INTERNATIONAL COMMISSION

FOR THE

NORTHWEST ATLANTIC FISHERIES

ANNUAL PROCEEDINGS

Vol. 11

for the year

1960-61

Issued from the Headquarters of the Commission
Halifax, N. S., Canada
1961

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CONTENTS

FOREWORD

The Commission's publications have been established in two annual series since 1953; an "Annual Proceedings" and a "Statistical Bulletin." Since 1957 a third annual series the "Sampling Yearbook" has been added. Special publications from the Commission are issued 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 this year, as every second year, Lists of Scientists and Laboratories engaged in the Commission's 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 Statistical Bulletins Vol. 1-3 dealt with the more important groups of groundfish. The Statistical Bulletins from Vol. 4 (year 1954) also deal with the other fishes and with shellfish, however in a more summarized form.

The "Sampling Yearbook" includes in tabular form length measurements, age determinations and other data relating to the stocks of commercial fish species, and collected by the member countries in ports or on board fishing vessels or research vessels. Its distribution is restricted to directly interested institutions or persons.

The Special Publications include reports of scientific meetings. No. 1, dealing with a symposium held at Biarritz, France, 1956, on some problems for biological fishery survey and techniques for their solution, was published in 1958. No. 2, containing the reports of the joint ICNAF-ICES-FAO meeting in Lisbon, Portugal, on fishing effort, the effect of fishing on resources and the selectivity of fishing gear, is printed by FAO, Rome, in 1960. No. 3, a joint ICES-ICNAF publication on the redfish symposium held by the two organizations in Charlottenlund, Denmark, in 1959, is printed in 1961. No. 4 is in preparation. It will include papers prepared for and reports of the ICNAF Symposium on North Atlantic Fish Marking held in Woods Hole, Mass., U.S.A., 24th - 27th May, 1961.

During the last two years a group of scientists, appointed by ICNAF, has worked on Fishery Assessment in Relation to Regulation Problems. The extensive report by this Group will be printed as an appendix, under separate cover, to the present volume of the Annual Proceedings.

A list of the Commission's publications is found on the two last pages of the cover.

Erik M. Poulsen,
Executive Secretary.

Halifax, 30 December, 1961.

PART 1

Administrative Report for the Year Ending 30 June 1961, with Financial Statements

BY THE EXECUTIVE SECRETARY, ERIK M. POULSEN

1. Officers during the Year.

Chairman of Commission—Mr. A. J. Suomela, U.S.A.

Vice-Chairman of Commission—
Mr. G. R. Clark, Canada

Chairman Panel 1: Dr. Jón Jónsson, Iceland
,, Panel 2: Dr. Ju. Ju. Marty, USSR
,, Panel 3: Capt. T. de Almeida, Portugal
,, Panel 4: Capt. L. J. Audigou, France
,, Panel 5: Mr. T. A. Fulham, U.S.A.

The above officers were elected at the 1959 Annual Meeting, and are serving for a period of two years.

Chairman of Standing Committee on Finance and Administration—
Mr. J. H. MacKichan, Canada

Chairman of Standing Committee on Research and Statistics—
Dr. M. Ruivo, Portugal.

These two chairmen hold office for a period of one year.

In March 1961 the Commission's Chairman, Mr. A. J. Suomela, took over the position as Fishery Attaché to the United States Embassy in Tokyo. For the remaining part of the year the Vice-Chairman, Mr. G. R. Clark, Canada, has exercised the powers and duties of the Chairman in conformity with the Rules (No. 9) of the Commission.

2. Panel Memberships 1960-61.

Country	Panel No. 1	2	3	4	5	Total
Canada		+	+	+	+	4
Denmark	+					1
France	+	+	+	+		4
Germany	+	+				2
Iceland	+					1
Italy			+	+		2
Norway	+					1
Portugal	+	+	+	+		4
Spain	+	+	+	+		4
USSR	+	+	+			3
United Kingdom	+	+	+			3
United States			+	+	+	3
	9	7	8	6	2	32

3. Changes in the Staff of the Secretariat.

On 1 September 1960, Ronald S. Keir, the Commission's Biologist-Statistician left the Commission to take over a position with the Canadian Defence Research Board, Ottawa. Mr. Keir had worked for ICNAF since 1954. His excellent work during these years has been highly appreciated.

On 1 December, 1960, Frank R. Thomas, B.Comm., Canada, took over the position as Biologist-Statistician.

4. Newsletters.

Newsletters were distributed from headquarters in order to circulate information relevant to the Commission's activities and interests on 8 July, 10 October, 1960, 18 January and 28 April, 1961.

5. Commission's Publications.

The Annual Proceedings Vol. 10 for the year 1959-60, was issued in February 1961.

The Statistical Bulletin, Vol. 8, for the year 1958, was distributed in December 1960.

The Sampling Yearbook, Vol. 4, for the year 1959, was circulated in June 1961.

The triennial "List of Fishing Vessels", dealing with vessels fishing in the Convention Area in 1959, was circulated in January, 1961.

The List is considerably larger than those previously issued (1953 and 1956), due to more member countries, larger fleets, and to a larger amount of detailed information on the vessels.

The 1960 issue of the "Red Book" was distributed in January, 1961. It concerns the 1960 Annual Meeting and includes the proceedings of the various meetings of the Standing Committee on Research and Statistics and its various working groups, together with a selected number of papers from the 1960 Annual Meeting.

The first part of the Report of the FAO/-ICES/ICNAF Joint Scientific Meeting on Fishing Effort, the Effect of Fishing on Resources and the Selectivity of Fishing Gear was published by the Food and Agriculture Organization of the United Nations (also as ICNAF Special Publication No. 2) in January, 1961.

The Report of the ICES/ICNAF Redfish Symposium held at Charlottenlund, Denmark, October, 1959, has been printed in Copenhagen as a joint ICES/ICNAF paper (ICNAF Special Publication No. 3). It is expected to be ready for circulation late in 1961.

6. Co-operation with other International Organizations.

This co-operation has been continued along the same lines as in previous years and with the same organizations. It mainly includes exchanges of observers at meetings, and of reports, programmes and publications, also the arrangement of joint meetings.

The FAO/ICES/ICNAF Continuing Working Party on Fishery Statistics in the North Atlantic Area met during the ICNAF Annual Meeting in Bergen in June 1960. A further meeting was held during the ICNAF Annual Meeting in Washington, June 1961.

7. Co-operation with Non-Member Countries.

The co-operation with Poland, whose fisheries in the Convention Area have increased considerably during recent years, has been continued. Poland provides the Commission with statistical data on their fisheries in the Convention Area, with detailed information on its fishing vessels, and participates in the Annual Meeting by observers.

Belgium has, in the last couple of years, carried out some exploratory fishing in the Convention Area, and has provided the Commission with statistical data on the landings from this fishery, and with information on the trawlers participating in the fishery.

The fishery by trawlers from Rostock (at the Baltic,) in the Convention Area is under strong development. Data on the landings and information on fishing vessels and gears are submitted to ICNAF.

8. Research Programs.

Research programs for 1961 were forwarded from member countries to the Secretariat in the period December 1960 to April 1961. They were distributed during the same months by the Secretariat.

9. Summaries of Research.

Summaries of the researches by the various member countries in 1960 were received in the Secretariat and distributed as documents for the 1961 Annual Meeting.

10. Sampling.

Data from samples of fish taken both by commercial vessels and research vessels in 1960 are being forwarded by member countries to the Secretariat. After being edited and converted to the Commission's standard form they will be published in the Sampling Yearbook, Vol. 5.

11. Collection of Statistics.

The Commission's collecting of statistics and the compilation of the data have been continued according to the Commission's requirements and—so far as possible—in accordance with decisions of the Edinburgh Statistical FAO/-ICES/ICNAF meeting in 1959. In all cases the high standard of collecting statistics by member countries has been maintained and in several cases additional detail has been added to the statistical submissions. Statistical data on fisheries by non-member countries in the Convention Area are also collected.

12. Otolith Exchange Program (Halibut)

In accordance with Commission's decision at the 1959 Annual Meeting, an exchange between interested member countries of otoliths of halibut was initiated in 1959/60.

13. Fisheries Regulations.

The collection of detailed information, from the member countries concerned, on systems of inspections and on the results of inspections carried out is being continued. The material collected for 1960 was considered by the Commission at the 1961 Annual Meeting.

14. Meetings during the Year.

A meeting of scientists concerned mainly with the researches in Subareas 3, 4 and 5 was held in the Biological Laboratory, Bureau of Commercial Fisheries, Woods Hole, Mass., U.S.A., on 12-16 December, 1960. On invitation of the Commission, Mr. R. J. H. Beverton, Lowestoft, England, participated in the meeting. From the Secretariat, the Executive Secretary and the Biologist-Statistician were present. A report of the meeting was prepared for the 1961 Annual Meeting.

The Assessment Group of six scientists appointed in accordance with Commission's decision in 1959 has continued its work in a 10-day meeting in March, in Lowestoft, England, chaired by R. J. H. Beverton. A report on the work and the findings of the Group was submitted to the Commission during the 1961 Annual Meeting.

The Environmental Group of seven scientists appointed in accordance with Commission's decision at the 1960 Annual Meeting has met in Aberdeen, Scotland, March, 1961, under the chairmanship of C. E. Lucas. A report was prepared for consideration by the Commission during the 1961 Annual Meeting.

The Commission's Eleventh Annual Meeting was convened in Washington, D.C., 5-10 June 1961. It was preceded by the following meetings in the Biological Laboratory, Woods Hole, Mass., U.S.A.:

(a) Symposium on Marking, 24-27 May;

(b) Meeting of the Environmental Group, 27 May;

(c) Meetings of the Standing Committee on Research and Statistics, 29 May-3 June.

15. Other Matters.

The annual addition to Guide to ICNAF Papers, covering the year 1959/60, was circulated on 1 November, 1960.

Dr. Meseck, Germany, represented ICNAF as observer at the 1960 Annual Meeting of ICES in Moscow in September, 1960.

Dr. Cannone, Italy, represented ICNAF as observer at the 1960 Meeting of the General Fisheries Council of the Mediterranean.

Dr. C. Lucas, United Kingdom, represented ICNAF as observer at the 9th meeting of the International Fisheries Convention of 1946.

During the ICES Meeting in Moscow, an informal, preliminary meeting of the Environmental Group took place.

The standard forms for collecting statistics prepared in accordance with the FAO/ICES/-ICNAF statistical meeting in Edinburgh in 1959 have now been printed by FAO and distributed to some countries for trial and consideration.

16. Moving of Commission's Headquarters

At the end of July the offices of the Secretariat were moved from the Forrest Building to the Education Building, also of Dalhousie University. This building is located on the premises of the university at the corner of Coburg Road and Oxford Street. The new offices are about twice the size of those in the Forrest Building. They include five offices, and a large and a small room for general work, for the library and for storage of Commission's publications and documents. This larger space is most advantageous as it offers a great improvement in the working conditions for the staff, much better storage conditions for papers, and more ready access to books and documents.

17. Financial Statements for the Fiscal Year ending 30 June, 1961.

The accounts of the Commission for the year ending 30 June, show an appropriation of $ Can. 58,800.00 and a total expenditure of $52,723.32.

The audit of the Commission's finances for the fiscal year ending 30 June, 1961, was made by the Auditor General's Office of the Government of Canada in July, 1961.

The report from the Auditor General's Office, of 20 Sep. 1961, says:

"In compliance with the requirements of Financial Regulations 11.2, I certify that, in my opinion:

(a) the financial statements are in accord with the books and records of the Commission;

(b) the financial transactions reflected in the statements have been in accordance with the rules and regulations, the budgetary provisions, and other applicable directions; and

(c) the monies on deposit have been verified by certificate received direct from the Commission's depositary.

We were given free access to all books of account and records necessary for the performance of the audit and all information necessary for the purposes of the audit was made available to us. The co-operation of the Executive Secretary and his staff is acknowledged with appreciation."

The following three financial statements are attached to the Auditor's report:

Statement 1

Statement of Budget Appropriations, Obligations Incurred, and Unobligated Balances of Appropriations for the year ended 30 June, 1961

(Expressed in Canadian Dollars)

Purposes of Appropriations	Appropriated by Commission	Authorized Transfers	Amended Appropriations	Obligations Incurred	Unobligated Balances of Appropriations
Personal Services—					
Salaries	$27,900.00	$ —	$27,900.00	$26,225.00	$1,675.00
Superannuation	2,600.00	—	2,600.00	2,297.70	302.30
Additional help	200.00	—	200.00	120.80	79.20
Travelling	9,500.00	—	9,500.00	8,069.47	1,430.53
Transportation of things	400.00	394.85	794.85	794.85	—
Communication Services	1,000.00	2.57	1,002.57	1,002.57	—
Rent and Utility Services	2,400.00	—	2,400.00	2,400.00	—
Other Contractual Services, including Printing	9,600.00	−397.42	9,202.58	7,853.09	1,349.49
Supplies and Materials	2,200.00	—	2,200.00	2,031.98	168.02
Equipment	1,000.00	—	1,000.00	952.95	47.05
Annual Meeting	2,000.00	—	2,000.00	974.91	1,025.09
	58,800.00		58,800.00	52,723.32	6,076.68

Statement 2

Statement of Income and Expenditure for the year ended 30 June, 1961

(Expressed in Canadian Dollars)

Income.		
Members' contributions assessed—		
Canada	$ 6,961.12	
Denmark	2,135.28	
France	6,961.12	
Germany	3,743.88	
Iceland	2,135.28	
Italy	3,743.88	
Norway	2,135.28	
Portugal	6,961.12	
Spain	6,961.12	
Union of Soviet Socialist Republics	5,352.51	
United Kingdom	5,352.51	
United States	5,352.51	$ 57,795.61
Miscellaneous income—		
Bank interest	176.64	
Refund of previous year's expenditure	51.30	
Sales of publications	15.00	242.94
		58,038.55
Expenditure.		
Obligations incurred (Statement I)		52,723.32
Excess of income over obligations, carried to Surplus Account		5,315.23

Statement 3

Statement of Assets and Liabilities as at 30 June, 1961

(Expressed in Canadian Dollars)

Assets		Liabilities		
GENERAL FUND				
Cash on deposit	8,919.99	Unliquidated obligations		$ 2,000.00
		Advances on future contributions		374.62
		Surplus Account.		
		Excess of income over obligations incurred, 1960-61 (Statement II)	$ 5,315.23	
		Balance of unliquidated obligations as at 30 June 1960, not required	313.80	
			5,629.03	
		Surplus as at 30 June 1960	916.34	6,545.37
	8,919.99			8,919.99
WORKING CAPITAL FUND				
Cash on deposit	$ 10,136.36	Principal of Fund		$ 10,000.00
		Bank interest		136.36
	10,136.36			10,136.36

PART 2

Report of the Eleventh Annual Meeting

5th to 10th June, 1961

BY THE VICE-CHAIRMAN MR. G. R. CLARK

1. Time and Place of Meeting

The Eleventh Annual Meeting of the Commission was convened in Washington, D.C. on 5th June, 1961, and continued through to the 10th June. The meeting was preceded, 24th to 27th May, by a Symposium on North Atlantic Fish Marking, and 29th May to 3rd June, by meetings of the Standing Committee on Research and Statistics and by the Groups of Scientific Advisers. The Symposium and the latter meetings were convened in Woods Hole, Mass.

2. Participants (Appendix I)

Commissioners with advisers and experts were present from all twelve member countries. Observers were present from Poland, the Food and Agriculture Organization of the United Nations, International Council for the Exploration of the Sea, International Fisheries Convention 1946, Great Lakes Fishery Commission, International North Pacific Fisheries Commission, International Pacific Halibut Commission and members of the Advisory Committee to the United States Commissioners.

3. Opening of the Meeting (Agenda Item 1)

The opening session was convened in the Department of State Building, Washington—where all the following meetings were held. Present were: Secretary of the Interior Stewart L. Udall, Members of Congress, Representatives of Fisheries Organizations, Representatives from Embassies of the Member Countries, and the participants.

As the Commission's Chairman, Mr. A. J. Suomela, had resigned from his position as Chairman, following his taking over a position as Fishery Attaché at the United States Embassy in Japan, the Vice-Chairman Mr. G. R. Clark, was in the Chair. He opened the meeting welcoming guests, observers and delegates. The U.S. Secretary of the Interior Mr. Stewart Udall, extended an address of welcome to the Commission. Mr. Klaus Sunnanaa, Norway, on behalf of the Commission, thanked Mr. Udall for his address of welcome. The Vice-Chairman concluded the Session by recalling the early history of the Commission from the First Annual Meeting held in Washington in 1951, and especially welcomed those Commissioners and Scientists now present who had also participated in the first meeting of the Commission.

Shortly after adjournment of the formal opening session, the First Plenary Session was opened by the Vice-Chairman. It was followed later in the week by a 2nd, 3rd and 4th (Final) Plenary, during which meeting the following business was concluded.

4. The Agenda (Item 2—Appendix II)

The agenda, circulated sixty days in advance of the meeting was adopted

5. Publicity for the Meeting (Item 3)

The U.S. Government had placed Press-Officer Mr. Dominus Davis at the disposal of the Commission. A committee consisting of the Vice-Chairman and the Chairman of the two Standing Committees was appointed to work with the Press-Officer.

6. Review of Panel Memberships (Item 4)

No amendments of panel memberships were proposed and panel memberships for 1961/62 remain as follows:

Panel	1	2	3	4	5	Total
Canada		+	+	+	+	4
Denmark	+					1
France	+	+	+	+		4
Germany	+	+				2

	1	2	3	4	5	Total
Iceland	+					1
Italy			+	+		2
Norway	+					1
Portugal	+	+	+	+		4
Spain	+	+	+	+		4
U.S.S.R.	+	+	+			3
U.K.	+	+	+			3
U.S.A.			+	+	+	3
TOTAL	9	7	8	6	2	32

7. Report on Staff Matters and Auditor's Report (Items 5, 6, and 18)

The Auditor's Report for 1959/60 was accepted. In connection with a suggestion by the Auditor it was decided that as much as possible of the money obtained by the Commission should be placed in the chartered bank savings account of the Commission.

The Commission approved the Administrative Report and the financial statements for 1960/61 (up to May 8th 1961).

8. Budget (Items 7, 8 and 18)

The Commission approved the recommendation of the Committee on Finance and Administration to appropriate $61,000 for the year 1961/62 for the following purposes:

1.	Personal services		
	a.	Salaries	$27,600
	b.	Superannuation	2,600
	c.	Additional help	1,200
2.		Travel	2,000
3.		Transportation of Things	400
4.		Communication Services	1,100
5.		Rent and Utility Services	2,400
6.		Other Contractual Services	16,200
7.		Supplies and Materials	1,800
8.		Equipment	500
9.		Annual Meeting	5,200
			$61,000

The Commission noted that the Committee proposed an advance-budget estimate for 1962/63 as follows:

1.	Personal Services		
	a.	Salaries	27,600
	b.	Superannuation	2,600
	c.	Additional help	1,200
2.		Travel	3,800
3.		Transportation of Things	600
4.		Communication Services	1,400
5.		Rent and Utility Services	2,400
6.		Other Contractual Services	16,200
7.		Supplies and Materials	2,200
8.		Equipment	600
9.		Annual Meeting	2,400
			$61,000

9. The Commission adopted the following recommendations of the Committee on Finance and Administration (Items 18 and 20)

(a) That the date of billing be 1 August 1961.

(b) That the acceptance of the invitation to convene the 1962 Annual Meeting in Moscow on 4th June be reconfirmed.

(c) That the 1963 Annual Meeting be convened in Halifax, Canada, on 3rd June.

(d) That in future the office of the Auditor General of Canada be remunerated for the auditing of the Commission's accounts

(e) That the Executive Secretary examine in consultation with the Commission's Chairman and the Chairmen of the two Standing Committees the procedure for the sale of certain of the Commission's publications and in this connection review the arrangements for free distribution.

The Commission approved the three reports of the Committee in their entirety (except for the part regarding invitations to attend meetings of other organizations—(see section 10) and noted that Mr. J. H. MacKichan had been re-elected Chairman for the ensuing year.

10. Invitations to Attend Meetings of other International Organizations (Item 16)

After consideration of proposals by the two Standing Committees the Commission decided:

That invitations to send observers to the following meetings be declined with thanks: ICES, Herring Symposium, 1961; FAO, Research Vessel Forum, 1961; and FAO International Conference on Fish in Nutrition, 1961.

That the invitation by ICES to send observers to its 49th Statutory Meeting, Copenhagen 1961 be accepted with thanks.

11. Inspections in Connection with ICNAF Trawl Regulations (Item 9)

The report by the *ad hoc* Committee was considered and adopted. It was noted that the report recommended the continued collection of data on results of inspections, the annual review of these data and the use of the prescribed forms for the reporting; further that the procedure for inspections had been reviewed and found satisfactory.

12. Meetings of Commissioners.

In two meetings of Commissioners a proposal for an amendment to the present Convention to bring harp and hood seals of the Northwest Atlantic under the provisions of the Convention (Item 12) was considered (vide Section 16). The Commission further heard a report by Dr. M. Ruivo of the work carried out by the Standing Committee on Research and Statistics during the Annual Meeting. The report dealt in the main with the following subjects: The Tagging Symposium held in Woods Hole, 24-27 May; the report of the Environmental Group which had met in Aberdeen March 1961; and the report of the Assessment Group, which had met in Lowestoft in March 1961.

13. Reports by ICNAF Observers on Meetings of other International Organizations were tabled or given (Item 13)

14. Report of the Standing Committee on Research and Statistics (Items 10, 15, 16 and 17)

This Committee, chaired by Dr. M. Ruivo with Mr. H. Eckles as rapporteur, and its *ad hoc* sub-committees and working groups met in the period 29th May-10th June.

The proceedings of the meetings note the considerable growth and the increase in complexity of the fisheries in the ICNAF Area during recent years which necessitate more rational and practicable systems of fishery conservation; this again increasing the demand for more comprehensive and more penetrating research work. In trying to meet these demands the Committee has concentrated its work on the following two main subjects: Environmental Studies and Assessment of Fish Stocks and Fisheries. Other major subjects, also considered at the 1961 meetings, were: Statistics and Sampling, Gear Research and Selectivity, Marking Techniques, and Ageing Techniques.

The proceedings, with all recommendations, from the meetings of the Committee are reprinted in the Red Book for the 1961 Annual Meeting and are here summarized as follows:

a. Fishery Assessment.

The final report by the Assessment Group (Doc. No. 20) was considered and the Committee recommended:

> That the Group continue in existence and conduct its business by correspondence during the year and convene 2-3 days in advance of the 1962 meeting of the Committee with Dr. L. Dickie as convener.
>
> That the final report of the Group (Doc. No. 20) be published as a supplement to the Annual Proceedings Vol. 11 (1960/61) in 2000 copies.

b. Environmental Studies.

The report by the Environmental Working Party (Doc. No. 25) was considered and a series of recommendations and decisions resulted aiming at the implementation of the research programme and the plans for collection and exchange of data elaborated by the Working Party; they are reprinted in the 1961 Red Book.

It was further **recommended:**

That a symposium on "The Influence of the Environment on the Principal Groundfish Stocks in the North Atlantic" be held over the six days, preceding the meeting of the Research and Statistics Committee in 1963; that ICES be invited to collaborate in securing contributions concerning fisheries environmental research in the Northeast Atlantic; that four "review" lectures be solicited on relevant aspects of environmental research; and that funds be made available in 1963 for (1) publication of the contributions anticipated, and (2) if required, for enabling special lecturers to attend.

That the Report (Doc. No. 25) with appendices be published in the 1961 Red Book, with an additional 200 reprints.

That member Governments endeavour to ensure that scientists directly concerned with the subjects of the symposium be included in their delegations for the meeting.

c. **Marking Symposium:**

The Committee noted the large number of highly valuable contributions to the Symposium and in order to derive the maximum benefit of the Symposium **recommended:**

That contributions to the Symposium, including the Proceedings, be published as a special publication of ICNAF in 2000 copies.

d. **Statistics and Sampling:**

A number of decisions and recommendations were made in order to guide the collection, compilation and publication of data. Thus it was **recommended:**

That Statistical Bulletin Table 1 be expanded to include American Plaice, Witch, Yellowtail, Winter Flounder, Wolffish, Pollock, Silver Hake and White Hake.

That member countries sample their redfish statistics in an attempt to report the distribution of redfish effort in six depth zones from 51-350 fathoms for each gear, division and month.

That timely reporting of statistics can be achieved by urging all countries to submit annual statistics reports before the May 1st deadline.

That special reports on discards be prepared by each country for the 1962 Annual Meeting.

A series of recommendations and proposals for revision of the Prescribed Statistics Forms (ESTANA) were elaborated and submitted to the ESTANA Working Party meeting in Washington June 6th.

e. **Gear Research and Selectivity:**

The research work during the year was reviewed and plans for future work were discussed and recommendations were adopted (see Red Book, 1961), i.a.

That ICNAF adopt, for research purposes, the measuring gauge finally chosen by the ICES Comparative Fishing Committee.

f. **Ageing Techniques:**

Work carried out during the year was reviewed and plans for future work were considered, especially as to (1) Techniques used in age readings (2) Interpretations of zone structures in otoliths and (3) Uniform set of terms and symbols. It was decided that the exchange of cod and halibut otoliths should continue and that an exchange of redfish otoliths should be initiated.

It was **recommended:**

That a small group of scientists should meet in Bergen, Norway (at their Government's expense) in autumn 1963 for the study of ageing techinques.

g. **General Recommendations:**

Recommendations as to the publishing of papers prepared for the 1961 Annual Meeting were made (see Red Book, 1961).

The Committee considered the rapid expansion in recent years of oceanographic researches. It stressed the great interest such studies had for fisheries research and made a recommendation to the Commission which resulted in the resolution cited under Section 19.

In the course of the Annual Meeting the following lectures were given:

Dr. W. R. Schevill—Whales and porpoises, their distribution and noises.

Dr. G. Rollefsen—The new aquarium and Institute of Marine Research at Bergen.

Dr. R. J. H. Beverton was elected Chairman of the Research and Statistics Committee, for the ensuing year.

15. **Reports of Meetings of Panels** (Item 4 10, 11, 19)

In the meetings of the five panels the status of the fisheries, the researches carried out and plans for future work were discussed based on the reports by the groups of scientific advisers. All panels noted that no changes in memberships were proposed.

(a) **Panel** 1 noted the endorsement by the group of advisers of the proposals for co-operative research in Subarea 1 and neighbouring waters made by the Environmental Working Group (1961 Red Book) and expected that arrangements could be made by representatives of member countries to plan such researches.

The panel considered the Report by the Assessment Group, and **recommended**:

That mesh size regulation should be introduced into the subarea as soon as possible in order to safeguard future stocks, and proposed that the minimum mesh size for all groundfish should be $4\frac{1}{2}''$ or 114 mm measured by the ICNAF gauge (which corresponds to 110 mm as measured by the ICES (research) standard gauge).

The panel considered, however, that it would be desirable to have the same minimum mesh size in, at any rate, the four northern subareas of the Convention Area, and the proposal is made on the understanding that similar mesh regulation arrangements are made in Subareas 2, 3 and 4, subject to any necessary exemption for certain species in those other subareas.

Mr. Klaus Sunnanaa (Norway) was elected Chairman for the next two years.

(b) **Panel 2.** In the absence of the Chairman, Dr. Ju. Ju. Marty, it was agreed that Mr. G. R. Clark act as Chairman. The panel considered the Report by the Assessment Group and, after several countries had expressed the desirability of a uniform mesh size through the Convention Area, the panel **recommended:**

That a trawl mesh size regulation of 110 mm as measured by the ICES (research) standard longitudinal pressure gauge, or 114 mm ($4\frac{1}{2}''$) as measured by the present ICNAF gauge, be introduced in Subarea 2 for cod, redfish, flatfishes and all other groundfish species.

The panel further considered the possibility of international inspection of mesh size regulation and agreed (1) that the Commission give consideration to the question of enforcement of mesh size regulations in the Convention Area (2) that an *ad hoc* committee of appropriate personnel be appointed to study the problem with a view to the question of an international inspection system being considered at the 1962 Annual Meeting.

Mr. B. C. Engholm (U.K.) was elected Chairman for the two ensuing years.

(c) **Panel 3.** Following a review by Mr. Beverton of the Assessment Report a general discussion issued and the Panel agreed to **recommend:**

That a trawl mesh size of 110 mm as measured by the ICES (research) standard longitudinal pressure gauge, or 114 mm ($4\frac{1}{2}''$) as measured by the present ICNAF gauge be introduced for cod, haddock, flatfishes, and all other groundfish species in Subarea 3 with the exception of redfish in Divisions 3N, 3O and 3P; that for these latter Divisions the Scientific Advisers of this Panel should study the effects on the redfish fishery of mesh size increases from the present small mesh up to 4" by $\frac{1}{4}''$ intervals and have the results available for the 1962 Annual Meeting; and that the present exemption clauses should be maintained for Divisions 3N, 3O and 3P.

Dr. G. K. Izevsky (U.S.S.R.) was elected Chairman for the two ensuing years.

(d) **Panel 4.** After a full discussion of the Assessment Report and consideration of the effects of increased mesh sizes on the fisheries it was concluded that no change from the $4\frac{1}{2}''$ minimum mesh size for use in fishing cod and haddock would be recommended. The Panel, however, **recommended:**

That the existing regulation be extended to the fishing for flounders.

Scientific advisers were asked to undertake further work to provide a basis for minimum mesh size regulations for use in fishing other species, particularly redfish.

A proposal to prohibit use of topside chafing gear was considered. A small group was appointed to consider the problem and to report its findings to the Panel at the 1962 Meeting.

Dr. G. Cannone (Italy) was elected Chairman for the next two years.

(e) **Panel 5.** After consideration of the Assessment Report it was decided not to recommend any change in mesh regulation for cod and haddock. The possible introduction of $4\frac{1}{2}''$ mesh size for use in the flounder fishery should be considered.

It was noted that there is now evidence that it may be advantageous to use a minimum ring size in scallop drags and it was agreed that the scientific advisers be asked to provide a basis for considering an appropriate regulation at the next Annual Meeting.

Mr. H. R. Earle (Canada) was elected Chairman for the two ensuing years.

16. Resolution on Harp and Hood Seals (Item 12)

After consideration in the Plenary Sessions and in meetings of the Commissioners, the Commission agreed unanimously to the following **resolution:**

"That the Commission request the Depositary Government to formulate and circulate for consideration by the member Governments an appropriate amendment to the present Convention providing (1) that harp and hood seals of the Northwest Atlantic area be brought under the provisions of the International Convention for the Northwest Atlantic Fisheries (2) that a separate Panel be established for the purpose of dealing with the conservation requirements of the harp and hood seal populations. AND FURTHER THAT the Commission request the Depositary Government to take such additional consequential action as would be necessary to open such document for signature by the Parties to the Convention."

17. Proposal for Trawl Regulations in Subarea 1, 2 and 3 (Item 11)

Based on recommendations by Panels 1, 2 and 3 the Commission agreed that:

1. The Contracting Governments take appropriate action to prohibit (except as provided in paragraphs 2 and 3) the taking of groundfish in Subareas 1, 2 and 3 by persons

under their jurisdiction with trawl nets or seine nets (hereinafter called nets) having a mesh size less than 114 millimeters or $4\frac{1}{2}''$ as measured by the ICNAF gauge specified in paragraphs (a) and (b) below. These mesh sizes relate to manila twine when measured wet after use or less than the equivalent thereof when measured dry before use. When nets other than manila are used, they shall have a selectivity equivalent to that of a 114 millimeter or $4\frac{1}{2}''$ manila trawl net. For the purpose of this proposal the 114 millimeter or $4\frac{1}{2}''$ 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 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.

2. The prohibition set out in paragraph 1 shall not apply to the taking of redfish (genus *Sebastes*) in the statistical Divisions 3N, 3O and 3P of Subarea 3.

3. In order to avoid impairment of fisheries conducted primarily for redfish (genus *Sebastes*) in the area specified in paragraph 2 and which take small quantities of groundfish incidentally, the Contracting Governments permit persons under their jurisdictions to take groundfish with nets having a mesh size less than that proposed in paragraph 1 so long as such persons do not have in possession on board a vessel fishing primarily for redfish, cod (together with other groundfish with the exception of haddock and redfish) or haddock (together with other groundfish with the exception of cod and redfish) in amounts in excess of 10% by weight for each of all fish on board such vessel.

4. 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 5, which would obstruct the meshes of the nets or which would otherwise, in effect, diminish the size of the meshes of the nets.

5. The Contracting Governments permit (1) any canvas, netting, or other material to be attached to the underside only of the cod-end of a 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 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 1. For the purposes of this sub-paragraph, the 114 mm. or $4\frac{1}{2}''$ 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 1 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 be fastened in such a manner that it extends forward of the splitting strap no more than 4 meshes and ends not less than 4 meshes in front of the codline mesh.

(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.

6. In these regulations groundfish shall include all those species defined as such in the Statistical Bulletin of ICNAF. Cod shall be defined as *Gadus morhua* L.; haddock as *Melanogrammus aeglefinus* (L); and redfish as the genus *Sebastes*.

7. These provisions as regards mesh regulation shall be substituted for those at present in force in Subarea 3.

18. **Proposal for Trawl Regulations in Subarea 4** (Item 11)

Based on recommendation by Panel 4 the Commission agreed that:

1. The Contracting Governments take appropriate action to prohibit (except as provided in paragraph 2) the taking of cod, *Gadus morhua* L., haddock, *Melanogrammus aeglefinus* (L), and flounders (witch), *Glyptocephalus cynoglossus* (L); yellow-tail, *Limanda ferruginea* (Storer); winter flounder, *Pseudopleuronectes americanus* (Walb,); and American plaice, *Hippoglossoides platessoides* (Fabr.) in Subarea 4 by persons under their jurisdictions with trawl nets, or seine nets (hereinafter called nets) having a mesh size less than 114 millimeters or $4\frac{1}{2}''$ manila twine as measured by the ICNAF gauge specified in sub-paragraphs (a) and (b) below when measured wet after use or less than the equivalent thereof when measured dry before use. When nets other than manila are used, they shall have a selectivity equivalent to that of a 114 millimeter or $4\frac{1}{2}''$ manila net. For the purpose of this proposal the 114 millimeter or $4\frac{1}{2}''$ 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.

2. In order to avoid impairment of fisheries conducted primarily for other species and which take small quantities of cod, haddock and flounders incidentally, the Contracting Governments permit persons under their jurisdictions to take cod, haddock and flounders with 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, haddock, or flounders in amounts in excess of 5000 lb or 2,268 kg for each, or ten per cent by weight for each, of all fish on board such vessel, whichever is greater.

3. 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 4, which would obstruct the meshes of nets or which would otherwise, in effect, diminish the size of the meshes of the nets.

4. The Contracting Governments permit (1) any canvas, netting, or other material to be attached to the underside only of the cod-end of a net to reduce and prevent damage and (2) a rectangular piece of netting to be attached to the upperside of the cod-end of the 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 1. For the purposes of this sub-paragraph, the 114 mm. or $4\frac{1}{2}''$ 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 1 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 be fastened in such a manner that it extends forward of the splitting strap no more than 4 meshes and ends not less than 4 meshes in front of the codline mesh.

   (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.

5. These provisions as regards mesh regulation shall be submitted for those at present in force in Subarea 4.

19. Resolution on Oceanography (Item 20)

Following a recommendation by the Standing Committee on Research and Statistics the Commission adopted the following **resolution**:

The Commission

Taking into account that the need for a more thorough knowledge of marine processes in relation to fisheries has been urged at several ICNAF meetings;

That this year the Commission is considering the initiation of a most important programme of fisheries-environmental research; and

That this can only be successful, for example, if the oceanic regime over a wider area is more thoroughly understood;

Considering that such understanding can be obtained much more quickly with the assistance of the national and international oceanographic bodies; and

That fisheries research has its own responsibilities but would welcome the collaboration of these bodies, and in return is convinced that it can further their investigations by focussing attention on vital gaps in practical knowledge

Urges member countries, recognizing the complimentary nature of fisheries and oceanographic research,—

(a) to insure that their national delegations to relevant international bodies, and in particular at the forthcoming and future meetings of the Intergovernmental Oceanographic Commission under UNESCO, be fully briefed on the oceanographic aspects of fisheries, research; and

(b) to work for the establishment of an international committee which might be convened by FAO, in consultation with national and intergovernmental bodies concerned with fisheries and fishery research, with the responsibility of providing advice to the Intergovernmental Commission under UNESCO on oceanographic aspects of fisheries research.

20. Appointment of an ad hoc committee to study the question of the establishment of an international inspection system (Item 20)

Following a proposal by Panel 2, the Commission adopted the following resolution:

> "That an *ad hoc* committee consisting of the Chairman of the Commission and the Chairmen of the Panels be appointed to study during the coming year the question of the establishment of an international inspection system and the practical problems related thereto, and to report to the Commission at its Annual Meeting in June 1962."

21. Election of Chairman and Vice-Chairman (Item 21)

Mr. G. R. Clark, Canada, was elected Chairman of the Commission for the ensuing two years.

Mr. B. Dinesen, Denmark, was elected Vice-Chairman of the Commission for the ensuing two years.

22. Acknowledgement and Adjournment (Items 20 and 22)

Mr. Sargent (U.S.A.) expressed the Commission's high appreciation of the excellent work accomplished by the scientists during the first decade of the Commission's history.

The Chairman thanked the Government of the United States for placing at the Commission's disposal for its Annual Meeting the excellent facilities in the State Department and in the Fish and Wildlife Service's Laboratory in Woods Hole. He further thanked the Marine Biological Association at Woods Hole for providing accommodation for the Tagging Symposium. He extended to the U. S. Government and also to the National Fisheries Institute the Commission's sincere thanks for their cordial hospitality. He continued by expressing to the Commission's staff and the additional staff provided by United States Government the Commission's grateful appreciation for the work done during the meetings. Finally he thanked the Commissioners and other members of the delegation for their helpful co-operation and for the excellent work accomplished during the Annual Meeting.

Dr. Izevsky, U. S. S. R. thanked the United States Government for the hospitality extended to the Commission and for the excellent facilities provided for the meetings He expressed his sincere appreciation of the great work the Chairman had accomplished in conducting this Annual Meeting and concluded by thanking the Executive Secretary for his able management of the secretarial work.

As there was no further business, the Eleventh Annual Meeting was adjourned.

APPENDIX I
LIST OF PARTICIPANTS

CANADA:

Commissioners:

- Mr. G. R. Clark, Deputy Minister, Dep. of Fish., Ottawa, Ontario.
- Mr. J. H. MacKichan, General Manager, United Maritime Fishermen Ltd., Halifax, N. S.
- Mr. H. R. V. Earle, President, Earle Sons & Co. Ltd., St. John's, Newfoundland.

Advisers:

- Dr. J. L. Hart, Director, Fish. Res. Board of Canada, Biological Station, St. Andrews, New Brunswick.
- Mr. V. M. Hodder, Fish. Res. Board of Canada, Biological Station, St. John's, Newfoundland.
- Mr. D. F. Holmes, Dep. of Fisheries, Halifax, N. S.
- Mr. J. H. LeBreton, Robin, Jones and Whitman, Paspebiac, P.Q.
- Mr. J. M. Lewis, Chief, Economics Intelligence, Dep. of Fish., Ottawa, Ont.
- Dr. W. R. Martin, Fish. Res. Board of Canada, Biological Station, St. Andrews, N. B.
- Mr. A. Proulx, Dep. of Fish., Ottawa, Ont.

Mr. H. D. Pyke, National Sea Products, Lunenburg Sea Products Division, Lunenburg, Nova Scotia.

Dr. Wilfred Templeman, Director, Fish. Res. Board of Canada, Biological Station, St. John's, Newfoundland.

DENMARK:

Commissioners:

Mr. B. Dinesen, Departementschef, Ministry of Fisheries, Borgergade 16 Copenhagen K.

Dr. Paul M. Hansen, Chief, Greenland Fishery Research, Charlottenlund.

Advisers:

Dr. E. Bertelsen, Director, Danmarks Fiskeri- og Havundersøgelser, Charlottenlund.

Mr. N. Bjerregaard, Chairman, Danish Fishermen's Association, Frederikshavn.

Mr. E. Jacobsen, Fisheries Attaché, Danish Consulate General, New York.

Mr. Svend O. Horsted, Greenland Fishery Research, Charlottenlund.

