 000 tons by 1992. The biomass index in Div. 3K (down to 1 000 m) peaked at 112 000 tons in 1984 but by 1987 biomass in this Division also began a steep systematic decline similar to Div. 2J and reached a low of just over 20 000 tons in 1992. 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 survey coverage in 1991-92 was complete to depths of 732 m. The cumulative biomass index for all three Divisions has 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. 42).

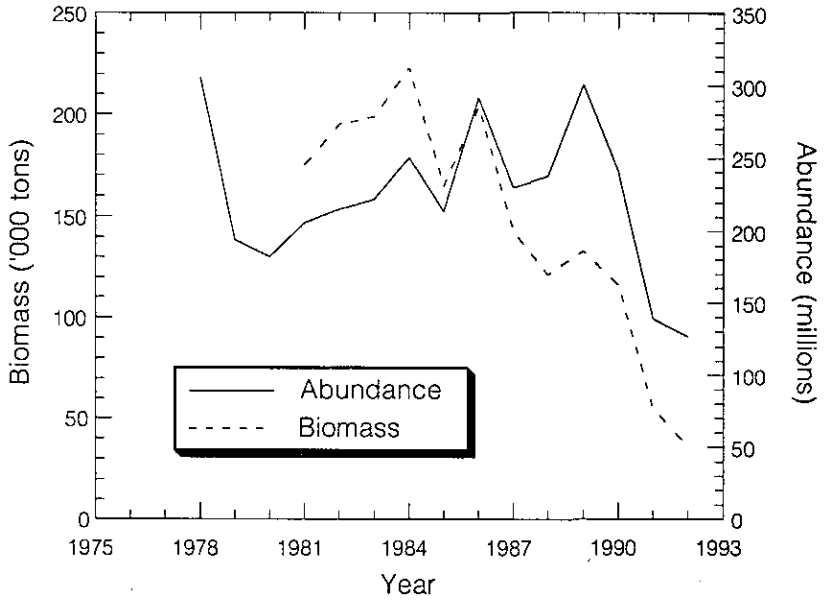

Fig. 42. Greenland halibut in Subarea 2 and Div. 3KL: biomass and abundance estimates from Canadian autumn surveys.

Longer term declines in abundance are less apparent than indicated by the biomass indices due to the fact that the declines were not consistent across all age classes. An examination of the age structure showed that the ages 7+ abundance had been declining since about 1982 whereas ages 4-6 were slowly increasing from the early-1980s to about 1989. From 1989 to 1992 these age groups declined very sharply and as with the biomass index fell to the lowest levels observed by 1992.

A review of Greenland halibut spacial distribution from Canadian surveys indicated that despite substantial reductions in biomass from the late-1970s to late-1980s in Div. 2GH there was no apparent change in the distribution pattern. No similar data were available for the 1990s to confirm whether this is still the case. In Div. 2J and 3K, the distribution pattern was also consistent until the late-1980s when Greenland halibut began to rapidly disappear from Div. 2J followed by Div. 3K a couple of years later. By 1992, the largest catches in the surveys were taken in southeastern Div. 3K and the northern tip of the Grand Bank in Div. 3L.

A Canadian deepwater survey in 1991 for Greenland halibut in Div. 3K, 3L and 3M between depths of 750-1 500 m indicated that there was no break in the continuity of the distribution from the deep slopes of Div. 3K extending into the Flemish Cap of Div. 3LM. Research vessel catch rates were similar throughout most of the area investigated although they were somewhat higher in Div. 3K.

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.

EEC 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 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-length data indicated that the abundance was clearly dominated by the ages 5-7 or the 1984-86 year-classes.

iii) **Biological studies**

STACFIS examined a length sample from the Canadian deepwater gillnet fishery. It indicated that while there were mature fish in the sample they constituted less than 15% of the catch. It was agreed that such data are critical to improving our understanding of this important resource and STACFIS **recommended** that *collection of biological samples from deepwater gillnet fishery 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 decided to use them as the basis for evaluation of stock status.

d) **Prognosis**

The large increase in catch in 1990 came as a result of a rapid expansion of the fishery in the deep water of the Regulatory Area in Div. 3LM. There was a further increase in the catch in 1991 to a level which may be as high as 25 000 tons above the recommended catch level of 50 000 tons and included further expansion into Div. 3N. In 1992 the catch was estimated to be 63 000 tons which was 13 000 tons above the recommended catch. It is of considerable concern to STACFIS that the recommended catch continues to be exceeded significantly. About 90% of the catch continues to be taken in the Regulatory Area of Div. 3LMN (mainly Flemish Pass) in comparison to the entire much wider stock area. STACFIS is also concerned that almost all fisheries on this resource are catching mainly immature individuals.

The current assessment clearly indicated that all indices of stock size in the traditional area of the fishery declined in recent years and by 1992 were at the lowest levels observed in the time series. It had been indicated from pre-recruit surveys that the 1984-86 year-classes were strong and an improvement in stock abundance and biomass were expected in this area. However, 1991 surveys showed a marked decline in their abundance and by 1992 these year-classes had virtually disappeared in Div. 2J and 3KL as determined by Canadian groundfish surveys. However, EEC surveys in Div. 3M do not show this declining trend at least to depths down to 732 m.

After evaluating the data presented at this meeting STACFIS agreed that there has probably been a redistribution of the Greenland halibut resource and that a substantial part of the stock component being exploited in the Regulatory Area of Div. 3L, 3M, and 3N is likely to have originated in Divisions to the north, at least from Div. 2J and 3KL. This was particularly apparent in that the strong 1984-86 year-classes, which disappeared in Div. 2J and 3K in recent years, appeared as a main component of the catch in 1992 in the Regulatory Area especially the 1986 year-class.

STACFIS noted that prior to 1991, advice was for the stock area in Subarea 2 and Div. 3KL, but in 1991 and 1992 concluded that the advice should include Div. 3M and 3N. STACFIS was unable to advise an appropriate TAC particularly because of the re-distribution aspect in concert with the lack of knowledge regarding stock abundance in the Regulatory Area and deeper water. It was clearly evident, nevertheless, that the current TAC is inappropriate as it applies to the historical fishing area. It is considered by STACFIS that intensive fishing effort on localized areas of abundance is imprudent given the lack of scientific information on stock structure and estimates of stock size.

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

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

Canada and Denmark (Greenland) concurred in requesting advice on Greenland halibut in Subareas 0, 1, 2 and 3 and comments on its management (see Appendix IV, Annex 2 and 3).

STACFIS addressed similar requests in 1991 (NAFO Sci. Coun. Rep., 1991, p. 84) and in 1992 (NAFO Sci. Coun. Rep., 1992, p. 120-121). STACFIS had discussed the stock structure also in 1990 (NAFO Sci. Coun. Rep., 1990, p. 88). The conclusion from those considerations was "from a biological point of view there was no reason to maintain two separate assessments for the area". STACFIS still maintains this position.

Request 1 - Denmark (Greenland). Analysis of existing information on stock delimitation in Subareas 0, 1, 2 and 3.

Request 2 - Canada. Should an overall TAC be subdivided by NAFO Divisions?

No new analyses of stock delimitation were available and Greenland halibut was still considered to comprise a single stock in Subareas 0, 1, 2 and 3. No detailed information on the distribution of the biomass was available for the total area.

In 1992 length and age compositions for the fishery in Div. 0B (1992) and in Div. 1CD became available (1987-92). The surveys series in Div. 0B (Russia), Div. 1ABCD (Japan-Greenland) and Div. 2GH (Russia) were continued. Information from groundfish and shrimp surveys in 1992 in Subarea 1 (Greenland), Div. 2J+3KL (Canada) and Div. 3M (EEC) were also available. After reviewing this information STACFIS still was unable to make a combined assessment. Particularly, the new fisheries in the Flemish Pass were not covered by surveys.

Until such time as when STACFIS can advise on a single TAC, STACFIS **recommended** the *suballocation of a possible total TAC by geographical areas. This was because the fishing fleets which exploit Greenland halibut offshore are highly mobile and STACFIS was concerned that this effort could be concentrated on a single component of the Greenland halibut stock in Subareas 0 to 3.* Even though Greenland halibut forms a single stock throughout this area, the stock does not totally mix within a year and STACFIS **advised** that TACs be set for each Subarea or Division to ensure that effort be spread fairly evenly over the stock area, and hence that no stock component be exposed to disproportionately high fishing mortalities. For management purposes, the establishment of separate allocations for inshore and offshore areas might be considered.

Request 3 - Denmark (Greenland). Allocate TACs to appropriate Subareas/Divisions and inshore/offshore areas to avoid excessive fishery pressure on single stock components.

Request 4 - Canada. What proportion of the stock occurs within the waters under the jurisdiction of the Coastal State?

STACFIS advised that the TAC for 1994 for Subareas 0 and 1 be set at 25 000 tons. For Subareas 2 and 3, STACFIS was unable to advise on an appropriate TAC, particularly because of the redistribution aspect in concert with the lack of knowledge regarding stock abundance in the Regulatory Area and deeper waters.

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 estimated biomass only included that occurring down to 1 500 m but as shown by long-line fishing, there are resources below this depth. The biomass of this stock component is unknown.

No estimate on the inshore biomass in Subarea 1 was available to STACFIS, this aspect will be investigated further in June 1994.

Concerning the stock component in Subareas 2 and 3, survey information for Div. 2GH, 2J and 3K existed for a series of years, but only one survey in 1991 provided information on the deep areas in Div. 3KLM. The stock biomass in the deep areas of Div. 3LM (Flemish Pass) was largely unknown. The survey results from earlier years were thought not to be applicable for the present situation as it is possible that a major stock redistribution has taken place after the mid-1980s.

Request 5 - Canada. Implications of changing current geographical distribution of catches between Divisions.

The inability of STACFIS to properly assess the stock, both because of the lack of data and because of lack of understanding of the stock structure, also implies that the effect of a major redistribution of fishing effort cannot be assessed. As stated above STACFIS considers that the fishery should not be concentrated on a single stock component neither in Subareas 0 and 1 nor in Div. 3LM. STACFIS is particularly concerned, when such concentrated fishing occurs, that this can generate high fishing mortalities on a single component.

b) **Research Recommendations**

The fisheries in the Flemish Pass (Div. 3LM) and offshore in Div. 0B and Div. 1CD have increased dramatically in most recent years. Research on these resources have so far not been appropriately coordinated. The different surveys have been undertaken at different times of the year, using different gears and surveys designs. No comparative fishing has been conducted.

In view of the present importance of these newly developed fisheries for Greenland halibut, STACFIS considered that there is an urgent need for joint research on these resources.

Canada and Greenland have, as Coastal States, repeatedly requested STACFIS to consider the stock boundaries of the Greenland halibut resource in Subareas 0-3. STACFIS has reviewed the available, but piecemeal information, on several occasions and have concluded that Greenland halibut probably forms a single stock unit in Subareas 0-3, but also that the exchange rate of fish between Divisions is unknown and fishing effort should therefore be spread out between Subareas/Divisions avoiding high concentrations of effort in a single small area. Two important unknowns are the southern limit of the stock distribution and whether the inshore resource in Subarea 1 contributes to the spawning stock.

The relative importance in abundance of the different offshore areas and the southern boundary of the stock distribution could be investigated by a joint survey. STACFIS therefore **recommended** that *a single joint deep water trawl survey for Greenland halibut be conducted throughout Subareas 0-3 preferably in August-September 1994. Participants in such a survey could be Canada, EEC, Greenland, Japan and Russia.* Research vessel opportunities should be investigated before the 1993 September Scientific Council meeting and the survey discussed at that meeting.

STACFIS further **recommended** that *the status of the inshore component of Greenland halibut be reviewed at the June 1994 STACFIS meeting, particularly whether these Greenland halibut contribute to the spawning stock in Davis Strait.* Also, the Greenland Fisheries Research Institute was invited to present information on investigations on estimates of sustained yield for the fisheries for Greenland halibut in these fjords.

STACFIS also **recommended** that *ongoing research programs in different laboratories be described in detail for the Scientific Council meeting in September 1993 and that the Scientific Council discuss research coordination at that meeting.* STACFIS was pleased to note the existing joint research programs, on surveys in Div. 0B and 2GH (Canada-Russia), in Subarea 1 (Greenland-Japan) and on age reading procedures. These programs have been ongoing for several years.

16. **Roundnose Grenadier in Subareas 0 and 1** (SCR Doc. 93/12, 58; SCS Doc. 93/10, 13, 16)

a) **Introduction**

A total catch of 193 tons, including 140 tons named "others" taken as by-catch in the Japanese Greenland halibut fisheries in Div. 0B and 1CD, have been reported to date for 1992 compared with 155 tons for 1991. The catch records presumably included roughhead grenadier, often taken as by-catch in the Greenland halibut fisheries, but misreported as roundnose grenadier.

Recent TACs and catches('000 tons) are as follows (Fig. 43):

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
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	0.1	0.4	0.5	0.08	0.16[1]	0.16[1]	0.19[1]	

[1] Provisional.

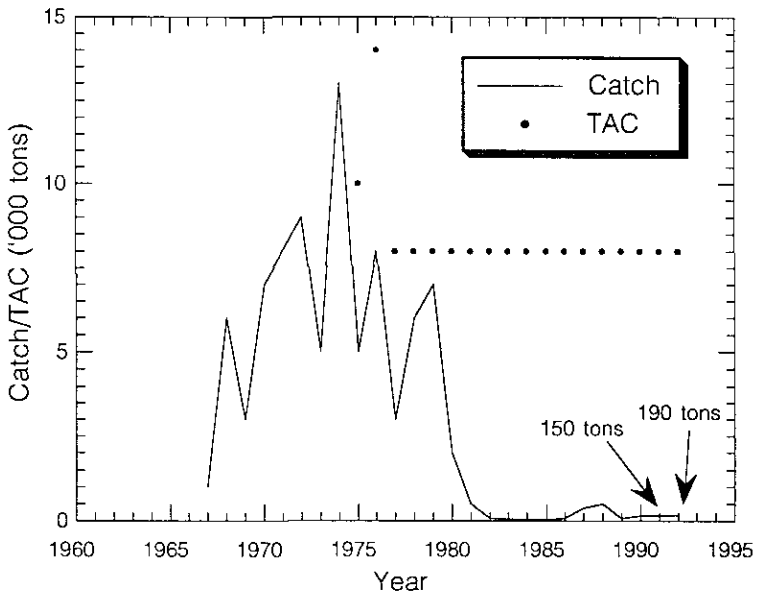

Fig. 43. Roundnose grenadier in Subareas 0 and 1: catches and TACs.

b) **Input Data**

i) **Commercial fishery data**

There has been no directed fishery for roundnose grenadier in these Subareas since 1978. No update of the catch/effort analysis which was presented previously (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
Biomass	45 800[1]	44 000[2]	5 900[3]	20 300[4]	41 700[4]	40 200[4]

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

In 1992 two surveys were conducted in August and in November/December. The August survey gave an estimated biomass of 40 200 tons in Div. 1CD while the biomass in the November/December survey which comprised comparable areas was estimated to be 1 000 tons only. The survey results indicated an immigration into the survey area during the early summer and an emigration during the winter. This migration pattern makes timing of the survey critical. Only a few roundnose grenadier were taken at depths less than 600 m. The size of the fish increased with depth and in the direction from north to south.

In November a trawl survey was conducted by Russia in Div. 0B covering depths between 500 and 1 500 m. Catches were small, maximum catches being 15 kg. Mean length was 41.1 cm and mean age was 7.8 years.

c) **Prognosis**

It was observed previously (NAFO Sci. Coun. Rep., 1987, p. 71) that the TAC of 8 000 tons represented an exploitation level of <10% of the biomass estimated from a 1986 Canadian survey, but about 20% of the biomass estimated from the Japanese surveys. The surveys did not cover the entire stock area, as roundnose grenadier also occur deeper than 1 500 m and Subarea 0 was not included in the estimate. Hence the trawlable biomass was an underestimate. STACFIS **advised** that the 1994 TAC should remain at the 1992 level of 8 000 tons.

17. **Roundnose Grenadier in Subareas 2 and 3** (SCR Doc. 93/12, 29, 74; SCS Doc. 93/10, 15)

a) **Introduction**

Prior to 1979, catches averaged about 26 000 tons but since then have only averaged about 5 000 tons. The provisional 1992 catch of 5 365 tons was down by about half from the estimated 9 000-14 000 tons taken in 1991 (Fig. 44). There has been no directed fishing effort by EEC-Germany or USSR/Russia since 1990. These fisheries traditionally took place in the Canadian zone, primarily in Div. 3K. The catch by EEC-Portugal increased from about 300 tons in 1989 to 3 211 tons in 1990, and has remained high since then. Their 1992 catch was estimated to be about 2 000 tons. Also in 1992, EEC-Spain reported 2 860 tons. These increases occurred in the Div. 3LM area and were associated with the increased effort directed toward Greenland halibut. Grenadiers are a by-catch in this fishery although there is concern that there may be some misidentification of the species actually caught, with roughhead grenadiers being reported as roundnose.

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

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
TAC	11	11	11	11	11	11	11	11	11	11	11
Catch	4	4	5	7	8	6	5	4[1]	9-14[1,2]	5[1]	

[1] Provisional.
[2] Includes estimates of misreported catches which could not be determined precisely.

Prior to the increase in Portuguese catches, the traditional fishery took place in Div. 3K and further north during the second half of the year. In the 1990s, the majority of catches had been taken in Div. 3LM and landings were reported over the entire year, reflecting the pattern of the Greenland halibut fishery.

b) **Input Data**

i) **Commercial fishery data**

Catch and effort data were available from the fisheries in the 'traditional' areas inside the Canadian zone from two sources; NAFO Statistical Bulletins and the Canadian Observer Program. The NAFO data indicated a continual gradual decline in catch rates from the

early-1970s onwards. No directed fishery data were available for the period after 1990. The Canadian Observer data were available for 1978 to 1991. The catch rates indicated a fairly stable situation from 1978 until about 1987, but they declined steadily after that.

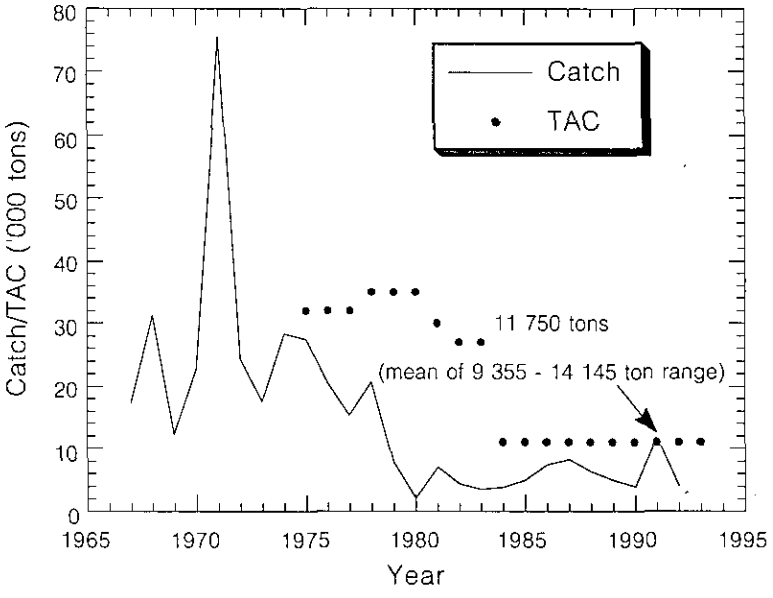

Fig. 44. Roundnose grenadier in Subareas 2 and 3: catches and TACs.

Distribution of fishing from the Observer data indicated that although in some years there was effort distributed in Div. 2G, 2H and 2J, the most consistent location was in Div. 3K at about 51°N. Depths fished ranged from just over 500 m to as deep as 2 400 m although most of the sets during the period were made at depths between 1 000-1 500 m.

STACFIS noted that there are no comparable data available from the developing fishery in the NAFO Regulatory Area.

ii) **Research survey data**

Information on catch distribution from Canadian autumn stratified-random trawl surveys was presented. It was acknowledged 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. Nonetheless, the highest catches were usually taken in Div. 3K, in the area corresponding to the location of most of the commercial effort. Catches during the surveys declined in the late-1980s and early-1990s similar to the declines in the Observer commercial catch-rate series.

Information was also available from surveys conducted by USSR/Russia from 1971 to 1992. In 1992, catches in all Divisions were below those of 1991. No concentrations were found at the traditional fishing depths in the surveyed Divisions. Catches of roundnose grenadier had decreased by a factor of 10 since the late-1970s. Mean length and age of the fish declined between 1991 and 1992. Similar to results from previous years, the mean lengths and ratio of females to males increased with increasing depth.

c) **Prognosis**

In the 1990s, the fishery in the 'traditional' area within the Canadian zone has declined and disappeared. Accompanying this decline have been declines in catch rates since about 1987

based on Canadian Observer data. Research surveys in the area, although restricted to depths less than 1 000 m, indicate similar declines during this period. In 1992, results of the Russian survey indicated no concentrations of roundnose grenadier in the traditional depths fished commercially for the areas surveyed. The precautionary TAC of 11 000 tons, in place beginning in 1983 was derived based on the fishery in this traditional area. Catch rates, as derived from Canadian Observer data, remained stable through most of the 1980s until 1987. Through this period, catches averaged about 6 000 tons. Since then, catch rates declined by approximately 50% to 1990-91. STACFIS therefore **recommended** that *the TAC for roundnose grenadier for 1994 be set at a new precautionary level of 3 000 tons, which is half the catch level for the period of catch-rate stability.* It is emphasized that this can only apply to fisheries in the 'traditional' areas within the Canadian zone.

STACFIS recognizes that in the most recent years, the catches of this stock have come from the Regulatory Area, primarily Div. 3LM. STACFIS has no information on the size or distribution of the resource in this area and therefore is unable to comment on an appropriate catch. It is noted, however, 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. Extensive research is necessary both in the Canadian zone and the Regulatory Area to better determine the status of the roundnose grenadier resource in these areas.

STACFIS is concerned that there may be considerable species misallocation of grenadier catches in the developing fishery for Greenland halibut (roughheads being reported as roundnose) and supports the STACREC recommendation to bring this matter to the attention of the Fisheries Commission.

18. **Capelin in Divisions 3N and 3O** (SCR Doc. 92/84; 93/21, 28, 54; SCS Doc. 93/10)

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:

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Advised TAC	0	0	0	0	10	10	28	30	30	30	0
TAC	0	0	0	0	10	15	28	30	30	30	0
Catch	0	0	0	0	1	7	9	25[1]	+[1]	0[1]	

[1] Provisional.

b) **Input Data**

i) **Commercial fishery data**

No commercial fishery data were available.

ii) **Research survey data**

USSR acoustic surveys during 1975-77 indicated a mean biomass of 912 000 tons. The mean stock size from 1981-89 was about 303 000 tons. Due to stocks mixing prior to spawning, STACFIS was unable to quantify what proportion of the 991 000 tons estimated from the USSR acoustic survey in May 1990 in Div. 3O would spawn in Div. 3L and in Div.

3NO. A USSR acoustic survey conducted in June 1991 in Div. 3N did not detect capelin, however, STACFIS concluded that the survey probably occurred before the arrival of spawning fish.

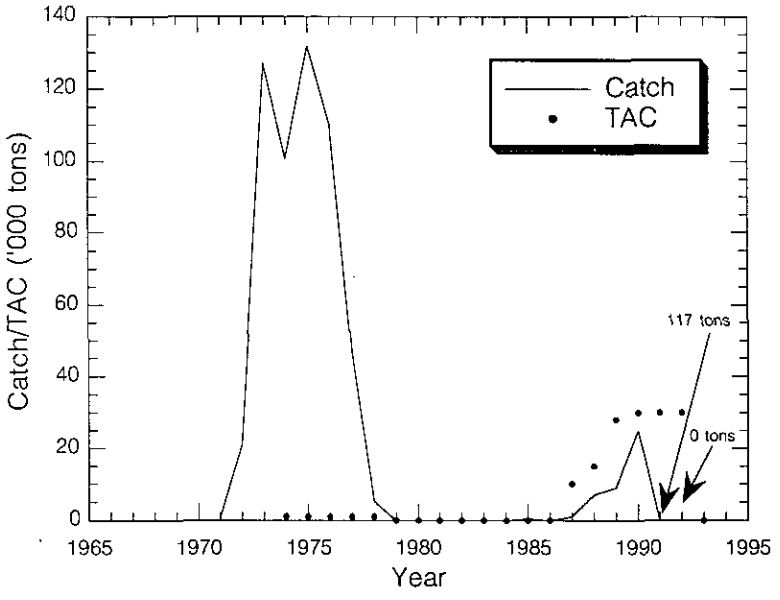

Fig. 45. Capelin in Div. 3N and 3O: catches and TACs.

An acoustic survey by Canada in Div. 3NO during 23 June-3 July 1992 provided a biomass estimate of 4 400 tons. There was a virtual absence of mature capelin older than age 2 in the survey area. Given the colder-than-normal bottom water temperatures and late spawning on beaches in Newfoundland in 1992, the very low biomass of mature capelin in Div. 3NO was most probably related to abnormal hydrographic conditions. STACFIS concluded that the Canadian acoustic survey occurred prior to the arrival of mature fish on the spawning grounds.

An 0-group capelin survey which was conducted by Russia in Div. 3LNO during 15-30 November 1991 indicated that the 1991 year-class was 88% of the strength of the strong 1983 year-class.

iii) **Trends of capelin stocks in adjacent areas**

An acoustic survey in Div. 2J and 3K by Russia during 30 October-15 November 1992 resulted in a biomass estimate of 9 600 tons, and by Canada in October 1992 in an estimate of 31 900 tons. For both survey series the 1992 acoustic biomass estimates were the lowest in their respective series.

Since 1990, as inferred from an examination of cod stomachs and somewhat from capelin by-catches collected in annual bottom trawl surveys by Canada during November and December, capelin in Div. 2J and 3KL have become aggregated into one area on the Southeast Newfoundland Shelf and the northeastern slope of the Grand Bank in Div. 3KL. In the 1980s, capelin were observed in two distinct areas, one in northern and western Div. 2J and 3K and the second in northeastern Div. 3L.

c) **Prognosis**

As in recent assessments of this stock, STACFIS had no data on Div. 3NO on which projections could be based. Similar patterns in year-class strength and biomass have been observed in capelin

stocks in Div. 2J and 3K, Div. 3L and Div. 3NO. Based on acoustic surveys, spawning stocks of capelin in Div. 2J and 3K and Div. 3L are expected to be low in 1993. *STACFIS is concerned about* the apparent low biomass levels in the Div. 3NO stock because of the implications for future recruitment to the stock and because of the importance of capelin as a forage species. Based on the above considerations, STACFIS **recommended** that *this stock be given maximum protection and advises that no capelin fishing be allowed in Div. 3NO during 1994.*

19. **Squid in Subareas 3 and 4** (SCS Doc. 93/10, 13)

a) **Introduction**

Catches 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 2 000 tons in 1992, while in Subareas 5 and 6, catches increased to 19 000 tons in 1992. Catches in Subareas 3 and 4 in 1992 were limited to by-catch in the silver hake fishery.

Recent TACs and catches('000 tons) are as follows (Fig. 46):

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
TAC	150	150	150	150	150	150	150	150	150	150
Catch	1	1	+	2	1	7	11[1]	4[1]	2[1]	

[1] Provisional data.

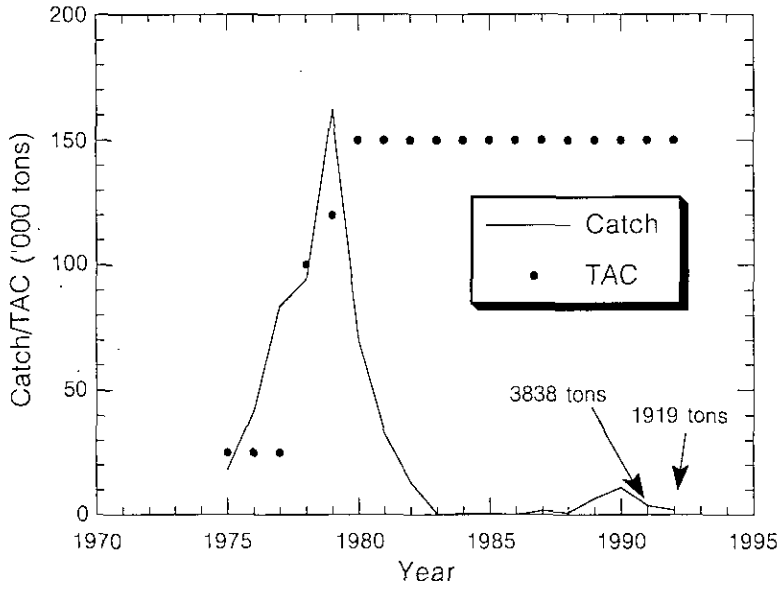

Fig. 46. Squid in Subareas 3 and 4: catches and TACs.

In comparison, the following statistics ('000 tons) are recorded in Subareas 5 and 6 for the last 5 years:

	1988	1989	1990	1991	1992
Catches	2	7	12[1]	12[1]	18[1]

[1] Provisional.

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. To estimate the recruitment, a juvenile survey which is conducted a few months in advance of the start of the fishery will be needed. 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 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.

b) **Prognosis**

There was a small scale directed fishery for squid in 1989-91 but in 1992 only squid by-catches were recorded 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. **Shrimp in Subareas 0 and 1** (SCR Doc. 93/64, 70, 72, 81; SCS Doc. 93/16)

a) **Introduction**

The nominal catch of shrimp in the offshore areas of Subarea 1 south of 71°N and the adjacent part of Subarea 0 (Div. 0A) increased from less than 1 000 tons before 1972 to almost 43 000 tons in 1976, fluctuated thereafter, but stabilized around a level of 44 000 tons during 1985-88. Preliminary statistics for 1992 indicate total catches of about 63 000 tons. The fishery has been regulated by TAC since 1977 (Table 5A; Fig. 47).

Table 5A. Shrimp in Div. 0A and Subarea 1: nominal catch and TAC (tons) included in TAC advice.

		1983	1984	1985	1986	1987	1988	1989	1990[1]	1991[1]	1992[1]	1993
Div. 0A	Total	5 413	2 142	2 640	2 995	6 140	6 087	7 235	6 177	6 788	7 493	
SA 1 Offshore, South of 71°N												
	Total	33 854	33 741	39 547	41 589	40 020	37 562	42 696	46 596	50 544	55 864	
0+1 offshore catch[2]		39 267	35 883	42 187	44 584	46 160	43 649	49 931	52 773	57 332	62 958	
0+1 advised TAC[2]		29 500	29 500	36 000	36 000	36 000	36 000	44 000	50 000	50 000	50 000	50 000
0+1 effective TAC[2,3,4]		34 625	34 925	42 120	40 420	40 120	40 120	45 245	45 245	46 225	44 200	40 600[5]

[1] Provisional data.
[2] Offshore south of 71°N.
[3] Including TAC in Div. 0A: 1983-84 - 5 000 tons, 1985-88 - 6 120 tons, 1989-90 - 7 520 tons, 1991-92 - 8 500 tons.
[4] Not including catches from vessels <75 GRT.
[5] SA 1 offshore south of 68°N + Div. 0A.

During the history of this fishery, the fishing grounds in Div. 1B have been the most important. Since 1987, however, there have been increasing catches in Divisions south of 1B.

The fishery in Div. 0A usually takes place from July to November. In Subarea 1 the fishery occurs in all months of the year, however, early in the year it is often confined to the fishing grounds in Div. 1C, 1D and 1E due to ice coverage in Div. 1A and 1B. This was also the case in 1992.

An offshore fishery north of 71°N, outside the fishing areas in Subareas 0 and 1 for which TACs have been advised, began in 1985 and yielded about 4 300 tons that year. In 1986 and 1987 catches increased to about 11 000 tons, decreased steadily to about 1 077 tons in 1991, and increased to 2 647 tons in 1992. This fishery normally occurs from June to November.

The West Greenland inshore shrimp fishery was relatively stable from 1972 to 1987 with estimated catches of 7 000-8 000 tons annually (except for 10 000 tons in 1974). Since 1988 catches have been increasing. Preliminary statistics indicate a total catch of 21 000 tons in 1992.

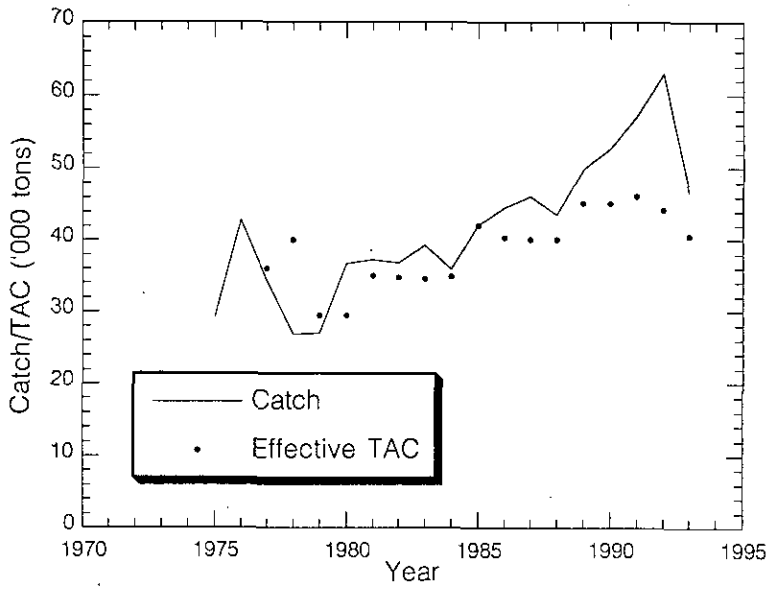

Fig. 47. Shrimp in Subareas 0 and 1: catches and TACs.

Total catches (tons) for all Subarea 1 are shown in Table 5B.

Table 5B. Shrimp in Subarea 1: total nominal catches.

	1983	1984	1985	1986	1987	1988	1989	1990[1]	1991[1]	1992[1]
SA 1 offshore (south of 71°N)	33 854	33 741	39 547	41 589	40 020	37 562	42 696	46 596	50 544	55 864
Greenland (N of 71°N)	-	-	4 349	11 045	10 700	6 660	2 522	2 121	1 077	2 647
Greenland (Inshore[2])	7 500	7 500	7 500	7 500	6 921	10 233	13 224	15 386	17 891	21 148
SA1 Total	41 354	41 241	51 396	60 134	57 641	54 455	58 442	64 103	69 512	79 659

[1] Provisional.
[2] Inside 3-mile limit. Inshore component of total catch is estimated.

At the June 1992 Meeting STACFIS advised a reduction in the TAC for Subarea 1 south of 71°N and adjacent areas in Subarea 0 from 50 000 to 40 000 tons in both 1992 and 1993. No reductions in TAC were imposed in either 1992 or 1993 for the Greenland fishery, but other measures to reduce the fishing pressure were implemented: minimum mesh size was increased from 40 to 55 mm (April 1, 1993), an Observer Program was initiated, and the size of the fleet is being reduced. Canada did not implement a reduction in TAC in 1992, but a reduction of 1 700 tons in 1993 is provisional on the 1993 assessment of the status of the resource. Also, an increase in mesh size is planned for 1993, pending new studies on the appropriate size.

b) **Input Data**

i) **Commercial fishery**

Fishing effort and CPUE (Fig. 48). Catch and effort data from the shrimp fishery in 1992 were available from Canadian vessel logbooks for Div. 0A and from Greenland logbooks for Subarea 1.

