INTERNATIONAL COMMISSION

FOR THE

NORTHWEST ATLANTIC FISHERIES

ANNUAL PROCEEDINGS

Vol. 17

for the year

1966 – 67

Issued from the Headquarters of the Commission

Dartmouth, N. S., Canada

1968

LETTER OF TRANSMITTAL

The Chairman of the International Commission for the Northwest Atlantic Fisheries presents his compliments to the Governments signatory of the International Convention for the Northwest Atlantic Fisheries signed at Washington under date of 8 February 1949, and to the Commissioners and observers representing those Governments and has the honour to transmit herewith annual proceedings of the International Commission for the Northwest Atlantic Fisheries for the year 1966–67.

This is the seventeenth annual report of proceedings of the Commission and is an authoritative record of its activities and achievements from 1 July 1966 to 30 June 1967. The report contains an account of the activities of the Commission's Secretariat; an account of the Seventeenth Annual Meeting; summaries of research carried out in each of the five Convention subareas; the report of a working group on joint biological and economic assessment of conservation actions; and a list of scientists and laboratories engaged in the Commission's work.

This report is prepared and transmitted in conformity with the requirements of Article VI (1) (f) of the International Convention for the Northwest Atlantic Fisheries and Rules 8 (g) and 22 (a) of the Rules of Procedure of the Commission.

Thomas A. Fulham,
Chairman,
International Commission for the
Northwest Atlantic Fisheries.

CONTENTS

PART 1

Administrative Report for the Year Ending 30 June 1967

1. The Commission's New Member

On 21 March 1967 the Socialist Republic of Romania deposited with the United States Department of State its instrument of adherence to the International Convention for the Northwest Atlantic Fisheries. The same instrument included Romania's adherence to the Protocol signed on 25 June 1956 relating to the holding of Annual Meetings, the Protocol regarding harp and hood seals signed on 15 July 1963 and the two Protocols signed on 29 November 1965 regarding measures of control and entry into force of proposals adopted by the Commission, respectively. Acceptance of the declaration of understanding concerning mollusks, signed on 24 April 1961, was also included.

By this action the Socialist Republic of Romania became, as of 21 March 1967, the 14th member of the International Commission for the Northwest Atlantic Fisheries.

Two large Romanian stern trawlers have been carrying out exploratory fishing in the southern part of the Convention Area for the past 2 years. During the 1966 fishing season they took almost 3,500 tons of, mainly, herring in ICNAF Division 5Z.

The Chairman of the Commission welcomed a delegation of four led by Mr C. Nicolau, General Secretary of the Ministry of Foodstuff Industry, to the 17th Annual Meeting in Boston.

2. The Commission's Officers

Chairman of Commission	—	Mr T. A. Fulham (USA)
Vice-Chairman of Commission	—	Mr V. M. Kamentsev (USSR)
Chairman of Panel 1	—	Dr H. A. Cole (UK)
Chairman of Panel 2	—	Mr A. J. Aglen (UK)
Chairman of Panel 3	—	Dr O. Rodríguez Martín (Spain)
Chairman of Panel 4	—	Mr J. Rougé (France)
Chairman of Panel 5	—	Dr A. S. Bogdanov (USSR)
Chairman of Panel A (Seals)	—	Dr A. W. H. Needler (Canada)

These officers, with one exception, were elected at the 1965 Annual Meeting to serve for a period of 2 years. Dr A. W. H. Needler was elected Chairman of Panel A at the 1966 Annual Meeting to serve for a period of 2 years.

Chairman of Standing Committee on Research and Statistics	—	Dr W. Templeman (Canada)
Chairman of Standing Committee on Finance and Administration	—	Mr R. Green (USA)

These officers were elected at the 1966 Annual Meeting to serve for a period of 1 year.

3. Panel Memberships for 1966–67

Panel:	1	2	3	4	5	A	Total
Canada		+	+	+	+	+	5
Denmark	+					+	2
France	+	+	+	+			4
Germany	+	+					2
Iceland	+						1
Italy			+	+			2
Norway	+					+	2
Poland	+	+	+				3
Portugal	+	+	+	+			4
Spain	+	+	+	+			4
USSR	+	+	+	+	+		5
UK	+	+	+				3
USA			+	+	+		3
TOTAL	10	8	9	7	3	3	40

4. The Commission's Office Accommodation

The office of the Commission has been located, since 1 August 1963, in the Bedford Institute of Oceanography under a lease arrangement with the Canadian Department of Mines and Technical Surveys (now Department of Energy, Mines and Resources).

The Institute for the past 4 years has continued its rapid recruitment toward full staff complement. Office and other space is in growing demand. The Commission's Secretariat has recognized the Institute's pressing needs and, to date, has relinquished 480 sq ft of the 1,680 sq ft of office space leased to it on 1 August 1963. Office accommodation, at present, is just adequate for the efficient handling of Commission requirements.

The Executive Secretary has been advised that a proposal to renew the present lease arrangement for a period of 3 years from 1 August 1967 has been approved by the Canadian Government.

5. The Commission's Secretariat

The staff members of the Secretariat are:

Executive Secretary	—	L. R. Day
Assistant Executive Secretary	—	B. J. Kowalewski
Editorial Assistant	—	W. H. Champion
Secretary	—	Miss Jean Maclellan
Clerk-Typist	—	Miss Gertrude Schrader
Clerk	—	Mrs Carol Turple

Additional clerical help was provided by:

Mrs Sheila Sabine (Annual Meeting)

Following the 1966 Annual Meeting in Madrid, the Executive Secretary discussed statistics and sampling matters with the Chairman of the Statistics and Sampling Subcommittee, Dr F. McCracken, and problems in connection with preparation of the Final Report of the First Meeting of the ICES/ICNAF Joint Working Party on North Atlantic Salmon with the Chairman of the Working Party, Mr K. R. Allen (St. Andrews, New Brunswick, Canada, 22–24 August 1966); discussed with Depositary Government the presentation to member governments of the 1966 Commission's proposals re (a) topside chafing gear, (b) mesh measuring gauges and (c) amendments to the ICNAF trawl regulations in Subarea 1 (Washington, USA, 20–21 September 1966); discussed arrangements for the 17th Annual Meeting with representatives of the US Office of International Conferences and Government Space Administration (Boston, USA, 22–23 September 1966); attended the 54th Statutory Meeting of ICES and 2nd meeting of the ICES/ICNAF Joint Working Party on North Atlantic Salmon (Copenhagen, 3–12 October 1966); attended a Meeting of Panel A (Seals) (Copenhagen, 13–15 October 1966): attended the 1st Meeting of the Working Group (established by ICNAF with participation by FAO, NEAFC, and OECD) on Joint Biological and Economic Assessment of Conservation Actions (London, 17–22 October 1966); discussed ICNAF matters with officials at the Headquarters of the Fisheries Research Board of Canada, at the Department of Fisheries and with Mr H. Ransom of the International Fisheries Commissions Pension Society (Ottawa, Canada, 22–25 January 1967); conferred with the Chairman of the Statistics and Sampling Subcommittee, the Chairman of the ICES/ICNAF Joint Working Party on North Atlantic Salmon, the Chairman of the Assessment Subcommittee (St. Andrews, New Brunswick, Canada, 23 February–2 March 1967); attended the 2nd Meeting of the Working Group (established by ICNAF with participation by FAO, NEAFC, and OECD) on Joint Biological and Economic Assessment of Conservation Actions (London, 3–8 April 1967) and attended the 5th Meeting of the Continuing Working Party (CWP) on Fishery Statistics in the North Atlantic Area (Aberdeen, Scotland, 10–15 April 1967).

6. The Commission's Publications

The 1966 *Meeting Proceedings* (80 p.) was distributed in July 1966. It contains the reports of the meetings of the Plenary and of the Panels (including the first meeting of the new Seal Panel (Panel A)), Commissioners, the Standing Committee on Finance and Administration and the *ad hoc* Committee on Trawl Regulations held during the Commission's 16th Annual Meeting, Madrid, 6–11 June 1966.

The *Redbook* 1966 was again issued in three parts. Part I (90 p.) contains the proceedings of the 1966 meeting of the Standing Committee on Research and Statistics and its Subcommittees. It was distributed in October 1966. Part II (123 p.) contains the reports by member countries on research conducted in the Convention Area in 1965. Part III (207 p.) contains selected scientific papers presented to the 1966 meetings. It was distributed in March 1967.

The *Statistical Bulletin* Vol. 14 for the year 1964 (84 p.) was distributed in October 1966.

The *Statistical Bulletin* Vol. 15 for the year 1965 (95 p.) was distributed in March 1967.

The *Annual Proceedings* Vol. 16 for the year 1966–67 (46 p.) was distributed in February 1967. It contains the Administrative Report with audited financial statements for the year ending 30 June 1965, the Report of the Sixteenth Annual Meeting, 1966, and Summaries of Research carried out in each subarea of the Convention Area in 1966.

The *Research Bulletin of ICNAF* No. 3 (114 p.) was distributed in May 1967. It contains 13 scientific papers on research important to the Commission.

The *Research Bulletin of ICNAF* No. 4 (126 p.) contains 11 scientific contributions. The papers are now in the page-proof stage. The book will be distributed in October 1967.

The *Sampling Yearbook* Vol. 10 for the year 1965 (212 p.) was distributed in April 1967. The volume contains length frequencies, age frequencies and age/length keys and tables for the major species sampled by the research agencies of Member Countries in the ICNAF Divisions in 1965.

The *List of Fishing Vessels and Summary of Fishing Effort in the Convention Area*, 1965 (164 p.) contains two parts. Part A is a list of fishing vessels over 50 gross tons operating in the Convention Area in 1965. Part B is a summary of fishing effort by these fishing vessels in the Convention Area in 1965. The book was distributed in March 1967.

The *ICNAF Special Publication No.* 7 (ICNAF Environmental Survey: NORWESTLANT 1–3, 1963) consisting of four parts as follows: Part I, Text; Part II, Atlas; Part III, Oceanographic Data Record; and Part IV, Biological Data Record, is in preparation.

7. Cooperation with Other International Organizations

Close working relationships continue with FAO, ICES, OECD, NEAFC, IOC, and SCOR.

The Commission's statistics continue to improve due, largely, to the activities of the FAO/ICES/ICNAF Continuing Working Party (CWP) on North Atlantic Statistics, with Mr L. P. D. Gertenbach of FAO as Secretary. The Executive Secretary represented ICNAF at the 5th Meeting of CWP which, in addition to the regular membership of FAO, ICES, ICNAF, Fed. Rep. Germany, Iceland, and UK, had representation from OECD and EEC, international organizations directly concerned with statistics of the fisheries in the North Atlantic. The Bibliography on North Atlantic Publications jointly sponsored by FAO, ICES, and ICNAF has been prepared for the printers. The FAO/ICES/ICNAF Symposium on Marine Food Chains is being prepared for July of 1968 in Denmark.

Close liaison was maintained through Commission Observers at the First and Second Meetings of the newly-formed FAO Committee on Fisheries (COFI) held in June 1966 (Observer: Mr D. McKernan) and April 1967 (Observer: Dr A. W. H. Needler) respectively. Dr J. L. McHugh represented the Commission at the January 1967 meeting of the COFI Subcommittee on Developing Cooperation with International Organizations concerned with Fisheries.

Exchange of information between ICNAF and ICES continues effectively through the exchange of subcommittee reports in which common problems are studied and reported upon. Dr H. A. Cole represented ICNAF at the 54th Statutory Meeting of the Council in October 1966. ICNAF provided the meeting with its reports on statistics, gear and selectivity, and extracts from its report on assessments dealing with Greenland cod and North Atlantic salmon. In exchange, ICES has provided the reports of its Statistical, Comparative Fishing, and Salmon and Trout Committees for consideration by the ICNAF Standing Committee on Research and Statistics

and its pertinent subcommittees. The ICES/ICNAF Joint Working Party on North Atlantic Salmon completed the Final Report of its First Meeting for consideration by ICES and ICNAF.

Close collaboration with the Fisheries Division, OECD, is found in the Working Group on Joint Biological and Economic Assessment of Conservation Actions. The Working Group, established by ICNAF with participation by FAO, NEAFC, and OECD, held meetings in October 1966 and April 1967 and completed a report which will be considered by ICNAF at its upcoming Annual Meeting.

The Commission continues to work closely with NEAFC in attempts to develop solutions to common problems such as international control measures, mesh measuring gauges, methods of measuring meshes, topside chafers, and effort regulation. Countries, members of ICNAF but not of NEAFC, participated by invitation in two special NEAFC meetings on international control in November 1966 and May 1967 respectively. Mr G. Möcklinghoff was ICNAF Observer at the 5th Annual Meeting of NEAFC which was held 9–12 May 1967 just prior to the Annual Meeting of ICNAF. Again in 1967 ICES and NEAFC have kindly allowed the Commission to have before its Annual Meeting for study, the 1967 Report of the ICES Liaison Committee to NEAFC.

Close contact has been maintained with IOC as the international body with world-wide responsibility for study of ocean environment. Proposals for cooperative investigations in ocean areas including the Convention Area are being given further study by IOC, SCOR, and ACMRR in cooperation with ICES and ICNAF. Mr A. Lee, Chairman of the Environmental Subcommittee, continues to represent the Commission at meetings of IOC and SCOR.

8. Cooperation with Non-Member Countries

Japan continues to maintain an interest in the work of the Commission and in the fishery in the Convention Area. The various Commission publications and documents are forwarded to the Government of Japan regularly. Information has been received in the Secretariat that the Japanese Fisheries Agency has issued a license to the *Kaimon Maru* (2,518 tons) of the Nippon Suisan Fishing Company to carry out experimental trawling operations in the Convention Area from 25 April to 24 July 1967. The Government of Japan has again accepted an invitation to send an Observer to the Commission's Annual Meeting.

Cooperation with the Romanian Government in providing publications and documentary information regarding the work of the Commission and the fisheries in the Convention Area has culminated in Romania becoming, on 21 March 1967, the 14th country to become a member of the Commission.

Further requests from the Government of Cuba for Commission publications have been filled. A small, but growing Cuban fleet is known to be fishing in the waters of the Convention Area.

Fishing activities by other non-member countries in the Convention Area continue to expand. Only limited information is available on expended effort and resultant catch.

9. Programs and Reports of Research

Programs of research to be carried out by member countries in the Convention Area during 1967 were received and distributed.

National research reports were received from member countries active in the Convention Area. Italy has not fished in the Convention Area since 1962.

The final version of the Report of the First Meeting of the ICES/ICNAF Joint Working Party on North Atlantic Salmon was completed following the Second Meeting of the Joint Working Party which was held in Copenhagen on 4 October 1966. The Report was approved by ICES at its October 1966 meeting and was presented to the Annual Meeting of ICNAF for consideration. For numerous reasons, the Working Party will not meet at the time of the ICNAF Annual Meeting. However, the Assessments Subcommittee will take responsibility for reviewing the statistics and any results of research efforts on the North Atlantic salmon for the Commission.

The Panel on Seals (A) held a mid-year meeting, 13–15 October 1966, immediately following the ICES meeting in Copenhagen. The Scientific Advisers to the Panel prepared a program of research which was approved by the Panel. Catch statistics on the Gulf and Front fisheries were reviewed and preliminary considerations of regulatory measures were discussed.

The Working Group on Joint Biological and Economic Assessments of Conservation Actions, set up by the 1966 Annual Meeting of ICNAF, met twice, with participation by FAO, NEAFC, and OECD, 19–22 October 1966 and 3–8 April 1967 in London and completed a report which will be presented to the upcoming Annual Meeting of the Commission.

A mid-year meeting of the ICNAF Working Group on Mesh Problems was held 21–23 November 1966 immediately after the First Special Meeting of NEAFC on International Control to decide on a standard mesh gauge and method of mesh measurement for the North Atlantic. The Report will be presented to the upcoming Annual Meetings of NEAFC and of ICNAF.

Plans for special consideration of the hydrography and meteorology of the Convention Area on 30 May 1967 by the Environmental Subcommittee were completed by its Chairman, Mr Lee.

10. Statistics and Sampling

Statistics on the fisheries in the Convention Area have continued to improve in quality and timeliness of reporting and publication due no little to the efforts of the Assistant Executive Secretary.

With excellent cooperation from all member countries and invaluable help from FAO (Mr Gertenbach, Secretary of CWP) in collecting data from non-member countries, it has been possible to send the manuscript of the ICNAF Statistical Bulletin, Vol. 15 for 1965, to the printers in November 1966 and to distribute the printed volume in mid-March 1967.

The List of Fishing Vessels for 1965 contained a Summary of Fishing Effort in the Convention Area in 1965 as an addition for the first time to this publication.

The ICNAF Sampling Yearbook continues to increase in size and value as more sampling is carried out on the commercial fisheries and more length and age keys and tables are included.

Statistics on discards for 1965, a summary of the trawl material and mesh size sampling in 1966, and a summary of the fishing effort for 1966 have been documented for the Annual Meeting. In addition, a summary of the selectivity data which was presented to the Gear and Selectivity Subcommittee over the past 5 years, 1962–66, was completed for the Annual Meeting.

Data on fish discarded and turned into fish meal at sea during 1966 will be available as of 15 July 1967 on a new form devised at the 1966 Annual Meeting.

The Secretariat took an active part in the 5th Session of the Continuing Working Party (CWP) on Fisheries Statistics in the North Atlantic Area held 10–15 April 1967 in Aberdeen, Scotland. The Executive Secretary attended the session.

Proposals for the extension of the ICNAF statistical collection area southward to the latitude of Cape Hatteras were reviewed by CWP. In addition, data on catch of ICNAF and non-ICNAF species for the years 1963–66 inclusive were collected for the proposed new statistical subarea. Documents containing the proposal and the statistical data were presented to the Annual Meeting.

Proposals for a new Table 3 of the ICNAF Statistical Bulletin to include NEAFC statistical data for comparative purposes were presented to the Annual Meeting. Proposed improvements to the design of the Bulletin tables were also prepared for consideration.

12. International Regulation of Trawl Fisheries

Amendments to the 1961 proposals for Subareas 1, 2, and 3, 1964 proposals for Subareas 1, 2, and 3, 1965 proposals for Subarea 1, 1965 codification proposal for Subarea 1, to provide for changes in the mesh size for Subarea 1 from 114 mm or 4 1/2 inches to 130 mm or 5 1/8 inches,

were adopted by the Commission on 10 June 1966 and forwarded to Depositary Government on 9 September 1966. Transmittal to Contracting Governments was completed on 31 December 1966.

On 17 March 1967 Contracting Governments were notified from the Secretariat in ICNAF Notification Series No. 1, of the authorized topside chafing gear in the Convention Area, and in ICNAF Notification Series No. 2 of the authorized mesh measuring gauges and mesh size equivalents in the ICNAF trawl fisheries in accordance with decisions taken at the 1966 Annual Meeting (Annu. Proc. vol. 16, p. 19–20).

12. Financial Statement for the Fiscal Year ending 30 June 1967

The accounts of the Commission for the year ending 30 June 1967 show an assessment against Member States for ordinary expenses of Can. $87,560 and an authorized transfer of Can. $5,241 to the General Fund from the Working Capital Fund to cover additional costs of the Environmental Symposium publication and travel and consultant's fees in connection with two mid-year meetings of the ICNAF Bio-Economic Assessment Group.

Obligations incurred during the year totalled Can. $92,309 which was Can $492 less than the Can. $92,801 appropriated by the Commission.

The audit of the Commission's finances was completed by the office of the Auditor General of Canada, in accordance with Section XI of the Commission's Financial Regulations, in July 1967.

The report of the Auditor General dated 29 September 1967 to the Chairman and Members of the Commission reads, in part, as follows:

EXHIBIT I

Statement of Budget Appropriations, Obligations Incurred, and Balances of Appropriations for the year ended 30 June 1967

(Expressed in Canadian Dollars)

Purposes of Appropriation	Appropriated by Commission	Obligations Incurred	Surplus or Deficit (–) Balances of Appropriations
Personal services—			
Salaries	$48,646	$48,691	$ – 45
Superannuation and Canada Pension Plan	1,200	1,621	– 421
Additional help	1,200	1,150	50
Medical plan	300	245	55
Travel	6,664	3,058	3,606
Transportation	500	176	324
Communications	3,000	3,780	– 780
Publication	13,000	17,538	–4,538
Other contractual services	4,000	3,166	834
Materials and supplies	3,500	2,898	602
Equipment	1,000	933	67
Annual meeting	3,000	3,974	– 974
Contingencies	1,000	—	1,000
	87,010	87,230	– 220
Supplementary appropriation	550	—	550
Totals, ordinary budget	87,560	87,230	330
Environmental symposium	3,241	3,241	—
Bio-economic assessment group	2,000	1,838	162
	$92,801	$92,309	$ 492

EXHIBIT II

Statement of Income and Expenditure for the year ended 30 June 1967

(with comparative figures for the year ended 30 June 1966)

(Expressed in Canadian Dollars)

		1967		1966
Income:				
Members' contributions assessed—				
Canada	$10,314		$ 8,946	
Denmark	4,442		2,632	
France	8,357		8,946	
Germany, Federal Republic	4,442		4,737	
Iceland	2,483		2,632	
Italy	4,442		4,737	
Norway	4,442		2,632	
Poland	6,399		6,842	
Portugal	8,357		8,946	
Spain	8,357		8,946	
Union of Soviet Socialist Republics	10,314		11,050	
United Kingdom	6,399		6,842	
United States of America	6,399		6,842	
		$ 85,147		$ 84,730
Miscellaneous—				
Sales of publications	3,788		2,530	
Refunds of previous years' expenditure	1,945		—	
Bank Interest	1,094		1,185	
		6,827		3,715
Appropriated from Working Capital Fund		5,241		11,000
		97,215		99,445
Obligations incurred (Exhibit I)		92,309		86,379
		4,906		13,066
Deduct: Transferred to Working Capital Fund—				
Sales of publications	3,788		2,530	
Refunds of previous years' expenditure	1,945		—	
	5,733		2,530	
Less—Appropriated for 1966–67 budget	550		—	
	5,183		2,530	
Balances of 1966–67 Appropriations	492		9,351	
		5,675		11,881
Amount carried to surplus account		$ (769)		$ 1,185

EXHIBIT III

Statement of Assets and Liabilities as at 30 June 1967

(with comparative figures as at 30 June 1966)

(Expressed in Canadian Dollars)

Assets	1967	1966	Liabilities		1967	1966
GENERAL FUND						
Cash on hand and in bank	$ 8,649	$ 26,388	Unliquidated obligations		$ 6,076	$ 13,887
			Credits due to Member States:			
Accounts receivable	1,026	1,028	Advances on 1967–68 contributions	$1,527		11,666
			Contribution of new member (Romania)	978		—
					2,505	11,666
			Surplus Account:			
			Balance 30 June 1966	1,863		
			Deduct: Transferred from Statement of Income and Expenditure (Exhibit II)	769		
			Balance 30 June 1967		1,094	1,863
	$ 9,675	$ 27,416			$ 9,675	$ 27,416
WORKING CAPITAL FUND						
Cash on deposit	$ 18,568	$ 18,134	Principal of Fund (Appendix I)		$ 18,568	$ 18,134
	$ 18,568	$ 18,134			$ 18,568	$ 18,134

APPENDIX I

Working Capital Fund

Principal of Fund		
Balance 30 June 1966		$ 18,134
Add: Transferred from Statement of Income and Expenditure (Exhibit II)		5,675
		23,809
Deduct: Appropriated for—		
Environmental Symposium	$ 3,241	
Bio-Economic Assessment	2,000	
		5,241
Balance 30 June 1967		$ 18,568

PART 2

Report of Seventeenth Annual Meeting of the International Commission for the Northwest Atlantic Fisheries Boston, USA, 5 – 9 June 1967

BY THE CHAIRMAN, MR T. A. FULHAM

1. Introduction

The International Commission for the Northwest Atlantic Fisheries (ICNAF), under the terms of a Convention signed in 1949, is responsible for the investigation, protection, and conservation of the fisheries of the Northwest Atlantic in order to make possible the maintenance of a maximum sustained catch from those fisheries. Based on the results of scientific investigations promoted and coordinated by the Commission, measures to ensure wise use of the stocks of commercial fish are recommended to member governments.

The Commission has six panels, five of which review the fisheries and recommend conservation measures in geographic subareas of the Convention Area (Subarea 1, off West Greenland; Subarea 2, off Labrador; Subarea 3, off South and East Newfoundland; Subarea 4, the Gulf of St. Lawrence and Nova Scotian Banks; and Subarea 5, the Gulf of Maine). The sixth panel has jurisdiction respecting harp and hood seals in the Convention Area.

2. Time and Place of Meeting

The Seventeenth Annual Meeting of ICNAF was held in the John F. Kennedy Federal Building, Government Center, Boston, USA, from 5 to 9 June 1967 under the chairmanship of Mr T. A. Fulham.

The Standing Committee on Research and Statistics with its various subcommittees and working groups met, in advance of the plenary sessions of the Commission, between 25 May–2 June under the general chairmanship of Dr W. Templeman. The Subcommittee on Fishery Assessments met 25–26 May under the chairmanship of Mr B. B. Parrish of UK. The Subcommittee on Statistics and Sampling met 26–27 May under Dr F. D. McCracken. The Steering and Publications Subcommittee met 28 May and periodically during the week under Dr W. Templeman of Canada. Between 29 May–2 June the Subcommittee on Herring and Other Pelagic Species met under Dr S. A. Studenetsky of USSR, the Subcommittee on Ageing Techniques under Mr E. Bratberg of Norway, the Environmental Subcommittee under Mr A. Lee, and the Subcommittee on Gear and Selectivity under Dr A. W. May of Canada. The Standing Committee on Research and Statistics met regularly in plenary session throughout the week to coordinate the work and to receive the reports of the various subcommittees. A special session of the Environmental Subcommittee considered a number of papers by experts concerning recent oceanographic and meteorological fluctuations in the ICNAF Area under the chairmanship of Mr A. Lee of UK. Scientific Advisers to each of the six panels met on 2–3 June.

From 5 to 9 June 1967, the Commission considered agenda items in Plenary Session and heard reports and recommendations from meetings of an *ad hoc* Committee on Trawl Regulations, an *ad hoc* Committee on Fishery Management, from meetings of the subarea and seal panels and of the Standing Committees on Research and Statistics and on Finance and Administration.

3. Participants (Appendix I)

Commissioners with their Advisers and Experts from 13 member countries including Romania which joined the Commission on 21 March 1967, were present. The 14th mem-

ber country, Italy, was represented by a member of the Italian consular staff in Boston. In addition, Observers from the Food and Agriculture Organization of the United Nations (FAO), the International Council for the Exploration of the Sea (ICES), the North-East Atlantic Fisheries Commission (NEAFC), the General Fisheries Council of the Mediterranean (GFCM), the Intergovernmental Oceanographic Commission (IOC), and the Scientific Committee on Oceanic Research of the International Council of Scientific Unions (SCOR) were present at the meeting. The Commission also welcomed Observers from Japan, Ireland, and the Netherlands.

Accredited participants are listed in Appendix I to this Report. The organization and officers of the Commission for the year 1967–68 are presented on the inside front cover of these Proceedings.

4. Opening of the Meeting (Agenda Item I)

The opening session of the Seventeenth Annual Meeting of the Commission was convened in the Old South Meeting House, corner of Washington and Milk Streets, Boston, Massachusetts on 5 June 1967. The Chairman of the Commission, Mr T. A. Fulham, welcomed the Commissioners, Advisers, Observers, and Guests. Mr Theodore W. Schulenberg, Commissioner of Commerce and Development of the Commonwealth of Massachusetts and Mr Daniel J. Finn, Commissioner of Housing and Building Development for the City of Boston welcomed the Commission to the Commonwealth of Massachusetts and the City of Boston respectively.

The Chairman then invited the Honourable Stanley A. Cain, Assistant Secretary for Fish, Wildlife and Parks in the U.S. Department of the Interior to address the meeting. The text of Mr Cain's address follows:

"It is my great pleasure to speak for Secretary Udall and to welcome you to the United States for this 17th Annual Meeting of the International Commission for the Northwest Atlantic Fisheries. Most of you have gathered together before, but for the first time representatives of the newest ICNAF member, Romania, are present, and we extend an especial welcome to them.

"It is fitting that the Commission should return periodically to the US for its Annual Meeting since the Convention was originally drafted at a conference in Washington in January 1949 and the first Annual Meeting of the Commission was held in Washington in 1951. Two other meetings have been held in the US since that time.

"This is the first meeting of the Commission in Boston, however, which is a most appropriate site for an ICNAF meeting. Fishing is one of the oldest New England industries and New England is one of the oldest regions in the Americas. That this meeting should be held in this historic structure is indicative of our link with the past.

"Fishing is still an important industry in New England and we expect that it will remain so in the future. The first plenary meeting of the Commission will convene at noon today in the new John F. Kennedy Federal Building. This location symbolizes the vibrant new spirit to be found in New England, in which we hope the fishing industry will share. We hope this lofty setting will also be symbolic of the achievements at the meeting.

"Boston is one of the leading fishing ports, not only in the ICNAF Area, but also in this country and, for that matter, in the world. But there are also other important fishing ports in this part of the country, and we hope the participants in this meeting will have an opportunity to visit some of them during your stay in the US.