FRANCE:

Commissioners:

Mr. L. J. Audigou, Shipping Attaché, French Embassy, Washington, D. C.

M. A. Ravél, Sous-Directeur, Direction des Pêches Maritimes, Secr. d'Etat à la Marine Marchande, Paris.

Advisers:

Dr. J. Ancellin, Chef du Laboratoire de l'Institut Scientifique et Technique des Pêches Maritimes, Boulogne sur Mer.

M. A. Dezeustre, Directeur des Pêcheries de Bordeaux-Bassens, Bordeaux.

M. E. LeBoeuf, Chef du Quartier de l'Inscription Maritime, St. Pierre & Miquelon.

GERMANY:

Commissioners:

Mr. G. Moecklinghoff, Ministry of Agriculture, Bonn.

Dr. G. Krefft, Federal Research Institute for Fisheries, Hamburg.

Mr. M. H. Rehder, Association of German Deep Sea Fisheries, Bremen.

ICELAND:

Commissioner:

Dr. Jón Jónsson, Director, Fisheries Research Institute, Reykjavik.

ITALY:

Commissioner:

Dr. G. Cannone, Conselheiro 1st Class, Ministero Marina Mercantile, Rome.

NORWAY:

Commissioners:

Mr. Klaus Sunnanaa, Director of Fisheries, Bergen.

Dir. G. Rollefsen, Director, Institute of Marine Research, Bergen.

PORTUGAL:

Commissioner:

Captain T. de Almeida, Captain, Portuguese Navy, Praça Duque da Terceira 24, 1° Lisbon.

Advisers:

Dr. Emygdio Cadima, Comissão Consultiva Nacional das Pescarias do Noroeste do Atlantico, Gabinete das Pescas, Lisbon.

SPAIN:

Commissioner:

Mr. Enrique Dominguez Passier, Commercial Counsellor, Embassy of Spain, Washington, D. C.

Advisers:

Dr. O. Rodriguez Martin, Direccion General de Pesca Maritima, Alarcon 2, Madrid.

Capt. J. L. Arambarri, Delegado de PYSBE, 7 Topsail Road, St. John's, Nfld.

UNION OF SOVIET SOCIALIST REPUBLICS:

Commissioner:

Dr. G. K. Izevsky, Res. Inst. of Mar. Fish. and Oceanogr., Moscow.

Advisers:

Mr. Peter I. Pogodin, Embassy of the USSR, Washington, D.C.

Mr. G. A. Semin, Res. Inst. of Mar. Fish. and Oceanogr., Moscow.

Mr. S. A. Studenetsky, Res. Inst. of Mar. Fish. and Oceanogr., Kaliningrad.

Mr. A. A. Volkov, Main Fish. Dep. State Planning Committee of the USSR, Moscow.

UNITED KINGDOM:

Commissioners:

Mr. B. C. Engholm, Fisheries Secretary,

Ministry of Agriculture, Fisheries and Food, London, S.W. 1.
Mr. R. J. H. Beverton, Deputy Director of Research, Fisheries Laboratory, Lowestoft, Suffolk.
Dr. C. E. Lucas, Director, Marine Laboratory, Aberdeen.

Adviser:
Mr. B. B. Parrish, Marine Laboratory, Aberdeen.

UNITED STATES:

Commissioners:
Mr. Thomas A. Fulham, Fulham Brothers, Inc., Boston, Mass.
Mr. Francis W. Sargent, Executive Director, Outdoor Recreation Resources Review Commission, Washington, D.C.

Advisers:
Mr. Frank P. Briggs, Assistant Secretary for Fish and Wildlife, Dep. of the Interior, Washington, D.C.
Mr. W. C. Herrington, Special Assistant for Fisheries and Wildlife to the Under Secretary, Dep. of State, Washington, D.C.
Mr. C. Pautzke, Commissioner of Fish and Wildlife, Dep. of the Interior, Washington, D.C.
Mr. D. L. McKernan, Director, Bur. of Com. Fish., Fish and Wildlife Service, Dep. of the Interior, Washington, D.C.
Mr. A. W. Anderson, Regional Fishery Attaché (Europe), American Embassy, Copenhagen.
Mr. Stuart Blow, Office of the Special Assistant for Fisheries and Wildlife to the Under Secretary, Dep. of State, Washington, D.C.
Miss Isla V. Davies, Office of the Special Assistant for Fisheries and Wildlife to the Under Secretary, Dep. of State, Washington, D.C.
Mr. Howard Eckles, Chief, Branch of Marine Fisheries, Div. of Biological Research, Bur. of Com. Fish., Fish and Wildlife Service, Dep. of the Interior, Washington, D.C.
Dr. R. L. Edwards, Bur. of Com. Fish., Fish and Wildlife Service, Dep. of the Interior, Woods Hole, Mass.
Mr. John Gharrett, Regional Director, Bur. of Com. Fish., Fish and Wildlife Service, Dep. of the Interior, Gloucester, Mass.
Dr. Herbert Graham, Bur. of Com. Fish., Fish and Wildlife Service, Dep. of the Interior, Woods Hole, Mass.
Mr. R. Hennemuth, Bur. of Com. Fish., Fish and Wildlife Service, Dep. of the Interior, Woods Hole, Mass.
Mr. John I. Hodges, Chief, Branch of Resource Management, Bur. of Com. Fish., Fish and Wildlife Service, Dep. of the Interior, Washington, D.C.
Dr. J. L. McHugh, Chief, Div. of Biological Research, Bur. of Com. Fish., Fish and Wildlife Service, Dep. of the Interior, Washington, D.C.
Mr. Max C. McLean, Oceanographer, Woods Hole Oceanographic Institute, Woods Hole, Mass.
Mr. Edward Power, Chief, Branch of Statistics, Div. of Industrial Research Bur. of Com. Fish., Fish and Wildlife Service, Dep. of the Interior, Washington, D.C.
Mr. Thomas Rice, Special Assistant to the Commissioner of Fish and Wildlife, Dep. of the Interior, Washington, D.C.
Mr. John Skerry, Bur. of Com. Fish., Fish and Wildlife Service, Dep. of the Interior, Gloucester, Mass.
Mr. William M. Terry, Director, Office of International Relations, Fish and Wildlife Service, Dep. of the Interior, Washington, D.C.

Secretary of Delegation:
Mrs. Marian S. Stilson, Office of International Conferences, Dept. of State, Washington, D.C.

POLAND:

Observers:
Mr. Edward Kmiecik, First Secretary, Embassy of the People's Republic of Poland, Washington, D.C.
Mr. Witold Jurasz, Office of the Economic Minister, Embassy of the People's Republic of Poland, Washington, D.C.

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

Observers:

Mr. Sidney J. Holt, Chief, Fisheries Biology Branch, FAO, Rome.
Dr. Mario Ruivo, Chief, Program Research Section, Fisheries Div., FAO Rome.

INTERNATIONAL NORTH PACIFIC FISHERIES COMMISSION

Observer:
Mr. H. Kasahara, Assistant Director, INPFC, Vancouver 8, B.C.

INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA:

Observer:
Dr. A. Fridriksson, Secretary General, International Council for the Exploration of the Sea. Charlottenlund, Denmark.

GREAT LAKES FISHERY COMMISSION:

Observer:
Mr. N. S. Baldwin, Executive Director, GLFC, Ann Arbor, Michigan.

INTERNATIONAL PACIFIC HALIBUT COMMISSION:

Observer:
Mr. Richard J. Myhre, IPHC, University of Washington, Seattle, Washington.

INTERNATIONAL FISHERIES CONVENTION 1946:

Observer:
Mr. K. Sunnanaa, Directorate of Fisheries, Bergen, Norway.

ADVISORY COMMITTEE TO THE UNITED STATES COMMISSIONERS:

Observer:
Mr. Robert Dow, Industry Adviser, Research Director, State of Maine, Dep. of Sea and Shore Fish, Augusta, Maine.

ICNAF SECRETARIAT:

Dr. Erik M. Poulsen, Executive Secretary.
Mr. Frank R. Thomas, Biologist-Statistician.
Miss Jean Maclellan, Secretary.
Miss Joan Edwards, Clerk-Stenographer.
Miss Else Poulsen, Typist.

ADDITIONAL CONFERENCE SECRETARIAT, U.S. State Department:

Mr. Dominus C. Davis, Press Officer.
Mr. Eugene R. Schelp, Administrative Officer
Mrs. E. McAllister, Registration and Information Officer.
Miss Dorothy Dalke, Stenographic Services.
Miss Elvina Dassatti, Stenographic Services.
Mrs. Joan D'Epiro, Stenographic Services.
Miss Carol Rapp, Stenographic Services.
Miss Janet Smith, Stenographic Services.
Mrs. Nori L. Uchida, Stenographic Services.
Miss Mamie Yancey, Reproduction Services.
Mr. Glenn Sorenson, Electronics Officer.
Mr. David Fabian, Electronics Officer.
Mr. Randolph Coyle IV, Order-of-the-Day . Officer

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 (vide Meeting Document No. 1).
5. Report on staff matters, with presentation of the Administrative Report 1960/61 and financial statements for 1960/61.
6. Presentation of Auditor's Report for the financial year 1959/60 (Annual Proceedings Vol. 10, pp. 7-9).
7. Consideration of budget estimate for 1961/-62 (See Appendix 1 to Agenda for the Committee on Finance and Administration).
8. Consideration of advance budget estimate for 1962/63 (See Appendix 2 to Agenda for the meetings of the Committee on Finance and Administration).
9. Consideration of "Annual Returns" showing inspections carried out in connection with ICNAF trawl regulations. Further, the appointment of an *ad hoc* committee to consider the collected information (vide

Chairman's Report, Item 10, 1958 Annual Meeting—Annual Proceedings Vol. 8, p. 12).

10. Review of the work carried out by the group of population scientists on Fishery Assessment in Relation to Regulation Problems (vide Chairman's Report of the 1959 Annual Meeting, item 13 — Annual Proceedings Vol. 9, p. 14).
11. (a) Review of current mesh size regulations.
    (b) Possible amendments or additions to mesh size regulations.
12. Consideration of conservation measures for harp and hood seal populations of the Northwest Atlantic area.
13. Reports by ICNAF observers on meetings of other organizations during the preceding year.
14. Date and place of Annual Meeting 1962.
15. Review of the work carried out by the group on Environmental Researches (vide Chairman's Report of the 1960 Annual Meeting, item 14b, Annual Proceedings Vol. 10, p. 13).
16. Invitation from ICES to attend its Herring Symposium, Copenhagen, September 1961.
17. Report on the meetings of the Standing Committee on Research and Statistics, May-June 1961.
18. Report on the meetings of the Standing Committee on Finance and Administration, June 1961.
19. Reports on meetings of Panels 1-5.
20. Other business.
21. Election of Commission's Chairman and Vice-Chairman for the two ensuing years.
22. Adjournment.

PART 3

Summaries of Research 1960

A. Summaries by Countries

I. Canadian Research Report, 1960

A. SUBAREAS 2 AND 3 — BY W. TEMPLEMAN

In 1960 researches have been carried out by the Fisheries Research Board of Canada in Subareas 2 and 3 on cod, haddock, redfish and American plaice. Between July 23 and August 25 six hydrograhic sections were taken. These ranged from southern Labrador to the southern Grand Bank, and from the coast to the edge of the continental shelf, usually to 1000 metres.

Cod, *Gadus morhua* L. Sampling of cod in the Labrador area was intensified during 1960 and cod catches were sampled in 13 inshore areas between Fishing Ship Hr. and Nachvak Fjord. These inshore collections were mainly from the commercial trap and jigger fishery. Offshore sampling of cod stocks was carried out by the "A. T. Cameron", mainly in the Hamilton Inlet Bank area. Age readings from otoliths collected inshore indicate that the most abundant year-classes are those of 1948 and 1950. Older fish were more numerous in the 1960 samples than in those of 1959. Growth curves from the inshore material show the usual picture of slow growth for the area, and slower growth in the north than in the south.

Catch and effort data were collected for the Bonavista cod fishery during the 1960 season and sampling was carried out in July and September. In most of the Newfoundland shore areas the 1960 fishery for cod was quite successful but in Bonavista catches declined below the 1959 level. Landings at Bonavista decreased to 7,100,000 pounds of cod during 1960 compared with 9,600,000 pounds in 1959, 8,700,000 pounds in 1958 and 15,300,000 pounds in 1957. Of the 1960 total 39% was from handlines (both jigs and baited hooks), 39% from traps, 4% from linetrawls and 18% from longlines.

Because of higher water temperatures in the inshore areas following a warm 1959-1960 winter, the inshore fishery at Bonavista began somewhat earlier than in 1959 and by the end of June landings from all gears amounted to 700,000 pounds higher than at the same period in 1959. Following June, however, monthly landings generally fell below those of similar periods in 1959 and the season ended with the total cod landings about 25% less than in 1959. Particularly in the handline and longline fisheries was the decrease noted, with the totals from each of these gears about 30% less than in 1959.

Since 1952, trends in the fishery at Bonavista by different gears have been studied. In 1953 the average catch per haul in the trap fishery was low. During the entire period the best average catch for cod traps was 5,300 pounds per haul during the 1954 season. Since that time there has been a steady decline to a low of 2,600 pounds per haul in 1960, less than half of what it was in 1954. In 1958 there were low average catches for all gears. This was widespread outside the Bonavista area as well, and was due in large measure to unusually stormy weather and, for the line gears, to a shortage of suitable squid bait.

In the handline fishery during the observed years there was more irregularity in the catch per unit of effort than for the traps, dropping to a low in 1953 following which there was an increase up to 1956 and then another decline to 1958 after which some improvement is shown. Poor fishing conditions in 1958 reduced the average in that year, so that, discounting this, there probably has been a relatively small decline in the average catch since 1957.

In the longline fishery, for the offshore deepwater grounds the average catch of cod per line of gear was reasonably stable from 1952-1955 but there has been a steady decline in the average in subsequent years. For the inshore grounds fished by longline, although some irregularity is evident in the earlier years, the same decline is apparent in the catch from 1956 onward.

From yearly observations made on the length-frequency distribution of the cod catch by various inshore gears at Bonavista it is apparent that, to a very large degree, the success of the fishery by these gears is closely associated with the relative abundance of young fish supplying the fishery each year.

In the trap fishery the high average catch of 1954 can be attributed to the abundance of cod with a modal group at 58-59 cm in the distribution. From 1955-1958 relatively few young fish entered the trap fishery and the larger and older fish supporting it were reduced in numbers to such an extent that the catch per unit of effort declined. Not till 1959 and 1960 did a large new group appear with a modal group at 47-48 cm. These fish were relatively small and their greatest contribution by weight should be in future landings by the trap fishery.

Cod traps catch fish at a smaller size than handlines. Thus, when a large group of young fish first appears in the trap fishery its influence is not so great in the handline fishery until a year or two later. For this reason, although there were high average catches in the trap fishery of 1954, the best catches for the handlines came in 1955 and 1956.

In the longline deep-water fishery cod caught in the early years were largely part of old, virgin stocks. When these older fish became reduced in numbers the continued success of the fishery depended largely upon cod with a modal group at about 62-65 cm. However, during the past few years the fishery in and near the Bonavista area has been more intense due to heavy exploitation by large European trawlers and longliners in addition to the local longline fleet. As a result the cod making up the 62-65 cm modal group have been greatly reduced in abundance and this reduction is reflected in the decline in the catch per unit of effort from 1955 onward. This continuing decline may be attributed to the intense fishery and the scarcity of new cod entering to replenish the stocks.

The longline shoal water fishery usually occurs in the autumn. The cod catches from this fishery are from the same stock which supplies the inshore handline fishery and thus the trend in the catch per unit of effort resembles that for the handline fishery.

For the inshore cod-trap fishery about 4 to 5 years elapse between a spawning and the subsequent entrance of fish of that year-class to the fishery. For the deep-water longline fishery an additional 3 to 4 years must elapse before sufficient numbers of the fish remain in deep water throughout the summer and become available to the longlines. Thus, the 1955 year-class caught in abundance by cod traps in 1959 will probably not add appreciably to the longline catches in deep water before 1962 or 1963, at the earliest.

From 1957-1960 data on catches have been gathered from the cod-trap fishery in the St. John's area. The fishery by cod trap depends for success on the availability of cod which have moved to the coast pelagically in the shallow warm surface water layers. Prospects for a successful cod fishery are generally much better following a cold winter and when the cold intermediate water layer extends so close to the surface that the cod are heavily concentrated in the shallow warm surface layer. After a cold winter the trap fishery is usually later in starting than after a warm winter, but will generally continue much later in the season unless summer storms produce severe mixing of the surface waters.

An examination of mean air temperatures at St. John's Airport from 1956-1960 showed that the winters of 1956-1957 and 1958-1959 were quite cold while the other two winters were warm. In 1957 the trap fishery at St. John's began in late June, in 1959 not till the first part of July. In both these years because of the large volume of the cold intermediate water layer, cod were concentrated within range of the traps until the first part of August and catches remained at a fairly high level. In 1958, after a relatively warm winter, the trap fishery began early in June with good catches. By the middle of July, however, the warm water of the surface layer extended deeply enough to permit cod to move out of the range of the traps and catches declined to an unprofitable level. In 1960 the trap fishery began in early June with good catches occurring early in the fishery and increasing in July following which there was a gradual decline. However, good catches occurred even in the first part of August, much later than would usually be expected following a warm winter. Although temperatures near the surface were high the summer was unusually calm and very little mixing occurred between the warm surface layer and the colder water below. With favourable weather continuing through the summer many fishermen kept operating their traps even though catches were considerably below those obtained in July.

Ages of cod from the St. John's inshore fishing area were determined from otoliths of trap-caught fish obtained from 1958-1960. In 1958 the 1953 year-class made up 40% of the catch by number, the 1952 year-class 27%. The strength of these year-classes was reflected in a strong modal group at 49-55 cm in the length distribution of the catch. In 1959 the abundant 1955 year-class accounted for 31% and together with the somewhat less abundant 1954 and 1953 year-classes for 70% of the catch by number. The 1955 year-class had a modal length of 48-50 cm in the 1959 length distribution. In 1960 the 1955 year-class accounted for over 60% of the trap catch by number and had a modal length of 51-53 cm.

It is apparent from this preliminary examination of ages that a particular year-class, even a strong one, only contributes appreciably to the cod-trap fishery for a short period. The 1953 year-class which comprised about 40% of the catch by number in 1958 made up less than 20% of the catch in 1959 and only about 5% in 1960. It is highly probable that this reduction was not due entirely to mortality for apparently, as the cod grow older, large numbers remain in deeper water out of the range of the traps.

Age readings from otoliths of cod collected from the Burin inshore area during 1959 and 1960 indicated best survival of the 1955 year-class, followed by moderate survival of the 1952, 1953, 1954 and 1956 year-classes. The linetrawl catches contained older fish than those from the trap or jig. The data suggest that 4-year-old fish are not fully recruited to the trap gear. Preliminary growth curves showed a moderate rate of growth with very little difference between the growth rates of the 1959 and 1960 samples.

During Cruise No. 26 of the "A. T. Cameron" to the Labrador Shelf (Fig. 1) significant catches of cod were made at 100-125 fathoms on the

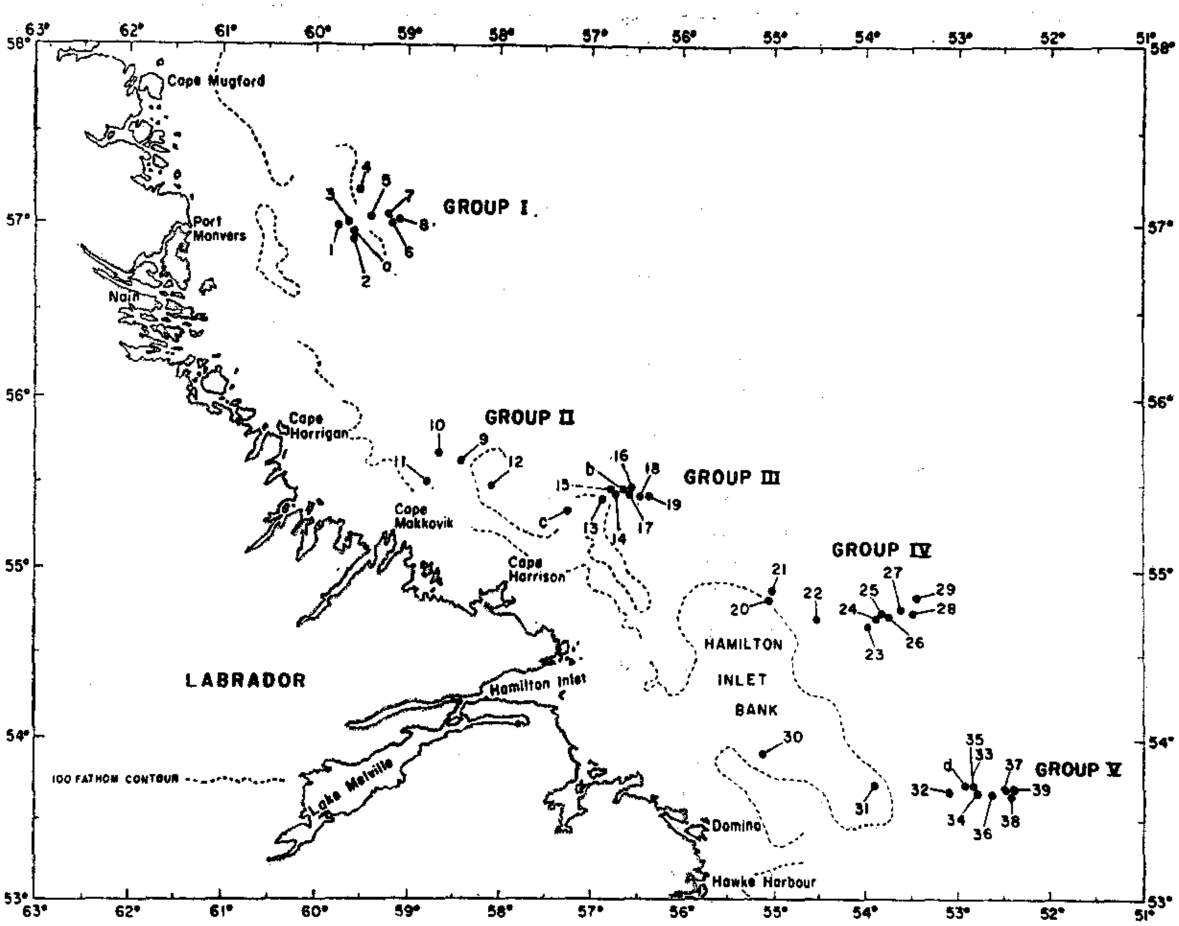

Fig. 1. **Locations of 1/2-hour otter-trawl drags by the "A.T. Cameron", Cruise 26 to the offshore Labrador Shelf, July 28 - Aug. 13, 1960.**

northeastern slope of Hamilton Inlet Bank (Group IV) especially at 125 fathoms (Station 22) where 3,000 pounds of cod were taken in a 1/2-hour drag at a bottom temperature of -0.17°C.

The series of surveys begun in the fall of 1959 to gather information on the inshore distribution and abundance of small cod of the 0+, 1+ and 2+ age-groups was continued in September and October 1960. The gear used in both years was a small Danish seine with a small-meshed, lined codend. The seine was used to explore beaches in the eastern Newfoundland area. Beaches found to be suitable for operating the gear in 1959 were visited again in 1960 and, in addition, explorations were extended to St. Mary's Bay and Notre Dame Bay and more beaches were explored in Trinity Bay and Bonavista Bay.

In all, 97 successful sets were made. The average number of cod of the 0+ group was 16 per set and older cod (mainly 1 year olds) 64 per set. In 1959 the 0+ cod averaged 50 per set and the older cod only 7 per set. On the basis of these surveys it appears likely that the 1960 year-class of inshore cod is less abundant than that of 1959.

Cod of the 0+ group had a modal length of 7 cm in Notre Dame Bay and Trinity Bay and 9 cm on the southern shore of the Avalon Peninsula. In the Trinity Harbour length distributions the mode of the 1960 year-class (0+ age), at 7 cm in October 1960, was 2 cm lower than that of the 0+ cod in October 1959. Cod of the 1+ age-group had a modal length as follows: Notre Dame Bay and Bonavista Bay, 15 cm; Trinity Bay and Conception Bay, 16 cm; southern shore of the Avalon Peninsula, 14 cm; St. Mary's Bay, 13 cm.

In Bonavista Bay, in the Chandler Reach catches, the modal length of the 1959 year-class shifted from 6 cm in October 1959 to 15 cm in October 1960, an increase of 9 cm for the year. In Conception Bay the mode of the length frequency of the 1959 year-class changed from 8 cm in early October 1959 to 16 cm in late September 1960, a growth of 8 cm for the year.

Haddock, *Melanogrammus aeglefinus* (L.). The annual groundfish otter-trawling survey over the haddock area of the southern half of the Grand Bank was made by the "A. T. Cameron" on April 23-30 and May 11-12, 1960. During these surveys each drag of the otter trawl is of 1/2 hour duration. In 1959, after a very cold winter, during the spring survey there were on the southwestern slope of the Grand Bank quantities of haddock at 100-125 fathoms and deeper, below an intermediate layer of below 0°C water, as well as in the shallower water above this cold layer. In 1960 after a warmer winter, there were very few haddock at 65 fathoms and deeper, but the best catches per 1/2-hour drag in the warmer water were 5 catches of 1,300-2,400 pounds at depths of 39-50 fathoms and bottom temperatures of 1.0 to 4.6°C and one of 9,500 pounds at 48 fathoms and 2.1°C.

As in the surveys of 1957-1959 the catches of haddock obtained during the St. Pierre Bank survey, June 3-10, were low. A total of only 1,060 pounds of haddock was caught in 37 sets at the regular survey positions extending over the shallow and deep-water areas of the bank where haddock are to be expected. Small and usually non-commercial concentrations of haddock, however, do exist, as indicated by catches of 1,200 and 730 pounds in 43-minute and 60-minute drags, respectively, from sampling sets (after the regular survey had been completed) in 90-120 fathoms on the southern part of the southwestern slope of the bank. These two small catches were obtained at bottom temperatures of 6.9°C, just below the cold intermediate layer. There has been no haddock fishery on this bank since 1956 and, because of the relative failure of year-classes since the very abundant one of 1949, it is unlikely that there will be a significant haddock fishery on St. Pierre Bank in the near future.

In July the "A. T. Cameron" carried out a savings gear cruise in the shallow 26-fathom depth of the central part of the Southeast Shoal of the Grand Bank. A total of 60 successful 40-minute sets were made resulting in catches of haddock mainly belonging to the 1955 and 1956 year-classes and almost all between 31 and 45 cm in fork length with peak catch sizes between 35 and 38 cm.

Four 40-minute drags produced catches over 20,000 pounds, the largest being 39,600 pounds; 16 catches ranged from 19,000-10,000 pounds; 25 catches were in the 10,000-5,000 pound range; the remaining 15 ranged between 5,000 and 850 pounds. The bottom temperatures throughout the experiment were between 3.1 and 4.2°C.

On the Grand Bank in recent years, year-classes of 1949 and 1955 have been the most successful and those of 1952, 1953 and 1956 survived only moderately well.

The once very abundant 1949 year-class had by 1960 been reduced in numbers to less than 2% of the research vessel catches. The 1952 and 1953 year-classes which, initially, were together probably not more than one-quarter as abundant as the 1949 brood, accounted for only 6%. None of these year-classes are now distinguishable as individual modes on the right limb of the length-frequency curve for 1960.

The success of the 1955 year-class was clearly evident by the large number of 1-year-old fish in 1956 followed by an even greater number of 2-year-old fish in the 1957 catches. By the spring of 1960 the mode of this group had progressed to 34-35 cm and in numbers accounted for 67% of the research vessel catches. The much less abundant 1956 year-class comprised about 16% of the survey catches as 4-year-old fish. This year-class in 1959 appeared to be about one-quarter as abundant as the 1955 brood and this evaluation still holds for the 1960 age-frequency data.

It takes 4 or 5 years for young Grand Bank haddock to grow large enough to enter the commercial fishery. The most recently successful year-classes, those of 1955 and 1956, were exploited in 1960 not only by the traditional Canadian and Spanish fleets but by a fleet of USSR factory vessels as well. The total haddock landings by all fleets from the Newfoundland banks (ICNAF Subarea 3) have decreased from a peak of 230 million pounds in 1955 to 77 million pounds in 1959, while Canadian landings are down from 107 million pounds in 1956 to 49 million pounds in 1959. Year-classes of 1957, 1958 and 1960 appear to be almost complete failures and survival of the 1959 year-class seems to be very low. As a result a crisis in the haddock fishery is evident with a rapidly declining population of haddock of commercial size in view at least for the period 1962-1964 and no significantly surviving year-classes of haddock later than those of 1955 and 1956 to provide a future commercial fishery.

Redfish, *Sebastes marinus mentella* Travin and *Sebastes marinus marinus* (L.). The comprehensive survey of the redfish of Subareas 2 and 3 by the "A. T. Cameron" (using a 41-5 otter trawl and 1/2-hour's dragging per set) has been continued during 1960 on the Northeast Newfoundland Shelf and on the southern part of the Labrador Shelf.

In the cruise to the Northeast Newfoundland Shelf (Aug. 20 - Sept. 1) no catches which could be considered indicative of good commercial fishing were obtained. Rather surprisingly the best catches of redfish occurred on the shallow bank area between Funk Island Deep and the edge of the continental shelf. The best catch, 2,380 pounds of redfish per 1/2-hour's dragging, was obtained at a depth of 150 fathoms in this area. Sets in the deeper parts of the Funk Island Deep (225-275 fathoms) showed redfish to be scarce though catches did improve on the seaward edge of the depression. Two lines of sets at standard depths across the edge of the continental shelf also yielded poor catches of redfish though on the more northern line in a set at 300 fathoms a catch of 1,400 pounds of large *mentella*-type redfish was obtained.

Thirteen *marinus*-type redfish were caught during sets in the Funk Island Deep and, rather strangely, none were taken in the four sets at depths of 120-180 fathoms across the shallower bank area. On the more northern of the two lines at the edge of the continental shelf the more usual distribution of *marinus* was found, specimens occurring in the sets at 150, 160, 180 and 200 fathoms with greatest numbers in the set at 180 fathoms, where 31 *marinus* averaging 5 pounds in weight wereobtained with 115 *mentella* averaging 1½ pounds.

Between July 28 and August 13, 1960 the "A. T. Cameron" explored the offshore waters of the Labrador Shelf along five lines or groups of stations (approximately between Lat. 57°N and 53°40′N) mainly between 100 and 400 fathoms (Fig. 1).

Noteworthy catches of redfish per 1/2-hour's dragging were 2,400 pounds *mentella* at 175 fathoms, Group IV, Station 25, NE of Hamilton Inlet Bank; 4,400 pounds, almost all large *marinus*, at 150 fathoms, Group V, Station 33, southeast of Hamilton Inlet Bank; 3,300 pounds mainly *mentella* at 200 fathoms, Group V, Station 36; and 3,900 pounds almost all *mentella*, at 250 fathoms, Group V, Station 37.

Except for one *marinus* in Group II all redfish in Groups I-III, north of Hamilton Inlet Bank were *mentella*.

In Group IV *marinus* occurred at 125-150 fathoms but were not abundant. *Mentella* occurred at 150-400 fathoms and were numerous from 175-250 fathoms. Almost all the redfish at 150 fathoms however were *marinus*.

On the southern line (Group V) where *mentella* were more abundant and *marinus* much more abundant, *marinus* ranged from 125-250 fathoms but were abundant only at 150-160 fathoms while *mentella* ranged between 125 and 400 fathoms and were abundant from 175-300 fathoms.

All large catches of *marinus* were at temperatures over 3°C and all large catches of the *mentella* were at temperatures of 4°C and over. The *marinus*, lying shallower, were living in lower temperatures than the *mentella*.

The *marinus* from this area were considerably larger and usually weighed from 2 to 3 times as much on the average as the *mentella* from the same set. In Group IV, the *mentella* increased in size with depth. In Group V the *mentella*, from the beginning of the large catches in 175 fathoms and proceeding deeper, increased in size with depth. There was also in this group a corresponding increase in size of *mentella* proceeding shallower from 175-150 fathoms. At 150 fathoms *mentella* were intermingled with far greater quantities of the large *marinus* and although they could be recognized as *mentella*, they had many characteristics more closely approaching the *marinus* than did the deep-water *mentella*. It is very likely that some of these *mentella* of the intermingling area of both types may have some *marinus* inheritance. However, the *marinus* of Group V also showed the same characteristic of increasing in size from 160-250 fathoms and also increasing in size from 160-125 fathoms. Numbers were small in both cases at each of the depth extremes and further investigations are needed to rule out the possible differential effects of time of day on movements of smaller and of larger redfish.

Information gathered during the "A. T. Cameron" surveys for haddock in April and May gave some information on redfish catches in relation to bottom temperatures. In 1959 the water at 80-100 fathoms on the southwestern slope of the Grand Bank was generally cold and redfish were scarce at these depths with an average catch (in four 1/2-hour sets at each depth) of 210 pounds at 80 fathoms (average bottom temperature -0.05°C) and of 1,170 pounds at 100 fathoms (1.2°C). In 1960 temperatures at these depths were considerably higher and the redfish catch was correspondingly greater - averaging (in four 1/2-hour sets at each depth at the same stations) 2,800 pounds in 80 fathoms (5.2°C) and 3,260 pounds at 100 fathoms (5.0°C). The redfish in this area are small *mentella*.

A study of the food and feeding of redfish is in progress. Unlike the other commercially important trawl-caught species in this area, the redfish is almost exclusively a pelagic feeder. The most important types of food are euphausiids, hyperiid amphipods, copepods and small fish. Smaller amounts of shrimps, mysids, squid, chaetognaths and ctenophores are eaten. Diet varies with the size of the redfish, the smaller food organisms being eaten by smaller redfish. There seem to be two major feeding periods during the day, during the ascent and descent phases of the nocturnal vertical migration. The intensity of feeding seems to be affected by the sexual cycle.

American plaice. *Hippoglossoides platessoides* (Fabr.). Growth curves from sveral localities indicate distinctly different growth patterns and it would appear highly likely that these can be used to identify populations.

During a survey by the "A. T. Cameron" along the eastern, northeastern and northern slopes of the Grand Bank from September 10-18 the best catches of plaice were taken in depths of between 60 and 150 fathoms on the eastern slope of the bank. The best catch, 4,800 pounds per 1/2-hour's dragging, was taken at a temperature usually considered high for plaice. 1.96°C, and at a greater depth 150 fathoms, than usual. The second largest catch, 2,700 pounds, was obtained in 60 fathoms at -1.06°C.

There was evidence from this survey that on the plateau and the 40-60 fathom slopes of the northeastern and northern Grand Bank where the bottom slopes vary gradually and temperatures are uniformly low there are fairly large numbers of small plaice of pre-commercial sizes.

A comparison of the incidence of jellied plaice from the 1960 survey on the northern and eastern Grand Bank with that recorded in 1950-1952 indicates a considerable reduction in this condition. Along the eastern and northeastern slope of the bank scarcely any jellied plaice were encountered. To the north the incidence was higher, but still lower than in 1950-1952. It would appear that in the areas where plaice were feeding well, the incidence of jellied fillets was lower than in areas where food was scarce or of inferior nutritive quality. Another factor that probably has changed the overall picture is the removal of many very old, slow-growing fish.

Some American plaice were found in the "A. T. Cameron" Cruise 26 to the Labrador Shelf (Fig. 1). The largest catch of plaice on this cruise was 520 pounds at 100 fathoms (Group IV, Station 20) on Hamilton Inlet Bank, but plaice were generally present from Group I southwards mainly in depths of 80-125 fathoms and at bottom temperatures from 0.3 to -0.8°C.

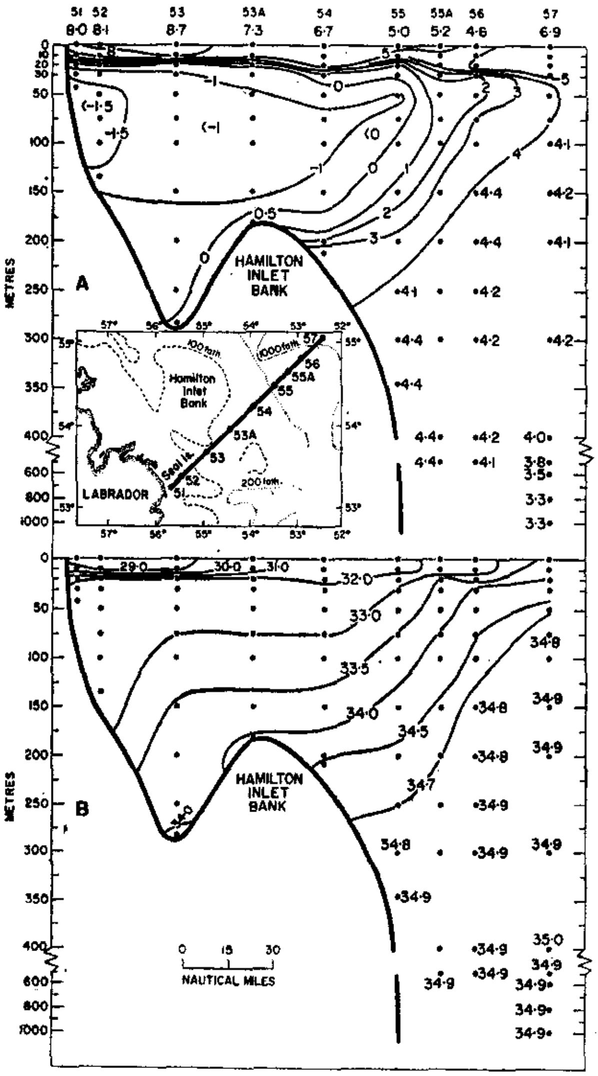

Fig. 2. **Hydrographic section from Seal Islands, Labrador, across Hamilton Inlet Bank, Aug. 2-5, 1960. A—Temperature °C; B—Salinity** per mille.

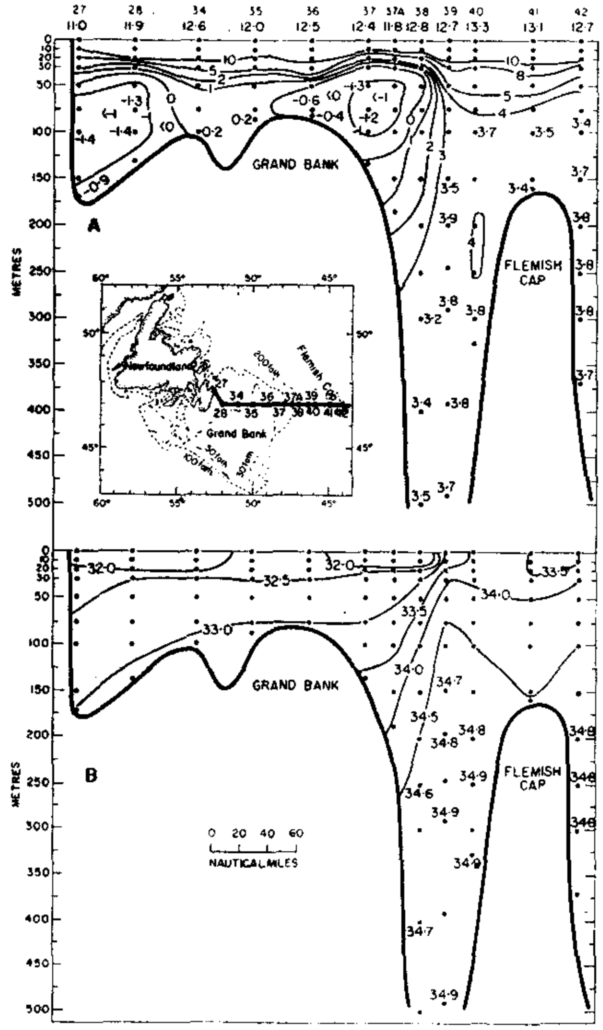

Fig. 3. Hydrographic section St. John's - Grand Bank - Flemish Cap, July 23-27, 1960. A—Temperature °C; B—Salinity per mille.

Hydrography. Between July 23 and August 25 the annual 6 hydrographic sections from southern Labrador to the southern Grand Bank were taken by the "Investigator II."