An overall increase in effort was observed from 1987 to 1991, followed by a slight decrease in 1992.

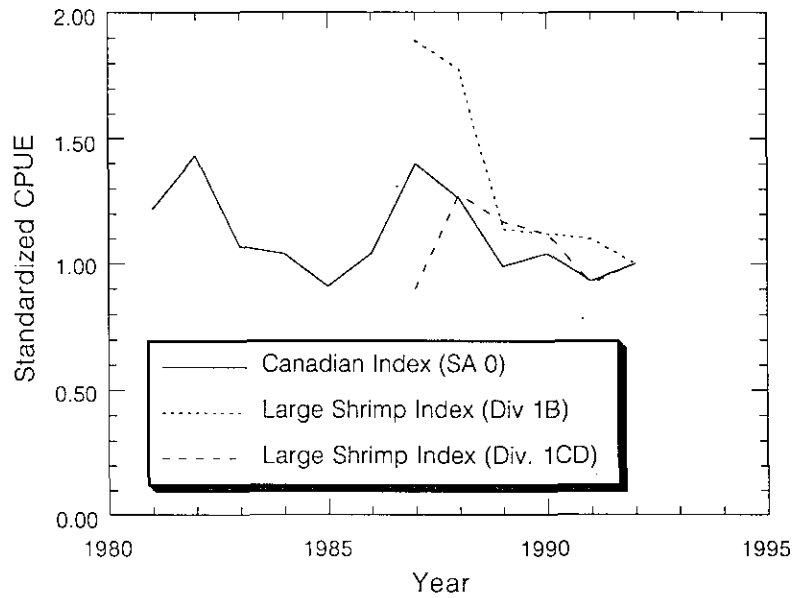

Fig. 48. Shrimp in Subareas 0 and 1: standardized CPUE indices from Div. 0A, Div. 1B and 1CD compared to nominal offshore catches (excluding catches north of 71°N in Subarea 1).

Unstandardized yearly catch rates were calculated using Canadian vessel logbook data from Div. 0A from 1981 to 1992. Because of seasonality in the catch rates and changes in the fleet over time, the same data were analyzed using a multiplicative model to produce standardized yearly catch rates. The series shows two periods of stable catch rates (1983-86 and 1989-92), separated by significantly higher levels in 1987 and 1988.

From 1987, logbook data from 27 Greenland trawlers, which record the shrimp catch by size category in the logbook, were used in a multiplicative model to establish a CPUE index for large shrimp >8.5 g (mainly females), for which discard is supposedly at a low level.

Hereby the uncertainty in interpretation of catch rates caused by possible changes in discarding procedures should be minimized. The index in Div. 1B showed a decrease from 1987 to 1989 followed by stability from 1989 to 1992. The index in Div. 1CD fluctuated without trend over the period 1988-92.

Length and age composition. Length frequency distributions obtained by observers were available from the commercial fishery in Div. 0A from 1981 to 1992 and in Subarea 1 from 1990 to 1992. The relative importance of the 1985 year-class was evident in 1990 as it

recruited to the fishery, and in 1991, when it clearly dominated the catches. This year-class was expected to change sex between 1991 and 1992, occurring as age 7 females in the 1992 catches. Although it contributed significantly as such in 1992, its occurrence was weaker than expected. Also evident was a strong component of large male shrimp, theoretically the 1986 year-class. This year-class was, however, considered to be weak based on data from preceding years.

The data from Div. 0A (separated by age) showed that the trend in catch rates series is due to the female component (age 7+).

Shrimp discards. In Div. 0A, discard rates increased from 1987 to 1991 and declined slightly in 1992, consistent with the growth and recruitment of the 1985 year-class. Since 1981, the observed average discard rate has varied between 2.3 and 6.5%. These figures are considered underestimates of the actual discard rate.

A Greenland study, initiated in 1990 to estimate shrimp *discarding* practices in Subarea 1, was continued in 1991 and 1992. Levels of discards in Subarea 1 were estimated at approximately 11 000 tons in 1990 and approximately 9 000 tons in 1991. In 1992 a discard of approximately 7 000 tons was estimated. This level of discard is not comparable to those of 1990 and 1991, since Greenland vessels in 1992 were allowed in excess of vessels quotas to land about 10 500 tons of small shrimp. The estimates indicate only a marginal decrease in discards.

Length frequency distributions obtained from the study showed that the 1985 year-class was heavily discarded in both 1990 and 1991.

ii) **Research survey data**

Abundance estimates. The data from the surveys from both offshore and inshore in recent years were recalculated for all years based on new information on wing spread.

Offshore: in July-August 1992, a stratified random trawl survey was carried out in the main area of shrimp distribution in Div. 1A to 1E and the adjacent part of Div. 0A. The area surveyed was the same as in 1990 and 1991 but extended south of the areas covered in 1988 and 1989. Because commercial fishery data suggest that shrimp densities in these southern areas appeared very low for the earlier years, the estimates from all five surveys were considered to be comparable.

The trawlable biomass estimates are as follows:

Biomass ('000 tons)	1988	1989	1990	1991	1992
South of 71°N	171	192	175	119	179
North of 71°N	22	11	12	6	21
Total	193	203	187	125	200

The estimated numbers of shrimp *in the* total areas surveyed are shown in the following table by sexual stage and year:

No. of shrimp (billions)	1988	1989	1990	1991	1992
Males (age < 7)	23.9	32.9	22.4	14.0	24.9
Females (age 7+)	10.0	6.4	8.2	5.3	6.5
Total	33.9	39.3	30.6	19.3	31.4

The abundance of male shrimp increased in 1989, due to the 1985 year-class, decreased in 1990 and 1991 and increased again in 1992 to the level of 1988. The number of female shrimp decreased from 1988 to 1989, increased in 1990, decreased in 1991 to the lowest number observed, and increased again in 1992 to the level of 1989.

Analysis of the research length frequency data showed the predominance of the 1985 year-class in 1989, 1990 and 1991 throughout the offshore area. In 1989, abundance was highest in shallower water, most animals being males of the 1985 year-class. In subsequent years, abundance was higher to the north and in deeper water, reflecting the growth and behaviour of this strong year-class. In 1992 recruitment of new year-classes (primarily the 1987 year-class) is indicated, especially in shallow water to the south.

In the abundance-at-age estimates, the 1985 year-class was well identified up to 1991. In 1992 this year-class was expected to change sex, but the number of small females was lower than expected. At the same time results show that the 1986 year-class, which was assumed to be weak in the length frequencies from earlier years, appears strong. Some concerns were raised, however, on the estimation of year-class strength from survey results, which are influenced by a few very high catches.

Inshore: in September 1992 a stratified-random trawl survey was conducted in the inshore areas in Disko Bay and Vaigat (Div. 1A). Biomass was estimated at 47 000 tons, close to the estimate from a similar survey in 1991.

The overall size composition of shrimp from the inshore survey in 1991 was similar to that for the offshore in relation to the occurrence of modes. In the inshore area, however, there was a higher proportion of younger male shrimp with a modal length of about 17 mm carapace length (CL), likely representing the 1987 year-class. In 1992, this group was found at 18.5 mm CL. Overall abundance of shrimp was similar in 1991 and 1992, but there was an evident shift in distribution between areas. In 1992 abundance of shrimp decreased in the southern parts of the Disko Bay and increased in the central areas and to the north in the Vaigat.

c) **Assessment Results**

Indices from the commercial fishery showed that the abundance in 1989-92 was stable but lower than the high 1987-88 level. The high level can be explained by the recruitment to the female component of at least two strong year-classes. The decrease from the 1987-88 level can be explained by mortality (both fishing and natural) of these year-classes. The stability since 1989 was maintained by recruitment of the strong 1985 year-class.

The research survey index from 1988 to 1992 varied around a level of 180 000 tons. The high biomass estimate in 1989 was due, in part, to the 1985 year-class which resulted in an increase in biomass in the southern areas and maintained the biomass level in the central areas. The low 1991 estimate might have been due to a decreased availability of shrimp to the research gear and/or survey area in that year and therefore the previous concerns for the level of the spawning biomass are no longer valid.

The strong 1985 year-class recruited to the fishery in 1990. It maintained catch rates in both 1991 and 1992 and should contribute significantly to the catches again in 1993. Data from both the 1992 survey and commercial fishery in Div. 0A suggested that part of the 1985 year-class did not change sex between 1991 and 1992. The reasons why a year-class would not change sex as expected could be related to density dependent or environmental factors. Accepting the former suggests the stock is healthy. If environmental factors apply, the implications are uncertain.

However, it is not until the performance of the 1993 fishery and results of the 1993 research survey are reviewed that evaluation of the status of the 1985 year-class with respect to abundance, maturation and overall contribution to the 1994 fishery can be made.

Further, the prospects for recruitment do not appear to be as bleak as forecast in 1992. The 1987 year-class shows some potential, and survey data in 1992 indicate the possibility of a strong 1989 year-class.

d) **Prognosis**

Given the success of the 1992 fishery and the estimate of shrimp biomass from the survey in 1992, it would appear that the 1991 survey underestimated the biomass and consequently that the concerns expressed about the level of the spawning biomass in 1992 are no longer valid. Also, no imminent recruitment failures were evident in the most recent data. Therefore, the basis for the STACFIS advice in June 1992 for a reduction of the TAC in 1993 by 10 000 tons no longer applies.

In light of recent stable trends in catch rates, the appearance of new year-classes in size composition data and the apparent stability in biomass estimates STACFIS **advised** that the TAC in both 1993 and 1994 be set at 50 000 tons. Concern is, nevertheless, expressed over the steady increase in catches in recent years. Continuation of this trend is not considered a cautious approach to resource management and could lead to over-exploitation. Any increase in fishing pressure should only be done after a level has been maintained for several years with no negative effects on stock size and composition.

e) **Response to Denmark (Greenland) Request for Advice**

The Scientific Council was requested to consider for Northern Shrimp in Subareas 0 and 1, *the biological and practical implications of combining all areas of stock distribution (i.e. including Subarea 1 north of 71°N and Subarea 1 inshore) for stock assessment purposes.*

Available commercial and survey samples from Div. 0A and Subarea 1 both north and south of 71°N and inshore in Div. 1A showed the occurrence of similar modes in the length distributions, and that the 1985 year-class was prominent in all areas. Although differences were observed in the abundance of size groups between areas, it was agreed that the areas might constitute parts of a single population. STACFIS noted that studies are being undertaken to determine the relationships between shrimp from the different areas by genetic methods.

21. **Shrimp in Denmark Strait** (SCR Doc. 93/51, 60, 63, 65, 66, 84; SCS Doc. 93/16)

a) **Introduction**

The fishery was initiated in 1978 and catches increased rapidly to 1980, decreased and remained stable from 1981 to 1983, increased steadily from 1983 to 1988 (12 500 tons) and then decreased again to 1992 (Fig. 49). In 1992 the total nominal catch was about *7 200 tons.*

Recent catches and TACs (tons) are as follows:

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Total catch eastern side	43	742	1 794	1 150	1 330	1 424	1 326	281[1]	465[1]	1 440[1]	
Total catch western side	4 132	5 989	6 316	9 814	10 848	11 125	9 416	9 895[1]	8 189[1]	5 767[1]	
Total	4 175	6 731	8 110	10 964	12 178	12 549	10 742	10 276[1]	8 654[1]	7 207[1]	
Advised TAC	4 200	4 200	5 000	...	...	...	10 000[2]	10 000[2]	10 000[2]	8 000	5 000
Effective TAC western side	5 725	5 245	6 090	7 525[3]	7 725[3]	8 725[3]	9 025[3]	14 100	14 500	13 000	9 563

[1] Provisional.
[2] Advised as a precautionary measure.
[3] Not including Greenland fishery north of 60°30'N.

The fishery takes place primarily in the area of Strede Bank and Dohrn Bank as well as on the slopes of Storfjord Deep. The available fishing grounds at any given time depends heavily on the ice conditions. The main fishing area extends from approximately 65°N to 67°30'N and between 26°W and 34°W. Effort patterns of the three most important fleets (Greenland, Norway and Iceland) were variable. Since 1990 the effort has decreased in both spring (January-June) and autumn (July-December). The Norwegian effort during the spring fishery was variable between 1986 and 1990, but increased substantially in 1991 and 1992, while effort in the autumn fishery increased to 1989, declining thereafter. The overall pattern over the years was quite variable for the Icelandic fishery.

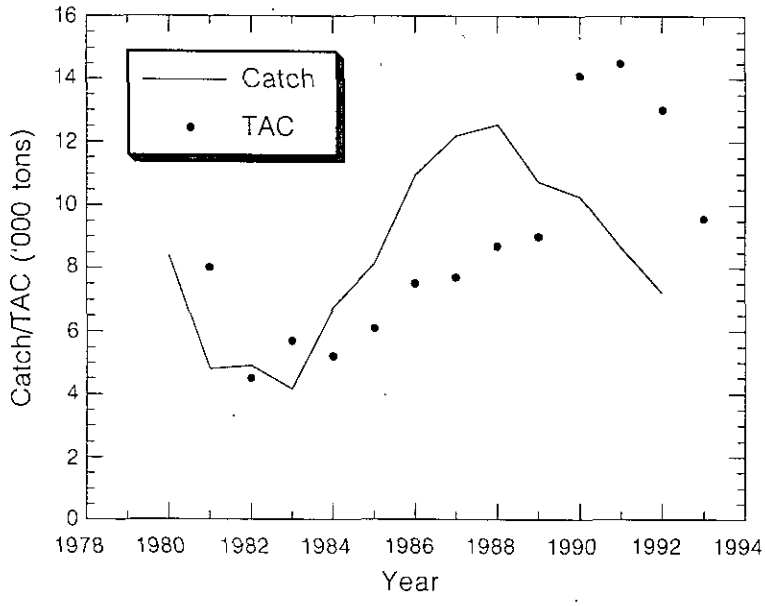

Fig. 49. Shrimp in Denmark Strait: catches and TACs.

b) **Input Data**

i) **Commercial fishery data**

Fishing effort and CPUE. Catch and effort data from logbooks were available from Greenland, Norway, Iceland and EEC-France since 1980, and from Denmark and Faroe Islands since 1986.

Total effort values showed the same pattern as catch. Between 1980 and 1989, effort increased from about 35 000 hours to more than 100 000 hours, declining thereafter to about 82 000 in 1992. The fishery from July-December became more important by the end of the 1980s, with effort increasing from about 26% to about 50% of the annual total.

Unstandardized catch rates (Fig. 50) were without trend from 1983 to 1987 followed by a substantial decline to 1989. Values for 1990, 1991, and 1992 were similar to the low 1989 level. The 1989-92 level was about 50% of the level seen from the early to mid-1980s.

Standardized catch rates series were calculated (Fig. 51). for the period 1987 to 1992 for the three countries, Greenland, Norway and Iceland. The Greenlandic catch rate declined steadily since 1987 whereas the Norwegian catch rate declined from 1987 to 1989 and remained stable thereafter. The Icelandic catch rate remained relatively stable between 1987 and 1989, increased substantially between 1989 and 1991, and remained stable between 1991 and 1992.

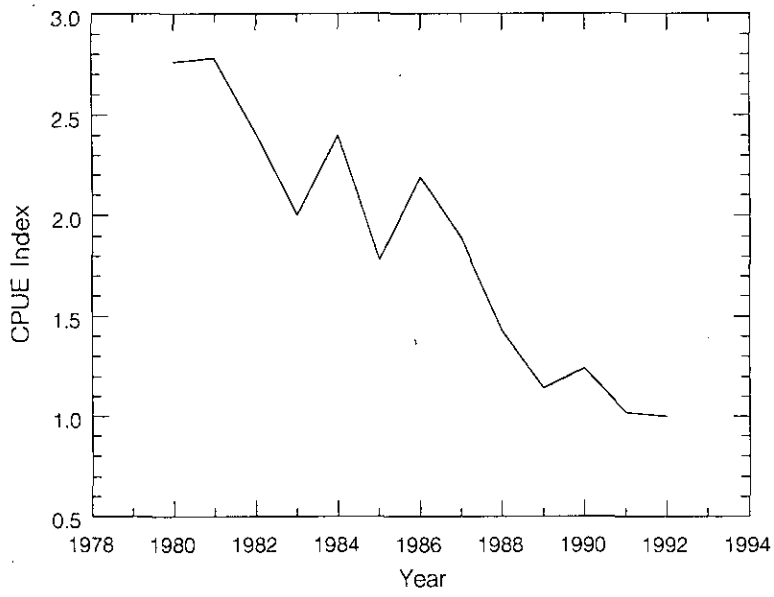

Fig. 50. Shrimp in Denmark Strait: unstandardized catch rates.

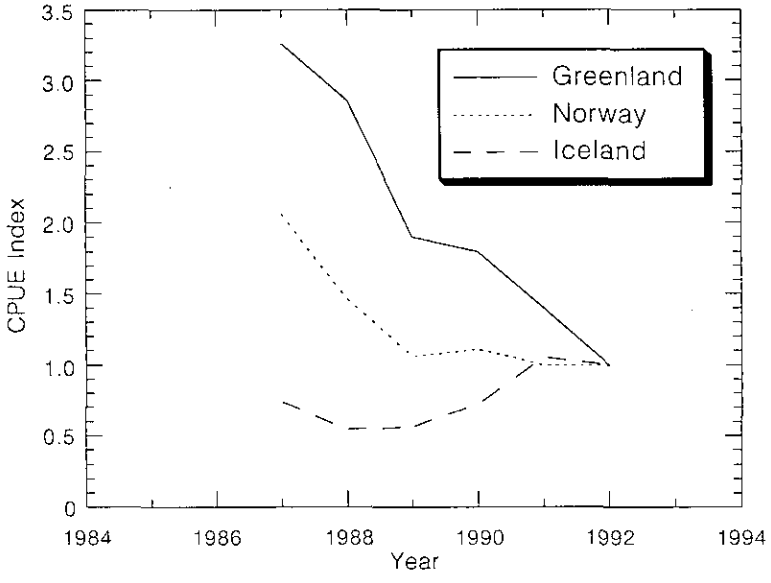

Fig. 51. Shrimp in Denmark Strait: standardized catch rates.

Biological data. The Icelandic observer samples taken in the autumn of 1987 and 1988 showed that the catches east of the midline were comprised mainly of female shrimp with a distinct mode at 30 mm CL. The 1990 autumn samples showed the increased importance of the male component (about 50% compared to 32 and 26% in 1987 and 1988). The 1991, 1992 and 1993 samples taken in spring showed that male shrimp dominated at this time in all three years.

The occurrence of a component of female shrimp with a mode at 26 mm in the 1990 samples suggested that sex change occurred earlier than normal. A study of female maturity ogives in Icelandic samples in the years 1985 to 1992 suggested a drop in the values of L_{50} for the year 1990 only.

ii) **Research survey data**

A stratified-random trawl survey was conducted by Greenland in Denmark Strait in October, 1992. The biomass estimate of 1 044 tons was lower than the 1990 estimate (1 860 tons) for the same area. The Norwegian surveys from 1985 to 1989 produced estimates between 25 000 and 50 000 tons. Investigations showed that differences in survey design should cause the Greenlandic survey (stratified-random) to provide biomass estimates of only 20-30% of the Norwegian survey (fixed stations) results.

Greenland survey samples from 1989, 1990 and 1992 showed an increase in the proportion of males over the period which was consistent with a trend evident from the 1985 to 1989 Norwegian surveys. However, overall abundance declined, especially for females.

	Percent males							
	1985	1986	1987	1988	1989	1990	1991	1992
Norway	43.8	41.4	53.5	58.5	58.0			
Greenland					63.1	62.5	-	78.3

The data also showed that males in 1990 and 1992 did not attain the large sizes evident in 1989. Further, the proportion of small females was higher in 1992.

The survey data showed an increase in the total numbers in the western part of the survey area in 1992. The number of both males and females were only 10% of the abundance of the stratum with highest abundance in 1990. Abundance increased in the area around the mid-line between Greenland and Iceland.

iii) **Future studies**

STACFIS also noted that in order to assess whether or not the process of sex inversion has changed since 1990, additional sampling would be required from all fleets over the entire fishing season. As well, a study of all samples available from each fleet should be initiated.

c) **Assessment Results**

As interpreted in recent years, the abundance of the resource on the fishing grounds is thought to be at a lower level than it was during the first half of the 1980s. The decrease of CPUE associated with an increasing proportion of male shrimp in the survey data reflects a decrease in the abundance of the females.

Standardized catch rates showed different trends for the Icelandic, Norwegian and Greenlandic fleets. The Greenlandic data show a declining trend from 1987 to 1992, whereas the Norwegian data suggest stability since 1989, and the Icelandic data an increase since 1988. Therefore, there is some uncertainty whether the stock has stabilized since 1989 at a low level, as indicated in the unstandardized catch rates and Norwegian data, or is still declining as suggested in the Greenlandic CPUE and in the estimates of biomass. At present, it is not possible to determine which is correct.

d) **Prognosis**

In 1991, STACFIS advised an arbitrary reduction of the TAC from 10 000 tons to 8 000 tons in response to the low levels of biomass. In 1992 a further reduction to 5 000 tons for 1993 was advised in an attempt to provide protection for the spawning biomass and rebuild the stock. Given the continued low level of the shrimp stock abundance in Denmark Strait and the uncertainty in the interpretation of the abundance indices, STACFIS **advised** that the TAC for 1994 should be 5 000 tons.

STACFIS anticipates that this TAC level of 5 000 tons will have to be maintained for several years to be effective.

22. **Other Finfishes in Subarea 1** (SCR Doc. 93/26, 53, 58).

Based on annual EEC-Germany groundfish surveys (1982-92) off West Greenland (0-400 m) a drastic decline in total fish biomass indices were observed beginning in 1988. The most abundant fish species (cod, redfish, American plaice and spotted wolffish) contributed most to the decline. In 1992 the overall decrease in biomass and abundance continued and amounted to 41% and 29%, respectively, in comparison with the last 1991 estimate.

During the annual joint Greenland/Japan surveys (1987-92) covering the depth range between 400 and 1 500 m in Div. 1A-1D, with emphasis on Greenland halibut, roundnose grenadier and redfish, the proportion of other finfish in 1992 amounted to about 20% of total fish biomass, which is at the same level as in 1991. As in the EEC-German survey the total biomass of other finfish decreased by 49% from 1991 to 1992.

There was no clear explanation to the decline in biomass, and it can not be explained by fishery. The phenomenon was observed elsewhere in the North Atlantic and among others, off eastern Canada.

A longline trial fishery for deepwater fish in Div. 1D and 1E in 1992 was carried out in cooperation between Norway and Greenland in May-June. Besides Greenland halibut the main catches consisted of roughhead grenadier, blue hake, northern wolffish and skates. Catch per 1 000 hooks for roughhead grenadier, blue hake and northern wolffish was 57, 16 and 12 kg, respectively.

V. RESPONSES TO FISHERIES COMMISSION REQUESTS

The following are the STACFIS responses to questions by the Fisheries Commission:

1) **Cod in Divisions 2J, 3K and 3L** (SCR Doc. 93/47)

The Scientific Council was again requested 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.

Estimates of the proportion of the cod biomass in Div. 3L in the Regulatory area were updated to include the 1992 research vessel survey data. The results for autumn surveys were similar to those presented previously. 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 and 16.1 % in 1991 and 1992 respectively. The results from the survey series used are as follows:

Season RV survey conducted	Years RV survey conducted	Range of proportions of Div. 3L biomass occurring in the Regulatory Area (1992 values in brackets)	Average
Winter	1985-86	23.8-26.8	25.3
Spring	1977-92	0.4-10.8 (16.1)	4.4
Autumn	1981-92	0.5-7.7 (1.2)	2.8

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 since 1981, continued to 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. The average breakdown of biomass by Division is as follows:

Division	Mean relative proportion of Div. 2J+3KL biomass (%)	1992 Autumn (%)
2J	33	3
3K	34	15
3L	33	82

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, and there were no annual trends. Values presented from recent spring and autumn surveys may be underestimated as there is evidence that there may be a distributional shift of cod to deeper water. These surveys are conducted to depths of 400 fathoms (732 m). Cod have been observed during winter hydroacoustic surveys in depths to 930 m and sampling reported from Portuguese commercial fishery in 1992 show cod catches in Div. 3L to 911 m.

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 combined for Divisions 2J+3KL were similar to those which occurred in Div. 3L inside the 200-mile fishing zone.

VI. AGEING TECHNIQUES AND VALIDATION STUDIES

1. Report on Methods of Ageing Silver Hake Otoliths

STACFIS continued to support co-operative studies on silver hake otoliths by Canada and Russia. As was stated in reports of the past two years, STACFIS recognized that experiments to validate age readings using radio-nucleotides was ongoing and encouraged its completion. STACFIS reiterated its previous **recommendation** that upon completion of the radio-nucleotide studies, one comprehensive ageing manual be prepared by Canadian and Russian scientists.

2. Report on the Otolith Exchange of American Plaice and Greenland Halibut

Exchanges of otoliths from American plaice and of otoliths and scales from Greenland halibut from various areas in the Northwest Atlantic have been carried out. For American plaice, the exchange was complete but the results have not yet been tabulated. Further work on age validation of American plaice from Div. 3M was also underway to estimate length-at-age from back-calculation (measurement of growth rings on otoliths) and compare these with the mean length-at-age from otolith readings. This work has focused on the strong 1979 year-class which was dominant in the catches from the Canadian RV surveys in 1982-85 and was still occurring in the fishery.

For Greenland halibut, the exchange was ongoing and results will be tabulated when completed. For many readers, scales were proving to be very difficult, if not impossible, to interpret.

3. **Other Ageing and Validation Studies Reported**

STACFIS had no further contributions on ageing.

VII. GEAR AND SELECTIVITY STUDIES

No new information was available on gear research. It was anticipated that scientists involved in gear research will be preparing results of their work for the upcoming NAFO Special Session during the Annual Meeting in September, 1993.

VIII. RELATIONSHIPS BETWEEN ACOUSTIC BIOMASS ESTIMATES AND OTHER METHODS

STACFIS noted its recommendations at the 1992 meeting.

There was no contribution on this item. Recognizing the importance of this item in relation to assessment work, STACFIS reiterated its **recommendation** for special research that the relationship between acoustic survey estimate of mature biomass and inshore catch rates continues to be investigated (NAFO Sci. Coun. Rep., 1992, p. 19).

IX. REVIEW OF SCIENTIFIC PAPERS

Recognizing the large number of SCR documents presented at this meeting and the lack of adequate time to review the majority of the non-assessment type papers, STACFIS deferred SCR Doc. 93/5, 22, 23, 30-39, 41-43, 45, 48, 55-57, 60, 65, 68 and 69 for consideration at the September 1993 Meeting. It was noted that some data from some of the above documents were presented to STACFIS for certain assessments.

Three documents containing biological information relevant to this meeting were reviewed and are summarized below.

1. **Greenland Halibut Feeding** (SCR 93/17; 18)

These documents dealt with feeding of Greenland halibut in the area where the Spanish deepwater fishery takes place, around the Flemish Pass, at depths between 700 and 1 500 m. A 24 hour feeding cycle was found according to which young individuals reach maximum intensity of feeding between 0600 and 1200 hours, whereas the largest individuals showed peaks at dawn and at dusk. An inverse relationship was found between intensity of feeding and catch rates.

The most important prey items were identified as follows: Cephalopods (32%), decapod crustaceans (22%) and fishes (39%). Cannibalism accounted for 2%. Waste products originated by commercial fleets also appeared as an important component of the diet. The variation of the diet according to predator size, bathymetric distribution and season of the year, was also described. The index of stomach emptiness was found to decrease with the length of the predator.

2. **Cod Trophic Relations on the Newfoundland Shelf** (SCR Doc. 93/14)

Data on the distribution, size-age composition and feeding of cod in NAFO Div. 3KLNO in the spring-summer seasons of 1987-91 were summarized. The diet of cod from Div. 3K was dominated by shrimp, from Div. 3NO by sand eel, and from Div. 3L by crab. Capelin was an important prey for cod in all areas. The distribution and biomass of the first three species did not show significant year-to-year variations. These species appeared to dominate the cod food supply and provide sustained minimum food requirements for sustenance of the population. Since the distribution and stock size of capelin were highly variable, the proportion of capelin contributing in cod diets was also variable. These changes were proposed to have been a major reason behind abrupt variations of yearly growth increments in cod during 1985-91.

X. OTHER MATTERS

1. Progress Report on the September 1993 Special Session

STACFIS received a status report for the Symposium on "Gear Selectivity/Technical Interactions in Mixed Species Fisheries" from the co-conveners S. Murawski (USA) and P. A. M. Stewart (EEC-UK). STACFIS encouraged the view of the co-conveners to set up a poster session and endorsed the draft program for the symposium as proposed by S. Murawski. The committee was pleased with the comprehensive slate of papers received to date, and was thankful to the co-conveners for their enthusiastic work preparing for what appears to be an interesting and popular program.

2. Progress Report on the September 1994 Special Session

STACFIS noted that the Environmental Subcommittee had addressed the progress to date on 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" (co-conveners E. Buch (EEC-Denmark), M. Sinclair (Canada) and M. Stein (EEC-Germany)), and was pleased with the considerable progress made with preparing and circulating the announcement notices for this Symposium.

3. Progress Report on the September 1995 Special Session

STACFIS received a Working Paper from the co-conveners J. Sigurjonsson (Iceland) and G. Stenson (Canada) reporting the proposed general theme of the Symposium and some potential specific topics. STACFIS was pleased with the proposal and suggested some additional specific topics. The Assistant Executive Secretary was requested to convey those to the co-conveners.

4. Review of Arrangements for Conducting Stock Assessments and Documentation of Assessments

STACFIS noted its preliminary discussion (under Agenda Item II.4.a) on the importance of having periodical workshops on stock assessment methodology every second or third year. It was agreed that further discussions should be undertaken by the Scientific Council. It was agreed that this matter should be undertaken at the September 1993 Meeting in conjunction with the question of restructuring the Scientific Council.

5. Review of Report by the Joint ICES/NAFO Working Group on Harp and Hooded Seals

STACFIS reviewed the report presented by the Working Group on the Workshop on Survey Methodology for Harp and Hooded Seals which was held during 5-12 October, 1992 in Archangelsk, Russia. During the workshop, documentation describing current survey methodologies and results was presented. Much of the current work had been directed at aerial survey techniques incorporating photography and/or visual techniques for population enumeration. There was also considerable discussion on the methods of analysis once the survey data had been collected, and a list of potential problems and sources of error identified. It was stressed that careful attention must be paid to these considerations when designing, analyzing and reporting on surveys.

A number of conclusions were reached during the Workshop: efforts should be continued to improve the biological, technical and analytical aspects of estimation surveys, all sources of potential errors should be considered when planning, conducting analyzing and reporting surveys, direction and extent of potential errors should be estimated whenever possible using the appropriate statistics, and groups using these data should include considerations of the statistics. The Workshop also suggested that a future Workshop be held to examine more closely the statistical aspects of the estimation survey methods. The final recommendation of the Workshop was that the proceedings be published by either ICES or NAFO.

STACFIS endorsed and supported all of the **recommendations** as well as the suggestion for a future Workshop. It was considered that the proceedings would be most appropriately published in the ICES Cooperative Research Report series. It was also agreed that a volume of Council Studies should be made available to the Working Group for publication of a collection of papers from the Workshop if they were deemed to be of acceptable standard. The Secretariat was requested to pass this information along to the Chairman of the Working Group. The letter should also indicate NAFO's continuing interest in activities of the Working Group.

6. **Other Business**

a) **Liver Abnormalities in American Plaice in Subarea 3**

It was noted that a preliminary note was received by the Secretariat from a private research group in Newfoundland regarding high levels of incidence of liver abnormalities in American plaice in Subarea 3. STACFIS agreed this matter should be reviewed during the September 1993 Meeting.

b) **Topic for Review of Assessment Methods**

Regarding recommendation made under Item II.4.a, STACFIS agreed that discussions on selecting possible topics for review of assessment methods should be deferred to the September 1993 Meeting.

7. **Acknowledgements**

There being no other business, the Chairman thanked the committee members for their good cooperation and extended special thanks to the Designated Experts having had the most strenuous work during the meeting. The meeting was then adjourned.

ANNEX 1. REPORT OF THE SUBCOMMITTEE ON ENVIRONMENTAL RESEARCH

Chairman: M. Stein Rapporteur: K. Drinkwater

The Subcommittee met at the NAFO Headquarters at 192 Wyse Road, Dartmouth, Nova Scotia, Canada, on 3 June, 1993, to consider environment-related topics and report on various matters referred to it by STACFIS. Scientists attended from Canada, Denmark (in respect of Faroe Islands and Greenland), European Economic Community, Iceland, Japan and Russian Federation.

The Subcommittee reviewed the following documents: SCR Doc. 93/1, 8, 9, 27, 33, 38, 41, 44, 46, 49, 50, 87, 88; SCS Doc. 93/12.

1. Chairman's Report

The Chairman welcomed the Subcommittee members and noted that they were meeting at the beginning of the NAFO Scientific Council Meeting as recommended by the Environmental Subcommittee last year and agreed upon by the NAFO Scientific Council. By holding the meeting early, environmental information would be available prior to discussion of stock assessments.

The Chairman also noted that although the number of papers this year was down, they were of high quality.

2. Marine Environmental Data Service (MEDS) Report for 1992 (SCR Doc. 93/46)

During the last year MEDS completed the implementation of their new quality control and duplicate checking programs and they are busy processing their backlog of data.

a) Data Collected in 1992

Data from 3 082 oceanographic stations collected in the NAFO area were sent directly to MEDS in 1992. An additional 3 659 stations were received through Integrated Global Ocean Service System (IGOSS).

The number of stations occupied whose data have not been received by MEDS was 3 597, approximately 35% of the total stations occupied. In comparison, 55% were not received last year.

The number of stations from which MEDS received data directly was up by a factor of nearly 5 from last year, while the number of stations from which data were provided through IGOSS decreased by 1 000.

b) Historical Data Holdings

Data from 6 646 oceanographic stations collected prior to 1992 were obtained during the year, up by approximately 1 900 over the previous year.

c) Drift-buoy Data

A total of 71 drift-buoy tracks were received by MEDS during 1992 representing 66 buoy months. This amounted to a decrease of 35% in buoy releases and over 50% in buoy months compared to the previous year. Plots of the buoy tracks by season were presented.

d) Current-meter and Thermistor Chain Data

Data collected in 1992 within the NAFO area included 21 sites, 68 instruments and 4 697 mooring days. Although the number of sites and instruments was down slightly from 1991 the number of mooring days was up almost 20%.

e) **Wave Data**

In 1992 almost 91 000 wave spectra were obtained, a substantial rise (almost 12 000) from the previous year. The large increase in number of spectra were due to the instalment of a permanent network of moored wave buoys in the area.

f) **Environmental Conditions**

Based on the 1992 IGOSS data, a review of monthly temperature anomalies relative to the Levitus climatology for the NAFO region was presented.

