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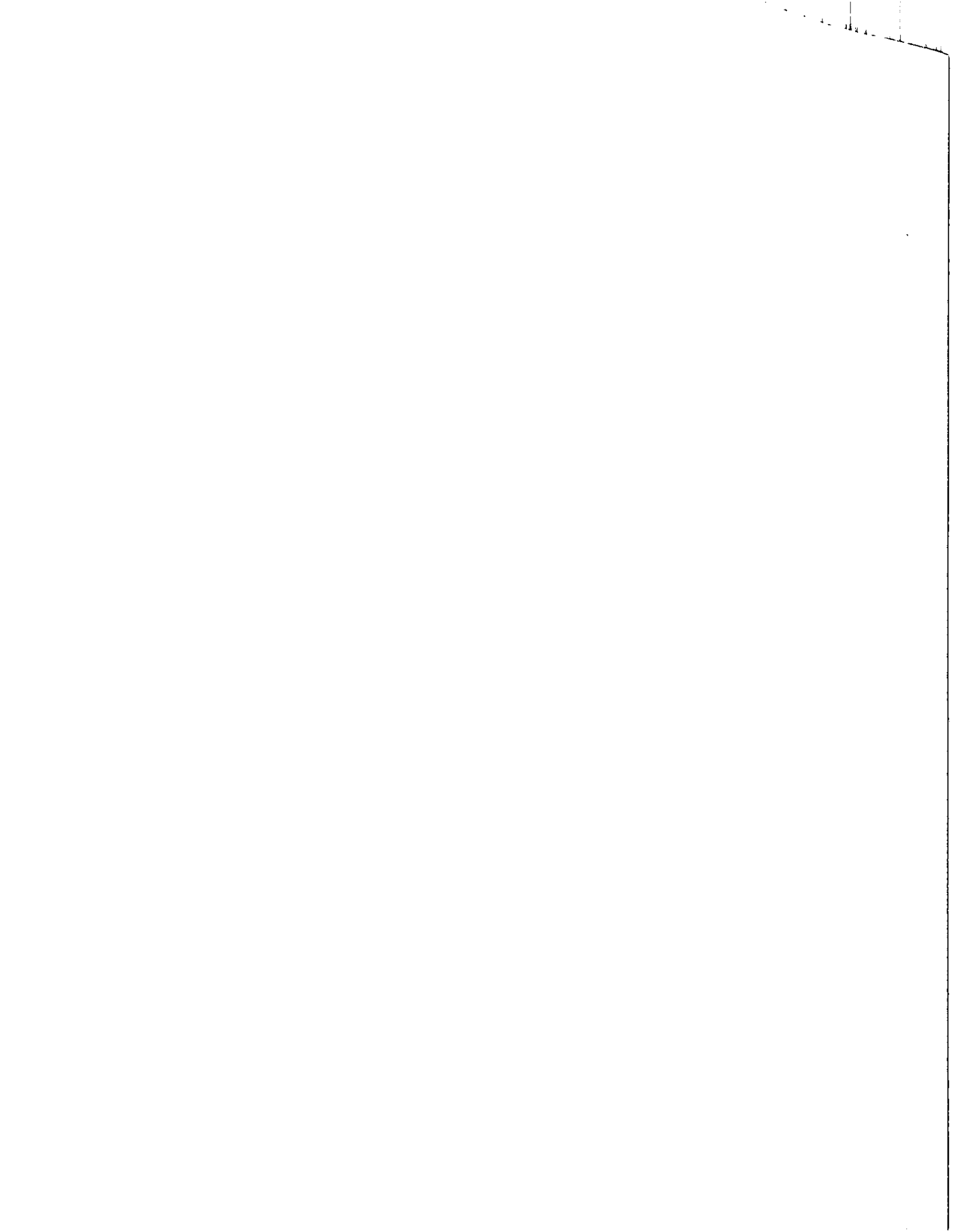
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SCIENTIFIC COUNCIL MEETING - MARCH 1992

Report of Scientific Council, March 1992 Meeting

CONTENTS

	<u>Page</u>
I. Plenary Sessions	3
II. Fisheries Science (see STACFIS report, App. I)	3
1. Stock Assessments	3
2. Other Matters	3
a) Preparation for Special Session 1992	3
b) Consideration of a Special Session in 1993	3
c) Review of Data Availability for Designated Experts for June 1992 Stock Assessments	3
• Summary Sheet - Capelin in Division 3L	4
• Summary Sheet - Capelin in Divisions 3NO	5
III. Publications (STACPUB)	6
1. Progress Review: Journal Issue of 1989 Special Session	6
IV. Adoption of Reports	6
V. Adjournment	6
Appendix I. Report of Standing Committee on Fishery Science (STACFIS) ..	7
I. Stock Assessments	7
1. Capelin in Division 3L	7
2. Capelin in Divisions 3N and 3O	15
II. Other Matters	16
1. Preparations for the Special Session in 1992	16
2. Consideration of a Special Session in 1993	16
3. Review of Data Availability for Designated Experts for June 1992 Stock Assessments	16
4. Acknowledgements	16
Appendix II. Agenda for Scientific Council Meeting - March 1992	17
Annex 1. Relevant Recommendations in 1991	18
Appendix III. List of Research and Summary Documents, 1992	21
Appendix IV. List of Participants	23



REPORT OF SCIENTIFIC COUNCIL

I. PLENARY SESSIONS

Chairman: H. Lassen

Rapporteur: T. Amaratunga

The Scientific Council met at the Northwest Atlantic Fisheries Centre, St. John's, Newfoundland, Canada, during 3-6 March 1992 upon the need identified at the September 1991 meeting to review the status of capelin stocks in Divisions 3L and 3NO. Participants from Canada and Denmark (Greenland) and the Assistant Executive Secretary were in attendance.

In the absence of the Chairman of the Scientific Council, V. P. Serebryakov, the Vice-Chairman, H. Lassen acted in his place. The meeting was called to order at 1005 hr on 3 March 1992.

The Council adopted the Agenda and appointed the Assistant Executive Secretary as rapporteur.

Sessions were concluded on 6 March 1992 at 0950 hr.

The adopted Report of the Standing Committee on Fisheries Science (STACFIS) is given in Appendix I.

The Agenda, List of Research Documents and List of Participants are given in Appendix II, III and IV, respectively.

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

1. Stock Assessments

The Council noted that STACFIS had reviewed the status of capelin stocks in Divisions 3L and 3NO. The summaries of the assessments are given below.

2. Other Mattersa) Preparation for Special Session 1992

The Council noted that preparations for this workshop were well under way and a three day meeting will be held 8-10 September 1992 at NAFO Headquarters, Dartmouth, Nova Scotia, Canada, with R. Mohn and R. Cook as co-conveners. A workbook will be issued at the Scientific Council Meeting in June 1992.

b) Consideration of a Special Session in 1993

The Council recognized the value in maintaining continuity in the Special Session series and agreed with the STACFIS decision that further consideration of possible symposium topics should take place. The Scientific Council endorsed the STACFIS recommendation on this matter and agreed to review the progress at the June 1992 meeting.

c) Review of Data Availability for Designated Experts for June 1992 Stock Assessments

The Scientific Council emphasized the importance of timely submission of data to the Designated Experts and concurred with STACFIS that the Secretariat should send reminders to the various Contracting Parties.