In the section off Seal Islands, Labrador (Fig. 2) water temperatures close to the coast were slightly lower than in 1959. In the offshore area the volume of below 0°C water was less than in 1959. For the second time since 1950 (the other occasion was on Aug. 6-7, 1957) temperatures higher than 4°C were present in the offshore deep water of this section.

In the Cape Bonavista section the temperature picture was essentially similar to that of 1959. The temperatures of the offshore deep water, however, were higher but not as high as in 1957 when temperatures between 4.1 and 4.3°C were found in the offshore deep water in this section.

In the St. John's-Grand Bank-Flemish Cap section (Fig. 3) temperatures of the inshore deep water and those over the surface of the Grand Bank and Flemish Cap were a little higher than in 1959. The offshore deep-water temperatures were as usual generally below 4°C.

In the section from St. John's to the southeastern slope of the Grand Bank surface temperatures were generally higher and the bottom temperatures over the northern part of the Southeast Shoal of the bank lower than in 1959.

In the section over the Grand Bank, mainly at about 75m (40 fathoms) fringing the southwestern slope of the bank, surface and bottom temperatures over the western bank area were generally higher than in 1959.

In the section at 275 metres (150 fathoms) fringing the southwestern slope of the bank, surface temperatures were higher but there was much more cold water from the eastern branch of the Labrador Current than in 1959. To the west bottom temperatures were higher and more like the usual conditions than in 1959.

The unusually warm summer produced higher surface temperatures than usual in the southern sections. To the north in the deep slope water of the continental shelf temperatures were higher than usual in the warmer West Greenland Current part of the Labrador Current, but this change was highly evident only in the Labrador section. Otherwise temperature conditions on the average in 1960 were not much different from those of 1959 apart from the changes evident in the very variable temperature conditions which are commonly encountered on the southwestern fringe of the Grand Bank.

The Atlantic Oceanographic Group surveyed the continental shelf along the Labrador coast during August and September, and the offshore portion of the western North Atlantic south to Bermuda in autumn. Chemical oceanography was given much attention, and plankton studies were carried out.

B. SUBAREAS 4 AND 5 — BY W. R. MARTIN

Canadian researches in Subareas 4 and 5 during 1960 were carried out by the Biological Station, St. Andrews, N. B., and the Atlantic Oceanographic Group, Halifax, N. S., of the Fisheries Research Board of Canada, and by the Marine Biological Stations of the Quebec Department of Fisheries at Grande-Rivière and La-Tabatière, P.Q. This report deals with the major groundfish species of Subarea 4, cod and haddock, Subarea 5 scallops, and oceanographic studies which are pertinent to ICNAF.

Cod, *Gadus morhua* L. Summer tagging of cod off northern New Brunswick has shown that western Gulf of St. Lawrence (4T) cod migrate to the Laurentian Channel off Cape Breton for winter months. Most winter returns have been taken by European trawlers which fish concentrations of cod at depths of about 100 fathoms from Scatari to St. Paul during the months of February to May. During summer months almost all returns have been taken by Canadians fishing in the shoaler waters of the western Gulf of St. Lawrence.

In order to learn whether or not the winter concentrations of cod off Cape Breton are from areas other than the western Gulf, cod were tagged at 80 fathoms off Sydney Bight in early February 1960 from the new offshore research vessel "A. T. Cameron." Most recoveries during February to May 1960 were taken along the western side of the Laurentian Channel between Scatari and Cape Smoky. European fishermen returned 25 of these tags and Canadians returned 15. During June to December 1960, 50 of the 52 recoveries were taken from the western Gulf of St. Lawrence, mainly off northern New Brunswick and Gaspé. All but one of the returns were from Canadian fishermen. None of these tagged cod were recaptured across the Laurentian Channel. Only one was returned from Nova Scotia banks, Banquereau, in July. Western Gulf of St. Lawrence cod appear to be a well-defined population, living in the western Gulf (4T) in summer, and along the western side of the Laurentian Channel off Cape Breton Island (eastern 4T and 4V North) in winter.

The cod surveys made in the Gulf of St. Lawrence since 1957 were extended to winter months for the first time in 1960. Two January cruises with the "A. T. Cameron" surveyed the western slope of the Laurentian Channel from Gaspé to Sydney Bight and the shallow waters southeast of Shippegan Island. The "Harengus" made one spring (May) survey cruise in the Cape Breton area and two cruises in the southwestern Gulf of St. Lawrence in June and September. The "A. T. Cameron" used a 41-5 and the "Harengus" a 36 otter trawl. All tows were 30 minutes in duration. Comparative fishing with these two research vessels indicated that fishing efficiency of the "Cameron" for cod is 1 1/2 times that of the "Harengus", and "Cameron" surveys were adjusted accordingly. Except for one tow east of Orphan Bank which caught 1,200 cod in 55 fathoms, winter catches were concentrated between 100 and 125 fathoms at bottom temperatures of 2° to 4°C. The largest numbers of medium-size cod per tow were found along the Laurentian Channel north of St. Paul Island and off Sydney Bight. Winter fishing in the Gulf, in keeping with the results of recent taggings, is showing that commercial-size cod migrate to deep water and south in late fall. It also showed that very small cod (0 and 1 age-groups) were still present in shallow water off Shippegan Island in January, at a bottom temperature of -1.5°C. In late spring (May) cod in the Cape Breton area were scattered over a wider depth range than in winter. Medium-size fish (39-68 cm) were caught in approximately equal numbers at all depths from 15 to 125 fathoms and at temperatures of 0° to 4°C. Small-size cod (up to 38 cm) were more numerous in shoal water. Later in the spring (early June) small cod were found in still larger numbers in shallow water in the Gulf. Medium-size cod appeared to be present in larger numbers in both shallow (15 fathoms) and deep (60 fathoms) water at temperatures ranging from -1° to 3°C. In the fall small cod were found mainly in shallow water at bottom temperatures of 6° to 8°C. The medium-size cod had moved to deeper water and were found mainly at depths of 50 to 70 fathoms, at bottom temperatures of 0° to 1°C. These observations show that market-size Gulf cod are concentrated in narrower depth and temperature ranges in winter than in late spring or early fall. They also show that small cod are found in shallow water at all seasons, at bottom temperatures of -1.5° in winter and at 7°C in early fall.

Diurnal variations in cod feeding and cod catches by otter trawl were observed off Grande-Rivière, Quebec (4T) in the summer of 1960. Fewer and larger cod were caught at night in the second half of the season, indicating vertical migrations of smaller cod (less than 51 cm) at night. The number of fish caught was related to the occurrence of euphausiids and possibly herring in the stomachs. Vertical migrations of food appear to affect movements of cod off bottom.

Quantities and sizes of cod discarded at sea by small otter trawlers were assessed by making five sea trips on commercial draggers during the period June to August 1960. The draggers used nylon codends of 4 3/8-to 4 1/2-inch mesh size, and no chafing gear on top of the codends. Discards were 6 to 16% by number and 2 to 8% by weight. This was comparable with 1959 when discards for nine trips amounted to 1 to 22% by number and 1 to 11% by weight. There were differences between the two years. In 1960, fishermen used nylon codends rather than manila, and thereby raised the 50% retention length by about 3 cm. In 1960 smaller fish were retained for landing; the 50% cull point was reduced from 44 to 42 cm. These changes would normally reduce discards to almost nothing. However, 4-year-old cod, the age-group most affected by discards, were about half again as abundant in 1960 survey catches as in 1959, and as a result, discards did not decrease appreciably in 1960.

The summer otter-trawl fishery for cod in the southwestern Gulf of St. Lawrence (4T) has been sampled for more than a decade. Data on age composition of the landings are plotted in Figure 1. It is obvious that a major change in the ages of landed fish has occurred between 1949 and 1960. In the earlier years, up to 1952, the ages of the fish were well spread out between ages 3 and 14. However, since 1955 there have been few individuals over 10 years of age, and in 1960 there were few over 7. These changes are believed to have resulted from greatly increased fishing effort by Canadian and European fleets on this population. The only dominant year-class that can be followed in these landings for more than two years is the one spawned in 1950. Recent results show that the increased intensity of the fishery rapidly reduces the size of each year-class, and even the stronger year-classes contribute to the commercial fishery for very few years.

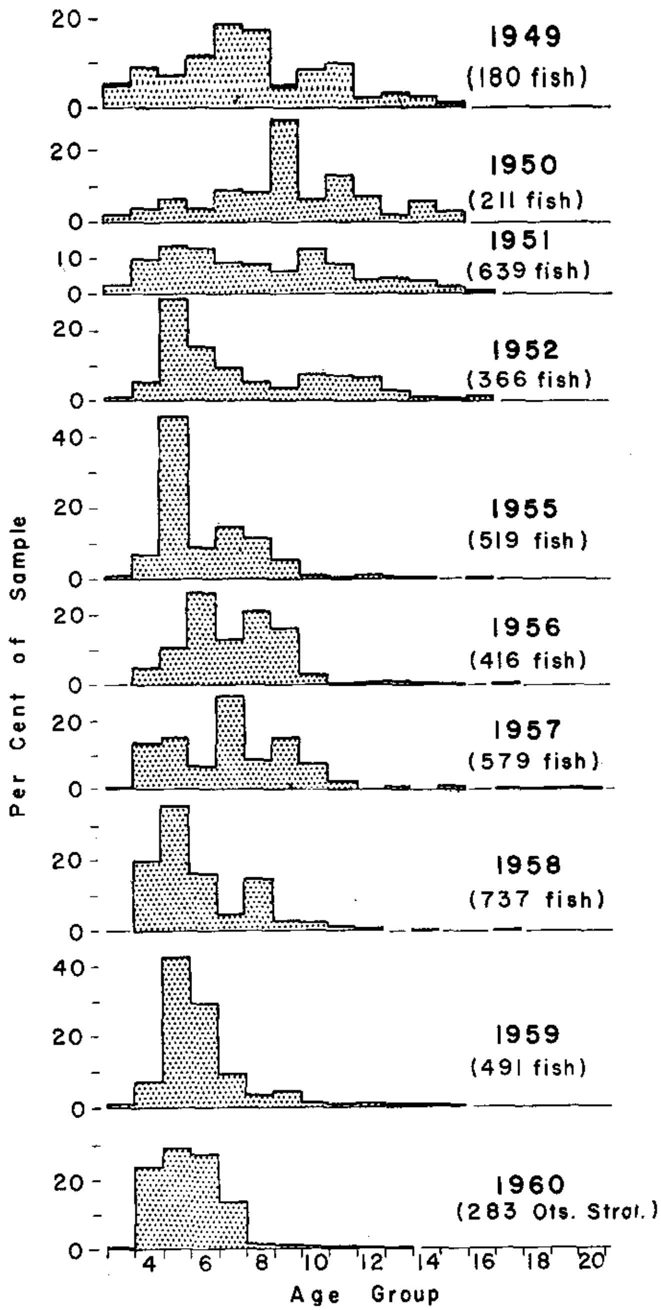

Fig. 1. **Age composition of cod landed by small otter trawlers, August to October, at northern New Brunswick ports from the Bay of Chaleur area of Division 4T, for the years 1949-1960. Numbers of otoliths examined are shown in brackets.**

Cross-sections of otoliths from 10-year-old cod, taken in 1957 and 1959 from the Gulf of St. Lawrence (4T), were examined for growth increments. The results conformed with, and supplemented, age-length data in showing faster growth in the period 1954 to 1955 than in the years immediately before and after. This period of fast growth corresponded with years of greater availability of moribund herring as food for cod.

Mortality estimates for Division 4T cod are being examined by several methods. Fishing effort is being related to catch per unit effort in numbers, to changes in abundance of year-classes,—and to tag returns. For the latter study, the results of a tagging experiment in 1955 and 1956 are available, and additional taggings by St. Andrews and Grande-Rivière Stations are continuing to supplement these results. The 1959 tagging in Chaleur Bay was repeated in August to October 1960 when 1,500 'otter-trawl' cod and 200 'line' cod were released.

The results of most of these studies and analyses of statistics and sampling of commercial landings are being used for an assessment of the effects of various mesh sizes and different fishing intensities on stocks and landings.

Increased otter trawling by Canadian and European vessels has resulted in higher total landings from the Division 4T cod population. However, the more intensive fishing has reduced the abundance of large, old cod. This is seriously affecting salt-fish operations which depend on the larger sizes of cod. Landings per unit effort by fresh-fishing draggers have also decreased significantly over the past 10 years.

Commercial catches of cod from Division 4T were unusually low in 1960. This appeared to be due to the thicker cold-water layer which enabled cod to spread out to a greater extent than in 1959. With reduced abundance and availability of 4T cod, draggers shifted part of their operations to Division 4S cod in 1960.

Studies of survey and commercial catches of Division 4T cod permit forecasts of the 1961 fishery. Three-year-old cod will escape if 4 1/2-inch nylon codends are used by Canadian draggers. Four-year-old cod (1957 year-class) will be relatively abundant. A large proportion will be caught by the nets and with the same commercial cull size as in 1960 about half of these will be retained for markets, to contribute about 20% of all cod landed by draggers. The remainder will be discarded. Five-year-old cod (1956 year-class) are expected to be dominant, contributing about 40% of those landed by draggers. Fish 8-years-old and older will constitute less than 10% of total landings. The average size of all cod landed is expected to be about one centimetre shorter in 1961 than in 1960.

Haddock, *Melanogrammus aeglefinus* (L.). Winter tagging of Nova Scotia bank haddock was repeated in 1960 in an attempt to define populations and their movements; 601 tagged haddock were released on Western Bank in March. Returns have been very low, with all from offshore banks near the region of tagging, mainly in the month following tagging.

Survey cruises in 1959 and 1960 from the Gulf of St. Lawrence (4T) to Emerald Bank (4W) have provided information on abundance and distribution of various sizes of haddock. In winter, catches of haddock in the eastern areas were small and confined to deeper water along the Laurentian Channel and the Gully between Sable Island and Banquereau. Throughout the region east of Western Bank haddock were virtually absent from the cold waters on top of the banks, where they are found in summer. Largest catches were obtained from depths of about 45 to 70 fathoms, in the vicinity of Western and Emerald Banks. In 1959 the cold-water layer extended deeper than in 1960, and as a result, haddock were generally deeper and more concentrated in 1959 than in 1960.

Otter-trawl landings of Division 4W haddock have been sampled for lengths and ages during the February-April quarter since 1948. Mean length at age has shown a marked decrease over the past 12 years. For example, mean size for 7-year-old haddock was 60 to 64 cm in 1948-50 and 53 to 55 cm in 1958-59. Similar decreases have been apparent for all ages from 5 to 8. Examination of size-frequency ranges for the various age-groups indicates that the change has been a result of decreased growth.

Low availability of pre-recruit sizes and lack of unusually strong year-classes currently in the fishery show that total haddock landings from Divisions 4T, 4V and 4W are likely to drop below average during the years immediately following 1962. The strong 1952 year-class is no longer of much importance to the fishery. The 1955 year-class which is now dominant does not appear to be of more than average strength. The 1956 and 1957 year-classes, now entering the fishery, are of about average strength. Survey results indicate that the 1958 and 1959 year-classes, which will enter the fishery in 1962-63, are small.

Other Groundfish. Less intensive studies were carried out on American plaice, *Hippoglossoides platessoides* (Fabr.) in Division 4T, halibut, *Hippoglossus hippoglossus* (L.) in Division 4V and 4W and pollock, *Pollachius virens* (L.) in Division 4X.

Gear Selection. A comparative fishing experiment was carried out in June to determine the effects of gear selectivity on length and age composition and on growth of cod. The M. V. "Harengus" fished as an otter trawler alongside a 55-foot commercial longliner close to the coast of northern New Brunswick (4T). There was a marked difference in length compositions of fish. The longlines took a much larger proportion of large cod (over 70 cm) than the otter trawl. The longline catch contained a larger number of fish aged 8 years and over, but comparable numbers of younger fish, with the 1954 year-class dominant for both gears. The growth curves showed no consistent differences.

The mesh selection of a cod trap was examined at LaTabatière, Quebec (4S). Cod released by a 4 1/2-inch nylon back were caught by a secondary 3-inch back. The selection factor was 4.3, with 50% released at 49 cm. As in previous trap experiments, the selection factor was higher than that observed for otter trawls with comparable codend mesh size.

The selective properties of a large-mesh (average 4 7/8-inch) double-strand, synthetic, Courlene codend were studied by catching released fish in a small-mesh cover during half-hour survey tows. Selection factors of 3.7 to 3.9 for cod, 3.3 for haddock, and 2.0 to 2.1 for plaice were slightly higher than for manila. On this basis, the mesh size equivalent to 4 1/2-inch manila would be 4 1/8- to 4 3/8-inch Courlene for roundfish. This is close to the 4 3/8-inch equivalent prescribed by Canadian cod and haddock regulations for double-strand, synthetic twines.

Sea Scallop, *Placopecten magellanicus* (Gmelin). Three sea trips were made to Georges Bank (5Z) in 1960—two on commercial scallop draggers to observe industrial practices and one on the U.S. Bureau of Commercial Fisheries' M. V. "Delaware" to observe methods of investigation. One commercial boat used drags with 4-inch rings, the rest, 3-inch, and all found scallops abundant. Some boats regularly took enough scallops by dragging for 2 to 3 hours in the morning and for 3 to 4 hours in the evening to keep their shucking crews busy 24 hours a day. This practice, called deck loading, resulted in discards suffering longer air exposure and more mechanical damage (10 to 20% killed) than in normal fishing operations. The 50% cull point stayed at 95 to 100 mm shell height, and the proportion, by count, of discards in the catch remained high, but not as high as in 1959. The fishery depended almost exclusively on one year-class (either 1954 or 1955). More recent year-classes seem much less abundant and a drop in landings has been predicted for 1961. Studies of spawning and early life-history were initiated in 1960, which should help explain year-to-year differences in the success of reproduction.

There was evidence of mass scallop mortality on one part of Georges Bank.

Experiments have shown that the lifetime of cluckers (attached empty shells of scallops) is longer than formerly supposed. This decreases our estimate of the normal natural mortality rate which is so important in population studies and in forecasts of conservation values of various fishing practices. Other experiments, still under way, are exploring the effects of air exposure in contributing to deck damage and the mortality of discards after they are returned to bottom. They can withstand freezing if not jarred, but jarring when frozen kills them. Many hours of air exposure at temperatures just above freezing is not harmful but desiccation is very damaging.

Hydrography. The monitoring sections off Halifax and across Cabot Strait were covered three times in 1960. The temperature and salinity distributions of the section off Halifax are given in Figure 2. The bottom waters of the Scotian Gulf and over Emerald Bank were colder in February 1960 than at the same time in 1959, but warmer in May and November 1960 than during the previous year. Along the edge of the continental shelf the waters were warmer in 1960. At all times in 1960 the observed temperatures on the bottom on the continental shelf were below normal.

In Cabot Strait, the deep, warm layer had regressed during the first half of the year but increased in volume during the last 6 months while its maximum temperature had increased. The zone on the slopes covered by water between 1.0 and 4.0°C seemed to be slightly deeper than in the last few years.

Over the Magdalen Shallows the distribution of the cold-water layer was equally extensive during the spring seasons of 1959 and 1960. In the late summer the cold-water layer did not dissipate as rapidly in 1960 as in previous years.

Study of the seasonal and long-term variations of temperatures was continued at monitoring stations along the southern Canadian mainland. In 1960 the surface coastal waters were warmer than in 1959. The increase in temperature was generally greater during the first 6 months as compared to the remainder of the year. However, in the Bay of Fundy area and along the outer coast of Nova Scotia at Sambro Lightship, the 1960 temperatures were below the 1950-1959 average. The surface waters in the Gulf of St. Lawrence were featured by unusually high summer temperatures and rapid cooling in late autumn. Considering long-term series of temperature observations it is estimated that the cooling trend experienced during the last few years is continuing in most areas for the surface and the bottom waters.

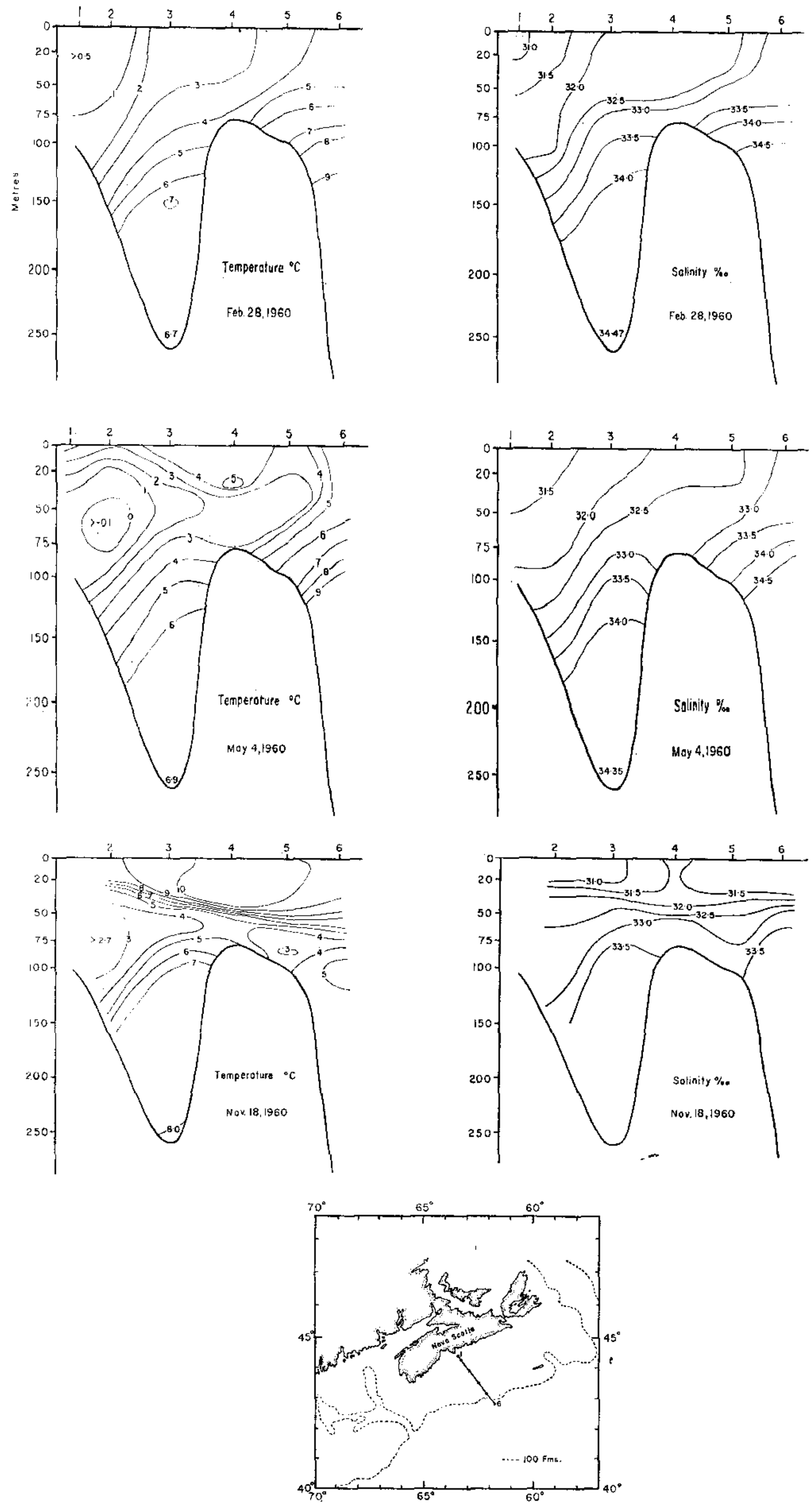

Fig. 2. Hydrograph section off Halifax, Feb., May and Nov., 1960.

The results of drift-bottle experiments over large areas such as the Gulf of St. Lawrence, the Gulf of Maine, the Bay of Fundy and the western sector of the Scotian Shelf made possible an assessment of the seasonal and in some cases year-to-year variations in the surface circulation. During one survey the drift-bottle experiment was augmented by the release of drift poles and markers and by geomagnetic electrokinetograph measurements.

A heat budget study of the waters of the Gulf of St. Lawrence was carried out to elucidate our concepts of advection in the area and of the formation and dissipation of the cold-water layer which may be at times an environmental barrier for certain groundfishes.

The submarine geology program initiated in 1959 was continued during 1960 with emphasis on the Laurentian Channel and the Bay of Fundy.

An oceanographic and seismic survey was undertaken during August and September, covering sectors of the Scotian Shelf and of the Gulf of St. Lawrence.

Plankton. From June to November 1960, 98 plankton tows were made off Grande-Rivière, Quebec (4T) with a Clarke-Bumpus sampler. Mean volumes of total plankton were about 0.3 ml/m^3, two to three times less than in 1959. This was possibly due to slower warming and generally colder mid-water temperatures in 1960.

II. Danish Research Report, 1960

A, B AND C BY PAUL M. HANSEN, D BY FREDE HERMANN

A. COD—WEST GREENLAND

1. Young Stages.

a. Occurrence of Cod Eggs.

In the period January to June, hauls with a 1 m stramin-net were made in the Godthåb Fjord area, both in the surface (100-50 m wire out) and in deep water (400, 500 and 600 m wire out). No cod eggs were caught in January and February.

On March 16th the first eggs were caught in the inner part of the fjord, near the most important spawning grounds. In hauls with 100-50 and 400 m wire out, 46 and 45 eggs were taken respectively.

On April 11th, 803 and 77 eggs were taken at the same place with 100-50 and 400 m wire out respectively, this was the largest number of eggs taken in the fjord in 1960. Thus, as in 1959, the numbers of eggs taken in the Godthåb Fjord area in 1960 were rather small. Also, in the coastal area at Godthåb few eggs were taken, the best haul (100-50 m wire) containing 140 eggs.

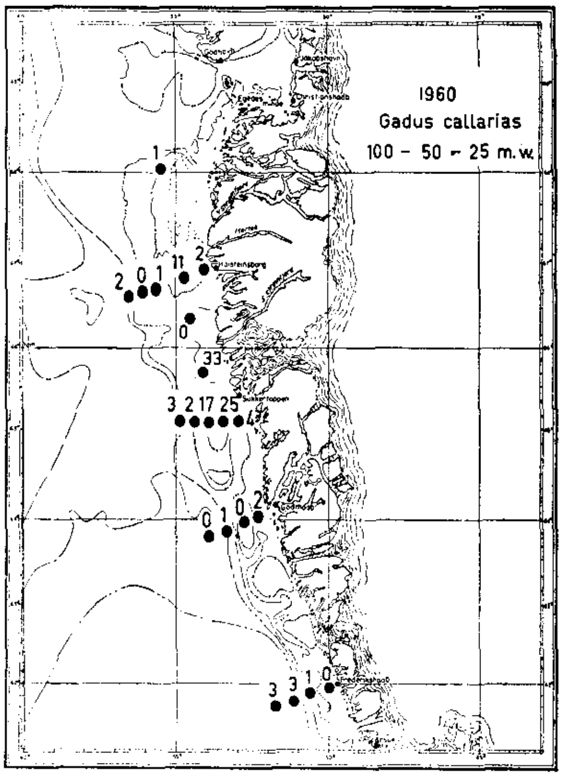

Fig. 1. **Numbers of cod larvae caught per 30 minutes step-hauls (100-50-25 mw.) with the 2 m stramin net, 1960.**

On April 30th three hauls (100-50 m wire) were made on the Fylla Bank section (1D). Between the bank and the coast 46 eggs were taken, while on the middle of the bank 22 eggs and over the western slope of the bank 3457 eggs were taken. At the last-mentioned station 545 eggs and 5 larvae were also taken, in a haul with 600 m wire out.

b. Occurrence of Cod Fry.

Owing to engine trouble the "Dana" could not work in Greenland waters in 1960 and the work in the Davis Strait, during July had to be carried out from the cutters "Adolf Jensen" and "Sujumut". On four sections, recommended hydrographical observations and hauls with 2 m stramin-net were made. The hauls were made with only 100-50 m wire out. It was impossible to work the westernmost stations normally taken from the "Dana", with these small vessels (Figure 1). On the southernmost section the occurrence of fry was better than in most of the previous years, the largest numbers being found between 65° and 66° N. Lat. The number of larvae, however, was not particularly large on the different stations, and it is therefore rather difficult to predict the importance of the 1960 year-class to the future fishery. It is, however, very likely that this year-class can not be considered a rich year-class, but rather, a medium one.

c. Occurrence of Small Cod of Age-Groups I, II and III.

In 1960 nine samples of small cod of the age-groups I to IV were collected. The length frequencies are given in Figure 2. The samples a-h were all taken in the area south of Godthåb (1D, ca. 64°N. Lat.). Sample i is from the harbour of Christianshåb (1B, ca. 68°50'N. Lat.), while samples a-f are from catches with a shrimp trawl (ca. 250 m depth) during January, February and March, samples g, h and i were caught with a hand seine from the shore during June, July and August.

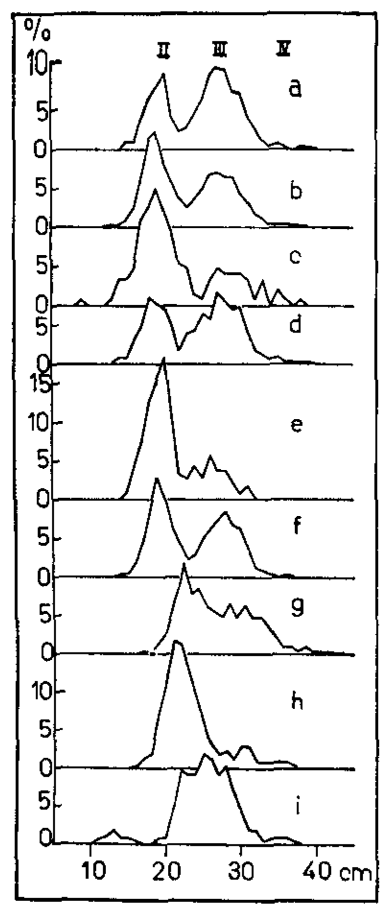

Fig. 2. **Length frequency curves for young cod (I to IV- Gr.) from coastal waters, 1960.**

Age-group I (1959 year-class) occurs in small amounts in samples a, c and i and is not represented in the other samples. Age-group II (1958 year-class) is strongly represented in all samples, which is rather surprising, because this year-class, in the previous year, was present in only one sample from 1F. Age-group III (1957 year-class) is strongly represented in all samples with the exception of sample h. This year-class was also strongly represented in the samples from 1958 and 1959. Otoliths of 199 cod (sample a) were taken for age determination. The mean lengths of cod belonging to age-groups II and III were 20.1 and 27.6 cm.

2. Commercial Fish, Coastal Waters and Offshore Banks.

a. Age-Composition.

Offshore Banks.

Otoliths of 3134 cod were collected from the offshore banks: 1459 from catches by handline and 1675 by longline. All catches were taken by the "Adolf Jensen" and "Sujumut" and were distributed, according to divisions as follows:

Division	Handline	Longline
1B	253	291
1C	555	634
1D	651	750
1F	234	830

The stations where the experiments have been carried out are shown on the map, Figure 3, while Figure 4 shows the age and length distributions. The lengths are given in 5-cm groups and the length distribution curves include aged as well as tagged cod and cod which had only been measured. In order to compare age compositions and length distributions of handline and longline catches, both gears have been used on eight different stations. From the figures it is evident that the handline catches consist of younger and smaller cod, than the catches taken by longline. The differences in mean ages and mean lengths are given in Table 1.

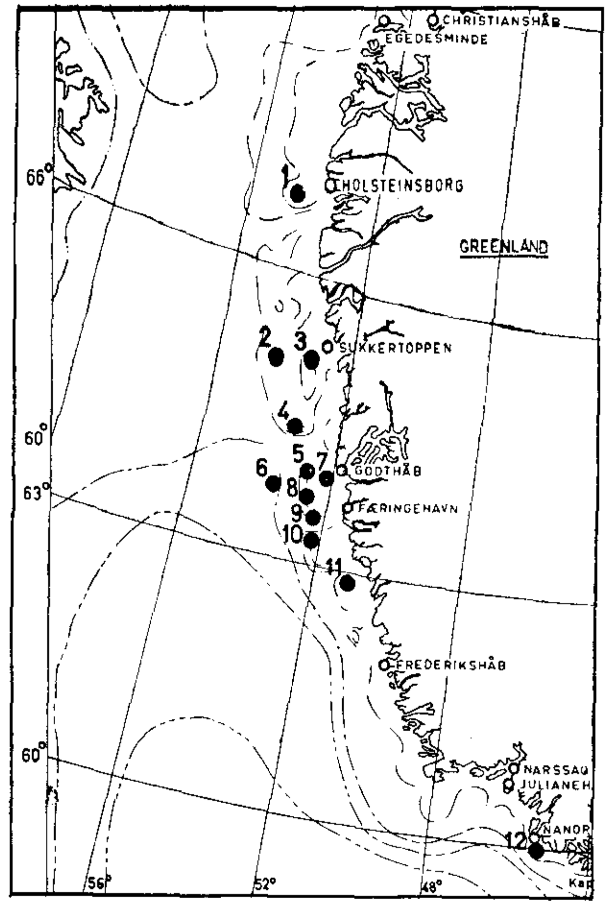

Fig. 3. Position of samples of offshore caught cod, 1960.

TABLE 1

Sample No.	Longline Mean Age	Handline Mean Age	Longline Mean length cm.	Handline Mean length cm.
1	8.08	5.85	79.3	62.6
2	10.69	9.47	79.4	77.0
3	10.06	8.28	76.0	---
4	8.65	8.01	75.1	73.9
8	9.52	6.86	75.7	68.2
10	10.11	8.31	83.4	78.1
11	11.60	9.74	83.3	79.9
12	10.94	8.12	73.2	68.9

It appears from Table 1 that the mean ages as well as the mean lengths are higher for cod taken by longline than for cod taken by handline. Age-groups younger than the V-group amount to 29% of the handline catches, but only to 11.2% of the longline catches.

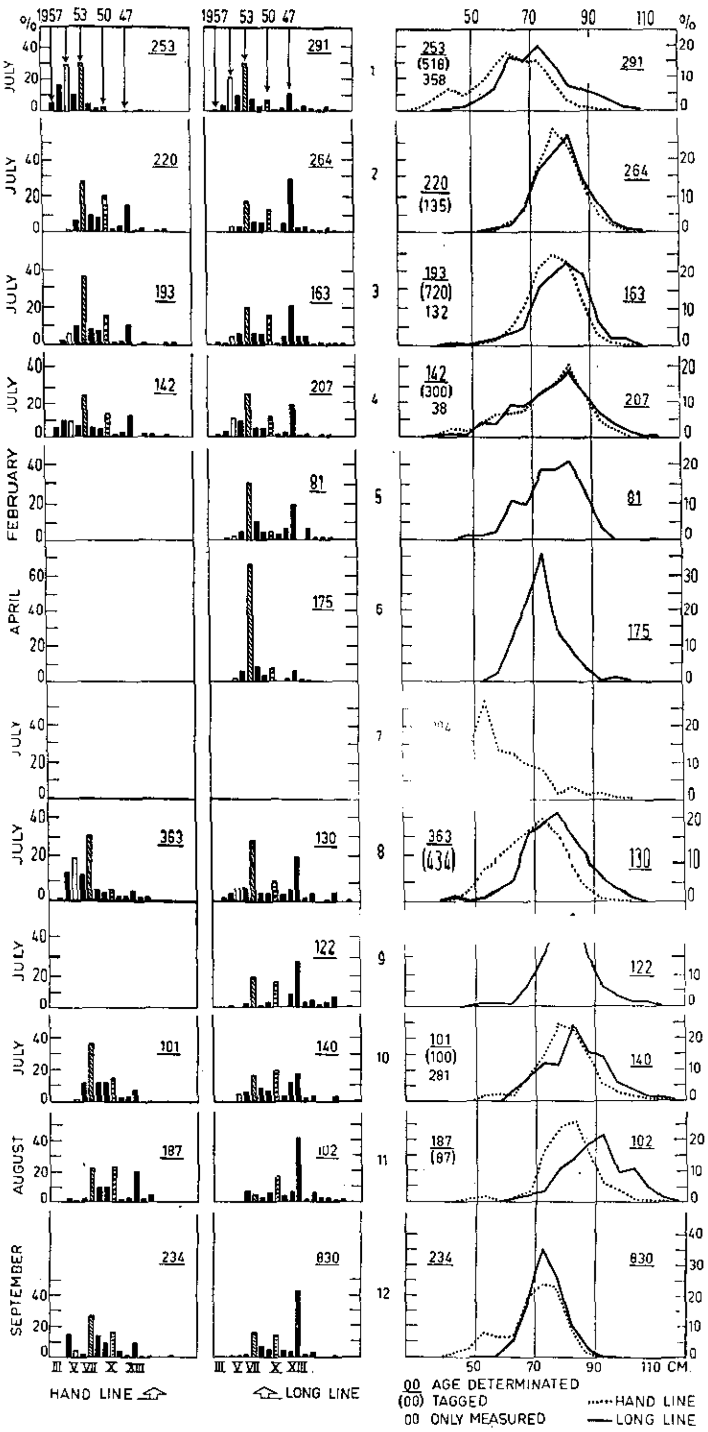

Fig. 4. **Age - and length distribution of samples of offshore caught cod, 1960.**

b. Inshore Waters and Fjords.

From the coastal area and the fjords, 4613 cod from 24 catches were aged. The results are shown in Figures 5 and 6.

The samples are distributed according to divisions as follows:

Division	Sample Number
1A	13, 14
1B	15, 16, 17
1C	no samples
1D	18, 19, 23 to 36
1E	20, 21
1F	22

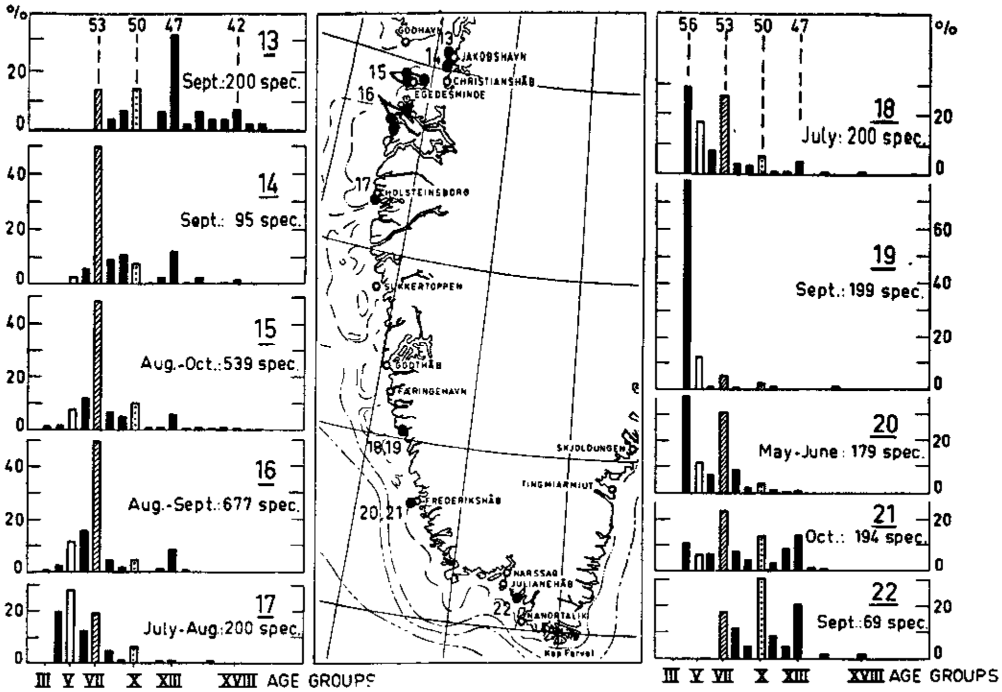

Fig. 5. Age distribution of samples of cod from inshore waters, 1960.

