INTERNATIONAL COMMISSION

FOR THE

NORTHWEST ATLANTIC FISHERIES

ANNUAL PROCEEDINGS

Vol. 5.

for the year

1954-55

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1955

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CONTENTS

FOREWORD

The Commission's publications are since 1953 established in two annual series, an "Annual Proceedings" and a "Statistical Bulletin". Occasional papers from the Commission may be published separately.

The Annual Proceedings contains the Commission's reports for the year in question: Administrative Report, Report of the Annual Meeting, Summaries of Research by the participating countries, scientific papers especially prepared for meetings, and lists of scientists engaged in the various branches of the Commission's work, and of main laboratories concerned with this work.

The Statistical Bulletin deals with the fisheries statistics of the Convention Area, mainly those for the year in question, but also with statistics for former years collected and compiled by the Commission. The earliest Statistical Bulletins only dealt with the more important groups of groundfish. The future Statistical Bulletin will deal also with the other fishes and with shellfish, however in a more summarized form. They will thus give an account of the total fishery of the Convention Area.

The Statistical Bulletin for the year 1954 will be published towards the end of 1955.

A list of the Commission's publications is found on the back of the cover.

Erik M. Poulsen,
Executive Secretary.

Halifax, 30 November, 1955

PART 1

Administrative Report for the Year ending 30 June 1955

BY THE EXECUTIVE SECRETARY, ERIK M. POULSEN

1. Personnel Changes in the Secretariat

Miss Johanne Welsh left the Commission, owing to her marriage, on 15th September, 1954. From that date Miss Theresa Devine took over the post as secretary.

On 1 November, 1954, Miss Jean Maclellan entered the Commission's service as clerk-stenographer.

In connection with the decision of the Annual Meeting, 1954, to abolish the post as statistician, and to establish instead a post as biologist-statistician, Mr. J. Côté left the Commission on 30 September. Mr. Côté had for 2 years served in the Secretariat. His excellent work during that period has been highly appreciated.

On the 1 November, 1954, Mr. Ronald S. Keir (Scotland), who for three years had worked as a biologist in the Newfoundland Fisheries Research Station, took over the post as biologist-statistician.

2. Officers during the year.

Chairman of Commission—Dr. Stewart Bates, Canada

Vice-Chairman—Capt. Tavares de Almeida, Portugal

Chairman Panel 1: Mr. Klaus Sunnanaa, Norway
,, Panel 2: Mr. Louis S. Bradbury, Canada
,, Panel 3: Comm. H. F. Barbier, France
,, Panel 4: Mr. C. L. Chicheri, Spain
,, Panel 5: Mr. B. M. Knollenberg, U.S.A.

The two year's terms of these officers end 30 June, 1955.

Chairman of Stand. Comm. on Finance and Administration—
Mr. J. Howard MacKichan, Canada

Chairman of Stand. Comm. on Research and Statistics—
Dr. C. E. Lucas, United Kingdom

Chairman of Subcom. on Cod-Haddock—
Dir. G. Rollefsen, Norway

Chairman of Subcom. on Redfish-Halibut—
Dr. H. W. Graham, U.S.A.

Chairman of Subcom. on Hydrography—vacant.

The above-mentioned Chairmen function on a one year's term.

3. Panel Memberships

(Confirmed in the Annual Meeting, June 1955) are as follows:

Country	Panel No. 1	2	3	4	5	Total
Canada		+	+	+	+	4
Denmark	+					1
France	+	+	+	+		4
Iceland						0
Italy	+	+	+	+		4
Norway	+					1
Portugal	+	+	+	+		4
Spain	+	+	+	+		4
United Kingdom	+		+			2
United States			+	+	+	3
TOTAL	7	5	7	6	2	27

4. Newsletters.

Four newsletters were distributed from headquarters in order to circulate information relevant to the Commission's activities.

The newsletters were issued on 20 Aug., 15 Nov., 21 Feb. and 21 May.

5. Commission's Publications.

The Annual Proceedings Vol. 4 for the year 1953-54 was issued in October 1954.

The Statistical Bulletin Vol. 3 for the year 1953 was issued in June, 1955.

A poster on fish taggings (in the English language) was issued from headquarters in

February 1955 in accordance with a recommendation from the 1953 Annual Meeting. In accordance with the same recommendation, it is planned to circulate the poster in the other languages used with the participating countries to the extent to which the separate countries find it desirable. The poster advertises the taggings and gives information as to the principal aims of the taggings and as to the procedure for the reporting of recaptured, tagged fish.

6. Co-Operation with Other International Organizations.

The co-operation by means of exchange of observers and exchange of reports and publications has been continued through the year with

a. The Food and Agriculture Organization of the United Nations (FAO).
b. Le Conseil International pour l'Exploration de la Mer (ICES).
c. The Permanent Commission of the International Fisheries Convention of 1946.

During the year co-operation along the same lines has been established with

d. The International North Pacific Fisheries Commission.
e. The International Pacific Halibut Commission.
f. The International Pacific Salmon Fisheries Commission.

ICNAF was represented at the Annual Meeting of ICES in Paris in October 1954 by Mr. A. T. A. Dobson, Dir. G. Rollefsen and the Executive Secretary. A report on that meeting, written by the Executive Secretary, was circulated on 20 Dec. 1954.

After the meeting the Executive Secretary went to Copenhagen, where he discussed with the General Secretary of ICES various problems connected with the statistics collected and compiled by ICES as well as by ICNAF from the West Greenland waters and the Grand Banks of Newfoundland.

Dr. H. B. Hachey represented ICNAF as observer at the meeting of the International Union of Geodesy and Geophysics in Rome in September, 1954. A report by Dr. Hachey on that meeting was circulated on 9 Nov. 1954.

At the United Nations International Conference on the Conservation of the Living Resources of the Sea in the FAO Headquarters in Rome in April, 1955, ICNAF was represented by the Executive Secretary as an observer. A report of the meeting was circulated in June, 1955.

7. Meetings Within the Commission During the Year.

Meetings of the Groups of Advisers to Panels 3, 4 and 5 were held in St. Andrews, 7-9 Dec. 1954, and in St. John's, 17-21 March, 1955. At the meetings reports were delivered on the effects of the haddock regulation in Subarea 5, and on the research work carried out by the various countries in the subarea. Plans for future research work were discussed and elaborated. The possible introduction of regulations of the trawl fisheries for haddock and cod in Subareas 3 and 4 were considered. Reports of the meetings have been delivered to the respective panels and circulated within the Commission.

8. Research Summaries.

Research summaries for the year 1954 were forwarded from the participating countries to the Secretariat during March and April. They were, together with a summary of researches by subareas, circulated as documents for the 1955 Annual Meeting, and are printed as Part 3 of this Proceedings.

9. Research Programs.

According to Commission's decision, research programs for 1955 were forwarded from the participating countries during December 1954 and January and February 1955. They were, together with a survey by subareas prepared in the Secretariat, circulated within the Commission during the same months.

10. Collecting of Statistics.

The Commission's collecting of statistics and the compilation of the data in the Secretariat has been continued according to Commission's requirements. The data are now far more refined and comprehensive than formerly, owing to the more and more complete way in which the participating countries are meeting the requirements.

11. Fifth Annual Meeting.

The Fifth Annual Meeting of the Commission was held in Ottawa, Canada, in the days 6-11 June 1955. It was preceded by meetings of groups of advisers during the 3 and 4 June (see Chairman's Report, Part 2 of this Proceedings).

12. Other Matters.

According to Commission's decision a circular concerning the reporting of hydrographic data to the Commission was prepared in the Secretariat. It was circulated in a tentative form to those persons reporting such data in August, and after consideration of amendments received, it was distributed in the final form 14 Jan. 1955.

A Guide to ICNAF Documents, Proceedings, Reports and Programs published or otherwise circulated up to 30 Sept. 1954 has been prepared in the Secretariat and circulated on 10 Nov. 1954 within the Commission and to organizations co-operating with ICNAF. Since the circulation a considerable number of requests for ICNAF papers have been received. Thus the "Guide" has obviously served one of its purposes, that of drawing attention to the work carried out by ICNAF.

A paper on Commission's statistical requirements was circulated on 15 Sept. 1954.

13. Financial Statements for the Fiscal Year ending 30 June, 1955.

The accounts of the Commission for the year ending 30 June, 1955 show an appropriation of $ Can. 33,686.00 and a total expenditure of $32,078.24, leaving an unobligated balance of $1,607.76.

The audit of the Commission's finances for the fiscal year ending 30 June, 1955, was made by the Auditor General's Office of the Government of Canada in July, 1955.

The report from the Auditor General's office, of August 23, 1955 says:

"As required by Section 11 (2) of the Financial Regulations for the Commission, I certify that:

(a) the financial statements are in accord with the books and records of the Commission; and
(b) In my opinion, the financial transactions reflected in the statements have been in accordance with the rules and regulations, the budgetary provisions, and other applicable directives; and
(c) Monies on deposit have been verified by certificate received direct from the Commission's depository.

Free access was given to all accounts and records, and such further information as was required in the carrying out of the examination was readily supplied. The co-operation and assistance provided by the Secretariat is acknowledged with appreciation."

To the report are attached the following three financial statements:

Statement 1

Budget appropriations, obligations incurred, and unobligated balances of appropriations for the fiscal year 1954-55

Purpose of Appropriation	Appropriated by Commission	Transfers approved by Commission	Actual Appropriation	Obligations incurred and liquidated	Unobligated Balances of Appropriations
Personal services	$21,386	$900	$20,486	$20,239.96	$ 246.04
Travel, including subsistence	4,000	420	4,420	4,343.53	76.47
Transportation of things	200		200	165.26	34.74
Communication services	1,000		1,000	584.31	415.69
Rents and utility services	300		300	0	300.00
Other contractual services, including printing	4,400	220	4,620	4,589.62	30.38
Supplies and material	1,100		1,100	805.21	294.79
Equipment	500		500	312.80	187.20
Annual Meeting	800	260	1,060	1,037.55	22.45
	33,686	0	33,686	32,078.24	1,607.76

Statement 2

Statement of income and expenditure for the year ending 30 June, 1955

Income:			
Contribution paid by France for the year ended 30 June, 1953		$ 1,577.11	
Credits due to Member Governments from the year ended 30 June, 1954 (Statement 2)		1,637.86	
Unobligated balances from year ended 30 June, 1954		3,862.09	
			$ 7,077.06
Members' contributions assessed:			
Canada	$3,588.18		
Denmark	1,292.04		
France	3,688.49		
Iceland	526.66		
Italy	3,588.18		
Norway	1,292.04		
Portugal	3,613.25		
Spain	3,613.25		
United Kingdom	2,057.41		
United States	2,822.78		
		26,082.28	
Add transfer from Working Capital Fund due to payment of French contribution		526.66	
			26,608.94
			33,686.00
Deduct obligations incurred and liquidated (Statement 1)			32,078.24
Excess of income over obligations incurred carried to Surplus Account			1,607.76

Statement 3

Statement of assets and liabilities as at 30 June, 1955

Assets			Liabilities		
GENERAL FUND					
Cash at bank		$1,779.40	Credits due to Member Governments:		
Contributions receivable:			from Italy's contribution 1952-53	$3,704.86	
Italy:					
1953-54	$4,546.12		France overpayment (12 Apr. 1955)	.01	
1954-55	3,588.18				
		8,134.30			
Accountable advances:			Spain overpayment (15 Sept. 1954)	1.07	
					$ 3,705.94
Travel advance to Dr. Erik M. Poulsen to cover expenses in Greenland waters (1955-56)		400.00	Surplus (Statement 2)		1,607.76
			Add transfer from Working Capital Fund		5,000.00
		10,313.70			10,313.70
WORKING CAPITAL FUND					
Cash at bank		$ 893.57	Credits due to member Governments from Italy		$ 626.97
Add credit due from General Fund (transferred 28 Feb. 1955 to General Fund)		5,000.00	Principal of Fund		5,266.60
		5,893.57			5,893.57

PART 2

Report of the Fifth Annual Meeting
6 - 11 June, 1955

BY THE CHAIRMAN — STEWART BATES

1. Time and Place of Meeting.

The Fifth Annual Meeting of the Commission was convened in the Railway Committee Room, House of Commons, Ottawa, Canada. Following the opening ceremony, the meeting reconvened in the Hotel Château Laurier, Ottawa, and continued on June 7, 8, 9, 10 and 11. The Commission's meeting was preceded by meetings of groups of scientific advisers on 3 and 4 June.

2. Participants (See Appendix I)

Commissioners, most of them accompanied by advisers, were present from Canada, Denmark, France, Italy, Norway, Portugal, Spain, United Kingdom and United States. Observers were present from Federal Republic of West Germany, Food and Agriculture Organization of the United Nations, Conseil International pour l'Exploration de la Mer, International Fisheries Convention of 1946, International Pacific Halibut Commission, and the Special Committee of the International Geophysical Year.

3. Opening Remarks.

Present at the opening ceremony were: The Prime Minister of Canada, the Rt. Hon. Louis S. St. Laurent, and the Minister of Fisheries of Canada, Hon. James Sinclair, Representatives of the Missions of Member Countries, Representatives of the Missions of other countries interested in fisheries, Representatives of Canadian Government Departments, Members of the House of Commons.

The Chairman, Dr. Stewart Bates, opened the meeting and addressed a welcome to the representatives of the Canadian Government, to the guests and to the participants.

The Minister of Fisheries of Canada, Hon. James Sinclair, welcomed the participants and introduced the Prime Minister.

The Prime Minister of Canada, Right Honourable Louis St. Laurent, addressed the meeting, welcoming the representatives of the member countries, the observers from other countries and institutions, and the guests. He drew attention to the vital interest that Canada had in the fisheries, to the need for a rational conservation of the resources of the sea, now and in future years, and concluded:

"The responsibilities of the Commission are significant in their scope and in their importance. I can assure you that Canada is pleased indeed to be a full participating member of this international organization, and I can tell you that the work of the Commission will at all times have the wholehearted support of the Canadian Government.

"I want to extend to you all our most cordial welcome and to express the hope that your stay in Ottawa will be both productive and pleasant. Good luck to you in your very important deliberations."

The heads of the delegations of the various member countries responded to the Prime Minister's address, expressing their thanks for the invitation to convene this Annual Meeting in Ottawa, and their countries' vital interests in the work carried out by ICNAF.

As Commission's Vice-Chairman, Capt. Tavares de Almeida added to his response the Commission's thanks to the Canadian Government for the courtesies and hospitality bestowed on the Commission.

With thanks to all present, the Chairman declared the adjournment of the opening meeting.

4. The Agenda (See Appendix II)

When the meeting reconvened in the Chateau Laurier, the Chairman welcomed the participants and especially Dr. J. Lundbeck, the first observer from West Germany to an ICNAF meeting.

The Agenda, which had been circulated 60 days in advance of the meeting, was adopted on a motion by U.S.A., seconded by Norway.

MacKichan (Canada) moved that proposals dealing with research and regulations should pass directly from panels to the Standing Committee on Research and Statistics and from there to the Plenary. This was seconded by U. K. and Norway and so carried.

5. Publicity for the Meeting.

The Chairman explained that the Canadian Department of Fisheries had arranged for information to the Press. He asked for the nomination of a small committee to work with the press officers and proposed that Lucas (U.K.) and Terry (U.S.A.) be chosen for this work. MacKichan (Canada) proposed to add Bradbury (Canada) to the committee. The Plenary Session agreed to the proposals.

6. Review of Panel Memberships.

There were no recommendations of changes in number of Panel Memberships. The 27 panel memberships for 1954/55 were therefore confirmed for 1955/56.

Country	Panel No.					Total
	1	2	3	4	5	
Canada		+	+	+	+	4
Denmark	+					1
France	+	+	+	+		4
Iceland						0
Italy	+	+	+	+		4
Norway	+					1
Portugal	+	+	+	+		4
Spain	+	+	+	+		4
United Kingdom	+		+			2
United States			+	+	+	3
TOTAL	7	5	7	6	2	27

The Plenary requested the Executive Secretary to submit to the Iceland Government the Commission's wish that Iceland, playing a considerable rôle in the fishery and research work in Subarea 1, take membership in Panel 1.

7. Report on Staff Matters.

The Commission approved the Administrative Report and the Financial Statements for the year 1954/55 and the Auditor's Report for the year 1953/54 upon recommendation by the Standing Committee on Finance and Administration. After having received information on the question of superannuation of staff members, the Commission expressed the wish that this matter could soon be brought to a satisfactory conclusion.

8. Budget.

The Commission approved the recommendation of the Committee on Finance and Administration to appropriate $34,100 for the year 1955/56 for the following purposes:

1.	Personal Services	$21,000
2.	Travelling	3,700
3.	Transportation of Things	200
4.	Communication Services	1.000
5.	Rent and Utility Services	300
6.	Other Contractual Services, including Printing	5,700
7.	Supplies and Materials	1,100
8.	Equipment	500
9.	Annual Meeting	600
		$34,100

The Commission noted that the budget for 1956/57 was estimated to approximate $36,000. Mr. MacKichan was re-elected Chairman of the Committee on Finance and Administration for another year. The date of billing would be 1 July, 1955.

9. Report of the Standing Committee on Research and Statistics.

Several papers dealing with research, statistics and Commission's publications had been placed before the Committee and considered by ad hoc committees and by the Committee itself. The following recommendations by the Committee were approved by the Commission:

Statistics.

(1) As an interim measure, two factors should be used for conversion from green salted wet to round fresh weight, one for European landings of 3.0 and one for Canadian landings of 2.7; however,

(2) These conversion factors should be considered to be tentative and subject to further revision, so that

(3) Back statistics should not be revised at this time, and

(4) The Secretariat should assist with the development of improved conversion factors by co-ordinating the program through such methods as distribution of prescribed forms for submission of results of conversion factor experiments.

(5) That, in addition to present statistical requirements, the Secretariat request governments to submit summary statistics on landings of all species by subareas. It is intended that the landings be broken down by species where practicable.

(6) That the Secretariat publish summary tables of total landings by species and by sub-areas.

(7) That, wherever possible, statistics of landings by gear and efforts be submitted and published by months and by sub-divisions.

The Commission further agreed

(a) That, otherwise, the present requirements concerning effort data remain as they are. The committee emphasized the usefulness of "days fished" as a measure of effort.

(b) That the classification of vessels adopted last year should be retained, but that further study of methods of classification should be made.

B. **Research**

(1) That the ad hoc committee on trawl mesh sizes should continue its work and report on it at the next Annual Meeting. Measurements should be made with the standard gauge described in the Subarea 4 regulation and the Secretariat should assist in obtaining information.

(2) That a symposium on cod be arranged to take place at the 1956 Annual Meeting with Mr. Rollefsen, helped by the Secretariat, as convener.

(3) It was also urged that scientists should exchange otoliths and other material to help standardize methods of age reading etc.

Dr. Lionel A. Walford was elected Chairman for the ensuing year.

10. Mesh Regulations for Trawl Fishery on Cod and Haddock.

The following recommendation was adopted for Subarea 5 (as a substitute for the one now in force.)

I. That the Contracting Governments take appropriate action to prohibit (except as provided in paragraph II) the taking of cod, *Gadus callarias L.*, and haddock, *Melanogrammus aeglefinus (L.)*, in Subarea 5 by persons under their jurisdiction with trawl nets having a mesh size less than $4\frac{1}{2}$ inches or 114 mm. manila twine when measured wet after use, or less than the equivalent thereof when measured dry before use. When trawl nets other than manila are used, they shall have a selectivity equivalent to that of a $4\frac{1}{2}$ inch or 114 mm. manila trawl net. For the purpose of this proposal, the $4\frac{1}{2}$ inch or 114 mm. mesh size when measured wet after use shall be taken to be:

(a) In the cod-end of the net, the average of the measurements of any fifty consecutive meshes running parallel to the long axis of the cod-end, beginning at the after end of the cod-end, and being at least ten meshes from the lacings, or, if the cod-end is less than 50 meshes in length, the average of the measurements of the meshes in any series of consecutive meshes running the full length of the cod-end, parallel to the long axis of the cod-end and at least ten meshes from the lacings, such measurements to be made with a flat wedge-shaped gauge having a taper of 2 cm. in 8 cm. and a thickness of 3/32 in. or 2.3 mm., inserted into the meshes under a pressure of not less than 10 lb. or 4.5 kg. nor more than 15 lb. or 6.8 kg. and

(b) In any part of the net other than the cod-end the average of the measurements of the meshes in any series of twenty consecutive meshes, such series to be at least ten meshes from the lacings, and such measurements to be made with a flat wedge-shaped gauge having a taper of 2 cm. in 8 cm. and a thickness of 3/32 in. or 2.3 mm., inserted into the meshes under a pressure of not less than 10 lb. or 4.5 kg. nor more than 15 lb. or 6.8 kg.

II. That in order to avoid impairment of fisheries conducted primarily for other species and which take small quantities of cod and haddock incidentally, the Contracting Governments permit persons under their jurisdictions to take cod and haddock with trawl nets having a mesh size less than that proposed in the preceding paragraph, so long as such persons do not have in possession on board a vessel fishing primarily for other species, cod or haddock in amounts in excess of 5000 lb. or 2265 kg. for each, or ten per cent by weight for each, of all fish on board such vessel, whichever is greater.

III. That the Contracting Governments prohibit the use, by any person to whom this proposal would apply, of any means or device, other than those described in paragraph IV, which would obstruct the meshes of the trawl net or which would otherwise, in effect, diminish the size of the meshes of the trawl net.

IV. That the Contracting Governments permit (1) any canvas, netting, or other material to be attached to the underside only of the cod-end of a trawl net to reduce and prevent damage and (2) a rectangular piece of netting to be attached to the upper side of the cod-end of the trawl net to reduce and prevent damage so long as such netting conforms to the following conditions:

(a) This netting shall not have a mesh size less than that specified in paragraph I. For the purposes of this sub-paragraph, the $4\frac{1}{2}$ inch or 114 mm. mesh size when measured wet after use shall be taken to be the average of the measurements of twenty consecutive meshes in a series across the netting, such measurements to be made with a like gauge inserted into the meshes as specified in paragraph I hereof.

(b) This netting may be fastened to the cod-end only along the forward and lateral edges of the netting and at no other place in it and shall not exceed 16 meshes in length counted parallel to the long axis of the cod-end.

(c) The width of this netting shall be at least one and a half times the width of the area of the cod-end which is covered, such widths to be measured at right angles to the long axis of the cod-end.

The same mesh regulation was recommended for Subarea 4.

Basically the same mesh regulation was recommended for Subarea 3, the mesh size here to be only 4 inches or 102 mm. with the necessary consequent changes in the protective netting.

11. Reports of Meetings of Panels 1 to 5.

The Commission approved the reports of Panels 1 to 5.

Panel 1 met twice and working parties on hydrography and on halibut met separately. The Commission noted the Panel's wish for periodic reviews of hydrographic data and that the Executive Secretary was asked (1) to arrange with ICES for the most suitable manner for member countries to supply information for both organizations and (2) to establish contact with the U. S. Ice Patrol for obtaining further information. The Commission further noted that the Panel was planning special researches on halibut in the Subarea. Mr. B. Dinesen (Denmark) was elected Chairman for the two ensuing years.

Panel 2 met twice. The Commission approved the Panel's recommendation that the Group of Advisers to Panel 3 should act also as advisers to Panel 2. Commander Barbier (France) was elected Chairman for the two ensuing years.

Panel 3 met three times. The Panel recommended the introduction of a 4 inches minimum mesh size for trawls used in fishing for cod and haddock in Subarea 3 (see Item 10). The Commission noted that a meeting of the Panel 3 Group of Advisers was planned for March 1956. Mr. Chicheri (Spain) was elected Chairman for the two ensuing years.

Panel 4. The Panel met on 8th June. The Panel recommended that a $4\frac{1}{2}$ inches mesh be introduced as minimum mesh size for trawls used in haddock and cod fishing in Subarea 4 (See Item 10.) Mr. MacKichan was elected Chairman for the two ensuing years.

Panel 5. The Panel met three times. The Panel recommended that a new regulation of mesh sizes be introduced in Subarea 5, differing from the one now in force in that it considers also the cod, specifies rules for exemptions, changes the rules allowing for the protection of the trawl and by a revised wording (See Item 10).

The Commission noted that studies of the cod would be taken up, that the study of the effects of the regulation of the haddock fishery would be continued. Mr. Sargent (U.S.A.) was elected Chairman for the two ensuing years.

12. Submission by F. A. O.

The Commission noted the paper by the FAO observer, Dr. Kesteven, on that organization's plan for a "Survey of Aquatic Animals." The paper was considered in the Committee on Research and Statistics. On recommendation of that Committee, the Commission agreed that its member countries give any possible help to FAO in its realization of this important plan, and suggested that FAO should give needed advice as to the collection of statistics for population research and as to the analyses thereof, for instance by establishing personal contact between FAO and agencies in the separate countries through ICNAF.

13. Co-Operation with the Technical Panel on Oceanography for an International Geophysical Year (CSAGI).

A request by the Panel for co-operation had been dealt with in the Committee on Research and Statistics. On recommendation by this Committee, the Commission agreed to offer CSAGI the offices of the Secretariat in obtaining the fullest use of oceanographic facilities of the fisheries agencies of the member countries.

14. Meeting of the Standing Committee on Research and Statistics in March, 1956.

Upon recommendation by the Committee on Research and Statistics, the Commissioners approved that the Committee should meet in Biarritz (France), 1-10 March, 1956, and that the Executive Secretary should attend the meeting.

15. Date and Place of Annual Meeting.

Following a proposal by the Danish delegation which had been considered by the Standing Committee on Finance and Administration, the Commission agreed that the Depository Government be requested to ask the participating countries to agree to an amendment of the Convention, to permit the Commission at its discretion to hold its annual meetings outside North America.

The Commission adopted a proposal by the Standing Committee on Finance and Administration that the 1956 Annual Meeting be held at Commission's headquarters in Halifax in the week beginning 11 June. It further approved that the Standing Committee on Research and Statistics should hold an additional meeting before the beginning of the Plenary meeting in 1956 (i.e. 8 June, in Halifax).

It finally agreed that during the 1956 Annual Meeting an afternoon symposium on cod, with G. Rollefsen (Norway) as convener, be held.

16. Election of Chairman and Vice-Chairman.

At its Final Plenary Session, the Commission on a motion by Mr. Bradbury (Canada), seconded by Dr. Lucas (United Kingdom) elected Capt. Tavares de Almeida Chairman for the next two years. On a motion by Mr. Ravel (France), seconded by Mr. Sargent (U.S.A.), the Commission elected Mr. Klaus Sunnanaa (Norway) Vice-Chairman for the same period. Both Captain Tavares de Almeida and Mr. Sunnanaa expressed their gratitude for the honour bestowed upon them. Mr. Sargent (U.S.A.) thanked Dr. Stewart Bates for the excellent service he had rendered the Commission during his two years' Chairmanship.

17. Acknowledgements.

The observers for West Germany, FAO, ICES and the 1946 Permanent Convention thanked the Commission for the opportunity of attending.

In his concluding remarks, the Chairman stressed how highly the Commission appreciated the attendance at the Annual Meeting of the observers from West Germany and the various international organizations. Finally, he expressed the Commission's thanks to all who had contributed to make the meeting a success, especially mentioning the Department of Fisheries, Canada, the Chairmen of Committees and Panels and the Secretariat.

The new Chairman, Capt. Tavares de Almeida thanked from the Chair the Canadian Government for the grand hospitality shown the Commission at this Annual Meeting, and the Fifth Annual Meeting then adjourned.

APPENDIX I

LIST OF PARTICIPANTS

CANADA

Commissioners:

Dr. Stewart Bates, President, Central Mortgage and Housing Corporation, Ottawa.

Louis S. Bradbury, Director, Fish. Industrial Development Service, Dept. of Fish., Ottawa.

J. Howard MacKichan, General Manager of the United Maritime Fishermen, Ltd., Halifax, N.S.

Advisers:

Loran E. Baker, Chief Supervisor, Dept. Fish., Halifax, N. S.

H. R. Bradley, Chief Supervisor, Dept. Fish., St. John's, Nfld.

G. R. Clark, Deputy Minister, Dept. Fish., Ottawa.

J. B. Estey, Member, Industry Advisory Comm. for Canada, Logieville, P. Q.

Allister Fleming, Newfoundland Fisheries Research Station, St. John's, Nfld.

Dr. J. L. Hart, Director, Atlantic Biological Station, St. Andrews, N. B.

Dr. J. L. Kask, Chairman, Fish. Research Board of Canada, Ottawa.

S. G. Lake, Member, Industry Advisory Comm., for Canada, St. John's, Nfld.

Dr. L. Lauzier, Atlantic Biological Station, St. Andrews, N. B.

Dr. W. R. Martin, Atlantic Biological Station, St. Andrews, N. B.

D. W. Munro, Member, Industry Advisory Comm., for Canada, St. John's, Nfld.

Dr. F. D. McCracken, Atlantic Biological Station, St. Andrews, N. B.

P. K. McGrath, Member, Industry Advisory Comm. for Canada, St. John's, Nfld.

J. E. Paloheimo, Atlantic Biological Station, St. Andrews, N. B.

Douglas Pyke, Member, Industry Advisory Comm. for Canada, Lunenburg, N. S.

Dr. W. E. Ricker, Editor, Fish. Research Board of Canada, Nanaimo, B. C.

W. R. Ritcey, Member, Industry Advisory Comm. for Canada, Riverport, N. S.

Dr. W. Templeman, Director, Newfoundland Fish. Research Station, St. John's, Nfld.