SUMMARY SHEET - Capelin in Division 3L

Source of Information:

Year	1984	1985	1986	1987	1988	1989	1990	1991
Recommended TAC	38	60	130	283	90	335	350	- ¹
Agreed TAC	26	26	55	25	45	46	56	56
Reported catches	33	25	48	19	53	52 ²	47 ²	21 ²
Non-reported catches								
Total landings	33	25	48	19	53	52 ²	48 ²	
Sp. stock biomass	382	596	1300	2830	900	3345	3500	1900 ³
Recruitment ⁴ (age 2)	73.2	73.2	63.7	87.8	380.4	31.48	353.2	
Mean F	No information available							

¹ STACFIS concluded that a catch of 50 000 tons as in recent years would be well below a 10% exploitation rate. Weights in '000 tons

² Provisional.

³ Up to 1990, these are projected. The 1991 estimate is back-calculated.

⁴ Recruitment at age 2 in the year shown. Recruitment 1982-85 were projections from acoustic surveys. From 1986 to present, measured directly from acoustic surveys.

Catches: All catches are inshore and determined by market. The dominant market is the Japanese roe market.

Data and Assessment: Projections from acoustic survey estimates of recruiting year-classes.

Fishing Mortality: Not estimated but very low. Recommended TAC based on exploitation rate of 10%. Catches were much lower than the recommended TAC in recent years.

Recruitment: Estimated from acoustic surveys. 1989 year-class at age 2 from acoustic surveys, 1988 year-class in 1991 estimated from a significant relationship between inshore trap catch rates and mature biomass from same year acoustic survey.

State of Stock: High during late-1980s but now declining.

Forecast for 1992: 1992 biomass projected to be about one-third of 1989 and 1990 levels.

Option Basis	Predicted catch (1992)	Predicted SSB (1.1.1993)
F _{0.1} =		
F ₉₀ =	No information available	
F _{max} =		

Recommendations: A catch of 50 000 tons, as in recent years, would not exceed 10% exploitation rate.

Special Comments: Based on recent analyses, the goal of providing a TAC of 10% of the projected mature biomass has been met reasonably well. The actual TACs and landings have been well below the advised TAC. STACFIS concluded that fishing has not contributed to the present decline in the capelin stock.

SUMMARY SHEET - Capelin in Divisions 3N and 3O

Source of Information:

Year	1984	1985	1986	1987	1988	1989	1990	1991
Recommended TAC	0	0	0	10	10	28	30	30
Agreed TAC	0	0	0	10	15	28	30	30
Reported catches	0	0	0	1	7	5 ¹	21 ¹	
Non-reported catches								
<u>Total landings</u>	0		0	1	7	5 ¹	21 ¹	
Sp. stock biomass ²	88	212	527	273	560	28	-	
Recruitment (age)	No information available							
Mean F								

¹ Provisional.

Weights in '000 tons

² 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.

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

Data and Assessment: Acoustic surveys of the spawning stock through 1981-89. No estimates available for 1990 spawning biomass.

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

Recruitment: No estimates but assumed to follow same trends as adjacent stocks.

State of Stock: Mean stock size 1981-89 was about 303 000 tons. USSR acoustic surveys during 1975-77 indicated mean biomass of 912 000 tons.

Forecast for 1992: Stock will probably decline.

Option Basis	Predicted catch (1992)	Predicted SSB (1.1.1993)
F _{0.1} =		
F ₉₀ =	No information available	
F _{max} =		

Recommendations: No basis to change advice.

Special Comments: Based on expected decline, a catch of 30 000 tons may exceed 10% of mature biomass.

III. PUBLICATIONS (STACPUB)

1. Progress Review: Journal Issue of 1989 Special Session

The three members of STACPUB present at this meeting met briefly on 6 March. STACPUB noted that while the review of some papers presented at the Special Session in September 1989 were still pending, several papers for this issue of the Journal were already in galley proofs. It was agreed that whatever papers are ready for print should be published before the end of 1992. Further, the editor should be approached for a discussion on how to conclude the reviews of the remaining papers. It was agreed that this topic should be further discussed and finalized at the June 1992 Meeting.

IV. ADOPTION OF REPORTS

The Scientific Council adopted the STACFIS report and adopted the report of this meeting.

V. ADJOURNMENT

There being no further business, the Chairman thanked all of the participants for their contributions. Gratitude was also expressed to the Secretariat for their assistance throughout the meeting.

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

Chairman: D.B. Atkinson

Rapporteur: Various

The Committee met at the Northwest Atlantic Fisheries Centre, St. John's, Newfoundland, Canada, during 3-6 March 1992 to consider and report on matters pertaining to capelin in Div. 3L and Div. 3NO referred to it by the Scientific Council. Discussions pertaining to Div. 3L capelin had been deferred from the June and September 1991 Meetings. In view of the uncertainty about the status of the capelin stock in Div. 3L, and noting that both Canada and USSR will be conducting surveys in Div. 2J and 3KL in late 1991, the Council had recommended that a Scientific Council Meeting be held to examine additional data in late February or early March 1992. In light of detailed discussions of Div. 3L capelin, the Committee reviewed advice from June 1991 pertaining to Div. 3NO capelin. The Agenda is listed in Appendix II. Participants were from Canada and Denmark (Greenland). The Assistant Executive Secretary was in attendance.

I. STOCK ASSESSMENTS

1. Capelin in Division 3L (SCR Doc. 91/125, 92/1, 2, 3, 4, 5, 6, 7, 8)a) Introduction

Nominal catches of capelin in Division 3L were less than 4 000 tons between 1970 and 1973, then increased to 58 000 tons in 1974 and declined to 12 000 tons in 1979. No offshore fishing has occurred since 1978. Provisional statistics for 1991 indicated a total catch of 21 000 tons in the inshore fishery by purse seines, traps and beach seines during July and August. The 1991 fishery occurred approximately one month later than normal due to the late appearance of capelin near spawning beaches. While catches in all bays of Div. 3L were lower than the 1988-90 catches and the 1991 TAC, catches were extremely low (<100 tons) in the southern areas (Southern Shore and St. Mary's Bay). In recent years, the final TAC has been based on the market forecast for roe capelin. Recent TACs and catches ('000 tons) are as follows:

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Advised TAC	30	- ¹	60	38	60	130	283	90	335	350	- ²
TAC	30	30	30	26	26	55	25	45	46	56	56
Nominal landings	24	27	25	33	25	48	19	53	52 ³	48 ³	21 ³

¹ No STACFIS advice.

² STACFIS concluded that a catch of 50 000 tons as in recent years would be well below a 10% exploitation rate.

³ Provisional data.

b) Input Datai) Commercial fishery data

A logbook survey of the inshore capelin fishery in Div. 3L, designed to provide estimates of catch-per-unit-effort, was initiated in 1981. Trapnets and purse seines (where catches were derived from the addition of the quantities of discards from logbooks) show a decrease from 1990.