"The fisheries of the Northwest Atlantic Ocean are the oldest in the Western Hemisphere, having been prosecuted for more than five centuries. It was recognized during the 1940's that some of the stocks of fish in the Northwest Atlantic Ocean, particularly off the New England coast, were showing signs of depletion. Recognition of the problem of reduced abundance and potential depletion of the fisheries of the North Atlantic led to the convening of several international conferences. Ultimately, it was decided to separate the North Atlantic into eastern and western sectons for conservation purposes and in 1949 a conference was held which led to the organization of this Commission in 1951. The Commission moved promptly to propose a $4\frac{1}{2}$-inch minimum mesh size for the haddock trawl

fishery in Subarea 5 at its Second Annual Meeting, and this regulation entered into force in 1953. In 1955 the Commission proposed further regulation for cod and haddock in Subareas 3, 4 and 5, and these regulations have been in force since 1957. In 1961 the Commission proposed extending the regulations to Subareas 1 and 2 and extending the regulations in Subareas 3 and 4.

"Unfortunately, these regulations have not yet entered into force. However, the Commission does have other achievements to its credit. Principal among these is a vast increase in scientific cooperation among the members of the Commission, which has led to a marked increase in knowledge of the stocks of fish in the ICNAF Area and their environment. This scientific cooperation serves as an excellent example of the benefits to be derived from gathering together and examining problems on a cooperative and friendly basis. The Commission has also led to a great improvement in communications among the governments and fishing industries of the nations involved.

"I mentioned the fact that the Commission's 1961 proposals which would greatly increase the scope of the ICNAF minimum mesh size regulations, have not yet entered into force. But the Commission is also faced with another major, perhaps even more serious, problem; that is the tremendous increase in fishing effort during the last few years. The Commission's scientists have concluded that additional regulatory action is necessary to supplement the minimum mesh size regulations when and if they enter into force. You are now giving urgent study to this very critical problem.

"As you face this new and troublesome problem for the Commission, I would like to review briefly the possible courses of action open to fishing nations, and the world fishing situation. Historically, fishing nations have been faced with two alternative courses of action: first, is international cooperation designed to relieve problems on a mutually agreeable basis and to enhance high seas fishing activities. ICNAF is an example of this course of action. The second alternative is that of greater national control of coastal waters; that is to say, jurisdiction of the coastal nation over the stocks of fish found close to its shore. Claims of two hundred miles of jurisdiction by several nations are examples of this course of action. More recently, a third choice has been introduced and is receiving interest on the part of some persons; that is, international ownership or control of the resources.

"The ICNAF members have been in the forefront of the nations who have been actively promoting use of the first alternative as the best method of solving international fisheries problems. In fact, almost every strong advocate of this solution is represented in this Commission.

"We are all keenly aware of the vast and continuing increase in fisheries throughout the world, which is highly desirable because of protein dietary deficiencies for millions of people. With this increase we have seen a growing concern of coastal fishermen and coastal nations for the conservation of the fishery resources and for the livelihood of the coastal fishermen. In the face of this concern, an increasing number of coastal nations are taking or considering action in the form of extension of jurisdiction. These nations are actively advocating this alternative as the best solution for all nations, and they are watching for any sign of failure of international cooperative action to provide them with additional arguments with which to persuade other nations to follow their course of action.

"The US shares this growing concern about possible depletion of stocks of fish in the Northwest Atlantic and particularly off its coast and is also deeply concerned about the livelihood of its coastal fishermen. This is particularly true in the important fishing areas of the ICNAF Area. We have noted the lengthy process that is often required to reach agreement on the necessary conservation action. While we recognize that many difficult problems are involved and that there are many diverse points of view about the nature of the problems and the best course of action for their solution, we are also keenly aware that modern technological developments no longer permit a leisurely approach to fisheries conservation measures. We have reached the stage in technological development where a fishery can be seriously depleted if adequate conservation measures are not taken expeditiously; and yet, as I have mentioned, the additional mesh size regulations which

the Commission found necessary for much of the Convention Area six years ago are not yet in force.

"This demonstrates that there remain serious problems before the Northwest Atlantic Commission. While ICNAF has achieved much in the fields of scientific cooperation and improved communications between governments and fishermen, it has not overcome some of the technical problems of regulating this complex fishery, nor has it overcome government slowness in accepting the recommendations of the Commission.

"If ICNAF is to succeed as an important world force in conservation, it must accelerate its pace, and it must do so quickly. Unless we are able to achieve the desired ends through agents such as this international cooperative mechanism, then the other alternatives will unquestionably be explored, to conserve the stocks and to protect the interest of the fishermen.

"I am aware that the member governments of this Commission are among the most sophisticated fishing nations in the world and the foremost advocates of international cooperative action to solve fishery problems. They are parties to many other agreements for this purpose. It seems quite apparent that if this Commission does not achieve its goal of cooperation in the field of conservation, it will seriously diminish the possibility that it can lead the world towards unanimous agreement that international cooperative action is by far the most effective way of providing for the reasonable use of the living resources of the high seas.

"We have a grave responsibility We have in our hands the possibility of taking action which will make this situation brighter. If we take a positive stance on this problem, we can set an example that will lead the world toward a reasonable solution to fisheries today. The USA looks on this as a most important undertaking.

"The USA is happy that you were able to come here for your Annual Meeting and sincerely hopes that significant progress can be made during this week. Beside the hard work of the Commission, we hope that you will have an interesting and happy time."

The Chairman thanked the Assistant Secretary for his appreciation of the Commission's problems and for his good wishes for their early solution and declared the Seventeenth Annual Meeting of the Commission officially opened.

Following adjournment of the opening session, the Chairman convened the first Plenary Session in the John Fitzgerald Kennedy Federal Building, Government Center, Boston. Second, third, fourth, and fifth Plenary Sessions were convened on 6, 8, and 9 June. During these meetings the following business was concluded.

5. Agenda (Item 2)

The Commission adopted the agenda (Appendix II) which, in accordance with Rule 12 of the Commission Rules of Procedure, was circulated 60 days in advance of the Meeting.

6. Publicity for the Meeting (Item 3)

The Commission, in accordance with past practice, appointed the Chairman of the Commission and the Chairmen of the Standing Committee on Research and Statistics and of the Standing Committee on Finance and Administration to a committee to control policy regarding public relations.

7. Report of the Standing Committee on Finance and Administration (Item 18)

All financial and administrative matters of the Commission were considered at four meetings of the Standing Committee on Finance and Administration held on 5, 7, 8, and 9 June 1967. Reports of the Standing Committee were presented to the Plenary Session of the Commission on 9 June 1967.

a) Panel memberships

The Standing Committee reviewed panel memberships as required under Article IV(2) of the Convention. Application by the People's Republic of Romania for admission to membership in Panel 5 was adopted by the Commission on the recommendation of the Standing Committee. This brought the number of panel memberships to 41 for the year 1967–68. Memberships are distributed among the 14 member countries as follows:

Panel:	1	2	3	4	5	A	Total
Canada		+	+	+	+	+	5
Denmark	+					+	2
France	+	+	+	+			4
Germany, Fed. Rep.	+	+					2
Iceland	+						1
Italy			+	+			2
Norway	+					+	2
Poland	+	+	+				3
Portugal	+	+	+	+			4
Romania					+		1
Spain	+	+	+	+			4
USSR	+	+	+	+	+		5
UK	+	+	+				3
USA			+	+	+		3
TOTAL	10	8	9	7	4	3	41

b) Reports by the Secretariat

The Executive Secretary submitted the following reports on administrative matters:

i) Auditor's Report for the fiscal year ending 30 June 1966 (1966 Annual Proceedings vol. 16, p. 10–13);

ii) Administrative and Financial Report for the fiscal year ending 30 June 1967 (complete to 17 May 1967) (Commissioners' Document 67/8);

iii) Budget estimate for the fiscal year ending 30 June 1968 (Appendix I to the 1967 Agenda for the meetings of the Standing Committee on Finance and Administration);

iv) Budget forecast for the fiscal year ending 30 June 1969 (Appendix II to the 1967 Agenda for meetings of the Standing Committee on Finance and Administration).

c) Recommendations on finance and administration

The Commission adopted the following **recommendations** of the Standing Committee;

i) that the Auditor's Report showing appropriations of Can. $95,730 and obligations incurred of Can. $86,379 for the fiscal year ending 30 June 1966 (1966 Annual Proceedings vol. 16, p. 10–13) be adopted;

ii) that the provisional Administrative and Financial Report for the fiscal year ending 30 June 1967 (estimated from 16 May 1967) (Commissioners' Document 67/8) be amended by adding supplementary appropriations of $550 from income and $3,240,55 from the Working Capital Fund to cover expenditures in excess of appropriations for 1966–67;

iii) that the People's Republic of Romania be admitted to membership in Panel 5;

iv) that the Romanian billing for its contribution to the Working Capital Fund on joining the Commission 21 March 1967 be made on the basis of a Working Capital Fund of Can. $10,000;

v) that the second sentence of Commission Financial Regulation 6.2 be amended to read: "The sources of monies of the Working Capital Fund shall be advances from the member states and the sale of publication; advances from new member states shall be 750 Canadian dollars";

vi) that a subcommittee, consisting of one member from each of Canada and USA (and other member countries if they so desire) with the Executive Secretary, be set up to review the financial regulations including consideration of the bank interest question and the crediting of Canadian income tax, if the Canadian Government action is favourable, and to consider a Norwegian proposal that the size of the Standing Committee on Finance and Administration be reduced.

vii) that, based on a reappraisal by the Civil Service Commission of Canada due to 1966 changes in classification standards, the position classification for staff members of the Commission's Secretariat be Administrative Services (AS) 9 for the Executive Secretary, Administrative Services (AS) 6 for the Assistant Executive Secretary, Information Services (IS) 1 for the Editorial Assistant, Secretarial Typing (ST) 7 for the Senior Secretary, Secretarial Typing (ST) 5 for the Clerk-Stenographer and Clerical Regulatory (CR) 2 for the Clerk-Typist, including the application of Canadian Government salary revisions effective 1 October 1965 and 1 October 1966;

viii) that the Contracting Governments be billed for payments due under the 1967–68 administrative budget of the Commission on 15 August 1967;

xi) that for the 1967–68 billing, the Commission income from bank interest be credited to the member states;

x) that the starting date for the Eighteenth Annual Meeting of the Commission in London, England, be changed from 3 June (Monday) to 4 June (Tuesday) 1968 and that the meeting continue through 8 June (Saturday) 1968 inclusive;

xi) that the kind invitation of the Government of the Polish People's Republic to hold the Nineteenth Annual Meeting of the Commission in Warsaw, Poland, from 2 to 7 June 1969 inclusive be accepted with thanks;

xii) that the Commission appropriate a sum of Can. $98,500 from Contracting Governments to meet ordinary expenditures and Can. $7,500 from the Working Capital Fund to cover additional publication costs of Special Publication No. 7 (NORWESTLANT 1–3 Report) ($4,000) and to cover the additional costs of retroactive salary ($3,500), for the fiscal year ending 30 June 1968, the appropriations to be used for the following purposes:

1.	Personal Services	
	a) Salaries	$ 55,200
	b) Superannuation	1,500
	c) Additional help	1,200
	d) Group medical and insurance plans	500
	e) Retroactive salary	1,000
2.	Travel	6,500
3.	Transportation	500
4.	Communications	3,000
5.	Publications	13,600
6.	Other Contractual Services	4,000
8.	Materials and Supplies	3,500
8.	Equipment	1,000
9.	Annual Meeting	6,000
10.	Contingencies	1,000
	Total Ordinary Expenditures	$ 98,500
	Special expenditures to be covered from Working Capital Fund for	
	a) Special Publication No. 7	$ 4,000
	b) Additional cost of retroactive salary	$ 3,500

xiii) that Contracting Governments note for consideration at the Eighteenth Annual Meeting, the following advance budget estimate of Can. $105,700 to meet administrative expenditures and Can. $8,000 to meet special expenditures for the fiscal year ending 30 June 1969:

1.	Personal Services	
	a) Salaries	$ 57,200
	b) Superannuation	1,800

	c) Additional help	1,200
	d) Group medical and insurance plans	500
	e) Contingencies	5,000
2.	Travel	6,500
3.	Transportation	500
4.	Communications	3,500
5.	Publications	14,000
6.	Other Contractual Services	4,000
7.	Materials and Supplies	3,500
8.	Equipment	1,000
9.	Annual Meeting	6,000
10.	Contingencies	1,000
	Total Ordinary Expenditures	$ 105,700
	Special expenditures to be covered from the Working Capital Fund for	
	a) Marine Food Chains Symposium	$ 8,000

xiv) that the Commission note the unanimous re-election of Mr R. W. Green of USA as Chairman of the Committee for the year ending 30 June 1968.

8. Report of the *ad hoc* Committee on Trawl Regulations (Items 5, 6, 7, and 8)

The *ad hoc* Committee, under the Chairmanship of Dr A. W. H. Needler (Canada), was assigned plenary agenda item 5 on infringements to the Commision's trawl regulations, item 6 on simplification of the Commission's trawl regulations, item 7 on topside chafing gear, and item 8 on mesh problems.

a) Infringements to the Commission's trawl regulations

Reports from Contracting Governments relating to mesh size, mesh obstruction, and excess landings for the year 1966 were reviewed by the Committee and adopted by the Commission.

b) Simplification of the Commission's trawl regulations

The Committee examined a simple codification of the Commission's trawl regulations prepared by the US delegation at the request of the Sixteenth Annual Meeting. Suggestions for improvement resulted in the completion of a Simplified Guide to ICNAF Fishery Regulations, 1967/68, with annexes on mesh size differentials and approved topside chafing gear. The Commission reviewed the simplification which included all proposals adopted through the 1967 Annual Meeting. The Commission **agreed** that the simplification should not be adopted to replace the basic regulations but should be termed a guide brought up to date at each Annual Meeting and made available as an easy reference to the Commission's trawl regulations.

c) Topside chafing gear

The Committee reviewed the scientific advice of the Standing Committee on Research and Statistics regarding the ICNAF-type, modified ICNAF-type, multiple flap-type, and Polish-type (large mesh-type) topside chafers approved by the Commission and noted that the use of the Polish-type chafer had proved effective in strengthening codends and showed no effect on selectivity. Based on scientific advice and the recommendation of the Committee and Panels 1–5, the Commission adopted the **recommendations**

i) that specifications of the Polish-type (large mesh-type) chafer which are set out in Appendix E to ICNAF Notification Series No. 1 be modified to allow the chafer to extend over all or any part of the length of the upper side of the codend if this is needed for additional strength to the codend;

ii) that experiments on means of eliminating the need for topside chafing gear be pressed.

d) Mesh problems

The Committee reviewed the temporary approval, until the 1967 Annual Meeting, of the ICES and NEAFC mesh measuring gauges as alternatives to the ICNAF mesh measuring gauge. It also reviewed the report of the ICNAF Working Group on Mesh Problems which met in London 21–23 November 1966 to consider the possibility of introducing a single mesh measuring gauge of

uniform application in the trawl fisheries throughout the North Atlantic. It noted that the Working Group considered two gauges: a **USSR modified ICNAF wedge-shaped gauge** with thickness and taper as prescribed by ICNAF regulation but with pressure applied by using a weight in order to eliminate the spring-loaded mechanism unacceptable in court proceedings, which the Working Group recommended for adoption as a standard ICNAF gauge, and a **UK modified NEAFC gauge** with alternate tapered and parallel-sided sections which NEAFC adopted at its 1967 Annual Meeting for its recommended scheme of international control. The Committee, in considering both gauges for possible ICNAF adoption, recognized that one of the main difficulties in standardization of gauges and of methods of measuring lay in the differences between ICNAF and NEAFC regulations. In order to bring the ICNAF mesh measuring requirements in line with the NEAFC mesh measuring requirements for the NEAFC proposed scheme for international control and thus take the first steps in attempts to standardize mesh measuring for the ICNAF and NEAFC areas of the North Atlantic, the following Committee **recommendations** were adopted by Panels 1–5 (see Section 15 (g)) and the Commission:

i) that the ICNAF mesh measuring regulations in Subareas 1–5 be amended to provide for a single standard pressure, force or pull of 5 kg, instead of a range of pressures from 4.5 to 6.8 kg, in the method of application of the ICNAF mesh measuring gauge;

ii) that the ICNAF mesh measuring regulations in Subareas 1–5 be amended to provide for the measurement of 20 consecutive meshes, instead of 50 consecutive meshes, in the codend;

iii) that the matter of a single standard mesh measuring gauge be reviewed again at the 1968 Annual Meeting with the understanding that use of a single gauge for international and national enforcement is most desirable, that the gauge with thickness, taper and pressure specified by ICNAF is to be used in international inspections, that the gauge is to be the final criterion for ensuring that minimum mesh sizes are being enforced by nationals and that adoption of the single gauge should not prevent development of any better method and gauge for enforcement;

iv) that arrangements be made for joint consideration by ICNAF and NEAFC of their respective regulations with a view to devising a single procedure and gauge for measuring meshes.

The Committee noted the expiration of the 1966 approval of the alternative ICES and NEAFC gauges. No recommendations were made for alternatives to the approved ICNAF guage for the 1967–68 period.

The Committee recognized the need to establish mesh size differentials for nets of different materials to meet the 130 mm mesh size regulation in Subarea 1 and accepted the following **recommendations** of the Standing Committee on Research and Statistics which were adopted by Panel 1 and the Commission:

v) that mesh differentials for Subarea 1 be the same as those in Region I of NEAFC, namely 110 mm for seine nets, 120 mm for such part of any trawl net as is made of cotton, hemp, polyamide fibres, or polyester fibres and 130 mm for such part of any trawl net as is made of any other material;

vi) that the need for mesh differentials be kept under continuing review.

9. Status of International Trawl Regulations
(Item 4b)

The Commission, in Plenary session, reviewed the status of the proposals for international regulation of the trawl fishery (1957–66) under the Convention. It was pleased to **note** that

approval of the modified Polish-type topside chafer (Section 8 (c) (i)) assured early action by Poland to accept the codification of regulations adopted at the 1965 Annual Meeting for Subareas 1–3 and by USSR to withdraw its conditional acceptance of the 1965 codification for Subareas 1–4; thus, bringing into force all trawl regulations proposed up to and including those for 1965 for Subareas 1–5 of the Convention Area.

The Commission was also **assured** of early acceptance of the 130 mm mesh size proposal for Subarea 1 by Denmark, Poland, Portugal, and Spain, which would bring into force the only 1966 proposal for international regulation of the trawl fishery under the Convention.

The Commission **authorized** the Executive Secretary to inform the Depositary Government that the Commission has considered the content of the diplomatic note received by Depositary Government on 1 December 1966 relating to the Portuguese approval of Polish conditional acceptance of 1961 proposals for trawl regulations in Subareas 1–3 and that the Commission has approved the modified Polish-type topside chafer for use in the Convention Area.

10. International Control (Items 4(a), 9 and 10)

a) Status of Protocol relating to measures of control

The Commission, in continuing its consideration of the possibilities for international inspection, **noted** that Denmark, Fed. Rep. Germany, Italy, Poland, Portugal, and USSR had not yet ratified the Protocol of June 1963 which would allow it to make proposals for national and international measures of control on the high seas for the purpose of ensuring the application of the Convention and measures of control in force thereunder. The Commission was assured by all those member countries, except Italy, that steps were being taken to ratify. Since Italy was not repreesnted at the Annual Meeting, the Commission adopted the following **recommendation:**

i) that the proper Italian authorities be approached by the Executive Secretary and by Depositary Government to urge early ratification.

b) Exchange of inspection officers

Meanwhile, the Commission was pleased to hear reports that member countries were continuing to broaden their knowledge and understanding of each other's enforcement methods and problems as background for establishing a suitable international inspection system. Portugal and Spain reported joint inspection in Subareas 2, 3, and 4 in May 1967. Canada and USA again proposed inspection at sea which had been started in 1965.

c) Form of international inspection scheme

In considering the form of a possible international inspection scheme, the Commission had before it the scheme of Joint Enforcement developed for NEAFC at its Special Meetings on International Control held in November 1966 and May 1967 and adopted by its Fifth Annual Meeting in May 1967. Following lengthy discussion, the Commission agreed that the NEAFC scheme, despite differences in the NEAFC and ICNAF trawl regulations, could provide a useful basis for an ICNAF scheme and adopted the following **recommendations:**

i) that the views of member countries in regard to an international inspection scheme based on the NEAFC scheme be assembled by correspondence by the Executive Secretary;

ii) that these views be considered by an *ad hoc* Committee on Trawl Regulations at a meeting prior to the 1968 Annual Meeting;

iii) that the Chairman for such a meeting of the *ad hoc* Committee be provided by Canada.

11. Possible Conservation Actions (Items 11 and 12)

a) Limitation of fishing

The Commission continued its consideration of the various kinds of action which it might take for the purpose of maintaining the stocks of fish

in the ICNAF Area at a level at which they can provide maximum sustained yields. It reviewed the report of a Working Group established by ICNAF at the 1966 Annual Meeting with participation by FAO, NEAFC, and OECD, on Joint Biological and Economic Assessment of Possible Conservation Actions in the Convention Area (Commissioners' Document 67/19). It also took note of the endorsement, by the Standing Committee on Research and Statistics, of the Group's main conclusions concerning the state of the exploited cod and haddock stocks in the ICNAF Area and in Region I of the NEAFC Area, that with a reduction in the amount of fishing on them the same or a somewhat higher average annual catch could be achieved and that expected growth in fishing power greatly increases the urgency for steps to introduce effective control measures in the North Atlantic fisheries.

Following full discussion, which took into consideration the difficult scientific and practical problems to be solved before positive regulatory action could be taken, the Commission adopted the following **recommendations** of a special *ad hoc* Committee on Fishery Management which it had set up to decide on terms of reference for studies by the Standing Committee on Research and Statistics and by administrators and economists of the problem of adequate regulation for the fisheries:

i) that a Standing Committee on Regulatory Measures be set up;

ii) that each member country be invited to appoint an appropriate representative to the Standing Committee;

iii) that the Standing Committee meet in the near future to consider its program of operations and its future work on the economic and administrative aspect of the problems of introducing regulatory measures and those of the Standing Committee on Research and Statistics on scientific aspects of these problems, in accordance with the following guidelines for terms of reference for the administrative, economic and practical aspects:

a) Procedure of fixing annual catch quotas;

b) The nature of the quotas to be fixed with respect to species and area;

c) Problems of enforcement;

d) Principles of distributing quotas between countries;

e) Administration of quotas within countries;

and for the scientific aspects:

a) Estimates of optimum reduction in fishing effort required to achieve the maximum sustainable yield;

b) Research required to establish annual catch quotas;

c) Precision that can be achieved with available data, and effects of the errors in annual quotas on yield;

d) What are the magnitudes of the year-to-year adjustments in quotas necessary to take into account for each stock, year-class fluctuation, recovery of the stock due to conservation measures, errors in setting previous quotas, etc.;

e) Estimation of appropriate annual global quotas to achieve part or all of reduction in (a);

f) Timetable.

iv) that the new Standing Committee present a preliminary report of its activities to the Eighteenth Annual Meeting of the Commission, London, June 1968.

b) Prohibition of fishing for Atlantic salmon

The Commission noted the Canadian proposal to prohibit fishing for Atlantic salmon on the high seas based on its concern about the possibility of the further development of major high seas fisheries for salmon in the Northwest Atlantic reducing the number of salmon available to Canadian Atlantic salmon fishing operations. Following consideration of the matter by a joint meeting of Panels 1–5 and the suggestion that further scientific investigations such as those recommended by the ICES/ICNAF Joint Working Party on North Atlantic Salmon (Commissioners' Document 67/17) could provide a firm background of scientific evidence on which to base a decision, the Canadian proposal was withdrawn for resubmission to a later meeting of the Commission.

12. Fishing Practices (Item 13)

The Commission was pleased to note that a draft Convention on Conduct of Fishing Operations in the North Atlantic was approved by representatives of 18 countries, including all members of ICNAF except the new member Romania, present at the Third Fisheries Policing Conference in March 1967. The Convention applies to the whole of the North Atlantic and Arctic. It establishes general rules of good conduct for fishing vessels; deals with methods of registration and marking of vessels; and makes detailed provisions for such matters as the light and sound signals to be given while fishing and the marking of gear. The Convention makes it clear that implementation is primarily for the flag state but there is also provision for investigations and reports to be made by the inspectors of one country regarding alleged contraventions by vessels belonging to another contracting party. Reservations may, however, be made against this provision.

The Commission **noted** that ratification of the Convention would mark an important step forward in international cooperation in the field of fisheries.

13. Relations with Other International Organizations (Items 14, 15, 16, and 23)

a) COFI Subcommittee on the development of cooperation with international organizations concerned with fisheries.

The Commission noted that the subcommittee was established to review the status, scope, and adequacy of regional and international fisheries bodies in respect of needs for and development of conservation measures based on scientific evidence and that there were no recommendations directly affecting ICNAF. A compendium of the scope, organization, and functions of the various regional and international fisheries bodies in existence throughout the world was being developed.

b) UN Resolution on marine resources 2172 (XXI)

The Commission reviewed the Resolution adopted by the UN General Assembly 6 December 1966 and noted that the Resolution called for a comprehensive survey of activities in marine science and technology and proposals for better coordination and exploitation of marine resources including the conservation of fish stocks. The Commission recognizing that the latter was a field of direct concern and could have important implications for the future of ICNAF agreed:

i) that the Executive Secretary, on behalf of the Commission, seek the approval of the Secretary General of the United Nations for an ICNAF observer to attend meetings of the UN Group of Experts established under A/RES/2172 Resources of the Sea to advise the Secretary General;

ii) that, following approval, the Commission accept the kind offer of Dr A. W. H. Needler (Canada) to act as ICNAF observer.

c) Legal aspects of scientific research on the high seas

The Commission noted the USSR proposal to create an IOC Working Group which would deal with the broad legal aspects of scientific research on the high seas (Commissioners' Document 67/22). Following brief discussion, the Commission **agreed**:

i) that, since most, if not all, ICNAF member countries are also members of the IOC and can be expected to

comment on this proposal at the IOC session in October 1967, the Executive Secretary inform the Secretary of IOC that ICNAF member countries prefer to deal with this proposal in IOC itself and, therefore, ICNAF has no suggestions to make at this time;

ii) that it be kept informed of IOC action on this subject.

d) International cooperation

The Commission has continued to cooperate effectively with FAO, ICES, NEAFC, and OECD in the development of statistical research, management programs and practices in the best interests of international fisheries in general and Northwest Atlantic fisheries in particular. Reports on subjects of mutual interest and concern were exchanged with other international organizations.

The Commission again appointed Mr A. J. Lee (UK) as observer to the 1967 meetings of IOC and SCOR and Dr H. A. Cole (UK) as observer to the 1967 ICES meeting.

14. Report of the Standing Committee on Research and Statistics (Item 17)

The Committee met under the chairmanship of Dr W. Templeman (Canada) with Dr R. L. Edwards (USA) as Rapporteur from 29 May to 2 June 1967. The Assessments and the Statistics and Sampling Subcommittees met 25–27 May. Further meetings of the Standing Committee were held from 5 to 9 June 1967.