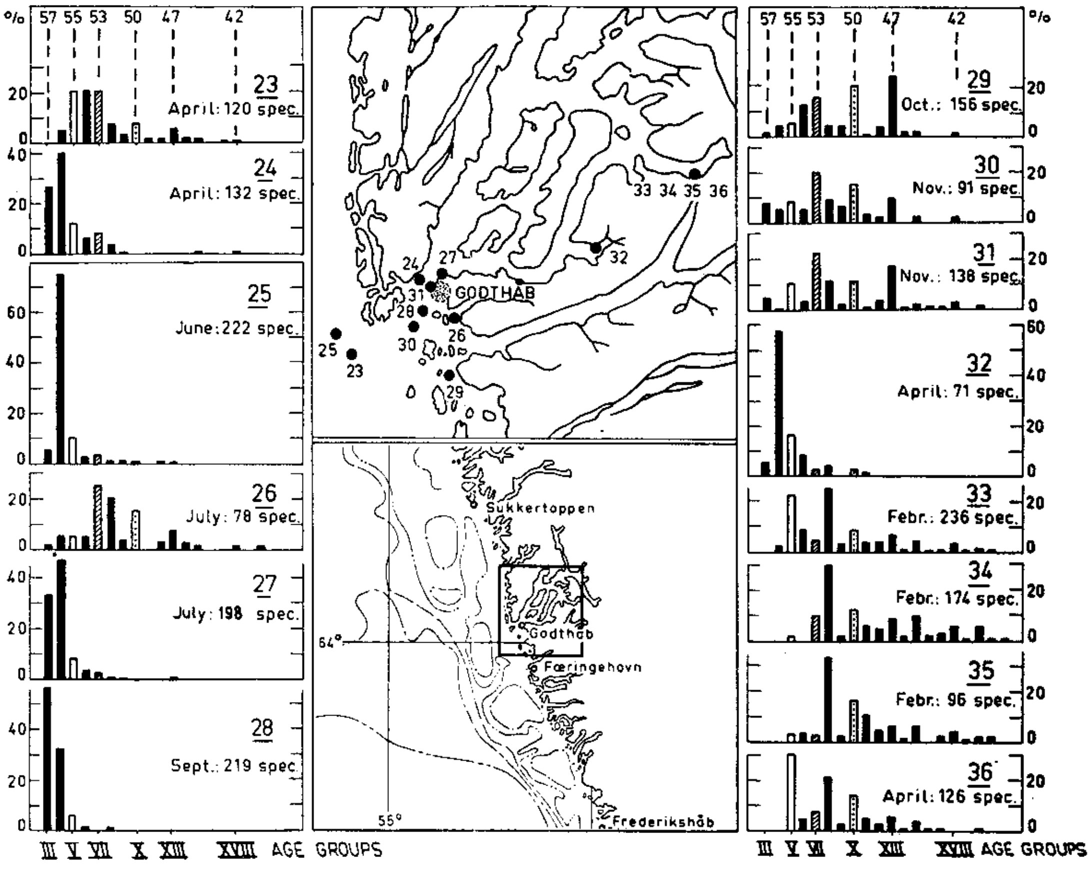

Fig. 6. Age distribution of samples of cod from the Godthaab Fjord area, 1960.

The 1947 year-class predominates in only two samples (13 and 29), and is below 20% in all other samples, except No. 22.

The 1953 year-class is strongly dominating in a sample from Division 1A (No. 14) and in the samples from the northern part of 1B (Nos. 15 and 16). It is also well represented in samples from the coastal region of 1D, where it is the predominant year-class in samples No. 26, 30 and 31. It is very poorly represented in the inner part of the Godthåb Fjord, where the 1952 year-class predominates in samples Nos. 33, 34 and 35. Outside the Godthåb Fjord, the 1952 year-class has been poor. In the two samples from 1E the 1953 year-class is strongly represented in No. 22 and predominating in No. 23.

The 1955 year-class is abundant in some samples from the Godthåb Fjord. In a sample from the inner part of the fjord (No. 36) it predominates with about 30 percent and in another sample (No. 33), from the same place, it amounts to about 22 percent.

The 1956 year-class predominates in seven samples, three from the mouth of the Godthåb Fjord (Nos. 24, 25 and 28), one from the middle part of the fjord (No. 32), two from the southern part of 1D (Nos. 18 and 19), and one from 1E (No. 20). In two other samples (Nos. 27 and 28), from the mouth of the Godthåb Fjord, it is represented by more than 30%.

The rich year-class 1957 has not yet entered the commercial catches. This year-class predominates with 56.7% in a handline catch (No. 28) from the mouth of the Godthåb Fjord.

3. Maturity.

Age at first maturity is determined by means of the otoliths of all aged, mature cod. Large amounts of material for such determinations are available for only the 1947 year-class. The age at first maturity for this year-class is shown in Table 2.

The data are given separately for the following regions: coastal area north of 63°N., coastal area south of 63°N. and West Greenland Banks. It appears from the table and also from previous data, that males as a rule mature earlier than females.

Table 2. Age at first maturity of the 1947 year-class of Greenland cod in 1960.

Coastal area north of 63°N.

Age Imm.	Males No.	Males ‰	Females No.	Females ‰
6	7	68	8	62
7	42	408	41	318
8	42	408	52	403
9	10	97	26	202
10	2	19	2	16
Total	103		129	
Mean Age		7.5		7.8

Coastal area south of 63°N.

Age Imm.	Males No.	Males ‰	Females No.	Females ‰
6	8	308	3	214
7	11	423	6	429
8	6	231	4	286
9	1	38	—	—
10	—	—	1	71
Total	26		14	
Mean Age		7.0		7.3

Banks off the west coast

Age Imm.	Males No.	Males ‰	Females No.	Females ‰
6	76	169	17	46
7	235	523	167	453
8	115	256	154	417
9	20	45	29	79
10	1	2	2	5
11	2	4	—	—
Total	449		369	
Mean Age		7.2		7.5

4. Tagging Experiments.

In 1960 a total of 4575 cod were tagged in West Greenland waters, 2882 on the offshore banks and 1693 in coastal waters and fjords. The distribution is as follows:

Division	Offshore banks	Coastal waters and fjords
1B	611	—
1C	1105	—
1D	1147	866
1E	19	—
1F	—	432

White Petersen discs were used for all tagging on the banks. In the coastal waters and fjords 731 cod were tagged with the white Petersen discs, while 545 were tagged with hydrostatic tags and 43 with red plastic tags.

At present the bulk of the expected recaptures have not been received.

B. Redfish.

A fishery with shrimp trawl for small redfish was carried out in continuation of previous years' experiments in the Godthåb Fjord (1D).

Tables showing the length distribution of the samples will be presented in the Sampling Yearbook Vol. 5, 1960. The total catch was 9997 redfish. Hauls were made in all months with the exception of May, June and August. In December two hauls were made, while in the other eight months only one haul was made. 281 large redfish caught in pound nets, or with a big jig, in the Godthåb Fjord, were tagged with white Petersen discs.

C. Greenland Halibut.

Investigations on the Greenland halibut have been carried out in Umanak Fjord and Disko Bay (1A), in the Godthåb Fjord (1D) and in Lichtenau Fjord (1F). A total of 173 specimens were tagged.

D. Hydrographic Conditions off West Greenland, July 1960.

Fig. 7 shows the position of the hydrographic stations worked by M/C "Adolf Jensen" and M/C "Sujumut" in July 1960, and the distribution of temperature at 50 metres.

The hydrographic situation is further illustrated by the sections I, II and III in figures 8, 9 and 10.

The observations show that the arctic component of the West Greenland current as usual was found off the slope of the banks. This component was, however, not very well developed and the minimum temperatures in its core were higher than usual. The warm atlantic component of the current, which is mainly found

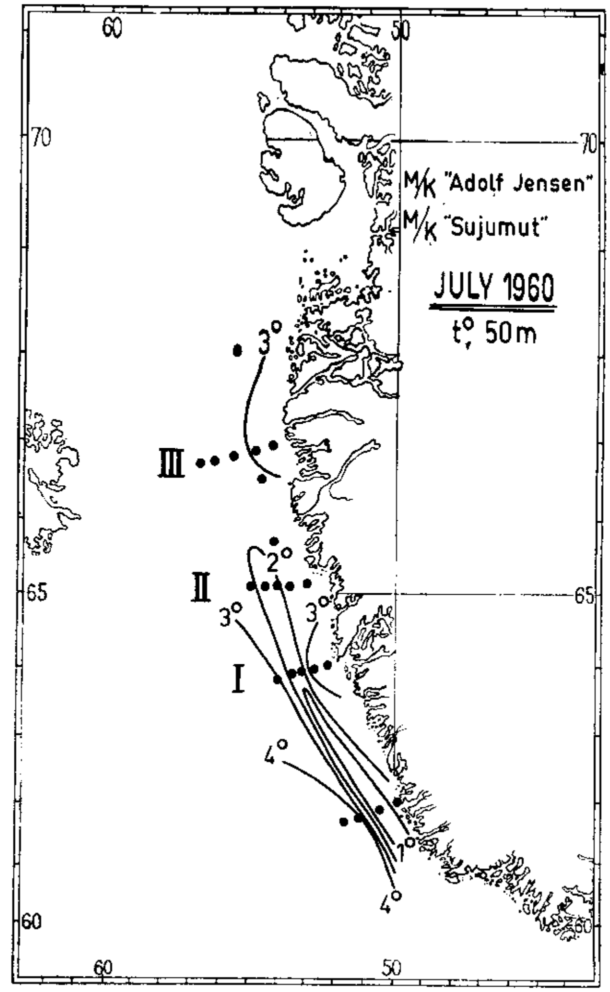

Fig. 7. Location of hydrographic sections and distribution of temperature at 50m. July 1960.

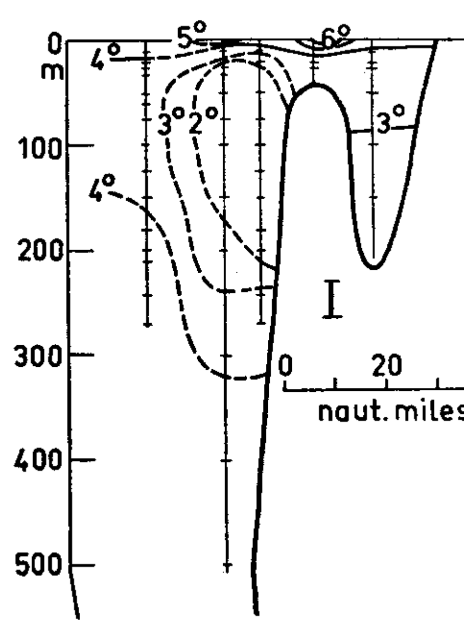

Fig. 8. Section I, across Fylla Bank.

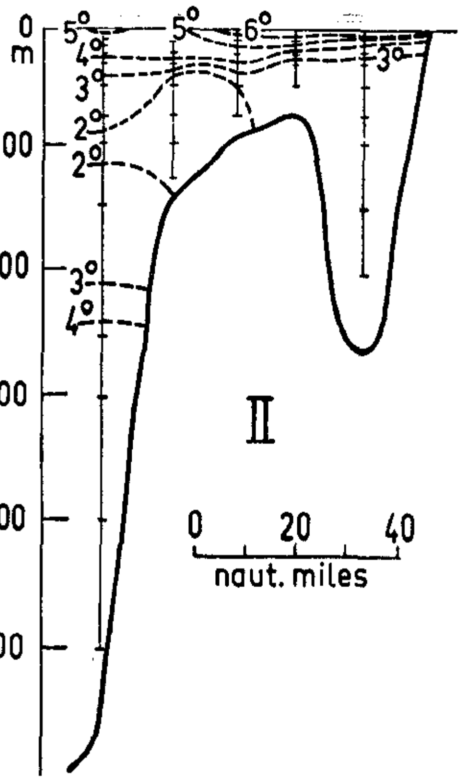

Fig. 9. **Section II, across Lille Hellefiske Bank.**

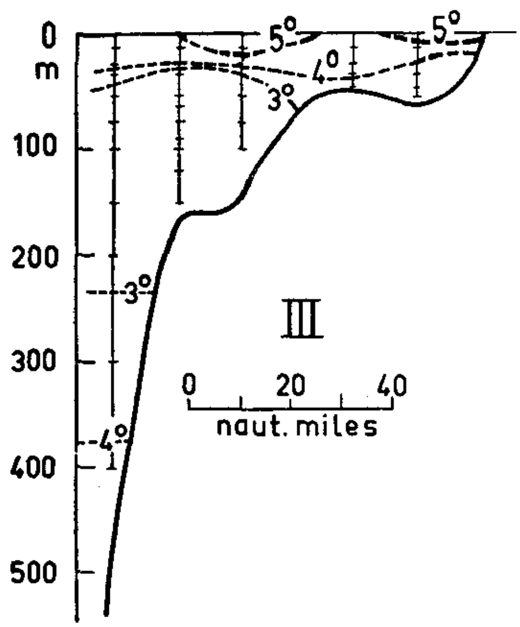

Fig. 10. **Section III, across Store Hellefiske Bank.**

as an undercurrent was very well developed and carried water with temperature above 4° as far north as 67°N.

The temperature conditions off West Greenland were thus very favourable at this time, being probably the highest found in the last ten years.

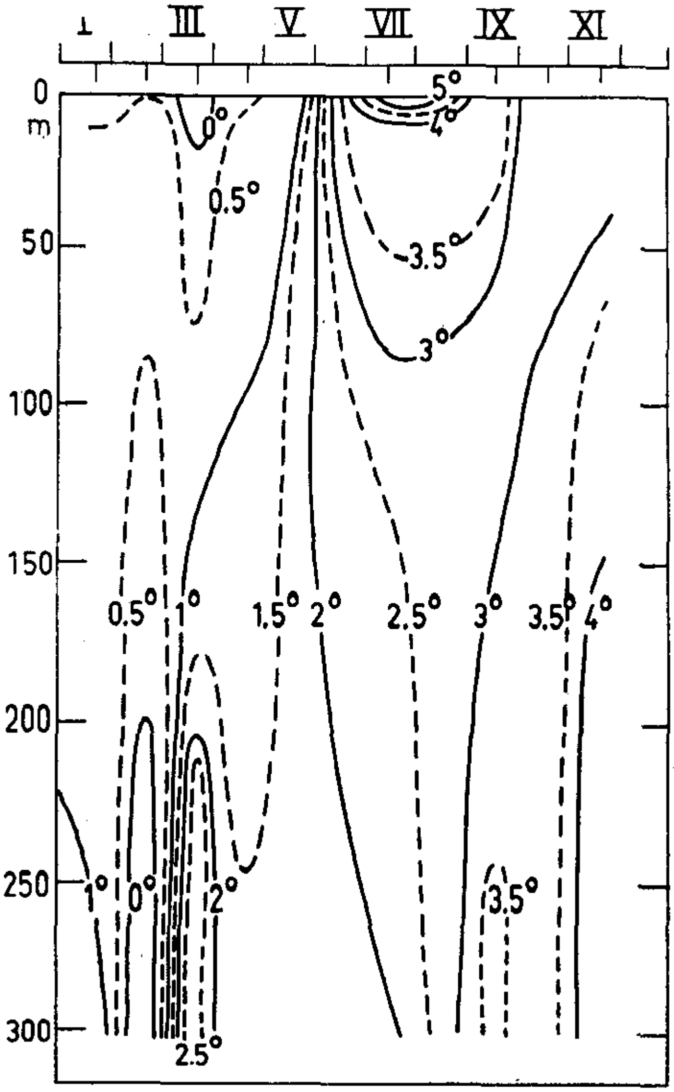

Fig. 11. **Yearly variation of temperature, Jan.-Nov. 1960 at a fixed station at the entrance to Godthaab Fjord.**

In April and June the Fylla Bank section was worked by M/C "Adolf Jensen" and also at this time of the year the temperatures were higher than usual. Over the shallow part of Fylla Bank (40 metres) the temperature was thus on April 30, 1°6 and on June 30, 2°6.

The station at the entrance of Godthåb Fjord (64°07′ N · 51°53′ W) was worked 8 times during 1960. The variation of the temperature throughout the year at this locality is shown on fig. 11. The figure shows that in February an inflow of cold bottom water with negative temperatures took place, but apart from this short period, warm conditions prevailed. Specially in November a strong inflow of very warm bottom water seems to have taken place.

III. French Research Report, 1960

BY J. ANCELLIN

A number of hydrographic observations were made by the frigate "l'Aventure" in Subareas 1, 2, 3 and 4. Especially to be noted is a section of nine stations with data from bottom to surface along the Polar Circle across the Davis Strait, 19th-20th September, 1960.

Due to bad weather conditions, only two stations could be worked (on the 7th and 9th November) of the section planned for the return trip from Newfoundland to Cherbourg.

The results of this hydrographic work will be published in "Bulletin de Comité Central d'Océanographie et d'Études de Côtes" (Service Hydrographique de la Marine, Paris).

Statistics concerning the French trawl fishery in the Convention Area have been collected. The total catch in 1960 was about 46,000 tons of cod (landed weight of salted cod); this is a slight increase over the preceding years. It is to be noted that an important fishery of cod took place in Division 2J (Labrador) during the summer, especially in June, which for this month amounted to 4,600 tons salted weight.

In 1961 the new French research vessel "Thalassa" will be operating in the Convention Area.

A preliminary report on sampling of cod carried out on board a French trawler early in 1961 (March-April) in the Gulf of St. Lawrence, off the east coast of Nova Scotia and the south coast of Newfoundland, has been prepared and circulated as Document No. 33 for the 1961 Annual Meeting.

IV. German Research Report, 1960

A. COD INVESTIGATIONS[1]

BY ARNO MEYER

Subarea 1

The year 1960, with landings of 92,393 tons (37.4% cod and 54.7% redfish), was the best year up to now for the German Greenland fishery. As the cod catch off East Greenland—15,378 tons—was almost the same as off West Greenland, 1960 proved also to be the best year for cod since the beginning of the German fishery off Greenland.

1. West Greenland (Division 1C-1E)

The fishery off West Greenland came to an end around mid-January, and, due to the good fishery off Labrador only began again by the end of March, and then as a fishery for redfish. Large quantities of cod were only caught from the end of April, and no information on the age-composition of the spawning stock can therefore be given.

From April to July the rich 1953 year-class predominated in the catches, as expected, with 51% (Fig. 1). The 7-year old cod had reached an average length of 70.7 cm. The two younger year-classes, 1954 and 1955, were the next richest with 12 and 11% respectively. The older 1950 and 1947 year-classes, which have hitherto been the more important, were met in the area of Noname Bank where large landings were made in June. The 1950 year-class, with a mean length of 79.1 cm, accounted for 17% and the 1947 year-class (81.7 cm) for 19%, following this, the mean length of the total catch reached 75.3 cm, which is a high figure for West Greenland.

In the large December landings, the younger 1954, 1955 and 1956 year-classes predominated for the first time, totalling almost 70%. The 1955 year-class was the strongest and, at the termination of the fifth feeding season, had reached a mean length of 65.0 cm.

The spring concentration of the older year-classes on the southern banks off W. Greenland

[1] Tables showing length and age distribution will be published in Sampling Yearbook Vol. 5.

appeared again from the "Anton Dohrn" catches in the Dana Bank area. Some of the younger cod, which as a rule concentrate for spawning later in the season, were still found spawning at the beginning of May in this area. A scouting trip provided further data on the maturity and spawning conditions at the end of April. On the Lille Hellefiske Bank, where the limit of the ice was along the northern edge at the end of April, 85% of the cod between 110 and 190 m were still immature; of the remainder, 87% of the mature cod were post-spawners and 13% spawners. In the area of Fylla Bank, 150-300 m depth, 37% were immature; of the mature cod, 17% were approaching spawning, 30% were spawning, and 53% had already spawned.

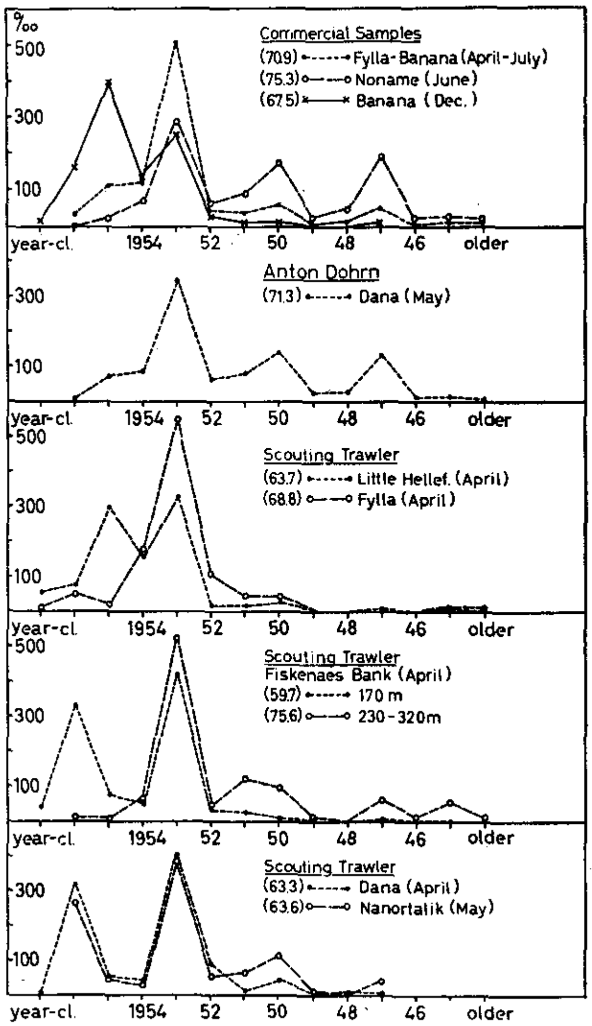

Fig. 1. **West-and South Greenland. Cod. Age composition, average lengths in brackets.**

Experimental hauls in the area of Fiskenaes Bank showed clearly that the ripe cod were mainly concentrated on the outer slope of the bank and in deeper water. On the inner slope of the bank, 170 m, 80% of the cod were immature, whereas on the S.W. slope, 230-320 m, 72% were mature. Spawning here, as well as on Dana Bank, was more advanced than on Fylla Bank; on Fiskenaes Bank 74%, and on Dana Bank 83%, had already spawned. Maturity and age investigations further revealed that the following percentages of the various year-classes had reached full maturity: 1956—0; 1955—2; 1954—31, 1953—58; 1952—44(!), 1951—75; and 1950—88%.

Contrary to 1960, fishery was carried out in Subarea 1 through the whole of the winter 1960/61. A successful cod fishery developed in 1D and 1C by the end of February 1961, in spite of heavy icing on the trawlers and obstruction to the fishery by low temperatures (-20°C). First and foremost, great concentrations of spawning cod were encountered in March and April at the surprisingly great depth of 350-550m.

The lower limit of the spawning concentrations was in no way established at 550m, but trawling was not possible below this depth due to adverse bottom conditions. At this depth the cod were just as dense as at 400m. The location of spawning cod at the depth of 550m, and even lower, may indicate that all previous scouting for spawning concentrations off W. Greenland remained unsuccessful because the search was not carried out in sufficiently deep water or far enough to the west. The frequently established western distribution of eggs and larvae in the Davis Strait further indicates that the spawning area of the West Greenland cod reaches still more to the west, off Fylla and Banana Banks, than observed by German trawlers in 1961, and that spawning, including pelagic, occurs in the warmer water of the left branch of the West Greenland Current flowing towards Cumberland Sound. The age composition of the 1961 spawning concentrations will be considered in the 1961 report.

2. South Greenland (Division 1F)

The fall concentration of 7-year old cod of the 1945 and the 1950 year-classes promised a successful fishery off S. Greenland in fall and winter, as in the years 1952/53 and 1957/58 during the Farvel season. This promise has, however, not been fulfilled. Although occasionally, large concentrations of 7-year old cod of the rich 1953 year-class were found between Cape Farvel and Nanortalik, these concentrations were so strongly mixed with smaller and younger cod that the trawlers turned to the more rewarding fishery for redfish off S. Greenland.

In the beginning of May, a scouting trawler made rewarding cod catches close to the ice border at Nanortalik Bank, in which—as could be expected—the 1956, 1953 and 1950 year-classes predominated, with 26, 38 and 12% respectively. The maturity investigations showed again that 88% of all cod caught here in May were immature, and, contrary to the west coast, that the cod off S. Greenland (and off E. Greenland) mature considerably later, as appears from the following summary:

Percentage numbers of immature and mature cod in the individual year-classes and ages off S. Greenland.

Year-class	Age	Immature %	Mature %
1956	4	100	0
1955	5	100	0
1954	6	100	0
1953	7	89	11
1952	8	88	12
1951	9	82	18
1950	10	77	23
1949	11	60	40
1947	13	27	73

Up to 12% of the mature cod in the catches had completed spawning. Again, not a single spawning or pre-spawning cod was observed in the area Farvel-Nanortalik, although at the same time spawning cod were found in the neighbouring areas (S.E. Greenland and Noname Bank). This once again confirms the earlier observation that no spawning occurs on grounds off S. Greenland hitherto fished, which can also be concluded from the hydrographic conditions. The most recent observations off W. Greenland may indicate the possibility of a S. Greenland spawning farther from the shore, either pelagic or on the lower part of the steep slope in the region of the warmer Irminger Current. The post-spawners caught at the beginning of May on Nanortalik Bank are noticeable on their return trip from the E. Greenland spawning grounds (cf. tagging results).

3. East Greenland.

The 1960 landings from E. Greenland total 49,421 tons, of which cod (15,000 tons) is the highest since the beginning of the fishery in 1955.

In 1960 the rich 1950 year-class was also the most important in the late winter catches off Angmagssalik, and in the fall catches from the Dohrn Bank; however, it was reduced from 52% to 38% in the former region, and from 41% to 31% in the latter. During 1960 the importance of the 1953 year-class increased (see Fig. 2), particularly on the difficult fishing grounds off S.E. Greenland where this year-class was the strongest in the spawning season, March-April, (28%), and during the summer (38%).

The spawning off Tordenskjold occurred from mid-March to early May in 1960, with its maximum in the first half of April.

Samples of ungutted cod showed that landings from Tordenskjold included not only spawn-

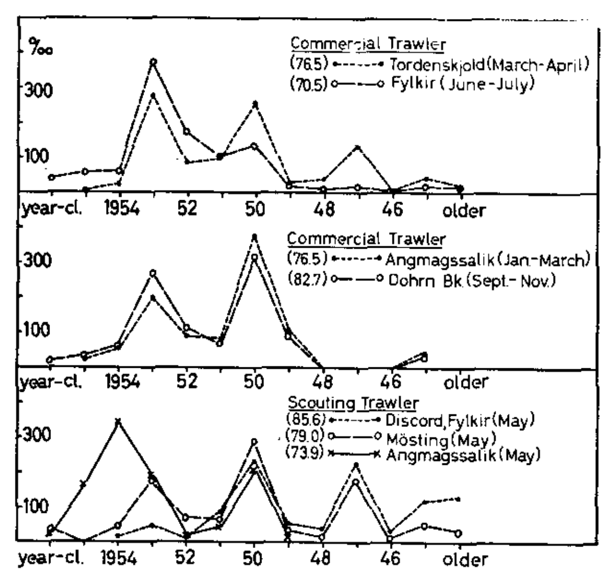

Fig. 2. East Greenland. Cod. Age composition, average lengths in brackets.

ing cod but also, on average, 29% immature cod —some up to 13 years old. Thus, the observed age distribution is not representative of the pure spawning stock. Of the stronger year-classes, the following percentages were still immature; 1953—30; 1950—24; and 1947—18%. This again reveals the long period required for the maturing of the S.E. Greenland cod, and how late maturity is reached.

Very old cod, up to 92% of them mature: were encountered on a scouting trip early in May on the exceedingly uneven and cleft Discord Bank (fished for the first time) and on Bille Bank and Fylkir Bank; 38% of these cod were spawning. On the Mosting ground, however, the scouting vessel observed a stock with as many as 65% immature fish, in spite of the high average age of 10 years. 73% of the 1950 year-class were still immature, and 32% of the 1947 year-class.

Among the cod caught during fishery for redfish off Angmagssalik, the 1954 year-class was the strongest, this year-class is also strong in Icelandic waters.

4. Cod Tagging.

From October 1959 to October 1960, 1728 taggings were carried out off S.W., S. and S.E. Greenland (yellow DHb plastic tags with yellow or blue-white-red flaps) in order to study the migrations of the cod. Up to April 1961, 32 (1.85%) recoveries were recorded. All recovered cod had migrated as expected (see Fig. 3). Cod tagged in October-December 1959, and recovered in February-June 1960, had all migrated **against** the current, from Dana Bank and Sermersut (S.W. Greenland), Nanortalik Bank (S. Greenland) and Bille Bank (S.E. Greenland) to northwest of Iceland. One cod tagged at Cape Farvel is probably recovered at Angmagssalik. Three others, tagged at the beginning of May or September 1960, and recovered February-April 1961, had migrated in the same direction, from Cape Farvel and Nanortalik to Bille Bank and Tordenskjold Bank, and from Noname Bank to Nanortalik Bank. All these cod, 8-14 years old and 71-92 cm long, were obviously on their spawning migrations to E. Greenland or Iceland.

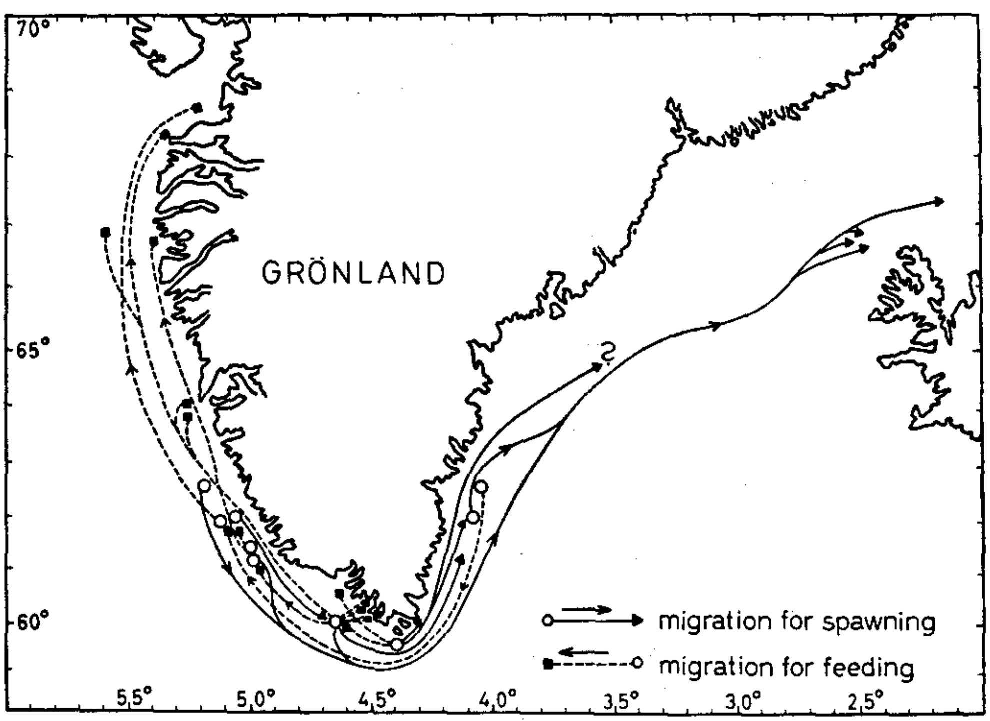

Fig. 3. **Spawning-and feeding migrations of cod tagged off SW-, S-, and SE-Greenland in 1959/60.**

All recoveries **after** the spawning season showed migrations **following** the current towards the feeding grounds. The longest migrations of these cod (tagged end of April-beginning of May, recovered June/Sept. 1960) were from Nanortalik Bank to Fylla Bank and northern Store Hellefiske Bank, and from Sermersut and Noname Bank to Holsteinsborg and Disko Bay.

Also from S.E. Greenland cod migrated west in early summer; one cod, 94 cm long, migrated as far as 430 miles (Fylkir Bank to Noname Bank) in 27 days. These feeding migrations, which also include the summer migrations to the coast and the fjords (German taggings), are carried out by both old and young cod (4-10 years).

B. SUBAREA 1. ICE CONDITIONS AND HYDROGRAPHY BY ARNO MEYER

The varying ice conditions were studied during the scouting trips in December/January and April/May. During both trips the W. Greenland waters were completely ice free, except for a few bergs. At the end of April the northern ice border was along the north edge of Lille Hellefiske Bank. The early ice-covering off S. Greenland was surprising. In December 1959 the ice-tongue already reached 47°W and southwards to 58°40'N.

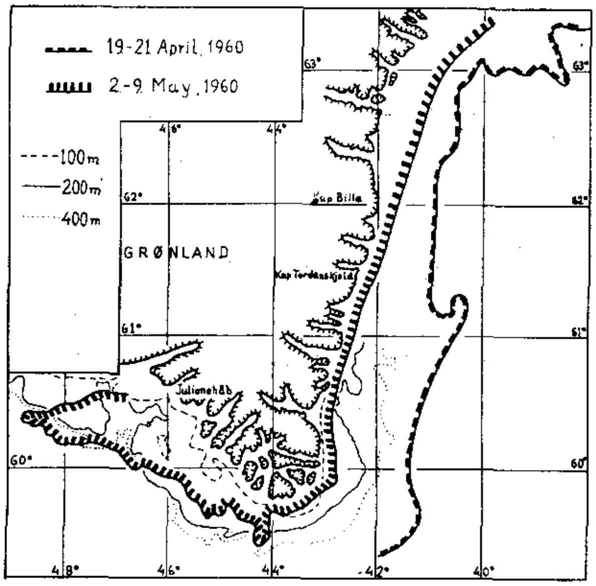

Fig. 4. **The boundaries of ice off SE-Greenland, 19-21 April and 2-9 May 1960.**

The ice conditions along the S.E. Greenland fishing grounds are dependent on the quantity of ice floating south from the Polar Sea and the E. Greenland fjords and, first and foremost, on the wind conditions as the ice is very wind-labil. Long-lasting west winds force the S.E. Greenland winter ice formations far towards the east over the continental slope, thus obstructing the fishery. Long-lasting east and north-east winds, however, press the ice toward the coast, leaving the banks ice-free. Prevailing north winds further the moving of ice from S.E. Greenland and impair the ice conditions off S. Greenland. The extent to which the wind can alter the ice-border in a short time appears from Figure 4.

The first extensive German winter trawl fishery off S.E. Greenland was mainly due to a favourable distribution of air pressure. In November 1959 and February 1960 particularly, the unusually high air pressure over S. Greenland, and also the unusually low air pressure over the eastern Atlantic, caused long-lasting N.E. winds (see Figures 5 and 6 showing mean air pressure, position of anomaly-centers and resulting winds).

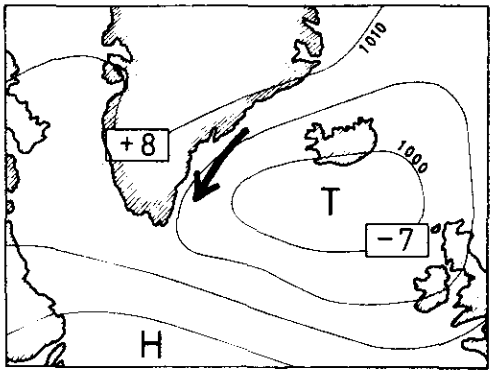

Fig. 5. **Mean atmospheric pressure (in mb) and position of centres of anomalies in November 1959.**

In the future, it will be of interest to study the influence of the yearly variations in mean air pressure distribution on the fishery and possibly on the varying size of year-classes of recruits.

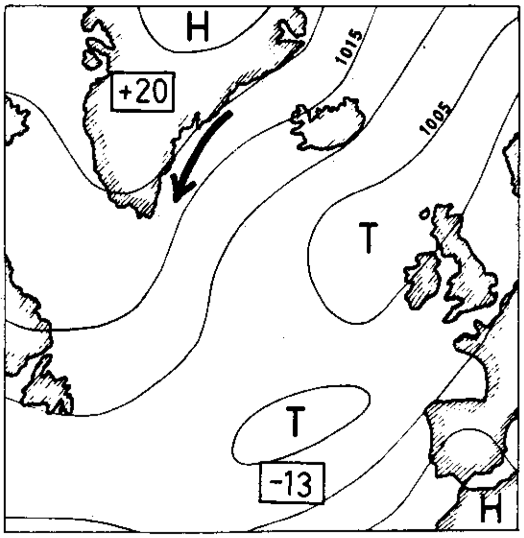

Fig. 6. **Mean atmospheric pressure (in mb) and position of centres of anomalies in February 1960.**

The measurements of temperature made during the scouting trips clearly show the relation between bottom-temperature and catch. Large cod concentrations were found in early winter and in spring with temperatures of over 3°C. Good catches of redfish were only made with temperatures above 4.15°C. mostly from 4.7 to 5.6°C.

The highest bottom temperatures off W. Greenland were found on the northern banks, 5.3°C from 250m and deeper on the western Banana Bank (23 Dec. 1959) and 5.0°C at 210m and deeper on the western part of Lille Hellefiske Bank (25 April 1960).

The temperature sections off S.E. Greenland (60°N and 61°15'N) at the beginning of May 1960 show that the fishing grounds are situated in the area of the warm Irminger Current (Figures 7 and 8), that the temperatures increase rapidly with deeper and more offshore water, and that spawning of cod can only be expected at great depths.

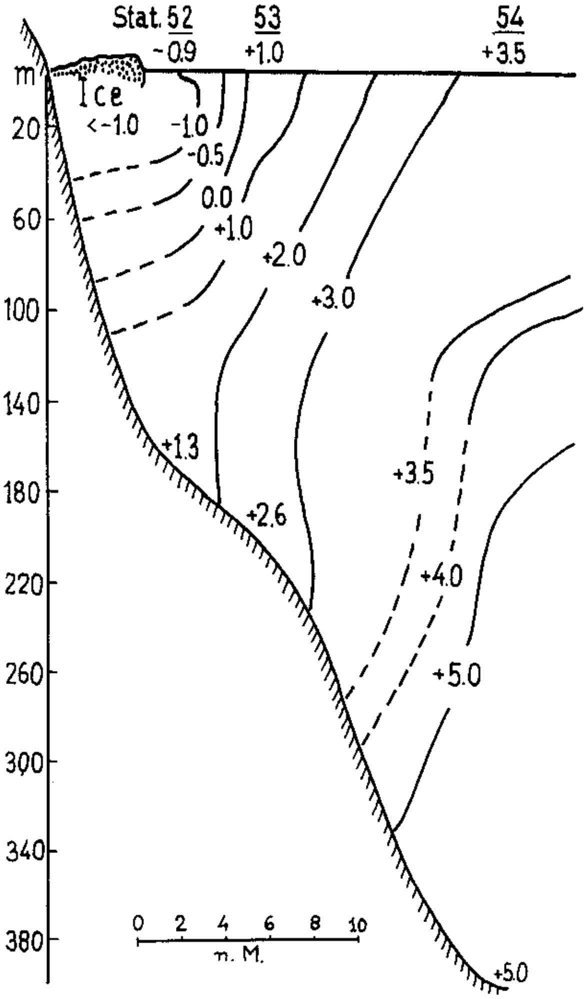

Fig. 7. **Hydrographic section off SE-Greenland, 60°N, beginning of May, 1960.**

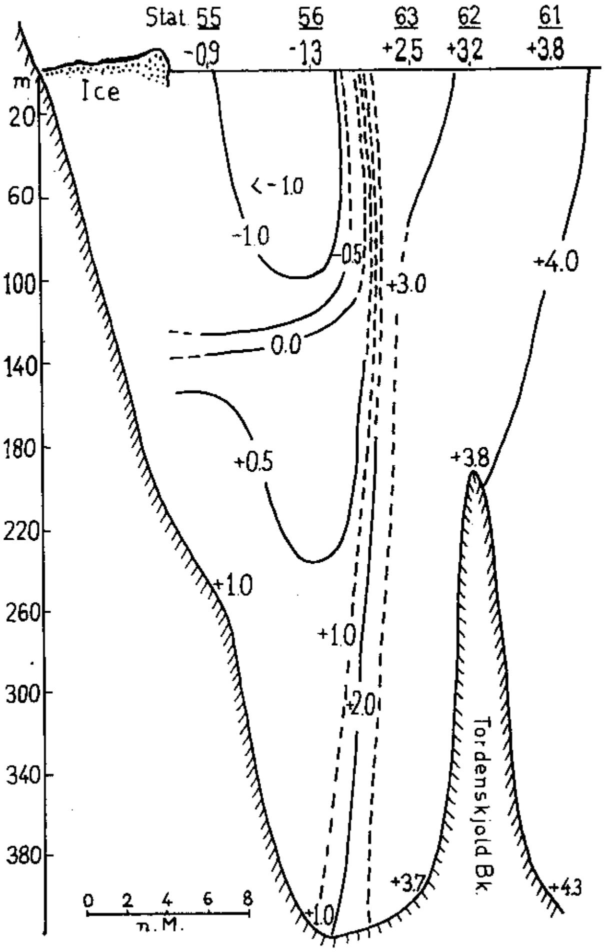

Fig. 8. **Hydrographic section off SE-Greenland, 61°15'N, beginning of May, 1960.**

C. SUBAREA 1. HADDOCK

BY ARNO MEYER

Until now few haddock have been caught off W. and S. Greenland and, so far as is known, these are all large fish—50-75 cm. During a tagging trip, end of September—beginning of October 1960, a number of small haddock (up to 25 in a haul) were caught in several cases. These haddock were 1-3 years old, mostly 2 (see Table 1) with the following sizes: I-Gr.—25.4 cm; II-Gr.—34.6 cm; III-Gr.—43.0 cm. The growth had been rather fast; at the end of November 1960, the same age-groups in the Barents Sea were only 24.6, 30.4 and 40.2 cm long. The otoliths were readable but the winter zones were not so clear-hyaline as in haddock from Iceland and the North East Atlantic. This is surprising as the Greenland cod present clearly readable otoliths with well-developed winter zones.