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Trapnets (tons/day)	2.9	3.1	3.4	2.9	4.6	4.6	8.8	6.2	6.7	8.6	7.3
Purse seines (tons/day)	9.4	16.4	18.8	14.3	16.4	19.0	18.1	20.7	24.3	21.4	16.2

The 1991 trap catch rate was above the 1981-90 average of 5.2 tons/day while the 1991 purse seine catch rate was below the 1981-90 average 17.9 tons/day. STACFIS recommended that means of daily catch rates and associated variances of the inshore capelin fishery in Div. 3L be calculated for future assessments.

Discarding rates in 1991 were 53% of landings for purse seines and 104% of landings for traps, both of which were higher than the 38% and 32% respectively reported for the 1990 fishery. This increase was due to the fact that capelin did not meet market requirements (size of capelin, redfeed and proportion of females).

Preliminary age composition data for the commercial fishery indicated that the 1988 (49%) and 1987 (31%) year-classes predominated in the catches.

ii) Research survey data

Aerial surveys. Aerial surveys of capelin in Trinity and Conception Bays were conducted in June and July during 1982-91. During 1990 and 1991, the photographic method of recording, measuring, and counting capelin schools was replaced by an imaging spectrometer, the Compact Airborne Spectrographic Imager (CASI). The latter technique provided more efficient data acquisition and analysis and a comparison of the two techniques indicated a significant correlation between the school area measurements. Total surface area of schools provided an index of abundance. The 1990 survey coverage was generally good except for one transect. The resulting estimate was about 60% of the 1989 estimate and about half the highest (1987). The 1991 survey recorded very few schools due to the late arrival of capelin inshore. Although the survey was extended into July the CASI portion of the survey ended (due to unavailability of equipment) several days before capelin schools were observed in the Bays and before spawning took place. Visual observations during overflights after the CASI survey indicated that more schools were arriving in the survey area. Consequently, STACFIS concluded that the 1991 estimate is not representative of stock status.

The aerial survey index 1982-90 is significantly correlated with the trap catch rate series and the projections of mature biomass from previous assessments.

Acoustic surveys. A USSR acoustic survey was conducted in Div. 3LNO during 6 June and 6 July 1991. This survey was approximately one month later than previous surveys because of heavy ice conditions over the northern Grand Bank and because few capelin had been observed during a May trawl survey over

ice-free areas. The biomass estimated from this survey was 36 000 tons in Div. 3L and 82 000 tons in Div. 3O for a total of 118 000 tons. The 1989 year-class predominated in Div. 3L and northern Div. 3O followed by the 1988 year-class. Prespawning fish of the 1988 year-class predominated (48%) in southern Div. 3O while the 1989 and 1987 year-classes were next in abundance.

Another USSR acoustic survey was conducted during 15-30 November 1991 concurrent with the 0-group survey. The biomass was estimated to be 11 000 tons with the 1990 year-class accounting for 94% of numbers.

Two acoustic surveys conducted by Canada in Div. 3L during May and late June-mid July 1991 were previously reported (NAFO Sci. Coun. Rep., 1991, p. 130). The biomass estimate from the May survey was 116 000 tons and from the later survey, 147 000 tons. Two strata in Div. 3L were surveyed by Canada during 21-28 October 1991 as an extension of a Div. 2J+3K survey. The original design of the Div. 2J+3K survey was altered during the survey based on an observer's report of large quantities of capelin in Div. 3L at the same time as no capelin had been detected in Div. 2J. The biomass estimate was 11 400 tons with the 1990 year-class accounting for 94% of the estimate by numbers.

Bottom-trawl surveys - Autumn. The distribution of incidental capelin catches in the annual bottom-trawl surveys conducted by Canada during November and December 1977-91 was examined. In Div. 2J+3K in 1991, capelin were recorded at 39% of the fishing stations. This was the third highest frequency of occurrence in the period 1981-91. However, the 1991 survey was not directly comparable to surveys in earlier years because the number of stations assigned to each stratum was not roughly proportional to stratum area as it had been in the past. Catches were moderately large. Very few capelin were caught on Hamilton Bank and toward the coast off southern Labrador and northeastern Newfoundland. Largest catches were obtained in the region of western Belle Isle Bank and Funk Island Deep, and on northern and western Funk Island Bank. The distribution in 1991 was similar to that observed in 1987 and 1990, with perhaps an even greater tendency toward a southeasterly distribution. Most of the large catches on Funk Island Bank occurred in those strata omitted from the Canadian acoustic survey.

In Div. 3L, capelin were recorded in 21% of the stations. This was similar to the frequency of occurrence in 1990, and approximately half the frequency recorded in 1988 and 1989. Capelin occurred primarily north of 48°N, with a few small catches along the northeast slope of Grand Bank, near the shelf edge in southeastern Div. 3L, and in the southern Avalon Channel. There were no catches on the plateau of Grand Bank.

Bottom-trawl surveys were also conducted in Div. 2GH in November 1991 and in Div. 3NO in October-November 1991. Only one capelin was caught in Div. 2GH. A few small catches of capelin were recorded in northwestern Div. 3O and near the shelf edge in northeastern Div. 3N. There was no evidence from these surveys that large quantities of capelin were distributed either north or south of the Canadian acoustic survey.

Sounder paper records from groundfish trawl surveys conducted during October, November and December 1991 in Div. 2J+3KLNO were visually examined for evidence of any large concentrations of pelagic fish. These sounder records were collected while the vessels were steaming between sets and during sets. Although the quality of the records was generally poor and in some cases, the entire water column could not be examined, there was no evidence of large concentrations of pelagic species.

Bottom-trawl surveys and predator stomach contents - Spring.

The distribution of capelin in Div. 3LNO was inferred from the by-catch of capelin in Canadian bottom-trawl surveys and the occurrence of capelin in stomachs of cod caught during these surveys. In many years, such as 1987, capelin were found in eastern, northern and western Div. 3L, northwestern Div. 3O and toward the shelf break in both Div. 3O and Div. 3N. Only rarely were large catches obtained on the plateau of Grand Bank in Div. 3O, Div. 3N and southern Div. 3L. In 1991, capelin were caught at many stations in eastern and northern Div. 3L and at numerous stations near the shelf break in southern Div. 3NO. A notable difference from earlier years was the absence of large capelin catches in southwestern Div. 3L.

Examination of stomachs of cod caught during the bottom-trawl surveys in 1987 and other years prior to 1991 revealed a geographic pattern of predation on capelin which was similar to the pattern shown by the capelin catches. In 1991, poor cod catches resulted in the absence of stomach content data from most stations in western and southern Div. 3L, many stations in Div. 3O, and most stations in Div. 3N. Large quantities of capelin were found in cod stomachs from northeastern Div. 3L, where large quantities were found in most previous years. There was little or no capelin found at the few stations for which stomach samples were available in southwestern Div. 3L.

Examination of stomachs of predators (cod, Greenland halibut, American plaice) caught during a USSR bottom-trawl survey in Div. 3LNO in April-May 1991 revealed the presence of capelin in northeastern and eastern Div. 3L and along the shelf edge in Div. 3N. Capelin were recorded in predator stomachs in a few stations in central and western Div. 3L. The majority of capelin found in predator stomachs were 13-16 cm in length.