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Dr. Å. Vedel Tåning, Head, Danish Institute for Fishery and Marine Investigations, Charlottenlund Slot.

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F. LeGasse, Compagnie Generale de Grande Pêche, Paris.

M. Quebriac, President du Comité General des Pêches Maritimes, Paris

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K. Sunnanaa, Director of Fisheries, Directorate of Fisheries, Bergen.

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Alfonso Varela Reducto, Jefe del Negociado de Pesquerias del Atlantico N. W.

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Alfonso Rojo Lucio, Biologist, Spanish Cod Fishing Industries Assoc., St. John's, Nfld.

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A. W. Anderson, Chief, Branch of Comm. Fish., Fish & Wildlife Service, Washington, D. C.

Dr. Herbert W. Graham, Chief, North Atlantic Fish. Inv., Fish and Wildlife Service, Woods Hole, Mass.

W. M. Terry, Office of International Activities, Dept. of the Interior, Washington.

Dr. Lionel A. Walford, Chief, Branch of Fishery Biology, Fish and Wildlife Service, Washington, D. C.

Assistant Advisers:

Howard H. Eckles, Marine Biologist, Branch of Fishery Biology, Fish and Wildlife Service, Washington, D. C.

J. Clark, Fish and Wildlife Service, Woods Hole.

G. Kelly, Fish and Wildlife Service, Woods Hole.

Giles M. Mead, Fish and Wildlife Service, Woods Hole.

Clyde C. Taylor, Fish and Wildlife Service, Woods Hole.

T. D. Rice, Executive Secretary, Massachusetts, Fish. Ass., Boston.

Leonard O. Warner, Member, Industry Advisory Comm., for U. S. Commissioners, Providence, R. I.

Dean F. Bumpus, Woods Hole Oceanographic Inst., Woods Hole, Mass.

FEDERAL REPUBLIC OF WEST GERMANY

Observer:

Dr. J. Lundbeck, Institut für Seefischerei, Hamburg.

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

Observer:

Dr. G. L. Kesteven, Fisheries Biology Branch, F.A.O., Rome, Italy.

INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA

Observer:

Dr. Å. Vedel Tåning, Vice-President, I.C.E.S. Charlottenlund, Denmark.

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Observers:

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Dir. Gunnar Rollefsen, Vice-President of the Permanent Commission, London.

INTERNATIONAL NORTH PACIFIC FISHERIES COMMISSION:

Observer:

Mr. George R. Clark, Deputy Minister of Fisheries, Ottawa.

INTERNATIONAL PACIFIC HALIBUT COMMISSION

Observer:

S. V. Ozere, Assistant Deputy Minister, Dept. of Fish., Ottawa.

THE SPECIAL COMMITTEE OF THE INTERNATIONAL GEOPHYSICAL YEAR

Observer:

Dr. Lionel A. Walford, Chief, Branch of Fishery Biology, Fish and Wildlife Service, Washington, D. C.

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APPENDIX II

AGENDA

1. Opening by the Chairman.
2. Adoption of Agenda.
3. Policy with regard to publicity for the Annual Meeting.
4. Review of Panel Memberships.
5. Report on staff matters, with presentation of the administrative report 1954/55 and financial statements for the year 1954/55.
6. Presentation of Auditor's Report for the financial year 1953/54.
7. Consideration of budget estimate for 1955/56.
8. Consideration of advance budget estimate for 1956/57.
9. Consideration of superannuation plan for staff members.
10. Date and place of Annual Meeting, 1956, including a proposal by the Danish Delegation to change the Article II, 5 of the Convention of 1949, and the rule No. 15 of "Rules of Procedure for the Commission", to the effect that annual meetings can be held in any of the participating countries.
11. Proposal from Panel 4 that a minimum mesh size of approximately four and one-half inches be introduced for trawl fishing for cod and/or haddock in Subarea 4.
12. Proposal from Panel 3 that a minimum mesh size larger than the smallest now in use be introduced for trawls used in the fishery for cod and/or haddock in Subarea 3.
13. Proposals by Panel 5:

    (a) that the Commission notifies the Governments concerned of the importance of the continuation of the study-boat program for controlling the effect of the haddock regulation in Subarea 5.

    (b) that the Commission eventually consider the possibility of making the said study-boat program a special project to be financed wholly or partly by the Commission (Convention Art. VI, 1 and XI, 5).

    (c) a change in the wording of the mesh regulations now in force in Subarea 5 to facilitate the enforcement of the haddock regulation.
14. Consideration of the question of possible exemptions from the haddock regulation now in force in Subarea 5.
15. Consideration of possible collaboration with F.A.O. Fisheries Division concerning that organization's plan for a "Survey of Aquatic Resources."
16. Report on meetings of Standing Committee on Research and Statistics, 6-10 June, 1955.
17. Report on meetings of Standing Committee on Finance and Administration, 6-10 June, 1955.
18. Reports on meetings of Panels 1-5, 6-10 June, 1955.
19. Other business.
20. Election of Commission's Chairman and Vice-Chairman for the two following years.
21. Adjournment.

PART 3

Summaries of Research 1954

(a) Summaries by Countries

I. Canadian Researches, 1954

SUBAREA 2. BY W. TEMPLEMAN

Redfish *Sebastes marinus* (L.). In September, 1954, the "Investigator II" carried out exploratory fishing for redfish in the deep water east of Hamilton Inlet Bank in Labrador. A small net, the three-quarter 35 otter trawl (39 ft. headrope), was used on a single wire. A series of five drags, fairly well distributed over the daylight hours, was carried out at each of five depths between 160 and 400 fathoms. The average catch of redfish per hour's dragging at the different depths is shown in Table 1. There is at present no commercial fishery for redfish in this area.

Table 1. **Observations on Redfish from Sets East of Hamilton Inlet Bank**

Depth Fathoms	160	200	250	300	390-400
Bottom Temp. °C.	2.1	3.1	3.9	3.9	—
Av. Catch per hour dragged (lbs.)	1,820	2,280	1,330	770	10
Av. Size (cm.)	32.5	33.7	35.3	39.0	—
Largest Immature Female (cm.)	37	—	—	47 *	—
Smallest Mature Female (cm.)	35	—	—	None*	—

*No mature specimens were found in a sample of 21 females of 32-39 cm. nor among 39 females of 40-47 cm.

Redfish sizes increased with depth. Some very large redfish of 60 to 70 cm. were present; one of 75 cm. and 19 pounds was captured. There was a very great difference in the size at sexual maturity of the fish in different depths. Whereas in a sample from 160 fathoms, the largest immature females were 37 cm. and the smallest mature spent females were 35 cm., only 5½ nautical miles distant in 300 fathoms there were no mature specimens in a sample of 21 female redfish of 32-39 cm. or in a sample of 39 of 40-47 cm. With the higher temperatures, which usually favour early maturity, occurring at the greatest depth (see the table) the lack of mature specimens at 300 fathoms was apparently due not to temperature but to some other factor such as lack of light.

The area surveyed is the chief centre of infection of redfish in Canadian Atlantic waters by the copepod parasite *Sphyrion lumpi*. The data on parasitization, collected from large numbers of redfish examined at sea, are shown in Table 2.

Table 2 **Parasitization by *Sphyrion lumpi***

Depth Fathoms	160	200	250	300
A. **Observed at Sea**				
% Parasitized by Living *Sphyrion*	5.8	6.2	1.3	0.8
No. of *Sphyrion* per 100 fish	8.7	9.2	1.4	0.8
B. **From Laboratory Samples**				
% Parasitized by Living *Sphyrion*	8.8	—	—	0.8
% of fish with old heads in fillets	19	—	—	8
No. of heads per 100 fish	42	—	—	9

Great differences in the distribution of the parasite *Sphyrion* occurred in samples only a few miles apart, four miles in the case of the highly distinct redfish populations from 200 and 250 fathoms. Samples of redfish from 160 and 300 fathom depth, from localities on Hamilton Inlet Bank only 5½ nautical miles apart, were examined at the Research Station. 8.8% were infected externally with *Sphyrion* at 160 fathoms and 0.8% at 300 fathoms. After removal of the heads of the living *Sphyrion* the fillets of these samples, each of 120 fish, were examined on a candling table for old heads of *Sphyrion*. Internally, 19% of the fish at 160 fathoms and 8% at 300 fathoms had encysted heads. There were 42 encysted heads per 100 fish at 160 fathoms and only 9 at 300 fathoms and this in spite of the considerably greater size of the redfish at 300 fathoms.

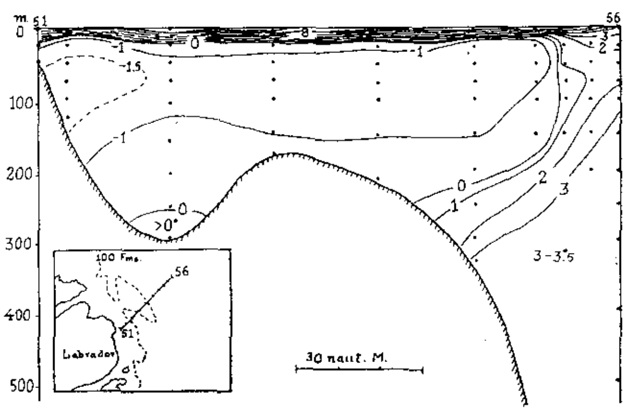

Fig. 1a. Hydrographic section, Hamilton Inlet Bank, 30-31 July 1954. Temperature °C. Position of section inserted. The close-lying isotherms of the surface water are only indicated.

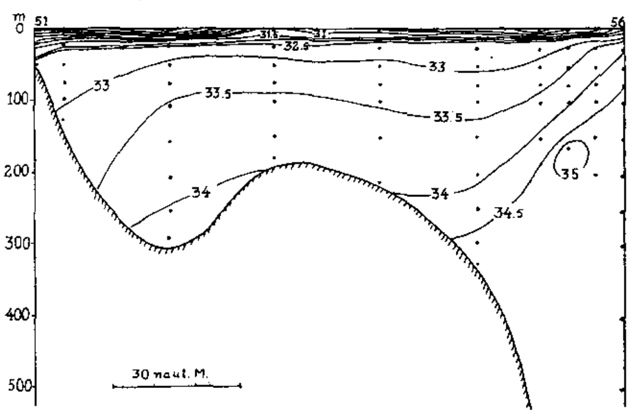

Fig. 1b. Hydrographic section, Hamilton Inlet Bank, 30-31 July 1954. Salinity ‰.

The living *Sphyrion* most likely have a life history of at least a year and the differences in distribution in the samples only 4 to 6 nautical miles distant, but with 50 to 140 fathoms difference in depth, indicate extremely little interchange in the redfish at different depths in the same area and also that the free-swimming stages of *Sphyrion* and the secondary host, if one exists, are largely restricted to depths above the 250 fathom line.

There was an absence of mature fish at 47 cm. length at 300 fathoms, while at 160 fathoms, 5½ nautical miles distant, the smallest mature female was 35 cm. and all females over 37 cm. were mature spent fish. This indicates a lack of mixing for many years.

It appears very likely, therefore, that once the redfish become adjusted, possibly at an early age, to depths of 160 to 200 or 250 to 300 fathoms it is very difficult for them to pass from one of these depth ranges to the other.

Hydrography. The section across the Labrador Current (Hamilton Inlet Bank, Fig. 1) was taken on July 30-31. The water in this section was much colder in 1954 than in 1953.

SUBAREA 3. BY W. TEMPLEMAN

Haddock *Melanogrammus aeglefinus* (L.). In May and early June the yearly haddock otter-trawl survey was carried out by the "Investigator II."

The 1949 year-class which formed most of the commercial catch was abundant on Grand Bank and St. Pierre Bank; there was little evidence of the 1950 and 1951 year-classes. The 1952 and 1953 year-classes were abundant on the Grand Bank while on St. Pierre Bank the 1952 year-class was very scarce and the 1953 year-class abundant only in one small area.

Redfish. In Hermitage Bay, through the trawling of the "Marinus", a small-redfish frequency peak was found with peak sizes at approximately 7¼ cm., December, 1953; 8¼ cm., June, 1954, and 8¾ cm. in September, 1954. These fish were most likely about 1½ years old in December, 1953. There are three well defined groups of fish and this will allow observations and checks on the age and growth of redfish. There are, judging from growth studies in other areas, about eight years between the younger group of fish and the older successful group of redfish in Hermitage Bay with a peak of 22 to 23 cm. There was apparently very little settling of young redfish in the area in the intervening years. Since the large-meshed trawl net with a shrimp-net cover probably does not catch the smallest group efficiently, it is difficult to know at present whether this group of tiny fish will represent a considerable stock.

Fishing for redfish usually ceases at night since redfish in many areas rise from the bottom and are no longer available in quantity to the trawls. During the last half of June and the first half of July, two trips were made to investigate the availability of redfish at night. In the south-west Grand Bank area there were indications that at 160 fathoms, catches were normal from 6 a.m. to 6 p.m. and dropped off to as low as 10 to 15% of the daytime catch by 1 a.m. In the northeastern Grand Bank region at 160 fathoms, a catch of 1,500 pounds in a half-hour's drag was obtained at 11.10 to 11.40 p.m. and one of 800 pounds from 2.35 to 3.05 a.m. These compared with catches ranging from 800 to 6,500 pounds or an average of 2,200 pounds during the day-light hours.

Tagging. Thirteen thousand cod *Gadus callarias* L. were tagged in 1954. The tagging areas were Burgeo Bank, St. Pierre Bank, St. Anthony, La Scie, Bonavista, Fermeuse, Cape St. Mary's and Trepassey. Many varieties of tags were used in an attempt to find the most suitable tags for future work.

Five hundred American plaice, *Hippoglossoides platessoides* (Fabr.) were tagged in St. Mary's Bay and 1,000 on the northern slope of the Grand Bank.

Mesh selection. Covered net experiments for haddock were carried out on several trips of the "Investigator II". The 50% selection point for haddock was 36 cm. for a 4 1/8 inch mesh and 32 cm. for a 3 3/4 inch mesh cod-end. An attempt using similar trawlers to show that the large 4 1/2 inch mesh cod-end was more efficient than the below 3 inch mesh cod-end in common use, was unsuccessful since most fish were in the 35-46 cm. range with a modal size of 39 cm. The fish plants were accepting small round haddock down to 35 cm. and the large-mesh gear caught such low catches of these small haddock that it was unprofitable to use it.

Statistics and population sampling. Catch, location and effort data were obtained for offshore boats and the offshore catch was measured and sampled at St. John's and Burin and the inshore catch at St. John's, Burin and Bonavista. A new departure during the year was a change in the haddock fishery toward the landing of haddock in the round condition and toward landing smaller haddock. By the end of the year over 90% of the haddock were being landed round. The haddock catch during the year increased greatly, and the cod were very abundant in the inshore areas and very close to the shore.

Hydrography. A hydrographic survey on the southern half of the Grand Bank and on St. Pierre Bank was carried out in April.

In July and August five hydrographic sections were taken across the Labrador Current and the banks from Bonavista to the southern edge of the Grand Bank. The section Grand Bank to Flemish Cap is shown in Fig. 2.

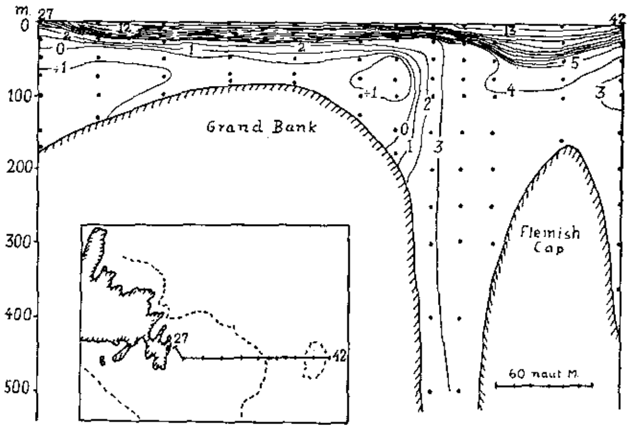

Fig. 2a. Hydrographic section, Grand Bank-Flemish Cap, 24-26 July 1954. Temperature °C. The inset shows position of section. The close-lying isotherms of the surface water are only indicated.

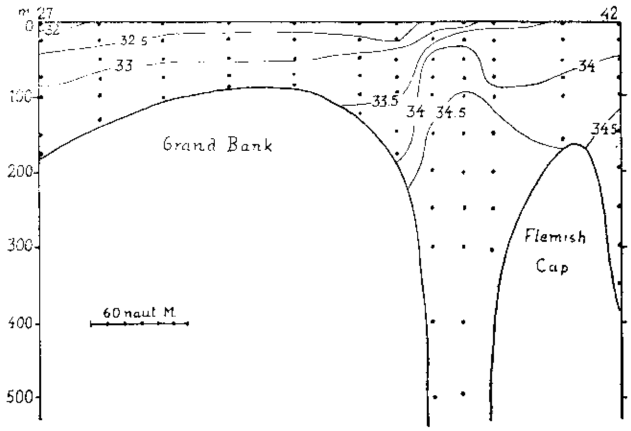

Fig. 2b. Hydrographic section, Grand Bank-Flemish Cap, 24-26 July 1954. Salinity °/oo.

Inshore, the surface layer of warm water was extremely shallow. The 0°C. line remained at twenty fathoms until the end of August and the 3°C. line above twenty fathoms till early September.

In the Labrador Current from Labrador to Cape Bonavista and in the inshore branch of the current from Cape Bonavista to the southern edge of the Grand Bank there was a considerably greater volume of below 0°C. water present in July-August, 1954, than in the same period of 1953.

SUBAREA 4. BY W. R. MARTIN

The researches in Subarea 4 were carried out by the Marine Biological Station of the Québec Department of Fisheries and by both the Newfoundland Fisheries Research Station and the Atlantic Biological Station of the Fisheries Research Board of Canada. Studies of redfish, cod tagging, mesh selection, hook selection, fish larvae and hydrography were pertinent to ICNAF interests. Abundance, growth and mortalities of the most important groundfish species were followed by sampling commercial landings. Emphasis was placed on an assessment of the need for mesh regulation in Subarea 4 and to this end, the following submissions were made to the Commission:

Canadian investigations of Subarea 4 stocks of cod and haddock.

A. Factors affecting annual yield—by W. R. Martin (ICNAF Ser. No. 268)

B. Gear selection in relation to sizes caught and landed—by F. D. McCracken (ICNAF Ser. No. 269).

C. The effect of increased mesh size on yield—by J. E. Paloheimo (ICNAF Ser. No. 274).

Redfish. Seasonal and diurnal movements of redfish in the Gaspé area of the Gulf of St. Lawrence were studied from the "J. J. Cowie" during the period May to September.

Seasonal changes in the sex ratio of redfish taken in a 40-foot flounder drag conformed with 1953 findings. In May and June, males outnumbered females while in August and September, the sexes were equally represented on the bottom. Larvae are released during the period May to July, with a maximum in mid-June. Surface and oblique plankton tows took maximum catches of larvae in mid-June, demonstrating that female redfish are in the area but off bottom at spawning time. Larvae are dispersed by the Gaspé current; the greatest numbers were taken off Cape Gaspé in early June and 30 miles south of this two weeks later.

Diurnal variation in redfish distribution was studied by alternating weeks of afternoon and pre-midnight drags with weeks of post-midnight and morning drags. The smallest catches were consistently made in the pre-midnight period. The largest catches of males were made in morning and afternoon periods. The largest catches of females were made in the post-midnight period. This diurnal variation in distribution of redfish is correlated with diurnal changes in the distribution of *Meganyctiphanes norvegica*, the staple food of redfish in this area. These phosphorescent euphausiids were taken in smallest numbers, by a 40 foot shrimp drag with a one-half inch liner, during the pre-midnight period. Bottom catches of both redfish and *Meganyctiphanes* were progressively smaller at 110, 120 and 130 fathoms.

Autumn redfish cruises have been carried out by the "Investigator II" in the Gulf of St. Lawrence more or less regularly since 1947. The depths investigated were between 120 and 200 fathoms.

The best catches were usually obtained between 140 and 160 fathoms, although there were occasional good catches at 120 and 180 fathoms.

In the early redfish frequencies obtained in the Gulf of St. Lawrence and on the western part of the south coast of Newfoundland by the "Investigator II" in 1947-50, before commercial fishing for redfish had begun in the area, there was evidence from all the deep-water areas of an abundance of large redfish, mostly between 30 and 42 cm. In 1953, after one summer of commercial fishing in the northern areas of the Gulf and several years fishing farther south, these large redfish were still abundant but, as a group, had essentially the same size distribution. In some cases they were slightly more grouped by some growth in the intervening years occurring at the smaller sizes, while there was no evidence of further growth at the upper part of the frequency. The peaks were essentially the same in 1953 as in 1947 and 1948.

While in 1947 and 1950 there was usually only slight evidence of sizes below 30 cm., there was in 1953 evidence of a group of redfish with peak sizes between 22 and 25 cm. as well as the larger group in which peak sizes for the males were 34 to 36 cm. and for the females 37 to 38 cm. These two groups of fish were completely separated in the frequency and with the very slow growth of the redfish there is at least a ten year difference in the ages of redfish at the peaks of the two groups. The younger redfish with peak sizes at 22 to 25 cm. were plentiful on the eastern side of the Gulf and on the western part of the south coast of Newfoundland and scarce on the western side of the Gulf, north of Anticosti.

It is evident that, in spite of the redfish being viviparous, and in the absence of mortality of spawning fish through fishing, only rarely is there a good survival of redfish larvae to the settling stage in the Gulf of St. Lawrence or on the western part of the south coast of Newfoundland. In the intervening years there is apparently little or no larval settling. Presumably the redfish in the course of their long larval life in the upper water layers usually drift out of the Gulf.

Cod and haddock tagging. 1954 recoveries from the cod and haddock tagging carried out off southwestern Nova Scotia in 1953 are summarized in Table 3. Recaptures of cod have been high indicating that a high proportion of the total mortality is attributable to fishing. Recoveries of tagged haddock were surprisingly high in view of the higher tagging mortality for this species. Petersen disk tags gave the best returns.

Cod recoveries were, for the most part, from the tagging area. Few winter recoveries were made, although large catches of cod were taken at this season.

Haddock recoveries showed a seasonal movement to offshore grounds. During winter months, the majority of the recaptures were taken on LaHave and Browns Banks.

During 1954, 1,284 cod were tagged off Louisburg and Canso, in eastern Nova Scotia and 2,000 cod were tagged along the north shore of the Gulf of St. Lawrence. In both cases the majority of the recaptures taken to date have come from the tagging area.

Table 3

1954 Recoveries from 1953 Cod and Haddock Tagging off southwestern Nova Scotia

Type of Tag	Maximum No. tagged fish Dec. 31/53	No. recovered to Dec. 31/54	% recovery during 1954
	Cod		
Hydrostatic	704	91	13
Red and white disks	191	78	41
Yellow disks	211	70	33
Strap	231	43	19
Total	1,337	282	21
	Haddock		
Hydrostatic	263	30	11
Red and white disks	92	17	18
Yellow disks	79	9	11
Strap	114	11	10
Total	548	67	12

Mesh selection. The selective properties of large-mesh manila and cotton trawls were studied from the "Pandalus II" and the commercial dragger "Harry G." operating consecutively during the period June through August (in the southern Gulf of St. Lawrence). Cotton three-quarter No. 35 and No. 35 Yankee trawls were used by the two draggers. Cod-ends were made of 50-yard, four-ply, double-strand manila or singlestrand, Lenco-treated, No. 96 to No. 120 thread cotton. Internal mesh sizes were measured with a United States gauge as defined in the Subarea 5 haddock mesh regulation. Escapement was measured by using a fine-mesh cover over the cod-end.

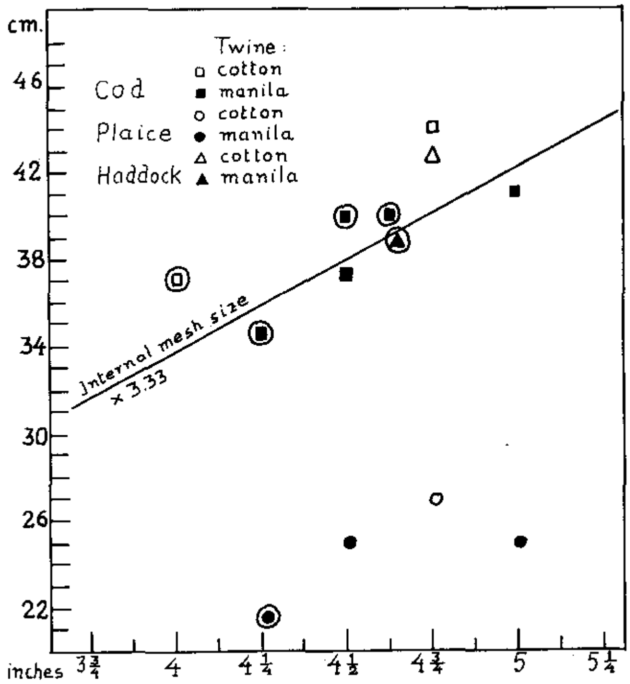

Fig. 3. **Fifty per cent selection points (cm.) for cod, plaice, and haddock in relation to internal mesh size (inches) of cod-end. Circled-35 Yankee tr., uncircled-$\frac{3}{4}$ 35 Yankee tr.**

The results are shown in Fig. 3. Fifty per cent selection points for cod taken with manila cod-ends conformed with results for haddock as established in these and earlier experiments. Cotton cod-ends released fish at larger sizes than did manila cod-ends of similar mesh sizes. As expected, the fifty per cent selection points for the plaice, *Hippoglossoides*, were much lower than those for cod and haddock.

The mesh experiments carried out during 1953-54 have demonstrated that the $4\frac{1}{2}$ inch mesh size now used for haddock fishing in Subarea 5 would release large numbers of small cod, haddock and plaice in Subarea 4 and practically no cod, haddock, hake (*Urophycis*) or flounders (*Glyptocephalus*, *Hippoglossoides*, *Limanda* and *Pseudopleuronectes*) of the sizes landed commercially on the Canadian mainland. Some offshore trawlers and Gulf of St. Lawrence draggers are voluntarily adopting large-mesh nets.

Hook selection. Fishing by hook and line is as important as otter trawl fishing in Subarea 4. and it is accordingly important to know the selective properties of the various sizes of hooks used in the fishery. Hook selection experiments, carried out off Lockeport, N. S., during 1954 demonstrated that larger hooks take fewer small fish. Four hook sizes were used, No. 17, No. 15, No. 14 and No. 11; No. 17 being the smallest commercial groundfish hook and No. 11 approximating the size of a halibut hook. The results for cod are shown in Fig. 4.

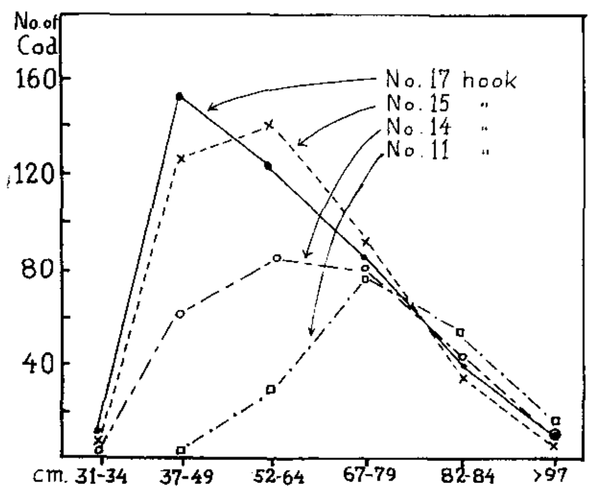

Fig. 4. **Hook selection. Cod. No. of cod caught on hooks of various sizes (nos. 11, 14, 15 and 17).**

The No. 17 hook caught some cod and haddock below acceptable commercial size and was effective in taking all commercial sizes. Available data suggest that selection with the No. 17 hook is comparable with that of a $4\frac{1}{2}$ inch mesh. The No. 11 hook caught few haddock and few small cod in comparison with the No. 17 hook. The No. 15 and No. 14 hooks showed intermediate selection.

If a mesh size greater than $4\frac{1}{2}$ inches is considered for conservation purposes, consideration must also be given to hook selection.

Fish eggs and larvae. The first of planned seasonal and annual samplings of Bay of Fundy, Scotian Shelf and Gulf of St. Lawrence waters was completed during August and September. Concentrations of larvae were found in Magdalen Shallows and on offshore banks to the northeast and southwest of Nova Scotia. Eggs were concentrated inshore off southwest Nova Scotia, off northeastern Cape Breton Island and on Quereau Bank. Cod larvae were taken in quantity in Magdalen Shallows, haddock off southwest Nova Scotia, and redfish off southwest Nova Scotia, on Quereau Bank and in the southern Gulf of St. Lawrence.