TABLE I.

Length (cm)	°/∞	Year-classes	°/∞
20-24	77	1959	207
25-29	115	1958	557
30-34	321	1957	165
35-39	282	1956	32
40-44	51	before 1956	39
45-49	51		
50-54	64		
55-59	—		
60-64	26		
65-69	—		
70-74	13		

D. GERMAN REDFISH INVESTIGATIONS IN THE ICNAF AREA

BY A. KOTTHAUS

Racial investigations on redfish were continued in 1960 and extended over the whole distribution area. In this connection all German redfish landings at the Bremerhaven fish market were registered according to type composition. The number of landings investigated was as follows: Subarea 1 (West Greenland)—62; Subarea 2 (Labrador)—84, Subarea 3 (Newfoundland)—17; Total—163. In addition, gill-raker counts were carried out on 411 fish from Subarea 1, 201 fish from Subarea 2 and 150 fish from Subarea 3. Measurements of fish and sampling of otoliths were continued as follows: Subarea 1: 16 samples, 4,997 measurements, 1,006 otoliths; Subarea 2: 6 samples, 1,611 measurements, 115 otoliths; Subarea 3: 4 samples, 987 measurements, 334 otoliths; Total: 26 samples, 7595 measurements, 1455 otoliths.

E. SUBAREAS 2, 3, 4

BY JOACHIM MESSTORFF

Field work was restricted to one search-trip in April/May 1960, and market sampling was carried out during the German trawl season in Northwest Atlantic waters. Because of a change in the expert staff detailed results of the investigations are not yet available but will be communicated in the next report (1961).

Subarea 2.

In the middle of May 1960 a scouting trawler visited the Sundall area but at that time no noteworthy catches could be taken. From November 1960 till March 1961 German trawlers fished in the Sundall- and Hamilton Bank area (2J). At the beginning of the season catches of redfish as well as of cod were rather moderate and during December the trawlers mostly preferred the Newfoundland- and Flemish Cap area. But at the end of December fishery off South Labrador became more successful and especially the increasing proportion of cod is to be noted. Already in the season of 1959/60 a remarkable increase of cod landings from Labrador was observed. In January and February 1961 the proportion of cod reached a still higher level as at the same time of the year before with 60-80% of the landings. From several trips cod constituted even more than 90% of the landings.

Subarea 3.

During the search trip in April/May 1960 fishery conditions in Divisions 3K, 3L, 3N, 3O, and 3P were examined. The proportion of cod in the catches in 3K and 3L was only about 3% and the fish were rather small (mean length 49.8 cm). Redfish catches too were not very successful (mean catch per one hour 1.5 t). In October and December 1960 and January 1961 German trawlers fished for a time in 3K, 3L and 3M, mainly for redfish. Only in October there was a marked increase of the proportion of cod (30-40%) in the catches from the Newfoundland area. At the southern part of the Grand Bank and off the south coast of Newfoundland fishery conditions were found unsatisfactory by a scouting trawler in late April 1960 (3N, (3O and 3P). Catches of cod (mean length 55.2 cm) and haddock (mean length 43.3 cm) and saithe *Pollachius virens* (mean length 81.6 cm) proved not sufficient for a profitable commercial fishery. Redfish of this area were too small for German market conditions.

Subarea 4.

On the same search trip in April 1960 fishing conditions in the Gulf of St. Lawrence as well as on the Nova Scotia Shelf have been examined. At that time the French and Portuguese salt-fish trawlers, which are usually fishing for cod in March/April in 4R, had already left the fishing grounds. The search fishery in 4R confirmed the poor density of cod at that time. Off Cape Ray and off Cape St. George (4R) catches of cod amounted only to about 1-1.5 t per hour trawling (mean length 56.3 cm). Somewhat better conditions were found off Cape Breton Island (4V North) with a mean catch of cod of 3 t per hour trawling (mean length 51.6 cm). All mature cod were found in advanced gonad stages (stages III-V). Search fishery in 4S and 4T was completely unsuccessful. Also experimental hauls on the Nova Scotia Shelf 4V South and 4W) yielded only small catches of cod, haddock and saithe which were not sufficient for a commercial fishery by German trawlers.

Note of printing error: In the German Research Report for 1959, Ann. Proc. Vol. 10 p. 56 2nd column line 15 from above 3.0 should read 3.9.

V. Icelandic Research Report, 1960

BY JÓN JÓNSSON

In 1960 two cruises were made in the ICNAF Area with a chartered trawler, mainly for the location of redfish. A total of about 2000 redfish otoliths from the Newfoundland area were collected for age determination and another 4400 were measured with regard to length and sexual maturity. From West Greenland about 700 redfish otoliths were collected and 750 were measured for length and their stage of maturity determined.

In these cruises some cod were also caught and a total of 758 otoliths were secured for age determination, and the results of these are shown in Table 1.

TABLE 1.

	West Greenland 1B 66°25'N - 54°50'W 7th Sept.		Newfoundland Sundall Area 3K 53°15'N - 52°10'W			
			2nd July		14th Sept.	
Age Groups	%	cm	%	cm	%	cm
3			0.6	37.0	7.0	40.5
4	0.6	60.0	8.0	41.2	13.1	48.1
5	5.3	64.0	4.6	47.9	21.1	55.0
6	7.0	69.4	12.6	50.7	15.6	58.5
7	28.2	74.5	17.1	55.2	14.6	63.1
8	8.8	79.5	17.1	57.6	7.0	64.1
9	7.0	79.0	10.3	62.7	4.0	62.4
10	10.6	82.2	12.0	62.0	5.5	66.7
11	2.4	83.8	5.1	61.6	1.5	71.3
12	9.4	82.9	3.4	64.8	3.0	75.0
13	15.9	84.6	4.0	69.4	1.0	60.5
14	2.4	83.5	2.9	70.2	1.0	79.5
15	1.2	84.0	2.3	67.5		
16						
17	0.6	85.0			0.5	73.0
No. of fish investigated	170		175		199	

The sample from West Greenland in September shows a predominance of the 1953- and 1947- year-classes, which is in accordance with the age distribution in previous years.

The two Newfoundland samples listed in Table 1 are both from the Sundall bank. The sample from the beginning of July shows a dominance of the 1952-, 1953- and 1954- year-classes, and the last two year-classes were also found dominating in some of our samples from this area in 1959. The sample from September shows a greater dominance of small fish, mainly the year-classes from 1953, 1954, 1955 and 1956.

VI. Italian Research Report, 1960

BY G. CANNONE, MINISTERO MARINA MERCANTILE, ROME

At the Tenth Annual Meeting, held in Bergen in June 1960, Italy presented a research program for 1960.

In 1960 two trips to the ICNAF Area were made by the otter trawler "Genepesca I" and the following data on the fishery were collected:

(a) Vessel and Gear.

The otter trawler "Genepesca I" has a gross tonnage of 1649.7, with an overall length of 76.5 meters; the engine is a Fiat, 1200 HP. marine diesel; the crew is 50 men. The trawls used are of the French type, manufactured of manila and nylon, and have meshes of 120 to 140 millimeters. The opening of the trawls is 25 meters, and the average speed when trawling in calm weather is about 3.5 knots. The trawls are used with a single codend, without chafing cover.

(b) First Trip.

The first trip began in Leghorn on 25 January, 1960, and ended in Leghorn 4 June, 1960. Sixteen days were used for reaching the ICNAF Area, and 78 fishing days in producing a total of 660.704 tons of frozen fish and 21.364 tons of fish meal, the trip also included 24 days of inactivity and 13 days for the return trip to Leghorn. The duration of the first trip, from port to port, thus was 131 days. During the trip the "Genepesca I" fished in Divisions 3L, 3O, 3P, 4R, 4T, 4V and 4W. The largest haul of the trip was in Division 4T, 2 April 1960, yielding 18.124 tons of commercial fresh fish, and the same day yielded the largest catch per one day fishing, viz. in two hauls a total catch of commercial fresh fish of 28.900 tons.

(c) Second Trip.

The second trip began in Leghorn 14 June, 1960, and ended in Leghorn 30 October, 1960. The trip to the ICNAF Area lasted 14 days, 88 fishing days were spent to produce a total of 672.382 tons of frozen fish and 24.000 tons of fish meal; the number of days of inactivity was 21 and the return trip to Leghorn took 15 days. The total duration of the trip was thus 138 days, from port to port. During the trip, the "Genepesca I" fished in Divisions 1C, 1D, 2H, 2J, 3K, and 3L. The largest haul was in Division 2J on 17 August, 1960, with 17.870 tons of commercial fresh fish and the largest catch per one day's fishing was on the same day: three hauls with a total catch of commercial fresh fish of 43.000 tons.

(d) Statistics on landings.

The following statistical data on landings show the weight of frozen fish landed from the two trips in 1960:

1)	Redfish	(1st Trip	1.500	
		(2nd ,,	10.700	12.200 tons
2)	Pollock	(1st Trip	4.740	
		(2nd ,,	—	4.740 ,,
3)	Halibut	(1st Trip	2.530	
		(2nd ,,	3.090	5.620 ,,
4)	Cod	(1st Trip	568.234	
		(2nd ,,	658.592	1,226.826 ,,
5)	Other commercial fish	(1st Trip	83.700	
		(2nd ,,	—	83.700
			Total Frozen Fish	1,333.086 ,,
	Fish meal	1st Trip	21.364	
		2nd ,,	24.000	45.364 ,,
			1960, total landed tons	1,378.450 ,,

(e) Discarded Fish.

During the catches from the two trips of "Genepesca I" in 1960, the percentage of discarded fish was estimated as less than 10%. Only a small quantity of the discarded fish was utilized for fish meal producton because the capacity of the vessel for manufacturing fish meal was restricted.

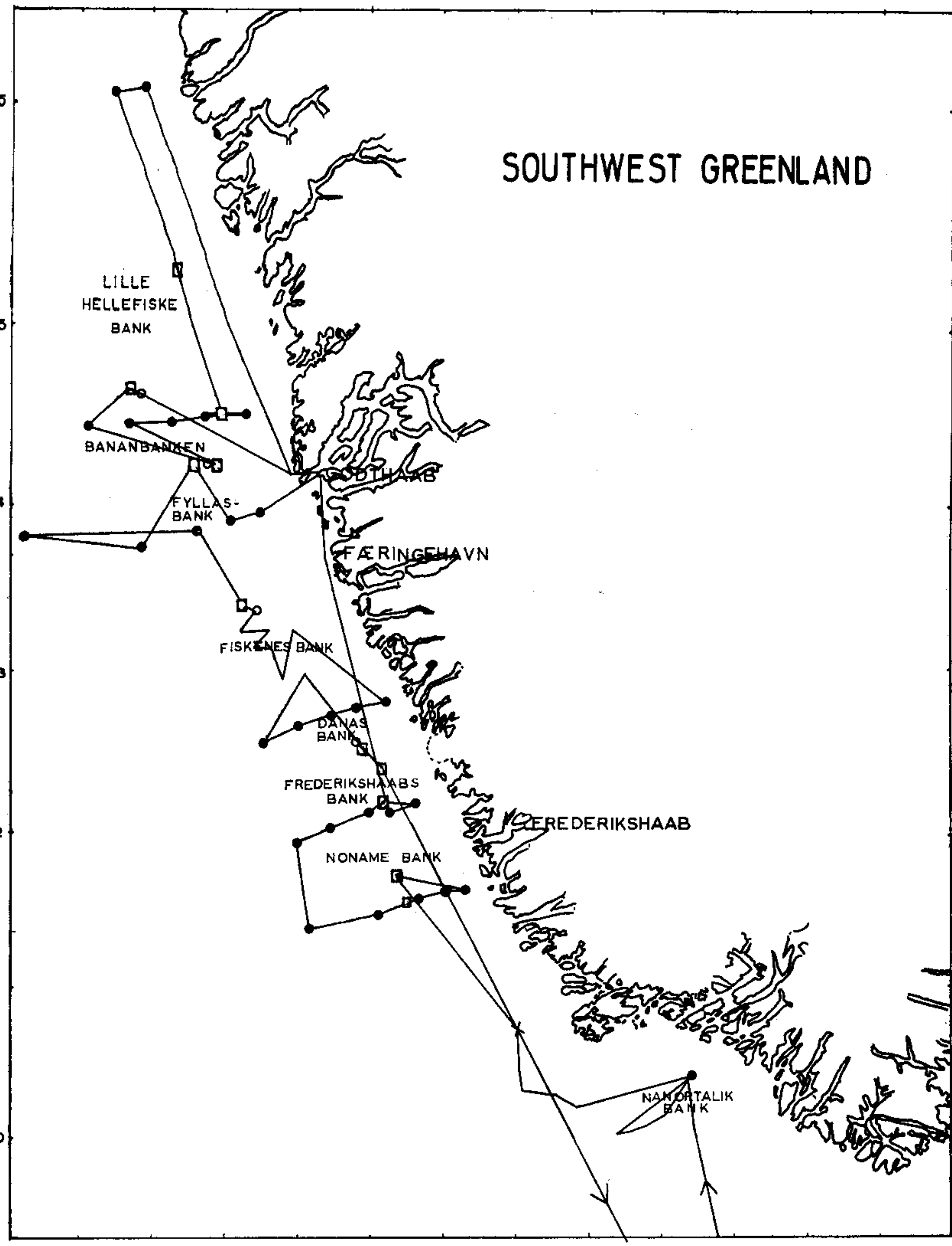

Fig. 1. Norway. "G.O. Sars", West Greenland, April 1960. Routes and net of stations. X—Bathy station, • -hydrographic station, ○ -trawl station, □ -Bottom long line and bathy station.

VII. Norwegian Research Report, 1960

BY ERLING BRATBERG

The Norwegian research vessel, "G. O. Sars" made a cruise to the waters off West Greenland between March 28 and May 6 in 1960. The actual working time on the West Greenland banks was from April 4 to April 26.

Compared with 1959 the ice conditions were good, but bad weather interfered very much with the work. The research programme was therefore much shortened.

Fig. 1 (p. 55) shows the route and the net of stations from the cruise.

Hydrography.

Between April 5 and April 24, 5 hydrographical sections were taken. In addition, 17 temperature registrations were made, most of them by means of a bathythermograph and in connection with the fishing stations. The isotherms in the sections are shown in Figs. 2 to 6.

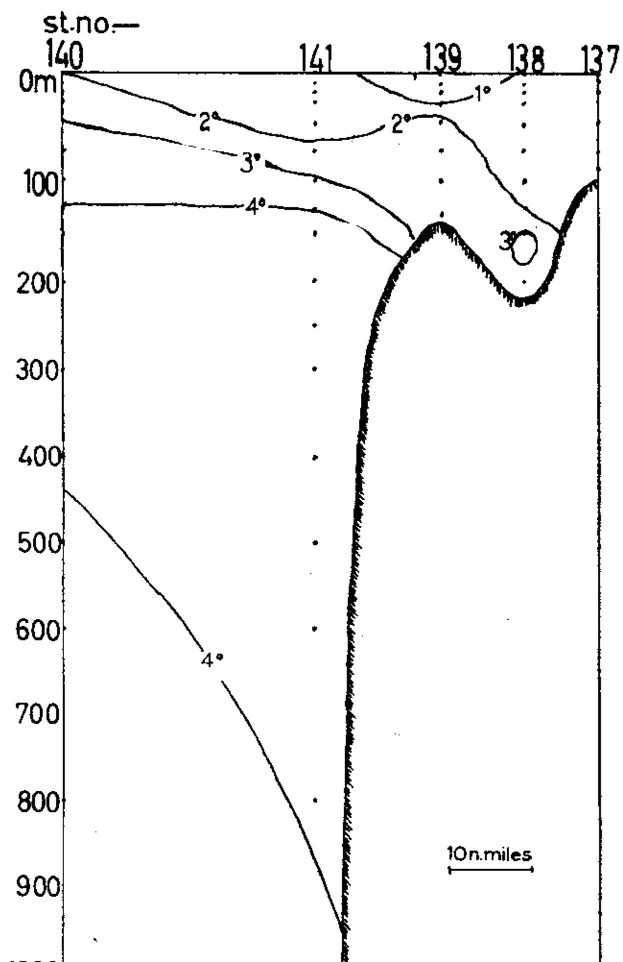

Fig. 2. "G.O. Sars," West Greenland, April 1960. Temperature section, Noname Bank westward.

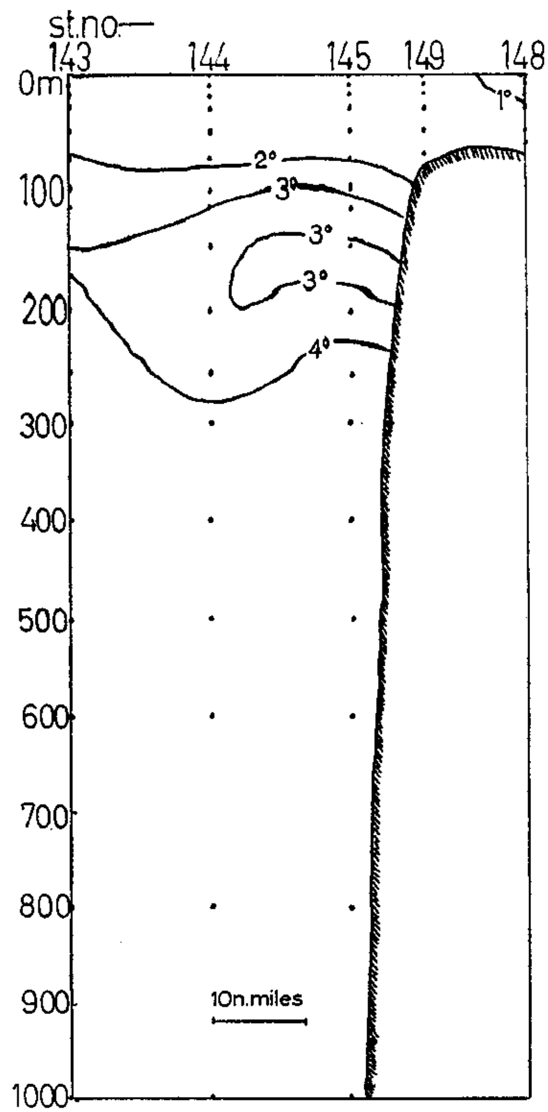

Fig. 3. "G.O. Sars", West Greenland, April 1960. Temperature section, Frederikshaab Bank —westward.

The temperatures showed no exceptional features compared with those taken in April 1959. As usual, the Arctic component of the West Greenland Current was well developed; and thus the cold Arctic water, with temperatures below 2°C, characterised the surface layers and penetrated down to the tops of the banks. The offshore slopes of the banks, that is, below 90 to 150 meters, were covered with water of Atlantic origin, and this water also characterised the mid-water masses in the investigated area.

From Figs. 2 to 6 it can be concluded that the water masses off West Greenland were warmer in April 1960 than in April 1959. This change in temperature is probably not due to a change in the main hydrographical situation, but is more likely to be a temporary change due to a heavy stirring caused by the constantly blowing winds at that time.

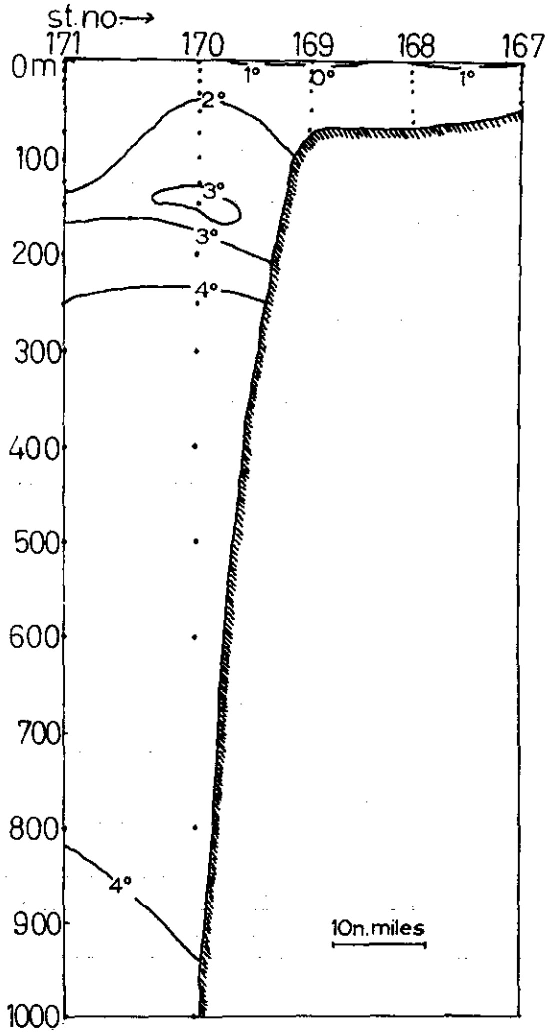

Fig. 4. "G.O. Sars", West Greenland, April 1960. Temperature section, Dana Bank—westward.

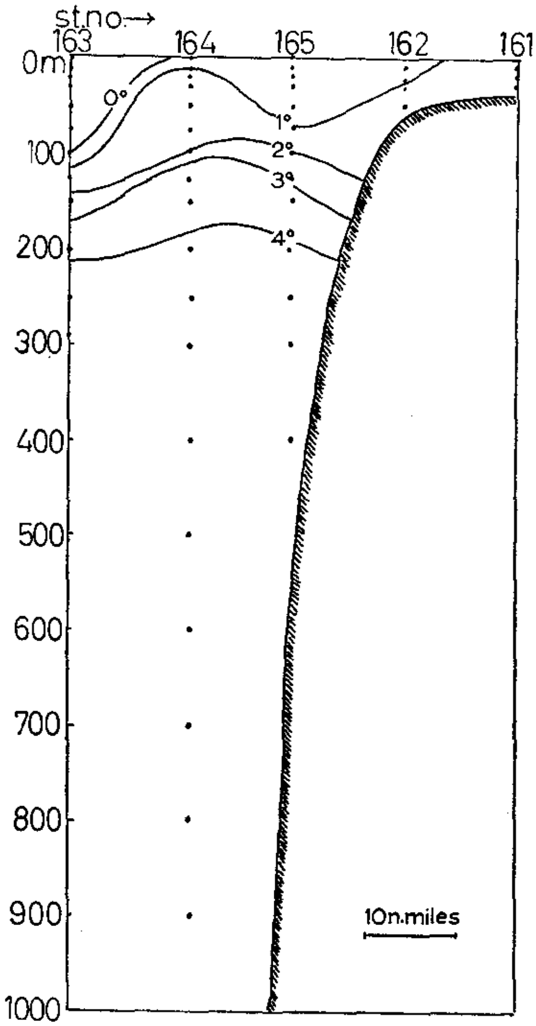

Fig. 5. "G.O. Sars", West Greenland, April 1960. Temperature section, Fylla Bank—westward.

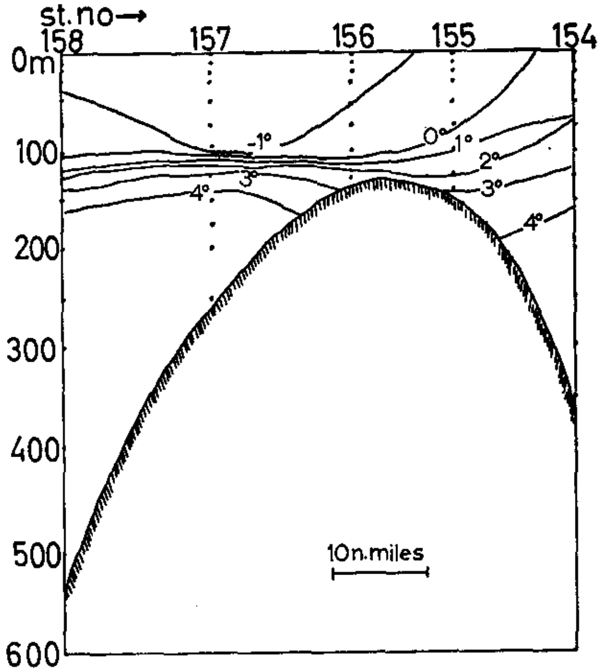

Fig. 6. "G.O. Sars", West Greenland, April 1960. Temperature section, Banan Bank —westward.

Cod Investigations.

On account of the weather conditions the survey with the echo-sounder was not very successful in 1960. Nevertheless, the registrations made with the echo-sounder indicated a different distribution of the cod than that of April the year before. As opposed to 1959, no cod were registered in the deeper parts of the western slopes of the banks where the temperature was 4°C or more. On the other hand, as in 1959, fish were found only on the top of one bank: namely, the middle part of Lille Hellefiske Bank.

The few successful registrations with the echo-sounder showed that most of the cod were staying in water where the temperature was between 2° and 4°C. This was confirmed by the fishing experiments (Tables 1 and 2).

Tables 1 and 2 could also indicate that the spawning temperature might have a lower limit than the 4°C-limit found the year before. This is probably not the case, because the cod were in a different stage of maturity than in 1959.

TABLE 1. "G. O. Sars" West Greenland April 1960. Cod bottom longline stations.

Date	Position		Depth	Bottom Temp. °C	No. of Hooks	Catch: No. of Cod	Catch: No. of Halibut
April 5	61°41′N	50°39′W	190	3.3	1800	242	28
April 6	61°29′N	50°28′W	205	3.1	2100	197	18
April 7	62°13′N	50°49′W	140	1.9	1950	139	16
April 12	65°19′N	53°42′W	125	3.9	2050	82	0
April 13	64°12′N	53°05′W	170	3.2	2050	41	40
April 14	64°40′N	54°17′W	155	2.6	1900	298	4
April 22	63°24′N	52°44′W	135	1.8	2050	80	1
April 25	62°32′N	51°07′W	210	2.3	2050	110	0
April 26	62°25′N	50°50′W	200	2.0	2050	234	0

TABLE 2. "G. O. Sars" West Greenland April 1960. Halibut longline station.

Date	Position		Depth	Bottom Temp. °C	No. of Hooks	Catch: No. of Halibut	Catch: No. of Cod
April 5	61°44′N	50°39′W	198	3.9	1000	7	20
April 7	62°12′N	50°34′W	125	1.7	1000	6	51
April 12	64°31′N	53°02′W	108	2.5	925	2	43
April 19	64°14′N	53°17′W	200	4.5	1000	0	1
April 25	62°32′N	51°07′W	210	2.3	1000	0	8
April 26	62°25′N	50°50′W	200	2.0	1000	0	51

Almost all the mature cod caught from all the banks had completed their spawning, Table 3. Only 10.5% of the cod were actually in the spawning stage, while 11.2% were still maturing.

Figs. 7 and 8 show the length distribution and the age composition of the cod caught by bottom longline.

The longline catch is dominated by relatively small fish, but a good part of the catch has the proper size for the Norwegian commercial fisheries. The mean length in the total longline catch is 73.27 cm, in Divisions 1C, 1D and 1E, 72.09, 74.16 and 73.55 cm respectively.

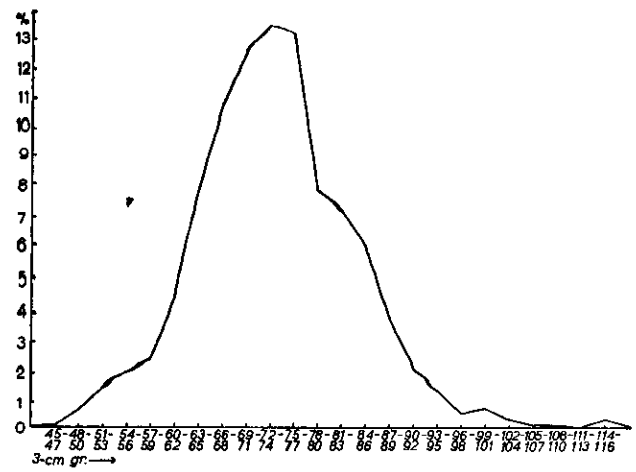

Fig. 7. "G O Sars", West Greenland, April 1960. Cod, length distribution. Total catch, bottom long line.

TABLE 3. "G. O. Sars" West Greenland April 1960. Cod. Total catch bottom longline and trawl. Stage of maturity.

Sex	Females						Males						Total
Length	Stage of maturity[1]						Stage of maturity[1]						
cm-group	0	1	2	3	4	5	0	1	2	3	4	5	
39-41	1	—	—	—	—	—	1	—	—	—	—	—	2
42-44	3	—	—	—	—	—	3	—	—	—	—	—	6
45-47	14	—	—	—	—	—	12	—	—	—	—	—	26
48-50	24	—	—	—	—	—	25	—	—	—	—	—	49
51-53	20	—	—	—	—	—	25	—	—	—	—	3	48
54-56	16	—	—	—	—	1	14	—	—	—	—	—	31
57-59	17	—	—	—	—	1	10	—	—	1	2	1	32
60-62	17	—	1	1	2	5	7	—	—	1	7	9	50
63-65	21	—	1	—	1	13	11	1	1	7	7	16	79
66-68	24	—	1	4	5	16	5	—	4	8	10	31	108
69-71	16	—	3	5	6	43	3	—	1	7	16	26	126
72-74	10	—	—	4	4	62	2	—	5	4	18	28	137
75-77	8	—	1	8	3	61	2	—	1	7	10	27	128
78-80	4	—	1	9	1	41	—	—	1	2	2	16	77
81-83	2	—	—	5	1	38	—	—	—	2	6	13	67
84-86	4	—	—	—	5	29	—	—	1	1	3	9	52
87-89	2	—	—	4	1	18	—	—	—	3	1	4	33
90-92	1	—	—	1	2	12	—	—	—	2	—	2	20
93-95	—	—	—	—	—	9	—	—	—	—	2	1	12
96-98	—	—	—	—	1	4	—	—	—	—	—	—	5
99-101	—	—	—	1	—	4	—	—	—	—	—	1	6
102-104	—	—	—	1	—	1	—	—	—	—	—	1	3
105-107	—	—	1	—	—	—	—	—	—	—	—	—	1
108-110	—	—	—	—	—	1	—	—	—	—	—	—	1
111-113	—	—	—	—	—	—	—	—	—	—	—	—	—
114-116	—	—	1	2	—	—	—	—	—	—	—	—	3
Total	204	—	10	45	32	359	120	1	14	45	84	188	1102

[1] The stages used here are a modification of the stages used by Maier and modified by Sivertsen.

Stage used here	Sivertsen stage	Maier stage
0	1	I, II, III
1, 2, 3	2	IV, V
4	3	VI
5	4	VII, VIII

The age composition of the bottom longline catch shows that the rich year-classes 1942, 1947 and 1950 do not play an important part in the catch any longer. Together these year-classes amount to only 12.79% of the total catch. The 1953 year-class is the most dominant, constituting 43.07% of the total longline catch.

In Figs. 9 and 10 the length distribution and the age composition are shown for the total trawl catch. As expected, these two figures differ a great deal from the corresponding figures for the bottom longline catch, but it must be borne in mind that the figures for the trawl-catch are based on only two samples from two different banks. The mean length of the trawl-caught cod is only 58.48 cm, and almost all the cod in these two catches are of a size that is far below the proper commercial size for the Norwegian needs.

The small mean length of the trawl-caught cod is due to the 1956 year-class with a mean length of 48.98 cm. This year-class does not appear with the same strength in the longline catch, because of the different selectivity of the two types of gear. The 1956 year-class seems to be a very strong one, but its influence on the trawl catch may be affected by different shoaling on the different banks.

From a comparison of the catch in April 1960 with the catch in April 1959, it is to be expected that the 1947 and 1950 year-classes will be of no importance to the longline fishery off West Greenland in 1961. The 1953 year-class will still play the dominant part and probably increase in relative strength. The increasing importance of the 1953 year-class may involve a slight increase in the mean length of the longline caught cod, but this depends on to what degree the 1956 year-class will influence the longline fishery.

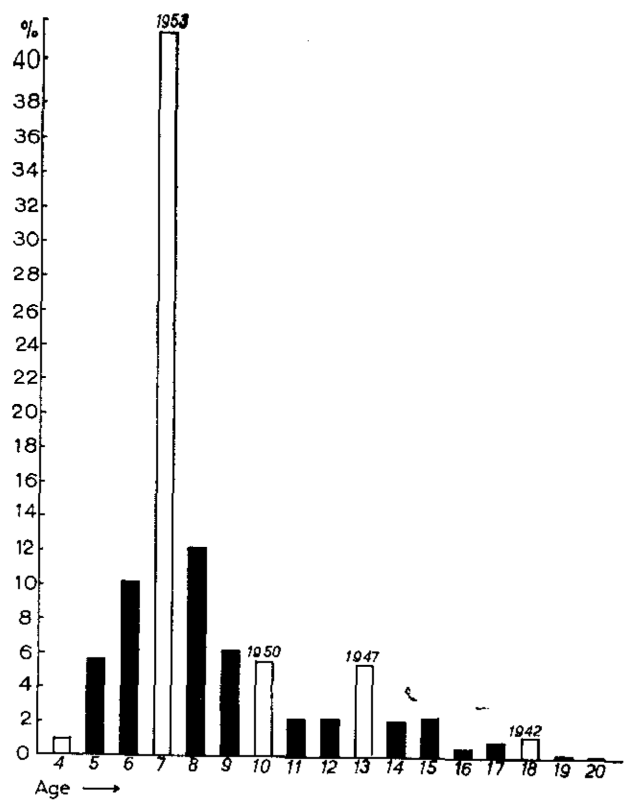

Fig. 8. "G.O. Sars", West Greenland, April 1960. Cod, age composition. Total catch, bottom long line.

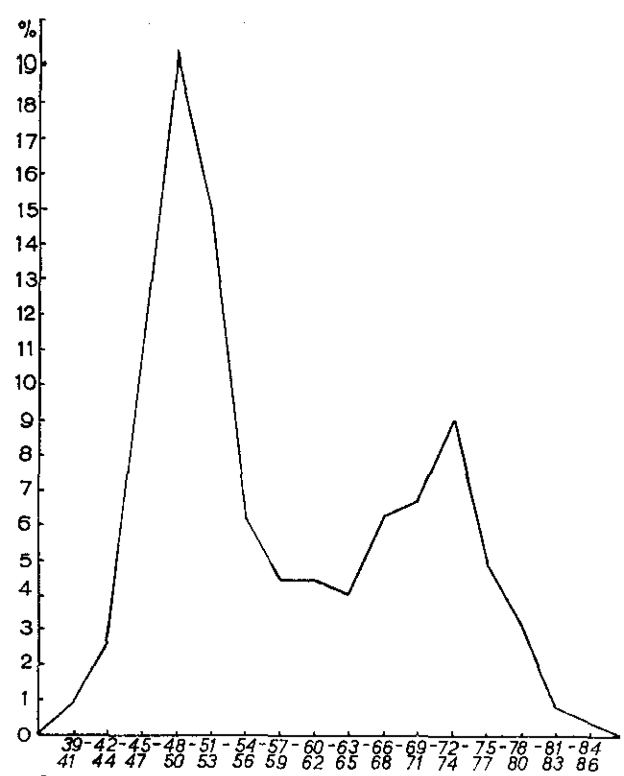

Fig. 9. "G.O. Sars", West Greenland, April 1960. Cod, length distribution. Total catch, trawl.

Halibut Investigations.

In April 1960 attempts were made with halibut longline in the localities where Norwegian longliners usually, and with some success, fish for halibut in the months June to September.

Table 2 shows the results of these fishing experiments. The catch was rather sparse, and, to some degree, the by-catch of halibut on the cod bottom longline was better (Table 1).

All the halibut caught were very small and immature. This may indicate that off West Greenland the mature halibut migrate from shallower and colder to deeper and warmer water during the year. The immature halibut probably stay on the upper slopes of the banks the whole year through.

Tagging Experiments.

Due to the bad weather during the cruise in April 1960, the tagging programme was very much shortened. Only 56 halibut and 107 cod were tagged. As usual, the halibut were tagged with the yellow plastic disks in the gill cover. All the cod were tagged with Lea tags attached with nylon anteriorly of the first dorsal fin.

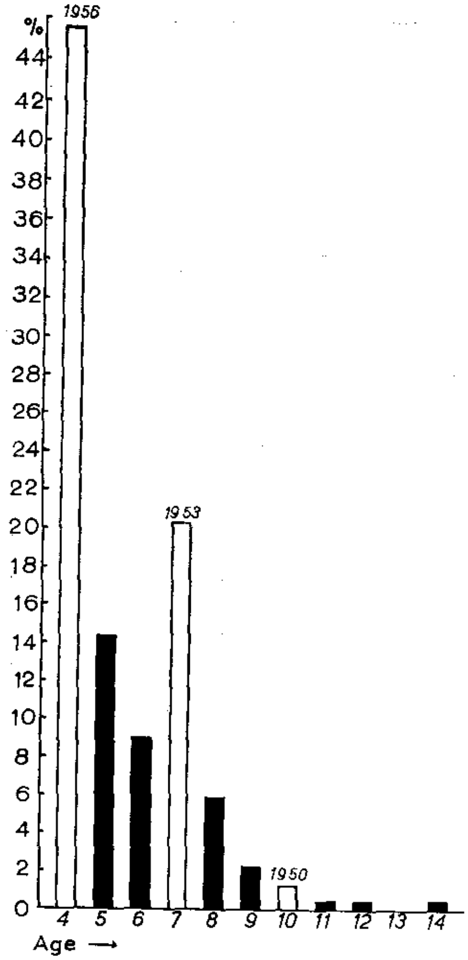

Fig. 10. "G.O. Sars", West Greenland, April 1960. Cod, age composition. Total catch trawl.

VIII. Portuguese Research Report, 1960[1]

BY MARIO RUIVO AND GLICINIA QUARTIN

The present paper summarizes the results of the samplings carried out on board Portuguese cod-fishing vessels in Subareas 1 (Greenland), 2 (Labrador), 3 (Newfoundland), and in Divisions 4R and 4Vn (Gulf of St. Lawrence and Nova Scotia). The material collected includes data on size-and age-distribution, weights, sex ratio, stage of maturity and parasitization. The gear used, the method of sampling and the technique of investigation are the same as in previous years (vide Portuguese Research Report, 1956, ICNAF Ann. Proc. Vol. 7).

TABLE 1. Greenland 1960. Sample groups studied (*samples without otoliths).

Sample Group	Sample No.	Division	Dates	Gear
A	1-3	1F	25/27-IV-60	Trawl
B	6-8-9	E	1/5-V-60	,,
C	7-10	1D	2/11-V-60	,,
D*	4	1F	28-IV-60	,,
E*	2	1F	26-IV-60	,,

[1]The tables giving the individual data will be published in Sampling Yearbook Vol. 5 when not included in this paper.