The general impression from bottom-trawl catches and examination of predator stomachs is that in May 1991 capelin were broadly distributed in northeastern and eastern Div. 3L, but that there had not been a migration of large quantities of capelin into southwestern Div. 3L.

iii) Environmental data

The environmental conditions on the Newfoundland and Labrador continental shelves were anomalous during 1991 and continued a general cooling trend initiated during the late-1980s. Below normal early winter air temperatures during 1990-91 increased ice growth and retarded ice melt of the advancing pack ice. Stronger northwesterly winds increased ice flux from higher latitudes, while less frequent offshore winds kept the ice floes over the shelf, reducing the ice melt. In

response to major storms with onshore winds in the spring, severe rafting occurred, increasing the ice volume over the shelf. Below normal spring/summer air temperatures reduced ice melt during ice retreat. The net result was the worst ice year in 30 years both in terms of ice cover and duration.

The surface warming in 1991 was 4 to 6 weeks later than normal and even when the maximum temperature was reached at the normal time, August, the peak values were more than 1°C below average. In comparison, even though a similar delay in surface warming occurred in 1984, another cold year, the near-surface peak temperature was about 3°C higher than in 1991. The surface cooling in the fall 1991 was not significantly different from normal.

Above zero temperatures, normally occurring in early May at 30 m, did not occur until the end of August. In contrast, even in 1984, temperatures reached above zero values by the end of May. The thickness of the warm surface layer was the lowest in 1991, about 30 m in August 1991 compared to over 60 m in other years. The bottom temperatures in 1991 were below normal and the areal extent of subzero temperatures at the bottom was the largest during 1991.

The 1991 July cold intermediate layer area was one of the largest since 1948, comparable to 1984 in total area. The subzero water mass extended further south in 1991 compared to other years.

iv) Biological data

Since 1987, capelin egg deposition has been estimated from the mid-tide zone of 15 capelin spawning beaches in Conception Bay. The estimates of egg deposition represent an index rather than total abundance because this study concentrates only on eggs released during peak spawning periods, eggs in the high-tide and low-tide areas are not enumerated and spawning may occur in subtidal areas, as occurred in 1991. Spawning was delayed up to 30 days in 1991 compared to 1987-90. The 1991 estimate for geometric mean egg concentration was about the same as 1987 and 1990, about one half the 1988 estimate and about 50% higher than the 1989 estimate.

A long-term (since 1977) monitoring of seabird diets during August indicated a shift in diet of gannets on Funk Island during 1990 and 1991 from mackerel and Atlantic saury to capelin. This shift was associated with unusually cold summer sea surface temperatures. During these cold conditions, mackerel and Atlantic saury which had been important components in the diet declined. These fish are seasonal migrants from southern waters. The maturity of capelin was delayed and they migrated into the nearshore regions later than usual. Murres feed almost exclusively on capelin during August. During 1990, 4% of females in murre diets were gravid whereas in 1991, 48% were gravid. This was indicative of the late maturity of capelin during 1991. The median egg laying date for murres was delayed in 1990 and 1991, and in 1991 was the latest in 16 years. The changes in behaviour for both seabird species could be linked to the cold water temperatures which were apparent in 1990 and intensified in 1991.

c) Estimation of Parameters

STACFIS examined several historical relationships in order to evaluate the data from the most recent years. Catch-rate-at-age values from inshore gears showed the same trends in relative year-class strengths for traps and purse seines in both Div. 3L and Div. 3K. The 1983 and 1986 year-classes were the highest (1978-87 year-classes) while the 1987 year-class was third highest. These year-classes have contributed to relatively high biomasses during the mid- to late-1980s in contrast to the early-1980s when year-classes were weaker and biomasses lower. The same trends in year-class abundance (1981-87 year-classes) was also evident in the estimates of abundance of age 2 capelin from acoustic series in Div. 3L and Div. 2J+3K.

There was a statistically significant relationship (Fig. 1) between the inshore catch rate of traps in Div. 3L and the mature biomass projected during previous STACFIS assessments using acoustic data from spring surveys in Div. 3L (1983-91). The mature biomass projected for 1991 was highest in the series while the 1991 trap catch rate was the third highest.

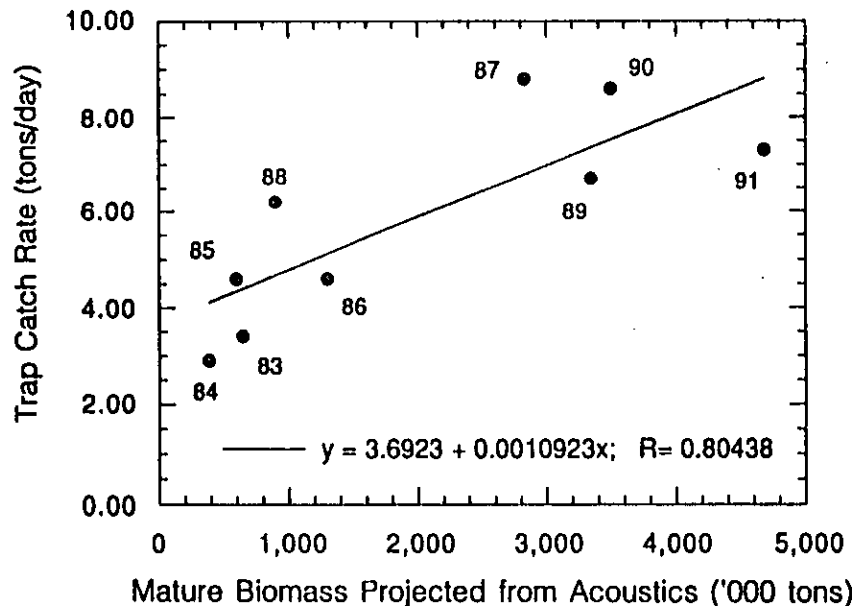


Fig. 1. Capelin in Div. 3L: relationship between mature biomass and trap catch rates. Mature biomass was derived using acoustic survey estimates of year-class abundance from the preceding year and projection parameters as in past STACFIS assessments.

The relationship (Fig. 2) between mature biomass estimated from Div. 3L Canadian surveys and the trap catch rate in Div. 3L in the same year was also statistically significant (1982-91). The 1991 trap catch value was higher than would have been expected from the 1991 survey results.

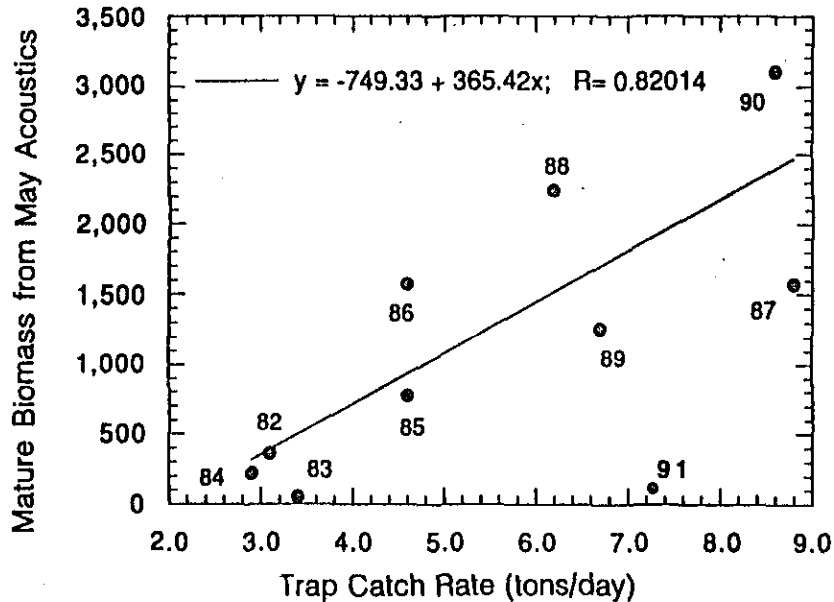


Fig. 2. Capelin in Div. 3L: relationship between trap catch rate and mature biomass. Mature biomass was estimated from Canadian acoustic surveys in the same year as the trap catch rates were observed.