The Report of the Standing Committee with the reports of its subcommittees as appendices is published as ICNAF Redbook 1967, Part I. The Report was adopted by the Commission in Plenary session on 9 June 1967 and is summarized below:

a) Assessments

The Assessments Subcommittee reported:

i) that the total fishing activity in the groundfish fisheries in the ICNAF Area in 1965 continued the increasing trend of recent years. In 1966, the total catch of groundfish decreased in both the northern and southern subareas, while herring catches increased greatly in the southern subareas;

ii) that new assessments confirmed that long-term gains would result in the cod fisheries of West Greenland and Northern Gulf of St. Lawrence from an increase in mesh size up to 150 mm and in the cod fisheries of Subarea 2 and the northern part of Subarea 3 from a reduction in total fishing intensity of up to 30%;

iii) that, since the increase in the fishing intensity in the spring cod fishery in Div. 4T and 4V in the early 1950's, the catch-per-unit effort has decreased, older age-groups are less abundant, younger age-groups have increased in abundance and growth has declined while the total yield since 1960 has remained stable;

iv) that the large increase in Subarea 5 haddock catch in 1965 and 1966 was due to an increase in fishing effort and recruitment by the strong 1963 and 1962 year-classes. The weak year-classes since 1963 are likely to result in below-average catches;

v) that it endorsed the views of the Working Group on Joint Biological and Economic Assessment of Conservation Actions that continued growth in fishing power is expected and that this greatly increases the urgency for steps to introduce effective control measures in these North Atlantic fisheries;

vi) that the mesh regulations controlling the size at which fish enter the fishery are of continuing importance. The fishing mortality rate in most of the cod and haddock stocks is such that even with larger mesh sizes, descreses in fishing intensity would not result in

a decrease in the long-term yield. Consideration was given to the biological data required to provide a system of catch quotas for the cod and haddock fisheries in the North Atlantic. Comprehensive data on the abundance of pre-recruit age-groups are needed to permit the adjustment of quotas following changes in stock abundance due to year-class fluctuations. A review of the data currently being collected in national research programs indicated that these data are available for one or more years prior to the age of recruitment for the haddock stocks and for some of the important cod stocks in the ICNAF Area, although it was recognized that in the event of a catch quota system being introduced in this area, increased research effort would have to be devoted to the estimation of pre-recruit year-class strength;

vii) that the 1966 report of the ICES/ICNAF Joint Working Party on North Atlantic Salmon should be approved and published in the ICES Cooperative Research Report series, meanwhile meetings of the Working Group should continue to be held at regular intervals with all countries concerned providing further information for a reliable assessment of the effects of the Greenland salmon fishery on the North American and European salmon stocks.

b) Statistics and sampling

The Committee approved the report of the Subcommittee endorsing the following **recommendations** of the ICES/ICNAF/FAO Continuing Working Party (CWP) on North Atlantic Statistics:

i) that ICNAF collect and publish data from a proposed Statistical Area 6 and that this area be designated as that part of the western North Atlantic bounded by a line beginning at a point on the coast of Rhode Island in 71°40′ west long; thence due south to 39°00′ north lat; thence due east to 42°00′ west long; thence due south to 35°00′ north lat; thence due west to the coast of North America; thence northward along the east coast of Hatteras Island, past Oregon Inlet along the coasts of North Carolina, Virginia, Maryland, Delaware, New Jersey, New York, Connecticut, and Rhode Island to the point on Rhode Island at 71°40′ west long. Further that the divisions of Statistical Area 6 be established as recommended by CWP, except for the line separating Div. 6B and 6C, which should run along 37°00′ north lat; from 70°00′ west long to 76°00′ west long; thence due south to shore. And, that the Secretariat should provide a specific description for each division, using any advice necessary;

ii) that Statistical Division 5Z be divided at 70°00′ west long into an eastern subdivision, 5Ze, and a western subdivision, 5Zw;

iii) that the CWP be renamed the Coordinating Working Party and that ICNAF continue to be represented at its future meetings. The Commission also endorsed recommendations relating to the methods of measuring and recording fish lengths, the evaluation of the ICNAF List of Vessels, the collection of fishing effort data and the designation of the hakes (*Urophycis*).

c) Gear and selectivity

The Committee approved the report of the Subcommittee which supported (1) measuring 20 meshes of the codend instead of 50 meshes as required by the trawl regulations; (2) having mesh size differentials for different trawl mesh materials in relation to 130 mm mesh size for manila in Subarea 1 conform with those in Region 1 of NEAFC; (3) amending the specifications of the Polish-type chafer to permit the length to be the same as the

length of the codend and experiment on eliminating the need to use topside chafing gear.

d) Environmental studies

The Committee noted that most of the data from the ICNAF Environmental Surveys NORWESTLANT 1–3, 1963 were now ready for publication, that 12 research papers from world authorities in meteorology, oceanography, and fisheries were presented at a special meeting of the Environmental Subcommittee on fluctuations in sea and air temperature in the ICNAF Area since 1960 (see Redbook 1967, Part IV) and that USA and USSR are to carry out a small trial survey of sampling gear and techniques as a preliminary to a larger Georges Bank environmental survey.

e) Other matters

The Committee, in special session, reviewed and discussed a draft outline of an FAO survey of the living resources of the Northwest Atlantic including a description of the fish stocks and fisheries in the ICNAF Area for the FAO Indicative World Plan which is concerned with the potential world food production in 1975 and 1985. The Committee also reviewed three USSR papers which indicated difference between the *marinus-type* and *mentella-type* redfish on the basis of protein patterns of blood serum and on the level of thermo-stability of isolated muscles and which differentiated male and immature female redfish from mature females by the presence of an antigen complex in the latter only.

The Committee **recommended** the following items on publications and other matters:

i) that the Commission provide $8,000 in the fiscal year 1968–69 in support of the FAO/UNESCO/ICES/ICNAF/IBP Symposium on Marine Food Chains to be held in Aarhus, Jutland, Denmark, from 23 to 26 July 1968 inclusive;

ii) that the Commission provide $4,000 in the fiscal year 1967–68 to cover the additional cost of publishing the Special Publication No. 7 (NORWESTLANT 1–3 Report);

iii) that the Chairman of the Assessment Subcommittee be invited to attend, at Commission expense, meetings of the new Standing Committee on Regulatory Measures;

iv) that a mid-year meeting of the Assessments Subcommittee be convened, if necessary, to provide information for the Standing Committee on Regulatory Measures, with the expenses of the Chairman of the Assessments Subcommittee to be met by the Commission;

v) that the Executive Secretary arrange for revising, redrawing, and reprinting the coloured map of the Convention Area;

vi) that the Assessments Subcommittee meet 23–24 May 1968, the Statistics and Sampling Subcommittee on 25 May 1968, the Steering and Publications Subcommittee on 26 May 1968, and the Standing Committee on Research and Statistics from 27 May to 1 June 1968, prior to the 1968 Annual Meeting of the Commission in London.

The Committee elected Mr Sv. Aa. Horsted (Denmark) its Chairman for the ensuing year and acknowledged the fine efforts of Dr W. Templeman as Chairman during the past 3 years

15. Reports of the Meetings of Panels
(Item 19)

The Commission received the reports of Panels 1–5 and Panel A (Seals) as well as the reports of two joint meetings of Panels 1–5. The status of the fisheries, research carried out and plans for future research were reviewed by each panel based on reports by its group of scientific advisers.

a) **Panel 1.** The panel, under the chairmanship of Dr H. A. Cole (UK), endorsed the recommendation of the Standing Committee on Research and Statistics for approval of the Report of the ICES/ICNAF Joint Working Party on North Atlantic Salmon

and its publication in the ICES Co-operative Research Report series. Noting that the salmon catch increased in 1966 to 1,300 tons from 900 tons in 1965, the Panel emphasized the need for continued ICES and ICNAF collaboration and for further improvement in statistical reporting for Atlantic salmon.

The panel noted that the 130 mm mesh size proposed for Subarea 1 in 1966 was not yet in force and that a further increase to 150 mm would result in increase in total catches and substantial reduction in the quantities discarded and used for industrial purposes and in the costs of fish handling and processing aboard freezer trawlers. The panel urged that further studies of the distribution and abundance of the pre-recruit age-groups of cod and increased sampling of commercial catches be undertaken. Mr O. Lund (Norway) was elected Chairman of the Panel for the ensuing 2 years.

b) **Panel 2.** The panel, under the chairmanship of Mr W. C. Tame (UK), noted that cod made up over 90% of the total catch and increased by 5,000 tons to 338,000 tons in 1966, and that assessments confirmed the preliminary conclusions of last year that fishing intensity has probably reached the level giving maximum sustained yield and that the higher catch-per-unit effort in 1965 was probably due to the variability of environmental factors. Mr W. C. Tame (UK) was elected Chairman of the Panel for the ensuing 2 years.

c) **Panel 3.** The panel, under the chairmanship of Dr O. Rodriguez Martin (Spain), noted that the total catch of all species in the subarea increased from 740,000 tons in 1965 to 748,000 tons in 1966. Cod catches which made up 67% of the total catch remained the same as in 1965 It was agreed that a pre-recruit survey for cod was desirable and that participating countries should provide more information on sampling, length/age relationships, mesh sizes in actual use and on discards particularly. Dr H. A. Cole (UK) was elected Chairman of the Panel for the ensuing 2 years.

d) **Panel 4.** The panel, under the chairmanship of Mr J. Rougé (France), endorsed the recommendations of the Standing Committee on Research and Statistics with regard to Atlantic salmon. The panel noted that total of all species in the subarea increased more than 3% to 805,000 tons in 1966 due to improved catches of redfish in Div. 4R, 4S, 4W, and 4X, and of flounders, argentine, and herring. New assessments on spring cod stocks in Div. 4T and 4V indicated that, since 1950, the catch-per-unit effort has decreased, the older age-groups are less abundant, the younger age-groups have increased in abundance and in recent years growth has declined. The panel endorsed the importance of continued detailed studies of density dependent changes in the exploited fish populations with special reference to growth, recruitment and concurrent environmental changes. Captain T. de Almeida (Portugal) was elected Chairman of the Panel for the ensuing 2 years.

e) **Panel 5.** The panel, under the chairmanship of Dr A. S. Bogdanov (USSR), endorsed the subdivision of Div. 5Z into 5Ze and 5Zw for statistical purposes. The panel noted that the present mesh regulations are not sufficient to ensure that the haddock stocks are not exploited too heavily and rapidly and are thus producing less than their maximum yield. The panel emphasized the urgency for supplementary regulations, in addition to mesh regulation, to obtain a more rational utilization of the stocks. The panel was pleased to note the

plans for an environmental survey of the Georges Bank-Gulf of Maine area. Mr T. A. Fulham (USA) was elected Chairman of the Panel for the ensuing 2 years.

f) **Panel A (Seals).** The panel, under the chairmanship of Dr A. W. H. Needler (Canada), heard briefs from the International Society for the Protection of Animals (ISPA) and the Ontario Humane Society concerning the humane killing of seals in the commercial sealing operations. The panel was pleased to note the mutual understanding of the conservation and humane points of view among representatives of government, industry and animal welfare agencies. Following discussion of the research and management requirements the panel adopted the following **recommendations** which were approved by the Commission in plenary session on 9 June 1967:

i) that seal scientists from Canada, Denmark, and Norway meet in Hamburg at the time of the 1967 ICES meeting to consider research requirements and formulate a coordinated program to provide data required for determination of population estimates and sustainable yields;

ii) that representatives of Canada, Denmark, and Norway meet in Hamburg at the time of the 1967 ICES meeting to give serious consideration to sealing regulations both from the conservation and humane points of view and to discuss international inspection and possible joint enforcement procedures;

iii) that the Contracting Governments take appropriate action to ensure that, for the 1968 season only, the open season for taking or killing harp seals, *Pagophilus groenlandica*, and hood seals, *Cystophora cristata*, in the "Front Area" (all the waters of the Strait of Belle Isle and the Atlantic Ocean east of a straight line between the lighthouse at Amour Point on the coast of Labrador and the lighthouse on Flowers Island in Flowers Cove, Newfoundland) shall be from 6:00 a.m. local time on 12 March 1968 to 12:00 p.m. local time on 25 April 1968;

iv) that the Contracting Governments take appropriate action to prohibit the killing of adult (harp) seals in whelping patches in the "Front Area" (see (iii) above).

g) **Joint Meeting of Panels 1–5** Two joint meetings of Panels 1–5 were held on 6 and 9 June 1967 under the chairmanship of Mr T. A. Fulham (USA). The early meeting considered the Canadian proposal to prohibit fishing for Atlantic salmon on the high seas in the Convention Area (see Section 11 (b)). At the later meeting the Panels adopted the following **recommendations** which were approved by the Commission in plenary session on 9 June 1967:

i) that the Commission, in accordance with Convention Article VIII, adopt and transmit to Contracting Governments, through Depositary Government, the two proposals of the *ad hoc* Committee on Trawl Regulations which would establish (a) that the pressure or pull specified for ICNAF mesh measuring regulations should be at 5 kg and (b) that the ICNAF standard used in measuring a codend should be set at 20 consecutive meshes instead of 50 consecutive meshes;

ii) that the Commission adopt and advise Contracting Governments through the Commission's Notification Series of the following items:

a) that, with the expiry of the 1967 ICNAF meeting's approval, for 1 year, of the ICES and NEAFC

mesh measuring gauges as alternatives to the ICNAF gauge (ICNAF Notification Series No. 2), the only mesh measuring gauge approved for use in the Convention Area is the ICNAF mesh measuring gauge as described in the ICNAF trawl regulations for Subareas 1–5;

b) that mesh differentials for nets of different materials for Subarea 1 shall be the same as for those in Region 1 of NEAFC in order to meet the proposed 130 mm mesh size regulation in Subarea 1;

c) that specifications of the Polish-type chafer (ICNAF Notification Series No. 1) shall be modified to allow it to extend the whole length of the codend if this is needed for additional strength to the codend.

16. Election of Chairman and Vice-Chairman
(Item 20)

The Commission unanimously elected Mr V. Kamentsev (USSR) as Chairman and Dr A. W. H. Needler (Canada) as Vice-Chairman of the Commission for the 1967–68 and 1968–69 sessions.

17. Acknowledgements and Adjournment
(Item 24)

The Chairman acknowledged the observers from IOC, FAO, Japan, Ireland, the Netherlands, and NEAFC who expressed the appreciation of his country or organization for the invitation to attend the meeting. Suggestions that joint sessions of NEAFC and ICNAF might be useful and that the activities of the Panels might be strengthened were noted.

The Chairman thanked the Chairmen of the Committees and Panels, in particular Dr Templeman (Canada) for his excellent work as Chairman of the Standing Committee on Research and Statistics and Mr Green (USA) for his fine work as Chairman of the Standing Committee on Finance and Administration.

The Chairman expressed the Commission's gratitude to the Government of USA for its hospitality and excellent meeting facilities and to the US delegation, the Commonwealth of Massachusetts, the City of Boston, the US Industry Advisers and the State of Maine for their generous contributions to the welfare of the meeting participants.

The Chairman also thanked the Executive Secretary for his outstanding work in connection with the meeting as well as the efficient and speedy work of the Secretariat.

The new Chairman, Mr Kamentsev (USSR), thanked the Commission for the high honour accorded him and his country and commended the former Chairman of the Commission, Mr Fulham, for his excellent service over the past 2 years.

There being no other business, the Chairman declared the Seventeenth Annual Meeting of the Commission adjourned at 4:55 p.m., 9 June 1967.

APPENDIX I
LIST OF PARTICIPANTS

CANADA

Commissioners:

Dr A. W. H. Needler, Department of Fisheries, Ottawa, Ontario.
Mr H. D. Pyke, National Sea Products, Lunenburg, Nova Scotia.

Advisers:

Mr K. R. Allen, Fisheries Research Board of Canada, St. Andrew's, New Brunswick.
Mr H. R. Bradley, Department of Fisheries, St. John's, Newfoundland.
Mr J. Grieve, Bowring Bros. Ltd., St. John's, Newfoundland.
Dr J. L. Hart, Fisheries Research Board of Canada, St. Andrew's, New Brunswick.
Mr R. E. S. Homans, Department of Fisheries, Halifax, Nova Scotia.
Dr Yves Jean, Department of Industry and Commerce, Quebec, P.Q.
Mr K. Karlsen, Karl Karlsen Co., Halifax, Nova Scotia.
Mr Spencer Lake, H. B. Clyde Lake Ltd., St. John's, Newfoundland.
Dr L. M. Lauzier, Fisheries Research Board of Canada, St. Andrew's, New Brunswick.
Mr John Lazier, Bedford Institute of Oceanography, Dartmouth, Nova Scotia.
Mr Guy LeBlanc, Quebec United Fishermen, Montreal, P.Q.
Mr W. C. MacKenzie, Department of Fisheries, Ottawa, Ontario.
Dr A. W. May, Fisheries Research Board of Canada, St. John's, Newfoundland.
Dr F. D. McCracken, Fisheries Research Board of Canada, St. Andrew's, New Brunswick.
Dr D. E. Sergeant, Fisheries Research Board of Canada, Ste. Anne de Bellevue, P.Q.
Dr G. F. M. Smith, Fisheries Research Board of Canada, Ottawa, Ontario.
Dr W. M. Sprules, Department of Fisheries, Ottawa, Ontario.
Dr W. Templeman, Fisheries Research Board of Canada, St. John's, Newfoundland.

DENMARK

Commissioners:

Dr P. M. Hansen, Grønlands Fiskeriundersøgelser, Charlottenlund.
Mr H. J. Lassen, Ministry for Greenland, Copenhagen.
Mr K. Løkkegaard, Ministry of Fisheries, Copenhagen.

Advisers:

Mr Sv. Aa. Horsted, Grønlands Fiskeriundersøgelser, Charlottenlund.

FRANCE

Commissioners:

Mr R. Lagarde, Ministère de la Marine Marchande, Paris.
Mr J. Rougé, Ministère de la Marine Marchande, Paris.

Advisers:

Mr M. Boisgerault, Quartier de l'Inscription Maritime, St. Pierre et Miquelon.
Mr J. Morice, Institut Scientifique et Technique des Pêches Maritimes, La Rochelle.

FEDERAL REPUBLIC OF GERMANY

Commissioners:

Dr G. Meseck, Bundesministerium für Ernährung, Landwirtschaft und Forsten, Bonn.
Mr G. Möcklinghoff, Bundesministerium für Ernährung, Landwirtschaft und Forsten, Bonn.

Advisers:

Dr J. Genschow, German Trawler Owners' Federation, Cuxhaven.

Dr J. Messtorff, Bundesforschungsanstat für Fischerei, Bremerhaven.
Dr A. Meyer, Institut für Seefischerei, Bundesforschungsanstalt für Fischerei, Hamburg.

ICELAND

Commissioners:

Dr J. Jónsson, Marine Research Institute, Reykjavik.

ITALY

Observer:

Dr G. Russo, Consulate General of Italy, Boston, Massachusetts.

NORWAY

Commissioners:

Mr G. H. Gundersen, Ministry of Fisheries, Oslo
Mr O. Lund, Directorate of Fisheries, Bergen.
Dr B. Rasmussen, Institute of Marine Research, Bergen.

Advisers:

Mr E. Bratberg, Institute of Marine Research, Bergen.
Mr P. Karlsen, Fishing Ships Organization, Brandal.

POLAND

Commissioner:

Dr F. Chrzan, Sea Fisheries Institute, Gdynia.

PORTUGAL

Commissioner:

Captain Tavares de Almeida, Commisao Consultiva Nacional das Pescarias do Noroeste do Atlântico, Lisbon.

Adviser:

Dr R. Monteiro, Instituto de Biologia Maritima, Lisbon.

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Commissioner:

Mr C. Nicolau, Ministry of Foodstuff Industry, Bucharest.

Advisers:

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Mr Vicente Bermejo, Dirección General de Pesca Marítima, Madrid.
Dr O. Rodríguez Martín, Dirección General de Pesca Marítima, Madrid.

Adviser:

Mr José-Luis Arambarri, Delegado do PYSBE, St. John's, Newfoundland

UNION OF SOVIET SOCIALIST REPUBLICS

Commissioners:

Dr A. S. Bogdanov, All-Union Research Institute of Marine Fisheries and Oceanography, (VNIRO), Moscow.
Mr V. M. Kamentsev, Ministry of Fisheries, Moscow.
Mr A. A. Volkov, Ministry of Fisheries, Moscow.

Advisers:

Dr S. A. Studenetsky, Atlantic Research Institute of Marine Fisheries and Oceanography, (AtlantNIRO), Kaliningrad.
Mr L. M. Zheltov, Ministry of Fisheries, Moscow.

UNITED KINGDOM

Commissioners:

Dr H. A. Cole, Fisheries Laboratory, Lowestoft.
Mr B. B. Parrish, Marine Laboratory, Aberdeen.
Mr W. C. Tame, Ministry of Agriculture, Fisheries and Food, London.

Mr D. J. Garrod, Fisheries Laboratory, Lowestoft.
Mr A. J. Lee, Fisheries Laboratory, Lowestoft.
Mr B. E. Sealey, Chr. Salvesen & Co. Ltd., Grimsby.

UNITED STATES

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Mr T. A. Fulham, Commonwealth Ice and Cold Storage, Boston. Massachusetts.
Mr R. W. Green, Department of Sea and Shore Fisheries, Augusta, Maine.

Advisers:

Mr James Ackert, Atlantic Fishermen's Union, Boston, Massachusetts.
Mr Joseph Chase, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts.
Mr Harold E. Crowther, Bureau of Commercial Fisheries, Washington, D.C.
Mr Richard E. Cutting, Atlantic Sea-Run Salmon Commission, Orono, Maine.
Mr J. Dykstra, Point Judith Fishermen's Coop., Narragansett, Rhode Island.
Dr R. L. Edwards, Bureau of Commercial Fisheries, Woods Hole, Massachusetts.
Mr S. J. Favazza, Gloucester Fisheries Commission, Gloucester, Massachusetts.
Mr G. A. Flittner, Bureau of Commercial Fisheries, La Jolla. California.
Mr Walter Folger, First United States Coast Guard District, Boston, Massachusetts.
Mr John T. Gharrett, Bureau of Commercial Fisheriest, Gloucester, Massachusetts.
Dr H. W. Graham, Bureau of Commercial Fisheries, Woods Hole, Massachusetts.
Mr Richard Griffith, Bureau of Sport Fisheries and Wildlife, Boston, Massachusetts.
Mr G. F. Kelly, Bureau of Commercial Fisheries, Woods Hole, Massachusetts.
Mr R. Kershaw, Gloucester Whiting Association, Gloucester, Massachusetts.
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Mr J. W. McGary, U.S. Coast Guard Oceanographic Unit, Washington, D.C.
Mr D. L. McKernan, Bureau of Commercial Fisheries, Washington, D.C.
Mr J. J Martin, National Maritime Union New York, N.Y.
Mr A. L. Meister, Atlantic Sea-Run Salmon Commission, Orono, Maine.
Mr T. A. Norris, Trawler Oil Corporation, Boston Massachusetts.
Mr V. J. Norton, Bureau of Commercial Fisheries, Washington, D C.
Mr H. O'Rourke, Boston Fisheries Association Inc., Boston, Massachusetts.
Mr J. A. Posgay, Bureau of Commercial Fisheries, Woods Hole, Massachusetts.
Mr G. Ridgway, Bureau of Commercial Fisheries, Boothbay Harbour, Maine.
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Mr B. E. Skud, Bureau of Commercial Fisheries, Boothbay Harbour, Maine.
Mr C. W. Starratt, F. T. O'Hara Gear Co., Boston, Massachusetts.
Mr W. L. Sullivan, Department of State, Washington, D.C.
Mr W. M. Terry, Bureau of Commercial Fisheries, Washington, D.C.
Mr L. W. Van Meir, Bureau of Commercial Fisheries, Washington, D.C.
Mr F. Wilbour, Marine Fisheries, Boston, Massachusetts.
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GENERAL FISHERIES COUNCIL OF THE MEDITERRANEAN

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INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA

Observer:

Dr H. A. Cole, Fisheries Laboratory, Lowestoft, England.

INTERNATIONAL NORTH PACIFIC FISHERIES COMMISSION

Observer:

Dr A. W. H. Needler, Department of Fisheries, Ottawa, Canada.

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION

Observer:

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INTERNATIONAL PACIFIC HALIBUT COMMISSION

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SCIENTIFIC COMMITTEE ON OCEANIC RESEARCH

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Mr A. J. Lee, Fisheries Laboratory, Lowestoft, England.

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Dr B. J. Kowalewski, Assistant Executive Secretary.
Mr W. H. Champion, Editorial Assistant.
Miss J. Maclellan, Secretary.
Miss G. Schrader, Clerk-Stenographer.
Mrs C. Turple, Clerk-Typist.

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Miss A. Cioffi, Department of State, Washington.
Mrs B. Thompson, Bureau of Commercial Fisheries, Gloucester.
Miss M. Ziccardi, Department of State, Washington.

CONFERENCE ADMINISTRATIVE STAFF

Mr W. W. Sabbagh, Department of State, Washington.
Mr E. T. Mike, Bureau of Educational and Cultural Affairs, Washington.

APPENDIX II
AGENDA

PROCEDURES

1. Opening.
2. Agenda.
3. Publicity.

COMMISSION PROPOSALS

4. Status of proposals adopted by Commission;
   a) for changes in Convention;
   b) for international regulation of fisheries.

TRAWL REGULATIONS

5. Annual Returns of Infringements.
6. Simplification of international trawl regulations.
7. Topside chafer.
8. Mesh measuring.

ENFORCEMENT

9. Exchange of national inspection officers.
10. Form of international inspection scheme.

CONSERVATION

11. Possible conservation actions;
    a) Regulation of fishing effort;
    b) Regulation of catch;
    c) Biological and economic effects of possible conservation actions.

12. Canadian proposal to prohibit fishing for Atlantic salmon on the High Seas in the Convention Area by any method and Reports of ICES/ICNAF Joint Working Party on North Atlantic Salmon.

FISHING PRACTICES

13. Review of Reports of 2nd and 3rd Fisheries Policing Conference, London, 17–29 October and 6–17 March 1967.

INTERNATIONAL COOPERATION

14. Development of cooperation with international organizations concerned with fisheries;
    a) FAO Committee on Fisheries, Subcommittee on Development of Cooperation with International Organizations concerned with Fisheries, Rome, 25–28 January 1967;
    b) UN Resolution on Resources of the Sea adopted by UN 6 December 1966.

15. Reports by Commission observers to meetings of other organizations concerned with fisheries:

    (INPFC, NEAFC, ICES, FAO, IOC, and SCOR).

16. Appointment of Commission Observers to meetings of other organizations concerned with fisheries.

REPORTS OF COMMITTEES AND PANELS

17. Report of Standing Committee on Research and Statistics.
18. Report of Standing Committee on Finance and Administration.
19. Reports of Panels.

OTHER MATTERS

20. Election of Chairman and Vice-Chairman for the two ensuing years.
21. Date and place of 1969 Annual Meeting.
22. Press statement.
23. Other business.
24. Adjournment.

PART 3

Summaries of Research and Status of Fisheries by Subareas, 1966

The following summaries were prepared from the research reports and other pertinent documents submitted to the 1967 Annual Meeting of the Commission from each Member Country. The summaries were prepared by the Chairmen of the Groups of Scientific Advisers to the Panels administering the work of the Commission in the Subareas. These Chairmen were:

for Subarea 1 — P. M. Hansen (Denmark);

for Subarea 2 — A. S. Bogdanov (USSR);

for Subarea 3 — H. W. Graham (USA);

for Subarea 4 — J. L. Hart (Canada);

for Subarea 5 — S. A. Studenetsky (USSR).

Subarea 1

Reports on research in 1966 were submitted by the following countries: Canada, Denmark, France, Fed. Rep. Germany, Iceland, Norway, Poland, Portugal, Spain, USSR, and UK.

1. Status of the Fisheries

Total catch of all species was 400,000 metric tons, a further decline of 4,000 tons from 1965. Catches by countries in 1966, with the 1965 catch in brackets for comparison, were: Denmark (Faroes) 65,000 tons (66,000); Denmark (Greenland) over 43,000 tons (40,000); France over 41,000 tons (40,000); Fed. Rep. Germany 101,000 (126,000); Iceland 3,000 tons (5,000); Norway 35,000 tons (32,000); Poland about 1,000 tons (45); Portugal over 75,000 tons (61,000); Spain 4,000 tons (1,000); USSR 224 tons (1,000); UK 21,000 (15,000); and non-member countries 11,000 tons (18,000).

Cod catches increased to over 362,000 tons from 360,000 tons in 1965. The Greenland inshore fishery was about 29,000 tons, 5,000 tons more than in 1965. Two Greenland vessels of 100 tons and two of 200 tons also fished for cod on the banks. Catches were used for the production of frozen fillets. Small cod taken in pound nets went for fish meal. Offshore fisheries were carried out by all countries mentioned except Canada. Catches by Iceland (2,000 tons), Poland (1,000 tons), Spain (4,000 tons), and USSR (224 tons) were insignificant. Of the major fishing countries, Fed. Rep. Germany caught over 20% less cod in 1966 (82,000 tons), Portugal 20% more (75,000 tons, of which 73,000 tons was taken by dory vessel), Denmark (Faroes) about the same (65,000 tons), France about the same (41,000 tons), Norway about 3,000 tons more (35,000 tons) UK 6,000 tons more (19,000 tons) and non-member countries 4,000 tons less (9,000 tons).

Redfish catches declined from 19,000 tons to 17,000 tons. Catches by the Fed. Rep. Germany decreased from 16,000 tons to 14,000 tons.

Salmon catches increased to over 1,300 tons from 860 tons in 1965.

2. Work Carried Out

a) **Canada:** Hydrographic and geological research work in northern Baffin Bay and Davis Strait. Parasitological work on salmon in Greenland.

b) **Denmark:** R/V *Adolf Jensen*, R/V *Dana* and Faroese M/T *Skalaberg*. Hydrographic work in coastal waters, especially at fixed station in Div. 1D and in Davis Strait. Studies on occurrence of cod larvae in Davis Strait. Sampling for age composition of cod stock and for age and growth studies of cod. Tagging experiments with cod and redfish. Salmon research work in collaboration with Scottish, English, and Canadian experts.

c) **Fed. Rep. Germany:** R/V *Anton Dohrn.* Hydrographic studies carried out in October 1966. Biological studies were carried out by factory trawlers and R/V *Anton Dohrn.* Collecting of material on cod for studies of age and size of cod and composition of year-classes in the cod stock. Observations on spawning cod. Studies on the strength of the 1962 and 1963 year-classes. Age of maturity of cod. Collection of small redfish for age studies. Studies on selectivity of different mesh sizes.

d) **Iceland:** Sampling for studies of age and length of cod mainly from Div. 1D in April and May; also some sampling of cod from East Greenland.

e) **Norway:** R/V *Johan Hjort.* Studies in Div. 1E, 1D, 1C, and 1B. Studies of the Irminger component of the West Greenland Current from 29 March to 4 May. Bottom longline and trawl for studies on cod year-classes. Occurrence of small cod using covered codend. Occurrence of cod eggs in the Davis Strait.

f) **UK:** R/V *Ernest Holt.* Biology of cod in Div. 1F and 1A–1D. Fishing in Div. 1A–1D for Atlantic salmon for tagging. Salmon research with Danish scientists.

g) **USSR:** R/V *Pobeda.* Hydrographic and biological research with cod food (*Euphausia*, launce, shrimps) and food migration of cod from May to August and September to November.

3. Hydrography

The winter 1965–66 was rather mild. In inshore waters at a station at the entrance to Godthaab Fjord below zero temperatures were not recorded during the winter. In Davis Strait, surface temperatures were very low in the early spring and much ice was observed in the sea. In deep water, temperatures were unusually high, especially in Div. 1A–1D. The Irminger component of the West Greenland Current was well developed. There seemed to be an inflow of cold polar water to the southern part of the area in August.