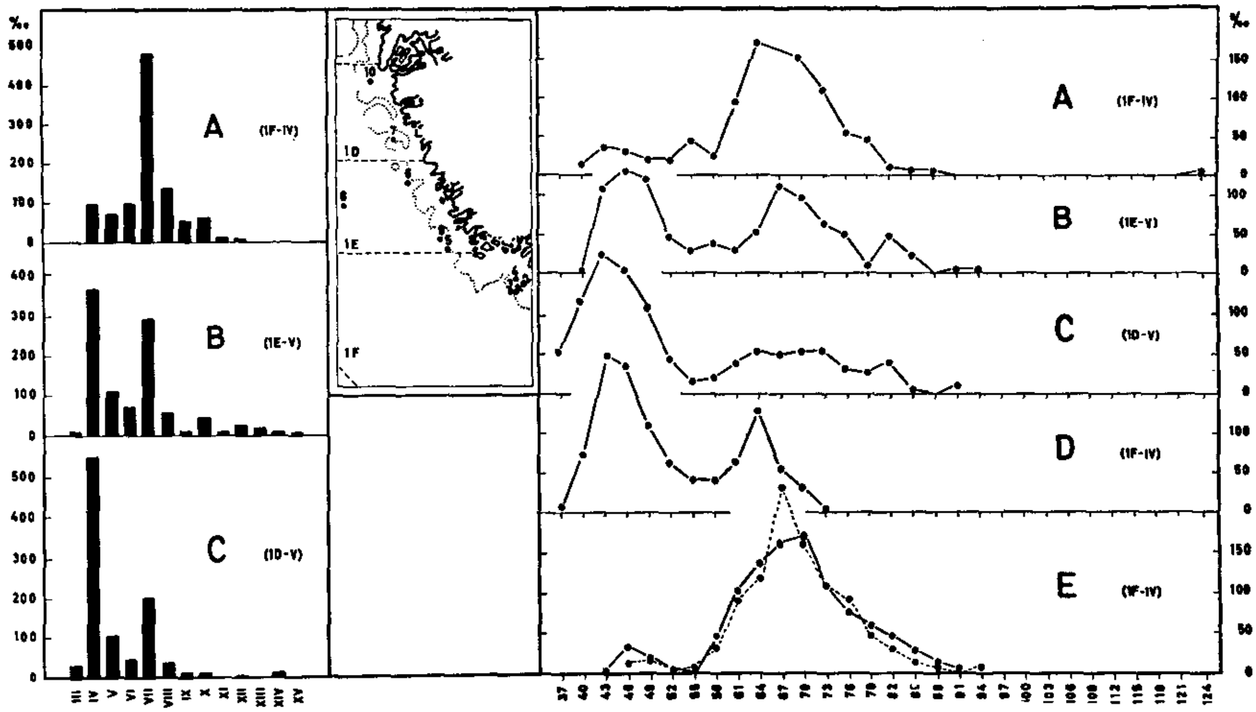

Fig. 1. **Cod, Subarea 1, 1960. Age- and length distribution of samples from trawlers. Left-age; centre position of samples; right length, (bold lines-day, stipled lines night samples).**

I. **Cod** (*Gadus morhua* L.), **Subarea 1 (Greenland)**

A total of ten samples, 1,500 specimens, were taken in Divisions 1F, 1E, and 1D (April-May) from trawlers. Seven of these samples, 700 specimens, were aged by means of the otoliths. As in previous years, the samples were grouped by months and divisions (Table 1, Fig. 1)

1. **Age-distribution** (Fig. 1)

In Division 1F (April, Gr. **A**), the age-group VII predominates (480°/₀₀), followed by VIII (135°/₀₀); the remaining age-groups are less than 100°/₀₀.

In 1E (May, Gr. **B**) age-group IV predominates (365°/₀₀), followed by VII (291°/₀₀) and V (110°/₀₀).

In 1D (May, Gr. **C**) age-group IV predominates (550°/₀₀), followed by VII (200°/₀₀) and V (105°/₀₀).

Summary: The 1953 year-class, which has been very abundant since 1957 (especially in the fishery of 1959), continues to yield an important share in the fisheries, and particularly in 1F in spring. The 1956 year-class appears in 1960 for the first time in the catches, with its highest abundance in the catches from 1E and 1D. The 1947 year-class is disappearing from the catches and the 1955 year-class is of some importance. The abundance of the separate year-classes in the fisheries 1955-60 can be denoted as follows:

Year of	**Year Class**									
Capture	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956
1955	+ + +	+	0	+ +	0	0	0	0	0	0
1956	+ + +	+	+	+ +	+	0	0	0	0	0
1957	+	0	+ +	+ + +	+ +	0	+ +	0	0	0
1958	+	0	0	+ + +	+ +	0	+ +	0	0	0
1959	+	0	0	0	0	+ +	+ + +	+	+	0
1960	0	0	0	0	+	+	+ + +	0	+ +	+ + +

2. **Size-distribution** (Fig. 1)

In Division 1F, in April (Groups **A, D***[1] and E*) the size-distribution is somewhat different from group to group. In **A** and **E***, which present similar characters, the lengths vary between 40 and 94 cm; in **A** the modal length is in the 64 cm-group, mean length 65.4 cm. In **E*** (day- and night-fishing) the length ranges from 43 to 94 cm, the length groups 67 and 70 cm predominate; the mean lengths for day-and night-samples are about the same: 68.9 and 68.5 cm. Sample Group D* is from about the same area, season and depth (130 m) as **A** and **E***, nevertheless its length-composition differs: the length ranges from 37 to 73 cm with peaks at 43 and 64 cm, and a mean length of 51.7 cm. i.e. the cod are considerably smaller than in **A** and **E***.

In 1E, May (Group **B**) the length varies between 40 and 94 cm; the curve has several peaks (at 46, 67 and 82 cm); the mean length is 59.9 cm.

In 1D (Group **C**) the length ranges from 40 to 91 cm with a peak off 43 cm; the mean length is 54.7 cm.

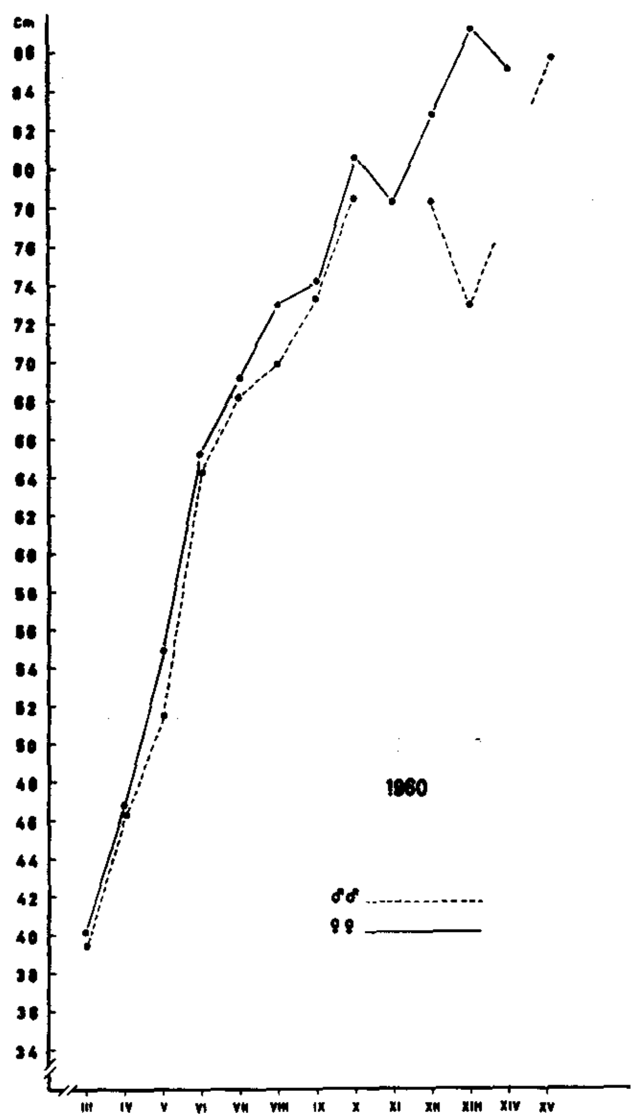

Fig. 2. **Cod, Subarea 1, 1960. Growth curves for males and females.**

3. **Growth** (Fig. 2)

Figure 2 presents the mean lengths for males and females of the various age-groups. The resulting growth curve reveals the more rapid growth of females; the inflexion point of the curves is for the 6th year.

4. **Sex Ratio.**

In Groups **B** and **C** the two sexes are evenly represented, in **A** the males predominate (55%), in **E***, females predominate in both day and night samples (60%).

5. **Stages of Maturity** (Table 2, Fig. 3)

Males. In April the majority of the males (73%) are in the developing stage, 26% are in the resting stage, and only 1% are post-spawners. In May the number in the developing stage has decreased to 26%, whereas the number in the resting stage has increased to 69%, spawners and post-spawners are rare, 2% and 4% respectively.

TABLE 2. Greenland 1960. Stage of maturity of gonads determined by macroscopic observation, samples from April-May Divisions 1F 1E and 1D.

Stage of Maturity	April		May	
	♂♂ %	♀♀ %	♂♂ %	♀♀ %
Resting	26	82	69	71
Developing	73	0.1	26	2
Spawning	—	—	2	—
Post-Spawning	1	17	4	27
Observed	109	91	206	194

[1] *—here and in the following: no otoliths collected.

Females. In April almost all (82%) are in the resting stage, the remaining (17%) are post-spawners. In May the number in the resting stage is smaller, 71%, whereas post-spawners now amount to 27%, scarcely 2% are in the developing stage.

6. First Maturity (Table 3, Fig. 4)

First maturity is rarely reached in the 5th year, and in only a few cases in the 6th year; most frequently it is reached in the 7th or 8th year, both for males and females. There appears to be a trend towards earlier maturation in the more recent year-classes (1954, 1953 and 1952). With the 8th year, all cod have reached maturity.

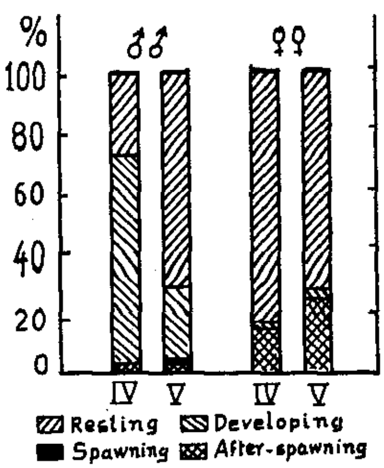

Fig. 3. Cod, Subarea 1, 1960. Percentage numbers of males and females of different stages of maturity in April and May.

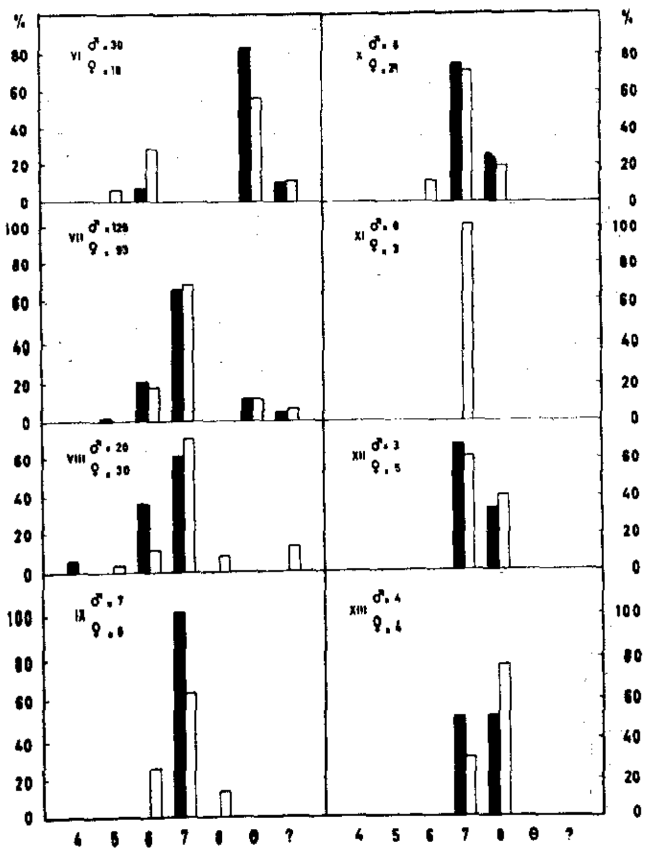

Fig. 4. Cod, Subarea 1, 1960. Percentage numbers of males (black) and females (white) of ages 4-8, spawning for the first time (only age-groups VI-XIII included). ○ = no spawning mark.

TABLE 3 Greenland, 1960 Age at first maturity, males and females of age-groups VI-XIII, April-May, 1F, 1E and 1D

Age-Group		♂♂ Age at First Maturity IV	V	VI	VII	VIII	IX	○	?	Total		♀♀ Age at First Maturity IV	V	VI	VII	VIII	IX	○	?	Total
VI	No.	—	—	2	—	—	—	25	3	30	No.	—	1	5	—	—	—	10	2	18
	%	—	—	7	—	—	—	83	10	100	%	—	6	28	—	—	—	56	11	101
VII	No.	—	1	25	84	—	—	14	5	129	No.	—	—	16	62	—	—	10	5	93
	%	—	1	19	65	—	—	11	4	100	%	—	—	17	67	—	—	11	5	100
VIII	No.	1	—	7	12	—	—	—	—	20	No.	—	1	3	21	2	—	—	3	30
	%	5	—	35	60	—	—	—	—	100	%	—	3	10	70	7	—	—	10	100
IX	No.	—	—	—	7	—	—	—	—	7	No.	—	—	2	5	1	—	—	—	8
	%	—	—	—	100	—	—	—	—	100	%	—	—	25	63	13	—	—	—	101
X	No.	—	—	—	6	2	—	—	—	8	No.	—	—	2	15	4	—	—	—	21
	%	—	—	—	75	25	—	—	—	100	%	—	—	10	71	19	—	—	—	100
XI	No.	—	—	—	—	—	—	—	—	—	No.	—	—	—	3	—	—	—	—	3
	%	—	—	—	—	—	—	—	—	—	%	—	—	—	100	—	—	—	—	100
XII	No.	—	—	—	2	1	—	—	—	3	No.	—	—	—	3	2	—	—	—	5
	%	—	—	—	67	33	—	—	—	100	%	—	—	—	60	40	—	—	—	100
XIII	No.	—	—	—	2	2	—	—	—	4	No.	—	—	-	1	3	—	—	—	4
	%	—	—	—	50	50	—	—	—	100	%	—	—	—	25	75	—	—	—	100

TABLE 4. Labrador, 1960. Sample groups studied.

Sample Group	Sample No.	Division	Dates	Gear
A	1	2J	29-V-60	Trawl
B	2-4-7-10-12	2J	1/12-VI-60	,,
C	13-14-16-18-22-25-26	2J	8/29-VIII-60	,,
D	29-31-34-35	2J	1/21-IX-60	,,
E	37-38-40-41	2H	24/28-IX-60	,,
F	42	2J	4-X-60	,,
G	43-44-46-48	2J	9/24-XI-60	,,
H	3-9	2J	2/9-VI-60	,,
I	15-17-20-23-24	2J	11/22-VIII-60	,,
J	30	2J	2-IX-60	,,
L	39	2H	26-IX-60	,,

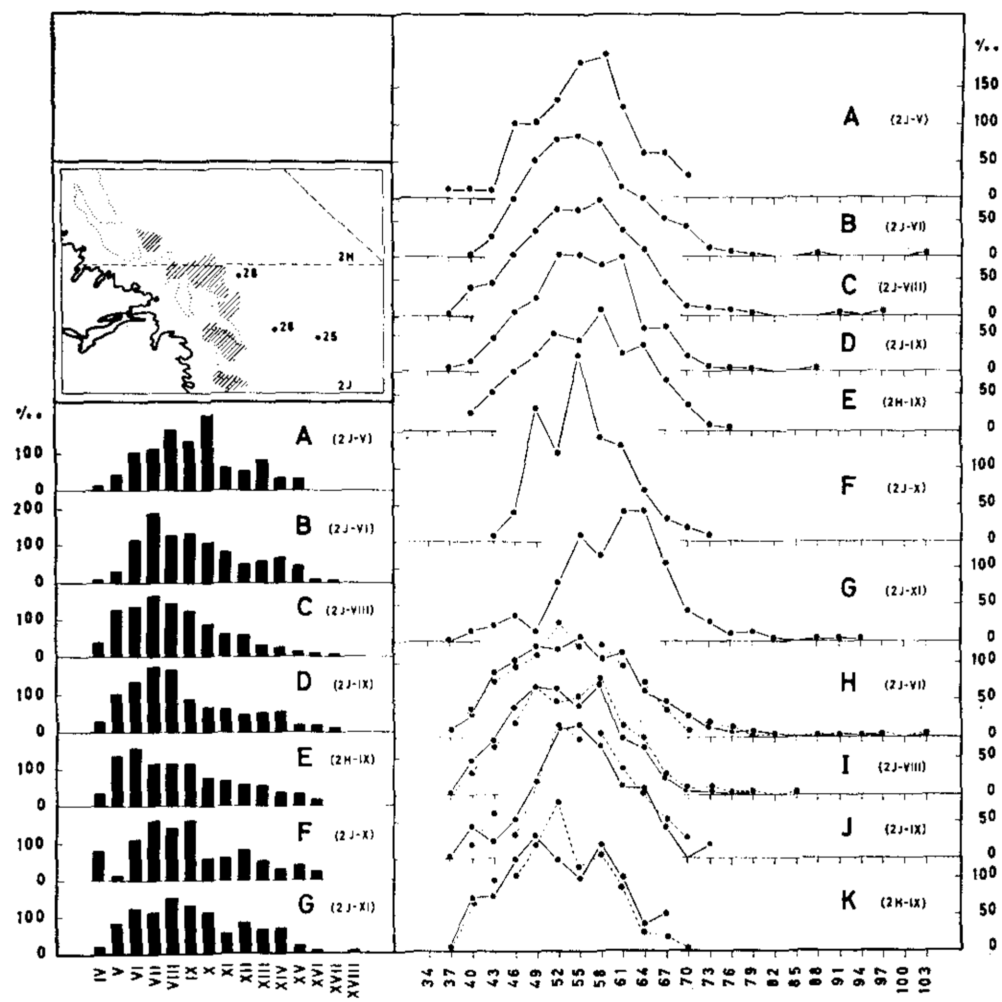

Fig. 5. Cod, Subarea 2, 1960. Age- and length distribution of samples from trawlers. Left above—position of samples; left below - age; right - length (bold lines day-, stipled lines - night samples).

II. Cod in Subarea 2 (Labrador)

A total of 49 samples from trawlers was collected in 2J and 2H (May through November), including about 8,000 cod; for 26 of these samples, 2,600 specimens, age-readings were carried out by means of otoliths. The grouping of the samples by division and month appears from Table 4).

1. Age-distribution (Fig. 5)

(a) First Cruise (May-June)

In 2J, May (Group **A**) the age-group X predominates (200°/₀₀), followed by VIII, IX and VII (160, 130, 110°/₀₀); Group VI accounts for 100°/₀₀, and XIII (which has been fairly abundant for years) for 80°/₀₀. Age-group VII predominates in June (Group **B**) with 186°/₀₀, followed by IX and VIII (about 130°/₀₀) and VI and X (about 110°/₀₀).

(b) Second Cruise (August-November)

In 2J, August (Gr. **C**) age-groups V to X predominate: VII with 166°/₀₀, the others with about 120-140°/₀₀. In September (Gr. **D**) the age-groups VII and VIII (176 and 160°/₀₀) and V and VI (100 and 133°/₀₀) predominate, the remaining groups are less abundant, below 100°/₀₀. In October and November (Gr. **F** and **G**) the case is similar, with a preponderance of the following age groups: VI - 110 - 128°/₀₀, VII - 160 - 118°/₀₀; VIII - 140 - 153°/₀₀; and IX - 160 - 133°/₀₀. It is to be noted that age-group V, which is very scarce (10°/₀₀) in October, reappears in November, with 85°/₀₀. In this month age-group X is also better represented, 110°/₀₀ compared to only 60°/₀₀ in October.

In 2H, September (Gr. **E**) the younger cod appear to be more abundant: VI 157°/₀₀ and V 139°/₀₀. The age-groups VII, VIII and IX account each for ca. 113°/₀₀.

Summary: As in 1955-58, this subarea continues to be characterized by the absence of strongly dominant year-classes. The 1953, 1952 and 1951 year-classes are the best represented, followed by 1955 and 1954. The 1950 year-class, which predominated in 1957 and 1958, is the richest in May, but then it decreases during the summer, being again better represented in November.

2. Size-distribution (Fig. 5)

(a) First Cruise.

In 2J, May-June (Gr. **A** and **B**) the size-distribution is fairly even, with lengths between 37 and 103 cm. The peaks of the curve are at 58 and 55 cm corresponding to mean lengths of 55.7 and 54.8 cm. In sample group **H*** (day and night fishing) the predominating lengths are a little lower (55 and 52 cm; mean length 55.0 cm).

(b) Second Cruise.

In 2J, August-September (Gr. **C, I*, D, J***) the size-distribution is also fairly regular; in August ranging from 37 to 97 cm, with peaks at 52-58 cm, and a mean length of 55.2 cm (**C**), in **I*** the average length is a little lower (day -53.4 cm, night -54.1 cm). In September (**D, J***) the range of lengths is between 37 and 88 cm, with peaks at 52 and 55 cm, the average lengths are: **D** - 55.6 cm, **J*** (day) - 55.9 cm, and **J*** (night) - 55.4 cm. In October-November (**F** and **G**) the size variation is from 37 to 94 cm; the distribution is less regular than in the previous samples, the peaks are at 55, 49 and 61 cm and the mean length is about 60.5 cm.

In 2H, September (**E, K***) the size-distribution varies between 37 and 76 cm; the curve presents several peaks: 58, 49 and 52 cm. The mean length is in one sample 55.9 cm, in another only 52.5 cm (day) and 51.7 cm (night).

3. Growth (Fig. 6)

Figure 6 summarizes the mean lengths of males and females by age-groups for 2J and 2H. The growth is virtually the same as in previous years and shows a more rapid growth for females.

4. Sex Ratio.

The sex ratio shows, in general, a preponderance of females (521-610°/₀₀); in Gr. **A,** May 2J, however, the males predominate (550°/₀₀).

5. Stages of Maturity (Table 5, Fig. 7)

Males. In May-June almost all males are either in the developing stage (49-31%) or in the resting stage (47-51%). In June a few spawners appear (12%) and still fewer post-spawners (4-6%). August-November reveals a decrease

TABLE 7. Subarea 3, Newfoundland, 1960. Sample groups studied. *Samples without otoliths).

Sample Gr.	Sample No.	Division	Dates	Gear
A*	5	3Pn	20-III-60	Trawl
B*	8	3L	13-IV-60	,,
C	16	3K	26-V-60	,,
D*	35	3L	2-XI-60	,,

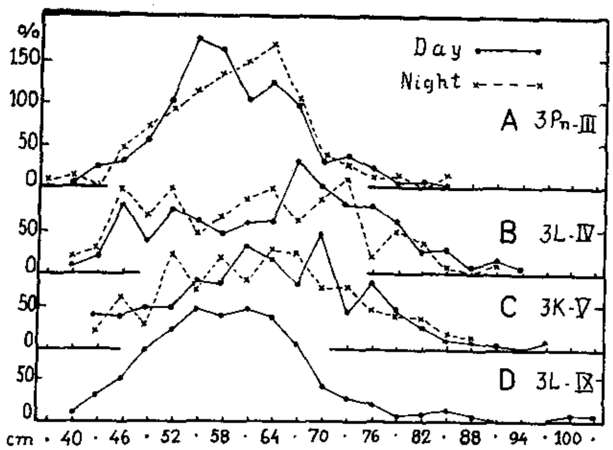

Fig. 9. Cod, Subarea 3, 1960. Length distribution of sample-groups A-D.

mean length of 59.1 cm; the curve for the night samples is more even with a peak at 64 cm and a mean length of 59.7 cm.

In 3L, April, (Gr. **B***) the lengths vary from 40-94 cm in day samples and from 40-91 cm in the night samples; both curves show several peaks: day - 67, 52 and 46 cm; night - 73, 64, 52, and 46 cm. The mean length is 64.0 cm (day) and 61.7 cm (night). In November (Gr. **D***) the lengths vary from 40 to 88 cm. The curve is fairly regular with a preponderance of the 55 and 61 cm groups, and a mean length of 59.2 cm.

In 3K, May, (Gr. **C***) the lengths range between 43 and 97 cm, the curves are rather irregular, with several peaks: 70, 61, 76 cm (day) and 52, 64, 58 cm (night); the mean lengths are 63.0 cm (day) and 59.2 cm (night).

IV. Observations on the Cod in Subarea 4, 1960.

The observations include 27 trawl samples (ca. 4,600 individuals) (see the map in Fig. 10), grouped as shown in Table 8; otoliths of 500 cod have been read. The present paper deals with the samples from Division 4Vn, age and length distribution, sex ratio, growth and maturity, and in the case of five samples (1,800 specimens) from 4R length distribution only.

1. Age-distribution (Fig. 10)

Division 4Vn. In February (Sample Gr. **A**) age-groups VI and V predominate with 280 and 200°/∘∘, followed by VII (160°/∘∘), IV (115°/∘∘) and VIII (105°/∘∘). In March (**B**) the VI-gr. also predominates (350°/∘∘); it is followed by VII (250°/∘∘), V (160°/∘∘) and IV (150°/∘∘). In April (**C**), the age-distribution is about the same as in the two preceding months: age-group VI (330°/∘∘), VII (290°/∘∘), V (160°/∘∘) and VIII (115°/∘∘). Age-group IV, which was relatively abundant in February-March is now represented with only 25°/∘∘.

Conclusion: The predominating year-classes are 1953, 1954 and 1955, i.e. the same as in 1959. The 1952 year-class can still be noted as fairly abundant, as has been the case since 1956. The 1956 year-class appears for the first time as a rather rich year-class (Groups **A** and **B**, February-March).

2. Size-distribution (Fig. 10)

Division 4Vn, February (Gr. **A**). The lengths range from 37 to 85 cm; the length curve is bi-modal, with peaks at 52 and 64 cm, the mean length is 54.7 cm.

In February, also 4Vn (Gr. **D***), the length distribution for the day samples is bi-modal with peaks at 46 and 58 cm and a range of lengths from 37 to 94 cm. However, the curve for the night samples has several peaks, at 43, 49, 58 and 73 cm. The mean length of the night samples is 57.4 cm compared to 56.2 cm for the day samples.

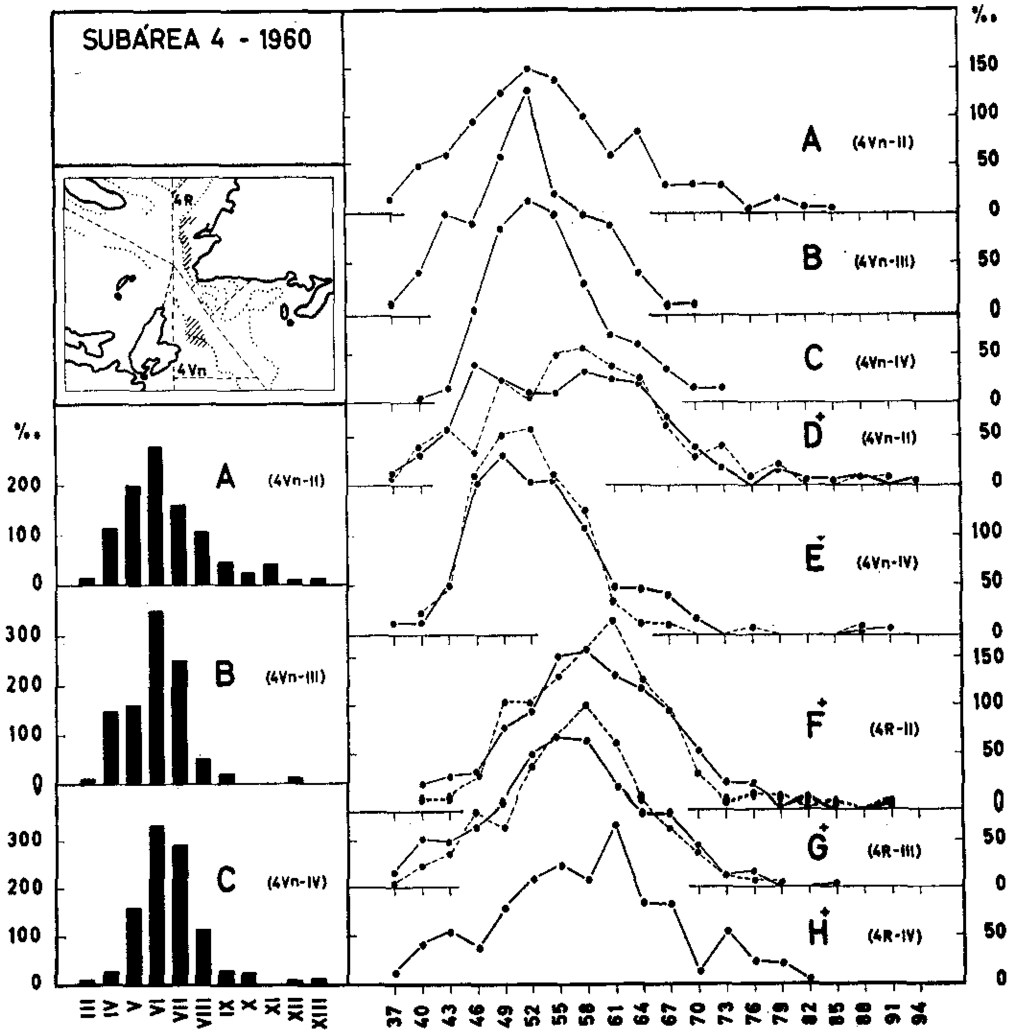

Fig. 10. Cod, Subarea 4, 1960. Age- and length distribution of samples from trawlers. Left above - position of samples; left below - age; right-length, (bold lines - day-, stipled lines - night samples).

TABLE 8. Cod, Subarea 4. Summary of sample groups (*samples without otoliths).

Sample Group	Sample No.	Division	Dates
A	21-23	4Vn	16/19-II-60
B	24	4Vn	7-III-60
C	25-27	4Vn	5/8-IV-60
D*	22	4Vn	17-II-60
E*	26	4Vn	7-IV-60
F*	3-6	4R	25/29-II-60
G*	14-16	4R	24/30-III-60
H*	19	4R	3-IV-60

In Gr. **B**, from March, the lengths range from 37 to 70 cm only, the curve has only one peak, at 52 cm; the mean length is 52.3 cm.

In April (Gr. **C**, same division) the mean length is 54.5 cm, with a range from 40 to 73 cm, and the peak off 52 cm.

In April (Gr. **E***) the lengths vary from 37 to 91 cm. The curves for both day and night samples are uni-modal, the peak for the day samples at 49 cm and for the night samples at 52 cm; the mean lengths are: day - 53.2 cm, night - 52.8 cm.

Division 4R, February (**F***). The length curve for the day samples has one peak only, at 58 cm; the lengths range from 40 to 91 cm, with a mean length of 57.7 cm. The curve for the night samples is bi-modal, with peaks at 49 and 61 cm, mean length—58.2 cm.

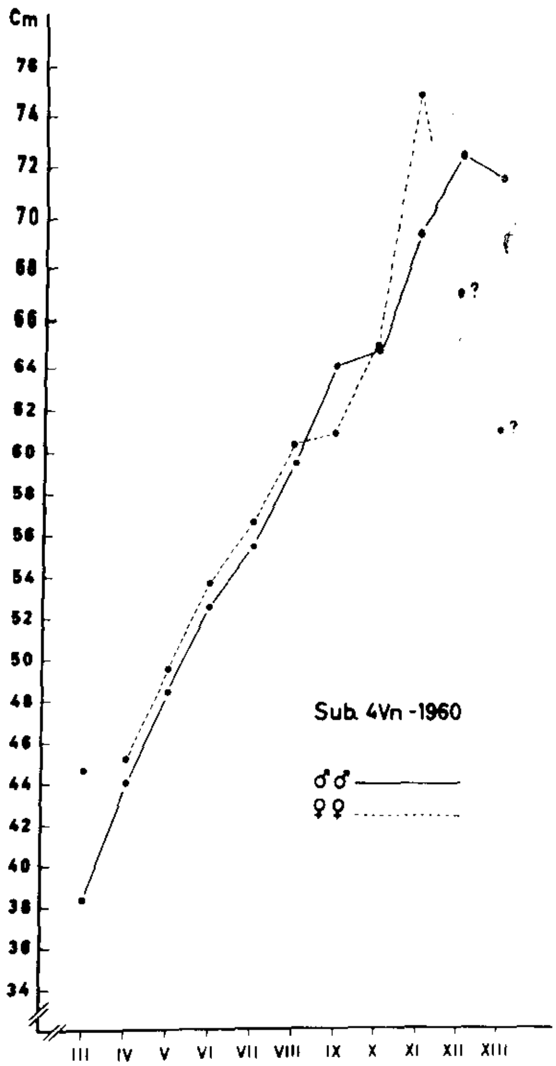

Fig. 11. Cod, Division 4Vn, 1960. Growth curves for males and females.

In March (Gr. **G***) the lengths range from 37 to 85 cm. For the day samples the curve is uni-modal, peak at 55 cm, mean length—55.8 cm. The curve for the night samples is more irregular, with two peaks: 46 and 58 cm; the mean length is 56.8 cm; the range is from 37 to 79 cm.

In April (Gr. **H***) the size curve has several peaks, the highest at 61 cm; the range is between 37 and 82 cm; the average length is 57.7 cm.

3. Growth (Fig. 11)

The average lengths of males and females by age groups were calculated for the samples from Division 4Vn. The growth of the females is a little greater than that of the males. For the females a decrease in growth rate occurs in the eighth year, but in the ninth year the growth rate reverts to that of the earlier years; a similar change occurs for the males, but here the decrease in growth rate occurs in the ninth year.

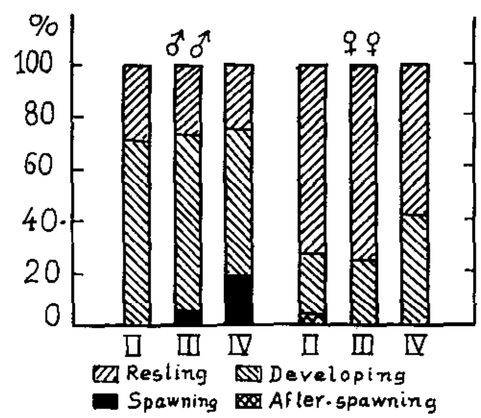

Fig. 12. Cod, Division 4Vn, 1960. Percentage numbers of males and females of different stages of maturity, February-April.

TABLE 9. Cod, Division 4Vn, 1960 Stage of maturity of gonads, determined by macroscopic observation, Feb-April, sample groups A, B and C.

Stage of Maturity	February		March		April	
	♂♂	♀♀	♂♂	♀♀	♂♂	♀♀
	%	%	%	%	%	%
Resting	29.7	72.0	26.9	75.7	24.5	57.1
Developing	70.3	24.7	68.7	24.2	56.9	42.9
Spawning	—	—	4.5	—	18.7	—
Post-Spawning	—	3.4	—	—	—	—
No. of Spec.	111	89	67	33	102	98

TABLE 10 Cod, Division 4Vn, 1960 Age at first maturity, males and females of age-groups VI-XIII in samples from February-April

Age-Group		♂♂ Age at First Maturity V	VI	VII	VIII	IX	X	⊖	?	Total	♀♀ Age at First Maturity V	VI	VII	VIII	IX	X	⊖	?	Total
VI	No.	—	15	—	—	—	—	67	7	89	1	10	—	—	—	—	52	5	68
	%	—	16.9	—	—	—	—	75.3	7.9	100.1	1.5	14.7	—	—	—	—	76.5	7.4	100.1
VII	No.	1	5	28	—	—	—	12	12	58	—	9	24	—	—	—	12	12	57
	%	1.7	8.6	48.3	—	—	—	20.7	20.7	100.0	—	15.8	42.1	—	—	—	21.1	21.1	100.1
VIII	No.	1	5	14	1	—	—	2	1	24	1	2	11	2	—	—	1	4	21
	%	4.2	20.8	58.3	4.2	—	—	8.3	4.2	100.0	4.8	9.5	52.4	9.5	—	—	4.8	19.1	100.1
IX	No.	—	—	7	3	—	—	—	1	11	—	1	3	2	—	—	—	—	6
	%	—	—	63.6	27.3	—	—	—	9.1	100.0	—	16.7	50.0	33.3	—	—	—	—	100.0
X	No.	-	1	4	2	—	—	—	—	7	—	—	1	1	1	—	—	—	3
	%	-	14.3	57.1	28.6	—	—	—	—	100.0	—	—	33.3	33.3	33.3	—	—	—	99.9
XI	No.	—	—	3	1	1	—	—	—	5	—	—	2	1	—	—	—	—	3
	%	—	—	60.0	20.0	20.0	—	—	—	100.0	—	—	66.6	33.3	—	—	—	—	99.9
XII	No.	—	1	1	—	—	—	—	—	2	—	—	2	1	—	—	—	—	3
	%	—	50.0	50.0	—	—	—	—	—	100.0	—	—	66.6	33.3	—	—	—	—	99.9
XIII	No.	1	—		1	—	—	—	—	2	1	—	—	1	—	—	—	—	2
	%	50.0	—		50.0	—	—	—	—	100.0	50.0	—	—	50.0	—	—	—	—	100.0

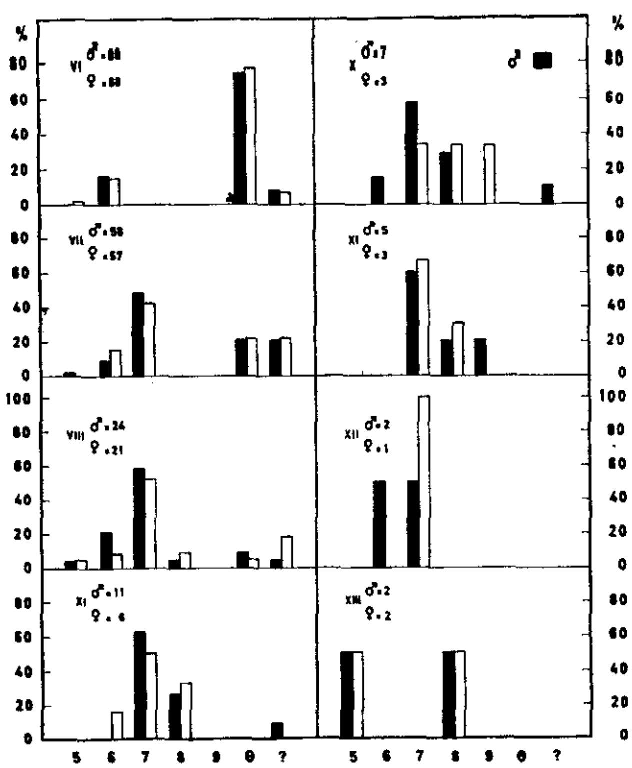

Fig. 13. Cod, Division 4Vn, 1960. Percentage numbers of males (black) and females (white) of ages 5-9, spawning for the first time (only age-groups VI-XIII included). ⊖ = no spawning mark.

4. Sex Ratio.

In general males are slightly more abundant in the samples than females (51-67%).

5. Stage of Maturity (Table 9, Fig. 12)

Males. In February almost all males are in the developing stage (70.3%), the remaining 29.7% are in the resting stage. During March-April there is a progressive decrease in the number of males in the developing stage (68.7-56.9%), and an increase in the number of spawners (4.5-18.7%, the remaining males are in the resting stage (27-25%).

Females. In February, the majority (72%) are in the resting stage; 24.7% are in the developing stage and 3.4% are post-spawners. During March-April the number in the developing stage increases (24.2-42.9%); but the majority (75.7-57.1%) are still in the resting stage.

6. Age at First Maturity (Table 10, Fig. 13)

The spawning zones in the otoliths of these populations are not very clearly defined. The age at first maturity was found to be between the 5th and 9th year; for most individuals maturity is reached in the 7th year.

IX. Spanish Research Report, 1960

BY OLEGARIO RODRIGUEZ MARTIN, DIRECCION GENERAL DE PESCA MARITIMA

During 1960 observers on board various trawlers have continued the collection of data for the study of size- and age-frequency of cod, *Gadus morhua* L. The following samples were investigated:

		Numbers of cod measured		
Division	Month	Monthly	Total by Division	Total General
1B	V	4,667		
	VIII	8,206		
	IX	632	13,505	
1C	V	735	735	
1D	IX	1,942	1,942	
1E	V	2,043	2,043	18,225
2J	IX	11,507		
	X	9,762		
	XI	7,954		
	XII	1,610	30,833	
2H	IX	3,095		
	X	1,377	4,472	35,305
3K	V	1,222	1,222	
3L	IV	6,019		
	X	1,279	7,298	
3O	IV	464	464	
3 P N	III	1,823	1,823	10,807
4R	II	2,501		
	III	7,794		
	IV	4,120	14,415	
4V N	II	5,278		
	III	2,413		
	IV	2,157	9,848	
4W	III	258	258	24,521
			TOTAL	89,858

Length Distribution.