Seasonal anomaly plots of temperatures at the sea surface and 200 m generally showed negative anomalies on the Grand Banks, northern Newfoundland and southern Labrador as well as in the outer Gulf of Maine and along the Middle Atlantic Bight. Slope waters were generally warmer-than-normal. The size of some of the anomalies exceeded 10°C. These were not considered to be real but rather indicated problems with the Levitus climatology. It was suggested by the MEDS representative that a better regional coverage on climatology is needed.

3. **Review of Environmental Studies in 1992**

a) **Subareas 0 and 1** (SCR Doc. 93/8, 9; SCS Doc. 93/12)

During the annual German groundfish survey (SCS Doc. 93/12) CTD measurements were taken at 42 fishing stations, however due to the lateness of the season standard sections were not occupied. XBT sections from surface to 750 m were taken in the eastern North Atlantic during late-November and December.

Monthly air temperature anomalies and changes in the ice cover in the Northwest and Northeast Atlantic regions were described in SCR Doc. 93/8. A computer video display of these data was presented at the meeting. Below normal air temperatures were observed over the Labrador Sea during most of 1992 continuing the trend of anomalous cold conditions since 1990 and similar to conditions in the early-1970s and early-1980s. In contrast, the air temperature anomalies over most of the Northeast Atlantic were generally above normal. The air temperature anomalies were attributed to the atmospheric circulation pattern. Predictions that the air temperatures will not begin to warm significantly until after the turn of the century were made on the basis of analysis of the past air temperature records from Nuuk. The ice extent in the Labrador Sea was above normal especially in the late-winter of 1992. Temperature and salinity distributions at three standard sections off East Greenland were also described.

Standard sections off West Greenland conducted by the Royal Danish Administration of Navigation and Hydrography in June were discussed in SCR Doc. 93/9. Cold air temperatures, especially in winter over West Greenland, resulted in cooling of the coastal waters and greater than normal coverage of sea ice. Cold sea temperatures were observed over Fylla Bank comparable in magnitude to the cold periods around 1970 and the early-1980s. At depths below 150 m near normal conditions were found in Atlantic waters. It was noted that Irminger Water was observed further north than usual.

b) **Subareas 2 and 3** (SCR Doc. 93/1, 33, 38, 41, 87, 88)

Surface layer temperatures from Russian surveys in Subareas 2 and 3 showed primarily negative anomalies from the long-term mean (1977-91) during May to October (SCR Doc. 93/1). However, there was an increase in temperature compared to 1991. Temperatures in the Labrador Sea also rose while those on the Scotian Shelf generally were lower than the previous year but still above the long-term mean.

Sea temperatures recorded during the annual autumn Canadian groundfish survey in Div. 2J+3KL showed colder-than-normal sea-surface temperatures in November 1992 and lower than that in the same month in 1991 (SCR Doc. 93/88). The CIL over the Northeast Newfoundland shelf and off

Cape Bonavista was more extensive than normal in the fall of 1992. Data from Station 27 off St. John's, Newfoundland, showed negative anomalies throughout the water column in the fall of 1992 although a slight warming relative to last year was observed in the near bottom waters. Negative bottom temperature anomalies were observed on the Grand Banks and the Northeast Newfoundland Shelf.

Temperature data from Div. 3L in the spring of 1993 indicated continuing cold conditions in the region (SCR Doc. 93/87). Air temperature anomalies along the Labrador coast and off Newfoundland were well below normal, the sea ice extended further south than usual, and ocean temperatures at Station 27 were well below normal.

The influence of temperature on cod distributions as deduced from trawl surveys was examined in SCR Doc. 93/33. Fish concentrations over the years 1981 to 1989 showed the winter assemblages offshore, the spring migration inshore and the cod on the plateau of the Grand Banks in summer. The relative abundances between Subareas showed that since 1989 cod have disappeared from Div. 2J and relatively more have been found in Div. 3L. Also, since 1989 the relative abundance in the autumn of the Bonavista trough/slope aggregation had increased sharply, whereas the plateau aggregations had undergone large variability with maxima in 1985 and 1990 and minima in 1982, 1986 and 1992. It was suggested that the relative densities associated with the plateau aggregation were positively correlated with the areal extent of the CIL.

Recruitment predictions for Div. 2J+3KL cod, based upon a previously published regression with salinity, were found to be well correlated with recent recruitment estimates (SCR Doc. 93/38). Good recruitment occurred in years of high salinity. The addition of spawning stock biomass in the regression significantly increased the percentage of the variance explained by the relationship. Based on this regression and recent salinity data, recruitment was expected to be low in 1990 and 1991. A similar but weaker relationship between recruitment and salinity was found for cod in Div. 3L and Subdiv. 3Ps.

Significant interannual differences in the spawning time of Atlantic cod as measured by examination of dissected gonads collected on research trawls in Div. 3L, Div. 3NO and Subdiv. 3Ps were found (SCR Doc. 93/41). Cold temperatures were associated with delayed spawning in Div. 3L but associated with early spawning in Subdiv. 3Ps. In Div. 3L the delayed spawning was attributed to the influence of temperature on gonad development. In Subdiv. 3Ps, however, the strong thermal gradient between the shelf and slope waters that develop during cold years was believed to delay onshore spawning migration. The cod remained in the warmer slope waters longer and the gonads developed more quickly than if they had moved inshore. When they did eventually move onto the Bank to spawn, it occurred earlier than normal.

c) **Subareas 4, 5 and 6** (SCR Doc. 93/27, 44, 49)

Over the past 45 years the dominant ocean climate feature on the Scotian Shelf and in the Gulf of Maine was a cooling and freshening between 1952-67 followed by a reversal of these trends (SCR Doc. 93/44). The largest decrease was subsurface and appeared to have originated in the slope waters adjacent to the shelf. The warm and cool periods corresponded to times of weak and strong transport in the Labrador Current. A simple model was presented that indicated the observed variations of the westward transport of the Labrador Current could significantly contribute to the measured temperature and salinity fluctuations from the Laurentian Channel to the Gulf of Maine.

Investigations of the seasonal and interannual variability in the position of the northern boundary of the Gulf Stream from upwards of 20 years of satellite imagery were described (SCR Doc. 93/49). The Gulf Stream was offshore during the winter and spring and further inshore from mid-summer through the autumn with the maximum northward position occurring in November. In the early-1980s the stream was approximately 30 km south of its long-term mean position. It moved northward to the mid-1980s, fluctuated at levels generally inshore of the mean, and in recent years had been at or near its maximum location, approximately 50 km north of its mean position.

Monthly monitoring of sea-surface temperatures on a transect across the Middle Atlantic Bight showed generally cooler-than-normal conditions, by 0.5°C in 1992 (SCR Doc. 93/27). Similar below normal temperatures were found in the Gulf of Maine. Surface salinities were above average for the year in the Middle Atlantic Bight but below average in the Gulf of Maine. Bottom temperatures on the Middle Atlantic Bight averaged slightly below normal through most of the year but below normal along the slope. Colder-than-normal bottom temperatures also covered the southern Scotian Shelf but in the Gulf of Maine they were near normal.

4. ***Overview of Environmental Conditions in 1992*** (SCR Doc. 93/50)

A review paper was presented based on several long-term oceanographic and meteorological data sets as well as results summarized from available research documents. Highlights 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 and westward shift in the position of the Icelandic Low.

b) Similar to 1991, ice formed early in 1992, 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 1992 was slightly less than half the number in 1991 but it was still the second highest in the past 7 years.

d) Below normal temperatures were observed throughout most of the water column at Station 27. For the near bottom waters, this continued a trend that has lasted ten years.

e) The areal extent of the CIL water was greater than normal but had decreased substantially from 1991.

f) In offshore waters, cold SSTs were found on the Grand Banks, off northern and southeastern Newfoundland, and along the Labrador Shelf. Similar cold conditions were observed in the Gulf of Maine and on the Middle Atlantic Bight.

g) Annual coastal sea temperatures at Halifax and St. Andrews were slightly below normal, and Boothbay Harbor was normal in 1992.

h) Deep water temperatures on the Scotian Shelf (Emerald Basin) and in the Laurentian Channel at Cabot Strait rose to above normal temperatures from the extremely cold conditions last year. This change was believed to be due to changes in the offshore slope water.

i) The Shelf/Slope front and the Gulf Stream were both north of their long-term mean locations.

5. **National Representatives**

The national representatives responsible for submitting oceanographic data to MEDS, including all changes, were reported as follows: A. Battaglia (France) to replace Mr. Francois and F. Troyanovsky (Russian Federation) to replace Mr. Rodin. The Subcommittee was not informed of any other changes. The representatives are: G. Glenn (Canada), R. Dominguez (Cuba), E. Buch (Denmark), F. Nast (Germany), R. Leinebo (Norway), A. J. Paciorkowski (Poland) and G. Withee (USA). The representative for the United Kingdom is unknown.

6. **Joint Russian/German Data Evaluation (ICNAF/NAFO Data, Status Report)**

At last year's meeting a proposal was put forward for a joint Russian/ German data evaluation of historical hydrographic data for the purpose of climatic analyses, consistency of events and possible interrelationship with recruitment patterns of fish. It was felt that much data had been collected which had not yet been fully analyzed. An inventory of the data was requested and the Russian representative agreed to explore the availability of the necessary data.

The Russian representative reported to the Subcommittee this year that most of the data, which had been collected by PINRO, had been sent to a central archive as required by the government. Although the original intentions of the central archive facility were admirable, in reality the access of the data by interested parties did not work well because of reductions in staff. It has become very difficult to obtain data out of the archive. To obtain these data will require both manpower to physically retrieve the data from the files and money as requested by the archives for any data obtained. Cooperation between Russia and EEC-Germany to obtain these data are being explored, in particular the necessary funds to cover the costs of retrieval and the required manpower are being investigated.

7. Other Matters

The Chairman asked whether the members of the Subcommittee felt that holding the meeting at the beginning of the NAFO meetings was beneficial. There was general agreement that it was and members agreed to continue to meet on the Thursday of the first week.

A general discussion of the usefulness of the environmental overview was also held. Members considered them useful when considering changes in the fishery and assessment problems although it was recognized that incorporation of environmental information in the assessment process is difficult. It was **recommended** that *information on the deep waters off the shelf should be provided in the overviews, given that in recent years several species appear to have been moving into deeper waters.* It was also **recommended** that *the representativeness of Station 27 to hydrographic changes on the various banks and the offshore regions be examined, not only for the long period changes, years to decades, but also shorter term fluctuations, e.g. months.* It was noted that enough data to provide statistically reliable information about the latter were probably not available but it was still worth exploring. It was agreed that there is a greater chance of success in providing information on the longer period fluctuations.

8. Acknowledgements

The Chairman closed the meeting thanking the participants for their contributions and cooperation.

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

Chairman: A. Avila de Melo Rapporteur: D.B. Atkinson

The Committee met at NAFO Headquarters, 192 Wyse Road, Dartmouth, Nova Scotia, Canada on June 7 and 10, 1993, to discuss various matters pertaining to statistics and fisheries research in the Regulatory Area. Representatives from Canada, Denmark (in respect of Faroe Islands and Greenland), European Economic Community, Iceland, Japan, Russian Federation and an observer from the United States of America were present.

1. Fisheries Statistics

a) Progress Report on Secretariat Activities in 1992/93

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

STACREC continues to be concerned about the ongoing delays in receipt of national reports of statistical information. At present 3 Contracting Parties have not provided STATLANT 21B forms for 1990, and 8 reports are outstanding for 1991 (SCS Doc. 93/11). These delays affect assessment work as well as publication of the Statistical Bulletins as noted below. The Secretariat continues to send reminders to national representatives but the situation has not improved greatly although there was more prompt reporting of STATLANT 21A information in 1992 than 1991. It was particularly noted that EEC-France (M) STATLANT data had not been submitted since 1988.

ii) Acquisition of statistical information from other NAFO Standing Committees

STACREC noted that additional data concerning catches in the Regulatory Area are contained in a number of Working Papers of other Standing Committees, notably STACFAC and other NAFO Working Groups. It was considered that these documents may contain information useful for assessment work, however, it was unclear as to whether these documents could be used by STACREC since they were of working paper status. STACREC requests that the Scientific Council investigate the status of these documents and determine through consultation whether Scientific Council can use the information they contain.

iii) Publication of statistical information

The Secretariat reported that publication of *NAFO Statistical Bulletin* (Vol. 39) containing 1989 statistics was completed without inclusion of data from EEC-France (M). The absence of these data was noted in the publication.

Because of the number of outstanding reports for 1990 and 1991, publication of the Bulletin Volumes 40 and 41 have been delayed. STACREC discussed the possibility of publishing the Bulletin with incomplete data. It was considered that this might be possible but would be dependent on which Contracting Parties had not reported, as well as the amount of fishing effort they exerted in the area for the period under consideration. The Secretariat was requested to compile all available information for delinquent parties for 1990 and 1991 so that STACREC would be able to assess the importance of including data from these parties. After this evaluation, STACREC will recommend to Scientific Council whether or not to proceed with publication without the complete dataset. It was noted that such a publication should include a section at the beginning of the report outlining what data are missing, as well as a qualitative evaluation of potential problems that may arise pertaining to particular fisheries. In the event that statistics arrive after publication, the most appropriate way to handle the matter will be addressed on a case-by-case basis.

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

In June 1992, STACREC recommended that the deadlines for reporting of 21A and 21B data be set at May 15 and June 30 respectively. Following this recommendation, a formal request was made by the Executive Secretary to the Fisheries Commission and General Council that these be agreed to and compliance be supported and encouraged. The General Council at its meeting in September 1992 agreed that these dates were reasonable and Contracting Parties would try to comply with the deadlines. Recognizing the support from the General Council, STACREC **recommended** that *the Scientific Council include the new Rule 4.3 as proposed by STACREC in June 1992 in the Scientific Council Rules of Procedure, to place a legal requirement for Contracting Parties to observe the deadlines for submission of STATLANT data* (N.B. the Scientific Council renumbered this as Rule 4.4).

Taking into account the EEC-EUROSTAT representative's comments about the difficulties in meeting the originally proposed deadlines as far as Community's national statistical services were concerned, STACREC **recommended** that *the new Rule 4.3*(renumbered to Rule 4.4. by Scientific Council) *be: for the purpose of Article VII and VIII, the appropriate preliminary monthly catch and effort information should be furnished to the Scientific Council in advance of meetings. With respect of STATLANT 21A and 21B, they should be submitted not later than on 30 May and 31 August, respectively.*

c) **Preparation for the CWP 16th Session: Review of the Logbooks and STATLANT 21B Forms**

STACREC noted that the Assistant Executive Secretary would be attending the *Ad hoc* Interagency meeting in Dublin, Ireland, in September 1993, in preparation for the CWP 16th Session. The meeting will address outstanding matters based on the recommendations presented to Scientific Council in the report of the CWP 15th Session, July 1992, while also preparing the agenda for the CWP 16th Session. STACREC **recommended** that *the Assistant Executive Secretary address issues discussed at this STACREC Meeting, particularly the questions of ICES and NAFO STATLANT forms.*

STACREC noted that ICES had decided to discontinue use of the STATLANT 27B forms (the form comparable to the NAFO STATLANT 21B) because the data were not generally used by the assessment working groups yet it required considerable resources to process the data. The problems ICES has with these data are in part related to the timing of the assessment meetings that take place throughout the year. In many instances the data from the STATLANT 27B forms are not available. The situation in the Northwest Atlantic is different in that assessments are usually done during the June meeting of NAFO, and considerable use is made of the STATLANT 21B data. Therefore, NAFO will not follow the ICES example but will continue to request and process the STATLANT 21B data.

The EEC-EUROSTAT representative reported that with the reduction of the number of fishing vessels from certain EEC countries, it will no longer be possible to provide their data in the details required on STATLANT 21B forms because it then becomes possible to identify individual vessels and their catches. Under EEC law this contravenes the rules of confidentiality.

STACREC was concerned about the possible implications of this but acknowledged that little can be done about it. The EEC-EUROSTAT representative assured STACREC that every effort would be made to provide national breakdowns of the data within the bounds of EEC law. STACREC noted that this possible change in reporting of statistics would result in changes to the Statistical Bulletin.

The Secretariat reported that there was an increasing problem of double reporting of joint venture catches in recent years. STACREC was informed that the Secretariat had reminded Contracting Parties that separate STATLANT forms must be submitted for joint venture catches. STACREC requested the Secretariat to continue sending reminders to Contracting Parties of the appropriate procedures to be followed when reporting such catches.

STACREC discussed the possible value of obtaining logbook data on a tow-by-tow basis rather than daily. It was agreed that this would be very useful and therefore it was **recommended** that *the Scientific Council approach STACTIC about the possibility of requiring logbooks to include tow-by-tow fishing data.* The information considered necessary with such a change should include set position (latitude and longitude), depth fished, time net on bottom (or fishing), target species, tow speed, codend mesh size, catches of directed species as well as by-catch species and estimates of discards by species.

2. Fundamental Research Programs for Stock Assessment

a) *Research Activities and Costs in 1992/93*

i) Review of national sampling programs

The *List of Biological Sampling Data for 1991* was available as SCS Doc. 93/9. The Secretariat reported that because of changes in procedures for data compilation, some of the headings were different from past tabulations but the document was fundamentally the same.

National representatives reported on their sampling programs of commercial fisheries for 1992/93 as follows:

Canada. Sampling data for most Canadian commercial fisheries were collected both at sea and on land for both the inshore and offshore components. Data were collected during 1992 and no major problems have been identified in meeting requirements. Sampling at sea was accomplished by observers.

Denmark (Greenland). Biological samples were obtained in 1992 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) and different sorting of products.

  Approximately 50% of the important fishing areas and periods were covered. Sampling in Subarea 1 covered Div. 1C and 1D in the 2nd and 3rd quarter and Div. 1A in the 4th quarter, whereas sampling in ICES XIV covered the 1st and 2nd quarter.

- **Greenland halibut, inshore (Div. 1A)**. Length measurements were taken from landings, covering the inshore gillnet/ longline fishery. Only few samples were taken and sampling was limited to the Ilulissat region in summer.

- **Greenland halibut, offshore (Div. 1C-1D)**. Length measurements were taken from the catch aboard a Japanese trawler covering most of the Japanese trawl fishery in Subarea 1, both in time and distribution.

- **Cod inshore (Div. 1A-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 1992).

EEC-Denmark. No sampling was carried out.

EEC-France. As French catches occurred only inside Canadian waters, length and age sampling for cod was done only in Subdiv. 3Ps, on landings.

EEC-Germany. Due to effects of the reunification of EEC-Germany, there was a considerable change during 1992 in the structure of the fishing fleet including changes of the main fishing area, objectives on species, as well as selling of ships of the former GDR fleet. This made the planning of sampling on board the vessels extremely difficult and consequently, there was no sampling activity in the NAFO Area in 1992.

EEC-Portugal. Two OTB6 stern trawlers were sampled from February to August 1992, mainly fishing in Div. 3L, 3M and 3N. Two gillnetters fishing in Div. 3M and 3N were sampled from May to October. Directed effort, catch rates, length and age composition of the catches, as well as mean weights-at-age and in the catch, have been made available for the target species/stocks of both fleets. By-catch rates have also been calculated for the more important Portuguese fisheries.

EEC-Spain. The three components into which the fleet is divided were sampled in 1992 by observers on board.

Catch of pair trawlers was sampled by only one observer in the 1st quarter, covering three months activity. A previous observer was on board a vessel that sank.

Catch of small freezers traditionally fishing for flatfish was sampled by one observer in the 1st half of the year. Each vessel had one observer on board in the 2nd half of the year, when the fleet moved to fish Greenland halibut.

Catch of large freezers fishing for Greenland halibut was sampled by one observer on board each of three vessels.

Japan. Japan did not collect any biological data in 1992 in the Regulatory Area, because of the fact that total fishing days of Japan in the Regulatory Area was below 300 days.

Russian Federation. For 1992, no information on length/age compositions of the Russian commercial catches in the Regulatory Area was available, and this situation will probably continue in 1993 and in the near future.

STACREC expressed concern that the level of sampling was continuing to decline and noted that this will have an increasingly important impact on the ability of the Scientific Council to assess the various stocks. The available data from commercial fisheries related to stock assessments for 1992 is given in Table 1. It was noted that there was an ongoing lack of data available from non-Contracting Parties, but these fisheries continued to catch substantial amounts of the various species in the Regulatory Area.

Table 1. Available Data From the Commercial Fisheries Related to Stock Assessment (1992).

				Biological Sampling				
Stock	Country[1]	Catch	CPUE	Sex	Length	Age	Individual Wt.	Maturity
2J3KL cod	CAN	28 976		X	X	X	X	X
	E/FRA	583						
	E/PRT	3 335	X	X	X	X	X	
	E/ESP	3 823		X	X	X	X	
	E/FRG	285						
	OTHER	6 857						
3M cod	E/PRT	2 201	X		X	X		
	E/ESP	4 215			X	X		
	RUS	1						
	OTHER	4 500						
3NO cod	CAN	7 684	X	X	X	X	X	
	E/PRT	448	X	X	X	X	X	

Table 1. (Continued)

Stock	Country[1]	Catch	CPUE	Biological Sampling				
				Sex	Length	Age	Individual Wt.	Maturity
3NO cod	E/ESP	1 984						
	RUS	51						
	OTHER	2 450						
SA 1 redfish	GRL	0.3						
3M redfish	CUB	2 303						
	GRL	1						
	JPN	1 353						
	KOR-S	8 350						
	RUS	2 937						
	LVA	7 741[2]						
	E/FRG	3 350						
	E/ESP	206						
	E/PRT	3 198[2]	X	X	X	X		
	OTHER	3 910						
	TOTAL	33 349						
3LN redfish	CAN	740	X	X	X			
	E/FRG	1 500	X					
	E/PRT	1 900	X	X	X			
	E/ESP	750						
	RUS	3 500						
	CUB	1 300						
	KOR-S	4 900						
	OTHER	9 000						
4VWX silver hake	RUS	14.7 kt	X	X	X	X	X	X
	CAN	4 kt	X	X	X		X	X
	CUB	16.5 kt						
3M American plaice	E/PRT	313		X	X	X	X	
	E/ESP	390			X			
	JPN	49						
	GRL	1						
	KOR-S	10						
	RUS	-						
	TOTAL	763						
3LNO American plaice	CAN	9 542	X	X	X	X	X	
	KOR-S	518						
	E/PRT	140	X	X	X	X	X	
	E/ESP	412		X	X			
	OTHER	500						
3NO witch flounder	CAN	4 296	X	X	X	X	X	
	E/PRT	403	X	X	X			
	E/ESP	182						
	KOR-S	44						
3LNO yellowtail flounder	CAN	6 809	X	X	X	X	X	
	KOR-S	3 825						
	E/PRT	1		X	X	X	X	
	E/ESP	122						

Table 1. (Continued)

Stock	Country[1]	Catch	CPUE	Biological Sampling				
				Sex	Length	Age	Individual Wt.	Maturity
SA 0+1 Greenland halibut	GRL	12 181		X	X			
	JPN	1 864	X	X	X			
	NOR	2 766						
	FRO	689		X	X			
	RUS	6 911						
	CAN	8 185		X	X			
SA 2+3KLMNO Greenland halibut	CAN	6 935	X	X	X	X	X	X
	E/ESP	34 520	X	X	X	X		
	E/FRG	42						
	E/PRT	10 539	X	X	X			
	JPN	1 882						
	FRO	759						
	GRL	10						
	E/GBR	9						
	KOR-S	49						
SA 0+1 roundnose grenadier	GRL	20[3]						
	RUS	22						
	CAN	13						
	JPN	48[3]						
SA 2+3 roundnose grenadier	CAN(M)	12						
	CAN(N)	487						
	SUN	2						
	JPN	4						
	E/PRT	2 000						
	E/ESP	2 860						
SA 0+1 shrimp	GRL	79 260	X		X			
	CAN	7 493	X	X	X	X		X
	FRO	105						
	E/DEU	294						

[1] OTHER refers to estimates of non-Contracting Parties who did not report catches to NAFO.
[2] Data of Canadian surveillance.
[3] The catches are probably a mixture of roundnose and roughhead grenadier.

ii) **Review of survey activities** (Tables 2 and 3)

As in the past, Contracting Parties provided the Secretariat with lists of research survey activities for the past and upcoming year.

STACREC noted with regret that survey activities in the NAFO Area in 1992 had declined from previous years (e.g. no juvenile silver hake survey). The representative of the Russian Federation indicated that a similar situation would probably exist in 1993.

iii) **Coordination of surveys**

It was noted that there is a growing interest in the fisheries for Greenland halibut. Although there were a number of different research initiatives taking place in SA 0, 1, 2 and 3, there was little to no coordination of those activities. STACREC proposed that the various interested Contracting Parties begin discussions of the possibility of carrying out a coordinated research survey in the entire area, using a number of different vessels working

simultaneously with standardized gear and trawling procedures, in order to get a comprehensive picture of the resource and its distribution. STACREC saw the importance of such a coordinated survey and encouraged interested Contracting Parties to continue discussions toward this goal.

Table 2. Inventory of biological surveys conducted in the NAFO Area during 1992.

Subarea	Division	Country	Months	Type of survey	No. of sets
				Stratified-random Surveys	
0	B	RUS	11	G. halibut, grenadier temperature, salinity	26
1	ABCD	JPN	8-9	Bottom trawl survey on groundfish (partially midwater trawl survey on redfish)	202
	CD	JPN	11,12	Bottom trawl survey on groundfish	49
2	G	RUS	11-12	G. halibut, grenadier, temperature, salinity	50
	H	RUS	11-12	G. halibut, grenadier, temperature, salinity	22
	J	CAN-N	10-11	Groundfish	
2+3	JK	CAN-N	11	Groundfish	
	JKL	CAN-N	2	Groundfish	
3	K	RUS	10	G. halibut, grenadier, temperature, salinity	29
	KL	CAN-N	12	Groundfish	
	L	CAN-N	5-6	Groundfish	
			6	Crab (NE St. John's)	
			8	Crab (inshore)	
			9	Juvenile flatfish	
			11	Groundfish	
	LN	CAN-N	5	Groundfish	
			11	Groundfish	
	LNO	CAN-N	8-9	Juvenile flatfish	
	M	E/ESP	7	Groundfish	117
		RUS	4	Groundfish, temperature, salinity	53
	M	E/ESP & E/PRT	5-7	Salinity	125
	NO	CAN-N	4-5	Groundfish	
			8	Juvenile flatfish	
			10	Groundfish	
	P	CAN-N	2	Groundfish	
	Ps	CAN-N	8-9	Scallop	
3+4	Pn+ RSVn	CAN-N	1	Groundfish	
	PRV	CAN-N	8	Redfish	
4	RS	CAN-Q	4	Cod migration	36
			5	Cod juvenile survey	148
			10	Cod juvenile survey	90
	RST	CAN-Q	8	Shrimp,redfish	227
	S	CAN-Q	7	Scallop assessment	261
			9	Scallop acoustic	
	T	CAN-Q	6	Mackerel assessment/larvae	128
			7	Crab assessment	64
			8	Mackerel acoustic	
4	VW	CAN-SF	3	Groundfish survey	80
			7	Groundfish survey	106
4+5	XYZ	CAN-SF	6-7	Groundfish survey	94
5	Z	CAN-SF	2	Groundfish survey	105

Table 2. (Continued)

Subarea	Division	Country	Months	Type of survey	No. of sets
				Other Surveys	
1	CD	JPN	9,10,11	Exploratory survey by bottom trawl on G. halibut	227
2	J	CAN-N	7-8	Shrimp	
2+3	JK	CAN-N	4	Cod	
			9-10	Capelin acoustic	
		RUS	11	Capelin, temperature, salinity	7
	JKL	CAN-N	1-2	Cod tagging	
			5	Ichthyoplankton	
			5-6	Oceanography	
				Ichthyoplankton	
			7	Oceanography	
			10-11	Oceanography	
3	K	CAN-N	4	Seal sampling	
	KL	CAN-N	2-3	Cod/seals	
			4	Cod	
			5-6	Cod/capelin	
			6	Oceanography	
			6-7	Cod tagging (inshore), groundfish acoustic	
			7	Oceanography	
			9	Oceanography	
			9-10	Cod/capelin	
			11-12	Herring (inshore)	
			12	Juvenile northern cod	
	L	CAN-N	4	Crab (inshore)	
			4-5	Larval fish (NE Nfld Shelf)	
			5	Cod spawning (inshore)	
			5	Capelin acoustic	
			5	Groundfish acoustic	
			6	Larval fish (NE Nfld Shelf)	
			6-7	Capelin tagging (inshore)	
			7	Ichthyoplankton (inshore)	
			8	Crab (inshore)	
			8-9	Oceanography (inshore)	
			9	Gear trials (inshore)	
			9	Crab (inshore)	
			9-10	Cod tagging	
			10	Oceanography (inshore)	
			11	Crab (inshore)	
	LM	RUS	10	G. halibut, grenadier, temperature, salinity	9
	LN	CAN-N	7	Gear trials	
	LP	CAN-N	5	Hydroacoustics	
			9	Hydroacoustics	
	LPs	CAN-N	1-3	Herring, pelagic (inshore)	
			3-4	Crab	
	M	E/ESP	2-3	Tagging for cod	58
	N	CAN-N	6	Flatfish tagging	
			8	Juvenile cod, gear trials	
	NO	CAN-N	6-7	Capelin acoustic	
	Ps	CAN-N	5-6	Capelin tagging (inshore)	
4	R	CAN-Q	8	Scallop assessment	82
	S	CAN-Q	2	Crab growth	
			3	Crab migration	
			5	Shrimp larval survey	
			8	Pelagic acoustic	
4	T	CAN-Q	4	Rock crab migration	

Table 2. (Continued)

Subarea	Division	Country	Months	Type of survey	No. of sets
4	T	CAN-Q	6	Mackerel fecundity	
	V		5	Mackerel acoustic	
	VWX	CAN-SF	5	Scallop survey	
			9-10	JGOFS biological oceanography	
	W	CAN-SF	1	Herring acoustic	
	WX	JPN	5-6	Commercial survey on *S. hake surimi* by bottom trawl	83
	X	CAN-SF	7	Zooplankton survey	
		CAN-SF	10-11	Herring larvae survey	
5	Z	CAN-SF	8	Scallop survey	
		CAN-SF	11	Herring resurgence	

Table 3. Biological surveys planned for the NAFO Area in 1993 and early-1994.

Country	Area	Type of Survey	Dates
		Stratified-radom Surveys - 1993	
CAN-N	2J+3K	Groundfish	Oct 28-Dec 16
	2J+3KL	Capelin acoustics	Sep 1-Oct 21
			Sep 22-Oct 11
			Oct 12-26
	3KL	Herring acoustics	Nov 13-26
			Nov 29-Dec 10
	3L	Crab	May 3-14
			May 25-28
			Aug 2-18
			Oct 11-22
	3LNO	Groundfish	Apr 26-May 7
			May 10-21
			May 24-Jun 11
			Aug 5-23
			Aug 9-20
			Aug 23-Sep 3
			Sep 7-17
			Oct 15-Nov 27
		Juvenile flatfish	Jun 14-23
	3P	Groundfish	Feb 5-25
			Apr 1-9
			Apr 12-21
	3Ps	Scallops	May 21-29
			Jul 23-Aug 3
	3Pn+4RST	Groundfish	Jan 6-30
CAN-SF	4VWX	Groundfish	Mar, Jul
	4X	Groundfish	Jul
	5Z	Groundfish	Feb
CAN-Q	3Pn4RST	Groundfish assessment	Jan
	4R	Cod larval survey	May 3-13
			Jun 18-26
		Stimpson assessment	Jul 16-27
		Cod juvenile survey	Oct 4-12
	4S	Scallop assessment	Jul 1-15
			Aug 27-Sep 7

Table 3. (Continued)

Country	Area	Type of Survey	Dates
CAN-Q	4T	Mackerel egg survey	Jun 17-Jul 1
		Crab assessment	Jul 28-Aug 11
		Lobster assessment	Sep 8-18
	4RST	Shrimp - redfish	Aug 13-Sep 11
E/ESP	3M	Groundfish	Jun 15-Jul 18
JPN	1A-D	Bottom trawl survey on groundfish	Sep 5-Oct 7
			Nov 25-Dec 9
RUS	0B+SA2+3K	Trawl survey for G. halibut, grenadiers, capelin temperature, salinity	Oct-Dec
	3LMNO	Bottom trawl survey for groundfish, biomass estimation capelin acoustics, temperature, salinity	May-Jul
	4VWX	Juvenile silver hake	Oct-Dec
		Other Surveys - 1993	
CAN-N	2J+3KL	Cod tagging	Jan 10-27
		Juvenile cod	Nov 29-Dec 19
	3KL	Cod tagging	May 31-Jun 9
		Cod acoustics	Jun 8-30
		Cod tagging	Aug 26-Sep 3
		Juvenile cod	Sep 20-Oct 13
	3KLP	Hydroacoustics	May 31-Jun 6
			Aug 25-31
	3L	Oceanography	Jan 11-15
		Herring acoustics	Jan 18-27
		Oceanography	Feb 15-19
			Mar 16-17
			May 17-21
		Gear trials	Jun 11
			Jun 14-15
		Oceanography	Jun 21-25
		Inshore cod	Jun 28-Jul 9
		Benthic sampling	Jul 5-13
		Ichthyoplankton	Jul 12-16
			Jul 19-23
			Jul 26-30
		Oceanography	Aug 20-24
		Crab	Sep 6-17
		Gear trials	Sep 20-22
		Oceanography	Sep 29-Oct 1
			Oct 4-8
		Juvenile cod	Oct 25-Nov 10
		Oceanography	Dec 13-17
	3LN	Gear trials	Jan 4-20
CAN-SF	4V	Herring acoustic	Jan
	4VWX	Scallop survey	May
	4W	Zooplankton	Jan
		Sealworm	Mar-Apr
		Silver hake cruise	Oct
	4X	Herring larvae	Oct
	5Z	Scallop survey	Jun
		Herring resurgence	Nov
CAN-Q	4R	Herring acoustic	Oct 25-Nov 15
	4S	Crab, turbot	Apr 20-May 5
		Crab recruitment	Sep 26-Oct 7
	4T	Lobster assessment	May 21-Jun 1
		Crab recruitment	Jun 17-30

Table 3. (Continued)

Country	Area	Type of Survey	Dates
CAN-Q	4T	Mackerel acoustic	Aug 12-26
	4Vn	Mackerel acoustic	May 28-Jun 15
JPN	1A-D	Exploratory survey (bottom trawl) on G. halibut	Jul 29-Aug 27
		Surveys Planned for Early-1994	
CAN-N	3LPs	Herring acoustics (stratified)	Jan 8-21
			Jan 24-Feb 4
	3L	Cod tagging	Feb 7-16
		Oceanography	Feb 18-22
CAN-Q	4RST	Groundfish (stratified)	Jan 7-31

b) **Assessment Data Needs for 1993/94 and Respective Budgets**

In September 1992 the Fisheries Commission requested the Scientific Council to describe the optimum volume and funding of scientific research in the NAFO Regulatory Area (FC Doc. 92/20, rev.). Contracting Parties were accordingly requested to provide information on current expenditures on research and commercial sampling in the Regulatory Area as well as information of costs for 'optimal' sampling and research. For this meeting, only data on current costs to the EEC were available. These indicated an annual expenditure of about 4.1 million ECU. STACREC requested the necessary information be made available in time for review in September 1993. These should not only indicate current costs, but should also contain information on the cost of at least maintaining base level sampling and research.