4. Cod

a) Eggs and larvae

Cod eggs were collected by Norway in early spring. Preliminary results seem to indicate that very few cod eggs were found. In July few cod larvae were taken with stramin nets in Div. 1B, 1C, and 1D. Best catches were made in Div. 1C. The 1966 year-class seems poor.

b) Cod age-groups 1, 2, and 3

Small cod were not abundant. The best year-class seemed to be 1963. This is surprising because this year-class was considered to be very poor owing to the low number of cod larvae found in West Greenland waters during the NORWESTLANT Surveys in 1963. It may be possible that small cod of this year-class were transported by the current from cod spawning places which were found in 1963 off East Greenland south of Angmagssalik. That the cod of the 1963 year-class are more numerous than the other young year-classes does not mean that it is a rich year-class. Possibly all the young year-classes are poor, the 1963 year-class included.

c) Commercial stock of cod

The commercial stocks of cod in the inshore waters and in the offshore waters were very similar. Two rich year-classes, 1960 and 1961, strongly predominate. The 1961 year-class has a more southerly distribution than the 1960 year-class. The 1957 and 1956 year-classes have nearly disappeared from the catches.

Cod tagging was carried out in offshore (USSR) as well as in inshore (Denmark) waters. Denmark has tagged 2,905 cod. From Danish experiments in 1959–66, 431 recaptures have been reported in 1966, of these 382 were recaptured in West Greenland waters, 7 off East Greenland and 39 in Iceland waters. USSR tagged a total of 4,500 cod. One tagging experiment with 2,000 cod yielded 1.2% recaptures.

In attempting to forecast the cod fisheries, it is believed that the two rich 1960 and 1961 year-classes will predominate in the catches in 1967. The 1960 year-class will occur in lesser numbers owing to the longer period of its exploitation. In Div. 1E and 1F small 4-year-old cod will be common.

5. Atlantic Salmon

Experiments were carried out by R/V *Dana* with drift nets in the Irminger Sea. Four salmon were caught. From mid-September to

mid-November, research work was carried out by Scottish, English, Canadian, and Danish salmon experts. A total of 728 salmon were tagged in Div. 1D. A total of 130 salmon tagged in foreign rivers were recaptured in inshore waters in West Greenland. The recaptures are from tagging experiments in Canada (111 recaptures), England (6), Scotland (11), and USA (2).

6. Redfish.

Denmark tagged 177 redfish in Godthaab Fjord. Previous redfish taggings have yielded 21 recaptures to 1966. Two of these recaptures were taken about 6 years after tagging. The stock of redfish, according to observations by the Federal Republic of Germany, has decreased greatly in the last few years, both in West and East Greenland waters.

Subarea 2

Research reports were submitted by the following member countries: Canada, France, Fed. Rep. Germany, Poland, Portugal, Spain, USSR, and UK.

1. Status of the Fisheries

Total catch decreased from an all-time high of 377,000 tons in 1965 to 366,000 tons in 1966. Over 70% of the catch was taken in Div. 2J (off southern Labrador.) Catches by countries in 1966 with the 1965 figure in brackets for comparison were: Canada 24,000 tons (27,000); France 31,000 tons (26,000); Fed. Rep. Germany 68,000 tons (44,000); Iceland 400 tons (600); Norway 1,200 tons (800); Poland 32,000 tons (23,000); Portugal 46,000 tons (73,000); Spain 49,000 tons (59,000); USSR 37,000 tons (67,000); UK 11,000 tons (11,000); and non-member countries 66,000 tons (46,000).

Cod made up over 90% of the total catch and increased by 5,000 tons to 338,000 tons in 1966. Greatest gains were shown by Fed. Rep. Germany from 39,000 tons in 1965 to 63,000 tons in 1966, Poland from 12,000 to 30,000 and non-member countries from 31,000 to 50,000 tons. Major decreases in catch were shown by Portugal from 73,000 tons in 1965 to 46,000 tons in 1966, Spain from 59,000 to 49,000 tons, USSR from 54,000 to 32,000 tons. Catches by Canada, France, Iceland, and Norway remained about the same.

Redfish catches declined from 23,000 tons in 1965 to 14,000 tons in 1966. The declines were in the Fed. Rep. Germany, Polish, USSR, and UK fisheries. A non-member country increased its catch from 6,000 tons to 8,000 tons.

2. Work Carried Out

a) **Canada:** Bedford Institute of Oceanography carried out oceanographic studies in Labrador and Irminger Sea in March–May 1966. Sampling for size and age in the Canadian inshore fishery was continued. In October R/V *A. T. Cameron* conducted studies on distribution and age and size composition of cod on the Labrador shelf. The Canadian icebreaker *d'Iberville* carried out studies on tagging of young harp seals during the hunting period in order to evaluate the rate of hunting intensity. One hunting vessel conducted work on determination of age composition for adult hood seal samples.

b) **France:** In August–September R/V *Thalassa* carried out oceanographic research from north of the Grand Bank to north of Hopedale Channel. R/V *Thalassa* and fishing vessels conducted studies on species composition of catches and its distribution by divisions and by depths.

c) **Fed. Rep. Germany:** In January 1966 R/V *Walther Herwig* studied oceanographic conditions and their influence on fish distribution. Age and size composition of cod in commercial catches as well as from research vessel catches was studied.

d) **Poland:** Studies were carried out on age and size composition of cod and flat-fish catches taken by fishing trawlers.

e) **Portugal:** Age and size composition of cod in catches made by fishing trawlers was determined.

f) Spain: Studies were carried out on age and size composition of cod catches taken by fishing trawlers

g) USSR: Research and scouting vessels conducted oceanographic surveys; size and age composition of catches was studied. Tagging of cod was continued, and experiments were carried out on selectivity of trawl codends with the Polish-type chafer.

h) UK: Size and age composition of fish in commercial catches was studied on shore. Collection of plankton samples was also continued.

3. Hydrography

Results of surveys carried out aboard the Soviet research and scouting vessels showed that during the first half of 1966 the temperature on the Labrador Shelf was considerably higher than long-term mean temperature. Some increase in salinity was also noted. It was obviously due to reduction of inflow of low-salinity waters of the inshore stream of the Labrador Current. Studies on ice distribution in the Northwest Atlantic carried out by PINRO (USSR) showed that in 1966 the amount of ice was the lowest for the past 5 years. Similar observations were made by German research vessels. The French R/V *Thalassa* surveyed distribution of temperature and salinity between 47°00′ and 56°30′N from the northern part of Grand Bank to the north of Hopedale Channel.

4. Plankton

UK reported continuation of the Continuous Plankton Recorder Survey, covering 4,400 miles in Subarea 2.

5. Cod

Canada continued studies on age and size composition of cod in catches taken by inshore fishery. Studies were also carried out on changes in growth rate of cod in relation to temperature from 1948 to 1966. France conducted research on distribution of catches by size with regard to depth. In August–September highest catches (400 kg per hour) were taken on the Labrador Shelf at depth of 150–275 m. Fed. Rep. Germany continued studies on age and size composition of cod in catches of commercial vessels as well as on board R/V *Walther Herwig*. The studies showed that age composition of cod changed in the following way: in 1965 the 1955, 1956, and 1957 year-classes made up 75.5% in catches In 1966 these year-classes made up only 44%. As a result, some decline in catches per unit of effort might be expected in the near future. Poland studied age and size composition of cod catches taken by commercial vessels. Four-to eight-year-old cod were dominant in catches. Growth rate of cod was also studied in different divisions of Subareas 2 and 3. Results point to the fact that growth rate of cod in Subarea 2 is lower as compared to cod in Subarea 3. Portugal studied age and size composition on board the commercial vessels. In March 5-to 8-year-old cod and in April–June, 8-to 10-year-old cod were predominant. USSR continued studies on age and size composition of catches on board the fishing and research vessels and on abundance of young cod. In 1966, 5- to 8-year-old cod were dominant in catches. About 5,000 cod specimens were tagged. Results of tagging allow the preliminary conclusion that cod of Labrador, North Newfoundland Bank, and the northern part of the Grand Bank belong to the same stock. Tagging by UK in 1962, results of which are summarized in 1966, also allowed the conclusion that cod of Hamilton Inlet Bank in late autumn was part of the Labrador-Newfoundland stock of cod, which is distributed over a wide area of the shelf and coast of Labrador and Northeast Newfoundland in spring and summer. Studies were carried out by Canada and USSR on influence of temperature conditions on growth of cod of the Labrador stock. The studies showed that temperature conditions are one of the main reasons for increase or decrease of growth rate of cod. Canadian inshore data indicate an increase in growth of older fish since 1959. This was not evident from USSR studies on samples collected on Hamilton Inlet Bank in spring. Experiments were conducted on selectivity of trawl nets with the Polish-type chafer. The experiments showed that the Polish-type chafing gear yields good results and does not impair selectivity of trawl nets.

6. Other Species

Studies on age and size composition of redfish catches were carried out by France, Poland, and USSR. Poland and France also studied the depth distribution of redfish catches. Poland carried out a study of size and age composition of flatfish catches on Hamilton Inlet Bank.

Subarea 3

Reports on researches were submitted by the following member countries: Canada, France, Poland, Portugal, Spain, USSR, UK, and USA.

1. Status of the Fisheries

Commercial fishing was carried out by all member countries except Italy. Total catch of all species increased from 740,000 tons in 1965 to 748,000 tons in 1966. Catches by Canada (279,000 tons); France (62,000 tons); Portugal (70,000 tons); Spain (127,000 tons); and USSR 115,000 tons) made up almost 90% of the total catch of all species.

Cod catches made up about 67% of the total catch of all species and remained the same as in 1965. Canadian catch was up 5,000 tons to 140,000 tons in 1966. Denmark (15,000 tons). France (56,000 tons), Fed. Rep. Germany (9,000 tons), Iceland (1,000 tons), Norway (1,000 tons), Poland (6,000 tons), Spain (124,000 tons), and the UK (25,000 tons) catches were about the same as for 1965. The Portuguese catch increased 21,000 tons while the USSR catch declined 21,000 tons in 1966.

Haddock catches (10,000 tons) continued at a low level due to poor recruitment.

Redfish catches declined from 112,000 tons in 1965 to 79,000 tons in 1966 due primarily to a decrease from 54,000 tons to 32,000 tons in the USSR catches. The Flemish Cap stock has decreased markedly according to USSR reports.

American plaice catch increased from 50,000 tons in 1965 to 56,000 tons in 1966. The Canadian fishery takes all but 2,000 tons of this total.

Greenland halibut catches made by, almost exclusively, Canadian vessels increased from 9,000 to 17,000 tons.

A total of 247,000 harp and hood seals (young and adults) were taken in the "Front" area, off southeastern Labrador and northeastern Newfoundland (Div. 2J, 3K, and 3L); by Canada (76,000) and by Norway (171,000) in 1966. A total of 135,000 seals of both species were taken in the same area by Canada and Norway in 1965.

2. Work Carried Out

a) **Canada:** R/V *A. T. Cameron* and other research vessels. Oceanographic section St. John's–Flemish Cap. Surface and bottom non-tidal drift in Div. 3L, 3O, and 3 Ps. Charting surveys and deep water oceanographic studies in deep waters off south-west side of Grand Banks. Surveys and sampling of inshore and offshore cod and haddock fisheries. Investigations of American plaice, Greenland halibut, herring, Atlantic salmon over oceanic depths, pink salmon transplanting, and capelin.

b) **France:** R/V *Thalassa*. Forty-Six oceanographic stations in 4 sections. Studies of commercial species including cod, redfish, American plaice, capelin and shrimp.

c) **Poland:** Factory trawlers *Feniks* and *Andromeda*. Sampling of redfish, cod, and flatfish from the commercial fishery.

d) **Portugal:** Sampling of cod from trawlers and dory vessel fisheries.

e) **Spain:** Sampling commercial cod catches.

f) **USSR:** Research and scouting vessels *Sevastopol*, *Kreml*, *Rossia*, *Pobeda*, and *Novorossijsk*. Hydrographic and plankton studies. Young cod and haddock surveys.

g) **UK:** Sampling commercial catches. Continuous Plankton Recorder studies.

h) **USA:** Oceanographic observations by US Coast Guard at ocean stations and at sections in the Grank Bank area.

3. Hydrography

Canada reported that temperatures were higher than in 1965 and higher than usual in the waters between St. John's and Flemish Cap. Near St. John's the deeper water temperatures

were higher than usual throughout the year. Salinities were generally similar to those in 1965. France also reported unusually high temperatures on the Grand Bank. USSR reported that, in the 1965–66 ice season, conditions were unusually favourable to navigation and that this was caused by a slackening of the influx of Arctic waters to the Labrador Current. USA reported that 1966 was the lightest ice season in the history of the International Ice Patrol; not a single iceberg was sighted in the Labrador Current south of 48°N.

4. Plankton

USSR studies included fish eggs and larvae in May–June on the Grand Bank to determine more exactly the area of haddock spawning and the areas of dispersion of the developing eggs and larvae. UK continued the Continuous Plankton Recorder program and made good progress in preparation of an atlas of the plankton of the North Altantic covering 200 species. In 1966 the spring outbreak of phytoplankton was about a month late on the Grand Bank occurring in May instead of April. The important copepod *Calanus* was abundant throughout the year on the Grand Bank, but just east of Newfoundland the spring increase was about 1 month late, occurring in April. Planktonic redfish larvae appeared to be below average abundance.

5. Cod

Canada reported the size of cod in the commercial fishery unchanged except in the trap fishery in which the size was smaller. During a research cruise of the *A. T. Cameron* to the southwestern part and northeastern part of the Grand Bank, catches were generally small. Poland reported that the predominant lengths of cod were 35–65 cm with a mean at 52.7 cm in May in Div. 3K. Ages were mostly 4–8 years. Examination of gonads showed 87.2% of the fish in the juvenile (I) stage of maturity. Portugal reported on cod sampled from Div. 3K, 3L, and 3M from March to November 1966. Mean lengths of samples ranged from 51.1 cm to 61.7 cm. Ages ranged from 2 to 20 years, with a predominance of the 1959, 1960, 1961, and 1962 year-classes. In Div. 3K in May, 55% of the males and 80% of the females were in the recovering or resting stage. In Div. 3L in March only about 4% of males were spawning. In Div. 3M in March about 50% of the males and 40% of the females were in the spawning stage. USSR reported extremely high abundance of the 1964 year-class of cod on the south of the Grand Bank and on St. Pierre Bank (Div. 30, 3P, and especially, 3N). They forecast that this year-class will increase catches on the Grand Bank in 1968 and 1969, although the mean length of cod in trawl catches will be somewhat lower because of the predominance of young fish.

6. Haddock

Canada investigated the biology and distribution of haddock on the southwestern part of the Grand Bank in May. The average catch per half-hour haul was about 18 kg compared with 250 kg in 1960. There was no indication of a strong new year-class in the stock. The USSR also reported poor year-classes of haddock on the Grand Bank.

7. Redfish

Poland reported that about 49% of the *mentella*-type females in Div. 3K were in the "running" stage during March–May. *Marinus*-type were also producing larvae during this period. In April 67% of females were in the "running" stage. USSR studies showed that the age-size composition did not change on Flemish Cap in spite of intensive and long-time fishing and pointed out that this peculiarity is common to all other areas of the North Atlantic.

8. American Plaice

Canada reported on her continuing studies of spawning of this species. Large, old fish spawn earlier, as do fish in shallower water. Plaice on Flemish Cap mature at an earlier age than plaice from other areas. Poland found plaice on Ritu Bank (Div. 3K) which were 28–45 cm in length (average 38.2 cm) and in the Grand Bank–St. Pierre Bank Region (Div. 3Ps) 18–61 cm (average 34.5 cm). USSR found 50% of the fish from the southern slope of the Grand Bank were 40–50 cm.

9. Greenland Halibut

Canada intensified its research on this species and conducted surveys in White, Notre Dame,

and Trinity Bays. The sizes caught by gill nets were smaller than those taken with longline. The largest taken with 178 mm mesh was 57.5 cm. The Trinity Bay commercial catch was composed principally of 8- to 12-year-old fish. Poland reported catches of 800–1,000 kg per hour on Woolfall Bank (Div. 3L). The length range of these fish was 25–95 cm with mean at 55.2 cm. Poland also measured witch flounder and yellowtail flounder from the subarea (Div. 3Ps). Witch had a mean length of 33.9 cm and yellowtail 39.7 cm.

10. Herring

Canada intensified research on this species and found that extensive changes have taken place in the areas of major catches from the south and west coasts of Newfoundland in the composition and location of the stocks over the past two decades. The fish are smaller and younger than during the period of highest catches (1942–48) and there are fewer year-classes contributing to the present population. A change in spawning time is also evident: spring spawners dominated in the late 1940's but autumn spawners now appear to be the dominant group.

11. Atlantic Salmon

Canada fished experimentally for salmon over oceanic depths east of the Northeast Newfoundland Shelf with surface drift nets between 21 March–16 April 1966; 38 salmon were taken. Most of them were taken inside the 1,000 fathom isobath. Water temperatures were 3.7° to 6.1° C.

12. Pink Salmon

Canada reported on plantings of eggs of this Pacific species in North Harbour River which resulted in heavy runs of fry and runs of returning adults. Spawning of adults appeared normal.

13. Capelin

Canada reported on studies of capelin from representative areas of Newfoundland, Labrador Coast, and the Grand Bank with a view toward determining differences in stocks. No differences in meristics were found, although there were differences in sizes of fish. Age compositions indicate a very successful 1962 year-class and a relatively poor 1963 year-class. Accompanying the dominance of the 4-year-olds in the spawning schools was an increase in the average size and fat content of the capelin.

Subarea 4

Reports on research were submitted by the following member countries: Canada, Fed. Rep. Germany, Poland, Portugal, Spain, USSR, UK, and USA.

1. Status of the Fisheries

Total production continued to rise with a yield of 805,000 tons in 1966, an increase of more than 3% over the previous year. Nine countries recorded fishing in the subarea: Canada, France, Norway, Poland, Portugal, Spain, USSR, UK, and USA. Nominal catches by Norway, Poland, and UK were less than 500 tons. Nominal catches of groundfish fell off to 504,000 tons (including 57,000 tons of flatfish) from 536,000 in 1965. Catches of pelagic fishes at 249,000 tons were substantially more than the 193,000 tons for 1965.

Cod catches fell in 1966 by about 4% to 215,000 tons. Cod provided much the most productive groundfish fishery but was second to herring in total production. Canadian production from Div. 4T, 4X, 4Vn, and 4W dominated the fishery. Spain from Div. 4W and 4Vs, France from Div. 4R, Portugal from Div. 4R, and USSR from Div. 4W and 4X also pursued active fisheries. The 10% decline in Canadian catches was accompanied by increased production of haddock and redfish. In the Gulf of St. Lawrence (Div. 4T) Canadian discards of cod were negligible.

Haddock landings fell off about one-quarter to 66,000 tons. This is associated with reduced production by USSR in Div. 4W which was only partly compensated for by exploitation in Div. 4X. Canadian haddock landings from Div. 4X improved significantly and US production from the division declined.

Redfish landings by Canada and USSR continued to rise to produce 106,000 tons mostly

from Div. 4R, 4S, 4W, and 4X, all of which showed improved production. Improved recruitment to the stock in Div. 4R and 4S has led to the transfer of effort to redfish fishing.

Silver hake production again dropped sharply to about 10,000 tons. USSR scientists consider the decrease a result of a series of poor year-classes (1961–64), possibly associated with cooling water temperatures on the Scotian Shelf.

Flounder landings continued to increase reaching 55,000 tons. The Canadian fishery showed no important changes. Discards remained high for American plaice and negligible for witch. Winter flounder seem to be increasing in importance in Div. 4T. Yellowtail in Div. 4Vs and 4W were subjected to less fishing pressure. USSR landings of flounders increased significantly.

Total pollock catches remained fairly constant at 25,000 tons but Canadian landings fell off by more than 40%. Much of the deficiency was made up by USSR and Spain. Most fishing was in Div. 4W and 4X.

Approximately 15,000 tons of argentine were taken by USSR vessels fishing along the slopes of the Shelf from Banquereau to Browns Bank (Div. 4W to 4X). This is almost three times the production of the previous year and almost twice the record catch of 1963.

Herring landings of 236,000 tons were about one-third higher than those of the previous year. The increase was mainly due to increased Canadian production in Div. 4X.

There were no noteworthy developments in mackerel or swordfish fisheries.

Converted catches of scallop show a little more than 5,000 tons. This is only a little over half of the catch of the previous year. Browns Bank (Div. 4X), Middle Bank (Div. 4W), Bay of Fundy (Div. 4X), and the southern Gulf of St. Lawrence all contributed to the catch. Economic factors are considered responsible for the decline.

A total of about 104,000 harp and hood seals (young and adult) were taken by Canada in the Gulf of St. Lawrence hunt in 1966.

2. Work Carried Out

a) **Canada:** R/V *A. T. Cameron* and other research vessels. Oceanographic conditions at coastwise stations, the Halifax section and Cabot Strait. Surface and bottom circulation in Div. 4T, 4W, and 4X. Activity coefficients of ions in seawater. Microdistribution of surface plankton. Benthos and sediments in Div. 4R, 4S, and 4T, and bioenergetics in a small bay in Div. 4X. Cod populations and egg and larval studies in Div. 4T. Population studies of Div. 4T cod. Haddock year-class strengths, food, maturity, and fecundity. Size, age, and recruitment of Div. 4W haddock. Biology and population studies of Div. 4R and 4S cod. Surveys and biological observations on redfish, herring, yellowtail, argentine, and sea scallop. Herring sampling, ages, fatness, and tagging methods. Mackerel growth rate, spawning, and migrations. Tuna sampling and tagging. Salmon smolt tagging. Harp seal mortalities and statistics.

b) **Fed. Rep. Germany:** R/V *Walther Herwig*. Environmental and biological studies, especially on cod, in Div. 4V and 4W. Cod tagging.

c) **Poland:** R/V *Wieczno*. Temperature and salinity observations. Distribution, abundance, and sizes of commercial fishes.

d) **Portugal:** Lengths, ages, and maturities of Div. 4R cod.

e) **Spain:** Discards, tag recovery, relative efficiencies of fishing practices.

f) **USSR:** Eight cruises in Div. 4X and 4W with six sections. The standard Halifax section six times. Lengths of silver hake in Div. 4W. Age composition of haddock from Sable Island area (Div. 4W).

g) **UK:** Continuous Plankton Recorder surveys.

h) **USA:** Validity studies on otoliths for age reading of Div. 4X haddock and cooperative study (with Canada) of haddock stocks there. Lengths, age, and meristics of herring. Identity of hake species.

3. Hydrography

Canadian observations showed surface temperatures generally to be higher in 1966 than in 1965, and bottom temperatures at the entrance to the Bay of Fundy (Div. 4X) showed autumn cooling to be less in 1966 than in the preceeding year. However, analyses indicated that the general cooling regime continued at least until 1965. Cabot Strait showed relatively low temperatures (4.3°C) in a reduced volume of the warm deep layer. USSR observations in Div. 4X and 4W showed the cooling process to continue into 1966. Poland confirmed increasing surface salinities along the coast of Nova Scotia from northeast to southwest and increasing bottom salinities on the slopes of the shelf with increasing distance from the coast.

4. Plankton

Egg and larvae studies by Canada (Div. 4T) show that in 1966 cod spawned earlier than in 1965 and that the eggs were spread more evenly through the Gulf of St. Lawrence.

5. Cod

The annual survey in the southern Gulf of St. Lawrence (Div. 4T) with small-meshed otter trawl in September showed catch per tow down by about 4% although small 2-year-old cod were numerous. Consideration by Canada of cod stocks in Div. 4T at the request of Panel 4 has shown a marked decrease in the size of fish landed, decreases in size at age, and greatly increased recruitment in recent years. These changes have been associated with mesh regulations and with greatly increased fishing effort. Analysis of the data suggest density dependent growth rates. Although changes in environmental conditions as described under "Hydrography" may be involved, changes in recruitment and thus in productivity may be related to stock size in a modification of a steady state model. Canadian studies of cod in the northern Gulf of St. Lawrence confirmed the validity of the otolith method of age determination for application there. In Div. 4R, 4S, and 3Pn growth rates in cod increased between 1961–66 coincident with the reduction in abundance of larger older fish and peak trawler landings and the resulting increased mortality rates. There is evidence of incomplete mixing. Size and age data on trap-caught cod from the north shore of the Strait of Belle Isle show the fishing to depend on newly recruited year-classes and an increased total mortality. The biology of the stock is dealt with in some detail. German tagging confirmed earlier conclusions that cod move from Div. 4Vn in January to Div. 4T in summer and presumably back again in autumn.

6. Haddock

Canadian survey cruises on the Scotian Shelf (Div. 4W) showed low catches of both commercial-sized haddock and smaller ones suggesting weak 1964 and 1965 year-classes. Predictions of good 1962 and 1963 year-classes were not realized in the Canadian fishery presumably because of heavy fishing in 1965 in the division which took about 45,000 tons. A Canadian report on the size, age, and recruitment of haddock of the central Scotian Shelf from 1948 to 1965 demonstrated that relative success of the fishery relied strongly upon year-class strength. Size and age composition was quite stable, and incidental mortalities from other fisheries were not significant in affecting recruitment. However, new heavy fisheries from 1963 to 1965 appear to have cut down the abundance of potential recruits to the fishery. USSR age analyses based on 1965 and 1966 otolith collections showed the 1963 year-class to be best represented in 1966 and the 1960 year-class in a small autumn 1965 sample.

7. Silver Hake

USSR found that as in the two previous years in Div. 4W, 4-year-old silver hake were best represented (41%) in their catches with 3-year-olds and 5-year-olds about equal.

8. Hake sp.

Canada studied hake biology and fishery in Div. 4T. Males were 50% mature at 49 cm and females at 52 cm. USA made a study of the hakes in Subareas 4 and 5 concluding that all hake northeast of 4Vs should be designated as white hake, *Urophycis tenuis*, for statistical purposes. Line-caught and large hake elsewhere can also be designated as that species.

9. Redfish

A Canadian survey involving five lines across the Scotian Shelf found water temperatures lower than in 1962 and redfish not abundant. However, on the east side of Sambro Bank good catches were obtained. Along the central part of

the Shelf, there were indications of commercial quantities of redfish at the seaward end of the lines at depths between 350–500 m.

10. Flounders

Canada is continuing biological studies of yellowtail flounder and American plaice. Clinal difference in yellowtail stocks are indicated on the Nova Scotian Banks but the population of small fish on the Magdalen Shallows (Div. 4T) is distinct from those on the Nova Scotian Banks (Div. 4W and 4Vs). Yellowtail appear to remain at the same area and depth throughout the year and must accordingly be subjected to a wide variety of temperatures. Growth and longevity studies of American plaice from four areas were completed. Passamaquoddy Bay (Div. 4X) was found to have the fastest growth rate, shortest life span, and smallest ultimate size.

11. Herring

Extensive Canadian sampling of herring in southern New Brunswick (Div. 4X) showed the 1964 year-class to predominate during the early part of the year with 1963 second in importance. From April until August, the 1963 year-class was most abundant. Around Southwest Nova Scotia (also Div. 4X) the 1963 year-class dominated with 1961 second in importance. USA studies of fish from about the same area showed strong year-classes for 1960, 1961, and 1962. Meristic studies did not reveal statistical differences between herring populations of Maine and Nova Scotia but did show differences between them and herring from Georges Bank and Cape Cod.

12. Argentine

Where good catches were made in Canadian prospecting for argentine in Div. 4Vs and 4W, echo sounder traces, which showed fish on the bottom where they were caught, extended off the Shelf in the same water layer. Catches were made at depths between 180–320 m. Biological studies are being continued. Poland made good argentine catches near Browns Bank (Div. 4X) over similar depths. Good catches were observed at depths between 250–300 m. Argentine were segregated by size with the larger fish coming from deeper water.

13. Mackerel

Canadian studies on mackerel in Div. 4X, 4W, and 4V found growth rapid during the first 3 years of life but slow growth thereafter. Tag recoveries confirmed migration northeast along the Nova Scotia shore.

14. Salmon

To increase data on the effects of the Greenland salmon fishery, Canadian salmon smolt tagging has been increased in the Miramichi River, N.B. and the Margaree River, N.S. Nearly 65,000 smolts were tagged in 1966. From 42,000 smolts tagged in 1965, 430 were recaptured as grilse in Canada and 111 in the Greenland fishery.

15. Sea Scallop

Canadian scallop surveys in the Bay of Fundy showed relatively offshore beds to support good populations of scallop which are currently not being fully exploited by fishermen.

16. Seals

Some 25 tags put on harp seal pups in Div. 4T in March were recovered from West Greenland between May and November. Two tags were returned from Labrador.

Subarea 5

Reports on researches were submitted by Canada, Poland, USSR, and USA.

1. Status of the Fisheries

Commercial fishing was carried out by Canada, USSR, and USA. Small quantities of fish were also taken by Norway, Poland, Spain, UK, and non-member countries.

Total catches of all species decreased from 890,000 tons in 1965 to 843,000 tons. Canada took over 84,000 tons (68,000 in 1965). USSR over 456,000 tons (501,000 in 1965) and USA took 271,000 tons (313,000 in 1965).