STACFIS recommended that the relationships between acoustic survey estimates of mature biomass and inshore catch rates continue to be investigated with more emphasis placed on the identification of the statistical properties.

In an analysis of acoustic data from the Canadian Div. 3L survey series (1982-91), estimates of survival for immature and mature capelin were calculated. The estimate of survival for immatures was substantially lower than that currently used. The survival estimate for mature capelin was constant over all ages and higher than those currently used. STACFIS noted that the differences would potentially result in very different stock perspectives and requested further analysis. Specifically STACFIS recommended that the new estimates of survival of immature and mature capelin be used in a time-series of projections and compared to the inshore catch-rate series. In addition, the survival of mature fish could also be compared to survival rates derived from inshore catch data.

Using the same acoustic data, the performance of the existing management procedure was assessed by Monte Carlo simulation. The results indicated that it is highly unlikely that the recommended TAC in any year exceeded 20%. STACFIS noted that this study was initiated in part to address a Fisheries Commission request in 1991 to Scientific Council concerning the validity of STACFIS recommendation of a 10% exploitation rate for capelin.

d) Assessment Results

STACFIS noted that several acoustic biomass surveys in both SA 2+ Div. 3K and Div. 3L had exhibited declines in capelin abundance during late-1990 and throughout 1991. These surveys have been the basis for the assessment and projections throughout the 1980s.

The inshore trap catch rates and egg deposition rates during 1991 were within the range of values observed in previous years. These observations indicated that the overall inshore abundance of mature capelin during 1991 did not decline substantially. This is in contrast to expectations based on the relationship between mature biomass measured during the offshore survey and trap catch rate several weeks later (Fig. 2). The trap catch rate would have been predicted to be less than one-half what was recorded.

STACFIS concluded that an explanation for the discrepancy, was that the 1991 offshore acoustic survey results for the 1988 and 1987 year-classes may not represent stock status.

Although no analyses were available to explain the survey results, STACFIS noted that the discrepancies were probably linked to the anomalous hydrographic conditions throughout the Northwest Atlantic during late-1990 and 1991. The capelin biological cycle apparently was disrupted in many instances; examples were the reduced capelin beach spawning in southern areas, the late spawning of capelin in other areas and the change in seabird diets and median egg laying times during cold years. In all cases, the unusually heavy ice cover and cold water conditions were probably contributing factors.

e) Prognosis

The major contributions to the mature population in Div. 3L during 1992 will be the 1988 and 1989 year-classes. STACFIS performed two projections, one which is comparable to past projections (Projection 1) and one which accounts for the conclusion that the 1987 and 1988 year-classes may have been underestimated during the offshore survey (Projection 2).

Projection 1: Spawning mortality and proportion mature were the same as used in previous assessments (Table 1). The weight-at-age vector used in this projection was derived from inshore sampling data for 1982-89. Unlike past projections, 1991 catches were removed during the projection. As in recent assessments, estimates of year-class strengths for immature and mature capelin were derived from the May 1991 Canadian survey.

Table 1. Capelin in Div. 3L: parameters used in the projections of stock size (former mean weights-at-age in parentheses).

Age (yr)	Spawning mortality	Proportion mature ¹	Proportion mature ²	Mean wt (g)
3	1.39	0.47	0.63	28.3 (21.2)
4	1.69	0.87	0.97	36.0 (28.4)
5	2.23	0.93	0.99	34.3 (31.1)

¹ Used to calculate mature biomass in 1992. Same procedure as in previous assessments.

² Means from survey data 1982-89. Used only in Projection 2 to estimate total numbers-at-age from mature numbers-at-age in 1991.

The results of the projections, using the estimates of year-class strength and parameters as outlined above, together with $M = 0.30$ and a spawning date of 1 June are given in Table 2.

Table 2. Capelin in Div. 3L: projections of stock size in 1992 from Projection 1.

Age (yr)	Number of fish (millions)		
	June 1991		June 1992
	Mature	Immature	
2	383	7 269	.
3	2 874	344	5 562
4	471	0	674
5	.	.	26
Biomass (tons) of mature fish 96 000			

Projection 2: Spawning mortality, proportion mature used to calculate mature biomass in 1992 and the new weight-at-age vector were the same as used in Projection 1 (Table 1). The estimates of mature and immature capelin of the 1989 year-class were from the May 1991 Canadian acoustic survey. The 1988 and 1987 year-classes were estimated from the relationship (1982-90) between mature biomass from the offshore acoustic survey and inshore trap catch rate (Fig. 2). The mature biomass was converted to age-group estimates using inshore sampling data and estimates of proportions mature from 1982-89 survey means (Table 1). The results of this projection using these parameters together with $M = 0.30$ and a spawning date of 1 June are given in Table 3.

Table 3. Capelin in Div. 3L: projections of stock size in 1992 from Projection 2.

Age (yr)	Number of fish (millions)		
	June 1991		June 1992
	Mature	Immature	
2	383	7 269	.
3	41 205	24 187	5 562
4	26 559	823	25 438
5	.	.	4 201
Biomass (tons) of mature fish 1 005 000			

STACFIS notes that both projections indicate a decline in capelin biomass for 1992. However, based on the previous discussion, STACFIS concluded that the second projection more reasonably reflects the likely spawning stock status in 1992 relative to previous years. The actual TAC is set on market considerations and in most recent years (1988-91) has been around 50 000 tons. STACFIS concluded that this level of catch in 1992 would probably not exceed a 10% exploitation rate.

f) Other Considerations

STACFIS noted that the projected biomass in 1992 represents a decline to about one-third of 1989 and 1990 levels.

Based on the analysis considered at this meeting, the goal of providing a TAC of 10% of the projected mature biomass has been met reasonably well. In fact, the actual TACs and landings have been well below the recommended TAC. Consequently, STACFIS concluded that fishing has not contributed to the present decline in the capelin stock, a conclusion which confirms a similar observation made during the 1991 September assessment meeting (NAFO Sci. Coun. Rep., 1991, p. 130).

2. Capelin in Divisions 3N and 3Oa) Introduction

During its September 1991 Meeting (NAFO Sci. Coun. Rep., 1991, p. 131), STACFIS recommended that the status of the capelin in Div. 3NO be reconsidered at the Special Meeting early in 1992.