3. **Non-traditional Fisheries Resources in the NAFO Area**

a) **Current Development of the Fisheries**

It was reported that there is a new fishery for shrimp (*Pandalus borealis*) developing on Flemish Cap (Div. 3M). STACREC was informed of the development of this new fishery since spring, 1993. A total of twenty-seven trawlers from Canada, EEC-Denmark, Greenland, Faroe Islands and Norway were reported to be actively fishing in the area in early June, achieving catch rates between 8 and 17 tons per day. By-catches (primarily redfish) were initially low (approximately 5%) but increased over time, to as high as 20% of the total catch.

STACREC stressed the need to obtain proper records for catch, effort, CPUE and location of fishing from all countries participating in this new fishery. It was noted that all the Canadian vessels were carrying observers who, in addition to collecting routine set and catch records, were sampling shrimp for length, sex and maturity.

Concern was expressed about the levels of finfish by-catch that might result from the use of small-meshed trawls in this area and it was **recommended** that *the activities of vessels engaged in this developing shrimp fishery on the Flemish Cap be closely monitored.*

There has also been a developing Greenland halibut fishery in the Regulatory Area since about 1990. STACREC noted that associated with this fishery were increased by-catches of roundnose and roughhead grenadiers. It was also noted that there appears to be an increase in catches of skate in the Regulatory Area.

b) **Available Data and Research Priorities**

STACREC noted there was 100% observer coverage on Canadian vessels licensed to fish shrimp in Div. 3M. Besides collecting data on the shrimp fishery, they have been instructed to monitor by-catches and to take length samples of these.

There was good sampling of the Greenland halibut fishery in the Regulatory Area but a problem of possible misallocating of roundnose and roughhead grenadier catches was indicated. It is probable that much of the catch now reported as roundnose grenadier was actually roughhead. In 1992, only EEC-Spain reported the two species separately. It was considered that most of the roundnose grenadier catches reported by Canada and EEC-Portugal were actually roughhead. To properly monitor the effects these new fisheries may be having on the resources, it is important to have the statistics reflect the species actually being caught. STACREC also noted that problems persist with the various flatfish species not being separated but reported as catches of flounder (unspecified). It was **recommended** that *the Scientific Council bring the matter of misallocation of roundnose and roughhead grenadier and flatfish species to the attention of the Fisheries Commission and request that care be taken to ensure proper identification of species being caught.*

STACREC requested that the Secretariat provide a breakdown of skate catches by NAFO Division. Once these are available, they can be compared with the distribution of skates in the Regulatory Area as determined from research vessel surveys to evaluate if the reported increases are realistic or not.

4. Proposals for Scientific Tasks of Observers in the Pilot Observer Program

STACREC noted Canadian observers collect considerable biological information while at sea. This includes information on fish sizes, sex and maturity, otoliths, by-catches, discards, and catch and effort. It was recognized that appropriate training was essential for other national observers and that experience was also necessary. Similar to the Canadian experience, it is anticipated that data quality from other observers will improve with time. Training must be done on a national basis and in conjunction with research institutes. Similar to Canada, EEC-Spain now provides their observers with a manual. Other Contracting Parties may wish to avail of these manuals for use by their own observers. After discussion, STACREC agreed that having biological data collected during the Pilot Observer Program was a good idea and **recommended** that *the Scientific Council bring forward for the information of and consideration by the Fisheries Commission that observers in the Pilot Observer Program should collect data on set location (latitude and longitude), depth fished, time net on bottom (or fishing), directed species, by-catches, discards, and catches and effort. Length sampling of the main species in each set should also be set out.*

5. Other Matters

a) Inventory of Sampling Data, 1985-1989

The final submission from Contracting Parties for the *Inventory of Sampling Data*, 1985-89 were received in April 1992. The publication was issued in March 1993, after the data were reconfirmed by the Secretariat.

b) List of Fishing Vessels for 1992

The request for updated lists of fishing vessels was sent out from the Secretariat in January, 1993. To date, 8 reports have been received but 14 are outstanding for next scheduled publication of the triennial *List of Fishing Vessels, 1992.*

c) Tagging Activities Reported in 1992

The Secretariat compiled a list of tagging activities in 1992 (SCS Doc. 93/7). Representatives were requested to check this list and report any errors or omissions.

d) Updating of Conversion Factors Used to Get Rounded Fresh Weights

It was considered useful to have information on current conversion factors being used to convert fish product weights back to round weights. The Chairman requested that national representatives provide all available information for review and discussion during the September 1993 meeting. The Secretariat was requested to draft a letter to Contracting Parties requesting this information.

e) **Other Business**

i) **Measurement protocol for grenadiers**

The NAFO Scientific Council (NAFO Sci. Coun. Rep., 1984) adopted the recommendation that roundnose and roughhead grenadiers should be measured from the tip of the snout to the base of the first anal fin ray. At present however, there are no records of this recommendation in such publications as the *NAFO Sampling Yearbook*, and some Contracting Parties continue to report total lengths. The Scientific Council was requested to remind national representatives of this measurement protocol, and the Secretariat should take steps to include information on this protocol in various publications as appropriate.

6. Acknowledgements

The Chairman thanked the rapporteur and the participants for their contributions and assistance. A special thanks was extended to the Secretariat for their assistance in compiling all of the pertinent information for the meeting.

There being no further business, the meeting was adjourned.

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

Chairman: H. Lassen Rapporteur: P. Kanneworff

The Committee met at NAFO Headquarters at 192 Wyse Road, Dartmouth, Nova Scotia, Canada on 5, 9 and 15 June, 1993. In attendance were H. Lassen (EEC-Denmark, Chairman), D.B. Atkinson (Canada), P. Kanneworff (Greenland), V.A. Rikhter (Russian Federation), M. Stein (EEC-Germany), A. Vazquez (EEC-Spain) and the Assistant Executive Secretary (T. Amaratunga).

1. Review of STACPUB Membership

There were no changes in membership, but for this meeting D.B. Atkinson substituted for J.E. Carscadden (Canada).

2. Review of Scientific Publications Since June 1992

a) Journal of Northwest Atlantic Fishery Science

STACPUB noted Volume 13, containing 7 miscellaneous papers, 1 obituary and 4 notices (114 pages) was published with the publication date of December 1992.

A special issue of the Journal, containing 13 papers presented at the Special Session on 'Changes in Biomass, Production and Species Composition of the Fish Populations in the Northwest Atlantic over the Last 30 Years and Their Possible Causes', was published as Volume 14 with the publication date of December 1992.

The next regular issue of Journal may be substantially delayed, in that completion dates for several other papers undergoing editorial review is still unknown. Four papers from the November 1990 Canada-USSR Meeting on Capelin will soon be available for a regular issue of Journal. The single issue planned for papers from this Meeting is no longer possible because many papers have been withdrawn after initial review. However, it was noted that if a suitable amount of papers selected from the 1992 Meeting were included a special issue of the Journal might still be possible.

An invitational paper on Decapod larvae from Ungava Bay was recently received for consideration. STACPUB agreed that this paper may be issued as a special volume of the Journal, and noted that the editorial process of the paper had advanced quite far to enable publication in late-1993.

b) NAFO Scientific Council Studies

A workbook entitled 'Introduction to Sequential Population Analysis' containing the text of the instruction sessions and the working papers presented at the Special Session on Fish Stock Assessment Calibration Methods, 9-11 September 1992 was published in February 1993 as Studies Number 17. There has been substantial interest on this issue with many requests for reprints.

Studies Number 18, containing 7 papers and 11 abstracts presented at the Cod Symposium entitled 'Changes in Abundance and Biology of Cod and Their Possible Causes' held 4-6 September 1991 is in the final stage of preparation, and is expected to be issued in mid-1993.

Studies Number 19, containing 8 papers, is in its final stage of preparation. The publication of this issue is expected to be complete in mid-1993.

The next issue of Studies (Number 20) containing miscellaneous papers is also expected to be completed for publication by late-1993.

c) NAFO Scientific Council Reports

STACPUB noted that the recent inclusion of a photograph of the participants at the June Meeting in the Scientific Council Reports was considered a success, but agreed that insertion of further photographs (e.g. of the chairmen) should not be made.

d) **Index of Journal and Studies**

The provisional *Index of Journal of Northwest Atlantic Fishery Science* and *NAFO Scientific Council Studies, 1987-93*, was compiled by the Secretariat and presented in SCS Doc. 93/2. Although both publications are included in ASFA, general interest was expressed by the participants in favour of a formal publication of the Index volume.

e) **Inventory of Sampling Data, 1985-1989**

The publication was completed after data were reconfirmed, and issued with a publication date of March 1993.

The Secretariat was asked to check whether the Journal was included in relevant citation indices.

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, the numbers of copies sold had increased due to the recent revision of the free mailing list. STACPUB agreed that the review of the free mailing list should be an ongoing activity of the Secretariat.

b) **Microfiche Project**

STACPUB noted that a total of 17 microfiche sets of ICNAF documents were sold to the end of May 1993, two of them were sold since the last June Meeting.

The storage of documents on other systems than microfiche (e.g. compact disks) was again discussed. The price of CD-hardware has a downward trend, however, STACPUB agreed that at present no steps should be taken to introduce this storage facility. The computer system at the NAFO Secretariat includes a scanning technique, which provides the Secretariat with the capability to transfer requested copies of documents to diskettes.

c) **Print Pages at the Secretariat**

The recent attempt to avoid double printing of meeting documents was, in general, considered a success. In future, however, laboratories involved will be requested to forward a list of anticipated papers (as complete as possible) together with short abstracts to the Secretariat about ten days before beginning of the Meeting. Authors who wished to refer to documents from the same Meeting could thus be informed by the Secretariat about the relevant document numbers for a final version of their documents.

In order to facilitate the workload of document production, and also to increase the readability of the documents the Secretariat agreed to work out a set of guidelines to authors. These guidelines will be issued together with the first announcement of the June Meeting. The Secretariat agreed to present a draft for the guidelines at the September 1993 Meeting.

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

a) **Publicity and Response Regarding the Journal**

An announcement of the Journal has been included in Allen Press Subscription Catalog, 1992. This catalog reaches about 10 000 readers. It was agreed that local libraries presumably are the best target for announcing, but STACPUB members were requested to consider other possibilities in their respective countries.

A change of the title of the Journal has been discussed in the past, and it was agreed to await the results of the new advertisement until further steps are taken.

b) **Invitational papers for the Journal**

In 1992, M. D. Grosslein (USA) was invited to prepare a special paper for the Journal. The Secretariat has now been informed that his time for such a preparation is too limited, however, he intended to ask his colleagues to consider joining him.

The Secretariat was requested to contact V. K. Zilanov (Russian Federation) about the prospects for the possible submission of scientific papers from various Russian research institutes.

It was noted that a complete scientific review of results from the Northern Cod Science Program will be undertaken by Canada in 1994. STACPUB agreed that the coordinator of the Symposium, J. S. Campbell, should be asked if the scientific papers could be submitted for publication in the Journal. The quick turn-around time for NAFO publication and the similarity of this review to the invitational paper on Greenland cod were thought to be attractive features for consideration.

c) **Proposed Award Scheme for Exceptional Papers**

STACPUB discussed the implications of introducing an award for the best papers, but recognized that difficulties in the selection of the "best document" could arise if none were of outstanding quality. It was also agreed that this initiative might not be the best way of increasing the general level of quality of the Journal.

5. **Editorial Matters Regarding Scientific Publications**

a) **Editorial Activities**

At its meetings since 1980, STACPUB had nominated a total of 411 research documents with potential for publication in the NAFO Journal or Studies. This includes 19 documents nominated at the June 1992 Meeting and one document at the September 1992 Meeting. Since 1980, a total of 312 papers have been published in the Journal (154) and the Studies (158).

The Workbook presented at the September 1992 Special Session was published as a single issue of Studies. STACPUB noted the very satisfactory turn-around time for this publication.

Since June 1992, a total of 52 papers were published or were in their final stages of preparation (22 in the Journal and 30 in Studies). In addition, a total of 17 papers are currently in various stages of editorial review for the Journal.

b) **Review of the Editorial Board**

STACPUB noted that there were no changes in the Editorial Board since the last Meeting.

6. **Papers for Possible Publication**

a) **Review of Proposals From the 1992 Meeting**

STACPUB was pleased that nine papers (including two combined as one) of the 19 nominations made in 1992 had been submitted for consideration for publication.

b) **Review of Contributions to the 1993 Meeting**

STACPUB noted the Secretariat had requested the authors of SCR Documents to indicate whether they wished to have their papers considered by STACPUB, and as a result STACPUB was able to focus on the review of only the requested papers. STACPUB considered 30 SCR Documents and nominated the following 12: SCR Doc. 93/8, 10, 14, 17, 18, 20, 23, 25, 26, 50, 62 and 65, noting SCR Doc. 50 was the standard paper on environmental overview. Accordingly, the Assistant Executive Secretary was requested to invite authors to submit them in a suitable form for consideration for publication.

In addition, STACPUB noted a group of 13 papers (SCR Doc. 93/29, 30, 32, 33, 35, 36, 37, 45, 54, 55, 56, 57 and 58) dealing with Northern Cod that appeared suitable for a single publication, although some papers were not completely reviewed by STACFIS and some were of a relatively preliminary nature. STACPUB was also uncertain of the intentions of various authors regarding publication. It was therefore agreed that the Assistant Executive Secretary should request their views so that STACPUB could make a decision during the September 1993 meeting.

7. Other Matters

A proposal from The Canadian Global Change Program, that NAFO consider methods to encourage authors to submit papers on description of data bases, was received and discussed by STACPUB. It was agreed that in general, such descriptions do not fall in the lines of neither the Journal nor the Studies of NAFO. Further consideration on this topic was deferred to a later occasion.

The Chairman in closing the meeting thanked the members for their contributions. He also asked the Assistant Executive Secretary to convey to the staff of the Secretariat the Committee's appreciation of their efforts made on producing the publications of NAFO.

PART B

Scientific Council Annual Meeting, 7-10 September 1993

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REPORT OF SCIENTIFIC COUNCIL

Annual Meeting, 7-10 September 1993

Chairman: H. Lassen Rapporteur: T. Amaratunga

I. PLENARY SESSIONS

The Scientific Council met at the Holiday Inn, Dartmouth, Nova Scotia, Canada, during 7-10 September 1993. Representatives attended from Canada, Denmark (in respect of the Faroe Islands and Greenland), European Economic Community (Denmark, France, Germany, Portugal, Spain and United Kingdom), Iceland, Japan and the Russian Federation. In the absence of the Chairman V. P. Serebryakov (Russian Federation), the Vice-Chairman, H. Lassen (EEC-Denmark), chaired this meeting. The Assistant Executive Secretary was in attendance.

The opening meeting was called to order on 7 September 1993 at 1030 hr.

The Chairman welcomed representatives to the 15th Annual Meeting. The Assistant Executive Secretary was appointed rapporteur.

The Chairman considering the provisional agenda, noted that many new specific items needed to be included in the agenda, *and proposed the* following changes:

Item II.2.b. Shrimp in Division 3M (this would represent a change in the numbering of the subsequent agenda items)

Item II.4.e. Proposal for annual shrimp meeting in November.

Item II.4.f. Adoption of work procedures for the June 1994 Scientific Council Meeting.

It was noted that the Item VIII. "Space Requirements for June Meetings and Structure of Scientific Council", would relate mostly to the work of STACFIS. The Chairman proposed that this item be undertaken by STACFIS, before the Council considered it. It was similarly proposed that STACREC undertake this item under Item III.8. However, it was proposed that this item be re-numbered as Item III.9, with the insertion of a new Item III.8. "Research coordination for Greenland Halibut". This agenda item was removed from the STACFIS agenda. The agenda (see Agenda II, Part D, this volume) was **adopted** with these modifications.

The Council noted the need for a new Designated Expert for the assessment of Silver Hake in Divisions 4V, 4W and 4X. M. A. Showell, Bedford Institute of Oceanography, Nova Scotia, was selected by the Council as Designated Expert.

With respect to Shrimp in Division 3M, D. G. Parsons, Northwest Atlantic Fisheries Centre, Newfoundland, was selected by the Council as Designated Expert.

Having considered the work plan for this meeting, the session was adjourned at 1050 hr.

The Council reconvened at 1100 hr on 10 September 1993 to address the outstanding agenda items, and these are reported under the relevant sections.

The Council noted the requests from the Fisheries Commission which were postponed during the June 1993 Meeting, for *further consideration by* the Council at this meeting, were addressed as given in the STACREC report (see Appendix II).

There were no formal requests from the Fisheries Commission received by the Council at this meeting. However, the Chairman attended several meetings of the Standing Committee on International Control (STACTIC) of the Fisheries Commission and responded directly to some of the questions posed. The Council noted these would be reflected in the report of the Fisheries Commission.

The concluding session was called to order at 1200 hr on 10 September 1993, and the Council considered and **adopted** the reports of the Standing Committees and the Scientific Council Report of this meeting.

The meeting was adjourned at 1415 hr.

Brief summaries of the Standing Committee Reports and other matters considered by the Scientific Council are given below in Sections II-VI. The Agenda, Lists of Research (SCR) and Summary (SCS) Documents and the List of Participants of this meeting are given in Part D, this volume.

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

1. Review of 1993 Recommendations

The Council noted the recommendations from the June 1993 Meeting were adequately addressed as required from the point of view of the agenda of this meeting.

The Council agreed that recommendations pertaining to specific stocks, should be worded to explicitly indicate the stock they pertain to.

2. Stock Assessments

a) Silver hake in Divisions 4V, 4W and 4X

The Council noted that the assessment of silver hake stock in Div. 4VWX which was deferred from the 2-16 June 1993 Meeting was completed, and endorsed the assessment as presented in the STACFIS report. The Summary Sheet as prepared for the assessment is given below.

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

Source of Information:

Year	1986	1987	1988	1989	1990	1991	1992	1993
Recommended TAC	100	100	161	235	-	100	105	75
Agreed TAC	100	100	120	135	135	100	105	86
Reported Catches	83	62	74	91	69[1]	68[1]	32[1]	29[1]
Sp. stock biomass								
Recruitment (age 1)[3]	1 880	840	822	1 274	1 045	642	400[2]	1 200[2]
Mean F (ages 3-5)	0.99	0.72	0.75	1.44	0.87	1.05	0.32	

[1] Provisional. Weights in '000 tons
[2] Estimated.
[3] 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 1992 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 1992, approximately 33% of that estimated for 1991.

Recruitment: The 1991 year-class is thought to be below average, while the 1992 year-class is estimated to be above average.

State of Stock: ADAPT analysis shows age 1+ and 2+ biomass for this stock to be the lowest in the time series 1977-93.

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 1994:

Option Basis	*Predicted catch (1994)*	*Predicted SSB (1.1.1995)*
$F_{0.1}$ = 0.72	51 000	
F_{92} =		
F_{max} =		

Recommendations: The retrospective analysis using ADAPT methodology indicated a consistent tendency for F estimates to increase by 40 to 60% for a particular year when additional years of data were added. There is no reason to expect that the current estimate of F in 1992 will not, in future, also appear to be an underestimate. It is likely, therefore, that the projected catch at $F_{0.1}$ in 1994 of 51 000 tons is also overestimated to some extent. Unfortunately, the extent of this is difficult to determine.

Special Comments: The year-classes which may be overestimated by ADAPT are those of 1990 and older which will account for about 45% of the projected catch in 1994.

b) **Shrimp in Division 3M**

The Council noted that the available information on shrimp in Div. 3M was reviewed by STACFIS and **endorsed** the report as presented by STACFIS.

In response to a request from the Fisheries Commission on the shrimp in Div. 3M, the Council endorsed the following response prepared by STACFIS:

STACFIS considered information pertaining to the status of the shrimp (*Pandalus borealis*) resource on Flemish Cap (Div. 3M). Although the presence of shrimp on Flemish Cap has been known for many years, no significant commercial effort on shrimp was reported from the area before spring 1993. Since then, a multi-national fishery has developed with removals of shrimp in the order of 20 000 tons up to late-August.

Fishery information from Canada, Faroe Islands, Greenland, Iceland and Norway indicated that effort was distributed around the Cap along the 400 m contour (see STACFIS report, Fig. 4). Catch rates generally declined from May to early-July 1993 and stabilized somewhat thereafter. Size composition data from all countries were similar, showing three size groups of males and one of females. Overall sizes ranged between 14 and 30 mm (oblique carapace length) and included at least 5 ages. Females were not ovigerous from May to July indicating that the egg bearing period lasts from about August to March. By-catch consisted primarily of small redfish (14 cm) and Canadian observer data indicated levels between 10-15% of the total catch in April-June, increased to higher levels in July. By-catch of other commercial species was low during that period.

STACFIS noted the general ocean circulation in the Flemish Cap area is characterized by an anticyclonic gyre, which could play an important role in the retention of shrimp larvae. Also, hydrographic data showed a cooling trend since 1988, which could favour the survival of shrimp. EEC groundfish surveys from 1988 to 1993 showed that the abundance from 1991 to 1993 was substantially higher than the 1988-90 period. The increase appeared to be due to the recruitment of at least one strong year-class produced in the late-1980s.

STACFIS agreed that shrimp abundance in recent years has increased but it is uncertain whether or not this high level of abundance will continue. The general decline in catch rates from May to July may be an effect of exploitation or due to the seasonality as observed in other shrimp stocks. Information is lacking on the history of the stock, present stock size, future recruitment and impact of the 1993 catch level. At present, it is not possible to conclude that a fishery at or near the 1993 catch level is sustainable in the Flemish Cap area and STACFIS has not sufficient data to provide a basis for the calculation of an initial TAC. However, based on the uncertainties mentioned above, concern was expressed for the level of removals in 1993 and a cautious approach to exploitation should be considered.

The by-catch of small redfish was considered as a potential for significantly impacting the redfish resource in this area. STACFIS **recommended** that, *effective immediately, sorting grates be mandatory in shrimp fishing operations on Flemish Cap as a means of minimizing the by-catch of redfish and other fish species.*

c) **Workshop on Assessment Methods**

The Council agreed with the STACFIS view that a special workshop on assessment methods should be considered as and when the need arises.

d) **Data Availability for Assessment of Northern Shrimp in November 1993**

With respect to the proposal from Denmark/Greenland to have a mid-term meeting for assessment of Northern Shrimp in Subareas 0 and 1, and Denmark Strait, the Council noted that STACFIS had reviewed the data available, and decided to set a meeting. The Council accordingly endorsed the **recommendation** to call a meeting of the Scientific Council in November 1993 at NAFO Headquarters.

3. **Review of Research Documents**

The Council observed that many of the Research Documents deferred from the June 1993 Meeting of the Scientific Council for further review at this meeting, were found to have been adequately considered at the June 1993 Meeting. The two papers that needed further review are summarized in the STACFIS report.

4. **Review of Current Arrangements for Conducting Stock Assessments and Documentation**

a) **Updating List of Designated Experts**

The Council noted that STACFIS had identified Designated Experts for the 1994 assessments with an additional expert required for the Shrimp in Div. 3M. The availability of the nominees would be confirmed by the Secretariat at the earliest convenient time.

b) **Review of Working Papers to be Prepared by Designated Experts on Their Workload**

STACFIS had noted that an important aspect of stream-lining the assessment work at the June meetings would be to have all the necessary data in advance of the meeting.

Recognizing the importance of making every effort to improve the data transference process between the laboratories and NAFO Headquarters, the Council endorsed the STACFIS **recommendation** that the Secretariat acquire a computerized e-mail system.

c) **Guidelines for Documentation of Assessments**

The Council noted STACFIS discussions on this matter.

d) **Status of Scientific Documents (Working Papers *vs* Research Documents)**

The Council noted STACFIS had considered some problem areas in the preparation of Research Documents, particularly in the light of time constraints at the June meetings. It was hoped that with the efforts currently underway by STACFIS, such problems will gradually rectify themselves.

e) **Proposal for Annual Shrimp Meeting in November**

The Council agreed that the Scientific Council mid-term meeting on Northern Shrimp be scheduled for 19-23 November 1993. With respect to holding these mid-term meetings annually, the Council agreed to review the results of the proposed meeting of November 1993 at its meeting in June 1994 before a decision was made.

f) **Adoption of Work Procedures for the June 1994 Scientific Council Meeting**

The Council took note of the STACFIS discussion of rearranging the assessment work, and considered the proposals made would be preliminary steps toward improving the efficiency in the work of the Council.

5. **Future Special Sessions**

a) **Special Session in September 1993**[1]

The Council was pleased with the interest generated for the Symposium on "Gear Selectivity/Technical Interactions on Mixed Species Fisheries" with S. A. Murawski (USA) and P. A. M. Stewart (EEC-UK) as co-conveners to be held during 13-15 September 1993. The Council extended a vote of appreciation to the co-conveners for their enthusiasm, and hoped for a successful and informative meeting.

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[1] The report of the Symposium considered and adopted by the Council by mail in October 1993 is Annexed to the STACFIS report.

Noting that the Acting Chairman of the Scientific Council, H. Lassen, was due to leave before the Symposium, the Council invited H. P. Cornus, STACFIS Chairman, to represent the Council as Chairman of the Symposium.

b) **Progress Report on September 1994 Special Session**

The Assistant Executive Secretary reported to STACFIS there were no new developments since the June 1993 Meeting.

c) **Progress Report on September 1995 Special Session**

The Assistant Executive Secretary reported to STACFIS there were no new developments since the June 1993 Meeting.

d) **Theme for September 1996 Special Session**

The Council took note that a theme would be selected at the September 1994 Meeting.

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

1. **Acquisition of STATLANT 21 Data and Publication of Statistical Information**

The Council agreed with STACREC that the publication of *NAFO Statistical Bulletin* Vol. 40 with the 1990 data should now be completed, in the absence of data for EEC-France (M) and France (SP). It was noted that the Volume 39 with the 1989 data was also published without data for EEC-France (M).

The Council agreed that the publication of *NAFO Statistical Bulletin* Vol. 41 also should proceed when the 1991 data as stated in the STACREC report become available.

2. **Acquisition of Statistical Information From Other Standing Committees**

The Council was pleased some progress was made in understanding the status of working papers in other Standing Committees. The Council believed that this communication process will assist in obtaining the relevant information for the work of the Scientific Council.

3. **Assessment Data Needs for 1994/95 and Respective Budget**

The Council noted that since the June 1993 Meeting, new information on conducting research surveys was available from the Greenland Fisheries Institute, which indicated an annual expenditure of about CAN $5.3 million. The cost of Japanese research was also summarized from the joint Greenland/Japan survey at CAN $1 million. The Council noted that relevant data had been presented by the Russian Federation to the Fisheries Commission. At present, taking into account that only two Contracting Parties had provided comprehensive documentation on this issue, the Council was unable to provide a response to the Fisheries Commission request.

4. **Non-traditional Fishery Resources in the NAFO Area**

The Council noted STACREC had reviewed the recent skate catch data. The Council recognized the importance of considering these and other non-traditional fishery data.

5. **Proposals for Scientific Tasks of Observers in the Pilot Observer Program**

The Council was pleased that the recommendation from the June 1993 Meeting was adopted by the Fisheries Commission, with the modifications as presented in the STACREC report.

6. **Updating of Conversion Factors Used to get Round Fresh Weight**

The Council was informed by STACREC that FAO was currently conducting a survey to revise the previously published conversion factors used by national fleets. This information was thought to be of some use to the

Council and these data should be obtained before any further work on compilation of conversion factors is attempted.

7. **Research Coordination for Greenland Halibut**

At its June 1993 Meeting, the Scientific Council recommended that consideration be given to the implementation of a joint multinational trawl survey for Greenland halibut from Davis Strait to the Eastern Grand Bank and Flemish Cap. The Council noted STACREC considered the data provided at this meeting by Canada and Japan/Greenland on current survey activity with additional estimates of the number of required days to complete the proposed survey. It was estimated that about 250 vessel-days would be needed to cover all Divisions from Div. 0A in the north to Div. 3N in the south. The Council noted that it was indicated that funding would not be provided in the foreseeable future to complete this proposed survey. The Council agreed that until such a survey is conducted, an adequate assessment of stock size and its relative distribution is unlikely.

8. **Other Matters**

The Council endorsed the **recommendation** that the Council should be represented at the 16th Session of CWP in Madrid, Spain, in July 1994 by the Chairman of STACREC, Assistant Executive Secretary and a national representative. The representative, E. de Cárdenas (EEC-Spain) was selected to attend along with STACREC Chairman, C. A. Bishop (Canada), and the Assistant Executive Secretary.

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

1. **Review of Scientific Publications**

The Council was pleased with the substantial progress made in review of papers and preparation for publication of papers since the June 1992 Meeting.

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

The Council was pleased to note that two Journal invitational publications (one on West Greenland Cod papers and the other on Northern Cod papers) under consideration will cover the cod stocks through most of the Northwest Atlantic. These two publications would be quite timely and provided very valuable coverage of the recently troubled cod stocks.

3. **Editorial Matters**

The Council endorsed the appreciation extended to R. Halliday for his long and valued services as a one-time Chairman and member of STACPUB and a decade of contributions as an Associate Editor. His advice and directions were often sought in the development of STACPUB processes.

The Council looked forward to an early replacement to his position in the Editorial Board of the Journal.

4. **Review of Papers for Possible Publications**

The Council was hopeful that a publication of significant scientific interest will result from the papers slated for the 13-15 September 1993 Symposium. The Council agreed with the STACPUB view that any recommendations by the co-conveners of the Symposium should be accepted regarding the suitable mode of publication.

5. **Guidelines for Authors**

Recognizing the importance of streamlining the document production by the Secretariat for the June meetings, the Council agreed with providing potential authors of Research Documents the guidelines prepared by the Secretariat.

V. RULES OF PROCEDURE

There were no Rules of Procedure considered at this meeting.

VI. COLLABORATION WITH OTHER ORGANIZATIONS

1. Scientific Council Representatives to CWP 16th Session in July 1994

The Council considered and endorsed the **recommendation** of STACREC (see above) regarding the 16th Session of CWP scheduled for July 1994 in Madrid, Spain.

The Council also noted the Assistant Executive Secretary was invited by FAO to review the NAFO/FAO database discrepancies during 28 September to 10 October 1993.

2. Scientific Council Invitations to Other International Bodies

It was noted that the status of the Scientific Council and the busy program of work it carries out was often quite different and not relevant to other international bodies. It was therefore agreed that Council invitations to other bodies will be made when necessary, and the Council will continue the current practice of reviewing each request for observer status on an individual basis.

VII. REVIEW OF FUTURE MEETING ARRANGEMENTS

1. Proposed November 1993 Meeting on Northern Shrimp

The Council agreed to the dates of 19-23 November 1993 for the mid-term Meeting of the Scientific Council to consider Shrimp in Subareas 0 and 1 and Shrimp in Denmark Strait. This meeting will be held at NAFO Headquarters, Dartmouth, Nova Scotia, Canada.

2. Special Session of 13-15 September 1993

Noting the Special Session (Symposium) would be held after this Annual Meeting, the Council agreed the report of that meeting will be considered for adoption if ready at the end of the Symposium or alternatively the report will be considered by mail (see STACFIS Report, Annex 1).

3. June 1994 Meeting of Scientific Council

The Council confirmed the dates of 8-22 June 1994 for the Meeting of the Scientific Council and its Standing Committees.

It was noted the Council would review the report of the November 1993 Meeting on Shrimp in Subareas 0 and 1 and Denmark Strait to determine if a November 1994 meeting will be called.

4. Special Session and Annual Meeting, September 1994

The Council agreed to hold the Special Session (Symposium) during 14-16 September 1994, immediately before the Annual Meeting of the Scientific Council during 19-23 September 1994.

5. June 1995 Meeting of Scientific Council

The Council agreed on the tentative dates of 7-21 June 1995 for its Meeting.

VIII. SPACE REQUIREMENTS FOR JUNE MEETINGS AND STRUCTURE OF SCIENTIFIC COUNCIL

The Council considered the possibility of holding its June meetings at an alternative venue to NAFO headquarters and was informed by the Standing Committee on Finance and Administration (STACFAD) of the General Council, that a sum of money would be made available to facilitate this. A proposal to meet at one of two hotels was discussed. However, it was suggested that a better alternative may be to rent office space for the duration of the meeting, and the Council requested that the Secretariat investigate this alternative.

IX. ADOPTION OF REPORTS

At its concluding session, the Council received and **adopted** the reports of the Standing Committees STACFIS, STACREC and STACPUB.

The Chairman then proposed that the Council report as discussed be adopted, noting that some text would be inserted by the Chairman and the Assistant Executive Secretary. The Council accordingly **adopted** the report of this meeting.

X. ADJOURNMENT

The Council noted the Chairman, V. P. Serebryakov, had fulfilled his 2-year term of office. The Council thanked him for this work during this period, and welcomed the incoming Chairman, H. Lassen (EEC-Denmark).

The Acting Chairman, H. Lassen, on behalf of the Council extended thanks to the work done by the Chairman of STACREC, A. Avila de Melo, during his 2-year term of office, and welcomed the incoming Chairman, C. A. Bishop (Canada).

Noting also that he himself would be stepping down from his position as Vice-Chairman of the Scientific Council and Chairman of STACPUB, he expressed his sincere thanks for the support he received during his term in office, and welcomed the incoming Vice-Chairman of Scientific Council and *ex-officio* Chairman of STACPUB, R. W. Bowering (Canada).

The Acting Chairman also noted that R. G. Halliday had tendered his resignation to the Editorial Board. This represented the end of a very long term of dedicated support to the Scientific Council from ICNAF times. This also represented the departure of a key founding member of STACPUB and the *Journal of Northwest Atlantic Fishery Science*. On behalf of the Council, sincere thanks and best wishes were extended.

There being no further business, the Acting Chairman closed the meeting and thanked everyone for their contributions and asked the Assistant Executive Secretary to convey to the Secretariat the Council's appreciation of its friendly and efficient assistance during the meeting.

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

Chairman: H. P. Cornus Rapporteur: Various

The Committee met at the Holiday Inn, Dartmouth, Nova Scotia, Canada, during 7-10 September 1993 to consider and report on various matters referred to it by the Scientific Council. Representatives from Canada, Denmark (in respect of the Faroe Islands and Greenland), European Economic Community (Denmark, France, Germany, Portugal, Spain and United Kingdom), Iceland, Japan and the Russian Federation were present. STACFIS reviewed the recommendations of the June 1993 Meeting and it was agreed that the review of assessment methods to be used will be considered under agenda item 2.c (see Agenda II, Part D, this volume).

I. STOCK ASSESSMENTS

1. **Silver Hake in Divisions 4V, 4W and 4X** (SCR Doc. 93/1, 2, 4, 5, 6, 7, 40, 102; SCS Doc. 93/10)

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 from 1977 to 1989, with the exception of 1983, 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.

Recent catches and TACs ('000 tons) are as follows (Fig. 1):

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
TAC	80	100	100	100	100	120	135	135	100	105	75
Catch	36	74	75	83	62	74	91	69[1]	68[1]	32[1]	29[1]

[1] Provisional.

The 1992 fishery commenced in mid-March, on an experimental basis and finished in July. Catch rates were generally poor, with pollock by-catch higher than that seen in previous years. In early-May a portion of the fleet (12 vessels) was forced to stop fishing for one week due to this high by-catch. The 1993 fishery followed a similar pattern, although by-catch was not a limiting factor at any time.

b) Input Data

i) Commercial fishery data

Catch rates. As in previous assessments, standardized catch-rates were calculated using a multiplicative model. The standardized catch-rate for this stock had dropped in recent years (Fig. 2), from a peak of 5.5 tons/hr in 1989 to 2.2 tons/hr in 1992. In 1993 the standardized catch-rate remained essentially the same as in 1992, at 2.2 tons/hr. The most recent catch rates were similar to those experienced in the late-1970s and early-1980s.