Total catches of herring moved from fourth place in 1965 (74,000 tons) to first place in 1966

(166,000 tons) due entirely to a more than three-fold increase in the USSR catch from 36,000 tons to 117,000 tons. The Polish fleet accounted for more than 14,000 tons.

Silver hake catches decreased from 323,000 tons in 1965 to 162,000 tons due entirely to reduced catches by the USSR fleet. In addition, the USSR fleet operating south of the Convention Area to the region of Cape Hatteras took about 93,000 tons, a six-fold increase from the 16,000 tons taken in 1965.

Haddock catches decreased from an all-time high of 155,000 tons in 1965 to 126,000 tons mainly due to reduced catches by USSR. Catches by USA remained the same while the Canadian catch increased from 15,000 tons in 1965 to 19,000 tons.

Red hake catches increased by 15,000 tons to 87,000 tons in 1966. USSR catches alone increased from 59,000 tons to 83,000 tons.

Cod catches increased from 42,000 tons to 58,000 tons while flounder catches decreased from 57,000 tons to 54,000 tons.

Total catches of sea scallops decreased slightly to 49,000 tons. Canadian catches rose about 4,000 tons while USA catches declined by a similar quantity.

2. Work Carried Out

a) **Canada:** Various research vessels. Biological studies of haddock, scallop, herring, and swordfish.

b) **Poland:** R/V *Wieczno.* Hydrography, November–December. Biology of herring, mackerel, alewife, haddock, silver hake, American plaice, butterfish, and spiny dogfish.

c) **USSR:** R/V *Olonets* and various research and commercial vessels. Four hydrographic surveys. Zooplankton sampling. Age and size composition of silver hake, haddock, herring, and red hake. Morphological and serological studies of silver hake. Studies of abundance of young silver hake. Observations on herring spawning.

d) **UK:** Sampling with Continuous Plankton Recorder.

e) **USA:** R/V *Albatross IV.* Hydrographic, plankton, benthic, and groundfish surveys. Biological studies on haddock, silver hake, scup, herring, salmon, and lobster.

3. Herring

Herring catches by USSR increased due to some increase in fishing effort. Herring fishery was conducted from late May until the first fortnight of October.

Studies on sex and age composition of catches showed that in 1966 as in 1963–65 the 1960 year-class was dominant (47.3% at an average for the year). Since this year-class has already decreased considerably and the following year-classes are poorer than the 1960 year-class, the USSR scientists think that in 1967 one should expect a decrease in herring stocks of Georges Bank.

USSR continued studies on enumeration of herring eggs in spawning grounds in order to determine the value of spawning population.

Canada did not conduct herring fishery in Subarea 5 in 1966. Analysis of age composition carried out by Canada showed that the 1961 year-class was predominant in samples taken in Div. 5Z (69%). The 1960 year-class made up 20%; next by importance were the 1962, 1959, and 1963 year-classes.

USA catch of small-sized herring from Gulf of Maine was 27,200 tons. It was noted that the said catch was the second lowest in 20 years. Some peculiarities in distribution of herring in the Gulf of Maine in 1966 were noted. Reasons for a decline in catches are not clear.

According to USA data in sardine catches taken from the Gulf of Maine, 3-year-olds of the 1963 year-class were dominant (49.3%). Next by importance were 2-year-olds of the 1964 year-class (42.4%). One-year-olds of the 1965 year-class made up 5.1%.

Poland increased herring catches in the Convention Area in 1966 up to 14,473 tons against 1,447 tons in 1965. In November–December 1966 studies were carried out on size composition of herring catches in Georges Bank.

4. Silver Hake

Total landings of silver hake in Subarea 5 reduced by half due to a decrease in the USSR catch.

In 1966 the USSR trawlers conducted fishery for silver hake mainly during the summer period. Silver hake concentrations were dispersed and unstable. The USSR scientists presume that at present silver hake stocks have decreased. Samples for age determination showed the predominance of the 1963 year-class (45.5% at an average for the year) in catches.

USSR carried out some work on evaluation of locality of silver hake stocks as well as on enumeration of juvenile.

USA catch of silver hake showed some decrease. Catch per effort (per fishing day) changed inconsiderably: 1965—12.8, 1966—12.5 tons.

During the year USA carried out studies on growth rate and age determination of silver hake. The studies showed that there was difference in growth rate during the first year of life in the Gulf of Maine and southern New England.

Canada did not conduct fishery for silver hake in Subarea 5 in 1966.

Poland carried out studies on size composition of silver hake catches. Smaller silver hake was caught on northwest slopes of Georges Bank.

5. Haddock

Total haddock landings from Subarea 5 went down by 20% against 1965. Canada somewhat increased the catch, whereas USA kept it at 1965 level. USSR decreased haddock catch by almost 40%.

Analysis of the size and age composition of haddock samples collected by USSR scouting and research vessels showed that the fish were mainly 38–51 cm long. The 1962 year-class was dominant in these samples.

Results of studies on age composition of haddock conducted by Canada showed that the 1963 year-class continued to predominate in catches.

According to USA data 3-year-olds (the 1963 year-class) made up 60% of the catch. At the same time the 1964, 1965, and 1966 year-classes are considered as weak ones. For this reason, one can forecast some decrease in haddock abundance in Georges Bank in 1968–69.

Poland carried out studies on size composition of haddock of Georges Bank in relation to its distribution depthwise. It was noted that haddock were larger in deeper areas than in shallower.

6. Cod

Total cod landings from Subarea 5 increased by more than 30% against 1965 due to increase in catches by Canada and USSR. USA kept cod catch at 1965 level. Over 8,000 tons of cod were caught by Spain.

USA research showed that cod abundance in 1966 was slightly higher than in 1965.

7. Flatfish

Flatfish catches in Subarea 5 in 1966 somewhat decreased. Fishery for flatfish was conducted mainly by USA. The bulk of USA catches was made of yellowtail flounder (about 54%). As in the previous years, USA conducted fishery for yellowtail flounder in two areas: South New England and Georges Bank. Total USA landings of yellowtail flounder in 1966 decreased by 18% against 1965. At the same time landings per day went down. All these point to the fact that stocks of yellowtail flounder have decreased. USA data on age composition also show some decline in abundance of yellowtail flounder in 1967.

Other member countries did not carry out studies on flatfish in Subarea 5 in 1966.

8. Redfish

Total redfish landings in Subarea 5 slightly increased in 1966 against 1965.

USA research report shows that catch of redfish per effort in Subarea 5 continued to increase while total fishing effort went down.

Other member countries did not conduct research on redfish in Subarea 5 in 1966.

9. Red Hake

Total catch of red hake in Subarea 5 in 1966 increased approximately by 20% against 1965.

USSR increased in 1966 food fish catch of red hake in Georges Bank. The main fishery for red hake was conducted on southwest slopes of Georges Bank at 150–250 m depth in January–February 1966. It was noted in USSR research report that 3- and 4-year-olds were the most numerous in catches.

10. Sea Scallops

Total catch of sea scallops in Subarea 5 in 1966 somewhat decreased. Canadian catch increased whereas USA catch went down as compared to 1965. Canada caught sea scallops mostly in the northeast part of Georges Bank. Besides, the fishery was also carried out south of the Convention Area.

In 1966 the Canadian scientists studied distribution of sea scallops on Georges Bank during the cruise of a research vessel.

USA catches of sea scallops from Subarea 5 in 1966 were the lowest in the past 5 years. It is noted in USA research report that sea scallop fishery outside the Convention Area was expanded.

11. Large Pelagic Species

In Subarea 5 in 1966, 1,998 tons of swordfish were caught. The bulk of the total catch was taken by Canada (1,818 tons).

Canada continued in 1966 studies on size and age composition of swordfish catches as well as on sex and maturity. Attempts were made to continue tagging of swordfish.

USA carried out tagging of tuna, skipjack, and marlin in Subarea 5.

12. Fishery for Industrial Purposes

In 1966 in Subarea 5, special industrial groundfish fishery was conducted by USA. In 1966 total industrial landings were lower by about 18% against 1965. USA research report points out that in 1966 the share of silver hake and red hake in industrial catches was altogether about 20% only against 60% in previous years. This may indicate some decrease in abundance of silver hake and red hake in Subarea 5.

In 1966 80% of USA industrial landings comprised 10–12 species. The share of each species was less than 7%.

13. Special Research

Apart from research work mentioned above, USSR carried out special environmental surveys in Subarea 5 in 1966. Throughout the year four standard surveys were completed on Georges Bank. Their results showed that cooling which had started in previous years continued in 1966.

USSR also conducted studies on plankton in the course of the year.

USA carried out in 1966 in Subarea 5 special research on currents in the Gulf of Maine-Georges Bank area with the help of near-bottom drifters.

Hydrographic surveys were carried out on the Continental Shelf between Nova Scotia and Long Island.

Research work carried out by USA research vessel on the distribution and abundance of groundfish indicated some influence of increased effort carried out in the subarea but several aspects require further study.

USA conducted some studies on lobsters in 1966.

Fed. Rep. Germany, Poland, and UK also carried out some research work in Subarea 5 in 1966.

PART 4

Report of the Working Group on Joint Biological and Economic Assessment of Conservation Actions [1, 2]

The Group was established at the 16th Annual Meeting of the International Commission for the Northwest Atlantic Fisheries (ICNAF) to "... carry out an examination of the problems of assessing the economic effects of possible conservation measures in time for the 17th Annual Meeting of the Commission ..." It was directed to "... utilize available biological and economic information and to supplement this by clearly stated assumptions ... taking into account the possible redistribution of fishing effort ... " This action stemmed from a recommendation of the Assessment Subcommittee of the Standing Committee on Research and Statistics (R & S) that "... the Chairman of R & S and the Executive Secretary arrange for a joint assessment by biologists and economists of the effects of possible conservation actions in the Convention Area ... (which) should be made in collaboration with any other appropriate international body willing to contribute..."

The Subcommittee's recommendation for a joint or interdisciplinary approach to this subject, culminating intermittent discussion of it in the Commission since 1962 or thereabouts, was based on the ground that "... collaboration (between biologists and economists) is desirable because economic consequences are an important feature of the results of regulatory measures and because biological assessments constitute an essential background for economic analysis, in that they provide the necessary information on the actual and potential output from the resources."

The Group met twice, from 17 to 21 October 1966, and from 3 to 8 April 1967, both times in London, with the following in attendance.

Mr P. Adam.....OECD, Paris, France.
Mr O. V. Bakurin.....Ministry of Fisheries, Moscow, USSR.
Dr A. S. Bogdanov.....VNIRO, Moscow, USSR.
Dr J. A. Crutchfield.....University of Washington, Seattle, USA.
Mr L. R. Day.....ICNAF Secretariat, Dartmouth, Canada.
Mr J. A. Gulland.....FAO, Rome, Italy.
Mr R. C. Hennemuth.....BCF Woods Hole, Massachusetts, USA.
Mr E. S. Holliman.....FAO, Rome, Italy.
Mr S. A. Horsted.....Greenland Fisheries Investigations, Charlottenlund, Denmark.
Dr W. Krone.....OECD, Paris, France.
Mr A. Laing.....British Trawlers' Federation, Hull, England.
Mr W. C. MacKenzie.....Department of Fisheries, Ottawa, Canada.
Mr B. B. Parrish.....Department of Agriculture & Fisheries, Aberdeen, Scotland.
Mr F. E. Popper.....FAO, Rome, Italy.
Dr G. F. M. Smith.....FRB, Ottawa, Canada.
Mr L. Van Meir.....BCF, Washington, D.C., USA.

The Group was equally divided between biologists and economists. Mr MacKenzie acted as chairman for the meetings and Mr Day as secretary.

As indicated, the Group was charged with the examination, and biological and economic evaluation, of alternative conservation measures that might be applied in the fisheries of the Northwest Atlantic. At the first meeting it was decided to study a few stocks or a few closely associated groups of stocks selected according to the criteria, (a) that they were understood to be exploited to a point where maximum physical yield could be

[1] The Working Group was established by ICNAF with participation by the Food and Agriculture Organization of the United Nations (FAO), the North-East Atlantic Fisheries Commission (NEAFC), and the Organization for Economic Co-operation and Development (OECD).

[2] Presented to the 17th Annual Meeting of ICNAF, June 1967, as Commissioners Document No. 67/19.

attained with a significant reduction in total effort and (b) that reasonably adequate statistical data were available for their assessment. As a result of discussion, however, it became evident that, although individual stock assessment is the proper approach for biological analysis of exploited fish populations, in the present case both the biological and the economic effects of catch regulation must be assessed on the basis of the ICNAF and NEAFC areas combined.

The reason for this is that certain vessels, or fleets of vessels, operate throughout both areas. A conservation measure in a particular convention area or subarea would be likely to cause a redeployment of fishing pressure to other areas. Such a redeployment would nullify any potential economic gain from fishery management and might even result in lower aggregate physical yield. In short, no conservation measures aimed at enhancing economic returns or protecting physical yields in the cod and haddock fisheries of the North Atlantic could be effective unless they applied to the entire area over which mobile high-seas fishing vessels range.

The Group decided (a) to undertake an evaluation of the possible economic gains from curtailment of the fishing mortality rate (intensity) in three areas where this appeared to be desirable on biological grounds and (b) to undertake a preliminary assessment of the short- and long-term effects on physical yield of a curtailment of fishing intensity throughout the cod and haddock fisheries of the ICNAF Area plus Region 1 of the NEAFC Area. These projects were assigned as follows:

1) Bio-Economic Assessments—

   a) Georges Bank cod and haddock stocks—Mr Hennemuth and Mr Van Meir;

   b) West Greenland cod stocks—Mr Gulland and Dr Krone;

   c) Northeastern Arctic cod stocks—Mr Parrish and Mr Laing;

2) "Global" Biological Assessment of cod and haddock stocks –Mr Parrish, Mr Gulland, Mr Hennemuth, and Dr Smith, with assistance of the ICNAF Assessment Subcommittee and the ICES Liaison Committee.

In addition, OECD undertook to prepare a projection (to 1970) of fishing-fleet development in the North Atlantic.

The papers produced on each of these subjects are attached as appendices to this report. They formed the basis for discussion at the second meeting of the Working Group. The factual content is summarized below, together with a review of the implications and the conclusions of the Group thereon.

A. State of North Atlantic Cod and Haddock Fisheries

General Aspects

Since 1945, fishing intensity in the major groundfish fisheries in the North Atlantic, especially those for cod and haddock, has increased greatly. This has been particularly noticeable in the northern part of the Northeast Atlantic (Region 1 of NEAFC Area) and throughout the Northwest Atlantic (ICNAF Area). The number of large and highly mobile vessels in these areas has increased substantially since the mid 1950's and especially during the 1960's. A striking feature of the cod and haddock yields from each of the main fishing areas is that, except for a rapid growth in the initial stage of the fishery, they have failed to increase at the same rate as the increase in fishing activity. This has been apparent since the mid 1950's in the major cod fisheries in the Northeast Arctic, Iceland, West Greenland, and more recently in the Labrador-Newfoundland area. These areas together contribute three-quarters of the total yield of cod from the North Atlantic.

Biological Assessment

Detailed biological assessments of the exploited stocks in these areas, based on population models currently used by ICNAF scientists, have shown that, with the increase in total fishing intensity, the total mortality rates of the exploited age-groups have increased and that fishing now

accounts for two-thirds to three-quarters of the numbers of fish dying each year. Examples of such assessments for the Northeast Arctic and West Greenland cod and the Northeast Arctic and Georges Bank haddock are given in Appendices I–III.

These assessments all give the same important result that, at the high level of fishing intenity reached from 1962 to 1965, the fishing mortality rate was higher than that necessary to give the maximum sustainable catch per recruit. In these fisheries, therefore, the catch could be sustained over the long term and perhaps increased as much as 10% with a reduction in the fishing mortality rate of 30–40%. In addition to the achievement of the same or a slightly greater catch with this reduction, there would be a substantial increase in the catch per unit fishing intensity, less year-by-year variability in total catches and an increase in the average size of fish in the catches.

Although the examples dealt with above are ones in which the effects of increased exploitation have been the most severe amongst the North Atlantic groundfish fisheries, the results of biological assessments on other cod and haddock stocks in this region show most of them to be in the same general state. The assessments indicate that, for the main stocks of these species in the ICNAF Area and Region 1 of the NEAFC Area, the fishing mortality rate is at or beyond the level giving the maximum sustainable catch. Consequently, in these cases, no sustained increase in catch can be expected from further increases in fishing intensity. Indeed, in most cases, a sustained reduction in the fishing mortality rate (fishing intensity) of 10–20% would not result in a decrease in average long-term catches and might result in a slight increase.

It must be recognized that the effects described above refer to the long-term situation which would be achieved after the exploited stocks had become adjusted to a reduced fishing mortality rate. There would be inevitably a transition period for this adjustment during which the catch, under conditions of average recruitment, would first fall and then build up to a higher level. For the cod and haddock stocks in the North Atlantic, this transition period would last for 4–6 years while a return to the original catch level would be effectively achieved in 3–4 years (see examples in Appendices I–III). In practice, owing to annual fluctuations in recruitment, it may be possible to minimize the transitional decrease in catch if the reduction in fishing mortality rate is made at a time when recruitment is high.

The above assessments have been made on the basis of the present situation as regards the mesh sizes in use in the trawl fisheries. As indicated in recent reports by the R & S Committee to the Commission, some long-term increases in cod and haddock catches in the ICNAF Area would accrue from further increases in mesh sizes, especially in the cod fisheries in the northern subareas. However, such measures alone would not solve the major economic problems resulting from the increased fishing intensity in recent years. Though the larger meshes would change the shape of the yield/effort curve, the fishing mortality rate in most stocks is so high that, even with the largest practicable meshes, a moderate decrease in fishing would not result in a decrease in sustained catch and might well result in a slight increase. Although it is desirable, therefore, that larger meshes be used in several fisheries, their use would not alter the conclusions of this report.

Economic Aspects

It is impracticable to define the objectives of a regulatory program involving several species, wide geographic distribution of fishing effort and multi-nation participation, in terms of an **optimum** level and composition of catch.

If an average cutailment of total effort of 10–20% could yield—after the transition period—the same or even slightly increased physical output, it follows that excessive capital and manpower are currently employed. It likewise follows that the resultant increase of 10–25% in the average catch per unit of effort reflects the extent of the economic benefits to be gained by curtailment.

The Group therefore accepts the view that the maintenance, at least, of total output (physical yield), accompanied by a reduction in inputs constitutes an appropriate target for a management program.

According to the stock assessments dealt with in this report, the long-term equilibrium catch curve is rather flat over a considerable range of effort. This means that long-term benefits would be mainly in terms of reduced costs and not in terms of increased landings. It is estimated that costs of about $50–$100 million annually could be saved if effort were reduced 10–20% in the North Atlantic cod and haddock fisheries, with additional economic benefits from improved size composition of the catch. Moreover, a management program that provided some assurance of long-run stability of output from international fishery resources would remove a condition of uncertainty that surrounds decision-making (by firms and agencies) at present.

To illustrate the economic implications and problems of a reduction in effort, two case studies have been undertaken (see the economic sections of Appendices I and II). These show that there would be economic advantages to be gained from reducing fishing effort on Georges Bank haddock and West Greenland cod. It is also demonstrated, however, that the total benefits will depend partly upon the manner in which fishing effort is curtailed. The investigation of the United States operations on Georges Bank haddock reveals this very clearly: if the number of days fishing **per vessel** is reduced by 30%, leaving the number of vessels and manpower unchanged, only very small long-term benefits would be achieved and the short-term effects on annual earnings for both vessels owner and crew would involve serious initial losses. If, however, the amount of input is adjusted to the reduced number of fishing days to allow full utilization of the remaining capacity, an immediate and substantial improvement of the economic situation is certain and in the long run this industry would become highly remunerative. Stock conditions (and thus physical yields) would improve equally under either method of reducing mortality; hence the anticipated economic results would determine the action to be taken.

The West Greenland exercise provides an example of how cost savings differ depending on which types of vessel and operation are affected by the cut in effort. It must be emphasized that the eventual outcome, within the range indicated, would depend upon the individual owners' decisions as to the operation of their fleets in a regulated fishery.

A difficult problem is to evaluate the means and impact of diverting or removing the excess capacity. It may be assumed that no alternative superior to its present utilization exists for the capacity (fish fleets) now employed in the North Atlantic cod and haddock fisheries. In some cases a country might be able to redeploy vessels and manpower into fisheries for other species in the North Atlantic that are not now fully exploited or to shift them to other waters. In some instances, however, this would necessitate the retiring of vessels.

For some countries this might not pose too serious a problem, since part of the fleet is obsolete. Assuming that the "freed" manpower could be obsorbed easily in other occupations, the elimination of capacity would involve slight loss to the industry itself and would even represent a gain from the viewpoint of public welfare.

In regions with employment difficulties, however, the manpower considerations would have important economic, social and political implications. This applies particularly to those remote areas where fisheries provide practically the only means of subsistence. To be effective, an international management program must enable each country to deal with these problems as it sees fit, while protecting the ability of others to adopt different national policies.

There are several, albeit limited, ways in which redundant fishing capacity could be handled by an individual country. Some North Atlantic stocks to which excess capacity might be diverted are herring, blue whiting, capelin, fquid, sand eels and redfish. Among areas outside the North Atlantic to which surplus vessels might be sent are the Central and South Atlantic areas, including the hake fishing grounds off South America and South Africa. Other alternative uses for surplus vessels might also be found in the future, e.g. in connection with oil prospecting. It is possible, in the last resort, to reduce costs simply by holding vessels idle. Moreover, the speed with which excess capacity is diverted or removed from fishing could be adjusted to the particular situation of a national fleet.

In summary, harvesting the North Atlantic stocks of cod and haddock with reduced inputs could result in economic benefits of considerable extent. The actual extent of the benefit realized by each country would depend to a significant degree upon the way in which the problem of reduction, or redeployment, or both, of excess fleet capacity is dealt with.

B. Projected Developments in Fishing Activity

In the preceding paragraphs it has been shown that, by 1965, fishing intensity on cod and haddock in the North Atlantic had reached the stage where the cost of harvesting the annual catches was substantially greater than necessary. Unless restrictions are imposed, this situation appears likely to persist and indeed to increase in severity. A recent enquiry by OECD into the development (to 1970) of fishing fleets in countries prosecuting the groundfish fisheries of the North Atlantic indicates that fishing capacity may be expected to increase (Appendix IV). The additional capacity coming into existence will not necessarily eliminate older capacity to an equivalent extent. The fact that a comparatively high proportion of total costs consists of unavoidable costs, on the one hand, and the existence of governmental support programs, on the other, precludes the operation of any self-adjusting mechanism to maintain capacity at any given level. It is unlikely, therefore, that economic forces alone can prevent further increases in fishing effort in these fisheries. The evidence suggests that, at a conservative estimate, fishing effort on the North Atlantic cod and haddock stocks may increase as much as 15–30% by 1970. This would probably result in a decrease in the total catch of these species and reduce the catch per unit of effort considerably below the 1963–65 level.

Outside the North Atlantic a similar situation is developing. The fleets of long-range vessels are steadily increasing. More and more countries in all parts of the world are starting to operate such vessels. Up to the present the problems which might have arisen from this increasing capacity have been mitigated by the development of fisheries on hitherto lightly exploited grounds, e.g. the Bering Sea, Northwest Africa, and Southwest Africa. Several of these grounds are now showing signs of depletion. There are few alternative grounds where fish of a suitable type are likely to be caught in economically attractive quantities.

As pointed out, the present state of the North Atlantic stocks is such that effort regulation of one area alone should not be considered because the surplus effort is likely to be directed to another equally heavily fished stock. At present, it is reasonable to consider a regulation for the cod and haddock stocks of the North Atlantic alone, and to assume that the surplus effort diverted to other areas would go to stocks which are still relatively lightly fished, and which are capable of producing an increased sustained yield following an increase in effort. It is likely that such an assumption will be much less reasonable in the future, when any policy of reducing fishing mortality on the cod and haddock stocks in the North Atlantic would have to take into account the problems of a restriction of fishing on a world-wide scale with the vastly greater scientific and administrative complications that this would involve. The need for taking positive steps toward effort limitation in the North Atlantic demersal fisheries before the problems become still more complex is therefore urgent. In addition, the development of a workable regulatory program in the North Atlantic would make it easier to anticipate and deal effectively with the problem of excessive fishing effort in other regions.

C. Types of Regulatory Measures

Various methods of limiting the fishing mortality rate have been reviewed in previous papers presented to ICNAF, e.g. the Templeman-Gulland statement[3] to the 1965 meeting and the UK Commissioners' paper[4] for the 1966 meeting. In these documents it was made clear that methods which in practice reduce the efficiency of fishing, e.g. restriction or banning of improved types of gear, closed areas or closed seasons (at least as the only method of regulation), waste the potential economic benefits of regulation. The only reasonable alternative is direct limitation of either total catch or total effort.

Direct limitation of total catch on a "global" scale, with all countries, fleets and enterprises continuing to fish until the prescribed quota is reached, would lead to a situation in which every

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[3] W. Templeman and J. Gulland. Review of possible conservation actions for the ICNAF Area. *Annu. Proc. int. Comm. Northw. Atlant. Fish.*, **15**: 47–56.

[4] United Kingdom Commissioners to ICNAF. Note by the United Kingdom Commissioners on the regulation of fishing effort. ICNAF Comm. Doc. 66/17, 1966.

unit strove to maximize its share. This situation, experienced in several fisheries where an overall quota has been in effect, e.g. the Pacific halibut and the Antarctic whale fisheries, causes most of the potential benefit of reducing mortality to be lost. A similar situation would obtain under a direct limitation on total effort. Mortality would be reduced but total costs would be increased, and the value of the product may be decreased. The overall quota, therefore, whether in terms of catch or effort should be allocated among participants in the fishery. In the case of fisheries under international management, this means first of all allocation among countries.

Within a national fishing industry there would still be a scramble if control stopped at the imposition of a quota for the country as a whole. A country, however, may regulate the utilization of its quota in the manner best suited to internal conditions, e.g. to provide maximum net income, full employment to the greatest number of fishermen or fish at the lowest price to consumers. The method by which a country administers a quota assigned to it is unlikely to affect the stock involved or the fisheries of other countries.

Fishing Effort (Input) Limitation

In principle, direct limitation of effort permits the maximum saving in costs. However, there are serious difficulties in effort regulation. These lie in the need for expressing effort in a standard form and in taking account of the continued improvement in fishing methods. This means that the effort quota would have to be frequently revised and that frequent recalibration would be required. In fact, a number of scientific problems, e.g. measurement of the effect of using more powerful echo-sounders, are not yet solved.

Moreover, if for any reason the customary distribution of fishing in space or time were disturbed, the relation between fishing effort, e.g. hours fishing, and the fishing mortality rate would be changed. In the Labrador cod fishery, for example, an hour's fishing in March on the average catches substantially more (perhaps two or three times as much) fish and causes a greater mortality rate than an hour's fishing by the same vessel in October. Regulation of catch or effort may well alter the seasonal pattern of fishing, e.g. when there is a scramble for a quota, and therefore standardization of fishing effort must take into account the time of fishing.

Further complications arise in the application of effort regulation by reason of the multinational character of the cod and haddock fisheries of the North Atlantic. In these fisheries, agreement on the weighting factor to be used for changes in the gear used by some of the countries concerned are likely to be very difficult. At present many of the basic statistics, which would be necessary to compute total effort in standard terms, are not available. As pointed out in the United Kingdom Commissioners' paper, when effort regulation is in force, the only real check on whether each country is exerting the correct mortality rate would be obtained from the record of catches. If a country's share of the total catch is increasing, so is the proportion of the total fishing mortality rate that it is exerting whatever the statistics of fishing effort may show.

Catch Limitation

National catch quotas involve few problems of standardization among countries. Both ICNAF and ICES (NEAFC) statistics of catch are expressed as live (round fresh) weight. For cod and haddock landed as wet or whole frozen fish, factors for conversion to live weight are available and the landed weight is well known. The area of origin is less certain. Cod and haddock are landed from areas in the North Atlantic outside the area defined in this report but the vessels fishing in the Baltic, the North Sea, and west of the British Isles are generally different from those fishing the northern part of the North Atlantic. The same vessels may fish at Faroes and Iceland, or at Faroes and in the North Sea, but cod from Faroes are relatively easy to identify on the market.

Factory trawlers, handling processed (filleted and frozen) fish, present greater problems in establishing the species, the area of fishing

(though such vessels are most unlikely to catch cod or haddock outside the defined area) and, the live weight. These difficulties, however, should not be insuperable. Fish below marketable size which are either discarded at sea or converted into fish meal are a greater problem. Probably there is no way of including rejects (discards) in any catch quota, desirable though this would be. So far as the future stock is concerned, the removal of these small fish has a greater influence than the capture of the same weight of larger fish. Fish used as fish meal should be included in the quota, although this will raise problems of determining the live weight, the species and of distinguishing between fish meal made of whole fish and that made from the residue of processed fish. Most of the relevant statistics are already available.

The chief disadvantage of setting catch quotas is that the relation between catch and the fishing mortality rate is not constant over time, but varies with changes in the stock abundance. Thus the catch quota would have to be regularly adjusted to maintain the fishing mortality rate at the desired level. If the catch quota were set too high, the excessive fishing mortality rate would reduce the stock, so that the discrepancy in the following year would be greater. Without adjustment of the quota, the stock would continue to decline and the fishing mortality rate would increase, as happened between 1950–62 in the Antarctic baleen whale fishery, where the quota set initially was only a little too high.