Hydrography. As a continuation of a long term program of seasonal surveys initiated in 1950, the Atlantic Oceanographic Group carried out four seasonal cruises in the Bay of Fundy, Scotian Shelf, and the Gulf of St. Lawrence areas. The winter cruise was extended to the head of the Bay of Fundy and included a large coverage of the

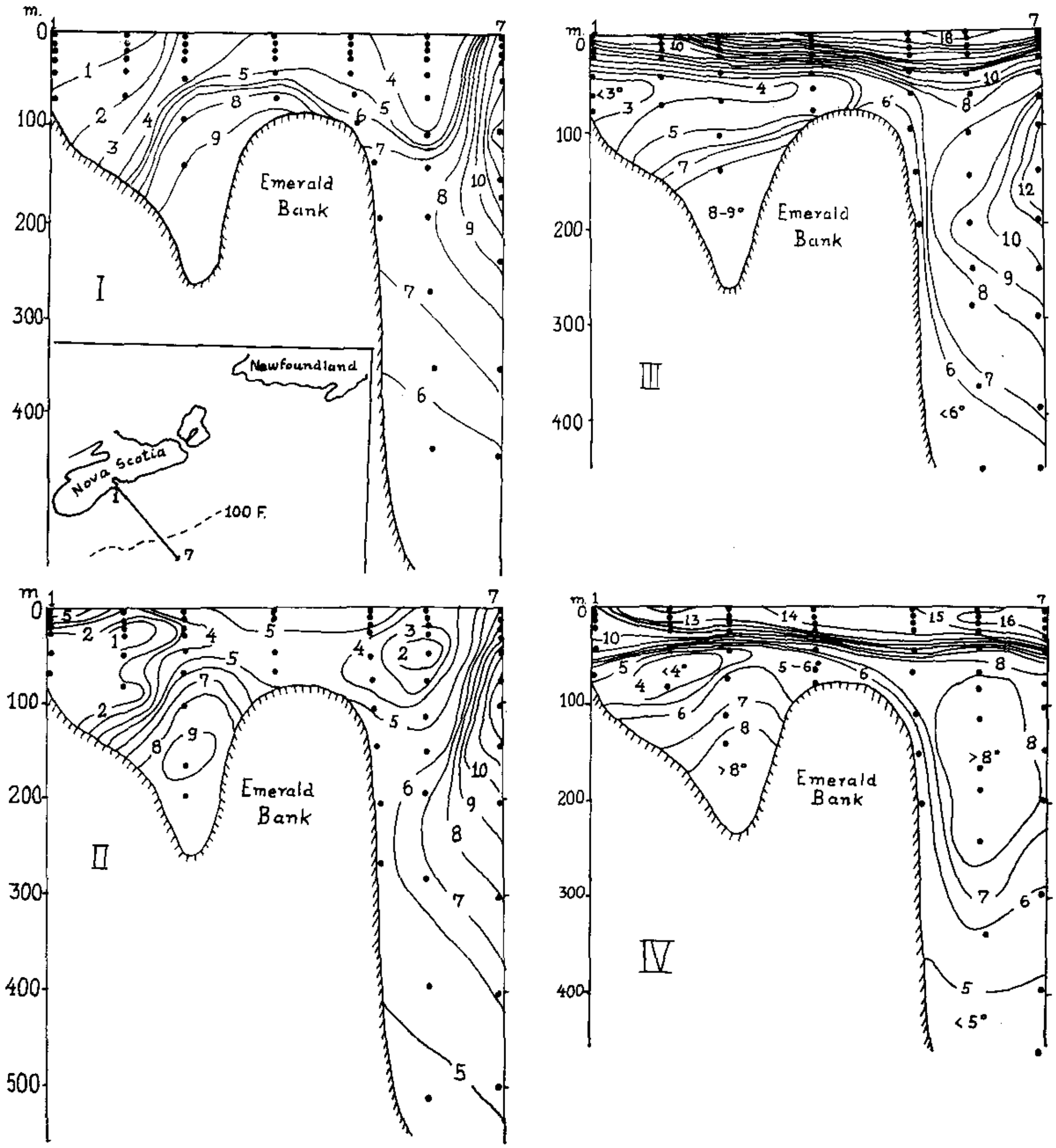

Fig. 5a. Hydrographic section across the Scotian Shelf off Halifax. Temperature °C. 1954. I-19/20 Feb., II-3 May, III-21/22 Aug., and IV-18/19 Oct.

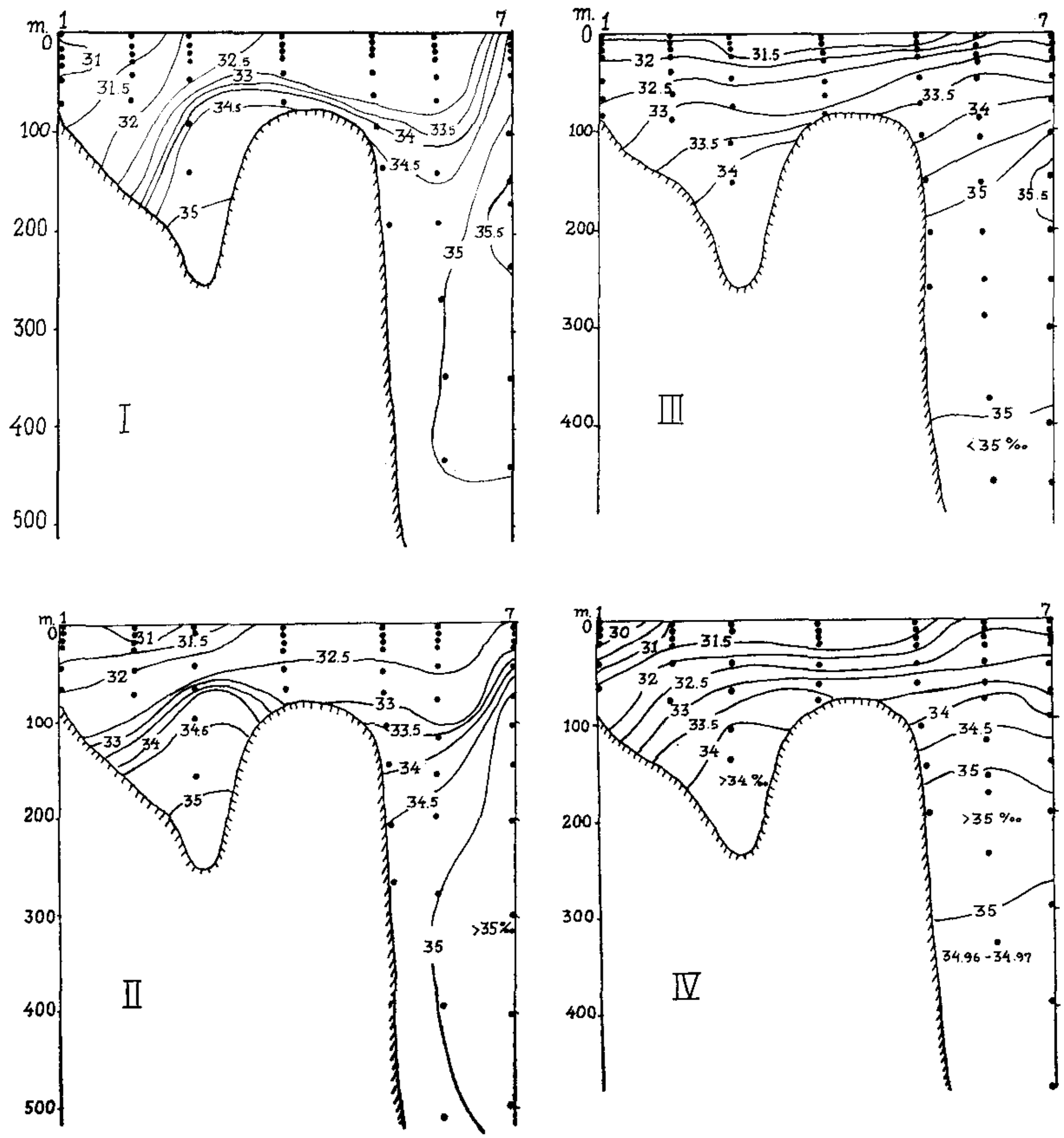

Fig. 5b. Hydrographic section across the Scotian Shelf off Halifax. Salinity °/₀₀.

area between Brown's Bank and the coast of Maine. During the summer survey, plankton tows were taken at strategic points and the Hardy Plankton recorder was used most of the time over the Scotian Shelf and in the Gulf of St. Lawrence. The quarterly section off Halifax is shown in Fig. 5.

Further study of the bottom temperatures on the Scotian Shelf has been made in comparing the data obtained between 1950 and 1953 with those from earlier surveys made over a somewhat more restricted network between 1934 and 1939. In general, bottom temperatures have tended to be higher during the recent period than they were prior to 1939, by as much as from one to three °C in the eastern sector and from two to three on LaHave Bank. It would appear that the main reasons for the variations in bottom temperature over the Scotian Shelf have been changes in the intermediate layer which was colder and thicker in the early years than it has been since 1950.

Analysis of the long term temperature records of surface waters at St. Andrews, N. B., and Sambro L. V. off Halifax, N. S., has shown a marked correlation between the annual mean temperature in any year and the amount of cooling taking place in the previous winter. Low annual mean temperatures have followed periods of intense cooling during the previous winter and high annual means have been related to lack of cooling rather than to excessive warming in summer. Annual means can be predicted by March with a fair degree of accuracy.

The data obtained from continued observations of surface water temperatures at strategic points along the Canadian Atlantic coast have shown that, in 1954, the annual means were equal to or higher than the average during the preceding five-year period. In the southwestern Gulf of St. Lawrence, the 1954 mean was lower than the average of the preceding quinquenniad.

In the oceanographic surveys of the waters around the Gaspé peninsula and along the north shore of the Gulf of St. Lawrence, emphasis was given to fishing areas such as Bay Chaleur, Miscou and Orphan Banks and fishing banks along the north shore.

II

Danish Research Report, 1954

(a) Cod in West Greenland Coastal Waters and Offshore Banks, 1954

BY PAUL M. HANSEN

1. Occurrence of cod eggs and larvae

The catches of cod, *Gadus callarias* L., larvae from the "Dana" (Fig. 1) show a more scattered distribution in 1954 than in 1953. The largest numbers were taken on stations between 66° and 67° N. Lat. In contrast to 1953, some cod larvae were found south of 64° N. Lat. Catches of larvae on two stations on the section Cape Farewell-Hamilton Inlet indicate probably a drift of cod fry from spawning grounds outside the West Greenland area (Iceland?).

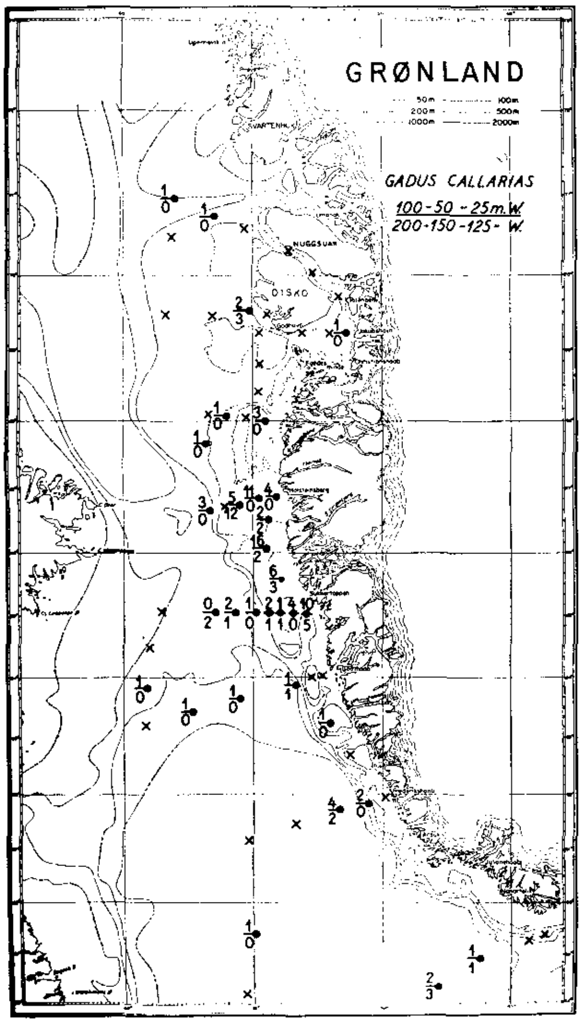

Fig. 1. Catches of cod larvae per 30 minutes haul with a 2 m. stramin bag from the "Dana", July-August 1954. Numbers in hauls with a 0-100 m. wire and with a 100-200 m. wire are shown respectively above and below the line.

2. Composition of year classes in catches of cod.

a. Offshore banks.

A total of 3,088 cod otoliths were collected in offshore water: 2,298 by the "Dana" from hand-line catches on the fishing banks, 281 from long-line catches from the "Adolf Jensen" (No. 8), 267 from long-line catch of a Portuguese dory vessel (No. 2), and 242 from otter trawl catches of a Faroese trawler (No. 9.).

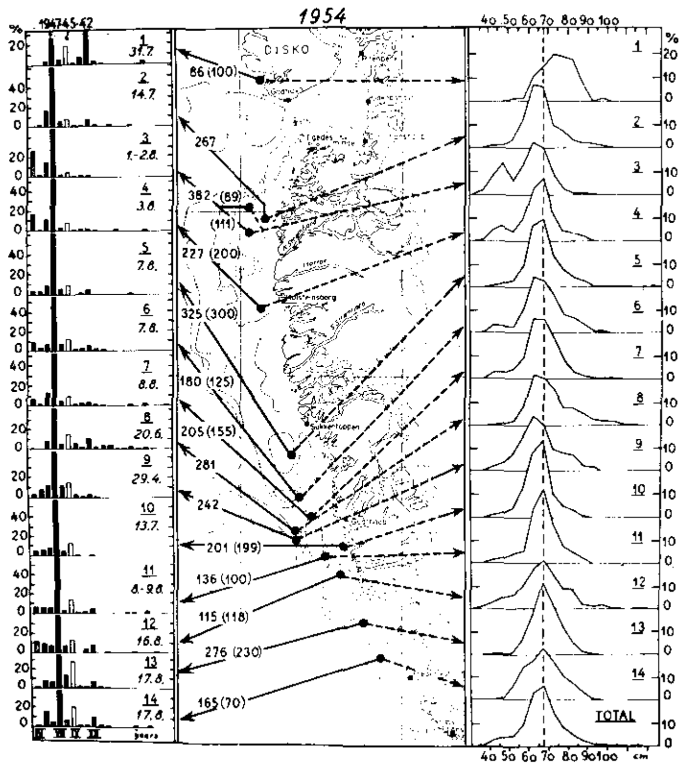

Fig. 2. Percentage age distribution (left) and and length measurements by 5 cm. groups (right) of cod caught on Greenland Banks, April-August 1954. Off each station are given no. of spec. investigated and in brackets of cod tagged.

The age and length distribution of the samples are given on the map Fig. 2. Table 1 gives for each year-class in the separate samples the frequency percentages and the mean lengths of males and females. The sample from the west coast of Disko (No. 1) differs from the other samples in that the 1942 year-class predominates and the 1947 year-class is less well represented. As in 1953 the 1947 year-class was the predominating one with the one exception (No. 1) noted. In each of the fourteen catches examined, it amounted to more than 20%, in twelve to more than 30%, in nine to more than 40% and in eight to more than 50%. In one sample (No. 5) it amounted to more than 60%, (percentages by number).

The 1945 year-class was of much less importance than in previous years, amounting to less than 20% in all samples with the exception of the sample from Dana Bank (26.8%).

The 1942 year-class was very poorly represented in the samples with exception of sample 1 where it predominated (31.2%). Of the remaining samples, only one (No. 8) yielded more than ten percent (10.8%).

Year-classes older than the year-class 1942 occurred in very small numbers. The 1934 year-class (20 years old) and the 1936 year-class (18 years old), which predominated in the catches during previous years, were represented in five samples.

TABLE 1. Cod from W.-Greenland Banks Year-classes 1934-50. Frequency percentages and mean lengths of males and females.

		1			2			3			4		
Year-Class	Age	Off Disko 69°27′N, 54°22′W. 31/7. 30-50m, 2.1°C. 86 spec.			Store Hellefiske Bank 67°55′N, 54°20′W 14/7 267 spec.			Store Hellefiske Bank 68°03′N, 54°42′W 1-2/8. 29m., 3.7°C. 376 spec.			Store Hellefiske Bank 66°52′N, 54°29′W 3/8. 30m., 3.5°C. 227 spec.		
		%	♂♂ cm	♀♀	%	♂♂ cm	♀♀	%	♂♂ cm	♀♀	%	♂♂ cm	♀♀
1950	IV				0.4	50.0	—	26.0	44.8	45.3	17.2	46.1	46.6
1949	V				2.2	53.0	45.8	1.9	52.0	50.0	0.9	52.0	56.0
1948	VI	3.5	52.0	58.5	15.4	59.3	59.5	14.6	58.2	55.8	11.4	58.5	62.8
1947	VII	25.6	61.6	64.7	59.5	63.3	65.3	50.1	63.1	63.3	54.1	65.0	65.7
1946	VIII	5.8	68.0	68.0	4.5	74.3	70.8	2.1	63.3	63.5	3.1	70.7	70.8
1945	IX	18.6	70.3	71.7	6.7	77.0	73.7	3.4	71.4	78.3	7.5	75.7	78.6
1944	X	1.2	77.0	—	2.2	73.0	84.3	0.3	67.0	—	0.9	76.0	81.0
1943	XI	7.0	79.7	75.7	0.7	73.0	94.0	0.8	81.5	76.0	1.3	77.0	82.0
1942	XII	31.2	78.2	80.2	6.4	83.4	87.5	0.8	74.0	88.0	1.8	79.0	78.5
1941	XIII	2.3	89.0	87.0							0.4	84.0	—
1940	XIV	1.2	—	80.0									
1938	XVI										0.4	—	85.0
1934	XX	3.5	96.0	111.0							0.9	84.0	—

TABLE 1 (con't)

		5			6			7			8		
Year-Class	Age	Lille Hellefiske Bank 65°01′N, 53°22′W 7/8. 40-60m. 325 spec.			Banana Bank 64°27′N, 53°13′W 7/8. 43-50m. 180 spec.			Fylla Bank 64°10′N, 52°51′W 8/8. 40m., 2.6°C. 204 spec.			Fylla Bank 64°04′N, 53°22′W 20/6. 281 spec.		
		%	♂♂ cm.	♀♀	%	♂♂ cm.	♀♀	%	♂♂ cm.	♀♀	%	♂♂ cm.	♀♀
1950	IV	4.3	43.6	47.3	8.3	44.6	45.3	7.3	47.0	49.5	0.7	—	46.5
1949	V	2.8	54.0	57.3	3.3	52.7	54.0	2.0	57.0	52.7	0.4	—	49.0
1948	VI	9.2	60.6	58.8	6.1	55.0	58.6	13.2	60.8	62.0	8.3	58.9	60.8
1947	VII	63.4	63.7	64.9	55.5	64.7	66.2	55.6	64.6	65.8	44.2	62.4	64.7
1946	VIII	4.9	70.3	69.4	6.7	72.0	71.5	4.4	70.2	68.4	4.7	70.2	70.6
1945	IX	9.2	70.9	75.4	11.7	74.2	75.7	8.8	72.5	74.1	14.7	71.4	72.4
1944	X				1.1	82.0	—	1.5	78.0	70.0	4.3	77.0	75.2
1943	XI	1.2	—	78.5	1.1	80.0	85.0	1.5	70.5	74.0	1.4	70.0	73.3
1942	XII	4.6	75.1	84.0	4.4	82.5	82.8	2.9	77.5	84.5	10.8	84.3	82.8
1941	XIII				1.1	80.0	95.0	0.5	—	103.0	1.8	88.5	96.3
1940	XIV				0.6	—	89.0	0.5	—	84.0	2.2	85.5	93.8
1939	XV										2.9	85.6	84.8
1936	XVIII	0.9	85.0	94.0				0.5	78.0	—			
1934	XX							1.0	104.0	83.0			

TABLE 1 (cont'd)

Year-Class	Age	9			10			11			12		
		Fylla Bank			Off Faeringehavn			Fylla Bank			Fiskenaes Bank		
		63°53′N, 53°22′W			63°38′N, 51°41′W			63°41′N, 52°27′W			63°26′N, 51°59′W		
		29/4. 150m., 0.8°C.			13/7			8-9/8. 45m.			16/8 43m., 1.7°C.		
		238 spec.			201 spec.			136 spec.			115 spec.		
		%	♂♂ cm	♀♀	%	♂♂ cm	♀♀	%	♂♂ cm	♀♀	%	♂♂ cm	♀♀
1950	IV	3.3	47.3	43.5	5.5	53.7	46.6	6.6	48.4	43.3	12.2	47.1	40.5
1949	V	6.6	53.8	51.7	7.0	56.0	56.3	4.4	50.3	52.3	9.6	54.6	61.3
1948	VI	12.0	56.5	57.5	8.5	57.3	59.8	4.4	64.3	59.3	7.0	56.6	58.7
1947	VII	46.7	62.2	64.2	59.5	63.6	64.5	59.5	64.5	66.1	39.1	64.0	66.7
1946	VIII	10.7	67.5	67.0	5.5	67.8	71.6	2.9	73.3	71.0	6.1	65.0	70.8
1945	IX	14.5	78.5	78.3	12.5	70.6	76.0	13.2	73.4	75.4	12.2	73.4	75.0
1944	X	2.1	83.0	80.3	1.0	74.5	—	0.7	—	79.0			
1943	XI	0.8	75.0	—				0.7	76.0	—	3.5	76.8	—
1942	XII	2.9	78.7	82.0	1.0	—	79.0	4.4	73.8	79.0	7.8	75.6	101.0
1941	XIII	0.4	—	90.0									
1940	XIV										0.9	—	80.0
1937	XVII							0.7	79.0	—			
1936	XVIII							0.7	—	83.0	0.9	—	98.0
1934	XX							1.5	—	92.5			

TABLE 1 (cont'd)

Year-Class	Age	13			14		
		Dana Bank			Frederikshåb Bank		
		62°47′N, 51°12′W			62°15′N, 50°47′W		
		17/8. 52m., 0.°5C.			17/8. 55m., 0.°4C.		
		276 spec.			162 spec.		
		%	♂♂ cm	♀♀	%	♂♂ cm	♀♀
1950	IV	1.1	45.0	53.0	1.2	45.0	—
1949	V	6.5	58.0	50.7	14.5	55.4	55.2
1948	VI	5.8	61.3	62.0	3.6	60.5	59.0
1947	VII	35.9	64.3	67.1	39.4	62.4	65.1
1946	VIII	13.4	67.1	70.3	5.5	68.8	71.8
1945	IX	26.8	71.2	74.0	20.0	71.6	79.9
1944	X	1.4	72.8	—	1.2	67.0	—
1943	XI	1.1	69.0	76.0	1.2	—	84.0
1942	XII	6.9	74.3	78.5	9.6	76.0	80.4
1941	XIII	0.7	76.0	75.0	1.8	82.7	—
1940	XIV	0.4	—	87.0	0.6	78.0	—
1936	XVIII				0.6	85.0	—
1934	XX				0.6	83.0	—

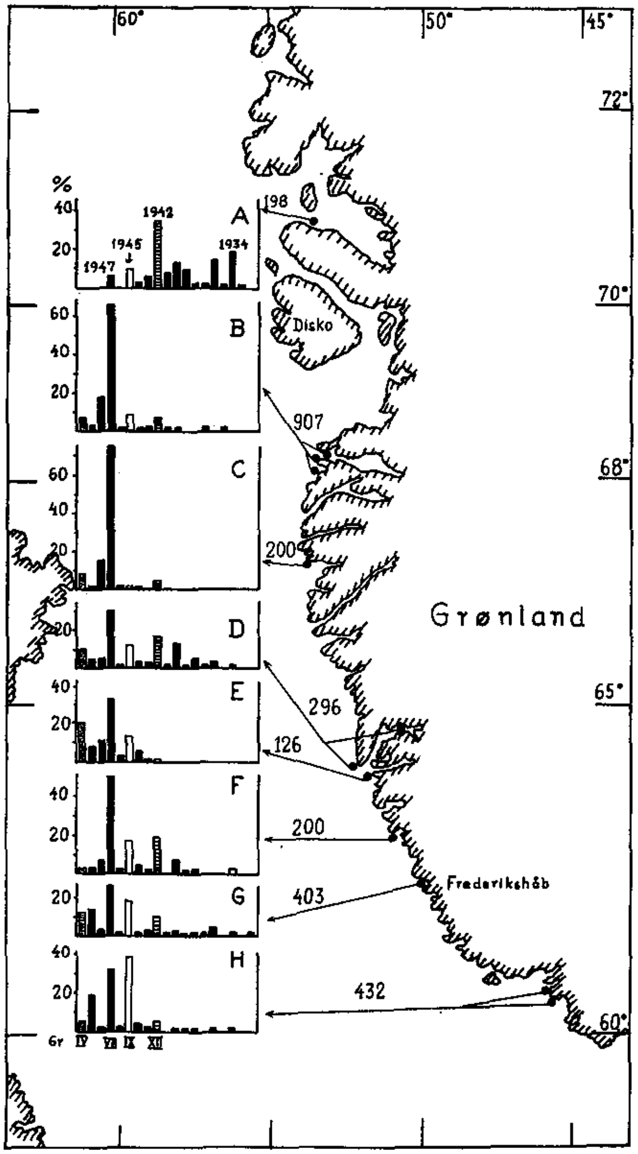

Fig. 3. **Percentage age distribution of cod caught in Greenland coastal waters and fjords in 1954. Off each station are given no. of spec. investigated.**

A new year-class, 1950, entered the catches on the banks in 1954. In 1953 a few specimens of this year-class were taken, and it was expected that it would occur in the catches in 1954, especially on the northern banks. In samples 3 and 4, from Store Hellefiske Bank, it amounted to 26 and 17.2% respectively. In all the other samples it did not exceed 10%, with the exception of No. 14 where it amounted to 12.2%.

Owing to the small size of the individuals (40 to 50 cm.) such a young year-class is only scarce in catches on the offshore banks. Therefore, judging then from its relative abundance in 1954 the 1950 year-class might possibly be a rather rich year-class which will be of importance to the commercial fishery in the coming years.

Sample 2 was obtained from the catches of Portuguese fishermen who discard small fish. This could account for the absence of the 1950 year-class from the sample.

b. Coastal waters and fjords.

A total of 2,762 otoliths have been collected in coastal waters and fjords from the catches of the "Adolf Jensen" and from the catches of the Greenlanders at the different fisheries stations. The age distributions are given in Fig. 3. The different graphs in the figure include samples from adjacent localities and sometimes samples taken at different times of the year. Table 2 gives for each year-class of the separate samples the frequency percentages and the total number of specimens.

The 1947 year-class predominated in the samples with exception of two, A and H. In A which came from a fishery station near the northern limit for cod, the 1942 year-class was predominant with 29.8% (compare the northernmost offshore sample, No. 1 in Fig. 2). The 1934 and 1936 year-classes amounted to 16.2 and 11.6% respectively. This confirms that the very old age-groups of cod are congregated in the northernmost part of the area.

Samples B and C consisted mainly of the predominating 1947 year-class and all other year-classes were without significance.

In D, including samples from coastal waters and from the Godthåb Fjord, was a more even distribution of year-classes, and the older year-classes, 1940 and 1942, were represented with more than 10% each, but the 1947 year-class was still predominant (29.1%). In samples F and G this year-class still predominated, while in H the 1945 year-class was the best represented (36.6%). As in 1953, the 1945 year-class was more strongly represented in the southern than in the northern catches, but it had decreased in 1954. The reduction of the 1945 year-class resulted in a decrease in the output of the cod

TABLE 2. Cod from coastal waters and fjords of W.-Greenland. Frequency percentages of the Year-classes 1932-1950.

Year-Class	Age	A	B	C	D	E	F	G	H
1950	IV		5.0	6.5	9.1	20.6	0.5	12.2	5.3
1949	V		2.4	1.0	3.7	6.3	1.5	13.1	17.1
1948	VI		10.7	14.0	4.7	11.1	4.5	2.7	1.6
1947	VII	2.0	67.8	74.5	29.1	33.3	49.0	29.5	31.2
1946	VIII		0.8	1.5	0.3	2.4	1.0	0.2	0.7
1945	IX	7.5	6.0	1.5	11.5	11.9	14.5	19.4	36.6
1944	X	1.5	0.6	0.5	1.7	4.8	2.5	0.5	1.4
1943	XI	4.0	1.4		1.4	1.6	1.0	1.2	0.9
1942	XII	29.8	4.0	0.5	15.9	1.6	17.5	9.7	3.5
1941	XIII	5.1	0.1		1.0			0.5	
1940	XIV	13.6	0.8		12.2		6.0	3.0	0.7
1939	XV	6.1			1.7		0.5	0.5	0.2
1938	XVI	1.0			3.7		0.5	1.0	0.2
1937	XVII	0.5			1.4			0.2	
1936	XVIII	11.6	0.4		2.4			4.7	0.2
1935	XIX	0.5							
1934	XX	16.2	0.1		0.3		1.0	1.0	0.2
1933	XXI	0.5							
1932	XXII							0.5	
Total number		198	907	200	296	126	200	403	432

fishery in Frederikshåb and Julianehåb districts (60°-62°30′). The question is—what happened to the 1945 year-class? Two obvious answers exist: 1) high mortality caused by overfishing, and 2) migrations to other areas.

As for 1, it is a fact that very extensive trawl fishery has been carried out, mainly by United Kingdom trawlers, in the open sea off the coast of Julianehåb district. From the U.K. report (see ICNAF Ann. Proc. Vol. 3, p. 47, 1953), it appears that the fishery has been supported chiefly by the 1945 year-class, which in 1952 made up about 60% of the trawl catches. There could be reason to believe that the heavy exploitation by trawlers of a single year-class in a rather limited area, would be disastrous.