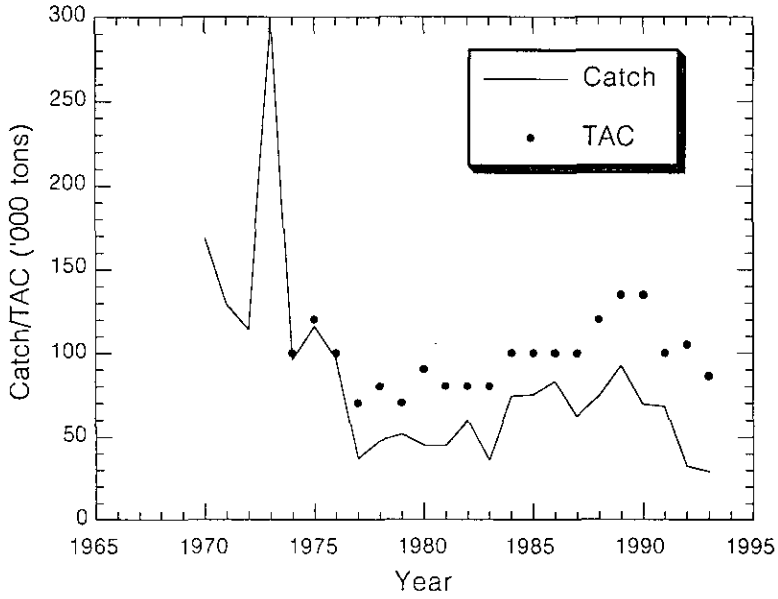

Fig. 1. Silver hake in Div. 4VWX: catches and TACs.

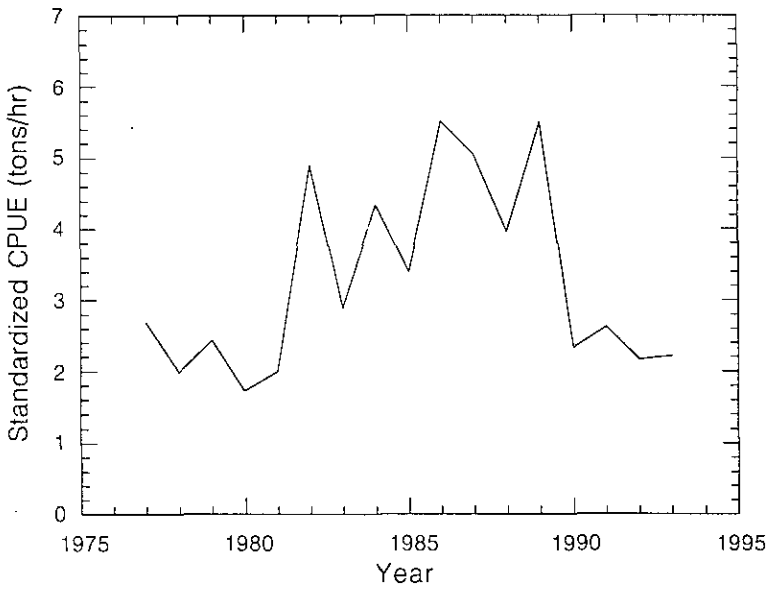

Fig. 2. Silver hake in Div. 4VWX: standardized catch rates.

Catch-at-age data. The commercial removals-at-age for 1992 were calculated from Canadian length samples and a combined Canada/Russia age-length key, following the same procedure used in the previous two assessments. Canadian July research vessel survey data were used in the calculation of weights-at-age. The removals-at-age and weights-at-age for 1977-91 were taken from the previous assessment to provide estimates for the period 1977-92 inclusive.

ii) **Research survey data**

The survey results indicated a continual decline in total numbers and biomass over the period 1986-92 (Fig. 3). Results of the 1993 survey indicated both numbers and biomass had risen moderately.

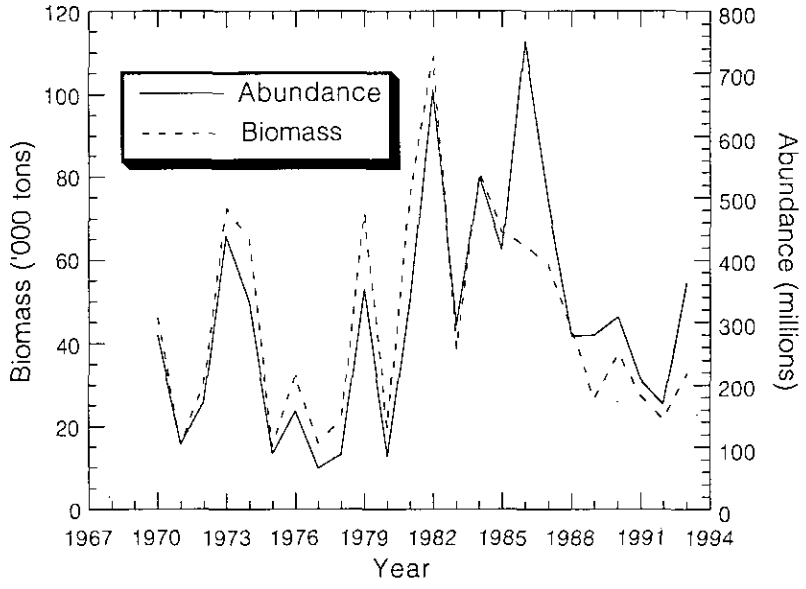

Fig. 3. Silver hake in Div. 4VWX: biomass and abundance estimates from July Canadian research vessel data.

In numbers-at-age the surveys showed the 1990 year-class to be below average in 1991 and 1992 at ages 1 and 2, respectively. The 1991 year-class appeared even weaker than the 1990 year-class at age 1. In 1992 a survey for 0-group silver hake was not conducted. However, an estimate of numbers at age 1 for this year-class were obtained from the 1993 July survey by adding all fish 21 cm and less, half those at 22 cm, together. This suggested that the 1992 year-class was above average in strength.

iii) **Environmental data**

One paper was presented summarizing oceanographic conditions (SCR Doc. 93/1). Analysis of sea-surface temperatures for 1992 showed negative anomalies in spring, summer and winter on the Scotian Shelf, over the 1991 conditions.

iv) ***Biological studies***

Several papers investigated the reliability of independent silver hake abundance indices (SCR Doc. 93/2, 4, 7).

Significant correlations were noted between commercial CPUE and research abundance indices at ages 1 and 2. These relationships were not significant at older ages.

Probable relationship between the fluctuations in year-class abundance for silver hake and other gadoids (Div. 4VWX+5 pollock, Div. 2J and 3KL, Div. 3NO, Subdiv. 4Vs, Div. 4W cod) was studied. During the 1980s an inverse relationship between year-class abundance of silver hake and other species was apparent. Such dynamics in abundance can be explained by the influence of the oceanographic processes influencing the Northwest

Atlantic. It was suggested that strong year-classes of the silver hake population under consideration appear predominantly in warm years.

The joint USSR-Canadian surveys in 1988 and 1990 in the Scotian Shelf area provided data to estimate silver hake concentration steadiness in relation to species composition, abundance, distribution of food organisms, and hake feeding dynamics. Relationships were noted between concentration locations, diurnal vertical migrations of food organisms, and silver hake aggregations.

Data on feeding, diurnal and annual food ration of silver hake in Div. 4VWX in 1988 and 1990 were summarized (SCR Doc. 93/40). Diurnal rations of hake females and males were calculated by size groups. Annual food uptake was estimated by food items. Comparison of food composition and amount revealed that euphausiids (27%) and young silver hake (56%) constituted the major food in July 1988, while in June 1990 the bulk of food consisted of three groups: euphausiids (34%), young hake (28%) and short-finned squid (28%).

c) **Estimation of parameters**

i) **Sequential population analysis**

Two formulations of the adaptive framework (ADAPT) were reviewed. The first (SCR Doc. 93/5, 6), incorporated a 'stabilization' factor in the model, in an attempt to correct the retrospective pattern. For reasons detailed in Section II.1, (Review of Research Documents), concern was expressed whether the use of the stabilization factor in the model was appropriate. For this reason the SPA was not accepted.

A second ADAPT analysis (SCR Doc. 93/102) utilized commercial catch-at-age, age disaggregated standardized CPUE, Canadian July survey catch-at-age and a juvenile index, with a dome-shaped partial recruitment pattern and M = 0.4.

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

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. It was noted that the high negative residuals associated with the 1992 estimates from both July research vessel and CPUE indices supported the conclusion that the most recent year did not fit the model well. Under these circumstances, it was reasonable to assume that the 1992 fishing mortality produced by ADAPT was also underestimated, however, the degree to which population numbers were being overestimated was difficult to quantify.

d) **Prognosis**

The 1992 year-class will make a significant contribution to the catch in 1994 at age 2. As an 0-group survey was not conducted, the only available estimate of this cohort is that from the 1993 July research vessel survey. The 1991 year-class is also important and its estimation in the SPA is based only on a single occurrence in the catch matrix. While it was decided to accept the estimates of the 1990 and earlier year-classes as given by the SPA, the strengths of the 1991 and 1992 year-classes were inferred from July survey data.

Year-class estimates from the research vessel survey (RV) were regressed against estimates from the SPA for the 1981-90 year-classes at age 1, using the model SPA = a + b(*ln* RV); $r^2 = 0.84$. Predictions from this relationship for the strength of the 1991 and 1992 year-classes were 0.4 and 1.2 billion fish, respectively. The estimate for the 1992 year-class was corroborated by data presented for the 1993 Russian commercial fishery. These show the appearance of age 1 fish in the catch in numbers similar to previous abundant year-classes.

An $F_{0.1}$ value of 0.72 was used as in last year's assessment, based on the yield-per-recruit analysis of the Scientific Council in 1990 (NAFO Sci. Coun. Rep., 1990). The mean weights-at-age for projection were taken as the average of recent years (1988-92) observed in the fishery. The partial recruitment pattern was based on the average F-at-age in the SPA for 1990-91. Weight- and PR-at-age used were as follows:

Age	Average weight (kg)	Partial recruitment pattern
1	0.059	0.01
2	0.138	0.29
3	0.189	0.92
4	0.219	1.00
5	0.260	0.88
6	0.310	0.89
7	0.403	0.50
8	0.466	0.33
9	0.662	0.09

The provisional catch of 29 000 tons in 1993 (Canadian observer data) was estimated to have resulted in a fishing mortality of F = 0.40. Fishing at $F_{0.1}$ in 1994 is estimated to equate to a catch of 51 000 tons.

The retrospective analysis using ADAPT methodology indicated a consistent tendency for F estimates to increase by 40 to 60% for a particular year when additional years of data were added. 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 only because TACs have not been fully harvested (due to allocation and other restrictions), that the actual F appears to have been close to $F_{0.1}$. There is no reason to expect that the current estimate of F in 1992 will not, in future, also appear to be an underestimate. This suggests that the abundance of year-classes estimated by ADAPT for 1992 may have been overestimated. These are the 1990 and older year-classes which will be ages 4 and older in 1994. These ages account for about 45% of the projected catch in 1994. It is likely, therefore, that the projected catch at $F_{0.1}$ in 1994 of 51 000 tons is also overestimated to some extent. Unfortunately, the extent of this is difficult to determine.

e) **Future studies**

STACFIS continues to support co-operative studies on silver hake. These include continuation of the joint Canada-Russia juvenile survey. As was stated in the past two reports, STACFIS recognized that a Canada-Russia experiment to validate age readings using radio-nucleotides is ongoing and encourages its completion. STACFIS reiterates its previous **recommendation** that *upon completion of the radio-nucleotide studies to validate silver hake age readings, one comprehensive document be prepared by Canadian and Russian authors.*

Attention is drawn to the paper by P. S. Gasiukov on stabilization of ADAPT estimates (SCR Doc. 93/5) as one possible method of resolving the retrospective problem. This is, of course, not an issue which concerns only silver hake but is central to improvement of many of the stock assessments conducted by STACFIS. Thus, further investigation of this and other approaches to the retrospective problem is encouraged. With respect to silver hake, the retrospective pattern in ADAPT SPAs should be examined more closely over a wider range of age groups to better quantify the extent of potential underestimates.

2. **Shrimp in Division 3M** (SCR Doc. 93/22, 101, 103, 104, 105, 107, 110, 111, 112)

a) **Introduction**

Although the presence of shrimp on Flemish Cap has been known for many years, no significant shrimp commercial effort was reported from the area before spring 1993. A shrimp fishery began

in late-April 1993 when two Canadian vessels were granted exploratory permits to fish the species in Div. 3M. By late-July, about 50 vessels from several nations were reported fishing for shrimp in the area. Preliminary reports (to August 23) indicated that over 21 000 tons of shrimp have been taken so far in 1993 and that, as of August 31, 18 vessels were still active in the fishery.

b) **Input Data**

i) **Commercial fishery data**

Fishery information from Canada, Faroe Islands, Greenland and Iceland indicated that effort was distributed around the Cap along the 400 m contour (Fig. 4). Catch rates generally declined from May to early-July, stabilizing somewhat thereafter.

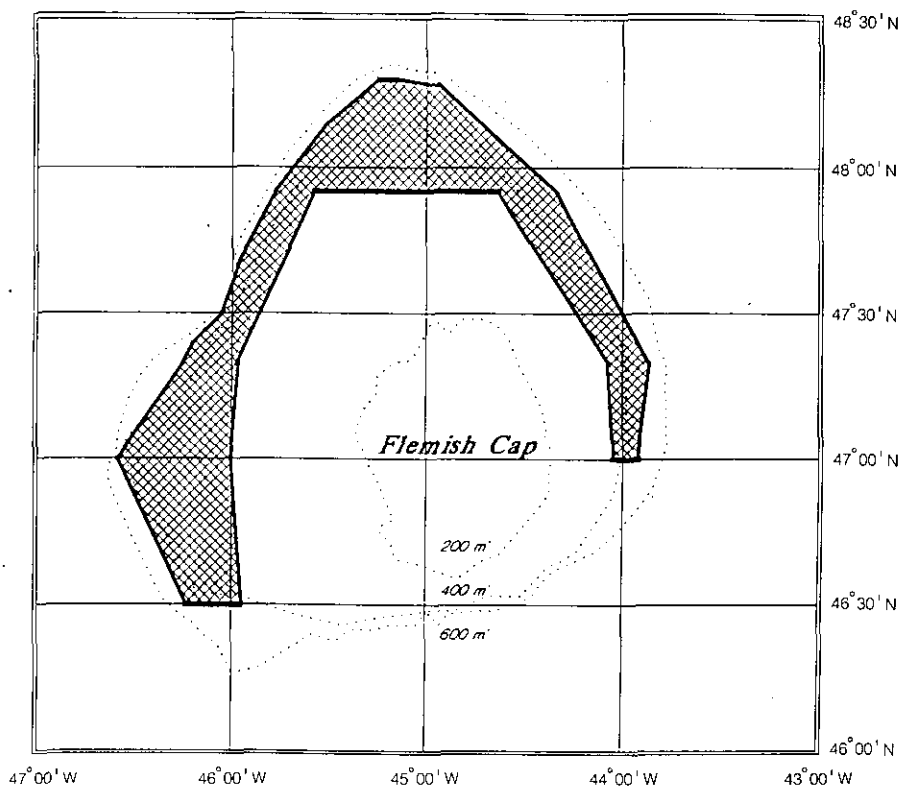

Fig. 4. Shrimp in Div. 3M: main shrimp area in May-August 1993.

Size composition data (oblique carapace length) from commercial sampling from Canada and Iceland showed three size groups of males (16, 20, 23 mm) and one of females (26 mm). Overall sizes ranged between 14 and 30 mm and included at least 5 ages (2 to 6). Females were not ovigerous from May to July indicating that the egg-bearing period lasts from about August to March.

By-catch consisted primarily of small redfish (mode at 14 cm) and Canadian observer data indicated levels between 10-15% of the total catch weight in April-June, increasing to higher levels in July. By-catch of other commercial species was low during that period.

ii) **Research survey data**

Oceanographic data were obtained from the Flemish Cap during a Canadian survey conducted in July 1993 and compared with historical data for the area. The general circulation in the area was characterized by an anticyclonic gyre which could play an important role in the retention of shrimp larvae. Also, the hydrographic data showed a cooling trend since 1988 which could favour the survival of shrimp.

EEC summer groundfish surveys were conducted on Flemish Cap from 1988 to 1993. Shrimp biomass estimates were calculated from the catches obtained using a groundfish bottom trawl and therefore did not represent the absolute shrimp biomass. However, they showed that relative shrimp biomass from 1991 to 1993 was substantially higher than during the 1988-90 period.

Year	Average Catch Per Mile (kg) and Standard Error
1988	1.54±0.28
1989	1.37±0.24
1990	1.53±0.21
1991	5.83±0.71
1992	11.75±1.86
1993	6.57±1.04

These surveys also showed that abundance was highest in the western, northern and northeastern parts of the Cap and in depths ranging from about 300 to 500 m. These were the areas fished commercially during May-August, 1993.

Age interpretation of the size distributions from the 1988 to 1992 surveys and the 1993 commercial fishery samples identified the 1988 year-class as strong, possibly accounting for the increase in biomass in recent years. The 1988 year-class was female in 1993 and at the sizes targeted by the industry which explains the success of the new fishery in 1993.

The occurrence of shrimp in cod stomachs taken during winter surveys on Flemish Cap from 1978 to 1984 provided information on shrimp distribution, age, growth and year-class strength. The data suggested that shrimp abundance also varied during this period. Length-at-age 1 was estimated at about 7 mm, and it was concluded that the first size group of male shrimp evident in trawl samples was age 2 (16-18 mm).

Cod predation data available from EEC surveys from 1989 to 1992 showed that shrimp increased in importance as prey for cod between 1989 and 1990. The proportion of cod stomachs containing shrimp increased from 12% in 1989 to 26% in 1990 and 33% in 1991.

c) **Assessment Results and Prognosis**

STACFIS agreed that shrimp abundance in recent years had increased, but it was uncertain whether or not this high level of abundance will continue. The general decline in catch rates from May to July may be an effect of exploitation or due to the seasonality as observed in other shrimp fisheries. Information is lacking on the history of the stock, present stock size, future recruitment and impact of the 1993 catch level. At present, it is not possible to conclude that a fishery at or near the 1993 catch is sustainable in the Flemish Cap area and STACFIS has not sufficient data to provide a basis for the calculation of an initial TAC. However, based on the uncertainties mentioned above, concern was expressed for the level of removals in 1993 and a cautious approach to exploitation should be considered.

The by-catch of small redfish was considered as a potential for significantly impacting the redfish resource in this area. STACFIS **recommended** that, *effective immediately, sorting grates be mandatory in shrimp fishing operations on Flemish Cap as a means of minimizing the by-catch of redfish and other fish species.*

d) **Research Recommendations**

The development of the Flemish Cap shrimp fishery represents a unique opportunity to monitor closely the response of a shrimp population from the beginning of its exploitation. A comprehensive monitoring program will provide valuable information which can be considered in assessing and managing this resource as well as other shrimp stocks of the Northwest Atlantic. Therefore, with respect to Shrimp in Div. 3M, STACFIS **recommended** that:

- *all countries participating in this new fishery provide levels of sampling for shrimp and important by-catch species as recommended by NAFO Conservation and Enforcement Measures;*

- *the EEC groundfish surveys, during summer on Flemish Cap which have provided a valuable time-series of data on shrimp, continue to include the detailed sampling of shrimp and the analysis of the data as in the past years;*

- *that since more data on the food and feeding of cod exist, they be analyzed to obtain additional and historic information on shrimp distribution and abundance in the area.*

3. **Workshop on Assessment Methods**

STACFIS discussed the suitable time to conduct another workshop on assessment methods and recognized that such a meeting should be planned if and when the need arises.

4. **Data Availability for Assessment of Northern Shrimp in November 1993**

STACFIS considered a proposal from Denmark/Greenland regarding the reinstatement of a mid-term meeting for the assessment of Northern shrimp stocks in Subareas 0 and 1 and Denmark Strait.

It was made clear that the data available for the shrimp stock assessments had improved considerably since the suspension of STACFIS mid-term meetings in 1987. Since 1988 a yearly trawl survey has been conducted in July-September giving an index for the trawlable biomass and information on distribution of the stock, size distribution of shrimp and recruitment (20 mm mesh in cod-end introduced in 1993). Further improvements include a new logbook system covering almost 100% of the large vessels since 1988, revealing information on catch rates, catch composition and distribution of the fishery. Additionally the coverage of sampling from the commercial fishery has also been extended.

It could not be stated to what extent the assessments and predictions had also improved, but it was felt that the survey was revealing key information, and that it would be appropriate to include the current information in the advice for the coming year at a mid-term meeting, i.e. to include the 1993 survey in the advice for 1994.

If a mid-term meeting was to be held at NAFO Headquarters in Dartmouth the extra costs to NAFO would be marginal. Accordingly, STACFIS **recommended** that *a mid-term meeting be held for Northern shrimp in Subareas 0 and 1 and Denmark Strait at NAFO Headquarters.*

II. REVIEW OF RESEARCH DOCUMENTS

1. **On the Stabilization of Commercial Fish Stock Estimates Obtained by Means of the Adaptive Approach** (SCR Doc. 93/5)

This document dealt with the phenomenon that may be called 'stock estimate instability' as revealed through retrospective analysis. To solve such a condition, special methods were developed, one of them based on

the use of a regularization algorithm. Utilization of this method was carried out using known biomass values from the converged portion of the VPA. Such an approach provided stable stock estimates for silver hake in Div. 4VWX. Average deviation of such estimates based on retrospective analyses was less than 10%.

Concern was expressed that although use of the algorithm removed the apparent retrospective pattern, there were no changes in estimates for the terminal year. Therefore, the method appears to be 'masking' the pattern rather than solving the problem.

STACFIS was pleased that work is being carried out to try and solve the retrospective problem and encouraged further work on this topic.

2. **Osteological Differences in Species of *Sebastes* on Flemish Cap** (SCR Doc. 93/23)

Several morphometric analyses were made on bones of the three species of the genus *Sebastes* that occur on the Flemish Cap. The basipterigium was described as the bone which best discriminated the three species. Cluster analysis indicated that *S. marinus* and *S. fasciatus* were species more closely related than with *S. mentella*.

3. **Miscellaneous Papers on Cod in Divisions 2J and 3KL** (SCR Doc. 93/30-39, 41-43, 45, 55-57, 68)

STACFIS noted that the highlights of these papers had been presented and discussed at the June 1993 Meeting in conjunction with the assessment of Div. 2J and 3KL cod. As such it was considered unnecessary to review these papers during this meeting.

III. REVIEW OF CURRENT ARRANGEMENTS FOR CONDUCTING STOCK ASSESSMENTS AND DOCUMENTATION

1. **Updating List of Designated Experts**

Recognizing the workload of the Designated Experts during the June Meetings, STACFIS felt it would be desirable to nominate one scientist per stock. However, it was noted that this was not practical at the present time. Accordingly, the list of Designated Experts for 1993 was reviewed and the following were tentatively identified for the 1994 assessments:

- From the Science Branch, Northwest Atlantic Fisheries Centre, Department of Fisheries and Oceans, P. O. Box 5667, St. John's, Newfoundland, Canada, A1C 5X1 [Telefax: (709) 772-4188],

for	Cod in Div. 3NO	C. A. Bishop
	Redfish in Div. 3LN	D. Power
	American plaice in Div. 3LNO	W. B. Brodie
	Witch flounder in Div. 3NO	W. R. Bowering
	Yellowtail flounder in Div. 3LNO	W. B. Brodie
	Greenland halibut in SA 2 + Div. 3KL	W. R. Bowering
	Roundnose grenadier in SA 2+3	D. B. Atkinson
	Capelin in Div. 3L	J. E. Carscadden
	Capelin in Div. 3NO	J. E. Carscadden
	Squid in SA 3+4	G. H. Winters
	Shrimp in Div. 3M	D. G. Parsons

- From the Instituto de Investigaciones Marinas, Muelle de Bouzas, 36208 Vigo, Spain [Telefax: 34-86292762],

for	Cod in Div. 3M	A. Vazquez

- From the Instituto Espanol de Oceanografia, Centro Oceanografico de Cantabria, Aptdo 240, 39080 Santander, Spain [Telefax: 42 275072],

	American plaice in Div. 3M	E. de Cárdenas

- From the Polar Research Institute of Marine Fisheries and Oceanography (PINRO), 6 Knipovich Street, Murmansk, 183763, Russia [Telefax: 70 95 9213463 - Telex: 126 111 PINRO],

  for Redfish in Div. 3M — K. V. Gorchinsky

- From the Greenland Fisheries Research Institute, Tagensvej 135, 1, DK-2200, Copenhagen, Denmark [Telefax: 45 35821850],

  for Northern shrimp in SA 0+1 — D. Carlsson
  Roundnose grenadier in SA 0+1 — J. Boje
  Wolffish in SA 1 — J. Boje
  Greenland halibut in SA 0+1 — J. Boje

- From the Institut für Seefischerei, Fischkai 35, D-27572 Bremerhaven, Republic of Germany [Telefax: 49 47173473],

  for Redfish in SA 1 — H. J. Rätz

- From the Marine Fish Division, Department of Fisheries and Oceans, Bedford Institute of Oceanography, P. O. Box 1006, Dartmouth, Nova Scotia, Canada, B2Y 4A2 [Telefax: (902) 426-7827]

  for Silver hake in Div. 4VWX — M. A. Showell

- From the Marine Research Institute, Skulagata 4, P. O. Box 1390, 121 - Reykjavik, Iceland [Telefax: 354 1623790],

  for Northern shrimp in Denmark Strait — U. Skúladóttir

The Secretariat was requested to confirm the availability of the Designated Experts from their respective laboratories.

2. Review of Working Papers to be Prepared by Designated Experts on Their Workload

A number of proposals were endorsed by STACFIS to streamline the assessment work at the June meetings. These consisted of having data such as catch-at-age and indices of abundance available before, or at the very latest, at the start of the meeting. As well, scientists who prepare such data should provide documentation for the STACFIS report.

To improve the transfer of data and information between scientists and the NAFO Secretariat, STACFIS **recommended** that *the Secretariat acquire access to a computerized e-mail system. This is considered to have several benefits to improve communications and reduce the costs.*

3. Guidelines for Documentation of Assessments

It was noted that the amount of information resulting from surveys was difficult to describe in the assessment documentation. STACFIS agreed a structural description would be helpful. A proposed structure for the description of survey results was based on biomass, abundance, distribution, length and age structure, recruiting year-classes, maturity and fecundity of the target species.

4. Status of Scientific Documents (Working Papers *vs* Research Documents)

STACFIS noted that due to time constraints during the June Meeting, some documents were not adequately reviewed. One immediate concern was that research documents of some assessments at times did not completely reflect the outcomes of the assessments and showed differences to the text reported in the Scientific Council Report. However, STACFIS agreed that these lapses could be overcome within the present framework of the meetings. It was also agreed that Designated Experts should be informed of these lapses and every effort be made to avoid them.

5. **Proposal for Annual Shrimp Meeting in November**

STACFIS agreed on a meeting on Northern shrimp at NAFO Headquarters during 19 to 23 November 1993. The agenda for this meeting will be circulated by the Secretariat 60 days in advance of the meeting.

6. **Adoption of Work Procedures for the June 1994 Scientific Council Meeting**

A proposal that the Scientific Council and its Subcommittees be restructured was presented for discussion. The specific issue addressed related to changes required to improve the efficiency of work during the STACFIS meeting. This resulted from the observations that conducting stock assessments continues to represent a considerable workload within the scheduled time for the June meetings of the Scientific Council. The main areas of restructuring considered at this time were; the creation of formal Working Groups to deal with the assessment of species or groups of similar species and changes to the meeting timetable.

STACFIS noted previous attempts to use a formalized working group approach had limited success. Some of the difficulties encountered related to the adequacy of peer review, required attendance of individuals at concurrent meetings and duplication of effort at subsequent review levels leading to reduced productivity.

A proposed timetable change was suggested to have the first meeting day determine the status of data availability and the status of preliminary assessments, as was done during the June 1993 meeting. The outcome of the first day's session would determine the course of action to be followed which could include the setting up of working groups to deal with specific issues or problems. The feasibility of this *ad hoc* approach was considered more practical than a more formalized one in dealing with unforeseen issues or problems. Scheduling the Environmental Subcommittee and STACREC meetings immediately after the first day might also permit additional time for determining the best course of action.

The unavailability to Designated Experts of necessary assessment related data at the beginning of meetings has been a persistent problem that has contributed to lost time and consequent reduced efficiency. It was suggested that data should be provided earlier, and in a form that would permit direct inclusion into the appropriate assessment model.

STACFIS concluded that any improvements that might result from the creation of formal working groups at this time were not clear and considered that the best current option involved changes to the timetable. It was also considered that during the meeting, Designated Experts or working groups should also keep the Chairman regularly informed as to progress with the assessments. In this regard it was also considered that this would be more feasible if more meeting and/or working space were available at one location.

IV. FUTURE SPECIAL SESSIONS

1. **Progress Report on 13-15 September 1993 Special Session on "Gear Selectivity/Technical Interactions in Mixed Species Fisheries", Co-conveners S. A. Murawski (USA) and P. A. M. Stewart (EEC-UK).**

STACFIS was pleased with the responses received to date for this Symposium, and the apparent keen interests expressed by scientists. STACFIS expressed its appreciation to the co-conveners for the enthusiastic work to create this interest.

STACFIS considered how the report of this Symposium may be adopted for the report of this meeting. While it was hoped that the report would be ready at the time of the closure of the Symposium, STACFIS agreed that alternatively the report could be adopted by mail (see Annex 1).

Noting the acting Chairman of Scientific Council, H. Lassen, was not available to attend the Symposium, STACFIS invited H. P. Cornus to represent him.

2. **Progress Report on September 1994 Special Session**

The Assistant Executive Secretary reported to STACFIS that there were no new developments since the June 1993 Meeting.

3. **Progress Report on September 1995 Special Session**

The Assistant Executive Secretary reported to STACFIS that there were no new developments since the June 1993 Meeting..

4. **Theme for September 1996 Special Session**

It was agreed that a list of possible themes for the 1996 Special Session will be reviewed and a topic selected at the September 1994 Meeting. Representatives were requested to forward their proposed themes to the Secretariat.

V. RESPONSE TO THE FISHERIES COMMISSION

There were no formal requests from the Fisheries Commission at this meeting. However, the Chairman of the Scientific Council attended several meetings of the Standing Committee on International Control (STACTIC), and responded directly to some of the questions posed. These are reflected in the report of that Standing Committee.

VI. OTHER MATTERS

There being no further business, the Chairman thanked everyone for their patience and cooperation during the very busy schedule of this meeting.

ANNEX 1. REPORT OF THE SPECIAL SESSION ON GEAR SELECTIVITY/TECHNICAL INTERACTIONS IN MIXED SPECIES FISHERIES

Since the Symposium was held after the Annual Meeting of the Scientific Council, 7-10 September 1993, the following report prepared by the co-conveners was considered and **adopted** by the Council by mail. The Council had agreed at its annual meeting to accept the recommendations of the co-conveners of the Symposium on the suitable mode of publication, and welcomed the co-conveners to undertake the editorial work on the papers submitted.

Introduction

The Symposium on "Gear selectivity/technical interactions in mixed species fisheries", with S. A. Murawski (USA) and P.A.M. Stewart (EEC-United Kingdom) as co-conveners, was held at the Holiday Inn, Dartmouth, Nova Scotia, Canada, during 13-15 September, 1993. Twenty five papers were presented (SCR Doc. 93/92-100, 93/109, 93/113-127, see Part C, this volume) and, additionally, four posters and two video presentations were displayed. The Symposium was organized into six thematic paper sessions: (1) Components of mixed fishery systems (S. Murawski, USA, Chair), (2) Influencing the selection pattern of fishing gears (P. A. M. Stewart, EEC-UK, Chair), (3) Interactions among competing gears (A. Sinclair, Canada, Chair), (4) Mixed species/multifishery effects (S. Murawski, USA, Chair), (5) Fleet dynamics in technical interactions (J. DeAlteris, USA, Chair), and (6) Gillnet selection studies (A. Bjordal, Norway, Chair). A final panel discussion consisted of brief presentations by the session chairmen, reviewing information presented at the six sessions, and their views on the content of the Symposium and future directions of research in the theme areas. The Symposium was opened and closed by H.-P. Cornus (EEC-Germany), Chairman of STACFIS. A total of 70 participants registered for the Symposium, representing 15 countries (Brazil, Canada, Chile, Denmark, Finland, France, Germany, Greenland, Japan, Norway, Portugal, Russian Federation, Spain, UK, USA).

The concept of this Symposium was rather revolutionary - to bring together experts in various scientific disciplines to address a common problem. The subject of technological interactions in mixed fisheries has many dimensions. Gear technologists, stock assessment experts, economists and social scientists view the nature of problems associated with mixed fishery harvesting, and their potential mitigation, from vastly differing points of view. The goals of the Symposium were (1) to summarize the current state of fisheries research on the topics of gear selectivity and technical interactions (2) to propose new directions for future research, and (3) to establish dialogue among experts from the various disciplines that may facilitate more integrative approaches to these problems. Based on the diversity of contributions and the summaries presented by the session chairmen, the goals of the Symposium were accomplished.

Thematic Contributions

The subjects considered in the papers, posters and videos presented spanned the diversity of issues intended in the announcement of the meeting and call for papers. Following is a brief summary of the contributions, by theme session:

Components of mixed fishery systems. Four papers and a poster presentation on this subject emphasized the evolution of data and analytic tools for revealing the structural elements contributing to mixed fishery systems. Seasonal components of the Gulf of St. Lawrence fisheries are dominated by the cyclical distribution patterns of species taken in single- and mixed-species fisheries. New computer-assisted methods for visualization of this complexity were demonstrated. The identification of fishery tactics and factors associated with by-catch and discard rates were evaluated in two papers that utilized tow-by-tow sea sampling data from otter trawl fisheries off the northeast USA. Options for the management of the transboundary Greenland-Iceland cod stock were considered, given the rates of migration and bioeconomics of fleets operating when components of the stocks occur in the two areas. Interactions between the pelagic and demersal fleets and fisheries of Chile were found to be dependent upon relative fishery success among industrial and artisanal components.

Influencing the selection pattern of fishing gears. Effects of gear modifications on the selective properties of fishing gears were considered in six papers and one video presentation. Two papers considered the analysis of data from 'trouser trawl' gear, used to evaluate selection properties of a mesh alternative, relative to a control mesh. The choice of empirical versus structural modelling of selection properties of gears focused on the goodness-of-fit of alternative models and the underlying reasons for choosing one approach over the other. Use of a sorting grate for herring in the Baltic resulted in some mortalities of animals passing through the grate and not retained by the gear.