Variations in year-class strength are an important cause of fluctuations in stock abundance. There may be a difference of as much as 100:1 between the best and worst year-classes but the resultant fluctuations in the abundance of the stock, which contains several year-classes, are much less. In many fisheries estimates of year-class strength can be obtained, e.g. from research surveys of O-group fish 1 or 2 years before the year-class enters the fishery. Further estimates of the strength of a year-class can be made after it enters the fishery, a year or two before it makes its biggest contribution to the catches. Thus it would be possible for estimates of stock abundance to be made 3 years, 2 years, and 1 year in advance and in the current year. The accuracy increases with each estimate. Such estimates might be used to establish a catch quota in the following manner: (a) in 1970, for example, a forecast could be made of a quota for 1972; (b) in 1971 a preliminary quota could be set for 1972, with participating countries being guaranteed say 90% of their eventual share; (c) in 1972 a definite quota could be established for the current season equal to 90% at least of the provisional quota.

Whether this scheme is feasible depends on the degree of adjustment to the current year's quota that is acceptable to countries and industries, as well as to the precision of the scientists' forecasts. Although it is desirable to have much better knowledge of the state of the stocks and of year-class fluctuations, in the opinion of the majority of the Working Group enough information is available to permit meaningful estimates of annual overall catch quotas being made. The validity of this opinion might be tested by estimating: (a) the stock abundance for 1968 and subsequent years; (b) the resulting quotas corresponding to given levels of the fishing mortality rate (perhaps those corresponding to the average 1963–65 level and 10 or 20% below that level), such estimates to be accompanied by an indication of their probable precision. The Group consider that such an exercise would be highly desirable. It would also be desirable to expand research on: (a) the abundance of young fishes and their influence on stock magnitudes; (b) on rates of total and fishing mortalities.

If a total catch quota were adopted as the international method of management, individual countries might still wish to exercise control of their own fishing operations by other methods. By itself a catch limit is likely to be a most inefficient method of control within a country. Direct control of input, e.g. by the licensing of fishing vessels, would give much better economic results. Given reasonable estimates of stock abundance, such as those used in setting the catch quotas, the number of vessel licenses that should be issued to obtain the desired catch quota could be estimated quite closely. A country that relied on input limitation usually might approximate its catch quota by adjustment of licensing as the season progressed. It might be preferable, however, to carry over moderate deviations from the annual quota (up to 10 or 20% of the total, for instance) to the next year. As an example

of how such deviations might be discouraged, a country could be credited with 90% of a shortfall and debited with 110% of an excess. Thus, if a country took 1,000 tons less than its quota in a given year, its quota for the subsequent year would be increased by only 900 tons. Similarly, if an extra 1,000 tons were taken in any year, the quota would be reduced by 1,100 tons in the succeeding year.

The Problem of Several Stocks

In the North Atlantic there are a number of distinct stocks of both haddock and cod. These stocks differ in their natural characteristics of growth rate, natural mortality, etc., as well as in the degree to which they are exploited. If the full potential from each stock is to be obtained, then the fishery on each should be separately regulated in terms of mesh size and of fishing mortality rate. Discussions of the practical problem of regulating the mortality rate on separate stocks brought out so many complications and difficulties of enforcement that it seemed preferable to consider first an overall restriction for much of the North Atlantic. The area covered should include all the stocks fished by the mobile fleet of large European vessels, with reference to which the problem of separate control by areas is most acute. The Group therefore believe that first consideration should be given to a single restriction or quota covering the cod and haddock stocks of the entire ICNAF Area and of Region 1 of NEAFC, i.e. East Greenland, Iceland, and the Northeast Arctic. The Faroes might or might not be included.

Such an overall quota in terms of catch could be established by simply adding the catch quotas for each area. The establishment of an overall effort quota on the other hand would be very difficult since an hour's fishing at Labrador is not equivalent to an hour's fishing on Georges Bank in terms of either cost or catch.

Year-class fluctuations in different stocks are to a large extent independent. Thus the fluctuations in a total catch quota are less than the fluctuations in the individual quotas. The differences in the occurence of good year-classes encourage the switching of fishing operations from one stock to another. However, a theoretical study suggests that the resultant deviations from the optimum level of fishing mortality do not lead to any appreciable loss in catch. In fact, there may well be a gain in overall efficiency from operating each year on the stocks and grounds which, during that period, are the most productive.

Appendix V describes a method by which an overall quota can be modified, either when first introduced or later when some of the operational problems have been solved, to ensure a better allocation of fishing among different stocks. The method is to declare closed seasons of suitable length for those stocks which, even under a correct total quota, may still be too heavily fished. This closure would apply particularly to the mobile fleets which could be diverted to other, underfished areas. As indicated in Appendix V this technique would contribute to the desired allocation of effort to different stocks without imposing hardship on those nations whose fleets are largely limited to one or two areas.

Another method would be to apply a weighting factor to each stock in a manner similar to that of the Whaling Commission which uses weighting factors of 1:1/2:1/6 for blue, fin, and sei whales, respectively, to obtain a total catch in terms of Blue Whale Units. Thus, for example, if the Northeast Arctic was being fished too heavily and Labrador not heavily enough, then 1 ton of cod from the Arctic might count as 1.2 'standard' tons and 1 ton of Labrador cod as 0.8 'standard' tons. Such a scheme might involve, though in a less extensive form, the problems of enforcement and identification of area of capture encountered in considering separate regulation of each stock.

D. Summary

Biological assessments based on population models currently used by ICNAF scientists were presented to the Working Group. These showed that most of the cod and haddock stocks in the North Atlantic are now so heavily fished that a moderate reduction in the fishing mortality rate would not result in a decrease in sustained catch and probably would result in an increased catch.

Cost studies were made of the effects of such a reduction in the fishing mortality rate for two areas, viz. Georges Bank and West Greenland. These showed that the economic benefits could be very large. A rough estimate of the effect of curtailing the fishing mortality rate on all North Atlantic cod stocks suggests a possible saving of $50–$100 million, with the average annual catch remaining constant or increasing slightly. However, the studies showed that the actual reduction of costs depends critically on how reduction of the fishing mortality rate is achieved.

Of the methods of reducing the rate of fishing mortality available to the international commissions, there are only two that would enable member countries to reduce their production costs, i.e. an allocation of definite shares of an agreed total amount of fishing expressed in terms of either (a) catch or (b) standard units of fishing effort. It would be necessary for countries individually to restrict fishing operations to the assigned limit. The method adopted for this purpose may be chosen to suit national objectives and would be irrelevant to the general effectiveness of the management program.

The use of fishing effort, e.g. days on the ground, as a measure of the amount of fishing under quota control would raise very great problems of inter-gear calibration and the like and, for that reason, may be set aside for the present. The use of catch in a similar way would require reasonably precise forecasts of fish stock abundance several years in advance, but a considerable quantity of data is available for this purpose and quota estimates corresponding to various levels of fishing, might be prepared for 1968 and subsequent years.

Separate regulation of the amount of fishing for each of the stocks in the North Atlantic, while desirable, would be impracticable. It follows, therefore, that any restriction of fishing should first be considered for the combined cod and haddock stocks of the northern part of the North Atlantic, i.e. the whole of the ICNAF Area and Region 1 of NEAFC, possibly excluding the Faroes. Methods of adjusting this overall control to provide some degree of differential regulation between stocks are suggested.

APPENDIX I

Biological and Economic Effects on Georges Bank Haddock of Conservation Actions

A. Biological Aspects

BY

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Introduction

The Georges Bank haddock stock was one of the first to be regulated by ICNAF, and has been extensively studied and reported on by the ICNAF working group on mesh assessment and other scientists.

The earliest comprehensive records of haddock fishing on Georges Bank begin about 1917, when fishing was still relatively light. The fishery expanded rapidly during the late 1920's, with annual landings increasing from about 50×10^3 metric tons in 1926 to 115 in 1929. In spite of increasing effort, landings dropped rapidly to about 55×10^3 tons in 1932. From 1932 to 1963, the fishery stabilized with average annual landings of 45×10^3 tons. Landings increased to 65×10^3 tons in 1964 and to a record high of 154×10^3 tons in 1965. The recent increases are the result of new fleets entering the fishery; the 1965 increase stimulated by the recruitment of a particularly large year-class to the fishery.

Available Data

Samples of length-frequencies of landings, scales for assessing ages and statistics of landings and effort expended by a homogeneous class of otter trawlers have been obtained since 1932. Data on length and age compositions prior to 1932 are not available. Landings and effort statistics prior to 1932 were obtained from records of fishing companies. By a series of adjustments based on comparisons of relative catch rates of the different types of fishing gear and vessels, the units of effort from 1917 to 1931 were made as comparable as possible to the post 1932 series. Total annual effort was estimated by dividing the total of the standard fleet.

Estimation of Mortalities

An average total annual mortality rate,

$$Z = 0.7.$$

was estimated from relative abundance at age of year-classes in the landings from 1932 to 1962. The estimates varied between 0.4 and 0.9 and were to some extent seasonal and age-dependent. Although the estimated annual days fished over the same period has varied from 5 to 9×10^3 days, most years were in the $6 - 8 \times 10^3$ days range, and it has not been possible to establish any relationship between Z and effort with these data.

No direct estimates of the relative magnitudes of fishing and natural mortality rates have been obtained. The consensus of those who have studies this population is that natural mortality.

$$M = 0.2; \text{ whence}$$
$$F = 0.5;$$
$$F/Z = 0.7;$$
$$F/M = 2.5;$$

on the average for the period covered.

The uncertainty of these numbers require that a reasonable range of values of these parameters be considered. We have chosen as follows:

$$Z = 0.5 - 0.9;$$
$$F = 0.4 - 0.6;$$
$$M = 0.1 - 0.3;$$
$$F/Z = 0.5 - 0.9;$$
$$F/M = 1.5 - 4.5.$$

Application of the limit values in the yield model employed below does have a substantive effect, although quantitatively the percentage changes in yield are small, and the degree of the action recommended would change, but not the action

itself. The estimates below are based on the central values.

Yield-Effort Relationship

The estimated annual landings and landings-per-day fished, assumed proportional to abundance, were plotted against the terminal year of a 3 year running average of days fished. The average landings per day fished has decreased from about 15 tons at a level of 2,000–3,000 days fished in the early 1920's to about 5 tons at a level of 10,000–11,000 days in 1963–64; roughly a one-third decrease. The periods 1927–33 and 1963–65 include large annual increases in effort. Hence, the observations of abundance beyond the 10,000 day level included in these years, which are of critical importance, do not represent the long run, equilibrium values, and cannot be used directly in assessing effects of regulation.

The equilibrium curve of yield-per-recruit and the expected reduction of abundance, both per unit of fishing mortality was calculated from the Beverton-Holt model. Assuming that days fished is proportional to fishing mortality, an estimate of the constant of proportionality was obtained from the average of F and days fished from 1932 to 1962. Using these values, a line of equilibrium conditions was obtained by choosing a value of initial abundance (at zero level effort) which produced a curve most closely fitting the observed points. The curve fits the data adequately up to about 10,000 days fished; it would not be wise to extrapolate much beyond this level.

The curve is quite flat from about 5,000 days annual effort onward. A maximum yield of 45×10^3 tons occurs at about 7,000 standard days. For an average level (of 3 years running) of 10,000 days, which is the 1963–64 level, the equilibrium landing is about 42×10^3 tons, a very small decrease from the maximum. The equilibrium landings per day for these two levels of fishing are 6.4 and 4.2 tons, respectively, a 34% decrease.

TABLE 1. A summary of the trends from 1960 to 1965.

	1960	1961	1962	1963	1964	1965
Annual landings (metric tons $\times 10^{-3}$)						
Actual	41	47	54	55	64	150
Equilibrium	44	44	45	42	40	—
Annual days fished						
Actual	7,700	7,200	8,600	12,400	12,100	26,700
3 year average	8,300	8,100	7,700	9,400	11,000	17,100
Percent[a]	119	116	110	134	157	244
Landings per day (metric tons)						
Actual	5.4	6.5	6.3	4.4	5.3	5.6
Equilibrium	5.4	5.5	5.8	4.5	3.6	—
Percent[a]	85	86	91	71	56	—

[a] Percent of maximum equilibrium yield level.

The state of the fishery in 1965 was far off the equilibrium curve. The recruitment in 1965 of a strong year-class and the increased effort has resulted in higher landings and landings per day than the long run expectation. It is estimated that in the long run a 30% decrease in effort from the 1963–64 level (it is highly unlikely that the 1965 level will be sustained) would increase landings by about 7% and landings per day by about 52%. These expectations are used in the economic assessment.

Interim Effects

A reduction of 30% in effort would cause an immediate and proportional drop in landings,

and only gradually would the benefits accrue. The calculated interim catches for each year following the decrease assuming an equilibrium state at year of decrease are as follows.

Years after decrease	Percent of 1963–64 landings
1st	75
2nd	86
3rd	93
4th	98
5th	100
6th	102
7th	105

Thus, in about 5 years the equilibrium landings would be back to the magnitude when the decrease took place, and the full benefit would accrue in about 7 years. The actual landings would of course vary because of varying year-class strengths, and would also be affected by the degree to which the fishery departed from the equilibrium state before the change in effort was accomplished. These factors could produce a marked departure from the expected yields in the haddock on Georges Bank, where year-classes do vary considerably in relative strength, and where effort has changed considerably in the last 3 years.

B. Economic Aspects

BY

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As indicated in the foregoing discussion of the biological model of the Georges Bank haddock population, fishing effort can fluctuate from 4,000 to 10,000 standard days without causing large long-run changes in total landings. However, variation in fishing effort has a significant effect on the catch per day of effort, and hence on returns to labour and capital employment in the fishery. But the manner in which fishing effort is curtailed to the 7,000 days of effort estimated to produce the maximum sustainable yield of of 45,000 metric tons is of greater consequence to earnings of the fishing firms than is the change in catch per day of effort.

Fishing effort, costs, and earnings for the Canadian and Russian vessels fishing haddock on Georges Bank were not available. Therefore, measurement of the economic results of changes in fishing effort was based on results of the Boston offshore-trawler fleet.

The average offshore-trawler fishing Georges Bank out of Boston spends 270 days at sea each year to achieve 180 standard days of fishing effort. Therefore, 56 such vessels would be required to apply slightly over 10,000 days of fishing effort annually on Georges Bank. If the fishing effort of the fleet of 56 vessels were limited to 7,000 days annually, each vessel would be limited to 125 days of fishing effort requiring approximately 188 days at sea. However, 7,000 days of fishing effort could be applied to the resource by a fleet of 39 vessels, each spending a full 270 days at sea. (An even smaller fleet would be required if the fleet were comprised of vessels like the more efficient vessels in the Boston fleet.)

Average Cost and Earnings per Vessel for 1965

Cost and earnings for the average Boston offshore-trawler are based on data taken directly from the settlement sheets for 23 vessels. Supplemental information was obtained for insurance, repair and maintenance costs incurred by the vessel operators. Although these vessels fish for haddock on Georges Bank, approximately 31% of their landings in 1965 consisted of other species of fish caught incidentially while fishing for haddock.

Fishing effort, cost, and earnings per average Boston trawler –1965.

Days at sea	270
Days of fishing effort	180
Total landings (metric tons)	1,057
Gross receipts	$253,279
Out-of-pocket costs	$ 51,476
Net for vessel and crew	$201,803
Crew earnings	$115,267
Vessel owner's share	$ 86,536
Insurance, maintenance, and repairs	$ 43,440
Balance for interest, depreciation, and management	$ 43,096
Interest @ 5% and depreciation 20 years	$ 51,000
Return to management	$ –7,904

The average vessel in the fleet in 1965 did not earn a sufficient gross to cover depreciation and interest on the investment, let alone a return to management. Furthermore, the average annual wage per fisherman of $6,619 is not an attractive annual wage considering the rigors, hazards, and long hours involved, and earnings in alternative occupations.

Average cost and earnings per vessel at 7,000 days fishing effort (56 vessels)

As indicated above, fishing effort could be reduced to 7,000 days annually by limiting the amount of fishing per vessel in the fleet. The catch of haddock per vessel would be somewhat greater but incidental catch likely would decline due to fewer days at sea per vessel per year. A slight increase in average ex-vessel price of haddock was introduced in the 7th year after regulation of fishing on the basis that haddock landings would include a higher proportion of the higher valued large haddock and for each year for incidental catch due to reduced landings of incidental catch. The estimated results per vessel in the fleet for the 1st, 5th, and 7th year of adjustment would be as follows:

Fishing effort, cost, and earnings per average Boston trawler, 7,000 days fishing effort (56 vessels).

Item	Years after decrease		
	1st year	5th year	7th year
Days at sea	188	188	188
Days of fishing effort	125	125	125
Total landings (metric tons)	775	975	1,025
Gross receipts	$184,875	239,175	262,392
Out-of-pocket costs	$ 35,025	36,890	37,354
Net for vessel and crew	$149,850	202,285	225,038
Crew earnings	$ 86,787	120,113	134,675
Vessel owner's share	$ 63,063	83,172	90,363
Insurance, maintenance, and repairs	$ 40,000	40,000	40,000
Balance for interest, depreciation, and management	$ 23,063	42,172	50,363
Interest and depreciation	$ 51,000	51,000	51,000
Return to management	$-27,937	-8,828	-363

The immediate impact on the fleet of reducing fishing effort without reducing the size of the fleet would be a significant decrease in annual earnings for both vessel owner and crew. The average earnings per deckhand would drop to $4,944 per year and the vessel operator would have about $20,000 less income annually to apply against depreciation and interest charges.

Returns to crewman and vessel operator would not be reinstated to the 1965 level until about the 5th year of reduced fishing effort. By the 7th year, the overall position of both crewman and vessel operator would be somewhat improved over the 1965 position. But even after the haddock stock had been completely rebuilt, returns to the vessel operator would not include anything for management. Thus, the prospects of this proposal cannot be viewed as being very acceptable to either the fishermen or the vessel operators.

The above analysis does not include an allowance for utilization of the vessel and crew in other fisheries. The vessel could spend an additional 80 days or so fishing for other species. However, if these vessels applied this fishing effort to haddock on Browns Bank or some other haddock fishery, the management problem would simply be transposed to the other fisheries. Furthermore, net gains from fishing these other fisheries would be much less because of the greater distance. No data are available to indicate what the Boston offshore-trawler would be able to do in fishing for whiting, hake, or some other species. However, considering the much lower price which these species command, it is doubtful it this could be profitable fishing for these vessels. Their best alternative might be to merely lay up when their quota of fishing for Georges Bank haddock was completed.

Average cost and earnings per vessel at 7,000 days fishing effort (39 vessels)

An alternative to reducing the fishing effort per vessel as a means of rebuilding the Georges Bank haddock population would be to reduce the number of vessels in the fleet. This means of reducing the amount of fishing effort in the fishery produces dramatic results in terms of return to economic inputs in the fishery. In order to demonstrate the immediate impact of a reduction in size of fleet as well as to illustrate the result of rebuilding the population, costs and earnings are calculated for the 1st year of adjustment, the 5th year, and at the 7th year when the stock would be completely rebuilt to yield the maximum sustainable yield.

Fishing effort, cost and earnings per average vessel, 7,000 days fishing effort (39 vessels).

Item	Years after decrease		
	1st year	5th year	7th year
Days at sea	270	270	270
Days fishing effort	180	180	180
Total catch (metric tons)	1,156	1,546	1,617
Gross sales	$301,948	337,938	361,208
Out-of-pocket costs	$ 53,191	54,803	55,540
Net for crew and vessel	$248,757	283,135	305,668
Crew share	$145,318	167,212	181,561
Vessel share	$103,439	115,923	124,107
Fixed costs	$ 43,440	43,440	43,440
Balance for interest, depreciation, and management	$ 59,999	72,483	80,667
Interest and depreciation	$ 51,000	51,000	51,000
Return to management	$ 8,999	21,483	29,667

Thus, a reduction in the number of vessels in the fishery brings an immediate and substantial improvement in earnings to fisherman and vessel owner. The average annual earnings per deckhand would increase to $8,395, and the vessel owner would be able to realize a positive return for his management in the first year of change. As the stock is rebuilt and catch per day of fishing effort increases, the return to labour and management becomes even more favourable. When the stock is fully rebuilt, the average earning per deckhand would be over $10,000 annually and management would realize a net return of almost $30,000 annually.

This is a conservative estimate of the economic advantages that could be gained from management. These data are based on the average achievement by the fleet. If the below-average vessels were eliminated, the average performance for the remaining fleet would be higher than reflected in the data used in this assessment. For example, a fleet of approximately 35 vessels could put 7,000 days of fishing effort on Georges Bank if the vessels performed in the manner that the above-average vessels now perform.

APPENDIX II

Biological and Economic Effects on West Greenland Cod of Conservation Actions

A. Biological Aspects

BY

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Introduction

The state of the stocks of cod at West Greenland has been considered in some detail by a special ICNAF working group. Though this group was specifically concerned with the effects of protection of small fish (by closed areas or large meshes), the results of the working group can be used to assure the effects of changes in fishing effort. No new analysis of the basic data has therefore been attempted.

As pointed out by the working group, there are at least two stocks of cod in the West Greenland area, and substantial numbers of all the larger fish, at least of the southern stock, move from West Greenland to East Greenland and Iceland. Ideally the analysis should therefore deal with cod stock separately, and include a study of the effects on the Iceland and East Greenland fisheries. Fishing in all these areas is heavy, so for simplicity the West Greenland fishery has been considered as a self-contained unit, but in interpreting the results it should be remembered that some of the increased numbers of older fish resulting from a reduction in effort would be caught at Iceland rather than at Greenland. This will make little difference to the total North Atlantic cod catch.

Trends in Effort

The character of the fishery at West Greenland has been changing so much that there is no one series of effort data which can be used to provide a consistent index over a period of years of of the effort in the biologist's sense, i.e. a quantity proportional to the fishing mortality coefficient. The working group report used two measures, based on the total catch, and the catch per unit effort of certain types of vessel at certain seasons. The report of the ICNAF Assessment Subcommittee at the 1965 and earlier meetings used a less precise measure derived from the catch per day's fishing or days on the grounds of all trawlers and the total catch of all species, i.e. the number of days fishing or on the grounds that the average trawler would have to do to catch an amount equal to the total catch by all gears. These are tabulated below:

TABLE 1. Estimates of fishing effort (mortality) at West Greenland from 1959 to 1965.

Measures of effort used	Years						
	1959	1960	1961	1962	1963	1964	1965
a) From Horsted 1965	0.99	0.95	1.38	1.42	1.43		
b) From working group report	1.10	1.18	1.36	1.25	1.43		
c) Trawler days fished				18,100	18,900	20,300	
d) Trawler days on grounds	18,200	16,200	22,100	23,400	24,100		
e) Mean of a) and b)	1.05	1.07	1.37	1.33	1.43		
Best measure, as % of 1960	98	100	128	124	134	145[a]	160[b]

[a] Estimated from the increase from 1963 to 1964 in days fished.

[b] Estimates assuming a 10% drop in catch per unit effort in 1965.

Mortality Coefficients

The working group report gives estimates of the mortality coefficients in 1960; these were:

$$F = 0.30 - 0.50;$$
$$M = 0.15 - 0.20.$$

If the fishing effort (in the biologist's sense) has increased 60% since 1960, then the range of values in 1965 are:

$$F = 0.48 - 0.80;$$
$$M = 0.15 - 0.20;$$
$$Z = 0.63 - 1.00;$$

i.e. F/Z is about 0.75 – 0.80, F/M is about 3 – 4.

If the catch/effort curves for West Greenland cod can be determined from the simple Beverton and Holt/Bertalanffy model, and taking $L_c = 50$cm (see fig. 5 of the working group's report[1], which gives the length compositions of catches and landings), and the parameters of the Bertalanffy growth curve as:

$$L\infty = 90;$$
$$K = 0.25;$$

then the yield/effort curve can be determined from the FAO yield tables, using suitable values of M/K, c, and F/M. For a set of probable values (M/K = 75, c = .56, F/M = 3.5), the effort is greater than that giving the maximum yield, which would be obtained with an effort 35% below the 1965 effort. This maximum catch would be about 2% greater than that obtained with the 1965 level of effort. Using different values of the parameters, the conclusions reached are quantitatively slightly different, but there is qualitative agreement within the probable range of values that the 1965 level of effort is not substantially below the level giving the maximum sustained yield, and may be well above it. Thus an appreciable reduction in effort could be made without appreciably reducing the sustained catch and is more likely to increase the sustained catch bearing in mind the fact that the actual values are most likely to lie in the lower and right hand side of Table 2. Specifically a 30% reduction in effort (fishing mortality) was considered, and the resulting change in long-term catch for different possible values of c (size at first capture, as a percentage of the maximum size) and F/M, are tabulated below.

TABLE 2. Change (%) in long-term catch as a result of 30% reduction in fishing effort (mortality).

	F/M			
c	2.0	3.0	4.0	5.0
.64	-6.0	-2.0	-0.2	+1.1
.60	-4.7	-0.6	+1.0	+2.5
.56	-3.4	+0.4	+2.8	+5.3
.60	-1.3	+3.1	+5.4	+8.5

From these figures it is reasonable to assume that long-term catch at a level of effort 30% below that of 1965 will be the same as that with the effort maintained at the 1965 level; possibly it might be very slightly higher. This figure of a 30% reduction in effort, with no change in total catch, has been used in assessing the economic effects.

Interim effects

The calculations in the previous section refer to the long-term steady state, and would not be reached immediately following a 30% reduction of effort from the 1965 level. Calculations have been made of the interim catches in each year following a 30% reduction in effort from a steady state situation with the effort equal to that in 1965; for a probable set of parameters, the catches, expressed as percentages of the initial catches are as follows:

Year 1..... 76%;
Year 2..... 86%;
Year 3..... 93%;
Year 5..... 100%;
Year 10..... 104%;

i.e. the reduction in catch is less than the 30% reduction in effort even in the first year (assuming the fishing is spread evenly through the year), and after 5 years the catch is close to the long term value.

As Table 1 shows, the effort on West Greenland cod is far from being steady, and has been

[1] See *Int. Comm. Northw. Atlant. Fish., Redbook* 1966, Part III, Section A, p. 3-84.

rapidly increasing; therefore the above calculations of the change from a steady state do not apply directly. However, it is likely that they do give a fair measure of the difference in catch to be expected from two possible courses of action—maintaining the effort at the 1965 level, or reducing the effort to 70% of the 1965 level. Because of the lower pre-1965 efforts the catches at the 70% effort would, during the interim period, be nearer the long-term value than is suggested in the table, i.e. would be larger. Equally the catches with the 1965 effort would also be different from the long-term value, i.e. would also be larger. The difference between the catches from the two regimes of effort may therefore still be close to those given in the table, i.e. the table gives a useful measure of the difference in catch from the two regimes even when initially the stock is not in a steady state.

Also it must be remembered that the actual catch in any year will depend on the strength of the year-classes present, and at West Greenland the year-classes are highly variable. However again, the table gives a fair measure of the difference in catch, in any year, resulting from the two possible regimes.

B. Economic Aspects

BY

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Introduction

The following analysis is based on the assumption that only the cod fisheries **off West Greenland** are regulated, i.e. the effort reduced by 30% of the 1965 level. While in the biological investigation an isolated approach can be taken without any harm, the economic evaluation of possible effects is rendered highly theoretical. Total benefits or losses—short-and long-term—can only be properly measured if repercussions on other stocks, total supplied and markets are taken into consideration. These will entirely depend upon how the eliminated fleet capacity is utilized.

Aggregate Costs

Latest information on costs for different types of vessels of various nationalities operating off West Greenland is available for 1964. On the basis of certain assumptions, the annual costs of the relevant vessels can be broken up and a proportional share be allocated to the operations off West Greenland. Estimates have been made where no data are available.

The results of the calculations are summarized in Table 1, which gives the aggregate total costs for 1964 operations off West Greenland amounting to about US $50 – $55 million.

TABLE 1. Estimated aggregate costs in million US $ for 1964 and 1965 (increase of effort in 1965=10%).

	1964	1965
1. Operating and crew expenditures	42.0	46.2
2. Interest on capital invested	5.2	5.7
3. Sub-total 1+2	47.2	51.9
4. Depreciation (5% on capital invested)	5.2	5.7
5. Total costs (1st alternative)	52.4	57.6
Sub-total 1+2	47.2	51.9
6. Depreciation (8% on capital invested)	8.7	9.6
7. Total costs (2nd alternative)	55.9	61.5

Taking the increase of the biological fishing effort as a basis (increase of 10% from 145 in 1964 to 160 in 1965), total aggregate costs for 1965 operations off West Greenland have, approximately, been US $55–$60 million. In this it is assumed that types of operations have not drastically changed from 1964 to 1965 and that costs per day fishing have not increased in this time. When assuming an average cost increase of 5% the aggregate cost figure is raised to US $58–$63 million. It seems therefore reasonable to use for the further calculation a figure of US **$60 million**; this is approximately made up of US $46 million exploited costs and $14 million interest and depreciation.

Cost Savings of a Reduction in Effort

As a most simple case it can be estimated that the annual cost reduction is proportional to the contraction of fishing effort (in the biological sense). A 30% reduction of fishing effort from the 1965 level would thus result in a 30% decline of costs, i.e. roughly **$18 million**. But there are a number of important assumptions underlying this calculation, assumptions which are more or less unrealistic. These are:

a) the redundant fleet capacity can be absorbed in other fishing, either inside or outside the North Atlantic, **without any economic disadvantage**;

b) the relative composition of the fleet as regards types of operations remains unchanged from year to year;

c) the total number of days fishing is proportional to changes in mortality rate,

Moreover, total beneifts can only be evaluated if the effects on market returns are taken into account. Even when assuming that, generally, cost/price ratios remain unchanged, the reudction in effort has an impact on supplies and market prices.