As for 2, tagging experiments have shown that an extensive migration of cod from Julianehåb district took place in the 'thirties. The small percentage of recaptures in Icelandic waters of cod tagged off West Greenland in the years after the war does not support the idea of an extensive migration to Iceland.

On the other hand according to verbal information given by Mr. Jónsson, the 1945 year-class occurred in the spawning shoals off Iceland in the spring of 1954 in a quantity about 25% more than he had calculated in advance. This fact indicates an immigration of cod of this year-class from other regions, probably from South Greenland. This is not in agreement with the few recaptures off Iceland of tagged Greenland cod as mentioned above. A possible explanation is that a great emigration of cod of the 1945 year-class took place from the southernmost districts in Greenland, but that a large proportion of these emigrants did not succeed in reaching the Icelandic spawning grounds. Instead they strayed out into the open sea where they perished. One recapture in the Lofoten area at Norway of a cod tagged in Greenland supports this hypothesis. The recaptured cod had a total length of 69 cm., and an age of nine years; year-class 1945. The place of recapture was Rost, position 67° 20′N, 13° 30′W. It was recaptured in the middle of April 1954 by a German trawler. The cod was tagged September 18, 1952, off Nanortalik, 60° 10′N, 45°28′W. A yellow plastic tag was used.

Of the year-classes younger than the 1947 year-class, the 1950 year-class was most strongly represented in the catches from the coastal area, and from the banks. The cod of this year-class are small, mostly below 50 cm., and are discarded by the fishermen as undersized. Therefore it only appears on a modest scale in the samples in Fig. 3. The 1950 year-class amounted to about 20% in sample E, and occurred in rather large numbers in catches from Julianehåb district made with fine meshed seine nets and with small jigs. There is reason to believe that this year-class will be of importance in the fishery in the future.

Among the smallest cod, I-III group, the I-group (1953 year-class) was observed in rather large shoals close to the shore and it was caught by seine in large numbers at Holsteinsborg and in Julianehåb district.

3. Length measurements of cod from the banks.

The length distribution in 5 cm. groups is given in Fig. 2. The numbers on the graphs correspond with the numbers of the age analyses to the left on Fig. 2. Ignoring sample No. 1, it appears that the peaks on the graphs lie between 60-65 and 65-70 cm. corresponding with the strongly predominating 1947 year-class. In samples No. 3 and 4, the 1950 year-class is comparatively strong. The length compositions of the catches in 1954 are much more even than those of 1953. The catches contain fewer big cod, especially on the middle and southern banks, but the great bulk of the cod was of a more valuable size for salting than in 1953, when a large number of undersized cod occurred. The better sizes were due to the growth of the predominating 1947 year-class, which in 1954 had a mean size between 60-65 cm. corresponding to mean weights between about 2-2.5 kg. (round fresh weight).

The quality of the cod was good during the whole season in contrast to 1953 when the cod was very lean and with low liver content, right from the beginning of the fishing season. The good quality and the high liver content were caused by good feeding conditions in 1953 when large amounts of valuable cod food as capelin (*Mallotus*), sandeels (*Ammodytes*), small cephalopods (*Gonatus*), occurred. In the cold year 1952 feeding conditions were poor, and the quality of the cod was as mentioned very bad in 1953.

In 1954 the feeding conditions for cod were favourable, as in 1953, so that there is reason to expect that the cod in 1955 will be of good quality.

4. Tagging experiments.

3,801 cod were tagged in 1954; 2,004 on the off-shore banks and 1,797 in coastal waters and fjords. From these experiments 102 were recaptured in 1954. A total of 424 recaptures were reported in 1954 from all the tagging experiments, 400 from Greenland waters and 24 from Iceland. In Table 3 a survey of the recaptures is given according to age groups and year classes, year of tagging and region of recapture.

The recaptures off Iceland only amounted

TABLE 3. Recaptures off Greenland-Gr. and off Iceland-Ic. from 1954 of age determined cod tagged in different years' tagging experiments.

Year-Class	Age Group	Year of Tagging 1946 Gr.	1946 Ic.	1948 Gr.	1948 Ic.	1949 Gr.	1949 Ic.	1950 Gr.	1950 Ic.	1951 Gr.	1951 Ic	1952 Gr.	1952 Ic.	1953 Gr.	1953 Ic.	1954 Gr.	1954 Ic.	Total Gr.[1]		Total Ic.
1934	XX	1				1						3		1		1		7	(3.3)	
1936	XVIII							1		1		1				2		5	(2.4)	
1937	XVII	1																1	(0.5)	
1938	XVI											2		2		1		5	(2.4)	
1939	XV									1				1		1		3	(1.4)	
1940	XIV			1						1		10		5		4		21	(9.9)	
1941	XIII			1										1				2	(0.9)	
1942	XII			1				3		1		6		9		7		27	(12.7)	
1943	XI							1						1		2		4	(1.9)	
1944	X									1	1	2	1		1	2		5	(2.4)	3
1945	IX					2	1	1	1	2	1	12	8[2]	14	1	13		44	(20.8)	12[2]
1946	VIII													1		3		4	(1.9)	
1947	VII					1				1		9		42		23		76	(35.8)	
1948	VI													1		4		5	(2.4)	
1949	V													1		2		3	(1.4)	
??				1		2		1		6	3	47	5	94	1	37		188		9
		2	0	4	0	6	1	7	1	14	5	92	14[2]	173	3	102	0	400		24[2]

1 % of cod whose ages have been determined in brackets.

2 Including one recaptured off Lofoten, Norway.

to 7.5%, (recaptures from the tagging experiments in 1954 omitted), against 13.3% in 1953.

The three rich year-classes, 1947, 1945 and 1942, amounted to 69.3% of the age analysed recaptures from Greenland. Only two year-classes, 1944 and 1945, gave recaptures from Iceland. There were four times as many cod of the 1945 year-class as there were of the 1944 year-class. As stated above, the results of the tagging experiments give no evidence of an extensive migration to Iceland as in the 'thirties.

The recaptured cod from Lofoten in Norway (Tab. 3) is the second example of a cod which has migrated from Greenland to northeastern Europe. The first was a cod tagged off Nanortalik September 22nd, 1932, and recaptured March 2nd, 1938, off Cape Kanin (See Rapp. et Proc Verb. Vol. CXXIII 1949 p. 59).

The age determinations of cod recaptured in Greenland waters show that the 1947 year-class was represented with the highest number (76), next the 1945 year-class (44), the 1942 year-class (27), and the 1940 year-class (21). In the recaptures from Iceland, only two year-classes occurred, namely 1944 and 1945, with 3 and 11 specimens respectively. The strong 1947 year-class was not represented in the recaptures from Iceland whose ages could be determined.

Of the 23 recaptures from Iceland, 14 originated from tagging experiments in Julianehåb district, 3 were tagged on Store Hellefiske Bank, 1 on Lille Hellefiske Bank, 2 on Fylla Bank, 1 on Fiskenaes Bank, 1 was tagged in coastal waters in Sukkertoppen district, and 1 was tagged in Ameralik Fjord in Godthåb district.

Of special interest are two recaptures of cod on Store Hellefiske Bank. Both were tagged with hydrostatic tags (Lea tags) in 1949. One tagged in Umanak Fjord at a length of 19 cm. was recaptured 225 miles south of the tagging locality. The other was tagged off Ritenbenk (69°44'N, 51°20'W), its length when tagged was 24 cm. It was recaptured 150 miles south of the tagging locality.

Table 4 gives the number of recaptures reported by the different nations from Greenland and Iceland in 1953 and 1954. The large number of recaptures taken by Portuguese fishermen is remarkable, even considering that extensive tagging was carried out on the Store Hellefiske Bank, where the largest number of Portuguese vessels were fishing at the very time of tagging. If we leave out the recaptures in the year of tagging, the number of recaptures by Portuguese ships were in 1953, 27, and in 1954, 185.

TABLE 4.

	Recaptures from			
	Greenland		Iceland	
	1953	1954	1953	1954
Denmark	38	10		
Greenland	87	98		
Faroes	6	7		
Norway	11	12		
Iceland	26	6	22	10
United Kingdom	15	10	2	3
France	11	7		
Germany		1	3	10
Portugal	39	247		
Spain		2		
Total	233	400	27	23

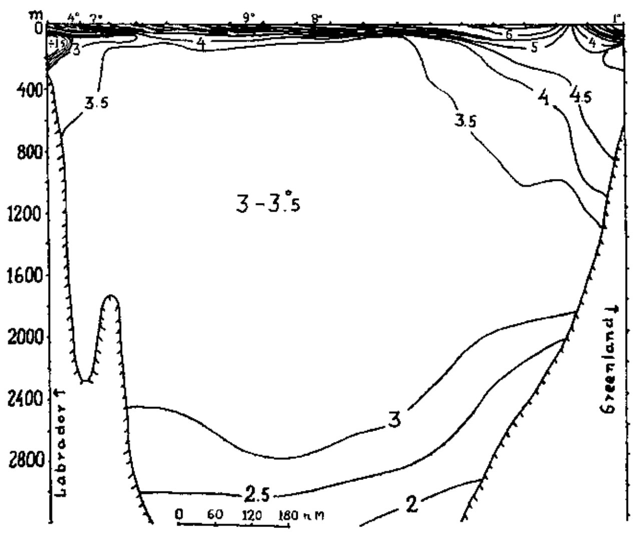

Fig. 4a. Section I. Kap Farvel to Hamilton Inlet Bank, 6-9 July, 1954. Temperature °C. The isotherms of the surface water only indicated.

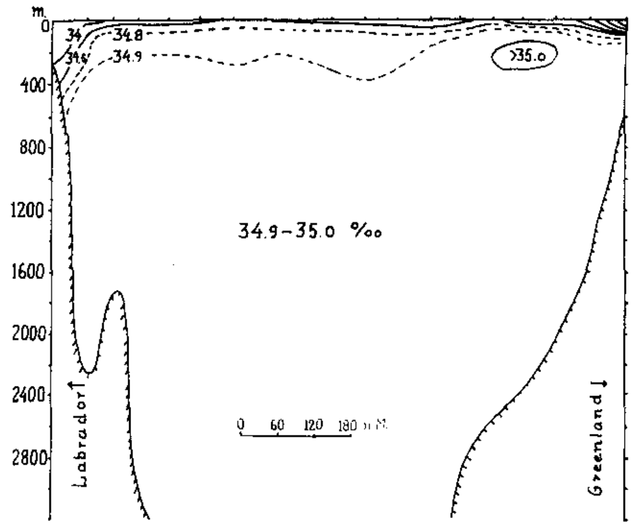

Fig. 4b. Section I. Kap Farvel to Hamilton Inlet Bank, 6-9 July, 1954. Salinity ‰.

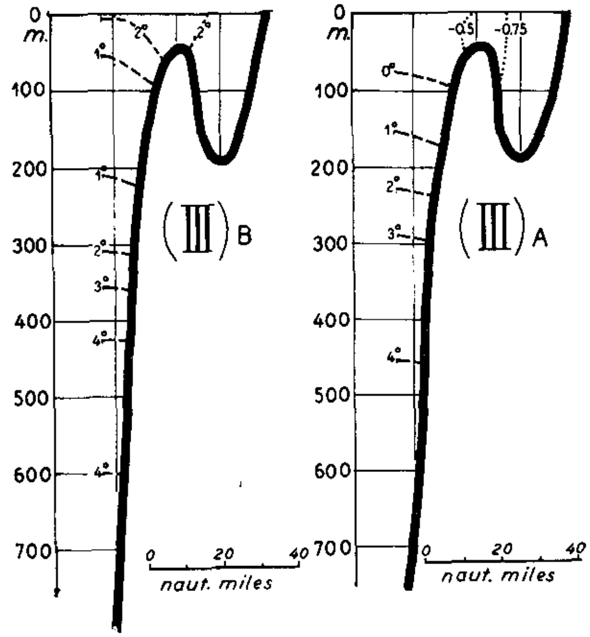

Fig. 6. Eastern part of Section III. Across Fylla Banke. A-29 April, 1954, B-20 June, 1954.

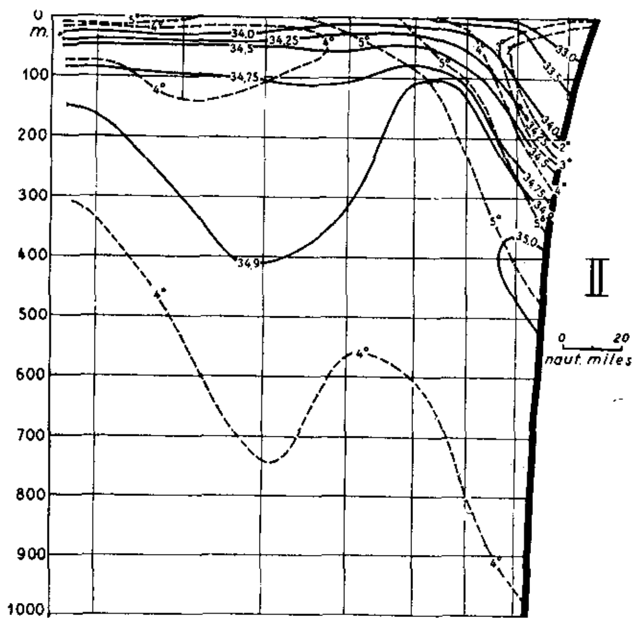

Fig. 5. Section II. Off Frederikshåb. 11-12 July, 1954.

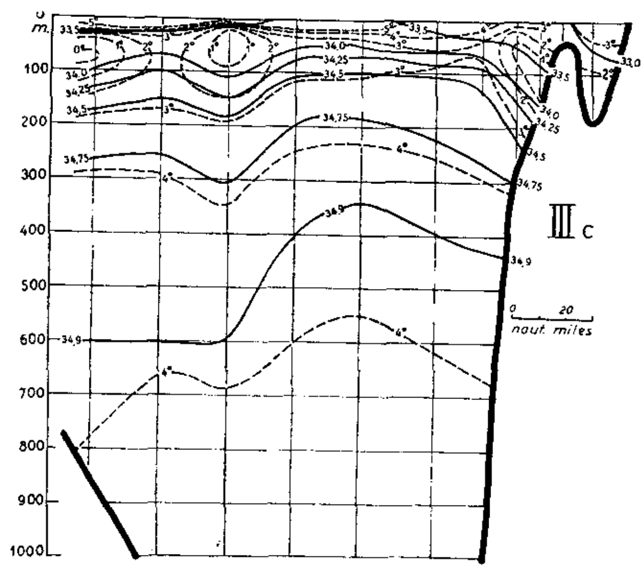

Fig. 7. Section III. Across Fyllas Banke. 21-22 July, 1954.

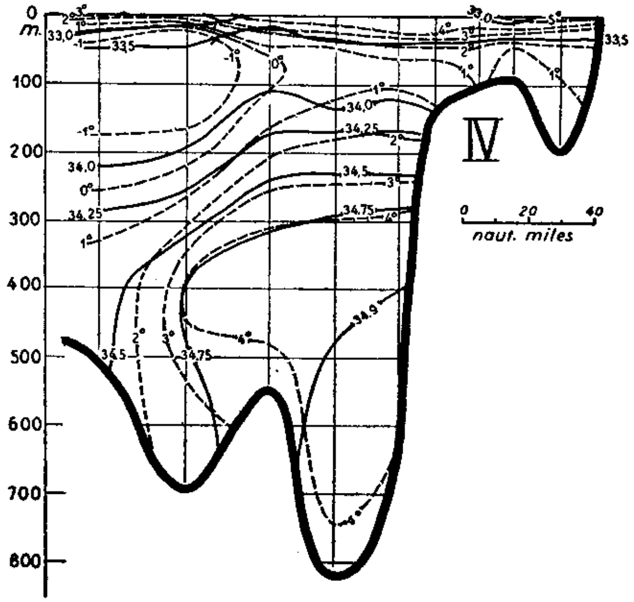

Fig. 8. Section IV. Across Lille Hellefiske Banke. 22-24 July, 1954.

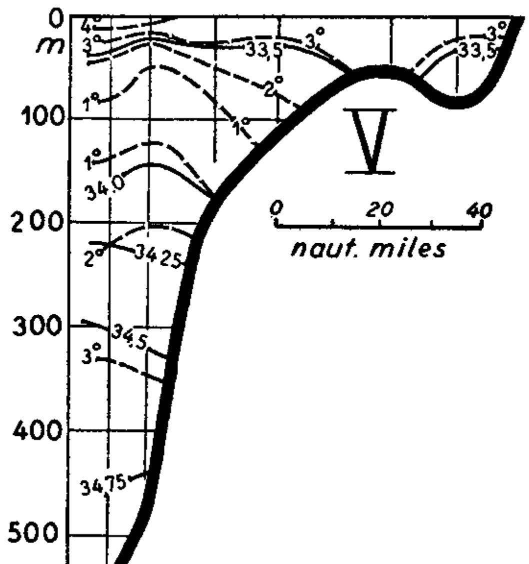

Fig. 9. Section V. Across Store Hellefiske Banke. 24-25 July, 1954.

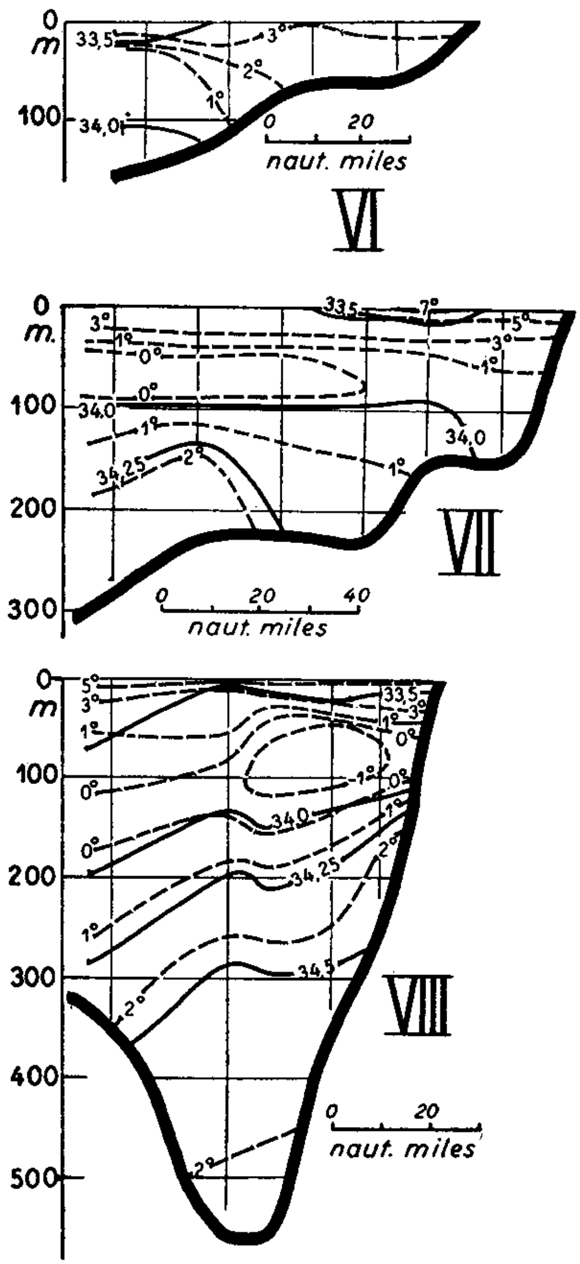

Fig. 10. Section VI. Off Egedesminde. 25 July, 1954.
Section VII. Off Disko Fjord. 31 July, 1954.
Section VIII. Off Hare Isl. 30 July, 1954.

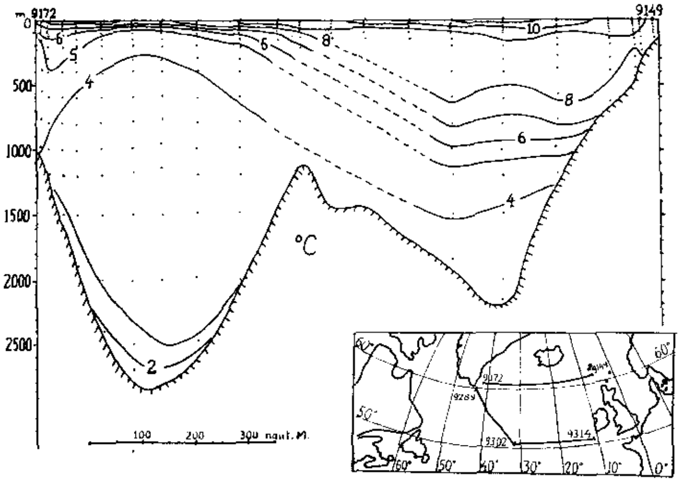

Fig. 11. Section, The Faroes-Kap Farvel. 29 June-5 July, 1954. Temperature. Inset shows the position of the two Atlantic sections (Figs. 11, 12 and 13).

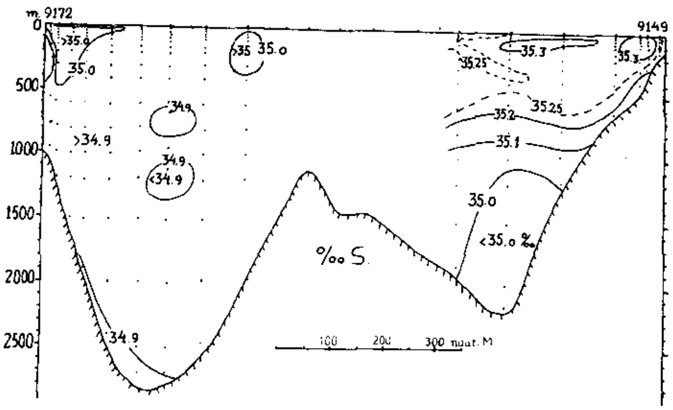

Fig. 12. Section, The Faroes-Kap Farvel. 29 June-5 July, 1954. Salinity.

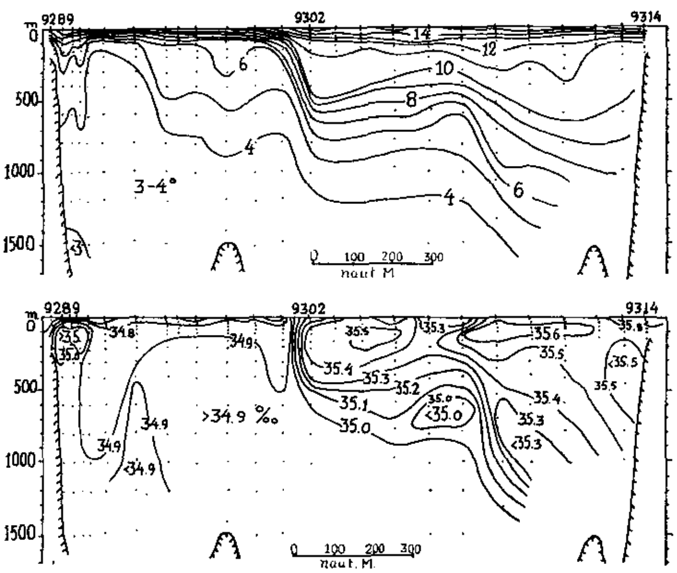

Fig. 13. Section, S. of Ireland-Kap Farvel. 22-30 Aug., 1954. Above—Temperature, below—Salinity.

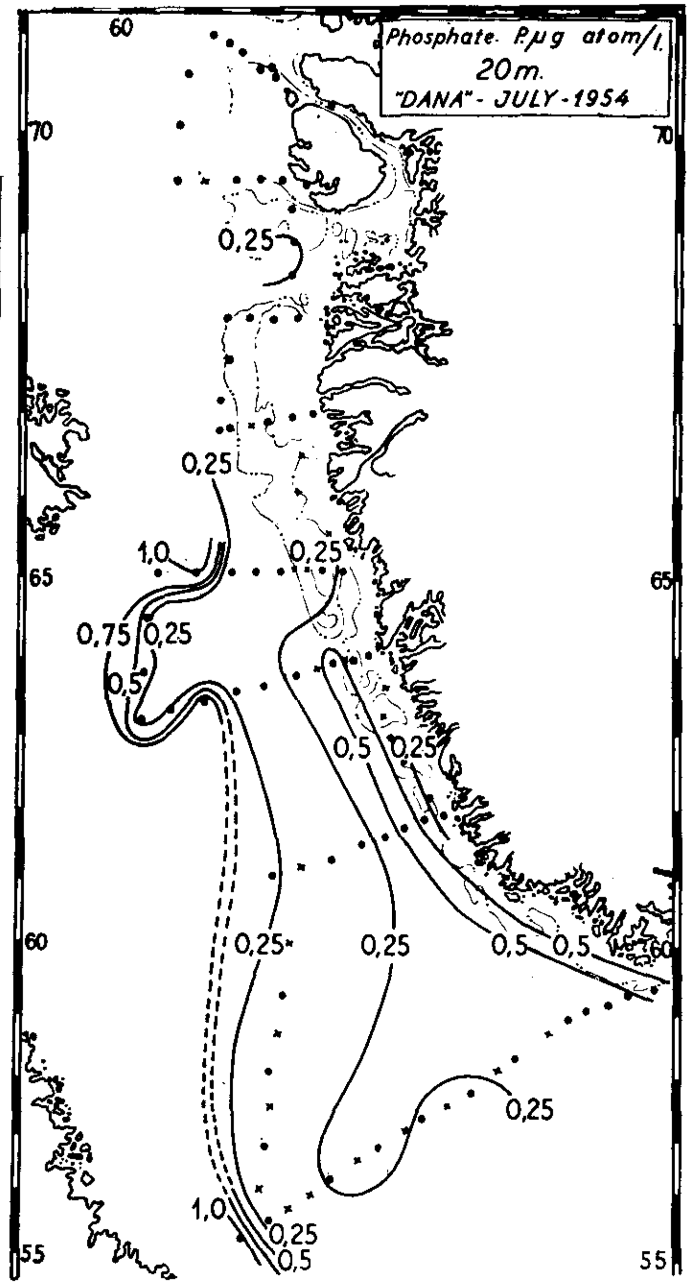

Fig. 14. Distribution of phosphate in West Greenland Waters. July 1954.

(b) Hydrographic Conditions in the Eastern Part of Labrador Sea and Davis Strait, 1954

BY FREDE HERMANN

The data from the hydrographic stations worked by the Danish R/V "Dana" during July 1954 are shown in the sections, figs. 4-13.

The temperature distribution shows that the conditions in 1954 were about normal in July. The Arctic component of the West Greenland current is found nearest the coast, but its water masses were not very cold. The core of the warm Irminger current is off the slope of the banks. North of the Fylla Bank section (III) it is mainly found as an undercurrent. Between section III and IV a part of the current turns westward joining the Baffin Land Polar current.

Phosphate determinations were carried out in the upper 100 metres. Fig. 14 shows the distribution of phosphate at 20 metres. High concentrations of phosphate were found in two areas, one maximum off the slope of the southwest Greenland banks nearly following the core of the warm current and another where the sections intersect the boundary of the Baffin Land and Labrador Polar Current.

The conditions are further illustrated by the vertical sections I to VIII, taken between Kap Farvel and Hare Island off Disko. Of special interest is the Fylla Bank section (III), worked by M/K "Adolf Jensen" in April and June and by R/V "Dana" in July. In April the influence of the cooling during the very cold winter was very pronounced. Water with negative temperature was found from surface to bottom over and inside the bank. On the west side of the bank the temperatures were higher on account of the influence of the Irminger Current and here negative temperatures were found only in the upper 75 metres. The June section indicates that a rather rapid increase in temperature had taken place since April. Water with negative temperature was not found, and over the shallow part of the bank the temperature exceeded 2°C. This rise in temperature continued to July, when the section was worked by "Dana". Specially the warm undercurrent with temperature above 4°C. increased much in thickness.

A comparison with the temperatures in July 1953 shows that the upper layers were about 1° colder in 1954 than in 1953.

III. Researches, carried out onboard the French Oceanographic Vessel "President Theodore Tissier" in the Newfoundland Area, April-May 1954

BY J. ANCELLIN,

CHIEF OF CENTRE DE RECHERCHES DE L'INSTITUT SCIENTIFIQUE ET TECHNIQUE DES PECHES MARITIMES A BOULOGNE S. MER.

The "President Tissier" sailed from Brest 15 March, 1954. Hydrographic and biological observations were made in the area off Newfoundland during a month and a half.

A. Biological Observations.

According to plans, biological observations were made in particular on cod *Gadus callarias* L. during April in the following areas:

Western edges of St. Pierre Bank
Halibut Channel (western edge of the Grand Bank)
Woolfall Bank
Banquereau
Scatari Bank
Gulf of St. Lawrence (Magdalen Islands)

The observations made were on sizes, age (2,300 otoliths were collected), seasonal stages of maturity, stomach content and on the relation between sizes and weights and conditions of the habitats.

In this report only a summary of some of the observations is included. Later the results of the reading of otoliths will be given.

All fishing operations were carried out with a trawl (mesh size 85 mm. stretched).

(a) Relation size-weight.

The curve (see Fig. 1) establishing the relation between the sizes and weights is based on cod fished on the Banquerau. The curve shows that the cod of 50 to 60 cm. weighed between 1 and 2 kg. The cod of 70 cm. and more weighed more than 3 kg.

(b) Hydro-biological observations in areas fished.