Implications of discard mortalities for witch flounder yields were evaluated in a poster. The size compositions of catches sampled at sea, using different mesh sizes and shapes used in the fishery were compared to experimental gear selection studies for these gears. Results in some cases conflicted. The selection properties of otter trawl gear for redfish were reviewed, in relation to the total catch and size composition, based on experimental fishing results. A video designed to explain principles of gear selectivity and measurement methods to managers and industry was presented.

Interactions among competing gears. Relative selection properties of fishing gears deployed to target various species were reviewed in four papers. The selection properties of various gears in some cases give clear differences in size/age retention, whereas when fisheries are more complex, selection attributable to the gear properties becomes more ambiguous. Choice of the 'optimal' gear to exploit a particular species must take into account not only biological goals such as protecting pre-spawning individuals, but the inherent trade-offs between species when species mixtures are taken. A modelling paper presented a framework within which the properties of gear selection (steepness of the curve and its placement) can be used to evaluate effects on yields and spawning stock biomass-per-recruit.

Mixed species/multifishery effects. Four papers and one poster emphasized the effects of interactions among species and fisheries on yields and values of complex fishery systems. Two presentations considered the short-term survivorship of roundfishes and flounders discarded from otter trawl fisheries off the northeastern USA. The impact of discards of young fish on standard assessment calculations (Fs, yields and spawning biomass), was considered for both retrospective analyses and in forecasts. The impact of survivorship of herring passing through the meshes of a herring trawl on yield projections assuming different mesh sizes was considered. Factors that influence decisions by skippers to target specific fishing grounds were evaluated in a probabilistic outcome framework.

Fleet dynamics in technical interactions. The interactions among multi-purpose fishing fleets with respect to fishery yields and associated economic and social considerations were considered in five papers. Choice of management units is a complex intersection of gear, species mix and targeting behaviour of fishermen. The use of standard predator-prey models for describing the targeting behaviour of multi-purpose fleets was reviewed. The impact of mixed-species harvesting on the fishing mortality of species was considered as an exercise in computing the partial fishing mortality rates due to each fleet. Optimization of the Greenlandic shrimp fishery was considered, particularly emphasizing the differential revenue of the product based on individual animal sizes. The evaluation of gear alternatives for Canadian shrimp fisheries were considered in a combined video and paper presentation.

Gillnet selection studies. Two papers evaluated various properties of gillnet selectivity, and predictions of selection based on theoretical aspects of fish length-girth and mesh size. Theoretical selection curves generally performed well in predicting percent retention, better than for mobile fishing gears.

Summary of Findings

The management of fishery resources, world-wide, is complicated by a general trend in increased fishing pressure, combined with the rapid pace of technological innovation in fishing gear, and competition for fishery resources among gears, fleets and nations. Managers are increasingly asking scientists of various disciplines questions such as: What is the 'best' age or size at which to exploit species x? What is the 'best' gear to exploit a particular fishery? What is the relationship between fishing effort and yield? What are the economic and social consequences of particular management actions that we are contemplating? More often than not, managers have addressed these and similar questions to the technical disciplines individually rather than collectively. Not surprisingly, the answers to the questions have been ambiguous and in some cases conflicting.

It is clear that a multi-disciplinary approach to the provision of management advice is necessary when complex fishery interactions occur. Tentative results presented at the Symposium emphasize the difficulty of management actions based solely on benefits to be derived from gear-based solutions. The actual benefits of improving selectivity of particular target species may be substantially reduced by a variety of operational factors, including mixed catches of non-target animals. Survivorship of sorted animals, either in the sea or on deck, may significantly alter our perceptions of the benefits expected from a proposed technological solution. Likewise, gear changes may have substantial economic and social consequences for mixed fleets. Choice of the 'best' way to harvest a particular species or species group is a complex decision involving the impacts on yields and spawning potentials of the resource, and the economic efficiency of the gears and fleets. Optimization of total yields or revenues for multi-fleet or multi-national fisheries may result in substantial social consequences which must be considered.

Participation in the Symposium by representatives of the Canadian fishing industry and domestic management bodies provided a focal point for deliberations, and a message to the scientists. The serious management problems of the day require the choice between management options that, in some cases, will have important societal and ecological consequences. These choices need to be made based on forecasts that incorporate the complexity inherent in the real world. Participants generally felt that they had new insights into the questions, approaches and findings provided by the various disciplines represented, and a better appreciation of how these various elements fit together into an integrated assessment of the biological and fishery consequences of management alternatives.

The consensus of the participants was the desire to publish appropriate papers from the Symposium in the *Journal of Northwest Atlantic Fishery Science*. A 1 November 1993 deadline for submission of final manuscripts to the Secretariat was established for those authors wishing to publish their papers. The co-conveners will serve as editors of the papers submitted.

The co-conveners expressed their thanks to the Secretariat for providing the excellent facility and technical accoutrements for the conduct of the Symposium and for their outstanding cooperation in assisting with the preparation of papers and presentations.

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

Chairman: A. Avila de Melo Rapporteur: W. Brodie

The Committee met on 9 September 1993 at the Holiday Inn, Dartmouth, Nova Scotia, Canada, to discuss various matters referred to it by the Scientific Council pertaining to statistics and fisheries research in the Regulatory Area. Representatives from Canada, Denmark (in respect of Faroe Islands and Greenland), European Economic Community (Denmark, France, Germany, Portugal, Spain and United Kingdom), Iceland, Japan and the Russian Federation were present. It was agreed that agenda item 1 and 3 will be considered together (see Agenda II, Part D, this volume).

1. Acquisition of STATLANT 21B Data and Publication of Statistical Information

For 1990, data for France (SP) and EEC-France (M) were still outstanding. STACREC proposed that the Secretariat should proceed with the publication of *NAFO Statistical Bulletin*, Vol. 40, for 1990 data as there was no indication that the French data would be available soon. STACREC noted that the Volume 39 for 1989 data was also published in absence of the French data.

For 1991, data for EEC-Denmark, France (SP), Japan, Norway, USA, and USSR were still outstanding. With the exception of France (SP), the Secretariat had been informed that the data should be available before the end of 1993. STACREC suggested that the *NAFO Statistical Bulletin*, Vol. 40 for 1991 should be published when those data were received.

It was noted that both the Assistant Executive Secretary and the EEC-EUROSTAT Representative will be present at the upcoming CWP *Ad hoc* Inter-agency Consultation in Dublin, Ireland, and noting that some statistical officers from EEC will be present at that meeting, STACREC agreed that they take that opportunity to raise the issue of outstanding data directly with the national statistical officers.

STACREC noted that the new deadlines for submission of STATLANT 21A and 21B forms (May 30 and August 31, respectively) were recently proclaimed as law by the EEC.

2. Acquisition of Statistical Information From Other Standing Committees

STACREC was informed that the Chairman had discussed this issue with the Chairmen of both the Standing Committee on International Control (STACTIC) and the Standing Committee on Fishing Activities of Non-Contracting Parties in the Regulatory Area (STACFAC). Regarding STACFAC, he was informed that there was no problem in using the data contained in Working Papers, since these were circulated as General Council documents at the annual September meeting. STACTIC's position was similar, in that they did not object to the use of data contained in their Working Papers. For preliminary catch and effort information tabulated by the NAFO Secretariat for future use by these committees, the Chairman of both STACFAC and STACTIC agreed that these data could be requested directly from the Secretariat for use in stock assessments.

STACREC noted that a landings declaration form is being developed by STACFAC to cover landings of non-Contracting Party vessels in the ports of Contracting Parties. It was stressed that such information could only be useful for scientific purposes if it contained a breakdown of catch by species, along with some indication of fishing effort.

3. Assessment Data Needs for 1994-95 and Respective Budgets

This item was retained on the agenda of this meeting from the June 1993 Meeting, following a Fisheries Commission request in 1992 on research activities and costs in 1992/93. New information from the Greenland Fisheries Institute, Japan and the Russian Federation were received as follows:

Research in Subareas 0 and 1 by Greenland. Greenland conducts research on a number of stocks under NAFO management, on its own and in joint ventures with Japan and Norway.

- **Shrimp in Subareas 0 and 1 and Denmark Strait**: research includes stratified-random trawl surveys covering the distribution area (Subareas 0 and 1 only), commercial sampling, analyses of logbooks and studies on selection, discard and stock delimitation. Annual costs amount to approximately CAN $2.4 million.

- **Greenland halibut in Subarea 1**: stratified-random trawl surveys are carried out offshore in joint venture with Japan. The surveys involve costs equivalent to CAN $1 million per year, which is covered in the form of additional feasibility fishing. Likewise a longline survey is done in joint venture with Norway involving costs equivalent to CAN $0.3 million per year. Greenland further conducts sampling and research inshore with longlines with costs of CAN $0.4 million per year. A trawl survey covering the entire Greenland halibut distribution in Subarea 1 would require additional funding in the range of CAN $1 million per year.

- **Roundnose Grenadier in Subarea 1**: research and sampling is done concurrently with the sampling on Greenland halibut. The total distribution area of roundnose grenadier is not covered.

- **Redfish in Subarea 1**: research and sampling is done concurrently with the Greenland shrimp/groundfish survey and the Greenland-Japan joint venture survey. Surveys cover most of the redfish distribution area.

- **Environmental research in Subarea 1**: environmental research and ecological studies linked to stock abundance are limited to few standard oceanographic transects. Costs amount to CAN $0.1 million per year. Optimum volume of scientific work would include further sampling and research on primary and secondary production (estimated at CAN $0.5-1 million per year).

The Japan joint venture with Greenland. The survey expense of Japanese R/V *Shinkai-Maru* is about CAN $40 000 per day. The necessary survey period to cover Div. 1BCD is about 25 days. Hence the total expense of the survey amounts to CAN $1 million.

At present, taking into account that only two Contracting Parties had provided comprehensive documentation on research survey costs, STACREC was unable to provide a global response to the Fisheries Commission request. STACREC noted that relevant information from the Russian Federation had been forwarded directly to the Fisheries Commission.

4. Non-traditional Fishery Resources

The Secretariat provided STACREC, as requested at the June 1993 Meeting, with documentation on skate catches for 1990-92. Although the data were preliminary (STATLANT 21A), they indicated a substantial reduction from 1991 to 1992 in the skate nominal catches for EEC-Portugal and EEC-Spain in Subarea 3. Data from research vessel surveys were, however, not available to compare the relative abundance of skates in each Division of Subarea 3 from year to year with the pattern of nominal catch.

5. Proposals for Scientific Tasks of Observers in the Pilot Observer Program

The Chairman informed STACREC that the Standing Committee on International Control (STACTIC) at this meeting had requested some clarifications to the June 1993 Scientific Council recommendation on this matter. The clarification was presented as the following text:

The observers in the Pilot Observer Program should collect catch and effort data on a set by set basis. These data should include location, depth, time net on the bottom, catch composition and discards. Length sampling of the main species of the daily catch should also be set out according to the NAFO standard procedures actually in use in the national sampling programs. Training should be done on a national basis and in conjunction with research institutes in charge of the sampling at sea, and a manual should be provided.

The Chairman informed STACREC that this was adopted by STACTIC as the recommendation from the June 1993 meeting.

6. **Updating of Conversion Factors Used to get Round Fresh Weight**

STACREC was informed that FAO was currently conducting a survey to revise the previously published conversion factors used by national fleets. This information was thought to be of some use to STACREC and these data should be obtained before any further work on compilation of conversion factors is attempted.

7. **Research Coordination for Greenland Halibut**

At its June 1993 Meeting, the Scientific Council recommended that consideration be given to the implementation of a joint multinational trawl survey for Greenland halibut from Davis Strait to the Eastern Grand Bank and Flemish Cap. It was believed that such a survey should be conducted by several large powerful vessels with similar trawling gear fishing to depths of at least 1 800 m, to cover the major depths of Greenland halibut distribution. STACREC was of the opinion that such a survey is necessary to provide the required information on total stock size and its relative distribution among Divisions in order to assess the status of the resource appropriately. Data were provided at this meeting by Canada and Greenland/Japan on current survey activity with additional estimates of the number of required days to complete the proposed survey. It was estimated that about 250 vessel-days would be needed to cover all Divisions from Div. 0A in the north to Div. 3N in the south. However, because it was indicated that funding would not be provided in the foreseeable future to complete this proposed survey, further logistical requirements were not pursued by STACREC. It was agreed, nevertheless, that until such a survey is conducted, an adequate assessment of stock size and its relative distribution is unlikely.

8. **Other Matters**

The 16th Session of CWP is scheduled for July 1994 in Madrid, Spain. STACREC **recommended** that *the Scientific Council should be represented at the 16th Session of CWP by the Chairman of STACREC, the Assistant Executive Secretary, as well as a national representative from Spain.*

9. **Acknowledgements**

In closing, the Chairman thanked the members for their support during his two-year term, in particular the various rapporteurs, the Assistant Executive Secretary and the NAFO Secretariat. The Chairman extended his best wishes to the Committee and the incoming Chairman C. A. Bishop.

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

Chairman: H. Lassen Rapporteur: T. Amaratunga

The Committee met at the Holiday Inn, Dartmouth, Nova Scotia, Canada, on 10 September 1993. In attendance were H. Lassen (EEC-Denmark, Chairman), D. B. Atkinson (Canada) on behalf of J. Carscadden (Canada), V. A. Rikhter (Russian Federation), A. Vazquez (EEC-Spain) and the Assistant Executive Secretary (T. Amaratunga).

1. **Review of Scientific Publications**

The Assistant Executive Secretary informed STACPUB that editorial work on papers had progressed substantially.

As requested by STACPUB, the Assistant Executive Secretary had inquired of J. S. Campbell (Canada) on the possibility of receiving papers related to the Northern Cod Science Program for a single issue in a NAFO publication. STACPUB was pleased to learn that the response was in general positive, and J. S. Campbell was hopeful of a compilation of papers for an issue of the Studies or Journal, and that he was available to undertake a coordination/editorial role. It was agreed that D. B. Atkinson and the Assistant Executive Secretary would finalize plans for such a publication, after discussions with J. S. Campbell during the 13-15 September Symposium[2].

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

The Associate Editor's review and technical editorial work on the invitational paper by H. J. Squires titled "Decapod Crustacean Larvae from Ungava Bay" was completed. However, in view of the printing backlog at the Secretariat, the single issue of the Journal (Volume 15) may be delayed to late-1993 or early-1994.

The editorial work on three of the five papers from the joint Canada/USSR Meeting on capelin in 1990 had been completed. The two other papers for an issue of the Journal were expected shortly.

b) **NAFO Scientific Council Studies**

The publication of Studies No. 18 containing 8 papers and 10 abstracts of the 24 papers presented at the Cod Symposium titled "Changes in Abundance and Biology of Cod and Their Possible Causes" held during 4-6 September 1991 was completed and circulated in July 1993.

A further 8 papers for the issue of Studies No. 19 have been edited and prepared for publication in late-1993.

In addition, another 6 papers were edited and are in various stages of preparation for publication in Studies No. 20 which is expected to be completed in late-1993 or early-1994. The publication date of this issue too, however, is subject to the printing backlog at the Secretariat.

STACPUB was also pleased to note that 2 papers nominated at the June 1993 Meeting have been submitted for Studies, and a further 3 responses had been received for submission in the near future.

c) **Other Publications**

STACPUB noted that the *Executive Summary* of the Scientific Council Report of the June 1993 Meeting was published by the Secretariat in preparation for this meeting.

STACPUB also noted the STACREC decision to publish shortly the *NAFO Statistical Bulletin* Vol. 40 containing the 1990 data.

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[2] It was agreed that J. S. Campbell would coordinate and edit a group of relevant papers for publication in a single Studies issue.

2. Promotion and Distribution of Scientific Publications

a) Invitational papers

STACPUB was informed that work on the invited papers on the West Greenland Cod Stock was progressing. The paper in preparation by Sv. Aa. Horsted, particularly, had received many of the requested reviews from experts.

STACPUB was also encouraged by the prospects of a Studies or Journal issue on the Northern cod (as reported above), especially in view that this would then complete a major geographic coverage of cod in the Northwest Atlantic.

b) Promotion of the Journal

No new information was available for consideration at this meeting.

3. Editorial Matters

STACPUB noted with regret that R. G. Halliday had announced in late-August his resignation as the Journal Associate Editor on Vertebrate Fisheries Biology. Special appreciation was extended to him in view that this was the 10th anniversary of his very valuable contributions to editorial work of the Journal.

STACPUB considered a possible replacement and agreed that a decision will be made soon by mail communication among members. STACPUB agreed that a note of appreciation for his long and dedicated work will be extended in the next issue of the Journal.

4. Review of Papers for Possible Publication

While STACPUB did not have the opportunity to consider the few papers presented at this meeting, SCR Doc. 93/40 would be reviewed for consideration at the June 1994 Meeting. It was recognized many interesting papers were due to be presented at the 13-15 September 1993 Symposium. STACPUB was of the view that it would accept the recommendation of the co-conveners of the Symposium on possible publication of those papers.

5. Guidelines for Authors of Research Documents

In order to facilitate the workload of document production and increase the readability of the documents, the Secretariat prepared a draft set of guidelines to authors as requested. STACPUB agreed the guidelines should be issued to potential authors of papers to the June Meeting of the Scientific Council.

6. Other Matters

The Committee expressed its appreciation to the outgoing Chairman for his dedicated and efficient work, and welcomed the incoming Chairman. The Chairman thanked the Committee for two years of work in which he had the good fortune to participate. He further thanked the Assistant Executive Secretary for his assistance and asked him to convey the appreciation of the Committee of the Secretariat's efficient work. He welcomed the incoming Chairman, W. R. Bowering.

PART C

Scientific Council Meeting, 19-23 November 1993

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REPORT OF SCIENTIFIC COUNCIL

Scientific Council Meeting, 19-23 November 1993

Chairman: H. Lassen Rapporteur: T. Amaratunga

I. PLENARY SESSIONS

The Scientific Council met at NAFO Headquarters, Dartmouth, Nova Scotia, Canada, during 19-23 November 1993. Representatives attended from Canada, Denmark (in respect of the Faroe Islands and Greenland), European Economic Community (Denmark, Germany), Iceland, Japan and the Russian Federation. The Assistant Executive Secretary was in attendance.

The opening meeting was called to order on 19 November 1993 at 0935 hr.

The Chairman welcomed representatives to this meeting primarily to conduct assessments on shrimp in Subareas 0 and 1, and Denmark Strait, and considerations on mesh size in the redfish fishery in the Regulatory Area and minimum fish size for witch, redfish and Greenland halibut. The Assistant Executive Secretary was appointed rapporteur.

The plan of work was reviewed, and the scientific considerations were assigned to STACFIS.

The Chairman noted that the STACFIS Chairman, H. P. Cornus (EEC-Germany) was due to arrive on 20 November 1993, and the Council agreed the Council Chairman should chair the STACFIS Meeting until he arrived. It was also agreed that since the Chairman was required to leave for Brussels on 21 November 1993, the STACFIS Chairman will act as Chairman of the Council on 22 and 23 November 1993.

The provisional Agenda (Part D, Agenda III, this volume) was **adopted**, and the session was adjourned at 0950 hr.

The Council reconvened from 1600 hr to 1700 hr on 22 November 1993 to consider and adopt the shrimp assessment reports prepared by STACFIS. The concluding session was convened at 1130 hr on 23 November 1993. The Council then considered and adopted the outstanding sections of the STACFIS report. Having addressed the two requests from the Fisheries Commission and all outstanding matters, the Council considered and **adopted** the Report of the Scientific Council of the 19-23 November 1993 Meeting.

The meeting was adjourned at 1200 hr.

Brief summaries of the STACFIS Report and other matters considered by the Scientific Council are given below in Sections II-V. The Agenda, Lists of Research (SCR) and Summary (SCS) Documents and the List of Participants of this meeting are given in Part D, this volume.

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

1. Stock Assessments

a) *Shrimp in Subareas 0 and 1*

Catch rate indices from the commercial fishery indicated a stable biomass from 1989 to 1993. Research survey indices from 1988 to 1993 varied around a level of 180 000 tons. Biological samples from both the fishery and research surveys showed that the stability in biomass was maintained by the strong 1985 year-class, which began recruiting to the fishery in 1990, and in 1993 also by the 1987 year-class. Survey data also indicated relatively good abundance of the 1988 and 1989 year-classes.

The Council noted that in light of the 1989-93 stability in catch rates, good prospects for recruitment and apparent stability in biomass estimates, STACFIS considered that the 1994 fishery will be similar to 1992 and 1993. The Scientific Council endorsed the STACFIS advice that the TAC in 1994 be set at 50 000 tons. The Summary Sheet of the assessment is as follows:

SUMMARY SHEET - Shrimp in Subareas 0 and 1

Source of Information: SCR Doc. 93/128, 129, 130, 132

Year	1986	1987	1988	1989	1990[1]	1991[1]	1992[1]	1993[1]
Offshore SA 0+1 (south of 71°N)								
Recommended TAC	36	36	36	44	50	50	50	50
Agreed TAC[2]	40.4	40.1	40.1	45.2	45.2	46.2	44.2	40.6[3]
Actual landings	44.6	46.2	43.6	49.9	52.6	57.1	63.4	[6]
Offshore SA 1 (north of 71°N)								
Recommended TAC	-	-	-	-	-	2.5	-	-
Agreed TAC	-	11.6	11.5	8	6.8[4]	6.8[4]	6.4[4]	8.3[5]
Actual landings	11	10.7	6.7	2.5	2.1	1.1	2.6	[6]
SA 0+1 total (including inshore SA 1)								
Actual landings	63.1	63.8	60.5	65.7	70.1	76.1	87.2	[6]

[1] Provisional landings. Weights in '000 tons
[2] Not including catches of vessels <75 GRT.
[3] SA 1 offshore, south of 68°N + Div. 0A.
[4] Including the area from 69°30'N to 71°N, west of 58°W.
[5] SA 1 offshore, north of 68°N.
[6] Not yet available.

Catches: Increased to about 50 000 tons in 1976, decreased to about 45 000 tons in 1980-84, then gradually increased to 87 000 tons in 1992. Figures include catches outside the TAC area.

Data and Assessment: Catch rates, research survey indices and biological sampling data.

Fishing Mortality: No information available.

Recruitment: Good recruitment of 1988 and 1989 year-class.

State of Stock: Catch-rate and research survey indices indicated that the stock is stable since 1989.

Forecast for 1994: Not available.

Option Basis	Predicted catch (1994)	Predicted SSB (1.1.1995)
$F_{0.1}$ =	No information available.	
F_{92} =		
F_{max} =		

Recommendations: TAC for 1994 be set at 50 000 tons for Div. 0A and Subarea 1 offshore south of 71°N.

Special Comments: Concern is expressed over the steady increase in catches in recent years.

b) **Shrimp in Denmark Strait**

New data were available on catch effort and CPUE for 1992 and 1993. It was agreed that these data confirmed Scientific Council opinion from the June 1993 Meeting that the shrimp stock in Denmark Strait was still at a low level of abundance and that the advice provided at the June 1993 Meeting (TAC of 5 000 tons in 1994) remained valid.

2. **Mesh Size in the Redfish Fishery in the Regulatory Area**

The Council received a request from the Fisheries Commission (see Agenda III, Annex 2, Part D, this volume) to consider the proposal by the Russian Federation to conduct a scientific/commercial project in 1994 in respect to minimum mesh size for certain redfish fisheries in the Regulatory Area. The Fisheries Commission requested the Council to consider this matter at this special meeting. The Council reviewed the STACFIS discussions on this subject and endorsed the following:

STACFIS reviewed the proposal by the Russian delegation to conduct a scientific/commercial project in the Regulatory Area of Div. 3NO in order to evaluate optimum utilization of redfish stocks using pelagic trawls with a mesh size of 90 mm. The Committee welcomed the proposal in principle as there have been very few studies conducted historically that evaluated the selectivity properties of different mesh sizes in the codend of pelagic trawls. During discussion of the details of the proposal, STACFIS considered that data collected utilizing only 90 mm mesh codends would be of limited value as it would not provide a comparison to the regulated minimum codend mesh size of 130 mm and the current exemptions from that. In consideration of this situation, STACFIS supports a selectivity study be conducted by Russia under the following provisions:

a) Main Objective: Evaluation of pelagic trawl codend mesh sizes for the redfish fishery in the Regulatory Area of Div. 3NO to assess the effect on the exploitation pattern by reducing codend mesh size to 90 mm.

b) Scope of Work and Methods:

i) The project be conducted and evaluated as a selectivity experiment.

ii) The experiment be conducted with codend mesh sizes of 90 mm, 120 mm and 130 mm, utilizing an appropriate cover over the codend and employing pelagic trawls that are currently used in the commercial fishery by the Russian fleet.

iii) The investigations be conducted on the same vessel to provide a controlling measure or standardization.

iv) Biological sampling for size and age composition, and estimation of a maturity ogive be conducted using NAFO standards and techniques.

Referring to the advice given in June 1993 concerning the stock status in Div. 3LN, which is considered to be at a low level, and an uncertain status of the stock in Div. 3O, the catches obtained from this experiment should be counted as part of the total allowable catch (TAC).

3. **Minimum Fish Size for Witch, Redfish and Greenland Halibut**

The Council received a request from the Fisheries Commission (see Agenda III, Annex 3, Part D, this volume) to consider the possible alternatives to current measures in respect of minimum fish size for witch, redfish and Greenland halibut. The Council received no data for consideration at this meeting.

III. OTHER MATTERS

1. **Shrimp in Division 3M**

The assessments of shrimp in Div. 3M was discussed in relation to availability of data and timing of meetings. It was agreed, that although the item would likely appear on the Agenda for the June 1994 Meeting, sufficient data to complete the assessment would not be available until later in the year. Given this situation, it was further agreed that the assessment should be deferred to the Annual Meeting in September 1994.

2. **November Shrimp Meeting**

The Council agreed that the present mid-term meeting for the assessment of shrimp in Subareas 0 and 1, and Denmark Strait was productive and efficient. Especially useful were the survey results and current-year fishery data for Subareas 0 and 1. It was noted that a survey will be conducted in Denmark Strait in 1994, thus making November meetings more useful for that area.

IV. ADJOURNMENT

There being no further business, the acting Chairman extended a special thanks to the Executive Secretary, the Assistant Executive Secretary and the staff of the Secretariat for their efficiency and support during the meeting. Thanks were extended to the participants for their valuable contributions. The acting Chairman then adjourned the meeting.

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

Chairman: H. P. Cornus Rapporteur: Various

The Committee met at NAFO Headquarters, Dartmouth, Nova Scotia, Canada during November 19-23 November 1993 to review the status of the shrimp stock in Subareas 0 and 1, and Denmark Strait and other various matters referred to it by the Scientific Council. Representatives attended from Canada, Denmark (in respect of Faroe Islands and Greenland), EEC (Denmark, Germany), Iceland, Japan and the Russian Federation.

I. STOCK ASSESSMENTS

1. **Shrimp in Subareas 0 and 1** (SCR Doc. 93/128, 129, 130, 132)

a) **Introduction**

The nominal catches of shrimp in the offshore areas of Subarea 1 south of 71°N and the adjacent part of Subarea 0 (Div. 0A) increased from less than 1 000 tons before 1972 to almost 43 000 tons in 1976, fluctuated thereafter, but stabilized around a level of 44 000 tons during 1985-88. Preliminary statistics for 1993 (January to September) showed total catches of about 41 500 tons (compared to 45 500 tons in the same months in 1992). The fishery has been regulated by TAC since 1977 (Table 1, Fig. 1).

Table 1. Shrimp in Div. 0A and Subarea 1: nominal catches and TAC (tons) included in TAC advice.

		1983	1984	1985	1986	1987	1988	1989	1990[1]	1991[1]	1992[1]	1993[1]
Div. 0A	Catches	5 413	2 142	2 640	2 995	6 140	6 087	7 235	6 177	6 788	7 493	4 882[6]
SA 1 offshore, south of 71°N												
	Catches	33 854	33 741	39 547	41 589	40 020	37 559	42 676	46 424	50 316	55 864	36 515[7]
0+1 offshore catches[2]		39 267	35 883	42 187	44 584	46 160	43 646	49 911	52 601	57 104	63 357	41 397
0+1 advised TAC[2]		29 500	29 500	36 000	36 000	36 000	36 000	44 000	50 000	50 000	50 000	50 000
0+1 effective TAC[2,3,4]		34 625	34 925	42 120	40 420	40 120	40 120	45 245	45 245	46 225	44 200	40 600[5]

[1] Provisional.
[2] January - November 1993.
[3] January to end of September 1993.
[4] Offshore south of 71°N.
[5] Including TAC in Div. 0A: 1983-84 - 5 000 tons, 1985-88 - 6 120 tons, 1989-90 - 7 520 tons, 1991-92 - 8 500 tons.
[6] Not including catches from vessels <75 GRT.
[7] SA 1 offshore south of 68°N + Div. 0A.

During the history of this fishery, the fishing grounds in Div. 1B have been the most important. Since 1987, however, there have been increasing catches in Divisions south of 1B.

The fishery in Div. 0A usually takes place from July to November. In Subarea 1 the fishery occurs in all months of the year, however, early in the year it is often confined to the fishing grounds in Div. 1C, 1D and 1E due to ice coverage in Div. 1A and 1B. In 1993 exceptional ice coverage hampered the access to some fishing grounds till the end of August.

An offshore fishery north of 71°N, outside the fishing areas in Subareas 0 and 1 for which TACs have been advised, began in 1985 and yielded about 4 300 tons that year. In 1986 and 1987 catches increased to about 11 000 tons, decreased steadily to about 1 000 tons in 1991, increased to 2 647 tons in 1992 and decreased again in 1993 (Table 2). This fishery normally occurs from June to November.

The effort in Subarea 1 decreased from 1992 to 1993 because a significant part of the fleet participated in the shrimp fishery on the Flemish Cap (Div. 3M). Also, the Greenland fishery was in 1993 affected by a legal application of a 55 mm mesh size in the cod-end from April to July.

The West Greenland inshore shrimp fishery was relatively stable from 1972 to 1987 with estimated catches of 7 000-8 000 tons annually (except for 10 000 tons in 1974). Catches in recent years have increased to over 21 000 tons in 1992. Preliminary data for 1993 indicate a decrease (10 500 tons taken by the end of September compared to about 14 700 tons in the same period in 1992), reflecting a shift from inshore to offshore areas of the small vessel fishery.

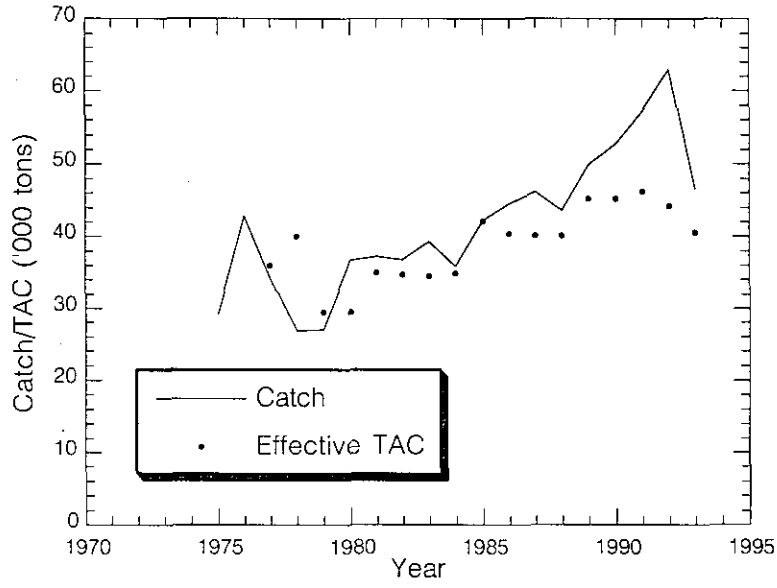

Fig. 1. Shrimp in Subareas 0 and 1: catches and TACs.

Total catches (tons) for all Subarea 1 are shown in Table 2.

Table 2. Shrimp in Subarea 1: total nominal catches (tons).

	1983	1984	1985	1986	1987	1988	1989	1990[1]	1991[1]	1992[1]	1993[1]
SA 1 offshore (south of 71°N)	33 854	33 741	39 547	41 589	40 020	37 559	42 676	46 424	50 316	55 864	36 515[2]
Greenland (N of 71°N)	-	-	4 349	11 045	10 700	6 660	2 522	2 121	1 077	2 647	378[2]
Greenland (inshore[3])	7 500	7 500	7 500	7 500	6 921	10 233	13 224	15 386	17 891	21 148	10 490[2]
SA1 Total	41 354	41 241	51 396	60 134	57 641	54 452	58 422	63 931	69 284	79 659	47 383

[1] Provisional.
[2] January to the end of September 1993.
[3] Inside 3-mile limit. Inshore component of total catch is estimated.

b) **Input Data**

i) **Commercial fishery data**

Fishing effort and CPUE (Fig. 2). Catch and effort data from the shrimp fishery in 1993 were available from Canadian vessel records for Div. 0A and from Greenland logbooks for Subarea 1.

An overall increase in effort was observed from 1987 to 1991, followed by a decrease in 1992 and 1993.

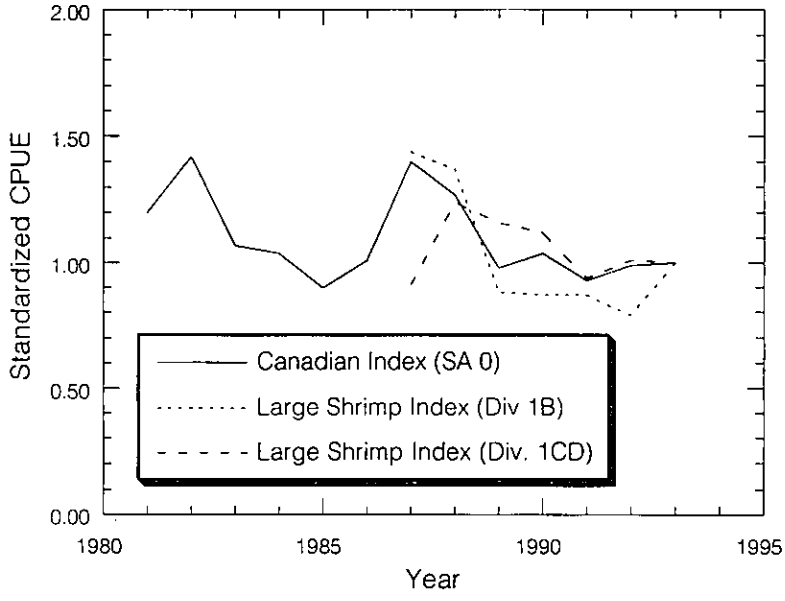

Fig. 2. Shrimp in Subareas 0 and 1: standardized CPUE indices from Div. 0A, Div. 1B and 1CD compared to nominal offshore catches (excluding catches north of 71°N in Subarea 1).

Unstandardized yearly catch rates were calculated using Canadian vessel logbook data from Div. 0A from 1981 to 1993. Because of seasonality in the catch rates and changes in the fleet over time, the same data were analyzed using a multiplicative model to produce standardized yearly catch rates. The series shows two periods of stable catch rates (1983-86 and 1989-93), separated by significantly higher levels in 1987-88.

From 1987, logbook data from 27 Greenland trawlers, which record the shrimp catch by size category in the logbook, were used in a multiplicative model to establish a CPUE index for large shrimp >8.5 g (mainly females), for which discard is supposedly at a low level. Hereby the uncertainty in interpretation of catch rates caused by possible changes in discarding procedures should be minimized. The index in Div. 1B showed a decrease from 1987 to 1989 followed by stability from 1989 to 1992, and an increase in 1993. The index in Div. 1CD increased from 1987 to 1988, decreased to 1991, and has remained stable thereafter.