Preliminary catch statistics for 1991 indicate a catch of 30 tons reported by EEC.

b) Input Datai) Research survey data

A USSR acoustic survey was conducted in Div. 3LNO during 6 June and 6 July 1991. This survey was approximately one month later than previous surveys because of heavy ice conditions over the northern Grand Bank and because few capelin had been observed during a May trawl survey over ice-free areas. The biomass estimated from Div. 3O was 82 000 tons. The 1989 year-class predominated in northern Div. 3O followed by the 1988 year-class. In southern Div. 3O, pre-spawning fish of the 1988 year-class predominated while the 1989 and 1987 year-class were next in abundance.

A USSR acoustic survey carried out on the spawning grounds in Div. 3N during the second half of June did not detect capelin. Given the late spawning on beaches in Newfoundland, this lack of capelin in Div. 3N is most likely related to abnormal hydrographic conditions. STACFIS concluded that this survey probably occurred prior to any arrival of ripe fish on the spawning grounds.

c) Estimation of Parameters

The relationship between the larval index from the USSR 0-group surveys and year-class strength measured in Div. 3L acoustic surveys conducted by USSR was not statistically significant for the years 1983-89 (1985 missing).

d) Prognosis

Based on the lack of any relationship between the 0-group larval survey and recruitment at age 2 as measured in the acoustic survey, the conclusions reached by STACFIS during the June 1991 assessment meeting may be optimistic. Specifically, the 1989 year-class appeared as abundant as the 1983 year-class in 0-group surveys;

however, this year-class was only about 2% of the 1983 year-class at age 2 in the USSR acoustic survey. STACFIS has no basis on which to alter its advice of a TAC of 30 000 tons in 1992 but based on the above considerations notes that a catch of 30 000 tons in 1992 may exceed 10% of the spawning biomass.

II. OTHER MATTERS

1. Preparations for the Special Session in 1992

A progress report of preparations for the upcoming Special Session on "State-of-the-Art in Fish Stock Assessment: a Tutorial/Workshop on Calibration Methods and Their Practical Use", was tabled. Based on responses to-date, it is anticipated that there will be from 25-30 participants. The session is planned to be of 3 days duration (8-10 September 1992) with lectures in the mornings and hands-on work in the afternoons. It is proposed to deal with three different types of sequential population analysis calibration: use of *ad hoc* techniques with aggregated data, Laurec-Shepherd, and ADAPT. A workbook is presently being prepared, and will be available for distribution during the June, 1992 meeting.

2. Consideration of a Special Session in 1993

During the September 1991 Meeting, three possible topics were discussed (Sci. Coun. Rep., 1991, page 132-133). It was concluded that 1993 would be too early to hold a symposium on any of those. It was also concluded then that it was not necessary to hold a symposium every year, and as such no symposium was proposed for 1993.

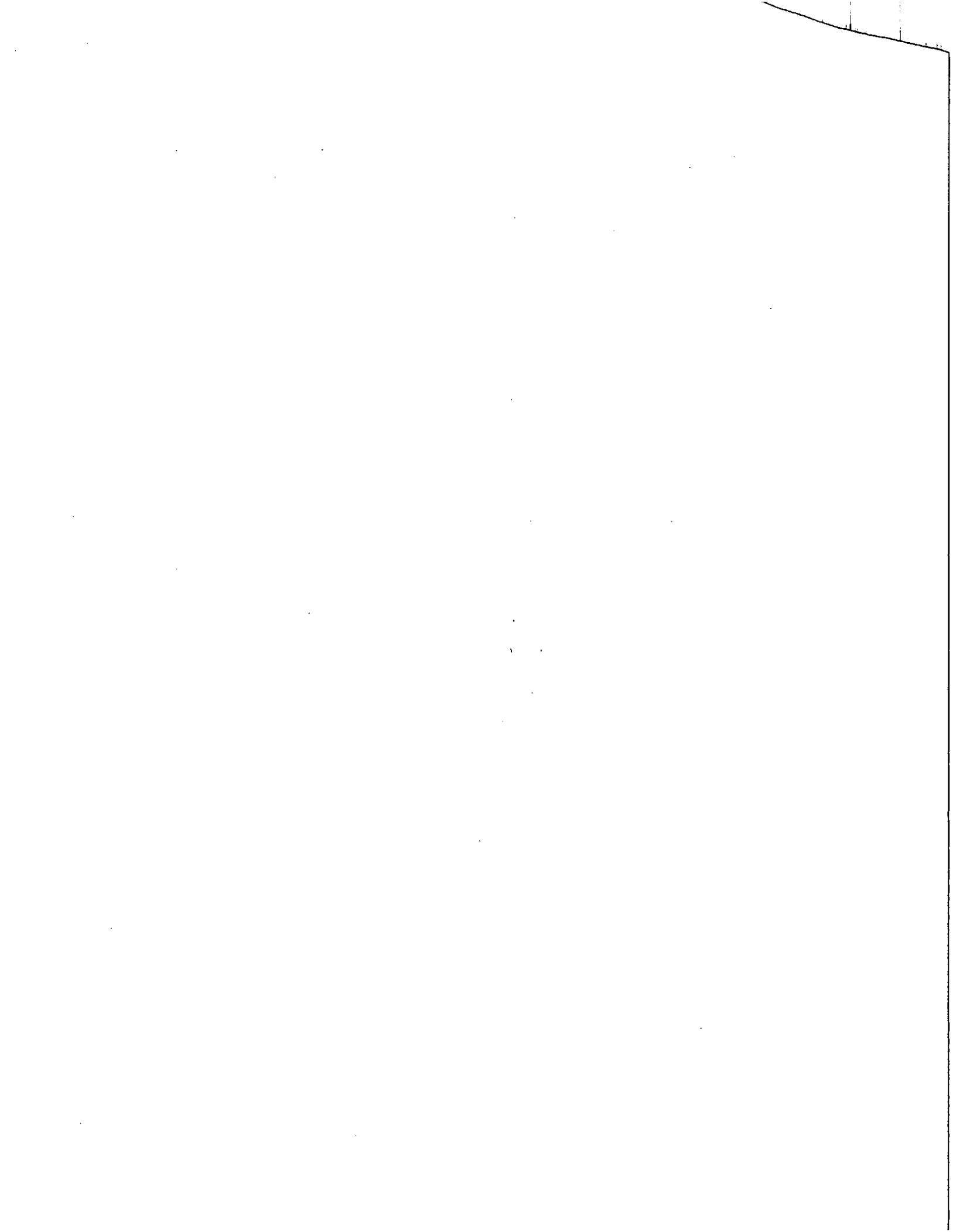
During this meeting, there was some recognition that there is value in maintaining continuity in the Special Session series. It was decided that further consideration of possible symposium topics should take place, and that a symposium could be held in 1993 if appropriate discussions take place early during the June 1992 Scientific Council Meeting. As such, it was recommended that the Assistant Executive Secretary draft a letter to Designated Experts requesting their consideration and input into the selection of a number of possible Special Session topics. These will be discussed at the beginning of the meeting in June, and a final decision on a 1993 symposium will be made at that time.