In several cases it was observed that cod were abundant in places where the food animals were abundant too. Thus at Woolfall, where numerous trawlers were fishing, the echosounder showed, between two water masses, important shoals of fishes which, judging from the stomach content of the cod fished, were shoals of capelin. The same feature was observed in the region of

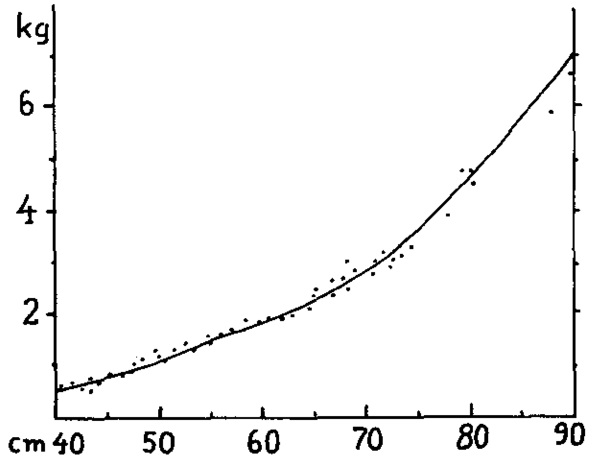

Fig. 1. Relationship between size and weight of cod caught on the Banquereau, April-May 1954.

the Magdalen islands where the cod was feeding mainly on herring. Here great shoals of herring were recorded by the echosounder, easily distinguishable from the spots closer to the bottom indicating cod. The temperature, especially at Woolfall, was not favourable, only -0.5°C at the bottom. In the region of the Magdalen islands the bottom temperature was about +2°C, that of the surface +0.7°C.

In the other regions good catches of cod were made with the following bottom temperatures:

Banquereau +1.9°
Halibut Channel and edge of St. Pierre Bank +3.5 to 5.0°

In the Halibut Channel and along the edge of St. Pierre Bank the influence of the Atlantic water was considerable and caused, together with the steep slope of the banks, pronounced differences as to habitat. The cod was found mainly at depths above 100 m. at temperatures not over +4.5°. In deeper waters with higher temperature haddock and redfish were dominating. The isobath 150 m. seems to be a rather definite limit for the distribution of redfish in this area and at this season (April-May).

B. Hydrographic Observations.

Three main hydrographic sections were taken during April and the first half of May.

Section A (Fig. 2) along 45°54′N. Lat., in mid April between St. Pierre Bank and the Whale Pit. The waters were in the stage of "winter stabilization," with rather cold water (0° to minus 1°C. covering the banks from bottom to surface. Only around St. Pierre Bank the surface water reached temperatures of +0.5 to 1°C.

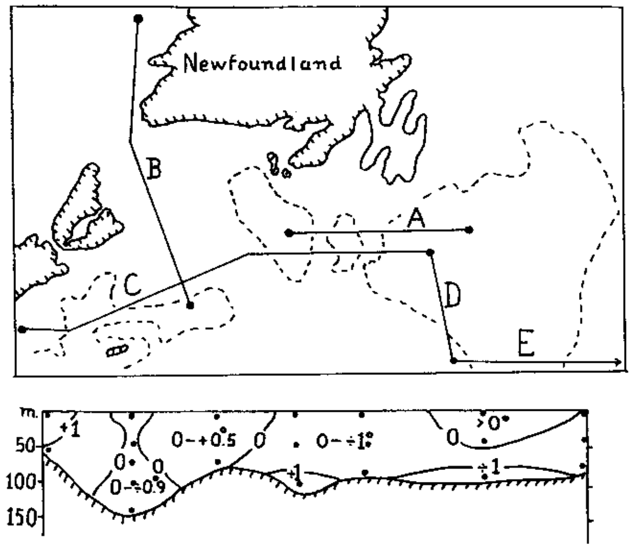

Fig. 2. Section A. St. Pierre Bank to Whale Pit. Middle of April, 1954. Temperature. The map above shows the position of the hydrographic Sections A-E taken during the cruise.

Section B (Fig. 3) from Banquereau to S. of Baie des Iles, end of April. It showed the presence of "slope water", influenced by Atlantic water in the deeper parts of the Cabot Strait. The cold arctic water was found above the slope water and beneath water that had already started to get warmer.

Section C from Halifax to the Whale Pit and along the 45°30′N. Lat., the first part of May together with the two following sections:

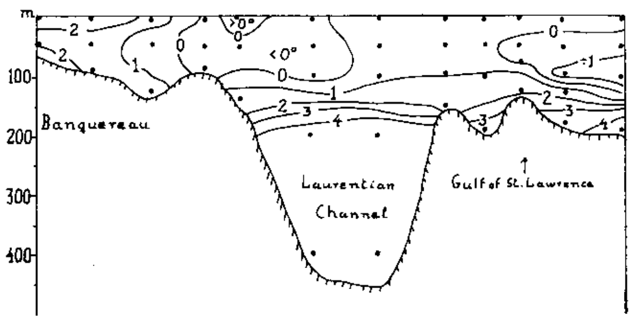

Fig. 3. Section B. Banquereau to Baie de Iles. End of April, 1954. Temperature.

Section D (Fig. 5) from the Whale Pit to the south slopes of the Grand Bank.

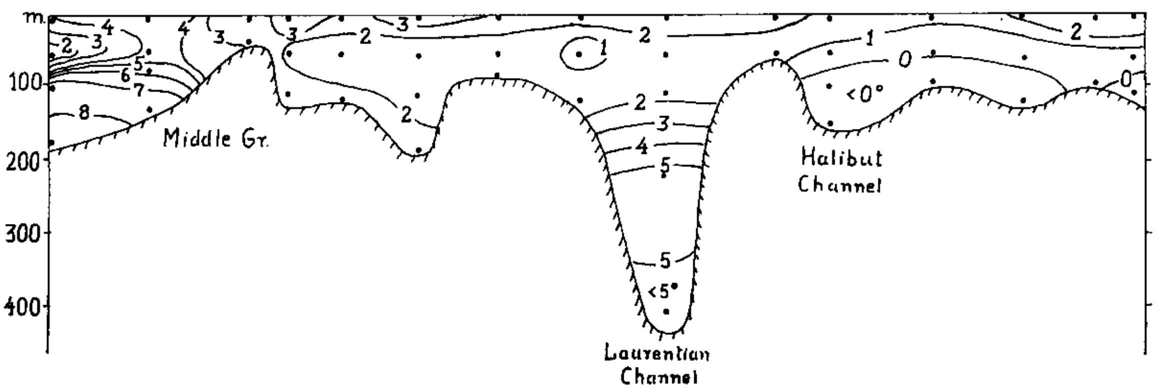

Fig. 4. Section C. Halifax to Whale Pit. Temperature.

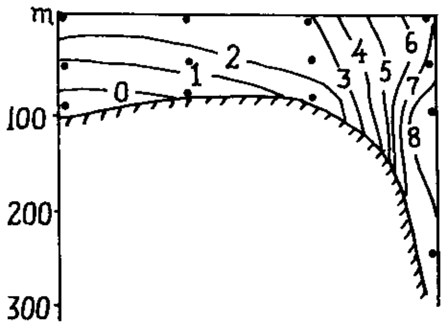

Fig. 5. **Section D. Whale Pit to S. Slope of Grand Bank. Temperature.**

Section E (Fig. 6) across the south part of the Grand Bank to 29°25′W. Long.

The eastern part of section C (St. Pierre Bank-Whale Pit) can be compared with section A taken in April. Section C showed a noticeable warming of the waters as is usual at that time of the year (beginning of May). It is important to note that the waters below 0° form a rather thin, 50-100 m., layer over the bottom. Further they do not reach the surface (St. Pierre Bank and the western part of the Grand Bank), nor the shallowest parts of the banks. These observations indicate (cf. Le Danois, Rev. Tr. O.S.T.P.M. Tome IV, fasc. 2) that the year 1954 is a warm year.

Section E shows the "cold wall" (Labrador current), off the eastern slope south of the Grand Bank and arctic waters around the slope. However, the western part of the Grand Bank is subjected to the direct action of the warming Atlantic waters.

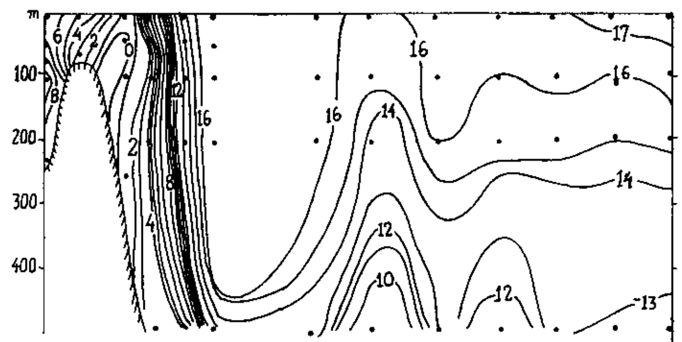

Fig. 6. **Section E. South part of Grand Bank and eastwards to 29°25′W. Long. Temperature.**

IV. Icelandic Research Report, 1954

BY JON JONSSON

The material on the age-distribution of Greenland cod, caught by Icelandic trawlers, presented here, covers three fishing areas on the Store Hellefiske Banke: the southern part, the middle of the bank and the northern part. It was collected on board the Icelandic trawler "Thorkell Mani" under the supervision of its captain, Mr. Hallgrimur Gudmundsson.

The table gives the position of the fishing grounds in question, together with the date and the age distribution (%) of the samples.

There is a rather peculiar rise in the percentage of the 1947 year-class as we advance north. This was also noted in the material from 1952 in which year the 1947 year-class amounted to 63.3% of the catches on Store Hellefiske Banke, compared to only 44.5% on the Fyllas Banke.

The scarcity of the 1945 year-class is very conspicuous. In 1953 it made up 36% of the trawler catches on Fyllas Banke, but 1954 it amounted to only 5.3% of the catches on the Store Hellefiske Banke. We do not know if it has migrated southwards or to the depths off the bank. In our material from 1953 the greatest part of the year-class 1945 had reached maturity, so the absence from the bank might be the result of a new phase in its biology.

Year Class	Age	7 Aug./54 66°49′N 54°45′W	9-11 Aug./54 67°22′N 55°24′W	16 Aug./54 67°50′N 54°20′W	Total
1950	4	2.2	3.4	1.7	2.5
1949	5	4.0	2.2	1.3	2.5
1948	6	23.5	15.9	13.8	17.8
1947	7	54.7	61.4	69.6	61.5
1946	8	5.4	7.1	5.8	6.2
1945	9	5.8	4.7	5.4	5.3
1944	10	1.4	1.2	0.4	1.1
1943	11	0.4	0.3	0.8	0.5
1942	12	2.5	3.1	1.3	2.4
1941	13	—	0.3	—	0.1
1940	14	—	—	—	—
1939	15	—	0.3	—	0.1
Total		276	321	240	837

V. Norwegian Research Report for 1954
Notes on the Composition of the Catch by Norwegian Long-Liners off West Greenland, 1954

BY BIRGER RASMUSSEN

During the 1954 fishing season, altogether 67 Norwegian long-liners participated in the fishery off West Greenland. Four of the vessels were fishing for halibut *Hippoglossus hippoglossus* (L.), the rest for cod *Gadus callarias* L. In addition, nine Norwegian trawlers carried out one or two trips each to these fishing grounds. Two of the trawlers were rather small, below 300 br. tons. The total Norwegian catch in West Greenland waters in 1954 is at a preliminary estimate 16,000 tons salted cod, with an additional 500 to 600 tons of halibut.

The Norwegian long-liners started their fishing at the end of April. During the first part of the season they were fishing on the western edges of Danas, Fiskenes and southern Lille Hellefiske Banke. The fishery was carried out in depths between 250 and 280 meters. According to the fishermen, the upper layers in the sea were very cold, and fishing in deep water was necessary. In the latter half of June and early July, the fish entered more shallow water and could be caught in satisfying numbers higher up on the slopes. But in July the fishery also here decreased.

When the fishery started in April, the cod were in good condition with a high content of liver. In July the fish had become thinner and were decidedly of inferior quality. In July the fishery with pelagic lines started in the Holsteinsborg Deep between Lille Hellefiske and Store Hellefiske Banke. In August and September the fishery was extended to other regions: Fyllas Banke, Store and Lille Hellefiske Banke northward to Disko Banke. By this time the quality of the fish was again improving.

As in earlier years the Norwegian Institute of Marine Research collected material for the investigation of the composition of the cod population in 1954, and likewise studied the temperature conditions in relation to fishing. Scientific assistant E. Bratberg and technical assistant A. Fröland arrived in Faeringehavn, West Greenland on June 23rd. On July 11th the two observers left for the fishing grounds on board the long liner M/S "Polhavet". The first cod sample was taken from a long-line setting on the northern part of Lille Hellefiske Banke. Later in the sea-

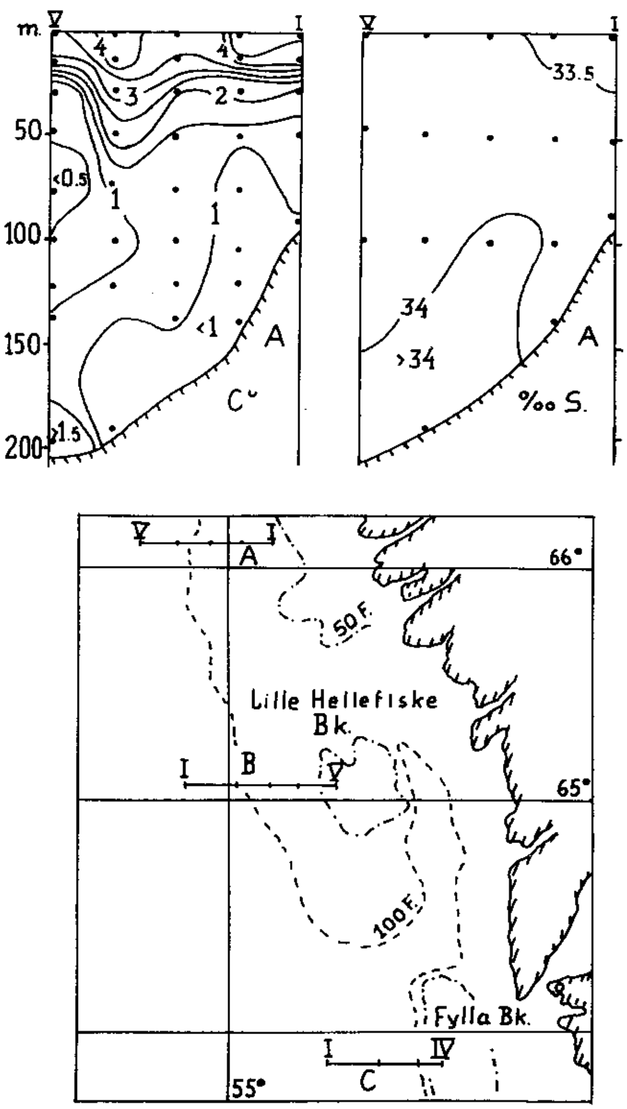

Fig. 1. **Section A. Northern part of Lille Hellefiske Banke. Temperature (left) and Salinity (right), 24/26 July, 1954. Below map showing position of the Sections A, B, and C.**

son the vessel was fishing on the south-western and northern slopes of Store Hellefiske Banke. However, during most of the observation period, the vessel was fishing with pelagic long-lines in the Holsteinsborg Deep.

Hydrographic Conditions.

On July 24-26, 1954, three hydrographic sections (see Figs. 1, 2, and 3) were taken by means of bathythermograph and ordinary Nansen water-bottles. The bathythermograph registered only to 137 meters. The hydrographic sections are: (A) from the northern part of Lille Hellefiske Banke westwards, (B) from the shallow part of Lille Hellefiske Banke westwards, and (C) from Fyllas Banke westwards.

The temperatures in the different depths were generally somewhat lower than in 1953. In the depths where the bottom lines usually are set, 150-200 meters, the bottom temperatures

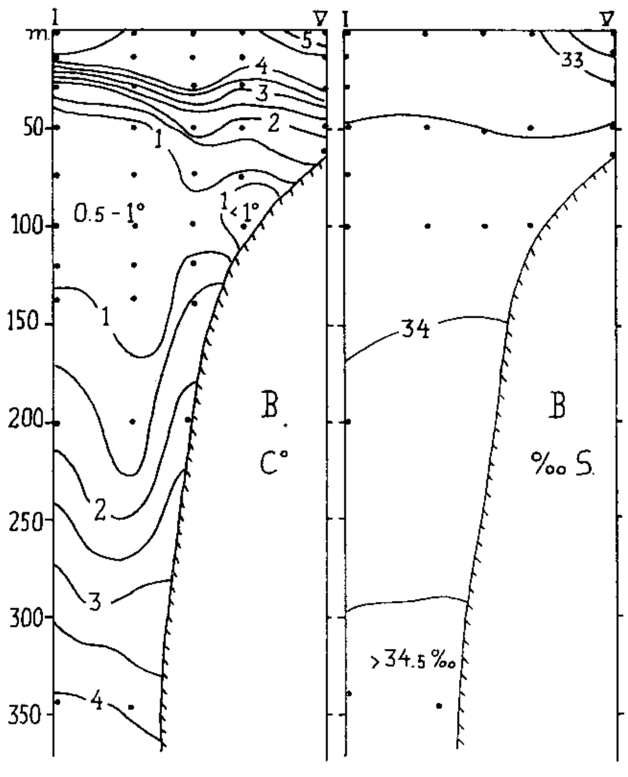

Fig. 2. **Section B. Southern part of Lille Hellefiske Banke westwards. Temperature (left) and Salinity (right), 24/26 July, 1954.**

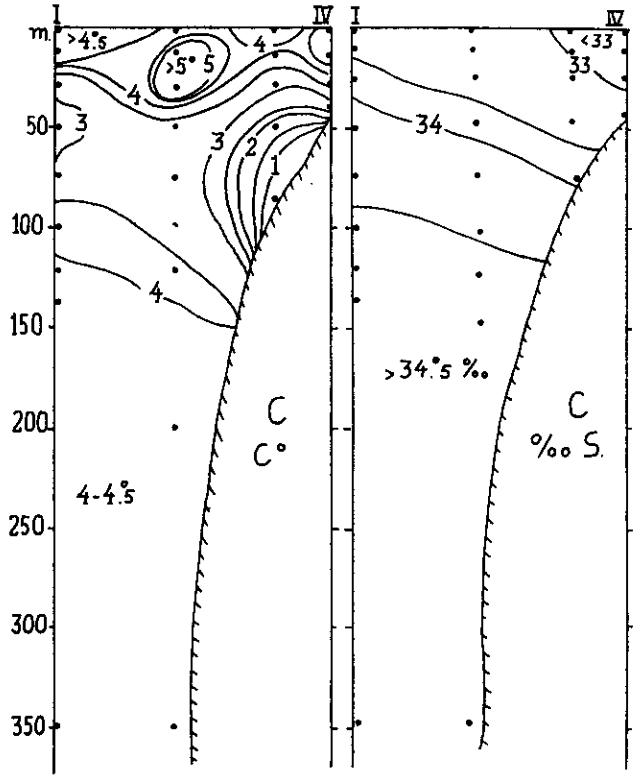

Fig. 3. **Section C. Fylla Banke westwards. Temperature (left) and Salinity (right), 24/26 July, 1954.**

showed the following trend: On the section westwards from Lille Hellefiske Banke, the bottom temperature in 150-200 meters was 1-2° C., i.e. conditions similar to those found in the summer of 1950. In 1953, the bottom water had been warmer, viz. 2-4°C. On Fyllas Banke the temperature in 1954 was 3-4° C. in these depths, while the year before it had been warmer (4-5°C.). In 1954 no water with temperature below O°C. was found along the western slope of the banks during the period of observation. Above the rather cool lower layers was found a relatively warm upper layer with temperature 3-5° from surface down to about 50 meters.

Fishing Conditions in the Holsteinsborg Deep.

In early July the fishery along the western slopes of the southern banks became relatively poor. On July 8th shoals of cod were observed 60 meters below surface in the deep channel between Store and Lille Hellefiske Banke. In this locality, the Holsteinsborg Deep, the fish seem to concentrate pelagically every year in the middle of the summer after the fishery has become unprofitable in deeper waters. In 1954 the long-liners started fishing in the Holsteinsborg Deep with pelagic long-lines on July 11th, and the fishery here was continued till the end of August.

In 1953 a study of the pelagic long-line fishery in the Holsteinsborg Deep was instituted. It was continued in 1954. From July 11th to July 24th the variations in temperature were noted together with observations on the catches made. The surface temperature varied between 3 and 4.5° C. This is about 1° colder than the year before. Below surface the temperature fell rapidly to about 1° C. in 80-90 meters depth, and still deeper the temperatures varied between 0.4 and 1.2°C. These deeper layers also showed temperatures about 1° below those found in 1953.

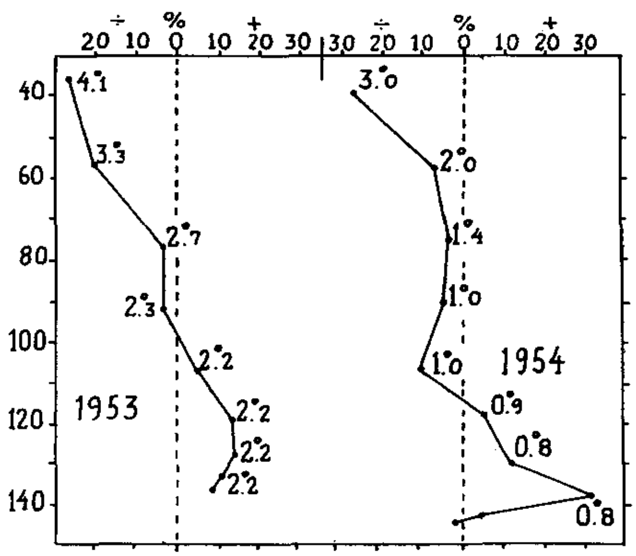

Fig. 4. **Catch of cod on pelagic long lines in different depths in Holsteinsborg Deep, 1953 and 1954, expressed as deviations from the mean. The average temperatures in the different depths during the fishing season are inserted.**

During the pelagic fishery in the Holsteinsborg Deep, a count was made of the number of cod on different sections of the line on four settings totalling 12,800 hooks. The counts showed that the cod were not particularly numerous in warm surface water. The greatest concentrations of cod were found in the cold water below the thermocline. Fig. 4 shows for 1953 and 1954 the variation in the catches in the different depths expressed as deviations from the mean catch of the whole line. The two curves have the same trend in spite of the fact that the temperature conditions in the two years were quite different. Disregarding the warm surface water, the temperature in 1954 generally was about 1.5°C. below the temperature in 1953. Furthermore the figure indicates that the greatest catches are made in the upper part of the cold water and below the warm surface water. In 1953 there was a decided increase in catch below 100 meters, in 1954 below 120 meters. After reaching a maximum below the thermocline the fish concentration decreases towards greater depths.

Apparently the level of temperature is of minor importance for the pelagic concentration of cod. It seems rather to be the stratification of the watermasses which determines where the fish will shoal. As was mentioned in the report for 1953, we find below the thermocline usually great concentrations of food organisms, e.g. capelin, sandeels, squid, jellyfish and larvae of fish. Apparently it is not the temperature which attracts the cod, but more the accumulation of food organisms due to current conditions in these particular layers.

The Composition of the Cod Population.

In 1954 samples of cod were obtained from the northern banks and from the pelagic fishery in the Holsteinsborg Deep. The cod caught on long-lines on the different banks shows the following mean lengths:

Northern part of Store Hellefiske..	74.75 cm.
SW part of Store Hellefiske	74.36 ,,
Holsteinsborg Deep..............	72.36 ,,
Lille Hellefiske Banke............	75.15 ,,
Total average....................	73.21 ,,

The size-distribution of the cod caught on long-lines on the different banks in 1954 is illustrated in Fig. 5. The curves for Store Hellefiske Banke and Lille Hellefiske Banke show two maxima, one at 65 cm. and another at 77 cm.

These maxima are mostly due to the prominence of the two year classes 1947 and 1942 as indicated in the lower part of the figure.

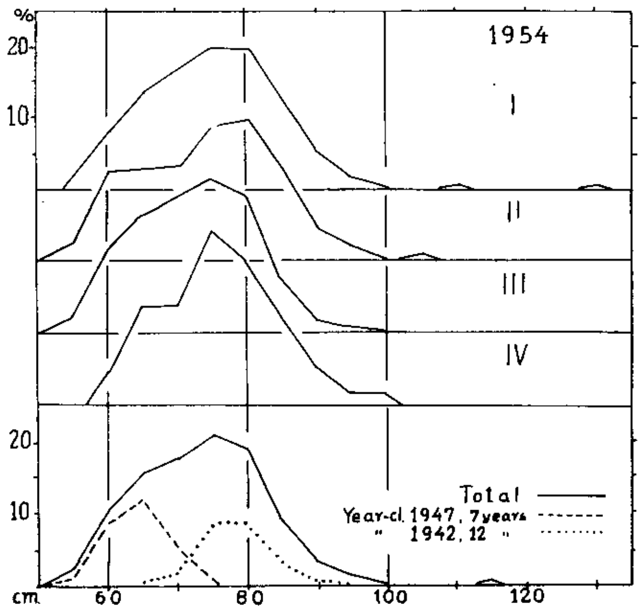

Fig. 5. **Size distribution of cod caught on long lines in different areas, 1954. I = slope of Store Hellefiske Banke (mean length-74.75 cm.), II = SW. slope of Store Hellefiske Banke (m. l. - 74.36 cm.), III = Holsteinsborg Deep (m. l. - 72.36 cm), IV = Lille Hellefiske Banke (m. l. - 75.15 cm.). At bottom all areas together (Total), and the year-classes 1947 and 1942 separately.**

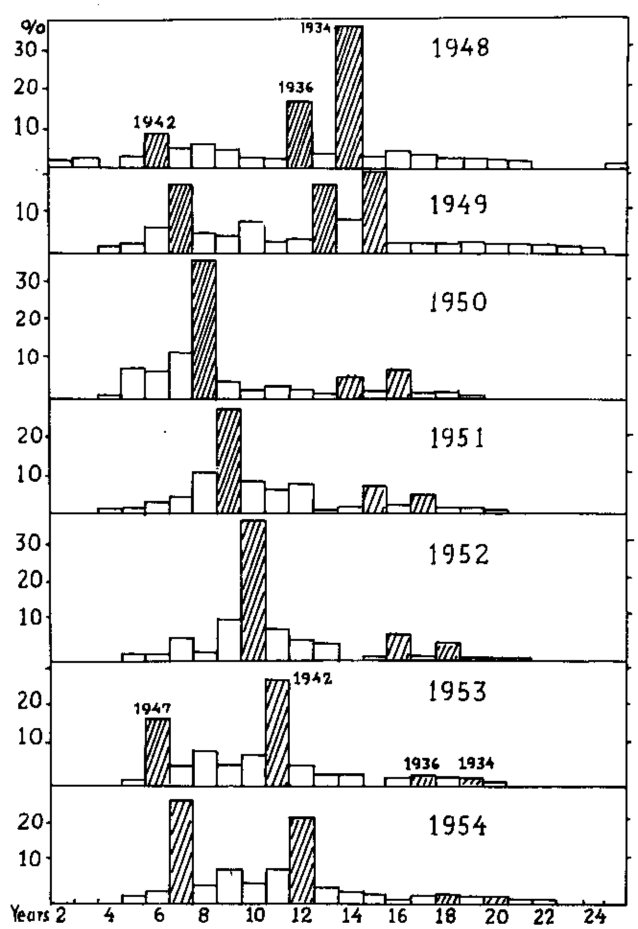

Fig. 6. **Age distribution of cod in Norwegian long line catches in the years 1948-1954.**

Fig. 6 shows the total age distribution of the cod in Norwegian long-line catches in the period 1948-1954. In recent years the 1942 year class has dominated the Norwegian catches. In 1954, however, the 1947 year class for the first time shows greater strength than the 1942 class. These 7 year old fish constitute 27.9% of the catch, while the 1942 class (12 year olds) constitute 23.1%. These two year classes together make up for 51% of the Norwegian long line catches.

The 1947 class has during the last 2-3 years been dominant in the catches of other countries, while it is not till 1954 that it has superceded the 1942 class in the Norwegian catches. The 1947 class is, according to investigations by the different countries, estimated to be one of the richest ever produced in Greenland waters. The cod belonging to the 1947 class have now reached such a size that they, in all probability, will carry the Norwegian long-line fishery in years to come, replacing the 1942 class.

The 1947 year class consisted in 1954 of still relatively small fish which could not give a satisfactory product for salted fish according to Norwegian demands. The 1947 class had, at an age of seven years, a mean length of 64.2 cm. The 1942 class had, at the same age, an approximate size of 70 cm. A similar difference in size at the age of 6 years for the same two year classes was found in 1953. (Year class 1942: 66.5 cm. 1947: 59.9 cm.). This difference in rate of growth in the two year classes seems to confirm the view that the growth conditions have not been so satisfactory after 1947 as before. The reasons for decrease in growth rate might be many and very complex. The decrease can, however, hardly be attributed to changes in temperature only. It is more likely that there is not enough food present for the cod population in West Greenland waters. The cod born in 1947 constitute perhaps the largest single year class ever born in Greenland waters, and the competition for food is therefore at present perhaps greater than ever before. The fact that the cod is in good condition when the fishery starts early in spring indicates that enough food is present in fall and winter. But in the summer when the cold melting-water from Cape Farewell overflows the bank slopes, the fish do not seem able to feed properly on the bottom fauna. Great masses of cod therefore have to seek their food pelagically. The quality of the fish from early July to the end of August is usually very poor. When the ice melting period is over and temperatures along the banks again are normal in August-September, the feeding range is extended. Seasonal changes in feeding conditions apparently have a rapid effect on the quality of the fish, and it may be assumed that the growth is also affected by these conditions.