Length and age composition. Length frequency distributions obtained by observers were available from the commercial fishery in Div. 0A from 1981 to 1993 and in Subarea 1 from 1990 to 1993. The relative importance of the 1985 year-class was evident in 1990 as it recruited to the fishery, and in 1991, when it clearly dominated the catches. This year-class was expected to change sex to females between 1991 and 1992, but data from the 1992 and 1993 fishery showed that the sex inversion took place over two years. In 1993 this year-class still accounted for a substantial part of the catches.

The data from Div. 0A (separated by age) showed that the trend in catch rates series is due to the female component (age 7+).

Shrimp discards. In Div. 0A, the percentages of shrimp discard estimated by observers declined in recent years from a high of 6.5% in 1991 to 1.9% in 1993, the lowest level achieved during the 1981 to 1993 period.

No new information on discard was available from Subarea 1. The discard rate in 1993 is expected to be lower than in previous years due increased observer coverage.

ii) **Research survey data**

Abundance estimates. Compared to previous surveys in Subareas 0+1 the mesh size in the cod-end was changed in 1993 from 44 mm to 20 mm, but this small mesh cod-end does not appear to have a significant influence on biomass estimates or overall length frequencies. Data from 30 sets of hauls with alternating cod-ends showed no significant changes in catch rates between the two mesh sizes.

Offshore: In July-August 1993, a stratified-random trawl survey was carried out in the main area of shrimp distribution in Div. 1A to 1F and the adjacent part of Div. 0A. The area surveyed extended further south than in previous years by inclusion of Div. 1F. Because commercial fishery data suggest that shrimp densities in these southern areas were very low for the earlier years, the estimates from all six surveys were considered to be comparable.

The trawlable biomass estimates are as follows:

Biomass ('000 tons)	1988	1989	1990	1991	1992	1993
South of 69°30'N	150	181	163	113	158	216
North of 69°30'N	22	11	12	6	21	9
Total	172	192	175	119	179	225

The recent increasing trends in biomass in the southern areas south of 65°N was continued.

The estimated numbers of shrimp in the total areas surveyed are shown in the following table by sexual stage and year:

No. of shrimp (billions)	1988	1989	1990	1991	1992	1993
Males (age < 7)	18.1	31.9	21.9	12.2	20.9	31.8
Females (age 7+)	7.7	6.0	8.0	4.4	5.5	7.9
Total	25.9	37.8	29.8	16.6	26.5	39.7

Analysis of the research length frequency data showed the predominance of the 1985 year-class in 1989, 1990 and 1991 throughout the offshore area. In 1989, abundance was highest in shallower water, most animals being males of the 1985 year-class. In subsequent years, abundance was higher to the north and in deeper water, reflecting the growth and behaviour of this strong year-class. In 1992 and 1993 recruitment of new year-classes is indicated. The increase in number of males in these years is due to recruitment of especially the 1987 year-class, but also the 1988 and 1989 year-classes contributed significantly to the male group in 1993. In 1992 the 1985 year-class was expected to change sex. Data from the 1992 and 1993 fishery, however, showed that the sex inversion took place over two years.

Inshore: In August 1993 a stratified-random trawl survey was conducted in the inshore areas in Disko Bay and Vaigat (Div. 1A). Biomass was estimated at 32 000 tons, lower than the estimates around 47 000 tons in 1991 and 1992.

The overall size compositions of shrimp from the inshore surveys were similar to those for the offshore in relation to the occurrence of modes. The observed decrease in the inshore biomass in 1993 compared to the previous years is due to a decrease in number of male shrimp, while the number of females remained stable. The overall size distribution, however, still shows the presence of a wide range of male year-classes.

c) **Assessment Results**

Indices from the commercial fishery showed that the biomass in 1989-93 was stable but lower than the high 1987-88 level. The stability since 1989 was maintained by the strong 1985 year-class and in 1993 also by the 1987 year-class.

The research survey index from 1988 to 1993 varied around a level of 180 000 tons.

The strong 1985 year-class recruited to the fishery in 1990 and maintained catch rates in 1991, 1992 and 1993. It changed sex over two years (1992 and 1993).

Survey data from 1993 indicated relatively good abundance of the 1988 and 1989 year-classes.

d) **Prognosis**

In light of the 1989-93 stability in catch rates, good prospects for recruitment, and apparent stability in biomass estimates STACFIS considered that the 1994 fishery will be similar to 1992 and 1993. STACFIS, therefore, reiterates its advice and the concern expressed in the 1993 June Meeting, specifically that the TAC in 1994 be set at 50 000 tons.

Available commercial and survey samples from Div. 0A and Subarea 1 both north and south of 71°N and inshore in Div. 1A showed the occurrence of similar modes in the length distributions, prominence of the 1985 year-class in all areas, and recruitment of the same new year-classes in all areas. Although differences were observed in the abundance of size groups between areas, it was agreed that the areas might constitute parts of a single population. STACFIS, therefore, **recommended** that *the entire shrimp stock in Div. 0A, and Subarea 1 both north and south of 71°N, and inshore in Div. 1A in the future be assessed as one single population.*

2. **Shrimp in Denmark Strait** (SCR Doc. 93/131, 133, 134)

At the 1993 June Meeting, STACFIS concluded that the shrimp stock in Denmark Strait was still at a low level of abundance and advised a TAC for 1994 of 5 000 tons. New information for the present meeting included updated catch, effort and CPUE data from all fleets for 1992 and preliminary figures for 1993 up to the end of October 1993. Also, length frequency distributions from samples taken in the Greenlandic fishery on the west side of the Midline were available. Updated catch statistics for 1992 indicated a total catch of 7 199 tons - 1 432 tons east of the Midline and 5 767 tons to the west. Preliminary catch estimates up to October 1993 were 7 319 tons - 2 586 east and 4 733 west. The Greenlandic fishery data also showed that effort in 1993 extended south of 65°N into several areas which previously were not fished or fished only occasionally. In these areas 909 tons were caught. Catches sampled in the traditional area north of 65°N were composed primarily of large shrimp with a modal length of 26-27 mm CL. Samples taken from the area just south of 65°N showed the occurrence of a broad size range whereas those taken between 62° and 63°N contained shrimp with modal length of 22-23 mm. Unstandardized catch rates for all fleets showed continued stability since 1989. Further, the standardized CPUE for Greenland and the unstandardized for Norway and Iceland in 1993, as estimated from the preliminary data, were similar to the 1992 values. It was agreed that the data confirmed the STACFIS opinion of the June 1993 Meeting that the shrimp stock in Denmark Strait is still at a low level of abundance and, therefore, the advice provided at the 1993 June Meeting remains valid. STACFIS also noted that a research survey will be conducted in the area in 1994 during which the distribution and stock structure of shrimp throughout the Denmark Strait can be investigated further.

3. Mesh Size in the Redfish Fishery in the Regulatory Area

Information was available from a Russian study (SCR Doc. 93/100) on the selectivity of bottom trawls during the 1993 fishery on the Flemish Cap. Selectivity experiments were conducted on 126 mm and 137 mm codend mesh sizes utilizing trawls used in the Russian bottom trawl fishery. Selection factors and 50% retention lengths were comparable to results of selectivity experiments conducted by Germany in East Greenland waters in 1990 (Dahm, 1991)[1] and ICNAF data from 1961 (ICNAF 1961 Doc. No. 40). STACFIS noted the selection curves presented for the Russian experiment were derived from an exponential function rather than the standard logistic function. However, the selection range derived by fitting data graphically from the Russian experiment was at most 60% of the range obtained from the estimated selectivity curves from German studies for comparable codend mesh sizes.

STACFIS reviewed the proposal by the Russian delegation to conduct a scientific/commercial project in the Regulatory Area of Div. 3NO in order to evaluate optimum utilization of redfish stocks using pelagic trawls with a mesh size of 90 mm. The Committee welcomed the proposal in principle as there have been very few studies conducted historically that evaluated the selectivity properties of different mesh sizes in the codend of pelagic trawls. During discussion of the details of the proposal, STACFIS considered that data collected utilizing only 90 mm mesh codends would be of limited value as it would not provide a comparison to the regulated minimum codend mesh size of 130 mm and the current exemptions from that. In consideration of this situation, STACFIS supports a selectivity study be conducted by Russia under the following provisions:

a) Main Objective. Evaluation of pelagic trawl codend mesh sizes for the redfish fishery in the Regulatory Area of Div. 3NO to assess the effect on the exploitation pattern by reducing codend mesh size to 90 mm.

b) Scope of Work and Methods.

   i) The project be conducted and evaluated as a selectivity experiment.

   ii) The experiment be conducted with codend mesh sizes of 90 mm, 120 mm and 130 mm, utilizing an appropriate cover over the codend and employing pelagic trawls that are currently used in the commercial fishery by the Russian fleet.

   iii) The investigations be conducted on the same vessel to provide a controlling measure or standardization.

   iv) Biological sampling for size and age composition, and estimation of a maturity ogive be conducted using NAFO standards and techniques.

Referring to the advice given in June 1993 concerning the stock status in Div. 3LN, which is considered to be at a low level, and an uncertain status of the stock in Div. 3O, the catches obtained from this experiment should be counted as part of the total allowable catch (TAC).

4. Minimum Fish Size for Witch, Redfish and Greenland Halibut

STACFIS was not provided with data for consideration at this meeting.

5. Other Business

There being no other business, the Chairman thanked the Committee members for their good cooperation and adjourned the meeting.

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[1] DAHM, E. 1991. Selektionsuntersuchungen an Kabeljau und Rotbarsch in grönländischen Gewässern., *Infn. Fischw.*, **38**(3), 1991.

PART D

Miscellaneous

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AGENDA I. SCIENTIFIC COUNCIL MEETING, 2-16 JUNE 1993

I. Opening (Chairman: V. P. Serebryakov)

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 1992

2. Review of recommendations from 1992 meetings

3. *Environmental research* (Subcommittee Chairman: M. Stein)

   a) Chairman's report
   b) Special Session September 1994
   c) Marine Environmental Data Service (MEDS) Report for 1992
   d) Review of environmental studies in 1992
   e) Overview of environmental conditions in 1992
   f) National representatives
   g) Joint Russian/German data evaluation (ICNAF/NAFO data, status report)
   h) 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):

      - 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):

      - Redfish (Subarea 1) (if possible, by species)
      - Northern shrimp (in Denmark Strait and off East Greenland)
      - 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):

- Greenland halibut (Subareas 0 and 1)
- Roundnose grenadier (Subareas 0 and 1)
- Northern shrimp (Subareas 0 and 1)

5. Fisheries Commission requests

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. Review of SCR and SCS documents not considered in items 1 to 8 above

10. Other matters

a) Progress report on the 13-15 September 1993 Special Session; Symposium on "Gear Selectivity/Technical Interactions in Mixed Species Fisheries" (co-conveners: S. A. Murawski (USA) and P. A. M. Stewart (EEC-UK))
b) 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))
c) 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))
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: A. Avila de Melo)

1. Fishery statistics

a) Progress report on Secretariat activities in 1992/93

i) Acquisition of STATLANT 21A for 1992 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

c) Preparation for the CWP 16th Session: review of the logbook and STATLANT 21B forms

2. Fundamental research programs for stock assessment

a) Research activities and costs in 1992/93

i) Review of National Sampling Programs

ii) Review of survey activities
iii) Coordination of surveys

b) Assessment data needs for 1994/95 and respective budgets

i) Compiling of commercial fisheries data by fleet
ii) Regular survey schemes by stock

3. Non-traditional fishery resources in the NAFO Area

a) Current development of the fisheries
b) Available data and research priorities

4. Proposals for scientific tasks of observers in the pilot observer program

5. Other matters

a) List of fishing vessels for 1992
b) Tagging activities reported for 1992
c) Updating of conversion factors used to get rounded fresh weights
d) Other business

IV. Publications (STACPUB Chairman: H. Lassen)

1. Review of STACPUB membership

2. Review of scientific publications since June 1992

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
c) Proposed award scheme for exceptional papers

5. Editorial matters regarding scientific publications

a) Editorial activities
b) Progress review: Journal issue of 1989 Special Session
c) Review of general editorial process
d) Review of Editorial Board

6. Papers for possible publication

a) Review of proposals resulting from the 1992 meetings
b) Review of contributions to the 1993 meetings

7. Other matters

V. Rules of Procedure

a) New Rule 4.3 on deadline dates for STATLANT 21A and 21B of 15 May and 30 June respectively
b) Ratification of an outstanding addition to Rule 3 (see Annex 4)

VI. Collaboration with other Organizations

1. Joint ICES/NAFO Working Group on harp and hooded seals
2. Sixteenth Session of CWP, 1994
3. Scientific Council invitation to other international bodies

VII. Arrangements for Special Sessions

[See under Fishery Science, Section 10(a), 10(b) and 10(c)]

VIII. Future Scientific Council Meetings, 1993 and 1994

IX. Nomination and election of Officers to the Scientific Council and its Standing Committees (except STACFIS)

X. Request for November Scientific Council Meeting on shrimp (Annex 5)

XI. Other Matters

XII. Adoption of Reports

1. Committee reports from this meeting (STACFIS, STACREC, STACPUB)
2. Scientific Council Report, June 1993 (receipt and adoption)

XIII. Adjournment

ANNEX 1. FISHERIES COMMISSION'S REQUEST FOR SCIENTIFIC ADVICE ON MANAGEMENT IN 1994 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 1993 Annual Meeting, provide advice on the scientific basis for the management of the following fish and invertebrate stocks or groups of stocks in 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)

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. 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 evaluated in relation to spawning stock size. As general reference points the implications of fishing at $F_{0.1}$, F_{1990} and F_{max} in 1994 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 1994 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.

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 1994 over a range of fishing mortality rates (F) at least from $F_{0.1}$ to F_{max}.

- a graph showing spawning stock biomass at 1.1.1995 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.

ANNEX 2. CANADIAN REQUEST FOR SCIENTIFIC ADVICE ON MANAGEMENT IN 1994 OF CERTAIN STOCKS IN SUBAREAS 0 TO 4

1. Canada requests that the Scientific Council, at its meeting in advance of the 1993 Annual Meeting, provide advice on the scientific basis for the management of the following fish and invertebrate stocks in 1994:

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 1993 Annual Meeting of NAFO, provide advice on the scientific basis for management in 1994 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 and comment on its management, including any further information on the questions asked in June 1992.

a) Should any overall TAC be sub-divided by NAFO Divisions (or combination of Divisions)?

b) What would be the implications of changing the current geographic distribution of catches?

c) What proportion of the stock occurs within the waters under the jurisdiction of the Coastal States?

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 1994 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 evaluated in relation to spawning stock size. All results should be expressed in terms of stock sizes, catch rates and TACs implied for 1994 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 biomass and spawning stock 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.

B. Rawson
Deputy Minister
Department of Fisheries and Oceans
Ottawa, Canada

ANNEX 3. DENMARK (GREENLAND) REQUEST FOR SCIENTIFIC ADVICE ON MANAGEMENT OF CERTAIN STOCKS IN 1994

1. Denmark, on behalf of Greenland, requests the Scientific Council of NAFO in advance of the 1993 Annual Meeting to consider the following stocks occurring in Subarea 1:

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, subject to the concurrence of Canada, that the following stocks overlapping Subareas 0 and 1 be included in the considerations of the Scientific Council:

i) Greenland halibut
ii) Roundnose grenadier
iii) Northern shrimp (*Pandalus borealis*)

Further, in cooperation with ICES, the Scientific Council is requested to analyse the following stock in the Denmark Strait and off East Greenland:

i) Northern shrimp (*Pandalus borealis*)

The Scientific Council is requested to provide advice on the status and on the biological basis for management in 1994 and as many years forward as the data allow for all stocks mentioned above.

2. In the analyses on which management advice will be based, the following should be included:

Considering uncertainties of stock delimitations for **Greenland halibut**, the Scientific Council in 1992 advised that TACs be set by Subarea/Divisions and by inshore/offshore areas to ensure an evenly exploitation on various stock components.

Denmark (Greenland) therefore requests the Scientific Council to provide advice for Greenland halibut on the following:

a) Analysis of existing information on stock delimitation in Subareas 0, 1, 2 and 3.

b) Allocate TACs to appropriate Subareas/Divisions and inshore/offshore areas to avoid excessive fishery pressure on single stock components.

For **Northern shrimp in Subareas 0+1** the biological and practical implications of combining all areas of stock distribution (i.e. including Subarea 1 north of 71°N and Subarea 1 inshore) for stock assessment purposes should be considered.

For **Northern shrimp in Subareas 0+1 and in the Denmark Strait**

a) analysis of the effects on the stocks of actual catches and the magnitude of shrimp discards should be continued if data so allow:

b) the by-catch of small finfish (notably redfish and Greenland halibut) in the fisheries for shrimp should be evaluated, and the effect of the by-catch on these fish stocks should be analyzed if data so allow.

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.

E. Lemche
Grønlands Hjemmestyre, Danmarkskontoret
Copenhagen N, Denmark

ANNEX 4. PROPOSAL FOR RULES OF PROCEDURE

Given below are relevant minutes of the 1984 Annual Meeting of the Scientific Council. The Scientific Council proposed an addition to Rule 3 of the Rules of Procedure for ratification by Contracting Parties prior to January 1985.

This rule had not been submitted to the Contracting Parties for ratification.

VI. OTHER MATTERS

1. **Provision of Scientific Advice at Meetings in the Absence of the Chairman and Vice-Chairman**

The problem which arose at the Special Meeting of the Scientific Council in January 1984, when neither the Chairman or the Vice-Chairman could be present, was discussed, with a view toward establishing a suitable guideline for similar situations in the future. After considering various options and in the absence of a quorum, the Scientific Council requested the Executive Secretary to submit the following proposed addition to Rule 3 of the Rules of Procedure of the Scientific Council for ratification by Contracting Parties prior to its meeting in January 1985: "In the circumstance that both the Chairman and Vice-Chairman of the Scientific Council are absent at the time and place of a scheduled Scientific Council Meeting, a Scientific Council representative shall be appointed as interim chairman by consensus among the Scientific Council representatives, or their alternates, who are present". The rule will be numbered 3.7.

ANNEX 5. DENMARK (ON BEHALF OF GREENLAND) REQUEST FOR REINSTATEMENT OF A MID-TERM MEETING OF NORTHERN SHRIMP STOCKS IN SUBAREA 0+1

Denmark, on behalf of Greenland, requests that the Scientific Council, at its meeting in advance of the 1993 Annual Meeting, consider the following proposal regarding the reinstatement of a mid-term meeting for assessment of Northern shrimp stocks in SA 0+1 and Denmark Strait.

From 1976 to 1978 the Standing Committee on Research and Statistics of ICNAF and from 1979 to 1987 the Scientific Council of NAFO organized mid-term meetings for the assessment of shrimp in SA 0+1 and (from 1980) in Denmark Strait. The rationale was based on experience from other shrimp stocks which showed that the species could experience sudden changes in abundance and distribution due to combinations of fishing effort and environmental changes. In order to detect such changes as soon as possible and to incorporate the findings in the provision of advice, a mid-term meeting was considered necessary. The alternative of conducting shrimp assessments at the June meeting would result in advising catch levels for the coming year based on data from the year before, thereby excluding the most recent information on stock status (*i.e. current year data*).

In 1987, the Scientific Council concluded that special meetings of the Council in January did not seem to allow more precise advice to be provided than would be possible in the previous June. This conclusion was reached based on the recognition that progress in determining reliable abundance and recruitment estimates was proving to be difficult and that the previously used indices (commercial catch rates and photographic survey results) were regarded as being less useful. Consequently, it was agreed to provide advice for 1988 at the September 1987 Meeting and for 1989 at the June 1988 Meeting. It was further agreed that, if it can be established that a significant improvement in the accuracy of advice can be obtained, a return to mid-term meetings would be appropriate.

At the June 1992 Meeting of the Scientific Council, it was concluded that the data on which advice for the SA 0+1 shrimp stock is based had improved considerably, especially since a time series of random-stratified trawl surveys and a better knowledge on size-at-age were available. At the same meeting, a reduction in TAC was advised not only for 1993, but also for the remainder of 1992, due to a significant decrease in stock biomass, concern for the level of spawning biomass, and indications of a lack of new recruitment. The 1992 survey data, obtained in July-August, have not yet been considered by NAFO, but a preliminary review of data indicated that the biomass in the summer of 1992 remained at a level similar to those observed prior to 1991 and that prospects for recruitment are more positive. If this information had been available for the Scientific Council at the 1992 meeting, the status of the resource would probably have been viewed differently.

It is therefore proposed that annual, mid-term meetings be reinstated to insure that assessments are based on the most recent data available. The first should take place in late-November 1993 with a review of the June 1993 assessment, using the 1993 research survey results and as much of the current fishery data as possible. By the same argument, the shrimp stock in Denmark Strait should be reviewed at this time. The assessment of this stock involves the same experts who conduct the assessment of the SA 0+1 shrimp stock.

Henrik Leth
Aalisarnermut Piniarnermut
Nunalerinermullu Pisortaqarfik
Direktoratet for Fangst, Fiskeri og Landbrug

AGENDA II. SCIENTIFIC COUNCIL ANNUAL MEETING, 7-10 SEPTEMBER 1993

I. Opening (Chairman: V. P. Serebryakov)

1. Appointment of rapporteur
2. Adoption of agenda
3. Plan of work

II. Fishery Science (STACFIS Chairman: H. P. Cornus)

1. Review of 1993 recommendations

2. Stock assessments

   a) Silver hake[1]
   b) Shrimp in Division 3M
   c) Workshop on assessment methods
   d) Data availability for assessment of northern shrimp in November 1993

3. Review of research documents

4. Review of current arrangements for conducting stock assessments and documentation

   a) Updating list of Designated Experts
   b) *Review of Working Papers to be prepared* by Designated Expert on their workload
   c) Guidelines for documentation of assessments
   d) Status of scientific documents (Working Papers *vs* Research Documents)
   e) Proposal for annual shrimp meeting in November
   f) Adoption of work procedures for the June 1994 Scientific Council Meeting

5. Future special sessions

   a) Progress report on 13-15 September 1993 Special Session on "Gear Selectivity/Technical Interactions in Mixed Species Fisheries", co-conveners S. A. Murawski (USA) and P. A. M. Stewart (EEC-UK)
   b) Progress report on September 1994 Special Session
   c) Progress report on September 1995 Special Session
   d) Theme for September 1996 Special Session

6. *Other matters*

III. Research Coordination (STACREC Chairman: A. Avila de Melo)

1. Acquisition of STATLANT 21 Data
2. Acquisition of statistical information from other standing committees
3. Publication of statistical information
4. Assessment data needs for 1994/95 and respective budget
5. Non-traditional fishery resources in the NAFO Area
6. Proposals for scientific tasks of observers in the Pilot Observer Program
7. Updating of conversion factors used to get round fresh weight
8. Research coordination for Greenland halibut
9 Other matters

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[1] Assessment was deferred from the 2-16 June 1993 Meeting of the Scientific Council.

IV. Publications (STACPUB Chairman: H. Lassen)

1. Review of scientific publications

2. Promotion and distribution of scientific publications

   a) Invitational papers
   b) Promotion of the Journal

3. Editorial matters

4. Review of papers for possible publication

5. Guidelines for authors of research documents

6. Other matters

V. Rules of Procedure

VI. Collaboration with Other Organizations

1. Scientific Council representatives to CWP 16th Session in July 1994
2. Scientific Council invitations to other international bodies

VII. Review of Future Meeting Arrangements

1. Proposed November 1993 Meeting on northern shrimp
2. Special Session of 13-15 September 1993 (see Attachment 2)
3. June 1994 Meeting of Scientific Council
4. Special Session and Annual Meeting, September 1994
5. June 1995 Meeting of Scientific Council

VIII. Space Requirements for June Meetings and Structure of Scientific Council

IX. Other Business

X. Adoption of Reports

1. Committee Reports of present meeting (STACFIS, STACREC, STACPUB)
2. Report of Scientific Council, September 1993

XI. Adjournment

AGENDA III. SCIENTIFIC COUNCIL MEETING, 19-23 NOVEMBER 1993

I. Opening (Chairman: H. Lassen)

1. Appointment of rapporteur
2. Adoption of agenda
3. Plan of work

II. Fishery Science (STACFIS Chairman: H. P. Cornus)

1. Stock assessments (see Annex 1)

   - Northern shrimp (Subareas 0 and 1)
   - Northern shrimp (in Denmark Strait and off East Greenland)

2. Mesh size in the redfish fishery in the Regulatory Area (see Annex 2)

3. Minimum fish size for witch, redfish and G. halibut (see Annex 3)

4. Other business

III. Other Matters

IV. Adoption of Reports

V. Adjournment

ANNEX 1

The Scientific Council at its meeting of 7-10 September 1993 considered the Data Availability for Assessment and the reinstatement of a mid-term meeting for the assessment of Northern Shrimp Stocks in Subareas 0 and 1, and Denmark Strait (NAFO SCS Doc. 93/20, Serial No. N2320). It was recommended that a meeting be held during 19-23 November 1993 at NAFO Headquarters.

ANNEX 2

The following request was received from the Fisheries Commission:

The Chairman of STACTIC reported that careful attention was given to the proposal by the Russian Federation to amend the NAFO Conservation and Enforcement Measures in respect of minimum mesh size for certain redfish fisheries in the Regulatory Area (see text below). He furthermore explained that the proposal should be understood only to comprise *a scientific/commercial project in 1994 with the following specifications:*

- maximum 5 vessels;
- maximum 250 fishing days in total;
- a team of scientists will monitor the project, circulating among the 5 vessels;
- only pelagic trawls will be used in the project;
- the scientific team will ensure that the trawls are set in such a way that catch of other groundfish is avoided.

The project is to be reviewed at the Special Scientific Council Meeting in November 1993.

Data resulting from the project should be made available as soon as it is compiled.

The project is to be decided upon at the Special Fisheries Commission Meeting in 1994.

Relevant text from the Russian Federation proposal:

"it is proposed that, on an experimental basis for the remainder of 1993 and 1994, the Fisheries Commission consider establishing a mesh size of 90 mm when fishing for redfish with midwater trawls in Divisions 3N and 3O. Such a measure would enable Contracting Party vessels to evaluate, and report to the Fisheries Commission, observed escapement patterns for small redfish in 90 mm trawls.

It is further proposed that the Scientific Council review the results of the above-noted period (remainder of 1993 and 1994) to determine if the mesh size exemption for redfish fisheries in Divisions 3N and 3O should continue beyond 1994".

ANNEX 3

Regarding Minimum Fish Size for Witch, Redfish and G. Halibut, the following discussions developed at the 15th Annual Meeting:

(Extract from the STACTIC Report)

7. Minimum Sizes for Cod, Yellowtail Flounder and American Plaice - Possible Alternatives to Current Measures (item 9 of the Agenda)

7.1 The Representative of Canada presented a proposal for technical discussions on adding 3 new species to the list - Witch, Redfish and Greenland halibut and three additional columns with their length equivalents.

7.2 The Chairman indicated the Scientific Council would have to be requested to provide information on round length for the three new species proposed but as indicated by some Contracting Parties it would be difficult for the Scientific Council to provide information on product form. Therefore, it **was agreed** that a proposal to the Fisheries Commission would be prepared that the Scientific Council be requested to look at the feasibility and desirability of establishing minimum fish size for the three additional species and to advise on the minimum round length for the three new species proposed in the Canadian paper. (Attachment 1)

7.3 There was continued discussion on the establishment of processed length equivalents.

The Russian delegation stated it was not reasonable to establish such regulations due to technological difficulties in the procedure of this inspection, as well it would be impossible to implement and to determine conversion factors.

7.4 The Chairman of the Scientific Council addressed the questions raised by STACTIC and stated that the Council did not have the information to give definitive answers (Attachment 2). Since scientific advice was not available, the Committee presented its draft for the request to the Scientific Council by the Fisheries Commission.

The Fisheries Commission adopted the STACTIC recommendations and directed its request to the Scientific Council.

Attachment 1
(STACTIC Working Paper 93/10)

REQUEST TO THE SCIENTIFIC COUNCIL ON MINIMUM FISH SIZES

Background:

At the 14th Annual Meeting, the Fisheries Commission adopted minimum fish size measures in an attempt to reduce or eliminate juvenile fish mortality in the Regulatory Area.

However, as currently written, the minimum fish sizes apply only to fish in the whole round state. As such, this measure can only be applied by inspectors to fish observed on the trawl deck or in the factory area.

Given that this fish represents a very small percentage on the total fish on board any vessel, STACTIC would like to consider the establishment of processed **length** equivalents for three of the major product types found in the Regulatory Area. These three product types are gutted, head-off gutted, and head-off tail off split fish.

Request:

STACTIC recommends that the Fisheries Commission request the Scientific Council to consider and provide advice on the following questions:

1. 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).

2. Is there a reasonably 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, and head-off tail-off split product forms for cod, redfish, American plaice, yellowtail, witch and Greenland halibut.

The Fisheries Commission refers the Scientific Council to NAFO SCR Doc. 82/VI/45 titled "The Shape of Cod on the Flemish Cap".

Attachment 2
(STACTIC Working Paper 93/14)

The following is the response from the Scientific Council to STACTIC with respect to Minimum Landing Size.

1. Minimum landing size (whole fish)

   Greenland halibut and flatfishes. STACFIS did not have data readily available to provide STACTIC with appropriate values. Data exist in laboratories, but such data need to be reviewed and the Scientific Council will put this item on the agenda of the June 1994 Meeting.

2. Minimum landing size (products)

   STACFIS realized that for cod some data are available, however, these data could not be produced at this meeting. These data will provide estimates of head-off and head-off/tail-off length corresponding to 41 cm standard length.

   The Greenland halibut and flatfishes data are not available and need to be collected. The Scientific Council will review data in June 1994 should the Fisheries Commission so wish.

LIST OF RESEARCH AND SUMMARY DOCUMENTS

RESEARCH DOCUMENTS (SCR)

SCR No.	Ser. #	Author(s) and Title
93/1[a]	N2176	SIGAEV, I. K. Oceanographic conditions in some areas of the Northwest Atlantic in 1992. (5 pages)
93/2[a]	N2177	RIKHTER, V. A. Variation in abundance of the Scotian Shelf silver hake and some other Gadidae in the Northwest Atlantic. (7 pages)
93/3[a]	N2178	RIKHTER, V. A. On dependence between pollock, cod and haddock by-catches and Soviet CPUE estimates for the Nova Scotian silver hake between 1977 and 1990. (4 pages)
93/4[a]	N2179	RIKHTER, V. A. On reliability of independent silver hake abundance indices in the Scotian Shelf area. (6 pages)
93/5[a]	N2180	GASIUKOV, P. S. On the stabilization of commercial fishes stock estimates obtained by means of the adaptive approach. (15 pages)
93/6[a]	N2181	GASIUKOV, P. S. Status of silver hake stocks in NAFO Divisions 4VWX in 1992 and TAC for 1994. (15 pages)
93/7[a]	N2182	VINOGRADOV, V. I. On hake feeding related to distribution of food organisms in the Scotian Shelf area in 1988, 1990. (13 pages)
93/8[a]	N2185	STEIN, M. Climatic conditions around Greenland, 1992. (13 pages)
93/9[a]	N2186	BUCH, E. Oceanographic conditions at West Greenland, 1992. (7 pages)
93/10[a]	N2187	MOROZOVA, G. N. Distribution of yellowtail flounder (*Limanda ferruginea*) on the Grand Bank of Newfoundland by the data from Russian surveys, 1971-1991. (8 pages)
93/11[a]	N2188	VASKOV, A. A., and T. O. IVANOVA. Stock assessment of redfish in Division 3M by the data from 1992 trawl-acoustic survey. (7 pages + Addendum 2 pages)
93/12[a]	N2189	SAVVATIMSKY, P. I. Results of investigations of roundnose grenadier in NAFO Subareas 0, 2 and Division 3K in 1971-1992. (8 pages)
93/13[a]	N2190	SAVVATIMSKY, P. I., and S. A. KUZMIN. On by-catches of cod during surveys on redfish in NAFO Divisions 3L, 3N and 3O in 1988-1991. (8 pages)
93/14[a]	N2191	GERASIMOVA, O. V., and S. A. KUZMIN. Spatial and functional structure of cod trophic relations on the Newfoundland Shelf in spring-summer season. (18 pages)
93/15[a]	N2192	GORCHINSKY, K. V. Results from Greenland halibut assessment in Divisions 0B, 2GH by the data from 1992 trawl survey. (7 pages)
93/16[a]	N2193	DE CARDEÑAS, E., E. RODRÍGUEZ-MARÍN, F. SABORIDO, M. CARNEIRO, and J. GIL. Preliminary results of European cod tagging programme in NAFO Division 3M (second year). (29 pages)

[a] Scientific Council Meeting, 2-16 June 1993

93/17[a] N2194 JUNQUERA, S. Feeding cycles of the Greenland halibut (*Reinhardtius hippoglossoides*) in the Flemish Pass area in relation to catch rates (1991-92). (11 pages)

93/18[a] N2195 RODRIGUEZ-MARIN, E., A. PUNZÓN, and J. PAZ. Greenland halibut (*Reinhardtius hippoglossoides*) feeding in Flemish Pass NAFO Divisions 3LM. (9 pages)

93/19[a] N2196 VAZQUEZ, A. Results from bottom trawl survey of Flemish Cap in July 1992. (22 pages)

93/20[a] N2197 CASAS, J. M., and G. PÈREZ-GÁNDARAS. Is otolith growth representative of cohort growth? (10 pages)

93/21[a] N2198 MILLER, D. S. Results from an acoustic survey for capelin in Divisions 3NO in 1992. (5 pages)

93/22[a,b] N2199 SAINZA, C. Northern shrimp (*Pandalus borealis*) stock on Flemish Cap. (5 pages)

93/23[a,b] N2200 SABORIDO-REY, F. Osteological differences in species of *Sebastes* on Flemish Cap. (9 pages)

93/24[a] N2201 SABORIDO-REY, F. Distribution, abundance and biomass trends in the Genus *Sebastes* on Flemish Cap (Div. 3M). (12 pages)

93/25[a] N2202 ZAMARRO, J., S. CERVIÑO, and M. GONZALEZ. Identification of female cod (*Gadus morhua*) from Flemish Cap (Northwest Atlantic) at the beginning of ripening. (18 pages)

93/26[a] N2203 RÄTZ, H. J. Abundance and present length structure of demersal fish stocks off West Greenland (Divisions 1B-1F, 0-400 m). (10 pages)

93/27[a] N2207 BENWAY, R. L., J. W. JOSSI, and C. A. GRISWOLD. Surface and bottom temperatures and surface salinities: New York to Gulf Stream, Massachusetts to Cape Sable, N.S. 1992. (15 pages)

93/28[a] N2208 BAKANEV, V. S. Results from acoustic capelin surveys in NAFO Divisions 2J3K in 1992. (4 pages)

93/29[a] N2209 ATKINSON, D. B. Some observations on the biomass and abundance of fish captured during stratified-random bottom trawl surveys in NAFO Divisions 2J3KL, fall 1981-1991. (18 pages)

93/30[a,b] N2210 ANDERSON, J. T., E. L. DALLEY, and J. E. CARSCADDEN. Distribution and abundance of pelagic 0-group cod in inshore and offshore areas for the northern cod stock (NAFO 2J3KL). (24 pages)

93/31[a,b] N2211 PEPIN, P., and S. M. CARR. Morphological, meristic and genetic analysis of stock structure in juvenile Atlantic cod (*Gadus morhua*) from the Newfoundland Shelf. (12 pages)

93/32[a,b] N2212 ANDERSON, J., and E. DALLEY. Inshore/offshore distributions and abundances of pelagic 0-group cod in NAFO Divisions 3K and 3L in fall of 1991 and 1992. (6 pages)

93/33[a,b] N2213 NARAYANAN, S., J. W. BAIRD, C. A. BISHOP, and G. R. LILLY. Climatic effects on cod distribution deduced from trawl surveys. (8 pages)

93/34[a,b] N2214 STENSON, G. B. The status of pinnipeds in the Newfoundland region. (4 pages)

93/35[a,b] N2215 DALLEY, E. L., and J. T. ANDERSON. Distribution and abundance of demersal juvenile cod from inshore to offshore locations on the northern Grand Bank and NE Newfoundland Shelf in December 1992. (9 pages)

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[a] Scientific Council Meeting, 2-16 June 1993.
[b] Scientific Council Annual Meeting, 7-10 September 1993.