Subarea 1 (Figure 1)

Cod below a size of 40 cm is not sought by the Spanish fishery. Therefore, cod of this size are only present in appreciable numbers in one case, viz. in Division 1B, August, here accounting for 5% of the total catch. In the other divisions and months, the catch of cod below 40 cm is negligible. The number of specimens over 90-92 cm is very low.

The modal size in the samples is 69-71 cm (3 cm-group), except for 1E, with 45-47 cm, far below any of the other regions.

In 1B the length curves for May and September correspond with one another, whereas the length distribution for August differs from that of the other two months.

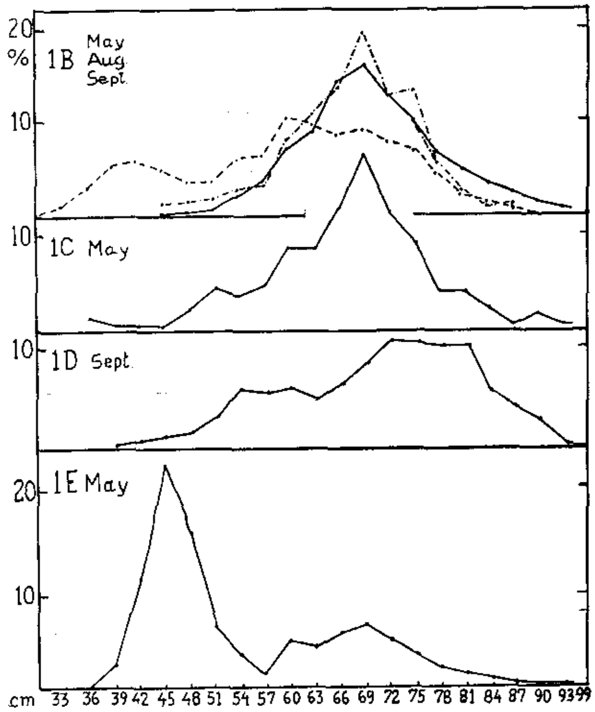

Fig. 1. Cod, Subarea 1, 1960. Length distribution of samples from Spanish trawlers.

Subarea 2 (Figure 2)

Cod below 40 cm account for 3.3% in 2J and for 3.6% in 2H.

In Division 2J the peak of the size curve is at 60-62 cm, and the curves for the four months sampled agree well with one another. A small increase in size is noted from September through November due to the individual growth in this period.

In 2H the peaks of the curves vary between 54-56 cm (September) and 60-62 cm (October). Cod larger than 80 cm are very scarce.

Subarea 3 (Figure 3)

The catch of cod below 40 cm is negligible: 3K - 0%, 3L - 2.1%, 3O and 3Pn - 1%. Individuals of more than 80 cm length are exceedingly rare.

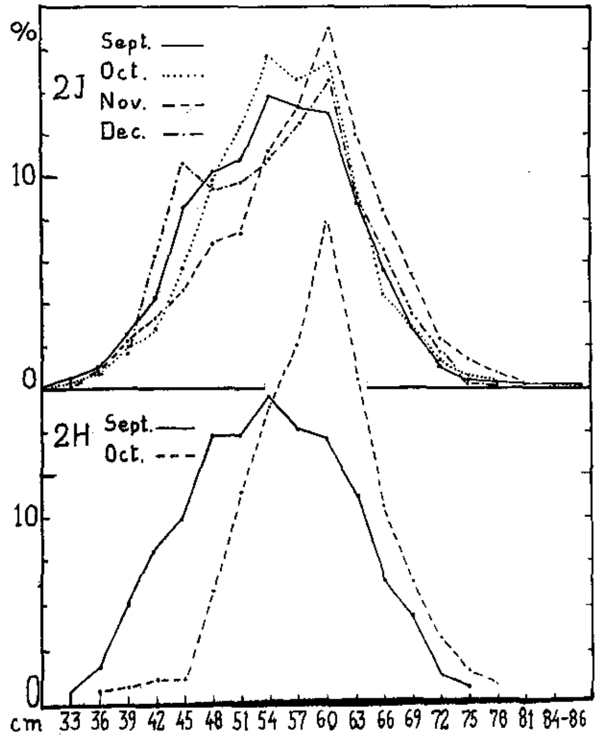

Fig. 2. Cod, Subarea 2, 1960. Length distribution of samples from Spanish trawlers.

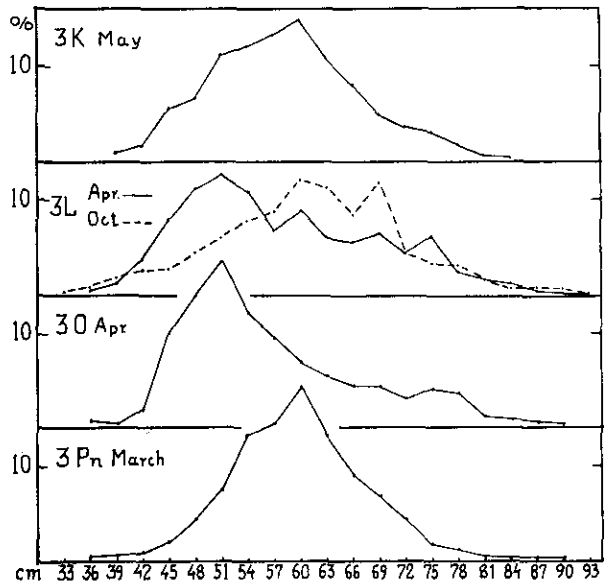

Fig. 3. Cod, Subarea 3, 1960. Length distribution of samples from Spanish trawlers.

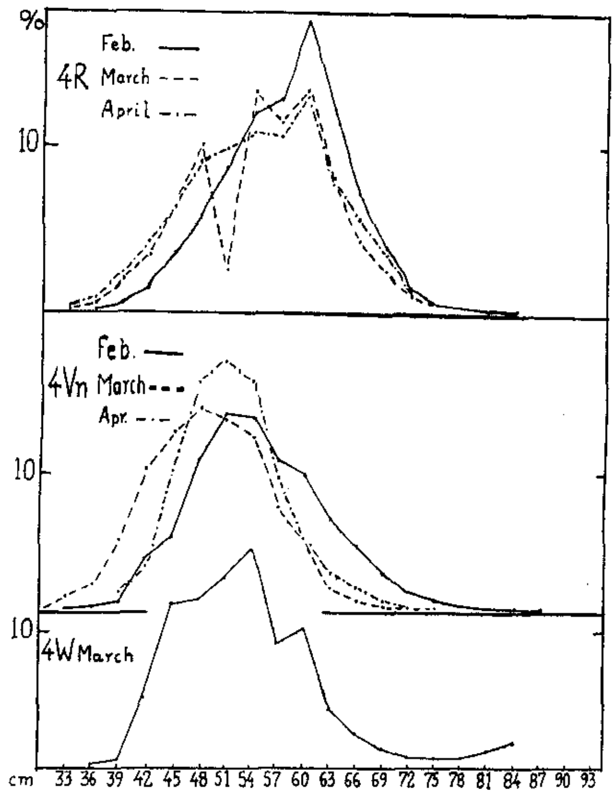

Fig. 4. Cod, Subarea 4, 1960. Length distribution of samples from Spanish trawlers.

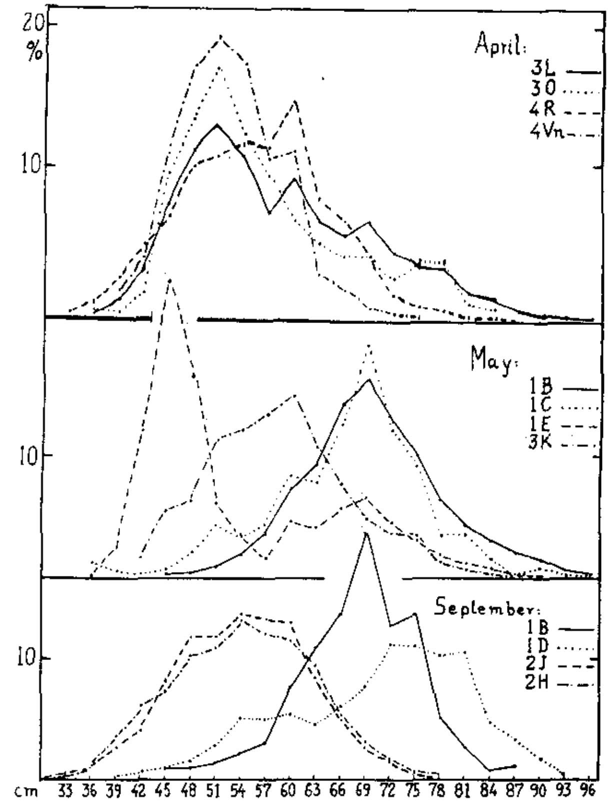

Fig. 5. Cod, 1960. Length distribution by months of samples from Spanish trawlers.

The peaks of the length curves are in 3K at 60-62 cm (14.8%), in 3Pn at 60-62 cm (18.4%), in 3L, October, at 60·62 (12.5%), in 3O at only 51-53 cm (17.4%); however, in 3O only 464 cod were measured.

Subarea 4 (Figure 4)

The catch of cod below 40 cm was 3% in 4R and 1.2% in 4W. In 4R the peak is at 60-62 cm (18.9% - February, 14.5% - March, and 14.8% - April). In 4Vn the size is smaller, 51-53 cm (15.7% - February, 15.3% - March, and 19.3% - April).

In 4W the peak is at 54-56 cm (17.4%). Cod more than 80 cm long are very scarce.

Frequencies by Months (Figure 5)

April: In this month the largest cod are found in 4R, with a peak at 60-62 cm (14.8%). The other divisions show peaks at only 51-53 cm (4Vn - 19.3%, 3O - 17.4%, and 3L - 12.9%).

May: The largest cod are in 1C with a peak at 69-71 cm (18.9%) and in 1B, also 69-71 cm (16.5%). 3K presents a peak at 60-62 cm (14.8%). Finally, in 1E the peak is only at 45-47 cm (22.4%).

September: In 1D the peak is at 72-74 cm (11.2%), but the size-groups through to 81-83 cm follow very closely (81-83 cm - 10.6%). In 1B the peak is at 69-71 cm (20.2%). The length curves for 2J and 2H are almost parallel, with their peaks at 54-56 cm.

Appendix to the Spanish Research Report

AGE AND GROWTH OF COD FROM THE FISHERIES IN THE NORTHWEST ATLANTIC, 1960

BY A. FIGUERAS, INST. DE INV. PESQ. VIGO.

The present paper forms part of the work which Spain undertakes, through the Direccion Gener?l de Pesca Maritima and its Junta Consultiva de Investigacion Cientifico-pesquera, as part of its cooperation with the International Commission for the Northwest Atlantic Fisheries. This work has been under way since 1952 and carried out by Margalef, O. Rodriguez, Lopez-Costa, A. Rojo and Figueras.

The material was collected by the trawler "Alisio" of PYSBE during February through May, 1960, and by the "Vendaval" in August-December of the same year.

The technique used is the same as for previous researches (Figueras, 1957). However, in order to ensure a more rapid and more accurate reading of the otoliths, otoliths from the same sample were fitted onto a plastic board with 32 hollows filled with plastilene (in previous years the otoliths were investigated singly). The present method both simplifies the work and makes possible a direct comparison of the otoliths of a sample when reading them.

For each otolith were noted: number of rings, number of "check rings", size of nucleus, aspect of edge of otolith (N - Narrow, W - broad, O - opaque, and H - hyaline).

Table 1 specifies some of the characters investigated in the various samples; it shows that otoliths have been collected from 4,546 specimens, distributed over 263 samples each corresponding to one haul. Most specimens are from September, and 2J is the best represented division.

TABLE 1. Summary of the Samples.

Month	Feb.	Mar.	Apr.	May	Aug.	Sept.	Oct.	Nov.	Dec.	Total	
No. of samples	20	35	32	23	27	53	45	24	4	263	
No. of spec.	399	512	395	281	463	1074	821	520	81	4546	
Size range	31–134	21–85	33–88	40–100	33–91	32–101	37–92	38–86	41–72	21–134	
No. of samples by divisions—1B				13	27	4				44	59
1C				3						3	
1D						8				8	
1E				4						4	
2H						9	3			12	101
2J				1		32	34	18	4	89	
3K				2			2	6		10	38
3L			18				6			24	
3P		4								4	
4R	6	23	9							38	65
4V	14	8	5							27	

The fishery is restricted to Divisions 4R, 4V, 3P and 3L in March and April. From May the fishery covers the whole northern part of the Convention Area, mainly concentrated, however, in 1B, 1C, 1D, 2H, 2J and 3K (Figure 1).

The samples were grouped by divisions for the study of growth, age and length distribution, particularly. Whenever the material allowed, comparison with results from previous years was made—either for the same or for neighbouring divisions. Thus growth, age and length have been compared as follows: 3N, 3O (1955) - 3L, 3P (1960) and 1D, 1E (1958) - 1D, 1E (1960).

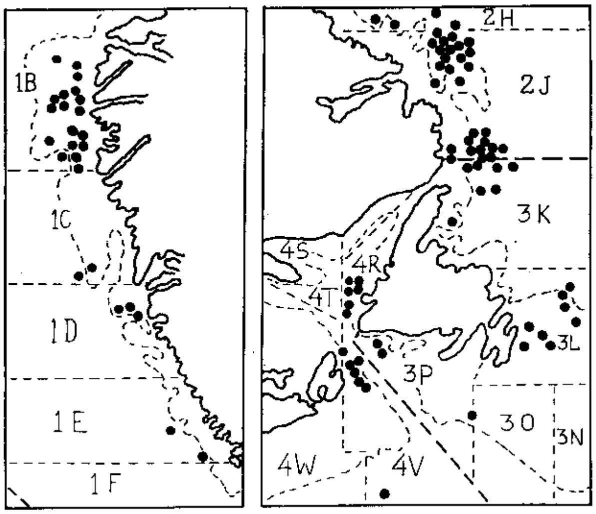

Fig. 1. Positions of samples of cod from Spanish trawlers, 1960.

The appearance of rings at the margin of the otoliths was studied as to localities and seasons in order to ascertain when the annual rings are formed. Attention is drawn to a very indistinct ring (refringent), the appearance of which can be followed through the divisions.

A comparison with the results obtained by other Spanish biologists during previous cruises completes the study.

Age and Growth.

Table 2 and Figures 2 and 3 reveal, firstly, a difference in growth for 1D and 1E between 1958 and 1960; however, the number of specimens investigated in the two years is very different—only 73 in 1960, compared to 1267 in 1958. Whereas the 1958 curve is very uniform with the points falling close to the theoretical curve, the 1960 results do not show such a uniformity. It is to be noted that after the fifth year all points of the 1960 curve are above those of 1958, the 1960 lengths being about 10 cm higher than those from 1958. From Figures 4 and 5 presenting age and length distribution, it appears that the average length is almost the same in the two years (1958 - 65.12 cm; 1960 - 65.84 cm) and that the 1954 year-class predominates in both years. The slight increase in size compared to 1958, and the lower mean age, close to 5 years in 1960 compared to close to 6 years in 1958, confirms the conception of an increased growth rate (as shown by the growth curves) for 1D in 1960.

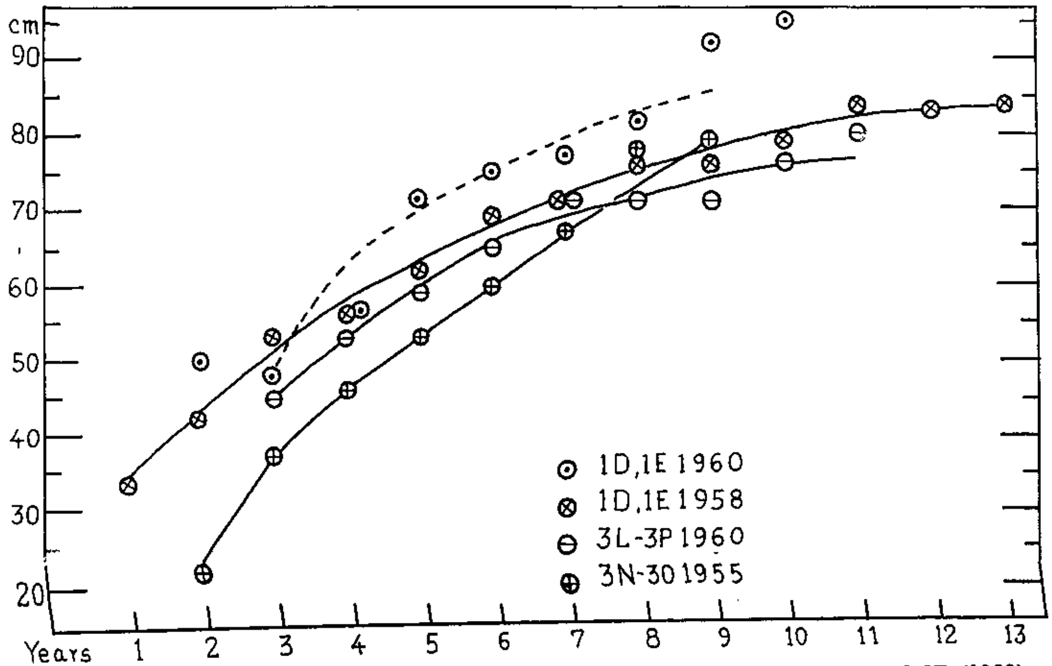

Fig. 2. Cod, growth curves. Divisions 1D and 1E (1960 and 1958); 3L and 3P (1960); 3N and 3O (1955).

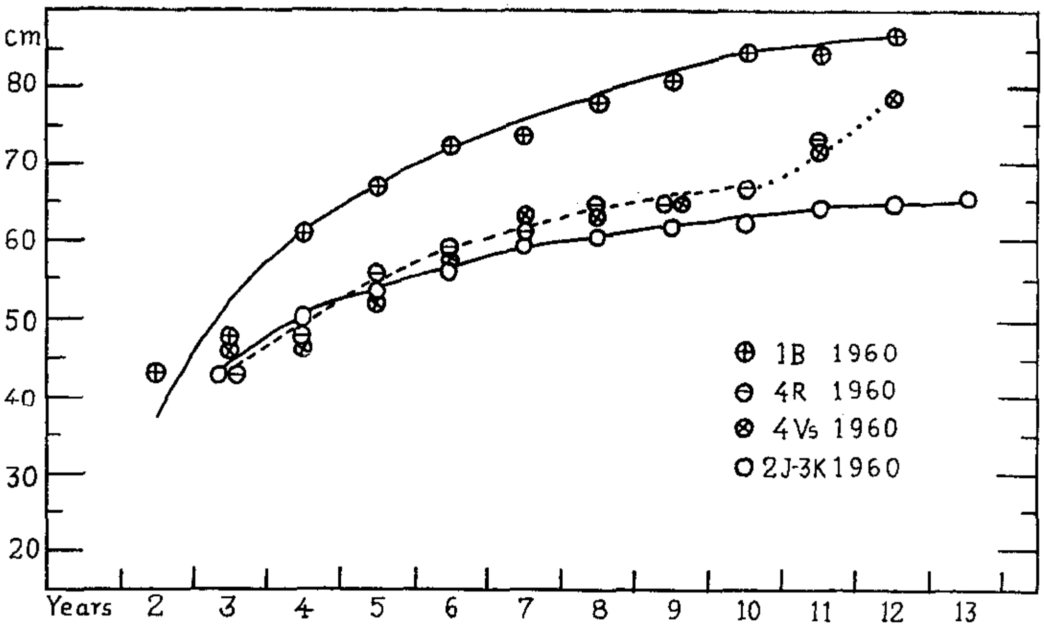

Fig. 3. Cod. Divisions 1B, 4R, 4Vs, and 2J + 3K; 1960. Growth curves.

TABLE 2. Frequency (number of specimens) and mean size by ages.

	1960-3L		1955-3N		1960-1D		1958-1D		1960-4R		1960-4V		1960-1B		1960-2J	
Age	N°	cm	N°	cm	N°	cm	N°	cm	N°	cm	N°	cm	N°	cm	N°	cm
I							1	33.0								
II			1	22.0	2	50.5	7	42.7					15	43.4	2	43.0
III	8	44.8	25	37.3	15	48.4	96	53.4	7	43.2	9	46.0	48	48.8	4	43.6
IV	44	53.0	41	46.2	8	57.3	387	56.0	32	48.1	32	46.2	56	61.7	99	50.2
V	33	59.0	44	53.1	16	72.0	213	62.4	69	55.8	74	52.2	69	67.5	122	53.0
VI	25	65.4	54	60.6	21	75.9	138	69.1	53	57.9	57	58.2	76	72.0	132	56.4
VII	25	71.2	16	67.0	5	77.0	177	71.8	23	61.1	25	63.8	17	73.8	91	59.3
VIII	9	70.6	5	78.3	3	81.0	59	75.9	16	63.4	13	64.7	13	78.0	79	60.3
IX	3	71.3	1	79.0	1	92.0	45	76.2	9	65.4	7	65.7	12	81.5	74	61.5
X	7	76.5			1	95.0	75	79.3	7	67.8			4	84.5	69	62.7
XI	4	80.7			1	101.0	23	84.6	1	73.0	2	72.5	6	84.3	43	64.6
XII	1	92.0					17	83.1			4	79.7	10	87.6	25	65.2
XIII							6	84.1							23	65.8
XIV							12	80.5							5	63.8
XV							6	98.0							4	79.0
XVI							2	97.5					2	93.5	3	66.0
XVII							3	93.3								
	159		187		73		1267		217		223		328		775	

When comparing specimens from 1955 (3O and 3N) with those from the neighbouring divisions 3L and 3P from 1960, the data of 1960 denote a greater growth. Here the number of specimens is about the same in the two years, and the results are therefore convincing; only the localities are somewhat different (Figueras, 1957) and thus too bold conclusions are not permissible. The frequency-figures also show a considerable increase in average size (length) of the stock in 1960 (61.8 cm in 1960; 55.7 cm in 1955). The 1949 year-class was predominant in 1955 and the 1956 in 1960, and the mean age is a little higher in 1960 (5.7 years).

TABLE 3. Length distribution.

cm		25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	
1955-3N	N°	2	8	5	25	30	52	47	55	32	16	14	5	5	1			2		299
	%	0.6	2.6	1.6	8.3	10	17	15	18	10	5	4	1.7	1.7	0.3			0.7		
1958-1D	N°			3	11	21	127	214	218	139	183	142	114	56	13	5	3	6	2	1257
	%			0.2	0.8	1.6	10	17	17	11	14	11	9	4	1	0.3	0.3	0.4	0.2	
1960-3L	N°				1	10	23	23	27	26	21	17	5	2	2					157
	%				0.6	6	14	14	17	16	13	10	3	1.3	1.3					
1960-1D	N°				3	6	6	6	2	7	14	8	9	6	3		1			71
	%				4	8	8	8	3	10	20	11	12	8	4		1.4			
1960-4R	N°			3	7	11	44	49	61	34	11	5	2		1	1			2	231
	%			1.3	3	4	19	21	26	14	4	2	0.9		0.4	0.4			0.9	
1960-4V	N°		1	1	8	27	56	44	36	33	9	7	3		1					226
	%		0.4	0.4	3	11	24	19	15	14	4	3	1.3		0.4					
1960-1B	N°			4	16	16	14	16	41	53	58	52	30	12	9	1				322
	%			1.2	4	4	4	4	12	16	17	16	9	3	2	0.3				
1960-2J	N°			3	21	64	114	193	212	135	57	17	4	1	1		1	1		824
	%			0.4	2	7	14	23	26	16	7	2	0.5	0.1	0.1		0.1	0.1		

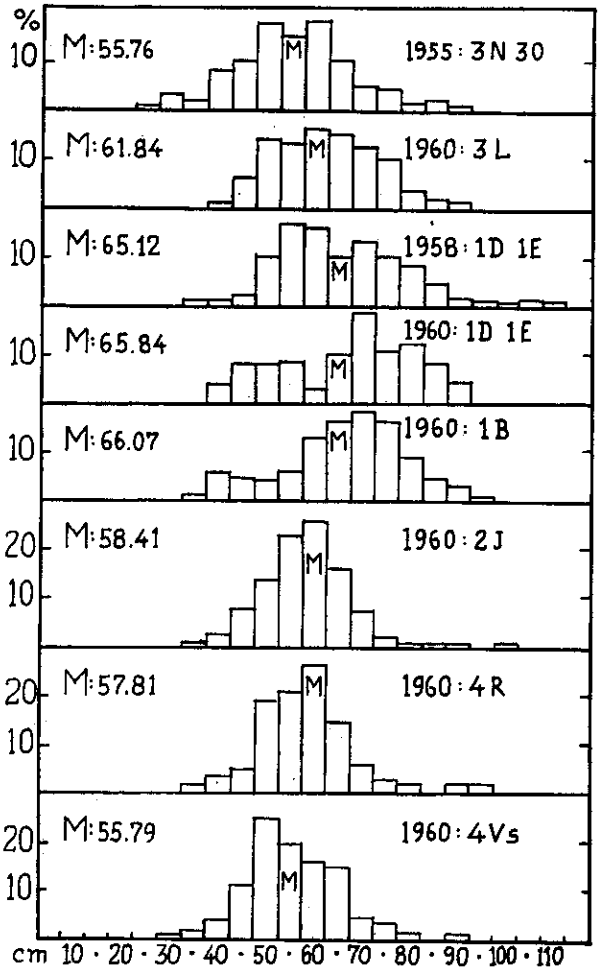

Fig. 4. **Cod, Length distribution by divisions, 1955, 1958 and 1960. M = mean length cm.**

By comparison of the samples of 1960 from the different areas in which "Alisio" and "Vendaval" have operated, the following results are gained:

(a) The average length increases gradually from south to north, from 55.8 in 4V to 66.1 in 1B (Figure 4).

(b) However, the average age (Figure 5) does not show the same grading; the highest age, 7.3 years, is observed in 2J; in the other divisions the average age varies between 5 and 6. The high age of 7 years in 2J in 1960 is remarkable; from the length distribution data a contrast is observed between the relative abundance of old individuals and the scarcity of cod over 75 cm in 2J and the low number of old individuals and the numerous cod over 75 cm in 1B and 1D (1960).

(c) In 2J we find the highest average age together with the lowest growth rate (see Figure 3); the difference in size between the younger and older cod (age groups 3 and 13) is only slightly more than 20 cm.

(d) The growth curves for 4R and 4V are almost the same. The mean length is, however, 2 cm greater in 4R (57.8 cm) than in 4V (55.7 cm). The 1955 year-

TABLE 4. Age distribution and year-classes (N).

Age	1960-3L N	1960-3L cm	1955-3N N	1955-3N cm	1960-1D N	1960-1D cm	1958-1D N	1958-1D cm	1960-4R N	1960-4R cm	1960-4V N	1960-4V cm	1960-1B N	1960-1B cm	1960-2J N	1960-2J cm
I							57	0.1								
II			53	0.5	58	2.7	56	0.5					58	4.5	58	0.3
III	57	5.0	52	13.2	57	20.4	55	7.5	57	3.2	57	4.0	57	14.4	57	0.5
IV	56	27.6	51	21.7	56	10.8	54	30.5	56	14.7	56	14.4	56	16.8	56	12.8
V	55	20.7	50	23.3	55	21.7	53	16.8	55	31.7	55	33.3	55	20.7	55	15.7
VI	54	15.7	49	28.6	54	28.5	52	10.9	54	24.3	54	25.6	54	22.8	54	17.0
VII	53	15.7	48	8.4	53	6.8	51	13.9	53	10.5	53	11.2	53	5.1	53	11.7
VIII	52	5.6	47	2.6	52	4.0	50	4.6	52	7.3	52	5.8	52	3.9	52	10.2
IX	51	1.8	46	0.5	51	1.3	49	3.5	51	4.1	51	3.1	51	3.6	51	9.5
X	50	4.4			50	1.3	48	5.9	50	3.2	50		50	1.2	50	8.9
XI	49	2.5			49	1.3	47	1.8	49	0.4	49	0.9	49	1.8	49	5.5
XII	48	0.6					46	1.3			48	1.8	48	3.0	48	3.2
XIII							45	0.4							47	3.0
XIV							44	0.9							46	0.6
XV							43	0.4							45	0.5
XVI							42	0.1					44	0.6	44	0.4
XVII							41	0.2								

class predominates in both divisions, and the average age is about the same (5.8 and 5.7 years).

(e) The 1957 year-class is rather predominant in 1D in 1960, and also relatively abundant in 1B. Probably the abundance of these year-classes conforms with the statement of Corlett (1958), who found, in comparing the quantity of available food during the pelagic phase of the young cod with the year-class strength, that the dry weight of plankton per volume of water in a certain year, in March-April to September (the pelagic phase of the cod), is strongly related to the strength of the year-class of that year. Thus, according to the abundance of plankton, the 1950 year-class (not known from our material) must be considered as very rich, and the 1949 and 1954 year classes—which actually were predominant in the area—as good. As mentioned earlier, the next rich year-class in Subarea 1 will be that of 1957; this will coincide with Corlett's prediction. Following Corlett's theory, it is probably that the 1953 and 1955 year-classes must be classified as medium, and those of 1951 and 1952 as poor. However, it remains to be investigated whether the year-class strength prediction method found valid by Corlett for the Northeast Atlantic is also valid for the Convention Area.

Season of Formation of Rings.

From the studies of the percentage of cod with a ring at the margin of the otolith during the year and through the divisions, it appears that the majority of rings are formed in August in Subarea 1 (Table 6). During August, samples from 1B only, 24% of the cod had a recently formed ring at the margin. Contrary to this, in Subarea 4 (4R and 4V) the highest percentage (13.6%) of cod with a marginal ring was found in February. For want of data, this phenomenon cannot be related to temperature, but compared with latitude it could be concluded that the ring is formed in winter in the southern subareas and in summer in the northern. This, however, cannot be confirmed before we have data from the summer for the southern, and from the winter for the northern subareas. For the solution of the problem, it is desirable to collect samples from both regions through all seasons of the year.

The Occurrence of a Particular, Very Indistinct Ring.

In rather many specimens a particular, very indistinct ring was observed; in almost all cases this ring was the second ring, occasionally also the first, third or fourth, and in these cases almost always also the second. This ring cannot be considered as a spawning ring, as first spawning only occurs at age 6 in Division 2J. Rojo, 1957. It must therefore be attributed to other causes, e.g. an ecological change in the environment. The distribution by months and divisions of this ring, or rings, is shown in Table 5. The ring occurs in the highest percentage of cod in 3K, and with decreasing percentages to the north as well as to the south. The most probable explanation is perhaps the previously mentioned possibility of a change in environmental conditions, perhaps related to the currents, although the authors note the larger confluence only more to the south. It can further be noted that this indistinct ring is much more common in the females than in the males.

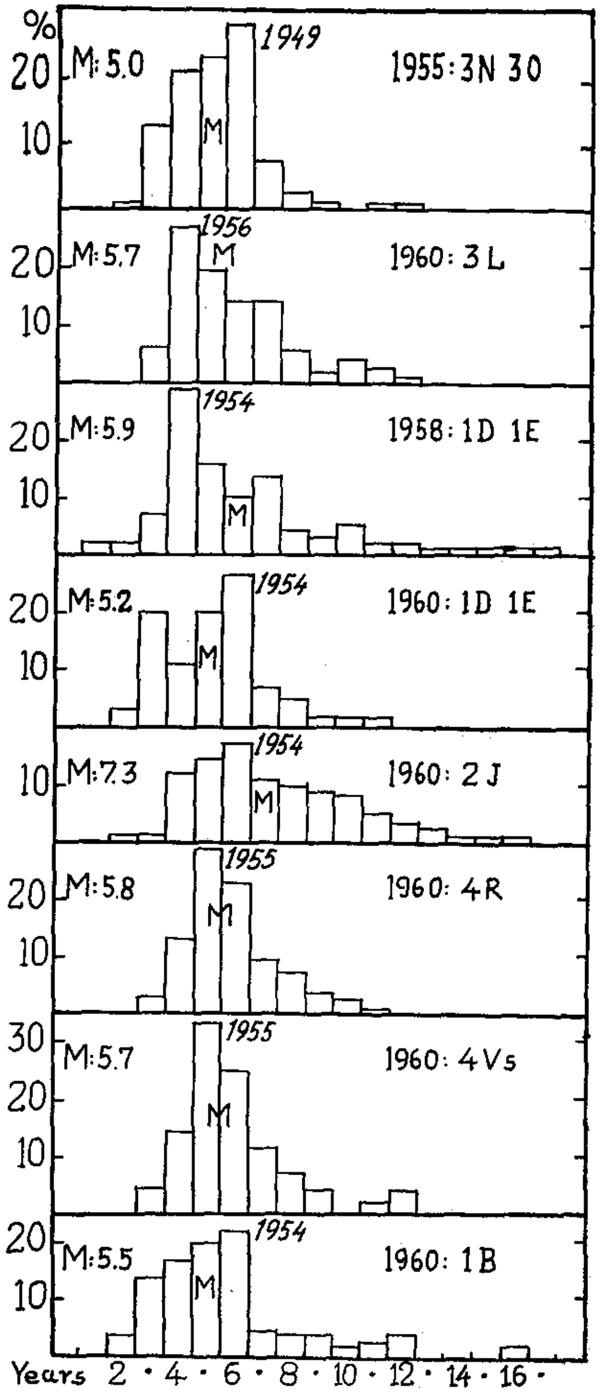

Fig. 5. Cod, age distribution by divisions, 1955, 1958 and 1960. M = mean age. Predominating year-classes indicated.

Comparison with Results Obtained in Previous Years by Spanish Authors.

The Spanish research cruises in the Convention Area began in 1953 when O. Rodriguez and Lopez Costa investigated Subarea 3 in February-April on board the trawler "Vendaval". The second cruise was carried out by O. Rodriguez and A. Rojo on board the "Mistral" in June-July, 1954. According to data published in ICNAF Annual Proceedings Vol. 5, the mean length of the cod in Subarea 3 was 51-55 cm (10 cm more than in 1953), and the richest year-class was that of 1949 (5 years old); it was followed by the 1948 year-class. From Figures 4 and 5, it appears that the mean length for this subarea is 60 cm and that the 1956 year-class predominates. Thus, a certain increase in growth rate has occurred for this subarea.

The third cruise was carried out in June-July 1955 on board the trawler "Cierzo" by O. Rodriguez. The mean length was 56-60 cm in Subarea 3 and the 1949 year-class was still predominant, followed by the 1950 year-class.

The fourth cruise was made by A. Rojo on board "Santa Ines" and "Santa Celia" in September 1956 and mainly in Division 3N. The mean length was 50 cm and the 1951 year-class predominated. The growth rate was about the same as that found for this division in 1955, but

TABLE 5. Frequency of the 2nd, Indistinct Ring.

By months:	March	April	May	August	September	October	November	Dec.
% monthly	3.8	15.2	2.7	0.8	6.5	10.2	12.7	2.4
% of males	27.2	13.3	20.0	0.0	40.0	30.9	35.2	0.0

By divisions.	1B	1E	2H	2J	3K	3L	3P	4R	4V
No. of spec.	3	3	10	84	15	16	2	14	10
%	0.4	3.7	5.1	5	7.5	3	2	1.8	1.8

TABLE 6. Frequency of rings at the margin.

Month	Division	No. of Specimens	%
February	4R, 4V	36	13.5
March	4R, 4V, 3P	32	11.0
April	4R, 4V, 3L	16	8.1
May	1B, 1C, 1D, 2J, 3K	18	10.0
August	1B	55	24.2
September	1B, 1D, 2J	9	1.6
October	2J	3	0.7
November	2J	3	1.1
December	2J	0	0.0

somewhat lower than in 1960 for 3L. From the figure showing year-class strength since 1953, it appears that the predominant year-classes in Subarea 3 have been: 1946, 1949, 1951 and 1956; however, corresponding data for the years 1957, 1958 and 1959 are missing.

The fifth cruise took place with "Abrego" in September-October 1957. A. Rojo (1958) gives the mean length for 1B as 50 cm, in 1960 the mean length had increased to 70 cm; the predominant year-classes were the 1953 (4 years old) in 1957, and 1954 (6 years old) in 1960. Therefore, the growth curve of 1957 is below that of 1960. The growth rate has increased. For 1D and for the same year, 1957, A. Rojo gives the mean length as 59.6 cm and the 1952 year-class as predominant, and he notes that in October the majority of otoliths had transparent margins. An inflection was observed in the growth curves between the ages of 7 and 8. Such an inflection is also observed in 1960 in 1D between ages 5 and 7 and in 3L between 7 and 9 (Fig. 2 and 3).

The sixth cruise was made in May-July 1958 by "Aliseo". The results obtained by O. Rodriguez have already been compared with those from 1960.

From the foregoing, it can be concluded that a tendency of increase in growth rate exists in certain divisions (1B, 1D). It can further be concluded that the year-classes which will form the basis for the fisheries in 1961 will be as follows: Subarea 1—1955 and 1957 year-classes; in Subareas 2 and 4—the 1956 year-class.

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A. SOVIET INVESTIGATIONS IN THE ICNAF AREA IN 1960

BY V. I. TRAVIN AND K. P. JANULOV

As in previous years, Soviet investigations of catch-composition and hydrography have been carried out on board the research and scouting ships. The cruises covered West Greenland, Labrador and Newfoundland areas and, to a certain extent, the Nova Scotia area.

In February / April and in June / August the R/V "Sevastopol" made two cruises to the Newfoundland and Labrador areas and a short trip to the Nova Scotia Banks.

Data on hydrography and samples of benthos, zooplankton, fish eggs and larvae, and bottom sediments were collected. Considerable efforts were aimed at studies of the race composition of redfish, and similar studies concerning cod and other fish were initiated.

Race investigations enabled us to establish a considerable degree of isolation of redfish populations and an apparent exchange of adults among them. But the majority of these populations can be grouped (with respect to *S. mentella*) in three large stocks. Apparently the exchange within these stocks is not large.

The scouting vessels "Rossiya", "Odessa", "Novorossiysk", "Stalingrad", "Zapad", with groups of scientists on board, made eleven cruises to different parts of the Convention Area.

Cod tagging was performed with Lea tags. In Subarea 1 a total of 1050 cod and in Subareas 2 and 3, 512 were tagged. Up to now, 29 returns from the West Greenland area and 3 returns from the South Labrador area have been reported.

439 plankton samples were taken, and 394,000 fish were measured (including 105,000 cod, 19,000 haddock, 256,000 redfish). Material for age determination was collected from 12,000 redfish, 8,000 cod and 1,500 haddock.

Subarea 1.

Biological data were collected in these waters by two scouting trawlers fishing in the Davis Strait area in April/May.

Cod occurred in all divisions, with the largest concentrations in 1D. The average size of cod was about 60 cm, in 1C larger cod were encountered (65-67 cm). In 1E and 1D the size curve has two peaks, at 42-50 cm and 69-80 cm. Small cod of 41-49 cm average prevailed in April in 1F.

The material on age-composition showed that the cod stock consisted of the 1956, 1955, 1954 and 1953 year-classes, the average age being 6 years.

Redfish (*S. marinus*) were caught in all divisions but they dominated in 1C and 1D. The maximum average size (about 44 cm) was observed in 1E. Smaller redfish were found in 1C and the minimum average size (40 cm) was observed in 1D. 15 to 18-year olds prevailed in the catches. The average age of redfish was 18 years; in 1E it was higher, amounting to 22 years. The number of males and females was almost equal in all divisions. As in previous years only immature redfish were observed.

Subarea 2.

The main part of the material is from 2J; in November/December redfish (*S. mentella*) and cod samples were taken in 2H.

The South Labrador area (2J) was of great importance to the fishery in the first half of the year, despite troublesome ice conditions. The commercial ships fished chiefly for pre-spawning and spawning cod which occurred in considerable concentrations on the southeastern and southern slopes of the Hamilton Inlet Bank. Specimens of 50-60 cm length formed the peak of the size curve, the average size being 52 cm. In 2H cod were larger, the average size being about 58 cm. Age determination of cod in 2J showed that fish older than 5 years made up more than 70% of the catches, and the 1952, 1953 and 1954 year-classes were predominant.