On the different banks we find variations in the size distribution and the mean size of the fish. Similar variations can also be found as regards age composition. In Table 1 the age-composition of cod in Norwegian long-line catches from different areas is shown. The table indicates that the number of young fish belonging to the 1947 group, and likewise fish of the 1942 group, increase in number from the northern part of Store Hellefiske Banke southwards towards Holsteinsborg Deep. Further south towards Lille Hellefiske Banke the influx of these two year classes decreases somewhat. Instead, the catches show an influx of 17-18 years old fish which here is found in comparatively deep water along the western slope of the bank. This also explains why the mean size of the fish on Lille Hellefiske Banke was considerably above that of other localities.

TABLE I.

Age	Northern Slope St. Hellefiske %	Southern Slope St. Hellefiske %	Holsteinsborg Deep %	Lille Hellefiske %	Total %
5	0.1	0	0.3	—	0.2
6	2.3	1.6	3.3	3.0	2.9
7	**22.8**	**25.6**	**30.5**	**24.2**	**27.9**
8	4.6	5.2	4.8	1.5	4.7
9	8.6	8.0	10.5	**10.6**	9.8
10	6.1	6.0	4.7	**4.5**	5.5
11	12.1	5.6	9.4	4.5	9.7
12	**20.7**	**21.2**	**24.5**	**22.8**	**23.1**
13	6.1	7.2	3.6	7.6	4.6
14	4.8	4.0	2.2	3.0	3.0
15	2.4	4.8	2.1	4.5	2.5
16	0.7	0.8	0.4	—	0.5
17	1.7	2.8	0.9	6.1	1.4
18	3.2	1.6	1.4	6.1	2.0
19	1.3	2.4	1.0	1.5	1.2
20	2.3	2.8	0.5	—	1.2
21	0.1	—	—	—	—
22	0.1	0.4	—	—	0.1
Total	745 ind.	250 ind.	1827 ind.	66 ind.	2888 ind.

Of particular importance for the Norwegian fishery are the pelagic schools of cod found in the Holsteinsborg Deep. The following table gives the mean age of the fish caught in this area during the last three years, the mean size, and how much the two year classes 1942 and 1947 have contributed to the catches.

Year	Mean age	Mean length	% of year class 1942	% of year class 1947
1952	11.1	75.99	37.2	0.5
1953	10.0	73.58	28.5	19.1
1954	9.9	72.36	24.5	30.5

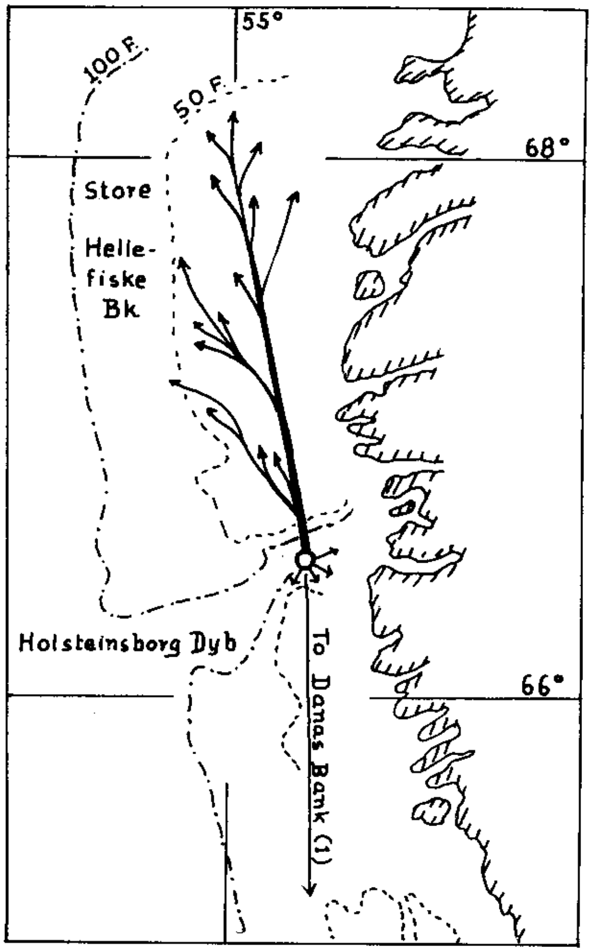

Fig. 7. Tagging experiment with cod in Holsteinsborg Deep in the summer of 1954, with recaptures within the same season.

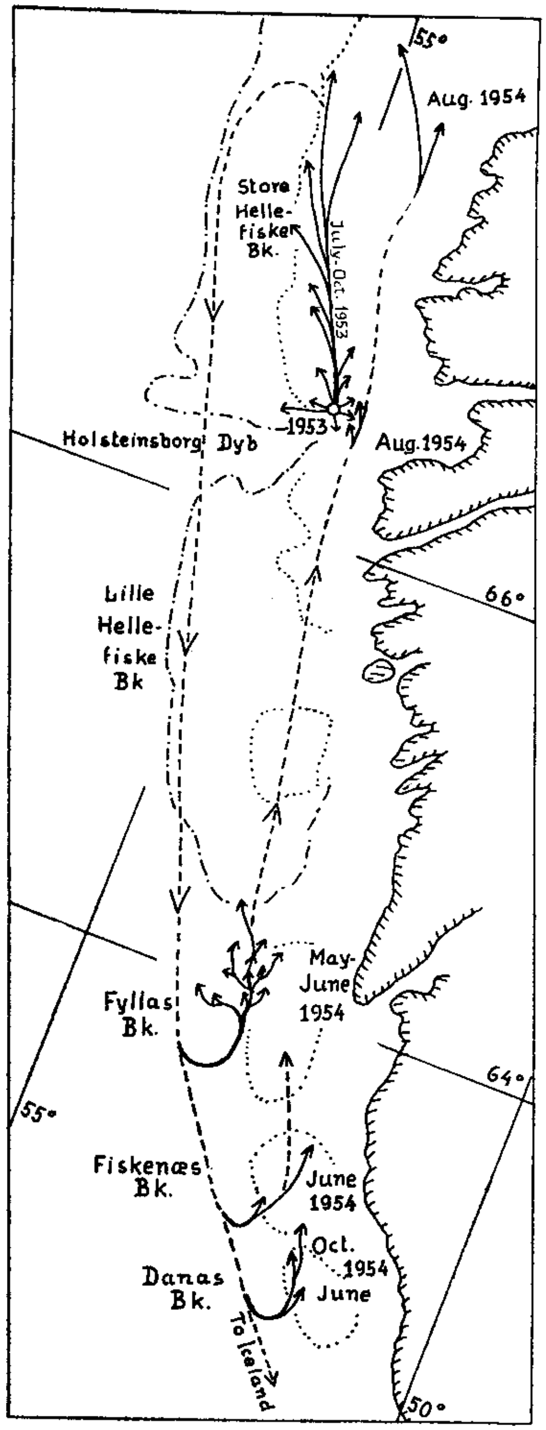

Fig. 8. Tentative drawing of the possible migrations of the Holsteinsborg cod, based upon taggings in 1953 and recaptures in 1953 and 1954.

In the Holsteinsborg Deep, the mean age of the cod decreased from 11.1 to 9.9 years and parallel with this the mean size has also gone down. The reason for this decrease is the steadily mounting influx of the 1947 year class. The 1942 class has in these years decreased from 37.2 to 24.5 percent of the catch, while the 1947 class has increased in strength from 0.5 to 30.5 per cent.

Marking Experiments.

In 1954, 33 cod were marked on Store Hellefiske Banke and 398 in the Holsteinsborg Deep. From these taggings 20 recaptures were made in the same fishing season between 7 and 58 days after tagging. Fig. 7 shows the localities of recaptures of the cod tagged in the Holsteinsborg Deep. When the cod leaves the Holsteinsborg Deep they undertake a northward migration spreading over Store Hellefiske Banke. This picture of the late summer and autumn migration is exactly the same as obtained by the tagging experiment in the Holsteinsborg Deep in the summer of 1953. However, this northward migration is only a partial picture of the wanderings of the bank cod in West Greenland waters as is indicated by the 1954 recaptures from the marking experiment in 1953.

In late July and early August 1953, 512 cod were tagged in the Holsteinsborg Deep. Recaptures in the fall of the same year show a northward migration and a spreading of the cod over Store Hellefiske Banke. In the following season, 1954, 21 recaptures from this tagging experiment were made: In May 2 recaptures, one from Iceland and one from Fyllas Banke. In June, 13 recaptures from Danas-Fiskenes-Fyllas Banke, mainly on the latter. In July one recapture from Fyllas Banke. In August, 4 recaptures from Holsteinsborg Deep and Store Hellefiske Banke. In October one recapture from Danas Banke.

The tagging experiment of 1953 may indicate the following seasonal movements of the Holsteinsborg cod: The northward migration to Store Hellefiske Banke in late summer is a feeding migration. Probably the cod leave Store Hellefiske Banke in early winter and start a southward movement. This is presumably mostly a spawning migration. According to Faeroese fishermen, spawning areas are found in the area of Danas-Fyllas Banke where spawning takes place in April. Most of our tagged fish have been recaptured in this area in May-June when the Greenland fishery starts. The recaptures at Holsteinsborg and Store Hellefiske in August indicate a possible northward feeding migration again which should complete the circle. One of the specimens has migrated to Iceland where it was taken on the spawning ground in May. Another recapture on Danas Bank in October indicates that the cod may linger in the southern areas after completion of spawning. A tentative sketch of the possible routes of migration is given in Fig. 8.

The tagging experiment 1953 has to date given 36 recaptures or 7 per cent.

VI. Portuguese Research Report for 1954

BY MARIO RUIVO

No scientific personnel has been available during 1954 for work on the Portuguese cod fishing in the Convention Area.

The only researches carried out by Portugal during 1954 have been those concerned with the study of conversion factors.

The questionnaires have this year been returned so late from the various vessels that it is only possible to give here a summary report of the results. A full report will be forwarded at a later date to the Secretariat.

The experiments have in 1954 been made in accordance with the plans and methods used in 1953. The material from 1954 consists of the data from 59 questionnaires comprising 5,900 kgs. of cod (samples of 100 kgs.; 24 samples from Newfoundland, and 35 from Greenland, no samples from the Labrador area).

The following table shows the conversion factors found (L.—Dory Line fishing, Tr.—Trawl fishing):

	Newfoundland			Greenland		
	L.	Tr.	Total	L.	Tr.	Total
Minimum	2.08	2.56		2.12	2.32	
Average	2.96	2.89	2.92	2.89	2.81	2.86
Maximum	3.33	3.33		4.00	3.12	
No. of Kgs.	900	1,500	2,400	2,200	1,300	3,500
1953			2.92 (1,900 kgs.)			2.62 (1,700 kgs.)

Average all samples (dory + trawl fishing)

1954	2.88	5,900 kgs.—Newfoundland and Greenland.
1953	2.84	5,034 kgs.—Newfoundland, Labrador and Greenland.

The questions of to what degree the size of the fish and their position in the hold of the vessel might influence the size of the conversion factor shall not be discussed here. Attention is, however, drawn to the remarkable agreement between the conversion factors found in the two years 1953 and 1954.

VII. Report on the cruise by the Spanish Trawler "Mistral" in the Waters off Newfoundland, June-July, 1954.

BY OLEGARIO RODRIGUEZ MARTIN AND ALFONSO ROJO LUCIO

Introduction

The area investigated during the cruise is on the southern part of the Grand Banks of Newfoundland (Subarea 3), between 44°25′ to 44°40′ N. Lat. and 50°00′ and 50°18′ W. Long.

The trawl used during the research work was a Vigneron-Dahl trawl, opening 40 m., with slight modifications. The meshes of the trawl were measured, a calibrator with a pressure of 12 lbs. was used. The following results for 10 consecutive meshes were obtained:

	Wings	Cod-end
Trawl, new and dry	133 mm. (5 3/16″)	127 mm. (5″)
Trawl, used and wet	117 mm. (4 9/16″)	113 mm. (4 7/16″)
Percentage of decrease	12.4%	11%

The cod—*Gadus callarias* L., and the haddock—*Melanogrammus aeglefinus* (L.), were the object of study.

Part of the gear used for the scientific researches was generously put at disposal by the Newfoundland Fisheries Research Station in St. John's.

Temperature of Water and Yield of Fishery.

In the first Spanish research cruise (March-April 1953), it was found that 2°-3°C. was the optimum temperature for the cod, and 5°-6° the optimum temperature for the haddock. During this second cruise in June-July 1954 the surface waters had temperatures of 14°C. or more. However, at the bottom the temperatures varied between 3.9° and 4.2° C. Thus the so-called "cod water" has a temperature between 2° and 4° C. in winter as well as in summer.

Conversion Factors.

In accordance with ICNAF recommendations studies of conversion factors for cod and haddock caught by Spanish fishing vessels were carried out during the summer cruise of 1954.

87 cod (45-124 cm., mostly 45-65 cm.) and 58 haddock (40-60 cm.) were weighed. The various discarded parts of these and the resulting split cod were weighed.

From these weighings the percentage loss at the various stages of the curing was determined.

The mean conversion factor calculated from all the experiments is: for cod—2.73; for haddock—2.82.

There is a considerable difference in the conversion factors found in the two Spanish campaigns.

	March-April 1953	June-July 1954
Cod	3.5	2.73
Haddock	3.10	2.82

This difference between the results in the two years is due (a) to the fact that in 1953 the fish were ripe with full gonads and testes; in 1954, however, recovering, and (b) that the fish in 1953 were placed deep in the hold of the vessels and subjected to the strong pressure for 5 months, in 1954 they were placed high in the hold under small pressure and only for one month before landing.

Yield of the Fishery.

One of the problems to which special attention was paid during the cruise was the varying yields of the fishing. To study this problem, data on catches and efforts were collected. From

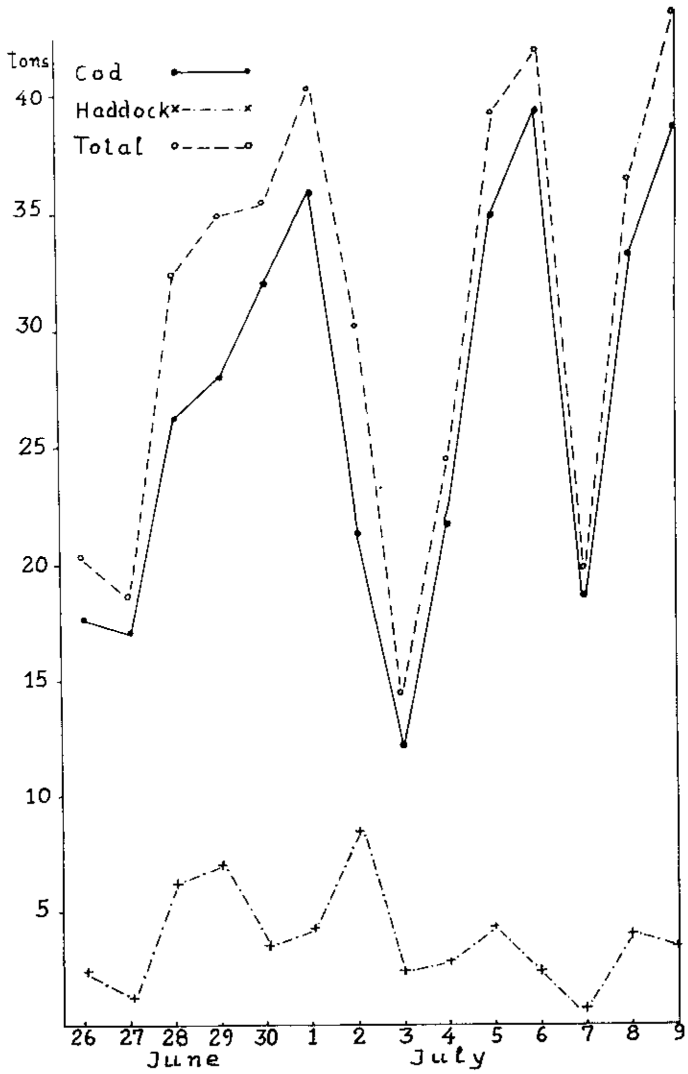

Fig. 1. **Catch in tons on each day, 26 June to 9 July 1954 of cod and haddock and total catch on the Grand Bank from "Mistral."**

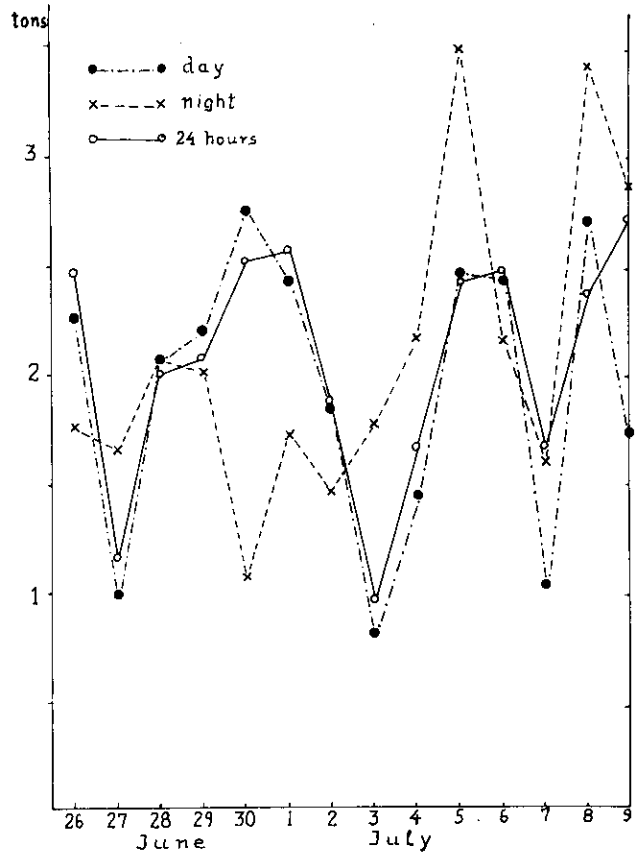

Fig. 2. **Yields (cod + haddock) per one hour's trawling on each day 26 June-9 July, in the 24 hours, by day, and by night. Grand Bank, "Mistral."**

this data, calculations of the catch per trawl hour were made:

(a) Yield per trawl hour during day fishing, 6 a.m.-8 p.m.

(b) Yield per trawl hour during night fishing, 8 p.m.-6 a.m.

(c) Yield per trawl hour during the whole 24 hours.

The unit used for the calculations of yield per effort has been the cesto, which equals 87.5 kilos of fresh round fish or 35 kgs. of salted, landed fish, using the conversion factor 2.5

The results are shown graphically in figs. 1 and 2.

The extreme values of yields per hour's trawling are given in the table below:

Range of Yield per Hour's Trawling in Kgs. (to nearest hundred)

	Minimum	Maximum	Range
Day	800 (3 July)	2,800 (30 June)	2,000
Night	1,500 (2 July)	3,500 (5 July)	2,000
24-hr. period	1,000 (3 July)	2,600 (9 July)	1,600

On the third July a steep fall was observed (Fig. 2) in the yield per hour for the 24 hours and for the daylight catches (coinciding with a smaller rise in the night yield per hour), and also a decrease in the size of the cod caught. It is possible that this decrease in average length is caused by an influx of small cod not used commercially for salting, and therefore discarded and not included in the figures of the catch.

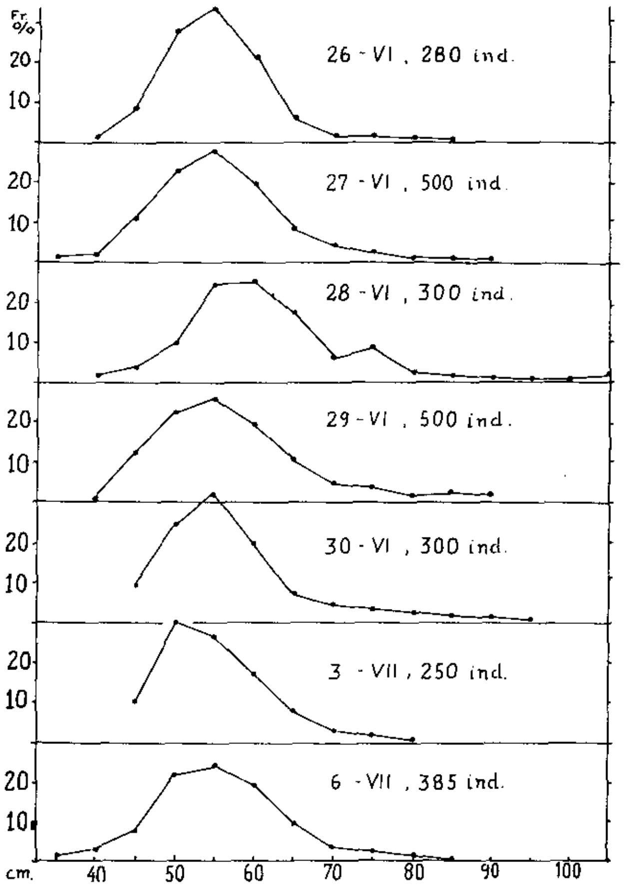

Fig. 3. **Length frequency curves for cod by 5 cm. groups on different dates, Grand Bank, "Mistral", June-July 1954.**

An agreement between the daily yield of the fishery and individual size appears from Figs. 2 and 3. Thus on the 28th June an increase in average size is found compared to the previous day, and also an increase in the yield per hour of about 1,000 kilos. The decrease in average size on the 3rd July coincided with a decrease in yield per unit of effort. On the 6th July again, the sizes increased and so did the yields.

Owing to the scarcity of haddock in the catches, the figures for this species cannot be considered as reliable as those referring to the cod. The data of the haddock and cod catches are given separately in Fig. 1. In Fig. 2, which shows the difference between night and day catches, only the totals for the two species are shown. As, however, the haddock catch is so small compared to the cod catch, the variations in the figures can mainly be attributed to the cod.

Cod.

Size. 2,500 cod taken at random were measured just after capture, from the anterior point of the snout to the central point of the hind margin of the tail fin. The results are shown in Fig. 4 (1 cm. groups) and in Fig. 5 (5 cm. groups).

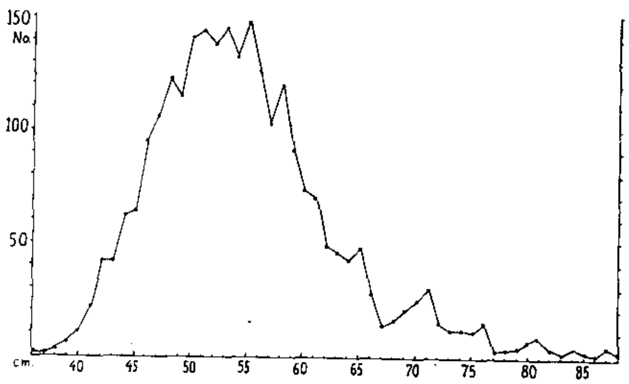

Fig. 4. **Cod. Length frequency curve (by cms.). Grand Bank, "Mistral", June-July 1954, 2,590 specimens.**

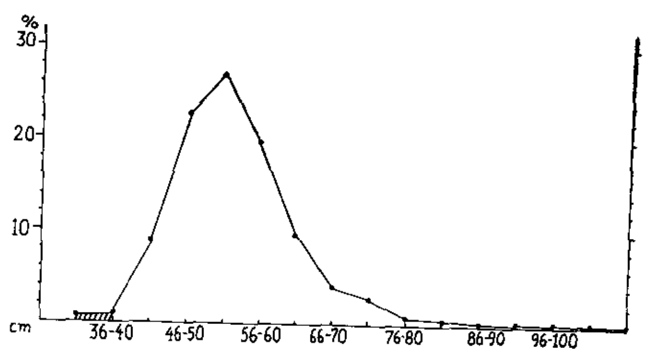

Fig. 5. **Cod. Length frequency curve (by 5 cm. groups), Grand Bank, "Mistral", June-July 1954, 2,590 specimens. The striated part (below 40 cm.) is the discarded catch.**

The maximum frequency is found within the 51-55 cm. group. A comparison with measurements from the cruise in March-April 1953 shows an increase of 10 cm. from 1953 to 1954 (Fig. 6).

The minimum commercial size of the cod is around 40 cm. During our stay on board the boat, only two percent by number of the cod

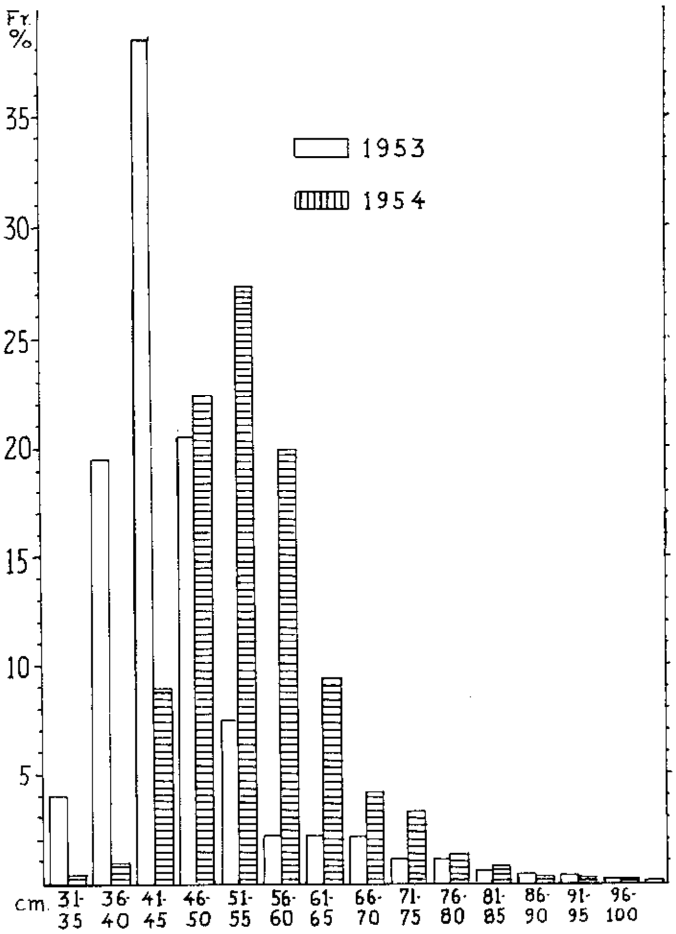

Fig. 6. **Cod. Length frequencies (by 5 cm. groups) for March-April 1953 and June-July 1954. Grand Bank, "Mistral."**

caught were below that size and therefore discarded. This is a considerably smaller percentage by weight.

Age. The age distribution (from otoliths) is shown in Fig. 7. During the fishing campaign of 1954 the 5 year old cod (year class 1949) were dominant, making up 32.7% of the total catch. In 1953 this year class was second in importance, making up 18% of the total catch. The 10 cm. increase in average size from 1953 to 1954 is obviously due to the growth of this year class in the intervening period.

Stage of Maturity. By the end of June, the major part of the cod had already spawned (see Table 1). Those having spawned (Stage VI) predominate, with 55 specimens against only 3 being in the act of spawning (Stage V). Males and females were present in equal proportions.

Food. The stomachs of the cod were found to be filled with capelin, which at this time are completely mature and in spawning schools. This is in contrast to what was found last year (March and April) when there was a great variety in the food of the cod.

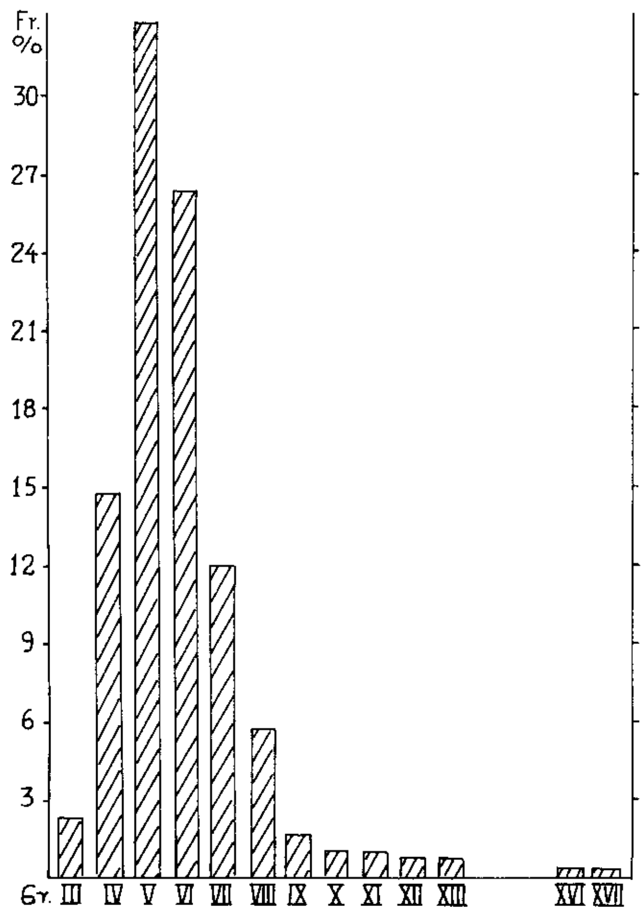

Fig. 7. **Cod. Age distribution in frequency percentages. Grand Bank, "Mistral". June-July 1954. 284 specimens.**

TABLE 1. COD. SIZE, SEX AND STAGE OF MATURITY.