Excess Capacity

There are various possibilities as regards the utilization of the redundant capacity:

a) cod fishing elsewhere in the North Atlantic;

b) fishing for other species in the North Atlantic;

c) fishing in areas outside the North Atlantic;

d) stopping fishing for part of the capacity (part of the year) and laying up the vessels;

e) scrapping of excess capacity.

A precise forecast of the course likely to be adopted would imply evaluation of a number of factors, which would lead too far for this limited case study. These include not only national and international consideration (e.g. composition of national fleets, structure of national market, relative abundance on alternative grounds, market prospects for alternatively fished species, etc.), but also individual operator's assessments of future trends, which again would be influenced by decisions competing fleet operators will take. These implications can only be properly evaluated by a much more detailed examination than is possible here.

Nevertheless, working on the premise that other cod stocks in the North Atlantic are not regulated, a switch of effort to these grounds seems inevitable. Present catching prospects would then suggest that this would have rather detrimental effects on these stocks, at least in the long run. Any benefit from reducing the effort at West Greenland would thus most likely be partly or totally dissipated. In fact, it becomes obvious that restricting regulations to single grounds is not feasible. It is therefore more logical to assess the problem of excess capacity in a wider context.

The foregoing remarks refer mainly to the mobile part of the fishing fleet off West Greenland. The alternatives for other vessels are much more limited. For example, the Greenlandic small boats have practically only the choice between laying up (or scrapping) and—to a little extent—switching to shrimp fisheries. Social reasons and problems of general economic development would therefore warrant that these operations are excluded from the regulation of effort.

Effects on Various Types of Operations

A reduction of fishing effort at West Greenland might affect different operations in various ways, depending on the composition of national fleets and on how the owners decide to operate these fleets under a regulated fishery. It is, however, unrealistic to assume that, total effort being reduced by 30%, the remaining fleet will have, proportionally, a similar (or even the same) composition. It has therefore to be assessed, how the costs saving of $18 million will be changed if one type of operation is more affected than the others.

TABLE 2. Aggregate costs according to types of operations in 1964 and 1965.

Types of operation	Annual costs			Days fishing		Days at sea	
	1964		1965[a]	1964	1965[a]	1964	1965[a]
	$ mill.	%	$ mill.				
Trawler	38.0	68	40.8	13,071	14,350	22,334	24,600
wetfish	7.7	(20)	8.3	2,147	2,350	5,617	6,200
freezer[b]	8.8	(23)	9.5	2,779	3,050	4,843	5,350
salter	12.6	(33)	13.5	5,701	6,250	7,382	8,100
not specified	8.9	(23)	9.5	2,444	2,700	4,492	4,950
Longliners and dories	13.5	24	14.5	12,222	—	16,600	—
Small boats	4.4	8	4.7	40,000	—	41,000	—
Total	55.9	100	60.0	—	—		—

[a] Estimated on the basis of a 10% increase in fishing effort from 1964 to 1965; the number of days fishing (and days at sea) for 1965 is only theoretical, because the same composition of the fleet as in 1964 is again assumed. In reality the effort of freezer trawlers and more efficient vessels has increased, so that the actual number of days fishing was lower.

[b] Including part-freezer.

Table 2 gives an approximate breakdown of total costs according to types of operations, together with a summary of days fishing and days at sea spent by the different groups.

Total costs are shared thus:

Trawlers 68%;
Longliners and dories 24%;
Small boats ..... 8%.

If all types would be equally affected the same shares would apply to the cost savings of $18 million:

Trawlers	$12.3 million
Liners, etc.	$ 4.3 million
Small boats	$ 1.4 million
Total	$18.0 million

But these shares (and the total) change considerably if various alternative assumptions are made regarding the composition of the fleet after reduction of total effort by 30%:

i) Assuming that the reduced number of days fishing of the trawling section (14,350 minus 30%×10,000) is **exclusively used by wetfish trawlers,** total costs of this section would amount to $35 million and savings thus be (reduction for liners and small boats being 30%:

Trawlers (wetfish)	$ 5.4 million
Liners	$ 4.3 million
Small boats	$ 1.4 million
Total	$11.7 million or about 20% of the 1965 level of total costs

High costs per day fishing, because of the long steaming time (up to about two-thirds of total trip duration) is the explanation for this drop in benefit.

ii) If it is assumed that the remaining fishing days are exclusively used by freezer (or part-freezer) trawlers, the following cost savings can be calculated:

Trawlers (freezer and part-freezer)	$ 9.6 million
Liners	$ 4.3 million
Small boats	$ 1.4 million
Total	$15.3 million or about 25% of the 1965 level of total costs

This saving would, however, be considerably increased if only the most efficient full-freezer vessels would continue to operate in the area.

iii) If, in another extreme case, all remaining trawling days would be taken up by salter trawlers, the following results would be obtained:

Trawlers (salters)	$19.2 million
Liners	$ 4.3 mililon
Small boats	$ 1.4 million
Total	$24.7 million or more than 40% of the 1965 level of total costs

The examples quoted above indicate that the cost savings would be quite different depending on which types of boats are more or less affected by the conservation measure ranging from about $12 to $26 million per annum, or 20 to 40% of the costs incurred in 1965.

The examples are theoretical extremes and only give the ranges of possible developments. A more likely approach would be to assume that small boats are exempted from the regulation because of social reasons and that longlining would drop less than 30% (say 15%), because better size composition of the catches from the improved stock could give them comparatively better gains. If this were the case and the same reduction in total effort (mortality) is to be achieved, effort of the trawling section would have to be lessened by more than 30%. Part of the additional diminution would have to be guaranteed by those countries operating a mixed fleet of trawlers and liners in the area. This raises then the question of how to relate a liner's fishing day to a trawler's fishing day, which in terms of yield are not the same. These remarks already involve the third assumption made about the direct relationship between effort (in days fishing or a similar yardstick) and mortality.

Effort/Mortality Relationship

The assumption that the mortality of the stock is proportional to changes in the number of days fishing underlies the biological forecasts: it should be pointed out here that while this may be a viable premise if applied to a gradually developing, unregulated fishery, it might no longer be realistic, when effort regulations are introduced. The effects of various types of gear and vessel on fish mortality are rather different and as sudden and drastic changes in the fleet composition may result from the enforcement of conservation action, a direct proportionality could no longer be assumed. If, for example, with the reduction of total effort at West Greenland the share of longlining and trawling for wetfish (smaller boats compared with freezer trawlers) is increasing considerably, a reduction of mortality of 30% (effort in the biological sense) would probably require a diminution in the number of days fishing of less than 30% or, in other words, a reduction in the number of days fishing by 30% would lead to an undesirably low level of exploitation. This is mainly a biological problem, but would lead to an undesirably low level of exploitation. This is mainly a biological problem, but as the biological "optmum mortality" would have to be translated into another yardstick in a conservation program, it will have to be borne in mind that the actual fishing intensity will depend upon the individual operator's decision as regards the various types of vessels.

Influence on Markets

It has been assumed that cost/price ratios remain unchanged during the conservation period, that is to say that costs of operating fishing vessels and prices returned for the produce move in the same proportion. Though it is, of course, obvious that neither costs nor fish prices will remain stable during a period of 5 years (or change at the same rate), the assumption is permissible if only the particular influence attributable to the conservation action has to be assessed. Its direct influence on operation and building costs of fishing vessels should be negligible. As regards price developments, distinction has to be made between the short-term effects in the intermediary period and the long-term effects after recovery of the stock.

It has been calculated that in the year following the reduction of effort by 30%, cod catches off West Greenland will diminish by 24%. In terms of total cod supplies from the North Atlantic this would mean—everything else remaining unchanged—a contraction of about 3–4%. But here again, it will depend upon how the redundant capacity is employed, whether this percentage will not actually be lower, e.g. if cod stocks in other areas are fished or other species liable to replace cod on certain markets, e.g. Cape hake or redfish. To evaluate the short-term effect on cod supplies of the regulatory action, an assessment of the employment of the eliminated capacity is therefore essential.

Nevertheless, a certain, though small, reduction in cod supplies can be taken for granted because it is logical to assume that alternative areas are comparatively less advantageous. The extent to which market prices are affected by the decline in cod catches depends on the average price elasticity of demand. The demand for mass consumption species, such as cod, shows a fairly general pattern with a rather elastic range until the saturation point is reached (this is mainly because these fish can be easily substituted by other products) and a very inelastic part, if supplies increase beyond that level. At the present supply and price level, demand is probably near to unit elasticity and a small reduction in supplies would then cause an equivalent price increase so that total revenues remain unchanged. For the West Greenland case it would mean that, though return for West Greenland cod will decrease (something less than 24%), this will be made good by higher prices for cod from other areas.

It has, however, to be stressed that this holds true only for a small decline in supplies. If this is greater, total supplies will most likely come into the range of elastic demand, thus causing a decline in gross returns. In this context, it has to be borne in mind that different national markets would be differently affected by the reduction in supplies according to the share they have in Greenland cod fishing. For example, in 1964 about 70% of German trawled cod originated from Western Greenland. A reduction of 24% would, in a case like this, mean a considerable reduction in total cod supplies (almost 20%). If these cannot be compensated to a large degree by cod from other areas, a diminution of total gross returns from cod is rather certain.

Considering the effects on markets it also has to be taken into account that different products might be differently affected. For example, price elasticities for frozen fish should be greater than for wetfish because of various factors (even easier substitution, wider distribution possibilities, and better keepability of the product and greater concentration on the buying side). Reduction in supplies would thus be made good only to a small degree by price advances. On the other hand, demand for saltfish and stockfish is rather inelastic and a decrease in production would probably induce relatively big increases in world-market prices. This has been manifested in the past years when prices for salted cod have shown distinct upward trends because supplies fell short of demand. It has, however, to be borne in mind that prices for saltfish are already nearing the price level for frozen fish.

In contribution of the conservation program catches will very soon approach the original level and market effects thus become smaller. The rebuilding of the stocks results in improved size composition of the catches and, as larger-size species generally achieve higher market prices a favourable effect on returns can be expected. Moreover, the larger sizes will particularly benefit certain operations, such as salting and long-lining. This might suggest that the regulated

cod stocks off West Greenland could become a most important reservoir for these types of operations.

Also to be taken into consideration is the gearing of mass-processing plants, such as those in the shore-based freezing industry, to handle the most common size of fish being landed. Any sudden changes in size composition might therefore tend to upset the equilibrium of the market but the effect would not be pronounced if the change was spread over 5 years.

Conclusions

The foregoing discussion presents evidence that a reduction of fishing effort would bring about considerable economic benefits. For example, even with the least favourable assumptions with regard to type of operations and market prices the long-term net gain would certainly by far exceed the total financial aid granted to this section of the fleets by the various governments. In fact, it would probably be two to three times greater.

Moreover, it is realistic to conclude that such a scheme would—in the long run—be associated with considerable profits for the participating industry. The level of profits would most likely be higher than could be achieved in any other industry and the problem would thus be to build up an enforceable system of controlled effort whereby access to the increasingly profitable ground could be restricted.

This is particularly relevant as it is almost certain that efficient regulation of the North Atlantic fishery as a whole would result in redundant fishing capacity. The possibilities of disposing of this capacity and its evaluation in economic terms is therefore a prerequisite for a complete assessment of the costs or benefits of a conservation program.

APPENDIX III

Biological and Economics Effects on Northeastern Arctic Fisheries of Conservation Actions

A. Biological Aspects

BY

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Introduction

Detailed assessments of the state of the fish stocks in the northeastern Arctic and of the effects of fishery regulations have been made in recent years by the ICES Arctic Fisheries Working Group. The main activities of this group were directed to the assessment of the effects of increases in mesh size in the trawl fisheries, but consideration was also given by it to the effects of a reduction in fishing mortality rate (=effective fishing intensity). The Working Group's assessments were made on data for the post-war period up to 1963. This report is based on the assessments made by the Working Group with, where possible, adjustments for more recent changes in the fisheries.

The Arctic fisheries are centred principally on cod and haddock, which together make up 75–80% of the total groundfish landings from the northeastern Arctic (ICES Statistical Areas I,

IIa, and IIb). The detailed assessments dealt with in this report are, therefore, confined to these two species. However, some general considera-ation is given to other species exploited in this area, with special regard to the utilization of surplus fishing effort.

Cod

The Arctic cod fishery is carried out in the Barents Sea, in the Bear Island-Spitzbergen area, and off the Norwegian coast (Lofoten). The Barents Sea and Bear Island-Spitzbergen fisheries are conducted principally by trawl on the immature and prespawning adult concentrations of cod, while the Norwegian coast fishery is a mixed gear one, centred principally in the spring, on mature, spawning cod.

Total landings of cod from these three areas combined increased rapidly after the war to a level of between 700 and 800 thousand tons by 1947 and, apart from 1965 and 1956, when they jumped to over a million tons, they fluctuated around this level up to 1963. Since then the landings have decreased substantially to between 400–500 thousand tons. The relatively stable total yield picture up to 1963 was maintained by a large increase in the landings of the younger age-groups of cod from the Barents Sea, due to a marked growth in the USSR fishery there; at the same time, the landings of large, mature cod from Norwegian coast fishery declined, their proportion of the total landings decreasing from around 40% in 1946–47 to around 15% in 1962–63. Catch-per-unit-effort data show that this was associated with a marked decline in stock abundance in this area and a decrease in its average age. The decrease in total landings since 1963 has been due partly to a decrease in fishing effort especially in the Barents Sea as a result of the diversion by the USSR of part of its fishing fleet, exploiting this stock to other, more productive fishing areas, and partly to low recruitment to the exploited stock due to poor year-classes. Detailed information is not currently available on the actual magnitudes of these two contributory factors since 1963. Therefore, in this analysis the assessment of the biological effects of a decrease in fishing effort are considered for the period prior to the reduction in fishing after 1963.

From 1947 to 1963 the total landings of cod have fluctuated about a fairly steady level, estimates of total fishing effort on the stock show a major increase throughout this period. This is shown by the estimates in Table 1, obtained by the Arctic Fisheries Working Group for the years 1947–52 and 1959–63.

TABLE 1. Estimates of total fishing effort on Arctic cod from 1947 to 1952 and 1959 to 1963.

Years:	1947–52						1959–63				
	1947	1948	1949	1950	1951	1952	1959	1960	1961	1962	1963
Estimates total fishing effort in English trawler units (ton-hours $\times 10^{-8}$)[a]	2.6	3.0	2.9	4.7	6.0	6.9	7.8	8.2	9.4	9.7	9.3

[a] These estimates refer to the total ton-hours fishing by the English trawl fleet required to take the total catch of all fleets combined in the whole area. They represent the sum of the estimates of English trawl effort (in ton hours) × **total catch by all fleets** for each of the main fishing areas catch by English trawlers—Barents Sea, Bear Island–Spitzbergen, and Norwegian coast. They provide the best available indices of the quantity which is proportional to fishing mortality rate.

Long-term Effects of Reduction in Fishing Mortality Rate

Data on estimated total mortality rates of Arctic cod in relation to the data for catch, catch-per-unit- fishing effort and estimated fishing effort, during the post-war period indicate clearly that in the period of high fishing effort in 1959–63 fishing was the major cause of mortality, probably accounting for about two-thirds of the deaths amongst the younger age-groups and perhaps more amongst the older ones. Although, as pointed out by the Arctic Fisheries Working Group, the nature of the Arctic cod fishery is such that the

fishing mortality rate is probably not constant for all age-groups in the exploited phase, the following estimates of the mortality parameters represent reasonable average values for the exploited phase as a whole:

$$Z = 0.6\text{–}0.8;$$
$$F = 0.4\text{–}0.6;$$

$$F/Z = 0.7\text{–}0.8;$$

$$F/M = 2.0\text{–}3.0.$$

Equilibrium yield per-recruit calculations in which the values of these parameters are assumed constant over the whole of the exploited phase indicate that for the present age of first capture, corresponding to a manila codend mesh size of 120 mm the fishing mortality rate and total fishing effort generating it was higher than that giving rise to the maximum sustained catch-per-recruit. They show that no loss and probably an increase of up to 10% in equilibrium catch-per-recruit would accrue for a reduction in the fishing mortality rate (and hence of **effective** fishing effort), on all age-groups of cod in the exploited stock, by up to 30–40% from the 1961 to 1963 level.

This assessment is based on the assumptions that the mortality rates under present conditions are the same for all exploited age-groups and that the reduction in fishing mortality rate also takes place proportionately on them. Neither of them are likely to be strictly valid. In particular, a reduction in fishing mortality rate on all age-groups would lead to an increase in the abundance of the larger, more valuable cod, so that unless restraints were imposed on the fishing fleets, there would be a tendency for the fishing effort to shift from the smaller to the larger fish areas. Such a situation would result in higher long-term gains than those predicted above from a proportionate decrease on all age-groups.

The estimates of long-term effects, given above, are on a "per-recruit" basis; they represent the average annual yield relative to what it would be in the absence of any change in fishing mortality rate (and natural mortality and growth rate). They can only be converted into absolute catch quantities if the future average annual level of recruitment is known or does not change significantly from the average level in past years. Future levels of recruitment cannot be predicted, but on the assumption that the average level does not change significantly from that of the past 10 years, the reduction in fishing mortality rate on all age-groups by 30–40% from the level of the early 1960's would be expected to increase the average annual cod catch by up to 60–80 thousand tons.

Interim Effects

With a decrease in fishing mortality rate, the recovery of the stock to its new, higher equilibrium level will be at the expense of a short-term decrease in total catch throughout the recovery period. For the Arctic cod, the total recovery period to the new equilibrium catch level would take 6–8 years, and to the previous catch level 4–5 years. The year-by-year changes in catch, assuming that recruitment remained constant throughout the recovery period would be as follows:

Years following reduction in fishing mortality rate	Catch as percentage of original catch
1st	74–76
2nd	85–88
3rd	92–95
4th	97–100
5th	100–105
6th, 7th, 8th	105–110

In practice, of course, owing to year-class fluctuations, the absolute changes in catch would not necessarily follow this course, but would be subject to wide variations from year to year. If the introduction of the reduction occurred at a time when a strong year-class was recruiting the fishery the decrease in catch during this period might be negligible; indeed, it might even be higher than the average for the preceding period.

The above assessments relate to the changes in catch following a reduction in fishing mortality rate (=effective fishing effort) from the high

level in 1961–63. As mentioned earlier, since 1963 there has been a decrease in total fishing effort (and hence fishing mortality rate) in the cod fishery. This has taken place mainly in the younger, immature cod area in the Barents Sea. Although the actual magnitude of this decrease has not yet been ascertained (a further meeting of the Arctic Fisheries Working Group, to assess this and other recent changes in the cod fishery and stock will take place in April 1967), it is clear that, **if sustained,** it will result in at least some of the recovery predicted above. The preliminary data available for 1964–66 suggest, in fact, that the reduction has been of sufficient magnitude to move the effective fishing effort (fishing mortality rate) close to the level yielding the maximum catch-per-recruit for the present age of recruitment to the fishery (corresponding with an "effective" manila trawl mesh size of 120 mm).

Haddock

The post-war history of the haddock fishery in the Northeast Arctic resembles closely that of the cod. Landings increased rapidly after the end of the war to a level of 120–140 thousand tons in the late 1940's, and except in 1955 and 1956, when they increased to over 200 thousand tons, they fluctuated around this level thereafter.

The main fishery for haddock in the Arctic is the Barents Sea where they are exploited by the same trawl fleets as exploit cod in this region. Therefore, as with cod, they were subject to the same large increase in fishing intensity in the period up to 1963, which was accompanied by a marked reduction in catch-per-unit fishing effort and a reduction in the average age of the exploited stock. Again, as with cod, the available data indicate that the high level of fishing effort during the early 1960's, the fishing mortality component was the largest of the mortality components, accounting for about three-quarters of the total deaths of haddock each year. Average mortality parameters for the haddock at this level of fishing are estimated to be as follows:

$$Z = 1.1 - 1.2;$$
$$F = 0.8 - 0.9;$$
$$F/Z = 0.7 - 0.8;$$
$$F/M = 2.7 - 3.0.$$

Estimates of the equilibrium yield per-recruit, using these parameters, indicate that, as with cod, in the early 1960's the fishing mortality rate had reached a level higher than that necessary to obtain the maximum sustained catch. They show that a decrease of 30–50% in this mortality rate should lead to no decrease in sustained catch and probably an increase of up to 10%.

Again, as for the cod, this assessment relates to the catch relative to what it would be with no change in fishing mortality rate; if average recruitment and other population parameters remained the same as during the past, the reduction should result in an average annual increase of up to about 15,000 tons of haddock. The interim changes, for a decrease in fishing mortality rate of 30% would be approximately the same as for cod, the recovery period to the previous catch level being 4–5 years and to the new equilibrium level 6–7 years.

Other Resources

The principal demersal resources other than cod and haddock, fished in the northeastern Arctic are saithe and redfish. While the distribution of saithe overlaps that of cod and haddock in the area at least for part of the year that of redfish is largely distinct from it so that it could be exploited independently of cod and haddock in this region. Also, in the spring, concentrations of saithe occur off the Norwegian west coast largely independently of these species.

The stocks of both of these species have been subject to intensive fishing in this area for a number of years, and for the redfish in particular there has been a substantial decrease in catch-per-unit-effort during the past 10 years. In this case, therefore, it is unlikely that with increased fishing this resource would sustain large increases in yield beyond the level of recent years. It seems likely on the other hand that the present exploitation of saithe is below the level giving the maximum sustained yield and therefore that catches could be increased somewhat above the present level, with a moderate increase in fishing.

In addition to these major resources the main alternatives for any large diversion of fishing effort in the northeastern Arctic would seem to be potential demersal and pelagic industrial fish species (e.g. blue whiting, silver smelt, capelin, and perhaps also herring) which are potentially capable of providing substantially greater yields than at present.

B. Economic Aspects

BY

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Careful consideration was given to the economic effects of a limitation of fishing effort (input) in the northeastern Arctic fisheries. It was concluded that it would not be helpful to make any detailed economic assessment of these effects at the international level. This region is exploited principally by the fleets of three countries that have widely differing cost structures, fishing patterns, marketing methods, product valuations and, to some extent, fishing techniques also. But there is little quantitative information in respect of any of them that could be used to make a meaningful international economic assessment. Moreover, there is insufficient material available on which to make a rational assessment of the manner in which these fleets would, on any given reduction of effort, redeploy their remaining fishing effort—spatially and temporally—within this region.

On one set of assumptions it is possible to show that one fleet would be a significant loser, another a significant gainer and the third a probable gainer. Other sets of assumptions result in two significant losers and a wide range of alternative sets of assumptions would produce gains for all but in differing absolute and relative amounts. There seems to be no basis for preferring one set of assumptions to another. To have presented an assessment on the basis of any one or even on a few sets would have served to highlight the artificiality of the exercise and, hence, to cast doubts upon the worthwhileness of effort limitation generally.

Moreover, it seemed that at best any attempt at an economic assessment in this region would add little or nothing to that which the biologists have already stated in clearly understandable terms. At bottom, any such economic assessment would say merely that we are offered the opportunity of landing, after some period of readjustment, the same or somewhat greater weight of fish at a proportionate saving in the economic resources devoted to its production more or less equal to the initial reduction in fishing effort. The distribution of this saving in each country among producers, processors, distributors, consumers, and the state would be a matter of national economic policy.

An economic assessment of effort limitation in this region which would go beyond what is largely a restatement of the biologist's proposition about the nature of the long-term yield/effort curve would, in this case at least, need to be done in national terms on the basis of a concrete and complete proposal concerning the limitation and the administrative arrangements made in respect of it.

In conclusion, therefore, we think it right to say, first, we have no doubt that the Northeast Arctic cod fisheries do offer the possibility of substantial economic gains to be obtained from effort limitation in that region; but, secondly, so far as the international commission is concerned, we doubt whether—at this stage and with the information currently available—the economists have anything helpful to add to the biological assessment.

APPENDIX IV

Projections of the Fishing Fleets Operating in the North Atlantic in 1970[1]

Introduction

Forecasting any future developments can never be exact and this certainly applies, but even more so, in fisheries in which rapidly changing and unpredictable conditions present particular difficulties. Past experience shows that the rhythm of new investments in never regular and that the decision whether a vessel is obsolete and should be scrapped depends on many factors. An exercise on fishing fleet projections, even for a relatively short period of 4–5 years, can therefore not be expected to give precise and definite results. It can only indicate the tendencies most likely to occur and give the possible range of increase or decrease in fishing power.

Even more difficult, is to forecast which part of the fishing fleet existing in 1970 is likely to exploit a definite area, like the North Atlantic. A considerable and rapidly expanding section of the fleet in and outside the North Atlantic is mobile enough to fish practically any area in the oceans. The proportion operating in the North Atlantic might therefore fluctuate considerably from year to year depending on the relative fish abundance in various areas. The forecasts given in the following sections have therefore to be interpreted cautiously.

Canada

In 1965 the otter-trawl fleet of the Atlantic coast of Canada numbered 110 vessels over 100 ft in overall length (200 gross tons and over).[2] Average size of these vessels is slightly over 300 gross tons, thus the total represents about 35,000 gross tons. This fleet's landings made up about 35–40% of total groundfish landings, but its contribution to cod landings was only about 20%, these being dominated by the small or "inshore" boats.

Prior to 1965 net additions to the fleet of these larger vessels were on average 10 units each year and forecasts for the immediate future resulted in an even greater rate for the years up to 1975. These have, however, to be evaluated carefully, because during the preceding 5 years or so a mood of extreme optimism had spread throughout the fishing industry of the Atlantic coast, due to the persistence of a strong market, appearance of capital from private sources outside the industry, and the mounting volume of financial and other forms of assistance in the region. In the meantime a brake on further rapid expansion of the fleet appeared in the form of a shortage of skilled manpower. At the same time, the price for the major product derived from groundfish species, i.e. frozen blocks of fillets, began to weaken. Moreover, the catch per vessel-ton-year (as a measure of yield per unit of input) has tended to decline: by 15–20% since 1950.

Under these circumstances it would be more realistic to assume that the present rate of expansion for the Atlantic large trawler fleet might be maintained for some time, at least for the period 1966–70. A net increase of 10 vessels per year would approximately amount to an increase of about 15,000 gross tons.

Development of the fleet of medium-sized craft and inshore boats, which accounts for the major part of the cod catches, cannot be assessed. Prior to 1965 there was a substantial increase in the number of medium-sized fishing craft (50-100 ft in length approximately) i.e. small draggers, longliners, and seiners, but these have, at least to a considerable extent, replaced larger numbers of small boats.

Faroe Islands

The Faroese fishing fleet in 1965 consisted of about 170 units above 20 gross tons, accounting for a total of about 35,000 gross tons. Most important were 59 steel longliners, representing 17,000 gross tons, with an average age of 4 years. The rebuilding of this fleet must be considered as terminated. Eleven trawlers with about 9,000

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[1] This contribution to the bio-economic study was prepared by the Secretariat to the Committee for Fisheries of OECD. It is stressed that while the Committee was kept informed on the nature of the contents of the contribution, the outcome of the Group's work as a whole has not been examined by the Committee. The OECD contribution should therefore be considered as a preliminary exercise which the Committee for Fisheries will eventually take up for full consideration when further and more advanced work will allow it.

[2] In addition there were about 55–60 vessels between 75–100 ft (100–200 gross tons).

tons are second in importance, but since 1957 there has been considerable decline in this section.

The Faroese fishery is at present in a transitional stage, the future way to go being difficult to anticipate. Salted cod operations face serious economic difficulties so that some conversion to purse seiners for herring fishing has already taken place. Traditionally, Faroese fishing is mainly a distant water operation and it is at present being considered whether its position can only be maintained by going into freezing at sea (or combined freezing/salting). One freezer trawler (part-freezer) was purchased from Germany in 1966 but whether more will follow until 1970 cannot be anticipated. It is therefore assumed that the Faroese fishing capacity (for groundfish) will remain stagnant or decrease slightly.

France

First, it must be decided which part of the French fishing fleet is to be included in this study. Obviously, the salters and the new freezers operated or ordered by the owners formerly specializing in salted cod must be taken in since they exploit far distant grounds (Newfoundland, Labrador, West Greenland). But among wetfish vessels, although a number of them are fishing exclusively in the North Sea or in the Atlantic south of the British Isles, others spread their operations over the North Sea, Norwegian Sea, and grounds as far west as the Faroe Islands or Iceland.

For the purpose of the present study, consideration will only be given to those vessels which can be called far distant, i.e. which are likely to fish grounds further than the North Sea.

a) Wetfish, or former wetfish, fleet

This heading covers the wetfish fleet (or former wetfish fleets), of 40, or more likely 50 m vessels. The decision to build such vessels is not at present easy. The financial help to be expected from the authorities is limited and the economic conditions are not too favourable. Competition from other European countries has increased partly as a result of the Common Market and market prices have not developed as favourably in France as they have in other European countries. Possibilities of development exist in the consumption of deep-frozen fish but French owners are entering this venture rather late and are faced with powerful foreign competitors.