93/36[a,b]	N2216	LAWSON, J. W., G. B. STENSON, and D. G. MCKINNON. Diet of harp seals (*Phoca groenlandica*) in 2J3KL during 1991-93. (15 pages + 1 Corrigendum)
93/37[a,b]	N2217	SHELTON, P. A., and M. J. MORGAN. An analysis of NAFO Divisions 2J3KL cod spawner biomass and recruitment. (14 pages)
93/38[a,b]	N2218	MYERS, R. A., K. F. DRINKWATER, N. J. BARROWMAN, and J. W. BAIRD. Salinity and recruitment of Atlantic cod (*Gadus morhua*) in the Newfoundland Region. (12 pages)
93/39[a,b]	N2219	MYERS, R. A., G. MERTZ, and C. A. BISHOP. Cod spawning in relation to physical and biological cycles of the northern Northwest Atlantic. (15 pages)
93/40[b]	N2220	VINOGRADOV, V. I. On the problem of feeding, diurnal, annual food ration and balance for silver hake population in the Scotian Shelf area. (23 pages)
93/41[a,b]	N2221	HUTCHINGS, J. A., and R. A. MYERS. The timing of cod reproduction interannual variability and the influence of temperature. (13 pages)
93/42[a,b]	N2222	HUTCHINGS, J. A., R. A. MYERS, and G. R. LILLY. Graphic variation in the spawning of Atlantic cod, *Gadus morhua*, in the Northwest Atlantic. (12 pages)
93/43[a,b]	N2223	HUTCHINGS, J. A., and R. A. MYERS. The effect of age on the seasonality of maturation and spawning of Atlantic cod, *Gadus morhua*, in the Northwest Atlantic. (9 pages)
93/44[a]	N2225	PETRIE, B., and K. DRINKWATER. The influence of the Labrador current on the ocean climate of the Scotian Shelf and the Gulf of Maine. (15 pages)
93/45[a,b]	N2226	STENSON, G. B., and D. J. KAVANAGH. Distribution of harp and hooded seals in offshore waters of Newfoundland. (13 pages)
93/46[a]	N2227	GLENN, G. F. Marine Environmental Data Service Report for 1992. (16 pages)
93/47[a]	N2228	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. (8 pages, revised)
93/48[a,b]	N2229	RØNNOW, B. M. A short presentation of hydrographic data sampled during the shrimp surveys in 1990 and 1992 in Denmark Strait. (7 pages)
93/49[a]	N2230	DRINKWATER, K. F., and R. A. MYERS. Investigations of the mean, seasonal and interannual variability in the position of the north wall of the Gulf Stream 45°W to 75°W. (6 pages)
93/50[a]	N2231	DRINKWATER, K. F. Overview of environmental conditions in the Northwest Atlantic in 1992. (33 pages)
93/51[a]	N2232	SKÚLADÓTTIR, U. The Icelandic shrimp fishery (*Pandalus borealis*) in the Denmark Strait in 1992 and early 1993. (7 pages)
93/52[a]	N2235	BECH, G. Survey biomass and abundance of Greenland halibut (*Reinhardtius hippoglossoides*) and redfish (*Sebastes* spp.) in Greenland trawl survey 1992 (NAFO Subarea 1). (8 pages)
93/53[a]	N2236	BOJE, J., and N.-R. HAREIDE. Trial deepwater longline fishery in the Davis Strait, May-June 1992. (6 pages)

[a] Scientific Council Meeting, 2-16 June 1993.
[b] Scientific Council Annual Meeting, 7-10 September 1993.

93/54[a] N2237 LILLY, G. R., and D. J. DAVIS. Changes in the distribution of capelin in Divisions 2J, 3K and 3L in the autumns of recent years, as inferred from bottom-trawl by-catches and cod stomach examinations. (14 pages)

93/55[a,b] N2238 LILLY, G. R. The food of cod in Divisions 2J, 3K and 3L during the autumns of 1978-1992. (14 pages)

93/56[a,b] N2239 BISHOP, C. A., and J. W. BAIRD. Spatial and temporal variability in condition factors of 2J3KL cod. (15 pages + 1 Corrigendum)

93/57[a,b] N2240 MORGAN, M. J., C. A. BISHOP, and J. W. BAIRD. Temporal and spatial variation in age and length at maturity in 2J3KL cod. (8 pages)

93/58[a] N2241 SATANI, M., S. KAWAHARA, and O. JORGENSEN. Results of two stratified random bottom trawl surveys off West Greenland in 1992. (12 pages)

93/59[a] N2242 USHAKOV, N. G. On investigations of capelin from the Barents Sea. (4 pages)

93/60[a,b] N2243 CARLSSON, D. M., and P. KANNEWORFF. The commercial shrimp fishery in Denmark Strait in 1992 and early-1993. (23 pages)

93/61[a] N2244 DE CÁRDENAS, E., S. JUNQUERA, and A. VAZQUEZ. Abundance indices of Greenland halibut in deepwater fishing zones of NAFO Divisions 3LMN. (8 pages)

93/62[a] N2245 BOWERING, W. R., and D. POWER. An examination of spacial distribution of Greenland halibut in the Labrador-eastern Newfoundland area of the Canadian Northwest Atlantic based on research surveys. (11 pages)

93/63[a] N2246 SKÚLADÓTTIR, U. The catch statistics of the shrimp fishery (*Pandalus borealis*) in the Denmark Strait in the years 1980-1992. (12 pages)

93/64[a] N2248 CARLSSON, D. M., and P. KANNEWORFF. The shrimp fishery in NAFO Subarea 1 in 1992 and early-1993. (32 pages)

93/65[a,b] N2249 SKÚLADÓTTIR, U. The sexual maturity of female shrimp (*Pandalus borealis*) in the Denmark Strait in the years 1985-1992 and a comparison to the nearest Icelandic shrimp stocks in 1992. (7 pages)

93/66[a] N2250 CARLSSON, D. M., and P. KANNEWORFF. Stratified-random trawl survey for shrimp (*Pandalus borealis*) in Denmark Strait in 1992. (13 pages)

93/67[a] N2251 DE CARDENAS, E., and H. LASSEN. Effects of mesh size changes in the Flemish Cap cod fisheries. (9 pages)

93/68[a,b] N2252 ANDERSON, J. T. Distributions of juvenile cod in NAFO Divisions 2J3KL during fall, 1981-92, in relation to bathymetry and bottom temperatures. (18 pages)

93/69[a] N2253 MYERS, R. A., N. J. BARROWMAN, and J. A. HUTCHINGS. Depensatory recruitment and the collapse of fisheries. (9 pages)

93/70[a] N2254 CARLSSON, D. M., P. KANNEWORFF, D. G. PARSONS. Stratified-random trawl survey for shrimp (*Pandalus borealis*) in NAFO Subarea 0+1, 1992. (23 pages)

93/71[a] N2255 WALSH, S. J. Dynamics of juvenile American plaice populations on the Grand Banks, NAFO Divisions 3LNO. (21 pages)

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[a] Scientific Council Meeting, 2-16 June 1993.
[b] Scientific Council Annual Meeting, 7-10 September 1993.

93/72[a]	N2256	CARLSSON, D. M., and P. KANNEWORFF. Stratified-random trawl survey for shrimp (*Pandalus borealis*) in inshore areas at West Greenland, NAFO Subarea 1, in 1992. (12 pages)
93/73[a]	N2258	POWER, D. An assessment of Divisions 3LN redfish. (31 pages)
93/74[a]	N2259	ATKINSON, D. B., D. POWER, and D. W. KULKA. The roundnose grenadier (*Coryphaenoides rupestris*) fisheries in NAFO Subareas 2+3. (20 pages)
93/75[a]	N2260	BOWERING, W. R., W. B. BRODIE, and D. POWER. An evaluation of the status of the Greenland halibut resource in NAFO Subarea 2 and Divisions 3KLM. (29 pages)
93/76[a]	N2261	BRODIE, W. B., S. J. WALSH, D. POWER, and W. R. BOWERING. An assessment of the yellowtail flounder stock in Divisions 3LNO. (43 pages)
93/77[a]	N2262	GORCHINSKY, K., and D. POWER. An assessment of Division 3M redfish. (10 pages)
93/78[a]	N2263	PARSONS, D. G., and P. J. VEITCH. The Canadian fishery for Northern shrimp (*Pandalus borealis*) in Davis Strait, 1979-1992. (16 pages)
93/79[a]	N2264	SIEGSTAD, H. An estimate of shrimp discard from shrimp factory trawlers in Davis Strait, 1992. (8 pages)
93/80[a]	N2265	JØRGENSEN, O., and J. BOJE. An assessment of the Greenland halibut stock component in NAFO Subareas 0+1. (6 pages)
93/81[a]	N2266	CARLSSON, D. M., M. ANDERSEN, P. KANNEWORFF, D. G. PARSONS, and H. SIEGSTAD. Assessment of shrimp in Davis Strait (Subareas 0+1). (19 pages)
93/82[a]	N2267	GODINHO, M. L., and E. DE CARDENAS. An assessment of the American plaice stock in Division 3M. (10 pages)
93/83[a]	N2268	BOWERING, W. R., D. B. ATKINSON, D. POWER, and W. B. BRODIE. An evaluation of stock status of witch flounder in NAFO Divisions 3NO. (21 pages)
93/84[a]	N2269	SKÚLADÓTTIR, U., M. ANDERSEN, D. M. CARLSSON, P. KANNEWORFF, D. G. PARSONS, and H. SIEGSTAD. Assessment of shrimp in the Denmark Strait. (10 pages)
93/85[a]	N2270	VAZQUEZ, A. An assessment of the cod stock in NAFO Division 3M. (3 pages)
93/86[a]	N2271	BISHOP, C. A., E. F. MURPHY, M. B. DAVIS, J. W. BAIRD, and G. A. ROSE. An assessment of the cod stock in NAFO Divisions 2J+3KL. (51 pages)
93/87[a]	N2272	COLBOURNE, E. State-of-the-ocean, Grand Banks area (3L), mid-spring 1993, with a comparison to the mean. (15 pages)
93/88[a]	N2273	COLBOURNE, E. Oceanographic conditions during the annual fall groundfish survey in NAFO Divisions 2J3KL. (31 pages)
93/89[a]	N2275	RÄTZ, H. J. Redfish Subarea 1 (0-400 m): present stock abundance indices, species and length composition. (10 pages)
93/90[a]	N2276	DAVIS, M. B., D. STANSBURY, E. G. MURPHY, and C. A. BISHOP. An assessment of the cod stock in NAFO Divisions 3NO. (38 pages)

[a] Scientific Council Meeting, 2-16 June 1993.

93/91[a] N2277 BRODIE, W. B., D. POWER, and M. J. MORGAN. An assessment of the American plaice stock in NAFO Divisions 3LNO. (60 pages)

93/92[b] N2282 CADIGAN, N. G., and W. M. HICKEY. Analysis of subsampled catches from trouser trawl size selectivities studies. (10 pages)

93/93[b] N2283 S. KUIKKA, P. SUURONEN and R. PARMANNE. Impacts of increased codend mesh size on the catches and fishery of herring in the northern Baltic Sea - uncertainties from the ecosystem and markets. (11 pages)

93/94[b] N2285 BOULOS, D. L., N. G. CADIGAN, and W. M. HICKEY. Combining selectivities from multiple trouser trawl tows. (12 pages)

93/95[b] N2287 DEALTERIS, J., and R. RIEDEL. Effect of size selection within and between fishing gear types of the yield and spawning stocks biomass per recruit and catch per unit effort for a cohort of an idealized groundfish. (23 pages)

93/96[b] N2288 REIS, E. G., and M. G. PAWSON. Characteristics of the fish's body affecting gillnet selectivity. (25 pages)

93/97[b] N2289 REIS, E. G., and M. G. PAWSON. Gill-net selectivity of bass and white croaker using commercial catch data. (23 pages)

93/98[b] N2290 CLAY, P. M. "Management regions, statistical areas and fishing grounds: criteria for dividing up the sea" WORK IN PROGRESS. (19 pages)

93/99[b] N2291 STEWART, P. A. M., and A. W. NEWTON. Observations on the size composition of haddock and whiting catches taken by the different fishing methods used in the Scottish North Sea demersal fisheries. (22 pages)

93/100[b] N2293 GORCHINSKY, K. V., S. F. LISOVSKY, and M. K. SADOKHIN. Selectivity of bottom trawls during the fishery for redfish on the Flemish Cap Bank. (9 pages)

93/101[b] N2294 SKÚLADÓTTIR, U., and S. EINARSSON. The Icelandic shrimp (*Pandalus borealis*) fishery at the Flemish Cap in 1993, with a preliminary analysis of the age structure. (9 pages)

93/102[b] N2295 SHOWELL, M. A., R. BRANTON, M. C. BOURBONNAIS, and R. G. HALLIDAY. Status of the Scotian Shelf silver hake populations in 1992 with projection to 1994. (24 pages)

93/103[b] N2296 NICOLAJSEN, A. Assessment of the shrimp stock on Flemish Cap (Division 3M) for 1993. (7 pages)

93/104[b] N2297 SAINZA, C. Northern shrimp (*Pandalus borealis*) stock on Flemish Cap in June-July 1993. (8 pages)

93/105[b] N2298 LILLY, G. R. Sizes, distribution and relative abundance of northern shrimp (*Pandalus borealis*) on Flemish Cap (Division 3M) in 1978-1984, as inferred from analysis of cod stomach contents. (10 pages)

93/106[b] N2299 COLBOURNE, E. Environmental conditions in Atlantic Canada, mid-summer 1993, with comparisons to the long-term mean. (19 pages)

93/107[b] N2300 COLBOURNE, E. Oceanographic conditions on the Flemish Cap during the summer 1993, with comparisons to the long-term mean average. (16 pages)

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[a] Scientific Council Meeting, 2-16 June 1993.
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93/108[b] N2301 HALLIDAY, R. G. An analysis of scientific advice and TAC levels for the Scotian Shelf (Divisions 4VWX) silver hake stock. (8 pages)

93/109[b] N2302 CASEY, J. Estimating discards using selectivity data: the effects of mesh size changes in the mixed demersal fisheries in the Irish Sea. (43 pages)

93/110[b] N2304 SIEGSTAD. H. The Greenland fishery for northern shrimp (*Pandalus borealis*) on Flemish Cap, May-August 1993. (5 pages)

93/111[b] N2305 PARSONS, D. G., P. J. VEITCH, and E. M. SEWARD. The Canadian fishery for northern shrimp (*Pandalus borealis*) on Flemish Cap (NAFO Division 3M), 1993. (10 pages)

93/112[b] N2306 PARSONS, D. G., and P. J. VEITCH. Age and growth of northern shrimp (*Pandalus borealis*) on Flemish Cap (NAFO Division 3M). (11 pages)

93/113[b] N2307 CHRISTENSEN, S., and H. LASSEN. Optimal management of the Iceland-Greenland transboundary cod stock. (15 pages)

93/114[b] N2308 HASSAGER, T. K., and H. LASSEN. Why skippers skip grounds: a probabilistic decision model for whether a skipper continues fishing on the same or change to some other ground, based on data from the West Greenland shrimp fishery. (17 pages)

93/115[b] N2309 MURAWSKI, S. A. Factors influencing by-catch and discard rates: analyses from multispecies/multifishery sea sampling. (17 pages)

93/116[b] N2310 CHRISTENSEN, S. On management of varying shrimp stock in the Davis Strait. (20 pages)

93/117[b] N2311 ENGÅS, A., S. LØKKEBORG, A. V. SOLDAL, and E. ONA. Comparative fishing for cod and haddock with commercial trawl and longline at two different stock levels. (14 pages)

93/118[b] N2312 NEDREAAS, K., A. VOLD SOLDAL, and Å. BJORDAL. Performance and biological implications of a multi-gear fishery for Greenland halibut (*Reinhardtius hippoglossoides*). (15 pages)

93/119[b] N2313 SUURONEN, P., E. LEHTONEN, and V. TSCHERNIJ. Possibilities to increase the size-selectivity of a herring trawl by using a rigid sorting grid. (12 pages)

93/120[b] N2314 SHOWELL, M. Effect of mesh size/type on size distribution and catch rates for 1991 Scotian Shelf groundfish fisheries. (19 pages)

93/121[b] N2315 SINCLAIR, A. Seasonal components in technological interactions in Gulf of St. Lawrence shrimp and groundfish fisheries. (20 pages)

93/122[b] N2316 GABRIEL, W. L. Factors influencing technological interactions in Mid-Atlantic Bight groundfish fisheries. (12 pages)

93/123[b] N2317 FRYER, R. J., and J. G. SHEPHERD. Models of codend selection. (12 pages)

93/124[b] N2318 HOKENSON, S. R., and M. R. ROSS. Finfish by-catch mortality in the Gulf of Maine northern shrimp fishery. (4 pages)

93/125[b] N2319 SINCLAIR, A. Estimating fleet specific F given catch quotas. (4 pages)

93/126[b] N2321 MURAWSKI, S. A. Dynamic models of technological interaction: man as a prudent predator. (8 pages)

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[b] Scientific Council Annual Meeting, 7-10 September 1993.

93/127[b] N2322 BALFOUR, D. A Canadian northern shrimp selectivity program 1993. (9 pages)

93/128[c] N2340 PARSONS, D. G., and P. J. VEITCH. The Canadian fishery for northern shrimp (*Pandalus borealis*) in Davis Strait, 1979-1993. (14 pages)

93/129[c] N2341 ANDERSEN, M., D. M. CARLSSON, and P. KANNEWORFF. Stratified-random trawl survey for shrimp (*Pandalus borealis*) in Disko Bay, West Greenland, 1993. (13 pages)

93/130[c] N2342 CARLSSON, D. M., P. KANNEWORFF, and H. SIEGSTAD. The shrimp fishery in NAFO Subarea 1 January to October 1993. (31 pages)

93/131[c] N2343 CARLSSON, D. M., P. KANNEWORFF, and H. SIEGSTAD. The commercial shrimp fishery in Denmark Strait January to October 1993. (24 pages)

93/132[c] N2344 ANDERSEN, M., D. M. CARLSSON, and P. KANNEWORFF. Stratified-random trawl survey for shrimp (*Pandalus borealis*) offshore in NAFO Subareas 0 and 1 in 1993. (19 pages)

93/133[c] N2345 SKÚLADÓTTIR, U. The catch statistics of the shrimp fishery (*Pandalus borealis*) in the Denmark Strait in the year 1980-1993. (13 pages)

93/134[c] N2346 SKÚLADÓTTIR, U., M. ANDERSEN, D. M. CARLSSON, P. KANNEWORFF, D. G. PARSONS, and H. SIEGSTAD. Assessment of shrimp in the Denmark Strait. (13 pages)

93/135[c] N2347 SKÚLADÓTTIR, U. The Icelandic shrimp fishery (*Pandalus borealis*) in the Denmark Strait in 1992 and 1993. (2 pages)

93/136[c] N2349 CARLSSON, D. M., M. ANDERSEN, P. KANNEWORFF, and H. SIEGSTAD. Assessment of shrimp in Davis Strait (Subareas 0+1). (12 pages)

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[b] Scientific Council Annual Meeting, 7-10 September 1993.
[c] Scientific Council Meeting, 19-23 November 1993.

SUMMARY DOCUMENTS (SCS)

SCS No.	Ser. #	Author(s) and Title
93/1[a]	N2167	NAFO SECRETARIAT. Provisional index and list of titles of research and summary documents of 1992 (29 pages)
93/2[a]	N2168	NAFO SECRETARIAT. Provisional index of Journal of Northwest Atlantic Fishery Science and NAFO Scientific Council Studies, 1987-93. (32 pages)
93/3[a]	N2169	RAWSON, B. Canadian request for scientific advice on management in 1994 of certain stocks in Subareas 0 to 4. (2 pages)
93/4[a]	N2170	LEMCHE, E. Denmark (Greenland) request for scientific advice on management of certain stocks in 1994. (2 pages)

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[a] Scientific Council Meeting, 2-16 June 1993.

93/5[a]	N2171	NAFO SECRETARIAT. Historical catches of selected species by stock area and country for the period 1981-91. (26 pages)
93/6[a,b]	N2172	BOUDREAU, P., M. M. ROBERGE, and J-D. LAMBERT. Canadian research report for 1992. (19 pages)
93/7[a]	N2173	NAFO SECRETARIAT. Tagging activities reported for the Northwest Atlantic in 1992. (2 pages)
93/8[a]	N2174	NAFO SECRETARIAT. Report of the ICES/NAFO Working Group on harp and hooded seals, SevPINRO, Archangelsk, Russia - 5-12 October 1992. (24 pages)
93/9[a]	N2175	NAFO SECRETARIAT. List of biological sampling data for 1991. (22 pages)
93/10[a]	N2183	BOROVKOV, V., K. GORCHINSKY, S. KOVALEV, P. SAVVATIMSKY, V. A. RIKHTER, and I. K. SIGAEV. Russian research report for 1992. (14 pages)
93/11[a]	N2184	NAFO SECRETARIAT. Notes on statistical activities and publications since June 1992. (2 pages)
93/12[a]	N2204	CORNUS, P., H.-J. RÄTZ, and M. STEIN. German research report for 1992. (3 pages)
93/13[a]	N2205	YOKAWA, K. Japanese research report for 1992. (3 pages)
93/14[a]	N2206	VAZQUEZ, A., and S. IGLESIAS. Spanish research report for 1992. (7 pages)
93/15[a]	N2224	AVILA DE MELO, A., M. L. M. GODINHO, R. R. ALPOIM, and E. SANTOS. Portuguese research report for 1992. (48 pages)
93/16[a]	N2247	LUND, H., and M. ANDERSEN. Denmark/Greenland research report for 1992. (5 pages)
93/17[a,b]	N2257	NAFO. Report of Scientific Council, 2-16 June 1993 Meeting. (154 pages)
93/18[a]	N2274	NAFO SECRETARIAT. A compilation of research vessel surveys on a stock-by-stock basis. (21 pages)
93/19[b]	N2292	SERCHUK, F. M. United States research report for 1992. (4 pages)
93/20[b]	N2320	NAFO. Report of Scientific Council, 7-10 September Meeting. (29 pages)
93/21[c]	N2348	NAFO. Report of Scientific Council, 19-23 November 1993. (19 pages)
93/22	N2250	NAFO SECRETARIAT. Provisional nominal catches in the Northwest Atlantic, 1992. (45 pages)

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[c] Scientific Council Meeting, 19-23 November 1993.

LIST OF PARTICIPANTS IN SCIENTIFIC COUNCIL MEETINGS, 1993

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N.B. The list of participants of the 13-15 September 1993 Symposium is appended to the Report of the Symposium.

LIST OF RECOMMENDATIONS IN 1993

PART A

Scientific Council Meeting - 2-16 June 1993

GENERAL

Response to the Fisheries Commission

Proposals for Scientific Tasks of Observers in the Pilot Observer Program (page 33)

STACREC agreed that having biological data collected during the Pilot Observer Program was a good idea and **recommended** that *the Scientific Council bring forward for the information of and consideration by the Fisheries Commission that observers in the Pilot Observer Program should collect data on set location (latitude and longitude), depth fished, time net on bottom (or fishing), directed species, by-catches, discards, catches and effort. Length sampling of the main species in each set should also be set out.*

COLLABORATION WITH OTHER ORGANIZATIONS

Sixteenth Session of CWP 1994 (page 38)

The Council noted the 16th Session of the CWP was planned for Madrid, Spain, in July 1994. The Council **recommended** that *the Assistant Executive Secretary should attend the 16th Session of CWP.*

STACFIS

GENERAL REVIEW

Available Assessment Data (page 43)

STACFIS noted the absence of an early announcement of the Scientific Council Research Documents (SCR Doc.) being submitted to the meeting was a disadvantage for the above-mentioned review, and therefore STACFIS **recommended** that *SCR Documents should be announced 15 days before the beginning of the Scientific Council Meetings to the NAFO Secretariat. This announcement should include the title, purpose of the paper and, if available, the abstract.*

REVIEW OF RECOMMENDATIONS FROM 1992 MEETINGS (page 45)

STACFIS reiterated 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.*

STOCK ASSESSMENTS

Review of Assessment Methods to be Used (page 46)

STACFIS agreed that this was an important part of the work of the Scientific Council and **recommended** that *a workshop on stock assessment methodology should be held for example every second or third year.*

Cod in Division 3M

Prognosis (page 58)

The abundance and biomass expected at that time will be very low. In this view, STACFIS **recommended** that *no directed fishery on cod in Div. 3M be conducted in 1994, to allow stock recovery.*

Cod in Divisions 3N and 3O

Prognosis (page 65)

Given the extremely low level of the stock, STACFIS **recommended** that *catches of cod in Div. 3NO in 1994 should not exceed 6 000 tons.*

Redfish in Subarea 1

Prognosis (page 67)

STACFIS acknowledged the importance of ongoing studies and **recommended** that *studies on distribution and abundance of 0-group redfish in Subarea 1 be continued.*

Redfish in Division 3M

Research Survey Data (page 69)

STACFIS **recommended** that *results of acoustic estimates of biomass in the 4-meter bottom layer as well as length and species composition of catches from midwater trawl conducted to verify acoustic signals during the USSR/Russia surveys should be presented in 1994.*

Prognosis (page 70)

STACFIS **recommended** that *the catch of redfish in Div. 3M in 1994 be maintained at a level conducive to a more stable fishery.* STACFIS notes that the catch advised for 1993, i.e. 20 000 tons is in a range of catch levels when stable conditions have been observed, and, in absence of a firm basis for making catch projections **recommended** that *the TAC for redfish in Div. 3M be 20 000 tons for 1994.*

Redfish in Divisions 3L and 3N

Research Survey Data (page 72)

STACFIS reiterates these requirements and **recommended** that (1) *details be provided to clarify how acoustic signals are separated between redfish and other species, and, that more detailed information be presented describing the vertical distribution as determined from the trawl-acoustic surveys,* and that (2) *further examination be conducted of the trawl-acoustic survey data to provide more detail on the location of concentrations of fish both near the bottom and in the water column in Div. 3LNO.*

Prognosis (page 73)

No improvement can be expected as long as catches exceed the current TAC. STACFIS therefore **recommended** that *for redfish in Div. 3LN catches be reduced and the total catch not exceed 14 000 tons.*

Future Studies (page 73)

STACFIS also noted there was no information available to address an outstanding recommendation regarding the integrity of Div. 3LN as a separate management unit from adjacent Divisions and, accordingly, **recommended** that *existing data be examined to evaluate the current separation of Div. 3LN and Div. 3O in relation to adjacent Divisions for the purpose of determining whether these management units are appropriate.*

American Plaice in Divisions 3L, 3N and 3O

Commercial Fishery Data (page 79)

To examine the reasons for these patterns in the CPUE, STACFIS **recommended** that *area fished by the commercial fleet be incorporated in future analyses of catch rates.*

Catch Projections and Prognosis (page 88)

Given the extremely low population size in 1992, concerns about the SSB, and the expectation of very poor recruitment, STACFIS concluded that a cautious approach was warranted and **recommended** that *the American plaice catch in Div. 3LNO in 1994 should be kept at the lowest possible level, and should not exceed a maximum of 4 800 tons.*

Greenland Halibut in Subarea 2 and Divisions 3K and 3L

Biological studies (page 103)

It indicated that while there were mature fish in the sample they constituted less than 15% of the catch. It was agreed that such data are critical to improving our understanding of this important resource and STACFIS **recommended** that *collection of biological samples from deepwater gillnet fishery be encouraged.*

Greenland Halibut in Subareas 0, 1, 2 and 3

Responses to Requests by Canada and Denmark (Greenland) (page 104)

Until such time as when STACFIS can advise on a single TAC, STACFIS **recommended** the *suballocation of a possible total TAC by geographical areas. This was because the fishing fleets which exploit Greenland halibut offshore are highly mobile and STACFIS was concerned that this effort could be concentrated on a single component of the Greenland halibut stock in Subareas 0 to 3.*

Research Recommendations (page 105)

STACFIS therefore **recommended** that *a single joint deep water trawl survey for Greenland halibut be conducted throughout Subareas 0-3 preferably in August-September 1994. Participants in such a survey could be Canada, EEC, Greenland, Japan and Russia.*

STACFIS further **recommended** that *the status of the inshore component of Greenland halibut be reviewed at the June 1994 STACFIS meeting, particularly whether these Greenland halibut contribute to the spawning stock in Davis Strait.*

STACFIS also **recommended** that *ongoing research programs in different laboratories be described in detail for the Scientific Council meeting in September 1993 and that the Scientific Council discuss research coordination at that meeting.*

Roundnose Grenadier in Subareas 2 and 3

Prognosis (page 109)

STACFIS therefore **recommended** that *the TAC for roundnose grenadier for 1994 be set at a new precautionary level of 3 000 tons, which is half the catch level for the period of catch rate stability.*

Capelin in Divisions 3N and 3O

Prognosis (page 111)

STACFIS **recommended** that *this stock be given maximum protection and advises that no capelin fishing be allowed in Div. 3NO during 1994.*

REPORT OF THE SUBCOMMITTEE ON ENVIRONMENTAL RESEARCH

Other Matters (page 130)

It was **recommended** that *information on the deep waters off the shelf should be provided in the overviews, given that in recent years several species appear to have been moving into deeper waters.* It was also **recommended**

that *the representativeness of Station 27 to hydrographic changes on the various banks and the offshore regions be examined, not only for the long period changes, years to decades, but also shorter term fluctuations, e.g. months.*

STACREC

Fishery Statistics

Deadlines for Submission of STATLANT 21A and 21B Data (page 132)

Recognizing the support from the General Council, STACREC **recommended** that *the Scientific Council include the new Rule 4.3 as proposed by STACREC in June 1992 in the Scientific Council Rules of Procedure, to place a legal requirement for Contracting Parties to observe the deadlines for submission of STATLANT data* (N.B. the Scientific Council renumbered this as Rule 4.4).

Taking into account the EEC-EUROSTAT representative's comments about the difficulties in meeting the originally proposed deadlines as far as Community's national statistical services were concerned, STACREC **recommended** that *the new Rule 4.3*(renumbered to Rule 4.4. by Scientific Council) *be: for the purpose of Article VII and VIII, the appropriate preliminary monthly catch and effort information should be furnished to the Scientific Council in advance of meetings. With respect of STATLANT 21A and 21B, they should be submitted not later than on 30 May and 31 August, respectively.*

Preparation for the CWP 16th Session: Review of the Logbooks and STATLANT 21B Forms (pages 132 and 133)

STACREC **recommended** that *the Assistant Executive Secretary address issues discussed at this STACREC Meeting, particularly the questions of ICES and NAFO STATLANT forms.*

It was agreed that this would be very useful and therefore it was **recommended** that *the Scientific Council approach STACTIC about the possibility of requiring logbooks to include tow-by-tow fishing data.*

Non-traditional Fisheries Resources in the NAFO Area

Current Development of the Fisheries (page 141)

Concern was expressed about the levels of finfish by-catch that might result from the use of small-meshed trawls in this area and it was **recommended** that *the activities of vessels engaged in this developing shrimp fishery on the Flemish Cap be closely monitored.*

Available Data and Research Priorities (page 142)

It was **recommended** that *the Scientific Council bring the matter of misallocation of roundnose and roughhead grenadier and flatfish species to the attention of the Fisheries Commission and request that care be taken to ensure proper identification of species being caught.*

Proposals for Scientific Tasks of Observers in the Pilot Observer Program (page 142)

STACREC agreed that having biological data collected during the Pilot Observer Program was a good idea and **recommended** that *the Scientific Council bring forward for the information of and consideration by the Fisheries Commission that observers in the Pilot Observer Program should collect data on set location (latitude and longitude), depth fished, time net on bottom (or fishing), directed species, by-catches, discards, and catches and effort. Length sampling of the main species in each set should also be set out.*

PART B

Scientific Council Annual Meeting - 7-10 September 1993.

STACFIS

STOCK ASSESSMENTS

Shrimp in Division 3M

Assessment Results and Prognosis (page 168)

The by-catch of small redfish was considered as a potential for significantly impacting the redfish resource in this area. STACFIS **recommended** that, *effective immediately, sorting grates be mandatory in shrimp fishing operations on Flemish Cap as a means of minimizing the by-catch of redfish and other fish species*

Research Recommendations (page 168)

Therefore, with respect to Shrimp in Div. 3M, STACFIS **recommended** that:

- *all countries participating in this new fishery provide levels of sampling for shrimp and important by-catch species as recommended by NAFO Conservation and Enforcement Measures;*

- *the EEC groundfish surveys, during summer on Flemish Cap which have provided a valuable time-series of data on shrimp, continue to include the detailed sampling of shrimp and the analysis of the data as in the past years;*

- *that since more data on the food and feeding of cod exist, they be analyzed to obtain additional and historic information on shrimp distribution and abundance in the area.*

Data Availability for Assessment of Northern Shrimp in November 1993 (page 168)

STACFIS **recommended** that *a mid-term meeting be held for Northern shrimp in Subareas 0 and 1 and Denmark Strait at NAFO Headquarters.*

REVIEW OF CURRENT ARRANGEMENTS FOR CONDUCTING STOCK ASSESSMENTS AND DOCUMENTATION

Review of Working Papers to be Prepared by Designated Experts on Their Workload (page 170)

To improve the transfer of data and information between scientists and the NAFO Secretariat, STACFIS **recommended** that *the Secretariat acquire access to a computerized e-mail system. This is considered to have several benefits to improve communications and reduce the costs.*

STACREC

Other Matters (page 181)

The 16th Session of CWP is scheduled for July 1994 in Madrid, Spain. STACREC **recommended** that *the Scientific Council should be represented at the 16th Session of CWP by the Chairman of STACREC, the Assistant Executive Secretary, as well as a national representative from Spain.*

PART C

Scientific Council Meeting - 19-23 November 1993

STACFIS

STOCK ASSESSMENTS

Shrimp in Subareas 0 and 1

Prognosis (page 195)

STACFIS, therefore, **recommended** that *the entire shrimp stock in Div. 0A, and Subarea 1 both north and south of 71°N, and inshore in Div. 1A in the future be assessed as one single population.*