3. Review of Data Availability for Designated Experts for June 1992 Stock Assessments

Because of the limited participation at this meeting, full discussion of this agenda item did not take place. Nonetheless, the Secretariat was requested to write the various Contracting Parties reminding them of the discussions concerning the timely provision of data which took place in June 1991 (NAFO Sci. Coun. Rep., 1991, page 44), and requesting their compliance. A list of Designated Experts along with their addresses should be included in this communication.

4. Acknowledgements

There being no further business, the Chairman thanked all of the participants for their contributions. Gratitude was also expressed to the Secretariat for their assistance throughout the meeting.



APPENDIX II. AGENDA FOR SCIENTIFIC COUNCIL MEETING, MARCH 1992

- I. Opening (Chairman: V. P. Serebryakov)
 1. Appointment of rapporteur
 2. Adoption of agenda
 3. Work plan
- II. Fishery Science (STACFIS Chairman: D. B. Atkinson)
 1. Stock assessments (see Annex 1 for relevant Scientific Council recommendations in 1991).
 - Capelin (Div. 3N and 3O)
 - Capelin (Div. 3L)
 2. Other Matters
 - a) Preparations for the Special Session in 1992.
 - b) Consideration of a Special Session in 1993.
 - c) Review of data availability for Designated Experts for June 1992 stock assessments.
 - d) Other Business.
- III. Publications (STACPUB Chairman: H. Lassen)
- IV. Adoption of Reports
- V. Adjournment

RELEVANT RECOMMENDATIONS IN 1991

Scientific Council Meeting, June 1991

STACFIS REPORTCapelin in Divisions 3N and 3O

STACFIS noted the value of the tagging experiments and recommended that *Contracting Parties contact fishing fleets soliciting the return of capelin tags.*

Because of the problem of stock mixing prior to spawning, STACFIS recommended that *acoustic surveys in Div. 3NO be conducted during the capelin spawning period.*

Capelin in Divisions 3N and 3O

STACFIS noted that the recommendation of a 10% exploitation rate was not based on an analytical analysis nor was one performed for this meeting. However, STACFIS continues to recommend a conservative exploitation rate for capelin based on the reasons outlined above.

STACFIS recommended that research be conducted in the following areas:

- a) *Research on stock structure and mixing should be continued.*
- b) *More research should be directed towards predator-prey interactions with the aim of incorporating the results in the advice for capelin.*
- c) *Studies on reproduction capacity estimation on different stocks of capelin should be initiated. This information would be useful in determining minimum spawning stock biomass.*

Scientific Council Annual Meeting, September 1991

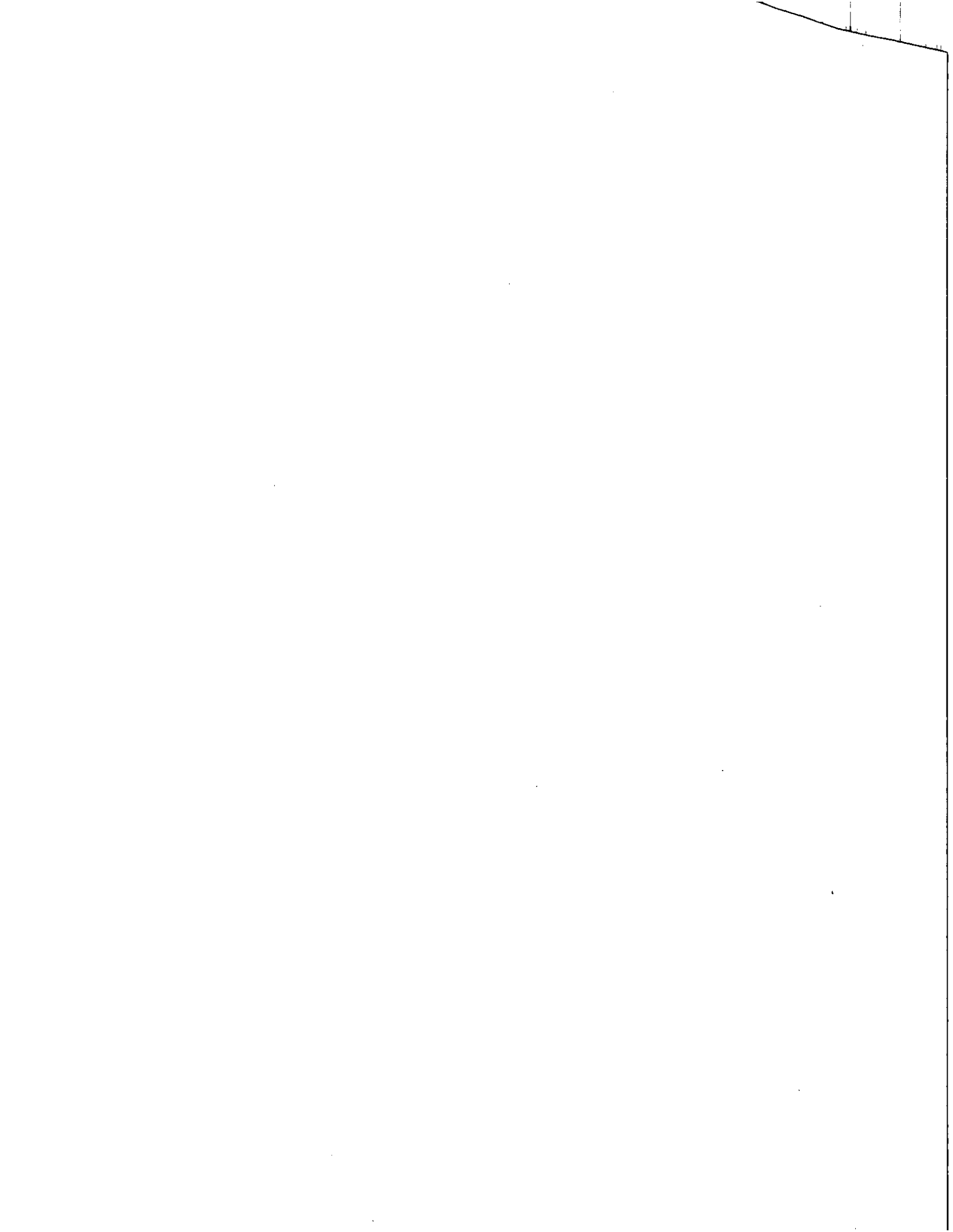
STACFIS REPORTCapelin in Division 3L (Page 131)

Because of the uncertainty about the stock status and the importance of capelin as a forage species, STACFIS wished to defer providing advice and recommended that *additional data be examined in late-February or early-March 1992 in an attempt to resolve the uncertainty.* STACFIS noted that both Canada and USSR will be conducting acoustic surveys in Div. 2J and 3K (and possibly Div. 3L) in late 1991 and recommended that *the results of these surveys be made available for this special meeting.*

STACFIS recommended that *several other sources of data be analyzed for this special meeting: capelin by-catch in groundfish bottom trawl surveys, all relevant research data as well as commercial data from inshore and offshore fisheries during 1991, hydrographic data from 1991 in comparison to other years, predation by cod and other major predators including historical comparisons, cod condition factors, Soviet acoustic data from the 1991 Div. 3L acoustic survey and any other new data available at that time.*

Capelin in Divisions 3N and 3O

This prognosis for Div. 3NO may be too optimistic based on the uncertainty surrounding recruiting year-classes and STACFIS recommended that the status of capelin in Div. 3NO also be reconsidered at the Special Meeting early in 1992.