It would perhaps be a reasonable forecast to schedule about 20 new vessels between 40–50 m, all stern trawlers and ready to be fitted with freezing equipment on board without structural modifications. It should be added that part of these vessels would be exploiting only the North Sea, being therefore outside the scope of the North Atlantic as defined for the present exercise. It is therefore between 6–10 vessels, nearer 50 m than 40 m, which might be added to the fleet exploiting North Atlantic grounds.

Any forecast on the degree of scrapping is much more difficult than on the rate of new construction. It can, nevertheless, be assumed that the older vessels will be kept in use as long as they are profitable. Therefore, if no radical changes happen in the course of the following years, either with regard to the catch rates of the different grounds of the North Atlantic or with regard to the market for fish and fish products, scrapping will only touch the older vessels and these scrappings would be more or less compensated by new entries of vessels in the range of 40 m.

b) Salters and cod fleet

The last new salter was launched about 5 years ago and it seems certain that present conditions will not allow any new vessels of this type to be built. The owners have, therefore, switched to part or full freezers, but this has created problems the investments are enormous and difficult for individual firms which explains why some of the new vessels have been built on a cooperative basis.

The new vessels at present in operation (2) or under construction and due to begin exploitation in 1967 (4), are stern trawlers, full or part freezers of a gross tonnage of between 1,500–2,000 GRT. Although other projects have been studied, it is not certain whether they would be confirmed. The financial means would be difficult to collect and the developments in the market for frozen fish during the last 1 or 2 years have been rather unfavourable. Taking into account unforeseeable developments, it is nevertheless possible that some of the projects for three new part-freezer trawlers could be realized.

With regard to scrapping, it would seem that most of the present salters which are more or less

completely written off are still in good condition and would be kept in operation.

Overall, this conservative forecast would, therefore, lead to the following increases (from 1965 until the end of 1970) all being full or part freezer.

around 50 m.....1,000 GRT.....6–10;
around 70 m.....1,500–2,000.....4–7.

The above figures include all vessels put in service from the end of 1966.

Federal Republic Germany

At the end of 1965 the German distant-water fleet consisted of 155 units representing a total gross tonnage of about 130,000. About half of this capacity (62,000 gross tons and 98 vessels) were wetfish trawlers, 14 of them being also fitted with fishmeal plants. Of the 57 freezer trawlers (68,000 gross tons) 7 units (15,000 gross tons) were full freezer trawlers, freezing all their catch, 11 (15,000 gross tons) potential full freezer trawlers, part of their hold capacity being convertible for wet or frozen fish and 39 units (38,000 gross tons) part freezers, with varying processing and storage capacity.

The development of the German distant-water fishing fleet in recent years has been characterized by the emphasis on freezing at sea. Of the 60 units (approximately) which entered the fleet after 1960, only eight were traditional wetfish trawlers; and, at present, a considerable share of the wetfish supplies in Germany is landed by part-freezer trawlers. The main factor for this development was the increased need to exploit more distant waters because the extension of fishing limits and biological changes in formerly exploited grounds had resulted in declining catches. Factors on the market side were very largely responsible for the emphasis on building **part**-freezer trawlers. Until 1964 the gap between first-hand prices for frozen fish and the higher prices for wetfish had widened; in 1965, however, this gap was nearly closed but in 1966 prices for wetfish rose considerably, while the international market for frozen fish showed a weakening tendency.

These factors are relevant when attempting to forecast future developments in the German fleet and the present uncertain conditions of both production and marketing make this very difficult. One will have to assume that certain conditions will not change drastically, e.g. catching prospects and market outlets; only then can broad tendencies be indicated.

Under present conditions the wetfish fleet is likely to be reduced. Considering the age distribution of this fleet, one can expect that in 1968–69 between 25–30 vessels (15,000–20,000 gross tons) will be scrapped and that this will be only partly compensated by new additions to this section of the fleet.

The fleet of part and full freezer trawlers is fairly new and no scrapping can be envisaged in this fleet before 1970. As some units of the wetfish fleet will be replaced by freezer trawlers there will be probably an expansion of this fleet with possible emphasis on full freezer trawlers.

Vessels	1965 fleet[a]		1970 projection[a]	
	No.	'000 Gross tons	No.	'000 Gross tons
Wetfish trawlers	98	62	74	54
Freezer trawlers				
part-freezer[b]	50	53	59	69
full-freezer	7	15	17	35
Total	155	130	150	158

[a] beginning of the year.
[b] including "potential full freezer."

Taking into account the consideration made above, it is likely that the total number of distant water trawlers will slightly decrease, but that there will be a certain net increase of the total gross tonnage in the range of 25,000 and 30,000 tons. As the wetfish fleet will show a contraction of about 8,000 to 10,000 gross tons, the expansion of the freezer fleet would amount to 35,000–40,000 tons, of which 20,000 tons would be full freezer vessels (see table above).

It has, however, to be emphasized that both scrapping and replacement will depend on the development of marketing conditions and that a further deterioration of catching prospects in the North Atlantic will accelerate the scrapping program and impede new investments.

But even if the estimated increase in total gross tonnage should eventually be realized, it cannot be assumed that all will be added to the catching power on the North Atlantic groundfish stocks. Already in the past year some trips of freezer trawlers have been made to the South Atlantic (South Africia) and some effort was diverted to herring stocks in the North Sea and off Iceland. If present catching conditions for groundfish do not improve an expansion of freezer operations in the South Atlantic is likely and it could even occur that most of the gross tonnage of full freezer trawlers is switched to these grounds. Also, considering the stable herring market in Germany (processing industry) some expansion of herring fishing cannot be excluded. The increase of total catching capacity exerted on North Atlantic cod and related species might thus only be in the magnitude of 10,000–15,000 gross tons, mainly consisting of part-freezer trawlers.

Greenland

Greenland's fishing fleet consists mostly of small boats for use in inshore waters; at the beginning of 1965 only five vessels were above 50 ft. In the course of 1965 two 80 footers (130 gross tons) and two 95 footers (200 gross tons) were commissioned and it is the expressed aim of the Danish authorities and the Royal Greenland Trade Department to develop cod fishing on the offshore banks. Plans exist for the construction of a 500 ton stern trawler. It should therefore be envisaged that the fishing capacity of the Greenlandic industry continues to increase.

Iceland

The number of deep sea trawlers has shown a declining tendency for a number of years. In 1965, 38 units representing about 27,000 gross tons were in operation as against 48 units (33,000 gross tons) in 1960. During 1966 another six trawlers were withdrawn from the fleet, total gross tonnage contracting to 23,000 gross tons.

Future developments are difficult to forecast. The present trawling fleet seems to be operating at a loss, but on the other hand, this sector is important as supplier of the processing, plants ashore (particularly deep-freezing). Operating subsidies have therefore been introduced to maintain present fleet strength.

Furthermore, consideration is being given to the question of which type (size, etc.) of new trawler would be suitable for operations from Icelandic ports. It can, however, be assumed that new units would basically only replace old trawlers taken out of commission.

Another section of the Icelandic fleets has expanded considerably in recent years: the number of vessels of 100 GRT and over increased from 86 (14,000 gross tons) in 1960 to 181 (40,000 gross tons) in 1966. Smaller decked vessels less than 100 GRT slightly declined in number (650 in 1960 to 575 in 1966) and gross tonnage (23,000 gross tons and 19,000 gross tons respectively). In the former group, emphasis has been on building purse seiners for herring fishing.

Norway

At the end of 1965 the Norwegian fishing fleet included the following vessels over 80 ft partly or totally used for groundfish fishing:

18 stern trawlers (including freezer trawlers);
45 side trawlers (> 200 gross tons);
about 50 longliners (some combined with purse seining);
about 70 combined purse seiners/side trawlers (100–200 gross tons).

In addition were the boats, all under 80 ft engaged in Lofoten spawning cod and the Finnmark young cod fishery. In 1964, 5,400 vessels participated in the fishery off Lofoten and 1,800 vessels off Finnmark.

Investment in the groundfish industry has been limited in recent years. Most of the capital available from the State Fishery Bank and private sources went into more profitable purse seiners for herring fishing, the number of which has augmented considerably. In 1965 the loan scheme provided by the State Fishery Bank was extended for liners and trawlers. This might encourage new capital injections to this sector from 1966 to 1970 but its eventual impact cannot be anticipated at this stage. No forecast for an increase or decrease of the Norwegian groundfish fleet is therefore made.

Poland

Poland's catches until now have been mainly derived from "middle waters". Of the 1965 catches (about 300 thousand tons) roughly two-thirds came from the North Sea and Baltic Sea, the remaining third being, approximately, divided equally between the North Atlantic (56,000 tons) and the South Atlantic.

Original Polish plans aimed at an increase in total catch to 450 thousand tons in 1970 (increase of 50% over 1965) and to 900 thousand tons by 1980. The plans assumed that catches from the Baltic and the North Sea are stabilized around 200 thousand tons, and an addition of about 100 thousand tons of herring was expected by 1980 from grounds in the North Atlantic. The rest of the 1980 plan was to be made up of 400 thousand tons of groundfish from the North Atlantic (of which about 250 thousand tons would be cod) and about 200 thousand tons from the South Atlantic (100 thousand tons of which would be for reduction to meal). In the meantime, this plan has been revised and the 1970 total has been raised to 500 thousand tons and the 1980 total to 1 million tons.

Implications of these plans would be that North Atlantic groundfish catches (particularly cod, haddock, and redfish are to increase to between 150 thousand and 200 thousand tons by 1970.

In trying to realize this program, Poland will expand its fishing fleet considerably, particularly as regards vessels capable of undertaking self-dependent trips to distant grounds. The number of factory trawlers (around 2,500–3,000 gross tons) is to increase from 15 in 1965 to 30 in 1970 (60 in 1980); the number of freezer trawlers (1,200–1,300 gross tons) from 6 to 20 (62 in 1980) and the number of "motor-trawlers with freezing plants" (around 800 gross tons) from 28 to 49 (128 in 1980). Up to 1970 this represents an addition of approximately 75,000 gross tons to the fishing fleet, against which only a restricted number of vessels not concerned with North Atlantic groundfish (drifter-trawlers and small cutters) are expected to be scrapped. (In the plans for the decade 1970–80 another 200 thousand gross tons will be added to the fleet).

According to production plans the larger part of the 75,000 gross tons net addition will have to operate on the North Atlantic groundfish stocks, and a conservative estimate would be that the total gross tonnage operating there under the Polish flag will increase by about 50,000 gross tons (40,000–60,000 gross tons).

Portugal

New vessels to be built for Portuguese owners might represent a tonnage smaller than the old vessels to be taken out of operation. The higher efficiency of the new vessels will however have the result that total fishing effort in 1970 should be about equivalent to the present one.

Spain

The Spanish fishing fleet has developed in recent years more than any other western European fleet, but this development mainly concerns vessels with deep-freezing equipment on board which were built for exploiting South Atlantic grounds. The consequence is, for the present exercise, that it is not difficult to assess which part of the increased capacity, which already exists, must be allocated to North Atlantic grounds; it is small indeed, but the Spanish fishing enterprises show an overall dynamic attitude which might also lead in future years to an increased capacity for the North Atlantic grounds.

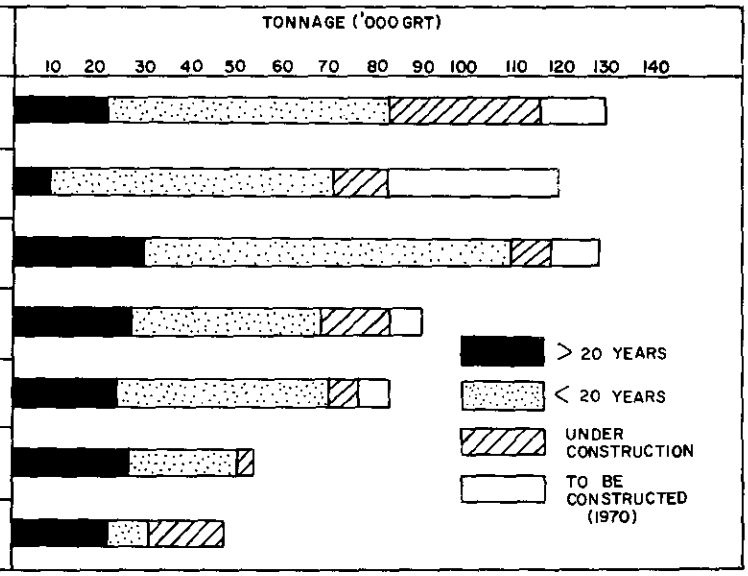
The Spanish authorities play an important role in the growth of the fishing fleet and publish, attached to the official statistics, figures for new constructions up to 1970. These figures do not unfortunately separate the vessels fishing for hake

in the South Atlantic from the vessels exploiting the cod stocks of the Northwest Atlantic. It can, nevertheless, be assumed that these two fleets will not easily be intermingled. The market for fresh hake is an important traditional market in Spain and it took a number of years to create a market for frozen hake, a product which is still sold at prices significantly lower than the same species as wetfish. The market for salted cod is also an important traditional market and there has not yet been any real attempt to establish a market for frozen cod. No radical market changes should occur before the end of 1970, but it is likely that the Spanish fisheries, pushed by the example of other North Atlantic fleets and by their own experience in the South Atlantic would in the years to come launch some frozen cod fishing in the North Atlantic. In any case, the length of time spent at sea by salters or freezers is only limited by the hold capacity of the vessel and by the necessity of refuelling; if the number of vessels remains unchanged, the pressure on stocks will not be considerably increased. It should, nevertheless, be noted that the new vessels which will be introduced into the North Atlantic grounds will benefit from the latest technical improvements, the results being a noticeable increase in fishing capacity.

The following table gives a summary of the present Spanish projections. It should be noted that they are specified in tonnage without indication of the number of vessels. As can be seen, the expansion should influence mainly the upper tonnage groups (> 500 GRT and between 500 and 250 GRT); the lower groups should be kept at a similar or lower total, but significantly modernized. It obviously means that the fishing capacity available for use on distant grounds including the North Atlantic, will be increased. It cannot, nevertheless, be said to what extent this increased capacity will be used in the North Atlantic waters.

Composition and Structure of the Spanish Fishing Fleet in December 1966.

GROUP	TONNAGE CLASS (GRT)	VESSELS BUILT		UNDER CONSTRUC-TION	CREW
		BEFORE 1950	AFTER 1950		
I	>500	16	59	33	3,000
II	>250-500	23	188	31	4,071
III	>150-250	156	467	55	9,484
IV	>100-150	210	355	121	8,742
V	>50-100	310	766	86	17,150
VI	> 20-50	761	647	84	17,186
VII	< 20	3,632	5,442	–	39,806



United Kingdom

Present structure of trawler fleet

The following table shows the age structure of the trawler fleet at 31 December 1965.

Year of construction	Near water 80–109.9 ft	Middle water 110–139.9 ft	Distant water 140 ft and over	Total
Pre–1921	4	3	—	7
1921–30	20	1	—	21
1931–40	10	—	17	27
1941–45	8	1	8	17
1946–50	17	7	65	89
1951–55	25	12	32	69
1956–60	85	111	46	242
1961–65	60	57	28	145
Total	229	192	196	617

Projected structure

In attempting to project this structure to 1972, reference has been made to the changes between 1962–65 as, at the same time, representing a recent period in which conditions are likely to be most similar to those operating in the next few years and more practically, because it was the earliest year in which the length groupings coincided with current ones.

Comparison of the 2 years showed that the distant water fleet was replaced more chronologically than either of the other two and the near-water fleet least so. This is thought to be due to the greater need for operating reliability in vessels fishing further afield and because smaller vessels are associated with smaller firms some of whom are perhaps prepared to accept a lower level of efficiency rather than bear the cost of replacement.

Thus, comparatively few pre-1946 **near-water** vessels were scrapped during the 3 years compared with three-quarters of the middle-water and two-thirds of the distant-water vessels built before that date. It has been assumed that by 1972 the near-water fleet will lose all pre-1921 vessels; 50% in the 1921–30 class and 20% to 1955. The replacement rate is assumed at the scrapping rate of 1:1½ although the effective rate could be greater than this if second hand vessels are bought from abroad or less than this insofar as vessels are scrapped without replacement.

For the **middle and distant water** projections, losses have been assumed at 100% pre-1940; 75% in 1941–45; 40% in 1946–50; 25% in 1951–55; and for the distant water fleet only, 5% in 1955–60. Thereafter it is assumed that net losses will be nil. As with the near-water fleet, replacement rates have been assumed at existing scrapping rates or 1:1½ for conventional trawlers and 1:2 for freezers although it is possible that the industry will succeed in replacing at a higher rate than this.

Application of these assumptions gives the following projected structure at December 1972.

Year of construction	Near water 80–109.9 ft	Middle water 110–139.9 ft	Distant water 140 ft and over	Total
1921–30	10	—	—	10
1931–40	8	—	—	8
1941–45	6	—	2	8
1946–50	14	4	39	57
1951–55	20	9	24	53
1956–60	85	111	44	240
1961–65	60	57	28	145
1965–72	23	15	37	75
Total	226	196	174	596

Similarly detailed projections have not been made for other parts of the fleet but the inshore fleet (vessels generally <80 ft) may increase its capacity by between a quarter and a third. As a result, the number of distant water vessels is forecast to decrease from 196 to 174. Against about 60 withdrawals from the fleet are 37 additions. Assuming that the replacements have a somewhat higher average tonnage than the older vessels, total gross tonnage might not change significantly. It should be added that the 13 freezer trawlers which entered the fleet in 1966 represented about 20,000 gross tons.

The number of middle-water trawlers shows a slight increase and taking into account a likely increase in average size, should increase their overall capacity.

United States

Conservative estimates about new investments in the New England trawler and dragger fleet up to 1970 have been given as follows:

2 stern trawler factory ships (292 ft) (one of which is scheduled to operate in the North Atlantic);

2 stern trawlers (135 ft);

25 trawlers or scallopers (90–110 ft), but mainly scallopers.

Considering the age composition of the New England trawling fleet (in 1961 about 40% were more than 40 years old) it can be assumed that apart from the factory ships, these investments will be exclusively for replacing vessels to be taken out of operation, and it is even likely that scrapping will outnumber replacements in tonnage; total fishing effort potential might, however, remain similar due to improved efficiency. The two factory vessels, the first to enter the fleet, represent a gross tonnage of about 4,000-5,000 gross tons.

USSR

Soviet official figures for shipping at 1 January 1965 give 2,370 vessels of over 100 gross tons in the Soviet fishing and whaling fleet, totalling about 1.8 million gross tons. According to another source, the following Soviet vessels have been estimated for the end of 1965:

800 medium and small trawlers <800 gross tons);
250 large factory trawlers (800–3,000 gross tons);
50 mother ships;
About 150 large refrigerated transport vessels.

The Five-Year-Plan 1966-70 provides for an increase in the USSR fishing fleet of 1,500 units, of which about 250 will be of the freezer-factory trawler type (2,500–3,000 gross tons). A mother ship of more than 40,000 gross tons is at present under constructions at Leningrad, and others (number unknown) will enter the fleet by 1970.

This 1966–70 plan also envisages an expansion in total annual fish production from about 5 million metric tons in 1965 to 7 million metric tons in 1970, an increase of 40%. The growth in catching power required to achieve this aim is in the order of 500 thousand to 600 thousand gross tons (this would exclude transport vessels and non-catching mother ships).

It is realized that the expansion in production can only be achieved if additional, at present unfinished, areas in the oceans are exploited and thus emphasis will be on the South Atlantic, South Pacific and Indian Ocean. The catch from the Pacific and Indian Ocean is to augment from about 2 million tons in 1965 to 3.2 million tons in 1970. Assuming that catches from freshwater, the Caspian, Black and Baltic Seas will stabilize around 1 million tons, the increase to be expected from the Atlantic will be about 800 thousand metric tons (from 2 million to 2.8 million tons). Thus the effort of the combined USSR fleet in the whole Atlantic Ocean can be expected to increase at least by 40%, or around 200 thousand gross tons. A large part of this additional effort will most probably be directed toward the South Atlantic and another part to pelagic species (herring) or species other than cod and haddock (e.g. silver hake) in the North Atlantic. What proportion of this completely mobile effort will exploit groundfish stocks will depend on relative catch rates, but even if only a small percentage of the total (say 20%) will be directed to these stocks, it would mean a considerable increase in gross tonnage (40,000 gross tons).

Other Countries

The foregoing sections do not include a number of countries known to have or to be developing a fleet capable of fishing in the Atlantic,

Italy, Greece, Netherlands, and Belgium. Italian and Greek operations are mainly confined to the middle Atlantic; for Belgium, no particular development has been envisaged; the Netherlands have recently launched the first freezer trawler (1,200 gross tons). Moreover, some other countries have to be mentioned here, which have recently started fishing operations: Israel and Romania, who operate a number of freezer trawlers in the Central and North Atlantic. Bulgaria has at present a fleet of four large freezer stern trawlers (about 3,000 gross tons) operating in the South Atlantic, and this fleet is to increase to 20 by 1970. Cuba has purchased a number of trawlers which are scheduled to produce salted cod etc. from North Atlantic grounds.

Summary and Conclusions

The assessments made for single countries in the foregoing sections will have made it clear that the margins of possibilities render it difficult to arrive at a meaningful overall forecast for the North Atlantic groundfish fishing fleet in 1970. By simply adding together the extremes for the various countries, one would arrive at a total net addition of between 100 thousand and 200 thousand gross tons or about 10–20% of the present North Atlantic trawling fleet. But this needs more specification to guard against misinterpretation.

The most important part of this overall estimate (60,000–140,000 gross tons) originates from the planned expansion of the fishing fleets of Poland and USSR. It should be recalled, however, that a considerable part of the scheduled growth in these countries has been excluded from the forecast as being built for other than North Atlantic whitefish fisheries but that most of these units will also be capable of operating in the North Atlantic. Indeed, they are likely to do so, particularly if favourable years occur, or if other grounds outside the North Atlantic show signs of over-exploitation, or both.

Changes foreseen in OECD member countries' fleets are relatively small and in fact, for most of them, no increase of gross tonnage is in prospect (e.g. Faroe Islands, Iceland, Norway, Portugal, UK, and USA). Moreover, it should be borne in mind that forecasts for these countries are largely based on present conditions as regards catch rates, markets, availability of capital including subsidies, manpower availability, etc. Any change of these data, mostly beyond the operators' influence, might completely change their decision as to both scrapping and new investments. Recent history provides ample evidence in a number of countries of the mood changing quickly from extreme optimism to pessimism or conversely. These additional circumstances render the forecasts for the OECD member countries particularly uncertain.

There is nevertheless an important aspect which is common to all these countries: all desire to maintain their present fishing capacity and, if financial means allow it, to improve efficiency by replacing old vessels by more modern ones. For a number of years the profitability of the different fleets has often been marginal or bad, which is an incentive toward improving efficiency. In this regard, it should be recalled that the trend toward more freezing at sea and better fishing techniques (electronics, progress in fishing gear), implies an increase in effort even if total number of vessels or total gross tonnage remain stable.

As new units, as well as replacements, will be more efficient than the average existing vessel the estimated net increase of gross tonnage does not provide sufficient indication of the expansion of fishing power to be expected. Freezer trawlers, in particular, represent a noticeable increase of fishing effort in terms of days or hours fishing, as the productive time spent fishing is about 70–80% of total trip duration as against 35–50% for conventional wetfish vessels.

APPENDIX V

Control of Fishing on Several Stocks

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Ideally each stock of fish should be separately managed, with its own appropriate control of size at first capture (mesh size) and fishing mortality (catch quota, effort limitation, etc.). This is impracticable, and probably the most easily enforceable control for the North Atlantic would be a global catch quota, allocated by countries, for each species. This however does not guarantee an appropriate level of fishing for any stock; for example in 1960 the Northeast Artic cod stock was overfished, though for the North Atlantic cod as a whole further expansion of effort was possible i.e. if a global quota had been set in 1960, as the sum of the desirable quotas of each stock, it would not have been reached, and the Northeast Arctic would have been still over-fished.

To illustrate the problem the fishing effort (mortality) on the three major cod stocks of eastern part of the North Atlantic (Arcto- Norwegian, Iceland, and West Greenland) in each year since 1953 has been calculated as a percentage of the optimum effort for each stock. These optima were estimated, from the various working group reports as being (i) half the 1963 effort; (ii) the 1954 effort; (iii) 70% of the 1965 effort respectively. In addition, the catches (quotas) that would have been taken each year if, in that year the effort had been brought to the optimum level, have been calculated, and the total of these quotas compared with the actual total catch from the three areas The total catch, expressed as a percentage of the total quota gives a measure of the reduction of effort which would be achieved by applying a global quota.

Table 1 shows that while appreciable reduction of effort on the Arctic stocks would have been desirable as early as 1953, in that year, and also in 1954, the total catch did not reach the global quota, so that a global quota would have caused no reduction in fishing. Later, say 1960, a global quota would reduce the total amount of fishing, —by 44% of the optimum level—but this is substantially less than the reduction needed in the Artic, while the Greenland effort in fact could still be increased.

TABLE 1. Fishing efforts (mortalities) in various areas of the North Atlantic as percentages of the optimum level of effort.

	Effort, % of optimum			'000 tons		Catch as
Year	Arctic	Iceland	Greenland	Total catch	Quota	% of quota
1953	124	88	41	1467	1758	84
1954	129	100	58	1669	1697	98
1955	168	96	57	1953	1713	114
1956	200	87	61	2145	1753	122
1957	170	103	60	1513	1353	112
1958	176	118	77	1598	1284	124
1959	168	125	87	1431	1073	133
1960	178	152	89	1339	929	144
1961	202	151	116	1502	934	161
1962	209	148	112	1738	1095	159
1963	200	156	120	1571	974	161
1964		187	129			

Note, that these quotas are the quotas that would be necessary if in that particular year, the effort was reduced to the optimum level. They therefore correspond to the reduced interim catches taken in the transitional period while the stocks are rebuilding to the optimum level. The quotas that could have been taken if the effort has been kept at the optimum level since 1955 would of course be much greater.

Some further protection of particularly heavily fished stocks, such as those in the Arctic, is therefore desirable. It is suggested that a closed season could provide such protection, provided that it is operated as a supplement to the global quota.

Since this possible over-fishing of one stock is assumed to be taking place within a global quota which is set correctly, some other stock, included in the total, must be correspondingly under-exploited. The season would then be chosen to take place at a time when substantial fishing occurred on the over-fished stock, but also fishing was also feasible on the under-fished stock. The closed season on the over-fished stock would then encourage fishing on the other. The duration of the closed season would be chosen to give the correct quantitative reduction; e.g. if fishing were spread evenly through the year a reduction of 8% would be achieved by a close season of about 1 month. Thus for example in 1953 the Arctic grounds might have been closed for a period during which, other things being equal, about 20% of the catch would have been taken—say for the months of July and August. This would not change the total fishing much, as some effort would be diverted from the Arctic to Iceland and Greenland—perhaps bringing the Iceland effort close to the optimum, and the Greenland effort up to 60% of the optimum. As another example, if limitation had been brought in 1960, to reduce the fishery in the Arctic very greatly, and increase the fishery at Greenland, then it might be necessary to close the Arctic grounds for 3 months, the Iceland grounds for 1 month, and leave the Greenland grounds always open.

By itself a closed season does not allow the economic advantages of reduced effort to be achieved. Without other restrictions the indivual country, or commercial enterprises will tend to increase its fishing during the open season so as to maximise its share of the catch, and there will be the well known scramble for the biggest share, leading to a shorter and shorter season and increased costs of applying a given fishing mortality. Under the present scheme, assuming the global quota has been allocated to countries this will not apply. If a country fishes harder say in the Arctic during the open season and thus gets a bigger share of the Arctic catch, then it will have less of its quota available to be taken at Iceland and Greenland, and will gain no overal advantages.

Any advantages in having more of the presumably more readily caught Arctic cod will be balanced by difficulty of keeping the fishing fleet fully occupied throughout the year. Thus any country which can fish in any area will have no need to compete in a scramble for the biggest share in an area where a closed season may apply.

A country which cannot switch its effort from area to area would however be at a disadvantage. For instance, if the concenstration of the USSR fishing on the haddock on George's Bank which occurred in 1965 were continued, then it might be necessary to close the area for 6 months to keep the effort at the optimum level, to the obvious disadvantage of the local USA fleet, which has little alternative, at least for cod and haddock, and therefore could not take advantage of less USSR fishing on other grounds, e.g. Labrador. This difficulty might be overcome if a country had its share of the total quota assigned to a particular area or stock; in return for an undertaking not to fish on other stock the country's vessels would not be bound by the closed season. For instance, the USA might decide to take its quota only in Subarea 5, and its share might be say 80% of the total. This could be taken at any time, and a closed season set, if necessary, for the mobile fleets such that their catch make up the other 20%. This seems to give a reasonable balance; any advantage that the non-mobile fleet has in its local area being set against the advantage for the mobile fleets in the other areas. This concept could be extended so that closed seasons only applied to mobile vessels (perhaps vessels above a given size, perhaps 400 gross tons), but that smaller vessels would noly be licensed to fish in one area; such an arrangement might cover the difficulties of some countries, e.g. Norway, with both large and small vessels.

This scheme seems to provide enough flexibility to achieve considerably better management of the separate stocks than would be achieved by global catch quotas alone. The problems of enforcement also seem not too large; at least there is no need, for enforcement purposes, to establish the source of a particular catch of fish, as there would be if separate catch quotas are established for each ground.

PART 5

List of Scientists and Laboratories Engaged in the Commission's Work

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