5 cm.	Stage of Maturity and Sex Groups	Immature ♂	Immature ♀	I ♂	I ♀	II ♂	II ♀	III ♂	III ♀	V ♂	V ♀	VI ♂	VI ♀	Total No. of Spec.
Cms.	36-40		2	9	6									17
	41-45		1	8	2									11
	46-50	5	5	12	12	2								36
	51-55	8	7	13	19	10	1			1	1	1	5	66
	56-60	3	4	8	11	4	1	2		1		4	5	43
	61-65		3	3	3	2	1	2				3	7	24
	66-70			1		1	1					2	3	8
	71-75	1	1			2						5	6	14
	76-80											2	2	4
	81-85												2	2
	86-90												1	1
	96-100											1	1	2
	101-105											1	1	2
	106-110												3	3
		16	23	54	53	21	4	4	0	2	1	19	36	
		39		107		25		4		3		55		233

Haddock.

Size. 1,045 haddock were measured, from the extreme point of the snout to the central point of the caudal fin. The size distribution is shown in Figs. 8 and 9, by 1 cm. and 5 cm. groups. The greatest abundance of individuals is in the size group 41-45 cm., five year old fish.

The minimum commercial size is, as for the cod, 40 cm. 20% by number were discarded (the striated zone in Fig. 9), This corresponds to a considerably lower percentage by weight. It is necessary to stress that this 20% discarded was registered at the end of the fishing campaign when the holds were nearly full of fish, and when the captains would be more particular as to size than at the beginning of the campaign.

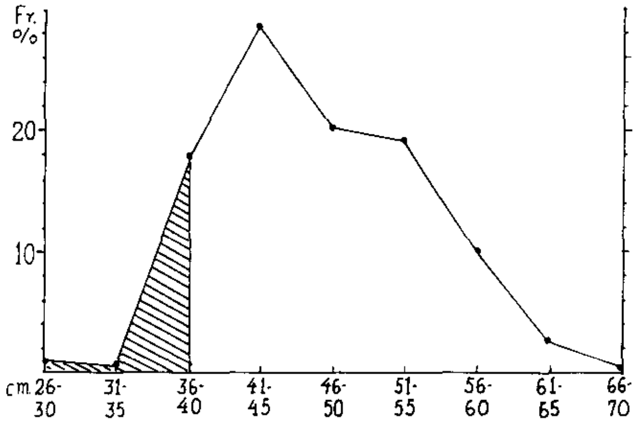

Fig. 9. Haddock. Length frequency curve (by 5 cm. groups). Grand Bank, "Mistral", June-July 1954. 1,045 specimens. The striated part (below 40 cm.) is the discarded catch.

Age. Growth curves for males and females based on scale-readings of 200 haddock are shown in Fig. 10. The mean length, and number of individuals ( ), of the various ages are as follows:

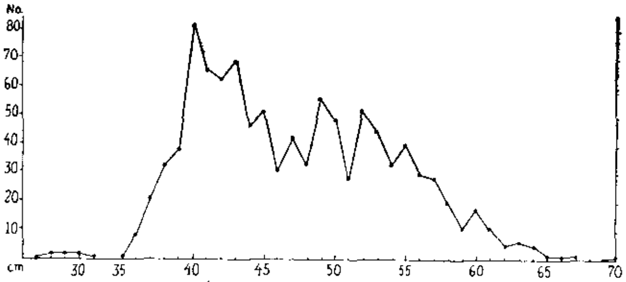

Fig. 8. Haddock. Length frequency curve (by cms.). Grand Bank, "Mistral", June-July 1954. 1,045 specimens.

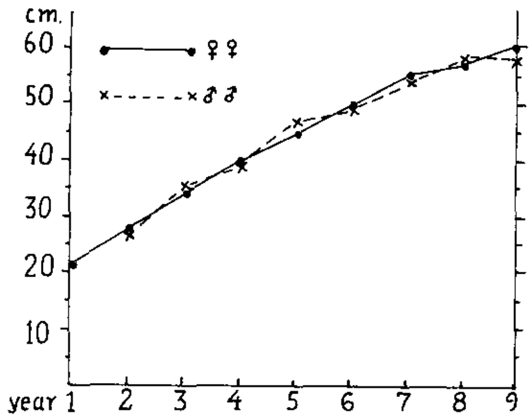

Fig. 10. Haddock. Growth curves for males and females. Grand Bank, "Mistral". June-July 1954. 200 specimens.

Years:	1	2	3	4	5	6	7	8	9	
Males		21.2(5)	37(1)	40(12)	47.5(28)	51.4(31)	56.3(12)	59.0 (5)	59.1(10)	=104 ind.
Females	22.0(1)	28.0(3)		41.0(8)	45.9(32)	51.8(18)	57.1(15)	58.3(14)	62.0(5)	= 96 ind.

Three year old haddock are about 35 cm., five year olds are around 46 cm., seven year olds around 56 cm. and those of nine years about 61 cm. The growth of males and females is nearly the same.

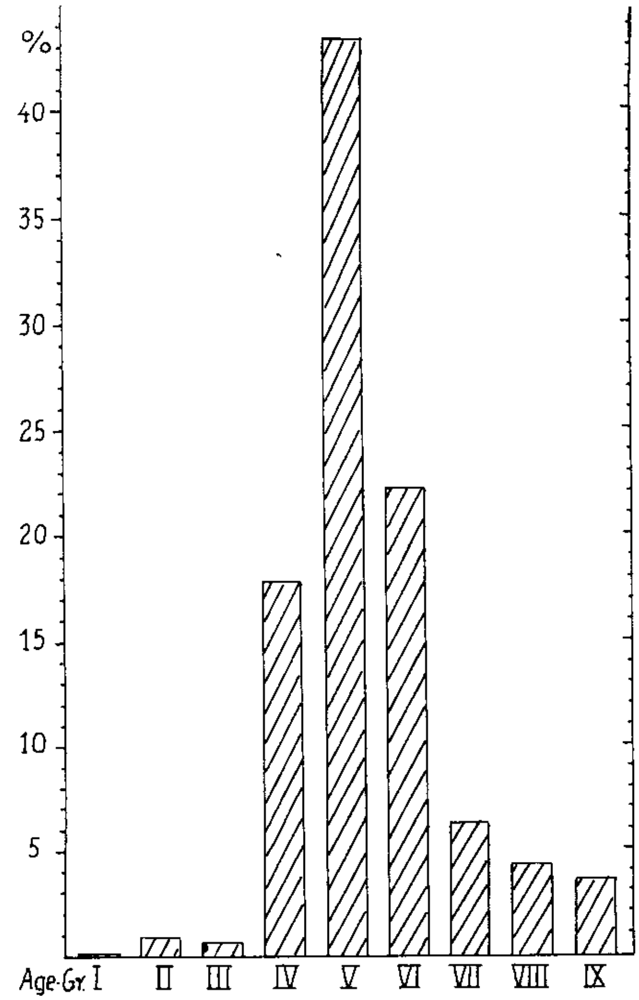

Fig. 11. Haddock. Age distribution in percentages. Grand Bank, "Mistral", June-July 1954. 200 specimens.

The age distribution is given in Fig. 11. Age group V (year class 1949) is dominant with 30%, closely followed by age group VI (year class 1948) with 25.5%. By applying age/size distribution to the length frequency data (Fig. 8), the age frequency of the sample measured (1,045 specimens) has been calculated, and is shown in Fig. 12. The age distribution shown in Fig. 12 follows nearly the same pattern as that of Fig. 11, the main difference being that the dominance of the age-group V is less pronounced.

Stage of Maturity. Table 2 shows sex and stage of maturity. Unlike the cod, which were nearly all spent, the haddock were in full spawning. There is a slight dominance of the males. This was confirmed by determining the sex of a further sample of 759 specimens which gave 400 males and 359 females.

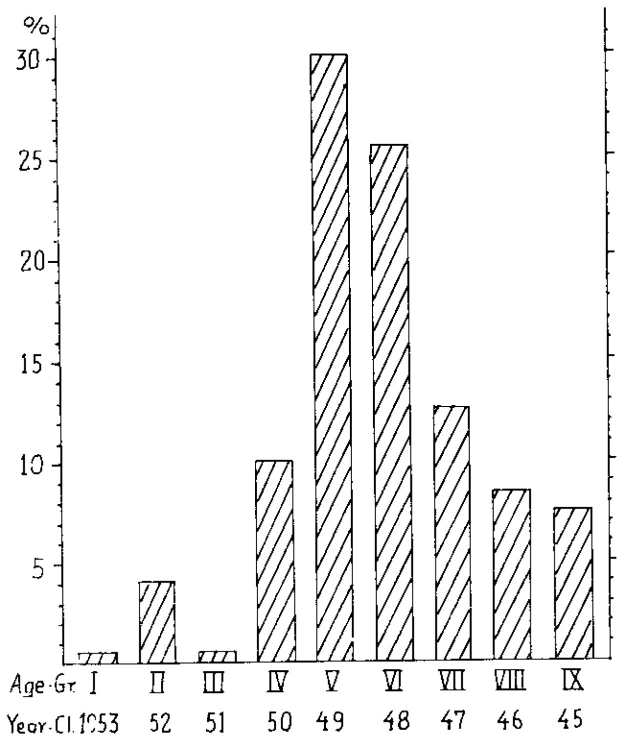

Fig. 12. Haddock. Calculated age distribution in percentages (based on 1,045 specimens measured). Grand Bank, "Mistral", June-July 1954.

Food. A study of the stomach contents of various specimens showed that the food preferred by the adults at this time of the year was the capelin. Great quantities of fish roe mixed with sand were found in the smaller specimens.

TABLE 2. HADDOCK. SIZE, SEX AND STAGE OF MATURITY.

5 cm.	Stage of Maturity and Sex Groups	Immature ♂	Immature ♀	I ♂	I ♀	II ♂	II ♀	III ♂	III ♀	V ♂	V ♀	VI ♂	VI ♀	Total No. of Spec.
Cms.	21-25		1											1
	26-30	4	3	1										8
	36-40	2		5	7	2		1		1	1			19
	41-45		1	1	15	3	1	2		4	1		2	30
	46-50				2		1	1		11	2	12	8	37
	51-55					1		3		10	8	15	15	52
	56-60							2		8	6	12	15	43
	61-65									1	2	2	8	13
	66-70												1	1
		6	5	7	24	6	2	9	0	35	20	41	49	
		11		31		8		9		55		90		204

VIII. United Kingdom Research Report for the Year 1954

By C. E. Lucas and G. C. Trout

I. Fisheries Laboratory, Lowestoft, by G. C. Trout.

The main effort of English distant water market samplings at the Humber ports of Hull and Grimsby was again directed towards the Arcto-Norwegian cod. From Subarea 1, however, some 4,700 cod were measured during the year. Unfortunately, no material for age-determination was obtained. No research vessel operated in Subarea 1.

The English Trawl Fishery at Greenland. During 1954 length measurements were obtained from samples of twenty cod landings derived from the five Subdivisions B, C, D, E and F of Subarea 1.

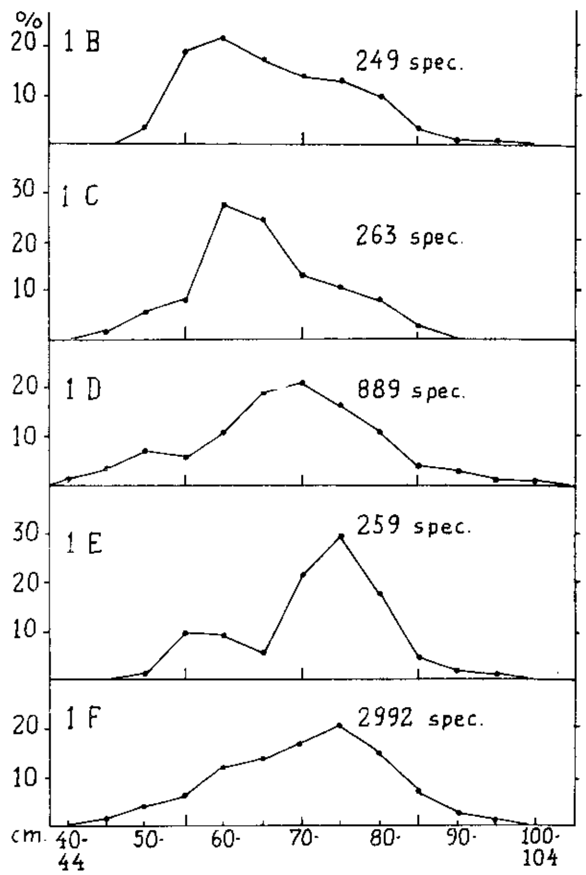

Fig. 1. Length distribution by 5 cm. groups of cod caught by trawl in the various subdivisions of Subarea 1 (B-F), 1954.

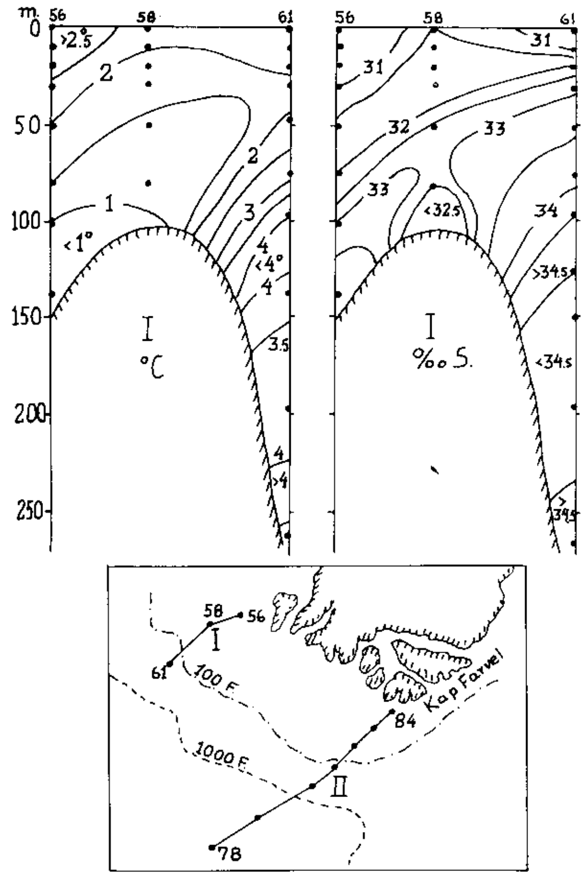

Fig. 2. Hydrographic section I, off Sermersok, 9-10 Sept. 1952. Temperature (left) and Salinity (right). The map below shows positions of the Sections I and II.

Tab. 1 (p. 60) and Fig. 1 give the percentage of each length group of the raised total catches from each subdivision. There is a progressive increase in the modal length of the samples from North to South. In the absence of any age data, and allowing for growth during the period under review, the differences in modal length are thought to reflect the continued predominance of the 1945 year-class in the Cape Farewell area—as was seen in 1952 and 1953—whilst the 1947 year-class remains more important in the more northerly subdivisions. The shape of the percentage length frequency curve for the Cape Farewell area in 1954 is substantially similar to that of 1953. The general inference is that some measure of segregation

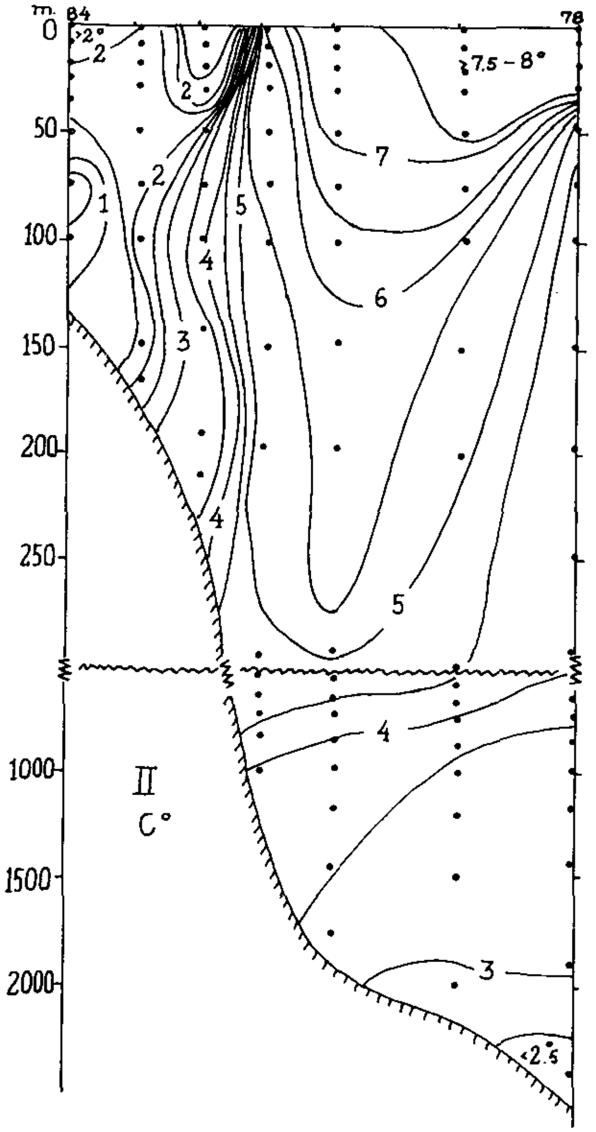

Fig. 3. **Hydrographic section II, off Kap Farvel, 14-15 Sept. 1952. Temperature. The depth scale changed from 300 m. downwards.**

between the southern cod population and the western bank populations continues.

During the year two cod, tagged at Cape Farewell in September, 1952, were returned from Iceland—making a total of five to date. Previously, three had been returned within the first year, after 222, 238 and 307 days respectively. Those returned during 1954 were at liberty for 649 and 805 days.

Figures 2, 3 and 4 give the hydrographic data for two sections made by the Ernest Holt in 1952.

II. Marine Laboratory, Aberdeen, by C. E. Lucas.

There were no Scottish landings from I.C. N.A.F. subareas during 1954 so that neither sampling nor measurement was necessary.

That part of the laboratory's work concerning the halibut stocks between Iceland and East Greenland may be relevant. A special cruise to investigate these waters was made between 12th May and 20th June, 1954, extending from Iceland to the ice barrier. The report on this cruise will be appearing in the "Annales Biologiques" of the International Council for the Exploration of the Sea, Vol. XI (Distant Northern Seas Section), by A. D. McIntyre and J. H. Steele.

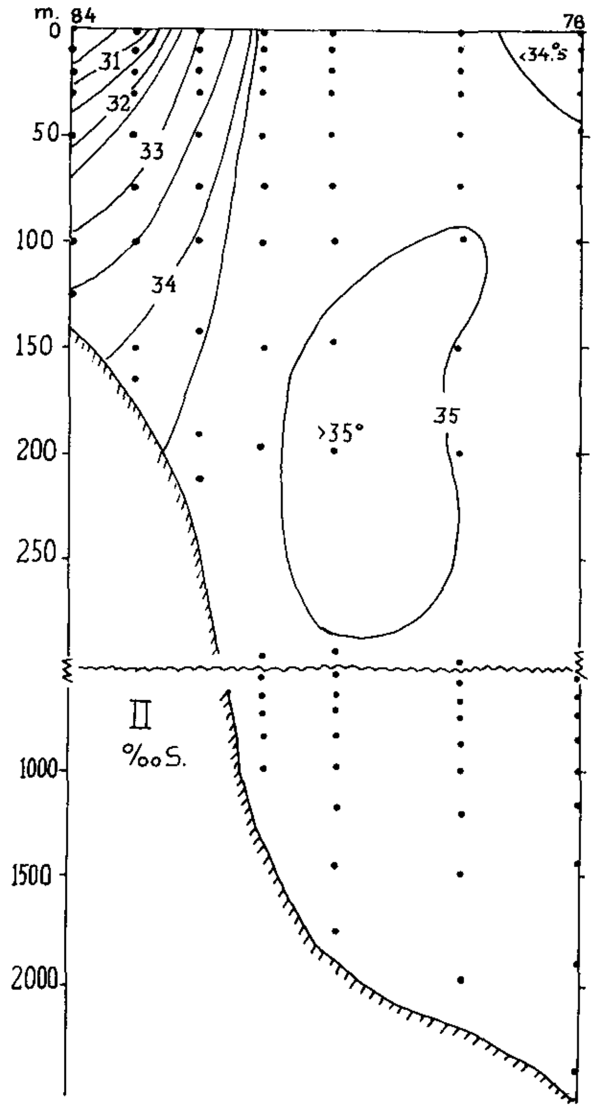

Fig. 4. **Hydrographic section II, off Kap Farvel, 14-15 Sept. 1952. Salinity. The depth scale changed from 300 m. downwards.**

TABLE 1. % LENGTH - DISTRIBUTION OF WEST GREENLAND COD 1954.

Area 5 cm. Groups	1B Raised Total	%	1C Raised Total	%	1D Raised Total	%	1E Raised Total	%	1F Raised Total	%
40/44					1,011	0.4				
45/49			519	0.8	8,341	3.4			3,383	0.6
50/54	3,654	3.5	3,319	5.3	16,673	6.8	128	0.3	23,234	3.9
55/59	19,510	18.5	4,907	7.8	13,593	5.5	4,078	9.7	38,207	6.3
60/64	22,312	21.1	17,587	27.8	25,149	10.2	3,806	9.0	70,999	11.8
65/69	18,054	17.1	15,205	24.1	46,578	18.9	2,241	5.3	83,571	13.9
70/74	14,786	14.0	8,205	13.0	50,561	20.5	9,155	21.7	101,438	16.9
75/79	13,604	12.9	6,500	10.3	39,806	16.1	12,282	29.1	123,404	20.5
80/84	8,348	7.9	5,122	8.1	27,696	11.2	7,535	17.9	91,587	15.2
85/89	3,560	3.4	1,803	2.8	9,969	4.0	1,877	4.5	41,363	6.9
90/94	904	0.8			6,421	2.6	789	1.9	15,341	2.6
95/99	904	0.8			806	0.3	258	0.6	7,171	1.2
100/104					132	0.1			1,194	0.2
105/109									224	0.0
120/124									193	0.0
TOTAL	105,636		63,167		246,736		42,149		601,309	
No. of fish measured	249		263		889		259		2,992	
No. of boats sampled	1		1		4		1		13	
Catch of boats sampled. Cwts.	3,951¼		2,468¾		11,822½		2,025		32,933¾	

IX. United States Research, 1954.

BY HERBERT W. GRAHAM

WITH APPENDIX: EFFECT OF MESH REGULATIONS IN SUBAREA 5 BY JOHN R. CLARK

Haddock *Melanogrammus aeglefinus* (L.)

Georges Bank Population in 1954. Scrod haddock dominated the fishery during 1954 for the fifth successive year. Earlier indications that the 1952 year class would be a strong one proved true, these fish entering the catches as two-year olds during the spring and summer in unusual numbers. The abundance of scrod depressed the price to a point where the Boston fleet tied up from August 11 to September 15. Because of the large mesh net now in use, practically all of the fish caught were landed and marketed, in sharp contrast to the heavy discard at sea which prevailed under similar conditions in the years prior to mesh regulation.

Total haddock landings from Georges Bank during 1954 were 88 million pounds, which is 17 million pounds more than was landed in 1953. This increase is due to several causes, among which are an increased amount of fishing on Georges Bank and the abundance of scrod from the 1952 year class. Analysis of the 1954 landings is being conducted to determine what part of the increase may be attributed to the application of the mesh regulation during 1953.

Effects of Mesh Regulation. The first opportunity for a critical test of the mesh regulation adopted in June, 1953, will be its effect on the yield of the 1952 year class. The immediate effects are already apparent in the savings of young, unmarketable haddock which would ordinarily have been discarded in large quantities but which appear in the catches of the large mesh nets in negligible amounts. The predominance of scrod in the landings during the summer months, however, gave the licensed study group of small mesh vessels an advantage in landings over the regulated vessels for the first time since the mesh regulation was effected. The small mesh vessels landed about 20 percent more haddock per trip during the summer months than the vessels using the large mesh. By November and December, however, these fish had increased in size to a point where they were being caught in quantities by the large mesh nets, resulting in a definite advantage to the vessels using the regulation mesh. (See Appendix).

Effects of Exemptions. The possibility that an economic problem resulting from the mesh regulation has arisen along the Maine coast is receiving close study. A small fleet of redfish trawlers between 50 and 100 gross tons has been accustomed to augment catches of redfish by catches of haddock on the same trip. In many cases the haddock catches exceed the limits of exemption allowed by the mesh regulation. Although the amounts of haddock involved are small (the total catch of haddock by these vessels amounts to less than two million pounds out of a total catch of all species of about 24 million pounds), the problem is being carefully investigated to determine the normal fishing practices of these vessels, the extent of loss to the fishermen, if any, and if the situation can be alleviated within the scope of the present regulation or by suitable modifications which will not jeopardize its purposes.

Certification of Nets. The practice of certifying new cod ends constructed of 45 yard doubled twine measuring 5-5/8 inches between knot centres continued during 1954. This size has been found to stabilize at 4-1/2 inches inside dimensions at the half life of the average cod end.

Food Habits. Crustaceans were found to be the major food of Georges Bank haddock. Mollusks, echinoderms, and annelids were of secondary importance as food items; fish were of minor importance.

Browns Bank haddock were found to subsist primarily upon echinoderms and crustaceans. Mollusks, annelids, and fish constituted a relatively small portion of the diet. Compared with haddock from the Northeast Peak of Georges Bank, the Browns Bank specimens contained noticeably smaller amounts of amphipods and pelecypods, and a much greater quantity of brittle-stars.

The average volume of stomach contents of haddock from Browns Bank was 39 percent less than Georges Bank specimens (all samples), and 28 percent less than comparable specimens from the Northeast Peak of Georges Bank.

Drift of Eggs and Larvae. The results of the early life history studies of haddock undertaken in the spring and fall of 1953 in an effort to predict year class strength and to determine the causes of fluctuations in year class strength are now being compiled. These results show that the non-tidal drift pattern was such that the majority of larvae hatched from eggs spawned on Georges Bank were swept off the southern edge of the bank and lost. The larvae hatched from eggs spawned on Browns Bank were carried into the Gulf of Maine where conditions were favourable for survival. The distribution of zero-group haddock determined from sampling in the fall of 1953 confirms the above conclusions. All evidence indicates that the 1953 year class of haddock on both Georges and Browns Banks was dependent upon the success of spawning and survival of haddock from the latter area.

Haddock Tagging. Tagging of line-trawl caught haddock continued during 1953 on inshore grounds. During these experiments, various types of tags were tested. The highest percentage of returns was from a Lea capsule anchored internally to a plastic belly tag by a nickel-silver chain.

Conversion Factors. Groundfish were measured and weighed by observers at sea and then marked with numbered discs. These fish were gutted and iced down in the hold with the rest of the catch. Whenever possible, fish were distributed from top to bottom of the pens. Upon arrival at port, these marked fish were recovered by the observers and again measured and weighed. Results have been obtained for 1,260 haddock, 151 cod, and 127 pollock for four seasons of the year. Some information has been obtained for cusk and hake. This work is continuing.

Silver Hake *Merluccius bilinearis* (Mitchill)

Silver Hake Mesh Selection. Cod end covers of shrimp netting were used to test the escape of the silver hake through cod end meshes. Nine cod ends differing in mesh size and material were tested. Manila, cotton, and nylon cod ends of 2-1/2 inch and 3-1/2 inch mesh size were compared in alternate tows. Significant differences in the selectivity of these materials were found.

By using covers on various forward parts of the trawl, it was found that good quantities of silver hake escape at these points but with very little selection by size, the 50 percent selectivity extending over a size range of about 20 centimetres.

Yellowtail *Limanda ferruginea* (Storer)

General. A program for investigation of the yellowtail fishery was started in late 1954. This program will include investigation of the related industrial (trash) fishery, since the latter fishery is now followed on many fishing grounds which formerly were highly productive in yellowtail. Concurrently with the decline of yellowtail landings from the southern New England fishing grounds and the rise of the industrial fishery there, the abundance of this flounder on Georges Bank has increased.

Redfish *Sebastes marinus* (L.)

Age and Growth. Field work was continued to obtain additional samples of small redfish in order to collect more evidence for the growth rate of redfish. The data from 1951-1954 were assembled and a manuscript was prepared on age and growth of redfish in the Gulf of Maine. Growth rate studies were begun for the Nova Scotia banks, the Gulf of St. Lawrence and the Grand Bank. Work was also started on estimating the mortality rate in the Gulf of Maine.

Abundance. The abundance of redfish in all areas was measured through market samples of the commercial catch. In the Gulf of Maine and along the Nova Scotian banks the catch per day remained about the same as in 1953. On the Grand Bank, the catch per day declined 10 percent from the 1953 value, whereas the catch per day in the Gulf of St. Lawrence increased 6 percent.

A manuscript is in preparation reviewing the variations in abundance of redfish since 1942, as measured from market samples.

Breeding Habits. Data on sex composition, size at maturity, time of spawning, fecundity and length of the gestation period collected from the commercial catch. Some field work was devoted to investigation of the vertical distribution of fry in the upper waters using plankton nets for sampling.

Racial Studies. Meristic counts on a small series of samples from ten different fishing areas were completed. The measurement of body proportions was begun on redfish from six regions as a study preliminary to more intensive work on racial characters.