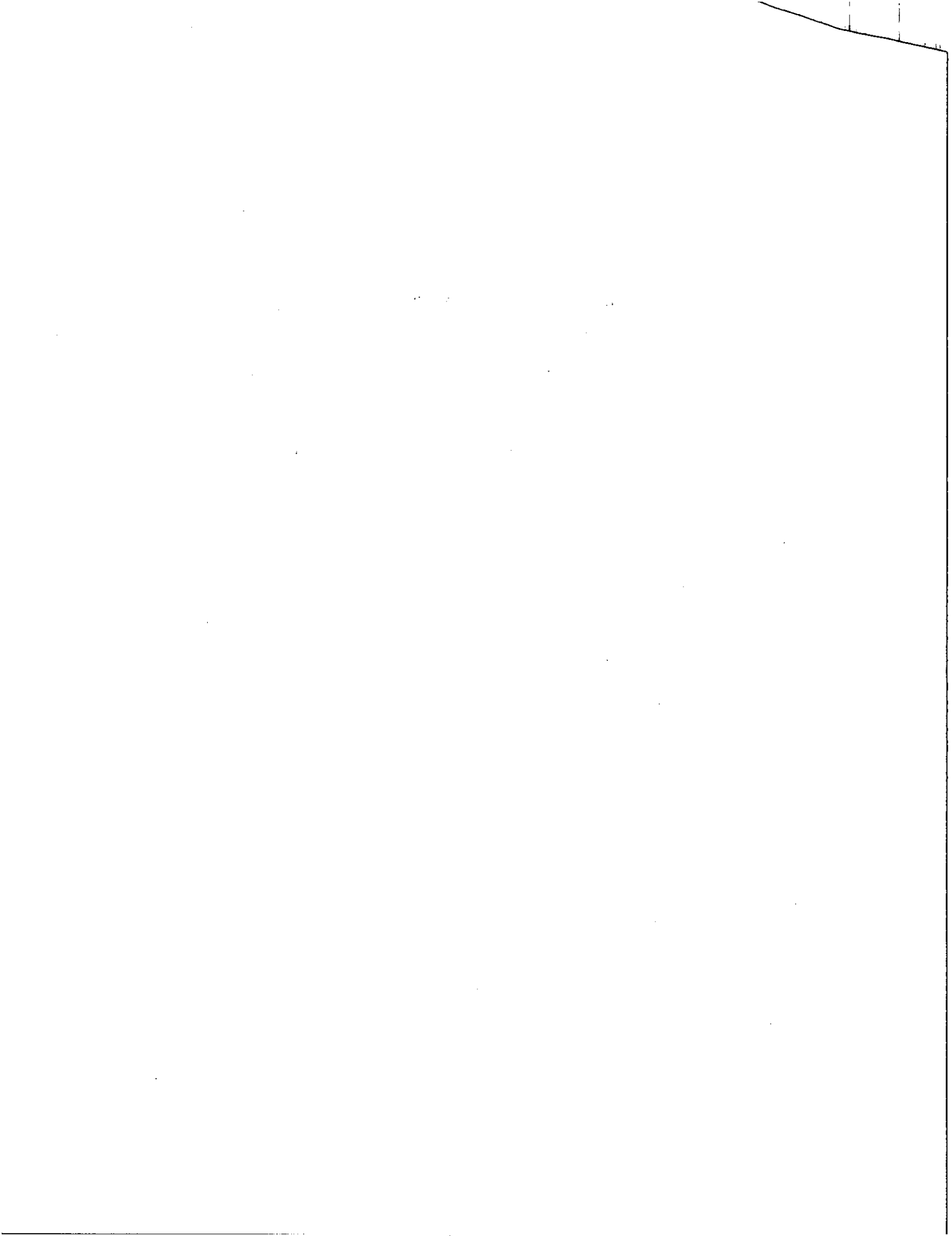
APPENDIX III. LIST OF RESEARCH AND SUMMARY DOCUMENTS, 1992

Research Documents (SCR)

<u>SCR #</u>	<u>Ser. #</u>	
92/1	N2034	<u>Bakanev, V. S.</u> Results from acoustic capelin surveys in Div. 3LNO and 2J+3KL in 1991.
92/2	N2035	<u>Nakashima, B. S., and B. W. Slaney.</u> Capelin (<i>Mallotus villosus</i>), egg deposition on fifteen spawning beaches in Conception Bay, Newfoundland in 1987-91.
92/3	N2036	<u>Nakashima, B. S., and R. W. Harnum.</u> The inshore capelin fishery in NAFO Division 3L in 1991.
92/4	N2037	<u>Shelton, P. A., J. E. Carscadden, and J. M. Hoenig.</u> Estimates of survival rates and risk evaluation of the 10% harvest rate procedure for capelin in NAFO Division 3L. (+ Addendum)
92/5	N2038	<u>Nakashima, B. S.</u> Results of aerial surveys of capelin (<i>Mallotus villosus</i>) schools using the compact airborne spectrographic imager (CASI).
92/6	N2039	<u>Narayanan, S., S. Prinsenber, and E. B. Colbourne.</u> Overview of environmental conditions in NAFO Divisions 2J+3KL in 1991.
92/7	N2040	<u>Lilly, G. R.</u> Distribution of capelin on Grand Bank (Div. 3LNO) in the springs of 1987 and 1991, as inferred from bottom-trawl by-catches and cod stomachs examinations.
92/8	N2041	<u>Lilly, G. R.</u> By-catches of capelin in Canadian bottom-trawl surveys from northern Labrador to the southern Grand Bank (Div. 2GHJ3KLNO) in autumn 1991.

Summary Documents (SCS)

<u>SCS #</u>	<u>Ser. #</u>	
92/1	N2042	Reports of Scientific Council, March 1992 Meeting.



APPENDIX IV. LIST OF PARTICIPANTS

CANADA

Atkinson, D. B.	Northwest Atlantic Fisheries Centre, P. O. Box 5667, St. John's, Nfld
Cahill, P. C.	" " " " " "
Carscadden, J. E.	" " " " " "
Lilly, G. R.	" " " " " "
Miller, D.	" " " " " "
Myers, R. A.	" " " " " "
Nakashima, B. S.	" " " " " "
Narayanan, S.	" " " " " "
Shelton, P. A.	" " " " " "
Wheeler, J. P.	" " " " " "
Winters, G. A.	" " " " " "
Hunt, J. J.	Marine Fish Division, DFO, Biological Station, St. Andrews, New Brunswick
Melvin, G. D.	" " " " " "
Clayton, R. R.	Science Branch, DFO, P. O. Box 5030, Moncton, New Brunswick
Grégoire, F.	Institute Maurice Lamontagne, DFO, 850 Rue de la Mer, Mont-Joli, Quebec
Lambert, J-D.	" " " " " "

DENMARK

GREENLAND

Lassen, H.	Danmarks Fiskeri-og Havundersøgelser, Charlottenlund Slot, DK-2920 Charlottenlund
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