Subarea 4, Haddock

Analysis of abundance data collected since 1930 from the fishing activities of U. S. vessels in Subarea 4 has been completed for those areas and years in which sufficient data were available. Fifteen years records on trends in abundance in the Browns Bank area show high abundance for the first and second quarters of each year, the only periods in which this area is fished to an appreciable extent by the United States fleet. The abundance since the war years has remained relatively constant. There is no evidence of depletion of the stock.

Growth rates determined from scale readings for the Browns Bank area are in good agreement with rates derived by other investigations for the same and adjacent areas in Subarea 4. The growth rate and length-frequency data indicate that the fish on Browns Bank do not become fully available until the age of six. The total mortality rate is estimated to be about 35 percent. Comparisons of the Browns Bank fish with the fish of the Lockeport area fished by the Canadian inshore fleet indicates that the two fisheries are exploiting substantially the same stock.

APPENDIX

Effect of Mesh Regulation in Subarea 5

BY JOHN R. CLARK

The first year of mesh size regulation in the Subarea 5 haddock fishery was reported by Graham and Premetz[1]. Comparisons were made of the pounds and numbers of fish of each size landed and discarded by the regulated boats using large mesh and a study group of small mesh boats. The purpose of the present report is to continue the comparisons through the period from July 1, 1954 to March 31, 1955.

Graham and Premetz showed that the large (regulation) mesh boats enjoyed an advantage over the small mesh (study) boats during the initial three quarters of the regulation due to in-

1. Graham, Herbert W. and Premetz, Ernest D. 1955. First Year of Mesh Regulation in the Georges Bank Haddock Fishery. U.S. Fish and Wildlife Service, Special Scientific Report-Fisheries No. 142, 29 pp.

TABLE 1.—Comparison of Landings Per Trip from Georges Bank by Boston Large Otter Trawlers Using Small and Regulation Mesh Nets.

Quarter	Thousands of lbs. of Haddock			Thousands of lbs. of all Groundfish		
July-Sept.	**1952**	**1954**	**% Change**	**1952**	**1954**	**% Change**
Group A (small mesh)	87.2	121.6	+39.4	100.3	132.5	+32.1
Group B (large mesh)	77.6	95.3	+22.8	93.4	108.0	+15.6
Oct.-Dec.	**1952**	**1954**	**% Change**	**1952**	**1954**	**% Change**
Group A (small mesh)	61.0	79.8	+30.8	83.7	103.0	+23.0
Group B (large mesh)	61.4	72.1	+17.4	78.0	91.2	+16.9
Jan.-Mar.	**1953**	**1955**	**% Change**	**1953**	**1955**	**% Change**
Group A (small mesh)	81.3	77.0	— 5.3	105.5	105.3	— 0.2
Group B (large mesh)	72.7	73.9	+ 1.6	94.3	104.6	+10.9

Group A: Landings of licensed study group of six vessels using small mesh compared with their landings in the same quarter before regulation.

Group B: Landings of vessels using regulation mesh compared with their landings in the same quarter before regulation.

creased efficiency of the larger mesh nets. During the fourth quarter, however, the small mesh boats did better due to a great abundance of small, two-year-old haddock which were within the selection range of the 4½ inch, large mesh codends. The high abundance of two-year-old haddock was due to the unusual strength of the 1952 year class.

The quarterly landings of large and small mesh boats during the period July 1954 to March 1955 compared with their landings in like quarters previous to the regulation are presented in Table 1. The comparison of landings is made in this way because direct comparison of the two groups of vessels does not take into account the great differences in efficiency between boats. There were six trawlers in the small mesh study group and from 22 to 26 trawlers using the large mesh. The data presented are for the Boston Fleet only. It can be seen from the table that the small mesh boats continued to enjoy an advantage until January-March of 1955. In this last quarter the advantage reverted to the large mesh boats. The size compositions of the catches of haddock afford an explanation for these changes. The numbers of fish of each size caught on the average trip are shown for each quarter in Fig. 1. It can be seen that the modal size progressed from about 39 cm. to about 43 cm. during the period and the landings of haddock of the larger sizes increased markedly. Thus, when the fish were of a very small size within the selection range of the larger mesh, the small mesh boats made the better catches. As the two-year-olds grew in size and decreased in abundance, the advantage reverted to the large mesh boats. Direct comparison of numbers of fish caught per trip are not valid as the data have not been adjusted for differences in efficiency of the boats.

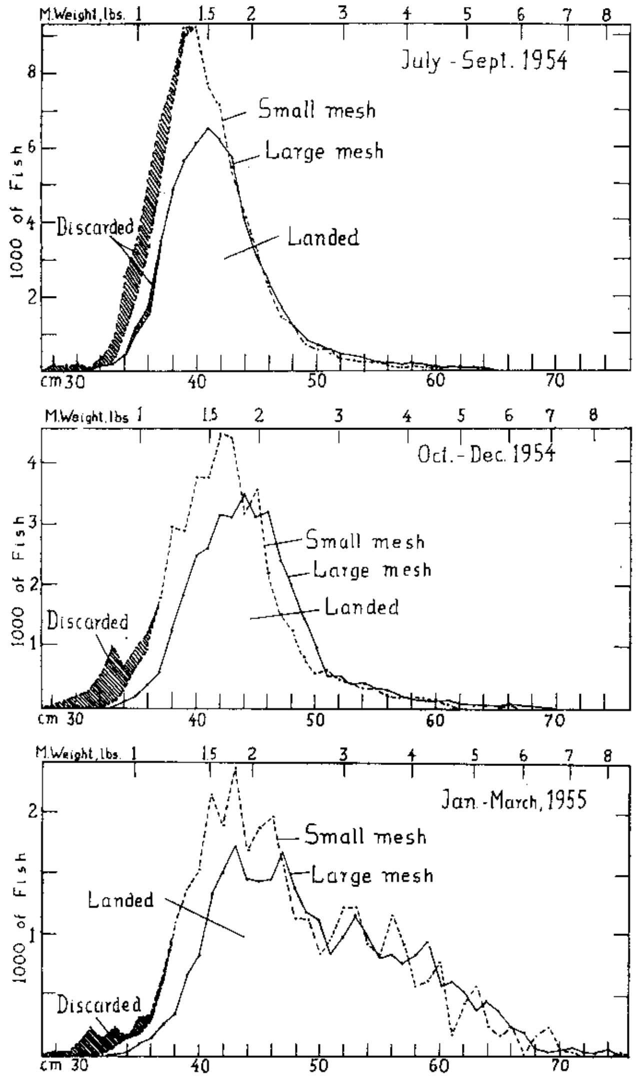

Fig. 1. Number of haddock, by length (and weight) caught on the average trip for each quarter, July 1954 to March 1955.

The effectiveness of the large mesh in preventing the discard of undersized haddock is demonstrated in the following table:

Numbers of haddock discarded per trip by Boston trawlers.

Quarter	Small mesh	Large mesh
July-Sept. 1954	8,020	200
Oct.-Dec. 1954	3,377	30
Jan.-Mar. 1955	1,039	—

It is estimated that nearly 3 million haddock were protected during the three quarters considered herein.

PART III B

Compilation of Research Reports by Subareas, 1954

BY THE EXECUTIVE SECRETARY

Summaries of researches in 1954 were reported by the following countries: Canada, Denmark, France, Iceland, Norway, Spain, Portugal, United Kingdom and United States. The table below shows the distribution of researches by subareas and countries.

(++indicates researches from special research vessels.)

Subarea	1	2	3	4	5
Canada		++	++	++	
Denmark	++	++			
France			++	++	
Iceland	+				
Italy					
Norway	+				
Portugal	+		+		
Spain			+		
United Kingdom	+				
United States			+	+	++

The Subareas 1 and 3 are those in which extensive research work has been carried out by more than one country and therefore those mainly to be considered in this compilation.

Subarea 1.

Research vessel "Dana" (Denmark), July-August.
Research boat "Adolf Jensen" (Denmark), over the year.
Trawler "Thorkel Mani" (Iceland), August.
Long-liner "Polhavet" (Norway), June-August.
Various fishing vessels, conversion factor experiments (Portugal).
Measurements of commercial samples (U.K.)

A. Hydrography.

7 sections from the coast of W. Greenland between Frederikshåb and Hare Island (Denmark), July, one of them also in April and June.
1 section Kap Farvel-Hamilton Inlet Bank (Denmark), July.
1 section The Faroes – Greenland (Denmark), June-July.
1 section Kap Farvel-English Channel (Denmark), August.
3 sections across Lille Hellefiske Bk. and Fylla Bk. (Norway), July.

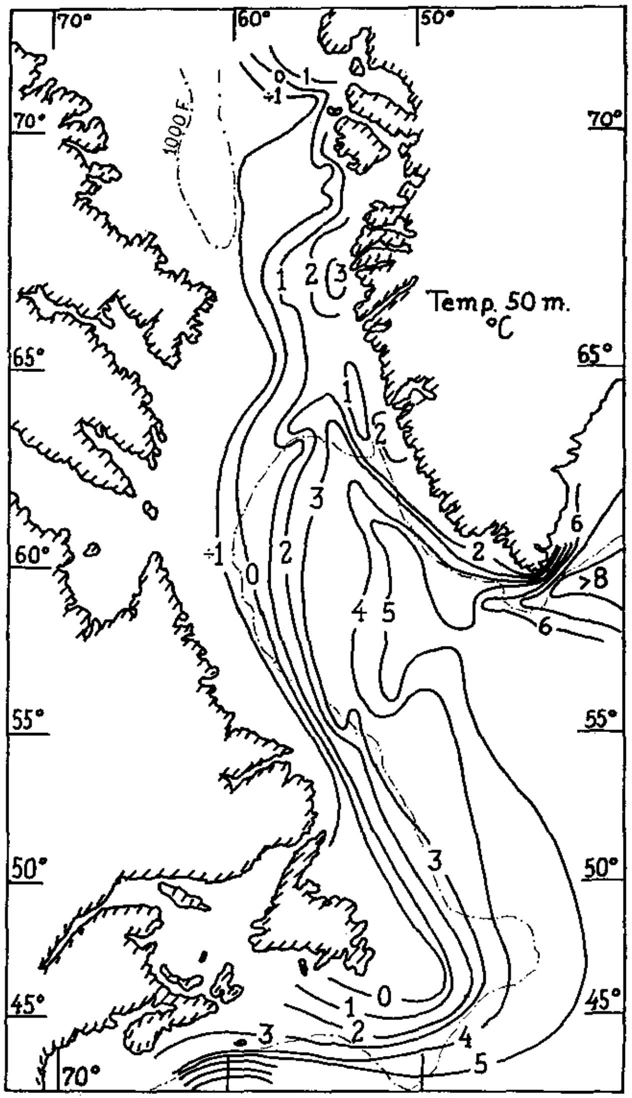

Fig. 1. Isotherms (°C.) in 50 m. depth in the Convention Area in the period end of June to beginning of September, combined from sections reported by Canada, Denmark, Norway and United Kingdom.

2 sections off Kap Farvel and off Sermersok (United Kingdom), Sept. 1952.

Compared to 1953, 1954 was a rather cold year; the temperatures over the banks being generally 1-2°C. lower in 1954. Fig. 1 shows the temperatures (°C.) in 50 m. depth observed in the period end of June—beginning of September 1954 over the Convention Area, from sections taken by Canada, Denmark, Norway and the United Kingdom. When comparing for W. Greenland, this figure with the figure showing the conditions in 1953 (Ann. Proc. Vol. 4, p. 33), it is seen that in 1953 an off coastal tongue of >6° water penetrated as far north as to off Frederikshåb (62°N); in 1954 water of this temperature only reached to Kap Farvel (60°N). In 1953 temperatures of abt. +3°C. was found right up to off Egedesminde (68°N); in 1954 only to off Godthåb (64°N), with a small, isolated patch off Holsteinsborg. In 1953 the +1° isotherm was found as far west as along the 57°L; in 1954 it was right along the edge of the banks along 55°L.

B. Cod, *Gadus callarias* L.

The distribution of larvae was more scattered in 1954 than in 1953. The largest numbers of larvae were taken between 66 and 67°N. Contrary to 1953, some larvae were taken south of 64°N. The search for larvae was carried farther westwards than in 1953, and a few larvae were found as far west as midway between Greenland and Labrador. These finds raise the question of an interchange of larvae or young between Greenland and Labrador.

Researches on size and age of cod caught in commercial gears were reported by Denmark, Iceland, Norway and United Kingdom. Denmark and Norway report age as well as size, Iceland age and United Kingdom sizes.

The rich 1947 year class was dominant from N. of Kap Farvel to off Egedesminde. In the northernmost area around Disko, the 1942 year class was still the most abundant. Just around Kap Farvel the 1945 year class was dominating.

The 1950 year class is appearing in considerable numbers in the Danish catches; on Store Hellefiske Bk. it constitutes up to 20-30% of the catches; farther south (61-62°N. Lat.) it is also fairly well represented, in places with 15-20%.

The Danish report, as well as the Icelandic mention the sudden strong decrease in the abundance of the 1945 year class:

Percentage of the 1945 year class in samples

	1953		1954	
Iceland	36%	(Fylla Bk.)	5%	(St. Hellefiske Bk.)
Denmark (Fylla Bk.)	30%		13%	
Denmark (Fiskenes)	39%		12%	

A comparison of Fylla Bk. with St. Hellefiske Bk. can hardly be considered adequate as the year class 1945 never was found abundant on St. Hellefiske Bk. However, the two other sets of figures clearly show a decrease in percentage of the 1945 year class from 1953 to 1954. How much of this decrease is due to a decrease in actual number of individuals or just to a strong increase in the numbers of individuals of other year classes, f.i. the rich incoming 1947 year class might be an open question.

Subarea 2.

Research vessel "Investigator II" (Canada) September.
Another vessel (Canada), July. Hydrography only.
Research vessel "Dana" (Denmark). Hydrography only.

A. Hydrography.

1 section across and off Hamilton Inlet Bk. (Canada), 30-31 July.
1 section Hamilton Inlet Bk.-Kap Farvel (Denmark), 6-9 July.

Both sections show temperatures of minus 1 to minus 1.5°C. and below in the Hamilton Bank area in depths between 50 and 150 m., and negative temperatures right up to 30 m. Between 30 m. and the surface a rapid increase is found on the 6-9 July up to +4°C. and on 30-31 July up to 7-9°C. The main part of the basin between Hamilton Inlet Bk. and Greenland is occupied by water of 3-3.5°C. The water along the bottom of the basin has temperature around and below +2°, the surface temperatures between 6.5° and 8.5°.

The water of the Labrador current off the Hamilton Inlet Bk. was considerably colder in 1954 than in 1953.

B. Redfish, *Sebastes marinus* (L.).

The exploratory fishing for redfish from "Investigator II" in deeper waters off the Hamilton Inlet Bk. showed greater concentrations of redfish between 300 to 400m. depth, with decreasing quantities down to ca. 700 m. where only few redfish were caught. Individual size was found to increase with depth.

Subarea 3.

Research vessel "Investigator II" (Canada), over the year.

Research vessel "Marinus" (Canada), over the year.

Research vessel "Président Theodore Tissier" (France), April-May.

Commercial fishing vessels, conversion factor experiments (Portugal).

Commercial trawler "Mistral" (Spain), June-July.

A. Hydrography.

5 sections across the Grand Bank from off Bonavista to off the south edge of the Grand Bank (Canada), July-August, data from the section St. John's-Flemish Cap reported to ICNAF. Hydrographic survey of Grand Bank and St. Pierre Bank (Canada), Apr. 1 section (A) St. Pierre Bk.-Grand Bank (France), April-May.

3 sections (C,D,E) Banquereau-St. Pierre-Grand Bank (France), Apr.-May.

Hydrographic observations on the S. part of the Grand Bank (Spain) July-August.

Temperatures were found to be considerably lower than in the same seasons in 1953.

B. Haddock, *Melanogrammus aeglefinus* (*L.*)

The rich year class 1949 dominated completely in the catches (Canada, Spain). Both the Canadian and the Spanish researches indicate that the 1952 year class is a fairly rich one.

C. Cod, *Gadus callarias* L.

The Spanish researches show a considerable increase in average size of commercially caught cod from 1953 to 1954. This is attributed to the growth of the rich year class 1949, which in both years constituted a great part of the Spanish catches. It is thus obvious that the low average size of the Newfoundland cod in 1953, which was of some concern to the fishing industry, was due just to the incoming rich year class 1949.

However, the average size of the Newfoundland cod as fished by the European countries is considerably below that of the Greenland cod, as it appears from the attached figure 2, showing

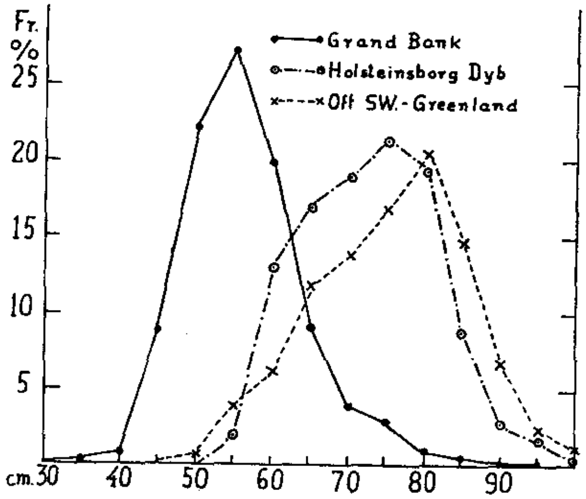

Fig. 2. **Length distribution of cod caught in the summer of 1954: on Grand Bank, trawl, Spain; in Holsteinsborg Deep, pelagic longliners, Norway; off SW-Greenland, trawl, United Kingdom. (40 cm., on the bottom scale, stands for the size group 36-40 cm.).**

length distribution of Danish, Norwegian, U.K. cod samples from Greenland and Spanish cod samples from the Grand Bank. We have not yet comparative measurements for these two areas for the same countries and the same fishing methods.

It is of interest to note the observation in the French report indicating for the Bank area just east of the Avalon peninsula shoals of cod feeding more or less pelagically on herring and capelin. This leaves open the possibility that we in this area may have—as it is the case off West Greenland—considerable stocks of cod temporarily living in midwater. A statement indicating the same is found in W. Templeman's paper: Groundfish stocks in the Western North Atlantic (Ann. Meet. 1955, Doc. No. 15).

D. Other Fish.

Researches on redfish were continued by Canada. Rich year classes only rarely occur with hardly any settling of young in intervening years. Fishing for redfish showed migrations away from the bottom during the night hours.

500 American plaice (*Hippoglossoides platessoides*) were tagged in St. Mary's Bay (south coast of Newfoundland) and 1,000 on the northern slope of the Grand Bank.

Subarea 4.

Various research vessels (Canada) over the year.
Research vessel "Président Theodore Tissier" (France), April-May.
Various vessels (U.S.A.), over the year.

A. Hydrography.

Several sections in various places and in various seasons (Canada), data from the section Halifax-Continental Slope, Feb., May, Aug., and Oct. reported to ICNAF.

Various hydrographic surveys (Canada), over the year.

1 section, Nova Scotia—across Banquereau (France), April-May.

1 section, Banquereau—Gulf of St. Lawrence (France), April.

The observations from 1954 show a certain decrease in temperature compared to 1953.

There is a good agreement between the western part of the French Nova Scotia section (April-May) and the rather closely corresponding Canadian section (May), with low temperatures 1-2°C. in depths between 30 and 100 m., and higher temperatures at the surface 4-5°C. and at the bottom 8-9°C. (cfr. Fig. 5AII Can. Res. Rep. and Fig. 4 French Res. Rep.). The edge of the Gulf Stream is clearly defined in the Canadian Section I and II to the SE of Emerald Bk. (Fig. 5A) and it is indicated also on the French Section D. (SW edge of Grand Bk. Fig. 5).

B. Cod and Haddock.

The Canadian research work was centered on the investigations for the assessment of the need for mesh regulations of the trawl fishery in Subarea 4. The more detailed reports on this work are not given in the Canadian Research Report but are found in the appendices to the reports from the Group of Advisers to Panel 4 (Ann. Meet. 1955, Doc. Nos. 5 and 8).

During 1954, 1,284 cod were tagged in Nova Scotian waters, and 2,000 in the Gulf of St. Lawrence (Canada). Cod recoveries from earlier taggings showed only few longer migrations. Haddock recoveries showed seasonal movements to offshore grounds.

The Canadian Research Report gives the results of experimental fishing for cod and haddock with hooks of different sizes, which shows very clearly that larger hooks catch larger fish and vice versa. Hook fishing may be regulated as well as trawl fishing.

U.S.A. researches on haddock in southern Nova Scotian waters (Brown's Bank) gave no evidence of a depletion of the stock.

C. Redfish.

The extensive study—especially in the Gulf of St. Lawrence—of the seasonal and the diurnal movements and of the growth of redfish were continued (Canada). Investigations on year-class strength confirmed the earlier observations of only few rich year-classes with series of intervening poor years. The picture is thus the same as that found in Subarea 3.

D. Fish Eggs and Larvae.

Seasonal and annual samplings were started in 1954 (August-September). They showed concentrations of cod larvae on Magdalen Shallows, of haddock larvae off SW Nova Scotia, and of redfish off SW Nova Scotia, on Quero Bank, and in the southern part of the Gulf of St. Lawrence.

Subarea 5.

Researches in this subarea were carried out only by U.S.A. They were centered on haddock and redfish. The study of fish eggs and larvae started in 1953 was continued. A study program of silver hake *Merluccius bilinearis* (Mitchill) and of yellowtail *Limanda ferruginea* (Storer), was started. U.S.A. being the only country reporting researches from this Subarea, no compilation has to be made.

Attention is drawn to Figs. 11, 12, and 13 of the Danish research report which give hydrographic data from two transatlantic sections taken from the "Dana", one from the Faroes to Kap Farvel (St. 9149-9172), 29 June-5 July 1954 and the other from Kap Farvel St. 9289 southeast to St. 9302 and east to St. 9314 to southeast of Ireland, 22-30 August 1954. In the southern one of these sections should be noted the squeezing together of the isotherms and isohalines in the area around ca. 30°W. Long. and 50°N. Lat. Here at depths of a few hundred metres over a relatively short distance from west to east the temperature increases from 5 to 10°C., and the salinity from 34.9 to 35.4 o/oo, indicating the westward boundary of the Gulf Stream. Farther east along the 18°W. Long. and at deeper water (500-1,000 m.) occurs another area with close lying isotherms and isohalines, their squeezing together being, however, not so pronounced as in the region around 30°W. Long.

PART 4

Lists of Scientists and Laboratories Engaged in the Various Branches of the Commission's work

1. LIST OF SCIENTISTS

Canada

W. Templeman	Director, groundfish-biology	Newfoundland Fisheries Research Station, St. John's, Nfld.
A. M. Fleming	Groundfish statistics, cod	,, ,, ,, ,,
T. K. Pitt	Groundfish biology	,, ,, ,, ,,
H. J. Squires	American plaice	,, ,, ,, ,,
T. Stowart	Witch, flounder	,, ,, ,, ,,
H. Macpherson	Cod, haddock	,, ,, ,, ,,
E. J. Sandeman	Redfish	,, ,, ,, ,,
J. L. Hart	Director	Atlantic Biological Station, St. Andrew's, N. B.
W. R. Martin	Groundfish biology and statistics, liaison with ICNAF	,,
F. D. McCracken	Groundfish, fishing gear	,, ,, ,,
J. E. Paloheimo	Cod and haddock population dynamics	,, ,, ,,
R. A. McKenzie	Cod and haddock stocks	,, ,, ,,
A. H. Leim	Eggs and larvae	,, ,, ,,
L. R. Day	Eggs and larvae	,, ,, ,,
A. C. Kohler	Cod and haddock, age and growth	,, ,, ,,
D. M. Scott	Cod, parasites	,, ,, ,,
D. H. Steele	Redfish	,, ,, ,,
R. W. Fassold	American plaice	,, ,, ,,
P. M. Powles	Cod	,, ,, ,,
H. B. Hachey	Hydrography	,, ,, ,,
H. J. McLellan	Hydrography	,, ,, ,,
L. M. Lauzier	Hydrography	,, ,, ,,
W. B. Bailey	Hydrography	,, ,, ,,
D. G. MacGregor	Hydrography	,, ,, ,,
N. J. Campbell	Hydrography	,, ,, ,,
R. W. Trites	Hydrography	,, ,, ,,
A. Marcotte	Director	Station de Biologie Marine, Grande-Rivière, Qué.

Denmark

Paul M. Hansen	Chief, cod, statistics	Grønlands Fiskeri-undersøgelser, Charlottenlund Slot, Charlottenlund
E. Smidt	Groundfish	,, ,, ,,
Aa. Vedel Taaning	Director, redfish, cod	Danmarks Fiskeri- og Hav-undersøgelser. Charlottenlund Slot, Charlottenlund
Frede Hermann	Hydrography	,, ,, ,,

France

P. Desbrosses	Cod, haddock	Inst. Scient. et Techn. des Pêches Maritimes, 59 Av. Raymond-Poincaré, Paris XVI[e]
R. Letaconnoux	Haddock	Laboratoire de l'Office des Pêches, 74 Allée du Mail, La Rochelle
J. Ancellin	Pleuronectidae, cod, haddock	Laboratoire d'Oceanographie, Boulogne sur Mer
C. Nédélec	Redfish	,, ,, ,,
A. Gougenheim	Hydrography	Serv. Hydr. de la Marine, 13 Rue de l'Université, Paris

Iceland

Jón Jónsson	Cod, redfish, hydrography	Fisheries Department, Borgartun 7, Reykjavik
J. Magnusson	Redfish	,, ,, ,,
J. Oskarsson	Cod	,, ,, ,,
U. Stephansson	Hydrography	,, ,, ,,

Italy

Norway

G. Rollefsen	Director, cod	Directorate of Fisheries, Inst. of Marine Research, Bergen
B. Rasmussen	Fishery Consultant, cod, redfish	,, ,, ,,
F. Devold	Fishery Consultant, pleuronectids, hydrography	,, ,, ,,
J. Eggvin	Fishery Consultant, hydrography	,, ,, ,,

Portugal

Tavares de Almeida	Cod, hydrography	Comissão Cons. Nac. das Pescarias do Noroeste do Atlantico, Gabinete de Estudos das Pescas, Av. da Liberdade, 211, 4°, D°, Lisbon
Mario Ruivo	Cod, haddock	,, ,, ,,

Spain

J. M. Guitian Vieito	Hydrography, statistics	Direccion General de Pesca Maritima, Alarçon 1, Madrid
A. Varela Reducto	Statistics	,, ,, ,,
O. Rodrigues Martin	Fishes	,, ,, ,,
R. Lopez Costa	Hydrography	Laboratorio Oceanografico, Felipo Sanches 20, Vigo
Alfonso Rojo	Cod, haddock	Spanish Cod Fishing Industries Association. Madrid.

United Kingdom

C. E. Lucas	Director, fishery ecology	Marine Laboratory, Wood Street, Torry, Aberdeen, Scotland
A. D. McIntyre	Redfish, halibut	,, ,, ,,
M. Graham	Director, cod	Fisheries Laboratory, Lowestoft, England
R. S. Wimpenny	Fishery ecology	,, ,, ,,
G. C. Trout	Cod, haddock	,, ,, ,,
R. Jones	Haddock	,, ,, ,,

United States

L. A. Walford	Chief	Branch of Fishery Biology, Fish and Wildlife Service, Washington 25, D. C.
Herbert W. Graham	Director, fishery biology	Fish and Wildlife Service, Woods Hole, Massachusetts.
J. R. Clark	Haddock	,, ,, ,,
G. F. Kelly	Redfish	,, ,, ,,
J. P. Wise	Haddock	,, ,, ,,
J. B. Colton	Hydrography, plankton	,, ,, ,,
Clyde Taylor	Population dynamics	,, ,, ,,
Giles Mead	General fish taxonomy	,, ,, ,,
Roland Wigley	Food habits	,, ,, ,,
Howard Tait	Silver hake	,, ,, ,,
Robert Edwards	Yellowtail	,, ,, ,,

II. LIST OF LABORATORIES

Canada:	Atlantic Biological Station, St. Andrew's, N. B. Newfoundland Fisheries Research Station, St. John's, Newfoundland. Station de Biologie Marine, Grande-Rivière, Qué.
Denmark:	Grønlands Fiskeriundersøgelser, Charlottenlund Slot, Charlottenlund. Danmarks Fiskeri- og Havundersøgelser, Charlottenlund Slot, Charlottenlund.
France:	Centre des Recherches de l'Institut Scient. et Techn. des Pêches Maritimes, Boulogne s/Mer.
Iceland	Fisheries Department, University Research Institute, Borgartun 7, Reykjavik.
Italy:	Ministero della Marina Mercantile, Piazza della Minerva, Rome.
Norway:	Institute of Marine Research, Directorate of Fisheries, Bergen.
Portugal:	Gabinete de Estudos das Pescas, Av. da Liberdade, 211, 4°, D°, Lisbon.
Spain:	Direccion General de Pesca Maritima, Alarçon 1, Madrid. Laboratorio Oceanografico, Felipo Sanches 20, Vigo. Spanish Cod Fishing Industries Assoc., Madrid and St. John's, Newfoundland.
United Kingdom:	Marine Laboratory, Wood Street, Torry, Aberdeen, Scotland. Fisheries Laboratory, Lowestoft, Suffolk, England.
U.S. A.:	Fish and Wildlife Service, Woods Hole, Massachusetts.