A considerable share of the catches was formed by redfish (*S. mentella*) with sizes of 32-37 cm predominating for the males and 34-40 cm for the females. The average individual weight of females was 755 grams, of males 665 grams. The ages of the redfish ranged from 5 to 27 years. with a predominance of the 12 to 16-year olds. On the whole, the sex ratios observed during the period investigated were equal, but with males considerably predominating in January and February. Beginning with May, males and females were encountered in the catches in approximately equal numbers.

Subarea 3.

The Newfoundland area was, as in previous years, the main fishing ground for the Soviet trawlers, but contrary to what was the case in the preceding years, a considerable portion of the annual catch was taken in 3N where the commercial fleet fished for haddock from July to November.

The importance of the northern divisions (3K, 3L, 3M) was reduced considerably as a result of the absence of steady, dense concentrations of redfish (*S. mentella*). Only in 3K, in the first half of 1960 (chiefly in February/April), redfish were caught as a large by-catch of the cod fishery.

The redfish size-composition (*S. mentella*) ranged from 20-53 cm, with modal sizes of 32-36 cm for males and 38-42 cm for females, the average sizes being 33.0 cm and 37.5 cm, respectively. The redfish were 7 to 26 years old, 13 to 18 years being the most common age. The sex ratio in the catches throughout the year was practically equal, but with a slight predominance of females, particularly in January.

The average redfish sizes observed in 3L were the highest (34.5 cm for males and 38.5 cm for females); 15 to 19-year old fish constituted the bulk of the catches. On the average, the catches, all year round, contained about 55% females.

On the Flemish Cap Bank (3M) the prevailing sizes were 31-34 cm for males (*S. mentella*) and 32-37 cm for females. The catches consisted of 7 to 27-year old fish, specimens of 12 to 15 years old predominating. In January and April males were observed in higher numbers (63 to 67%) than females, but the average yearly percentage of males taken in the catches did not exceed 53%.

In 3N and 3O small redfish up to 30 cm long were caught. In 3O fish under 30 cm long amounted to more than 80%; the peak of the size curve was off 25-26 cm for males and off 28-30 cm for females. At the same time in 3N the size curve is more even, and a considerable by-catch, up to 50%, of fish more than 30 cm long was observed. In this division the average size of males was 30.5 cm and that of females, 31 cm, whereas in 3O 26.5 cm and 28.0 cm, respectively. In the latter division redfish were less than 17 years old, with the 9 to 13-year olds prevailing. In both divisions females predominated (56% in 3N and 61% in 3O).

In 3P redfish were slightly larger than in 3O. The average sizes were: males—28 cm, females—29 cm.

Cod appeared with the following average sizes, by divisions: 3K - 57.7 cm, 3L - 68.0 cm, 3M - 52.5 cm, and 3N - 52.0 cm. The 1953, 1954 and 1955 year-classes were the most important ones.

Haddock caught in 3N were mainly small, with the peak of the size curve at 34-39 cm.

Subarea 4.

The bulk of material taken in 4V was caught by scouting trawlers and the R/V "Sevastopol", which, however, made only insignificant redfish catches (*S. mentella*) there. The average size of males was 31 cm and that of females, 33 cm. The average sizes of cod in the samples were from 48 to 55 cm.

In 4W and 4X several trawlings were made along the outer slope of the Nova Scotia Banks and *S. mentella* samples were collected. The average sizes in these divisions were: 4W - 26.9 cm (males), 29.8 cm (females); 4X - 29.5 cm (males), 34.2 cm (females).

B. SOVIET TRAWL FISHERY IN THE NORTHWESTERN ATLANTIC, 1960

BY M. A. PAVLOV AND V. I. TRAVIN

The Soviet trawl fishery in the ICNAF area differed in 1960 from all previous years. In the course of ten months (January-October), the highest share of the total catch, about 40%, was taken in Division 3N where until that time practically no fishery had taken place. As before, 2J (about 30%) and 3K (30%) were of the greatest importance. In other divisions the fishery was insignificant and varying.

In 3L and 3M, which in previous years played a significant role in the Soviet fishery, the catches in 1960 were varying and the trawlers moved to these divisions only when the catches in other areas decreased.

Apart from this, the 1960 catches were characterised by the predominance of cod and haddock. It was only from February to April that redfish made up about 50 to 60% of the total catch. In January and May cod and haddock contributed about 50%, and in the second half of the year, 70 to 90% of the total catch.

Two periods may be clearly distinguished in the fishery: (1) from January to June when trawlers fished for redfish, mainly *Sebastes mentella*, and haddock on the northern Newfoundland Bank and off Labrador; (2) from July to November when the fishery was based on the haddock of the southeastern Newfoundland Bank. In the course of the first period, redfish fishery on the northern slopes of the Great Newfoundland Bank was carried out continuously. *Sebastes mentella*, with an insignificant by-catch of large haddock, was found at depths of 290 to 350 meters. Female redfish predominated in the northern part of the area, while males were predominant in the southern part. The fish concentrations gradually moved southward.

During this period, redfish fed on Ctenophores, krill, Calanus, Gammarus, prawns, young cod and lantern anchovy. During daytime, catches were higher than in the evening or at night, in connection with diurnal migrations of the redfish.

At the same time, fairly large concentrations of cod with redfish (mainly *S. mentella*) in the by-catch were fished on the Hamilton Bank and in the southern Labrador area. Here the fishery was sometimes hindered by approaching ice.

The appearance of ice on the fishing grounds was observed in late February, late March and in April. Cod was found at depths of 260 to 300 meters. Cod concentrations during this period (January-June) were stable and it was only in late June that the fish started moving to the northern ice-covered areas, and the trawlers proceeded to fish for isolated cod schools moving to this area from the south along the edge of the slope of the Newfoundland Bank and from the St. Lawrence Gulf via Belle Isle Strait.

During the first period (January-June), cod and redfish catches did not exceed 2.5 tons per hour trawling. In January and May-June the greatest contribution to the catch came from 2J, but in February-April, from 3K.

In April and May an exploratory cruise was conducted in the Davis Strait. 353 tons of cod and redfish were taken with a relatively low average catch per hour trawling (1.6 tons in April; 0.9 tons in May). The fishing operations were hampered by highly unfavourable weather conditions.

The size composition was very good. According to data supplied by research vessels 60-75 cm cod prevailed in the catches in 1C, while two size groups, 45-55 cm and 65-75 cm, predominated in 1D and 1E. 35-50 cm fish occurred only in 1F.

Redfish (*S. marinus*) were fairly large: in 1C fish below 30 cm in size made up 2 to 3% of the catch, while those above 40 cm contributed 55%; in 1E there were practically no fish below 30 cm, while redfish above 40 cm formed 65 to 75% of the catch. In 1D redfish were somewhat smaller: about 6% was made up by fish below 30 cm, while about 46% consisted of fish above 40 cm.

In the second half of the year the most important fishery was carried out in 3N.

TABLE 1 **Size Composition of Cod catches in 1960 (according to data of research and exploratory vessels).**

cm-group		25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	Total
Labrador	No.	4	56	180	486	1429	2710	3311	2517	1447	522	112	37	7	—	—	—	—	12818
	%	0.1	0.4	1.4	3.8	11.1	21.1	25.8	19.6	11.3	4.1	0.8	0.4	0.1	—	—	—	—	100
Newfoundland	No.	—	—	3	10	26	95	61	64	60	70	26	36	24	15	6	5	2	503
	%	—	—	0.6	2.0	5.2	19.0	12.2	12.8	12.0	14.0	5.2	7.2	4.8	3.0	1.2	1.0	0.1	100

TABLE 2. **Size composition of *S. marinus* catches in 1960 (according to data of research and exploratory vessels).**

cm-group		22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	Total
Labrador	No.	—	—	—	—	—	3	3	12	7	4	13	29	26	25	26	26	23	25	17	5	1	3	248
	%	—	—	—	—	—	1.2	1.2	4.8	2.8	1.6	5.2	11.8	10.6	10.0	10.6	10.6	9.2	10.0	6.8	2.0	0.4	1.2	100
Newfoundland	No.	—	—	—	—	5	12	13	16	45	61	54	100	67	83	46	47	31	7	15	3	—	—	605
	%	—	—	—	—	0 8	2 0	2 2	2.6	7.5	10.0	8.8	16.6	11.1	13.7	7.6	7.8	5.1	1.2	2 5	0.5	—	—	100
Flemish Cap	No.	8	16	24	39	77	143	218	362	532	632	780	836	626	311	92	—	—	—	—	—	—	—	4696
	%	0.2	0.3	0 5	0.8	1.6	3.0	4.7	7.6	11.2	13.2	16.4	17.6	13.2	6.5	2.0	—	—	—	—	—	—	—	100

TABLE 3. **Size composition of *S. mentella* catches in 1960 (according to data of research and exploratory vessels)**

cm-group		20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	Total
Labrador	No.	—	2	7	25	97	151	403	668	523	346	315	222	229	130	62	19	7	—	1	3207
	%	—	—	0.2	0.8	2.7	4.7	12.6	21.0	16.4	10.8	9.9	6.9	7.2	4.1	1.9	0.6	0.2	—	—	100
Newfoundland	No.	1	9	30	117	319	577	1056	1846	2295	1790	1587	1625	1079	402	195	42	6	—	—	12976
	%	—	0.1	0.2	0.9	2.4	4.5	8.1	14.3	17.7	13.8	12.2	12.6	8.3	3.1	1.5	0.3	—	—	—	100
Flemish Cap	No.	1	3	20	20	52	337	992	1271	1291	1087	542	146	57	3	—	—	—	—	—	5822
	%	—	0.1	0.3	0.3	0.9	5.8	17.1	21.8	22.2	18.7	9.3	2.5	0.9	0.1	—	—	—	—	—	100

TABLE 4. **Size composition of haddock catches in 1960 (according to data of research and exploratory vessels).**

cm-group		25	30	35	40	45	50	55	60	Total
Newfoundland	No.	49	741	1310	212	62	16	6		2396
	%	2.0	31.0	54.8	8.8	2.6	0.6	0.2		100

In January haddock concentrations were found in the southern and southeastern parts of the Newfoundland Bank, in July on the southeastern Newfoundland Bank; at depths of 60 to 100 meters these fish formed commercial concentrations which were fished by trawlers.

The haddock stayed on a small bank with a sandy bottom covered with numerous mollusc shells. They fed on capelin eggs which were spawned there in July, and the great quantities of capelin eggs may have accounted for the stable concentrations and consistent catches of haddock during July. Later (August-November) haddock concentrations were still fairly good, which may be due to the facts that this area was not covered by cold Labrador water and that the summer warming was rather high and reached to the bottom—there was an increase of the near-bottom temperature from 2° in August to 3° in September.

The maximum haddock catches (4 tons per hour of trawling) were taken in July; in late November the catch dropped to 2 tons. During the entire period the highest catches were taken at night.

Another object of the trawl fishery was redfish, which was fished off southern Labrador and on the northern Newfoundland Bank at the beginning of the period (July) and along the edge of the northeast slope of the Bank and on the Flemish Cap from August to October. The average catch in the second period ranged from 2.2 to 2.6 tons per hour trawling.

In November the trawler fleet moved to the northern slope of the Great Newfoundland Bank and in December to the Labrador area, where *Sebastes mentella* concentrations appeared at depths of 250 to 300 meters, at that time not affected by winter cooling.

Tables 1, 2, 3 and 4 show size composition of fish from catches by research and exploratory vessels. In the Labrador area fishing was conducted for cod (Table 1) mainly 45-65 cm long and off Newfoundland for cod of 50-70 cm. Besides, larger fish (up to 105 cm) occurred in the Newfoundland area.

In the Labrador area *Sebastes marinus* was larger than on the Newfoundland and Flemish Cap Banks—the predominant sizes were 44-56 cm and 38-48 cm respectively (Table 2).

The larger sizes of *Sebastes mentella* occurred in the Newfoundland Bank and Flemish Cap areas (Table 3).

The number of larger fish increased in northern areas, for both *S. marinus* and *S. mentella*. Thus, in the Labrador area *S. marinus* above 50 cm in length made up 40% of the catch, on the Newfoundland Bank only 17%, while on the Flemish Cap Bank fish above 50 cm did not occur.

As shown by the 1960 data supplied by exploratory vessels, haddock ranged in size from 30 to 60 cm (Table 4).

According to preliminary data, the total catch by the Soviet trawler fleet in the ICNAF area in 1960 was about 250,000 tons.

C. REDFISH STOCK DISTRIBUTION IN THE ICNAF AREA

BY V. TRAVIN, K. JANOULOV, A. POSTOLAKY, G. ZAHAROV

The Soviet investigations which began in 1957 have, only for the last two years, covered most of the ICNAF subareas. For this reason, the Soviet scientists do not possess sufficient quantity of data on the redfish biology, distribution of adult fish concentrations, and dispersal of the larvae and young during the first years of life, for allowing final conclusions as to the existence of separate local stocks of redfish in the different parts of the Convention area. Our earlier considerations of the possibility of the existence of several local stocks of *S. mentella* in the regions of Labrador and Newfoundland were based on the analysis of the seasonal fishery, which partly reflected the displacement of commercial stocks, as well as on the analysis of age/length composition, sex ratio and maturity of the gonads, of the catches; further, on the observation of so-called "natural marks" (parasites, external and internal spots on the skin and muscles), and finally, on the morphometric measurements of the samples taken in different parts of the Convention area.

As the Soviet investigations were mainly conducted in the most important fishing areas, the data on the distribution of local redfish stocks were collected for the main species characteristic of the particular regions: *S. marinus* in Davis Strait, *S. mentella* off the Labrador coast and in the Newfoundland divisions. Data collected in Subareas 4 and 5 are insignificant and fragmentary, so they cannot be used for the solution of this problem.

Our views on the distribution of redfish stocks are as follows:

Subarea 1 - West Greenland.

Catches of the research and scouting vessels included, besides cod, a large number of *S. marinus*. The limits of the distribution of this fish extend to at least 69° N, but commercial stocks are mainly found up to 66°N (Division 1C inclusive). Within these limits (from Cape Farewell up to 66°N), commercial stocks of *S. marinus* may be found all the year round, but the largest catches come, as a rule, from the northern divisions (1C and 1D) in March to August. In the other months rich catches were made in the more southern divisions (1E and 1F).

Redfish schools keep along the west slopes of the banks, spreading into the guts between the banks, sometimes moving to the deeper grounds east of the banks when the waters are warmed up, and westward to greater depths when the waters are cooled. The catches consist of fish of all age and size groups, from the smallest and youngest to 20-year-old and older.

However, mature fish are hardly found in any of the seasons in the areas off West Greenland, neither at the embryonal stage of development, nor at the pre-extrusion or post-extrusion stages: even the biggest specimens, both males and females, have as a rule resting sexual glands. This fact testifies against the spawning of *S. marinus* in the waters off West Greenland; this stock is not genetically independent and must be linked to the more south-eastern regions of the North Atlantic: Iceland and the Danish Strait. Larvae from the spawning grounds of these regions apparently drift to the coasts of West Greenland (where they grow up) with the Irminger Current and its branch of the West-Greenland current. The return of the adults from the West Greenland coasts to Iceland or the migration of mature post-spawning specimens from Iceland to West Greenland were, however, not observed. It is quite possible that the young fish drift and the adults swim from West Greenland into the Labrador region in a relatively warm stream which branches off from the West Greenland Current at the latitude of Godthåb and joins the Labrador Current on the western side of the Davis Strait.

This may explain the presence of *S. marinus* concentrations in the waters of the continental shelf of the Labrador coast, which are fished from time to time by the Soviet fishing vessels.

Subarea 2 (Labrador coast)

Catches of *S. mentella* (the main object of commercial redfish fishing in this subarea) display great seasonal and yearly fluctuations; however, if permitted by the ice and meteorological conditions, fishery could be carried out all the year round.

The northern limit of *S. mentella's* distribution has not been established, but it undoubtedly extends far to the north of the Hamilton Bank area (2J) where the Soviet fishing fleet is mainly operating. The richest catches on this bank are observed from October until February, when redfish concentrations move from 3K and 3L, first to the north and then to the south. The approximately equal distribution of sexes in catches during all seasons indicates the absence of the seasonal separation of male and female schools, so characteristic of the Bear Island-Spitzbergen stock of *S. mentella*. Extrusion of larvae takes place on the eastern slope of the Hamilton Inlet Bank in May or beginning of June. Only a very small number of females with their larvae not liberated are observed toward the end of June.

The problem of larval drift has not yet been fully studied, in spite of its great importance for the understanding of the position of the Labrador stock of redfish.

We believe that the main drift proceeds along the extreme eastern (warm) component of the Labrador Current which flows along the edge of the slope of 2J, 3K and on the northern side of 3L, where it deflects to the southeast, then (north of Flemish Cap) to the north and northeast, forming a cyclonic eddy. Only such a pattern of distribution of larvae and young fish can explain the existence of a *S. mentella* stock, off the Labrador coast and in the northern regions of the Newfoundland shallows (3K and 3L), which is shown by the available data.

Subarea 3 (Newfoundland Bank)

In this subarea the existence of the following three *S. mentella* stocks, with only little intermingling in the marginal regions, can be outlined:

1. The northern stock in the Labrador region and northern parts of Newfoundland (3K, northern part of 3L);
2. The Flemish Cap stock in Division 3M;
3. The south Newfoundland stock on the southeast and south slopes of the Newfoundland Bank (3N, 3O, 3P).

This division of stocks appears from morphometric differences as well as from differences in parasites, already referred to. It is further confirmed by a considerable difference in the length-composition of catches observed rather consistently during the various seasons (Table 5).

The Flemish Cap stock is more distinctly isolated, especially by morphometric and parasitologic indices. It can only accidentally be recruited from specimens of the southern stock, whose larvae can be brought there in years when the waters of the Gulf Stream penetrate to the southern slope of Flemish Cap. The southern and northern stocks are also delimited by morphologic indices and average sizes; they are intermingling in Division 3N and in the southern part of 3L, in both cases due to the penetration of adults and to a small-scale southward transport of larvae from the northern stock with the main branch of the Labrador Current.

TABLE 5. Mean sizes of *S. mentella* in the catches of the Soviet research vessels in different regions (in brackets —months when samples were taken.

Region	Sex	Mean sizes by years			
		1957	1958	1959	1960
2	male	34.45	33.48	34.29	33.81
	female	35.91	37.45	37.94	37.54
		(X-XI)	(VIII-XII)	(VI-VIII)	(I-II-V-VI)
3K	male	34.49	34.41	35.22	33.20
	female	39.45	36.72	37.96	37.61
		(X)	(X-XII)	(I-VIII-XII)	(I-VII)
3L	male	33.91	34.54	34.20	34.20
	female	35.93	37.10	37.51	38.83
		(X-XII)	(IV, VIII-XII)	(I-VIII, XII)	(I-VIII)
3M	male	34.80	32.72	33.21	33.13
	female	37.05	34.42	35.65	35.02
		(I-VI)	(III, IX, XII)	(III-IX, XII)	(I-VII)
3	male	—	—	39.59	29.35
	female	—	—	31.56	31.01
				(I, VIII)	(I-VIII)
3O	male	—	—	36.07	26.48
	female	—	—	27.65	28.27
				(III-VIII)	(I-VIII)
3P	male	—	—	—	27.94
	female	—	—	—	28.93
					(I-II, VII-VIII)

D. HYDROGRAPHIC CONDITIONS OFF THE WESTERN COAST OF GREENLAND IN THE SPRING OF 1960

BY M. M. ADROV, POLAR RESEARCH INSTITUTE, MURMANSK

From early April till beginning of June, the "Odessa" carried out investigations on the fishing banks off the west coast of Greenland, from Frederikshåb Bank to Lille Hellefiske Bank; surface and near-bottom temperature were taken during each of the numerous hauls. The majority of the measurements were done in April. Besides, the following hydrographic sections were worked:

(a) South-west from Frederikshåb Bank—5.IV.60.

(b) South-west from Lille Hellefiske Bank—(done twice) 5. V. 60 and 3. VI. 60.

The distribution of surface and near-bottom temperature in April (Fig. 1a-b) shows that in spring 1960 the water masses off West Greenland were characterized by higher temperature than during the two previous years both in the upper and lower layers. The extremely great undulation of the near bottom isotherms shows that the Irminger Current exerts increased pressure upon the coastal waters. The closeness of the isohalines indicates the same. Evidently, owing to this, temperatures below 1°C are not found near the coastal zone, whereas in other years temperatures below 0°C were frequent. The surface isotherms show the irregularity of the temperature pattern due to the varying influence of the colder surface water formed by the melting of floating ice. It is noteworthy that the surface temperatures in April/May for the two previous years did not exceed 1°C. The presence of certain patches of water with more than 1°C also indicates the increased warming up of the waters in spring 1960.

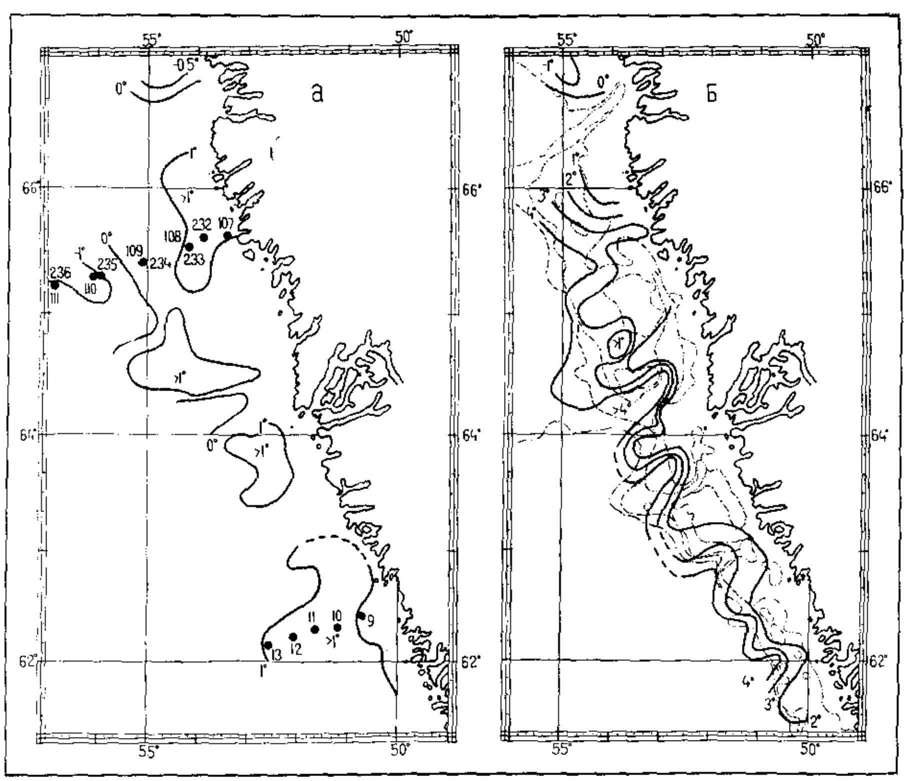

Fig. 1. Surface (a) and near-bottom (b) isotherms, April 1960. The dots indicate the stations of the sections taken by "Odessa".

The temperature and salinity distribution in the spring of 1960 at the sections mentioned earlier is in good agreement with the general thermal distribution in this area. On the western slope of Frederikshåb Bank beginning at 100 m depth waters of 2°C are found (Fig. 2). Judging from the salinity these waters are strongly mixed with Irminger Current water. But in the upper 50 m layer especially high temperatures were observed, together with increased salinity. In early May 1958 the temperature of this layer was mainly below 0.5°C, in cases even slightly below 0°C; its salinity ranged between 33.5-33.8°/₀₀. Also the section across the Lille Hellefiske Bank (Fig. 3), at the very beginning of May 1960, showed very high temperatures, especially in the near-bottom layer over the top and the western slope of the Bank. The character of the bottom isotherms and isohalines shows that such warming up is caused by the invasion of deep water masses of the Irminger component of the West Greenland Current. The salinity values in the shallow part of the Bank are 0.2-0.3°/₀₀ higher than those observed in the same period in 1959. The core of cold surface water approaching the bank from the west was as well developed as in 1959.

When the same section, Lille Hellefiske Bank, was taken a month later, 3 June 1960 (Fig. 4) the forming of the bank water as a mixture of the intermediate cold layer from the west and the deep warm water had already begun. It results inevitably in the subsequent cooling of the near-bottom waters on the bank, observed every year on many of the West Greenland banks.

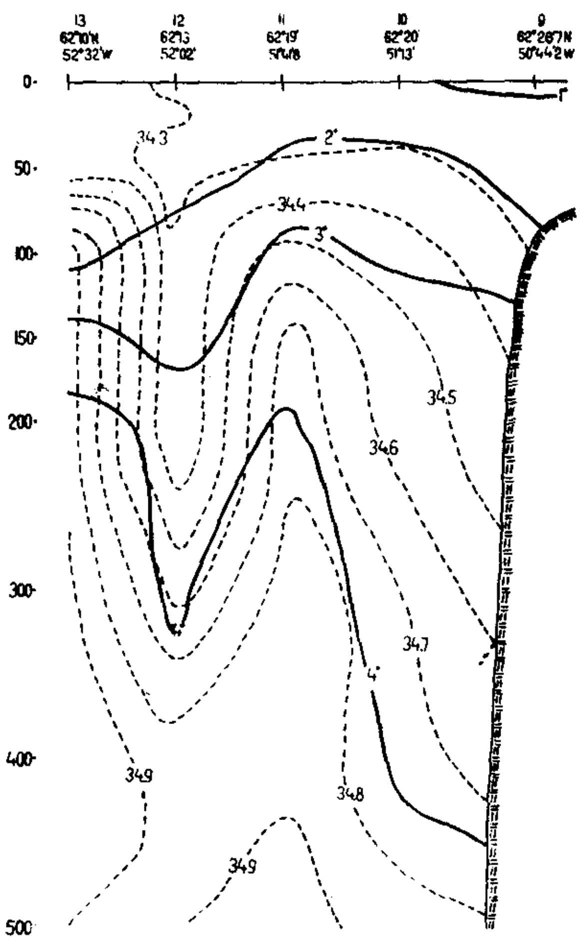

Fig. 2. Isotherms and isohalines of the section SW from Frederikshaab Bank, April 5, 1960.

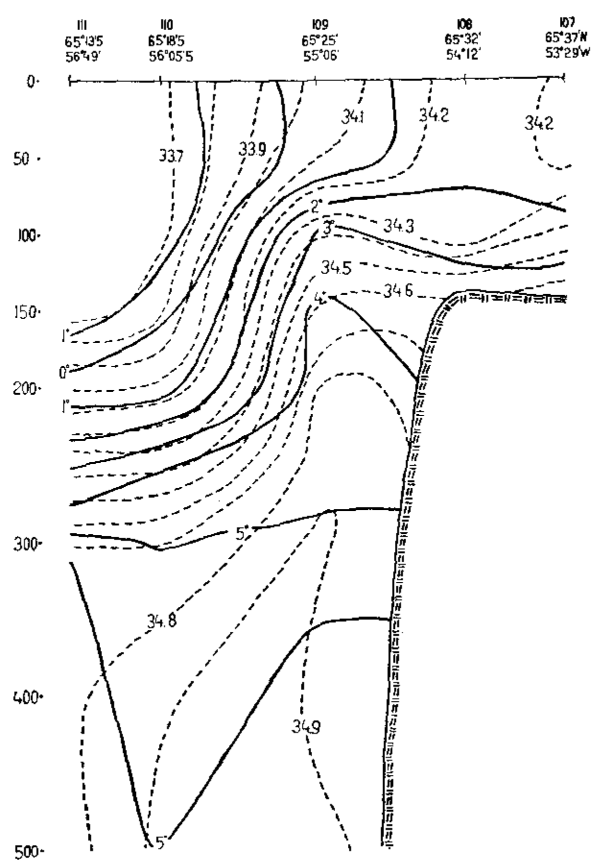

Fig. 3. Isotherms and isohalines of the section SW from Lille Hellefiske Bank, May 5, 1960.

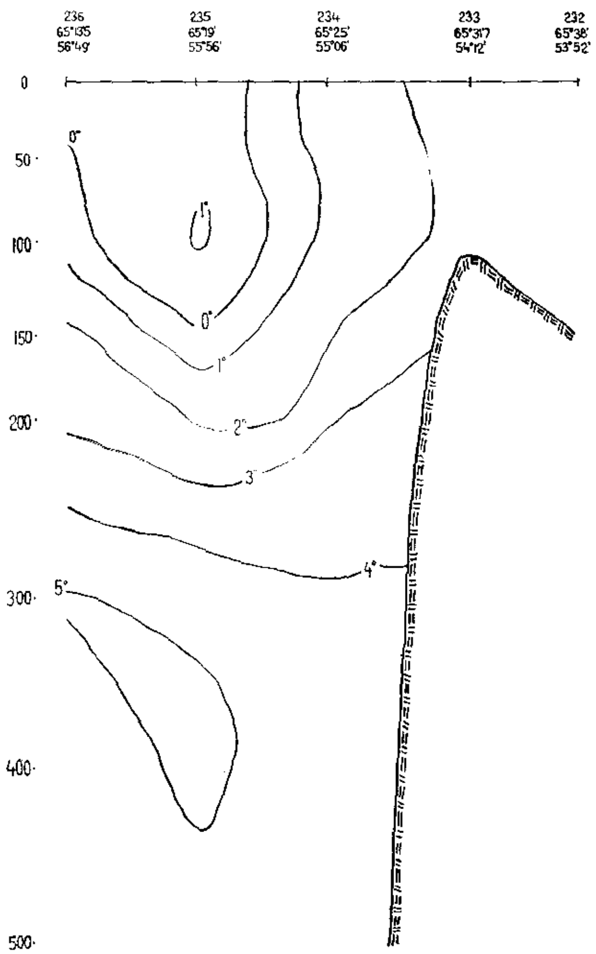

Fig. 4. Isotherms and isohalines of the section SW from Lille Hellefiske Bank, June 3, 1960.

As observations from other years show, the cold intermediate layer later approaches the bank still closer, finally completely covering the bank, whilst warming up takes place simultaneously from the surface. Unfortunately, in 1960 we had no opportunity to repeat the section still later in the season. But, from analyses of the observations by the expeditions of different countries, the USSR included, the author concludes that the seasonal temperature minimum of the near-bottom layers of the West Greenland banks is not at all connected with the hypothetical seasonal increase of the influx of cold water of the West Greenland Current, but with the effect of the intermediate cold layer, which is formed every year owing to vertical winter circulation.

XI. United Kingdom Research Report for 1960

BY C. E. LUCAS AND R. J. H. BEVERTON

1. Commercial Fishing.

Considerably more fishing was carried out by English vessels at West Greenland in 1960 than in 1959, but the total catch was nearly the same. Data are as follows:

	1959	1960
Hours Fishing	7,231	12,694
Catch of cod (cwt)	217,878	218,611
Catch (cwt) per 100 ton-hours	4.06	2.11

2. Market Sampling.

About 7,500 cod from West Greenland were sampled at Hull and Grimsby in 1960, and otoliths taken from 262 of these. Compared with 1959, the 1960 catches contained relatively more small fish and fewer medium and large. The numbers caught per 100 hours fishing in 1960 are presented in Figure 1; the corresponding data will be published in "Sampling Yearbook, vol. 5.

3. An observer (Mr. G. C. Trout) spent the period from January 7th to February 5th on the stern trawler FAIRTRY II, (1960 Ann. Meet. Doc. no. 42) and obtained length compositions of her cod catches in Divisions 3L and 3P by sampling the various size categories into which her catch is sorted prior to processing. Since the daily output of fillets was available, changes

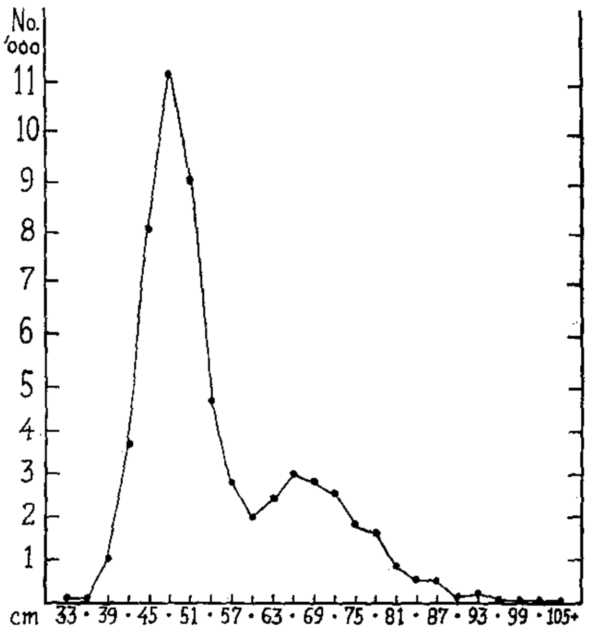

Fig. 1. **Numbers of cod (raised figures) by 3 cm groups caught per 100 trawl hours off W-Greenland, 1960.**

in the length composition of the total catch between grounds could readily be obtained. A similar survey has just been made on FAIRTRY I, on which a report will be issued (1961 Ann. Meet. Doc. no. 7). Routine sampling by shipborne personnel is being arranged on FAIRTRY I, II, and III.

4. Comparative Fishing.

No comparative fishing experiments were conducted in the ICNAF Area during 1960 but some undertaken elsewhere may be relevant to the Commission's program. These have included further mesh selection experiments, in particular with single and double twine and with cod-ends made of courlene. In addition, experiments have been made on diurnal variations in fish catches and on the reactions of fish to fixed and moving obstacles. Following a recent review by a special Mesh Selection Working Group (Convener, Mr. J. A. Pope), ICES intends to prepare a report summarizing all selectivity data for the ICES Area.

5. Fishery Assessments.

Members of the research laboratories at Aberdeen and Lowestoft participated in the Fishery Assessment Working Group (Convener, Mr. R. J. H. Beverton) which met in Lowestoft from March 17th-26th, 1960. Further meetings of the Group in Bergen before and during the Meeting of the Research and Statistics Committee enabled a Progress Report to be submitted giving provisional assessments of the effect of mesh size in the majority of cod and haddock fisheries of the ICNAF Area. A further meeting of the Group was held at Lowestoft from March 21st-30th, 1961.

6. Environmental Studies.

During a cruise of the R. V. ERNEST HOLT to East Greenland in August-September 1960, a hydrographic and plankton section off Cape Farewell was worked (August 26th and 27th).

The Continuous Plankton Recorder survey, conducted from the Oceanographic Laboratory in Edinburgh, was further extended during 1960 along two slightly differing routes (one summer and one winter) between Iceland and Newfoundland, again with the assistance of Icelandic scientists. Seven records (8,200 miles) were obtained during the year and have contributed further to knowledge about the distribution of redfish larvae, as well as providing basic information about the abundance of and seasonal variation in many plankton organisms. Brief reports on both aspects of the work have been prepared by the Edinburgh laboratory for general ICNAF purposes (see this "Proceedings" p. 102) and particularly for the meeting of the ICNAF Environmental Working Party, Aberdeen March 1961.

XII. United States Research in the Convention Area during 1960

A. BY HERBERT W. GRAHAM
LABORATORY DIRECTOR, BUREAU OF COMMERCIAL FISHERIES
BIOLOGICAL LABORATORY, WOODS HOLE, MASS.

Market sampling of the major species landed from the Convention Area continued at all important ports. Research samples of bottom fish, samples of bottom fauna, and hydrographic observations were made on eight cruises of the research vessel *Delaware* and on two cruises of a charter vessel.

Haddock (*Melanogrammus aeglefinus* (L.))

The fishery. The abundance of haddock on Georges Bank and the landings in 1960 were higher than in the previous two years (Table 1). This was due largely to the abundance of the 1958 year-class which contributed heavily to the catch as 2-year-old scrod. Scrod comprised about 50% of the landings in 1960 compared to about 47% in 1959. The increase in landings occurred in spite of a drop in effort. The age composition of the landings for the last three years is shown in Figure 1.

The fishery should improve in 1961 as the fish in the 1958 year-class grow to larger size. Fall survey cruises designed to assess the abundance of pre-recruit haddock showed low numbers of young-of-the-year (1960 year-class). Thus, it is expected that scrod landings will drop in 1962, which may possibly have an effect on total landings, depending upon the abundance of the 1958 year-class which will then be four years old.

Tagging. Tagging records were analyzed to determine the effect of the condition of the fish at time of tagging upon numbers of returns.

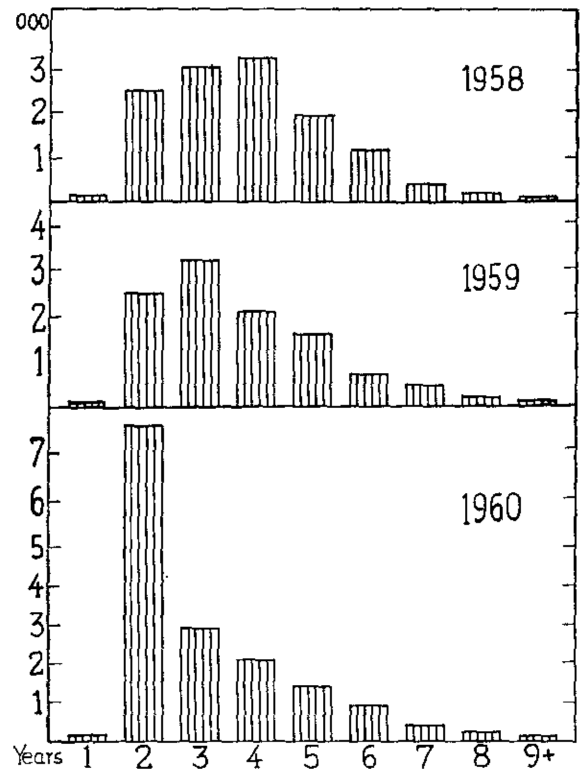

Fig. 1. Age composition of Georges Bank haddock, 1958-60. Catch per day (thousands of fish) of ages 1 to 9 +; for 1960 only the first nine months.

TABLE 1. Trends in the Georges Bank haddock fishery.

Year	Landings (thousands of pounds)	Days fished	Average Landings per day (pounds)
1951	91,508	6,490	14,098
1952	83,645	5,933	14,098
1953	69,476	6,511	10,671
1954	89,710	5,807	15,448
1955	78,942	5,059	15,603
1956	94,505	6,794	13,910
1957	89,251	8,050	11,087
1958	68,655	7,836	8,761
1959	69,350	9,432	7,353
1960	79,470	7,669	10,362

Preliminary results indicated fewer recaptures of fish with evidence of scale loss or subcutaneous bleeding as compared with undamaged fish at time of tagging.

Another analysis was made to compare percentage return of different types of tags. Percentage returns were twice as high for spaghetti tags as for Petersen disc tags whether inserted in the dorsum or the operculum. These tagging experiments were conducted in Divisions 4X and 5Z.

Age Determination. Age analysis of special collections of scales and otoliths from groundfish surveys and from routine port collections continues for comparative age and growth studies.

A critical review of the scale method for haddock age determinations was completed.

Cod (*Gadus morhua* L.)

The Fishery. Total U.S. cod landings in 1960 were down about 4 million pounds from the 1959 landings, bringing the figure near the 1957 level of 32 million pounds.

Research. In 1959, we reported a study in which drift bottles were dropped from U.S. Navy airships (blimps) in the offing of New Jersey. Bottle recoveries to date have shown no clear pattern of surface currents in the area. Most of the bottles were recovered within about 25 miles or less of the drop station, but there have been three long-distance recoveries. One bottle stranded in the Azores, one in Bermuda, and one in Ireland.

U.S. cod studies were started only a few years ago and on a limited basis. The initial program comprised studies of the number of stocks, migrations, and growth rates. We have now started a study of the age composition of cod in Subarea 5. These data are essential to population studies of the fish in this subarea and should provide vital information on the effects of fishing.

Silver Hake (*Merluccius bilinearis* (Mitchill)

The Fishery. Landings of silver hake for 1960 from Subarea 5 decreased slightly from the previous year. Landings and catch per day of small and medium otter trawlers fishing out of Gloucester, Massachusetts, are shown in Table 2. The year 1957 was a peak year for both landings and abundance. The abundance figures show an irregular decline since then, but landings at Gloucester are still higher than in 1956. An analysis of the catch per day for each fishing ground showed some decrease in abundance on all grounds fished.

Research. Survey cruises were conducted to determine the winter distribution of the silver hake. The largest number was caught in depths greater than 100 fathoms, in temperatures ranging from 44°F to 52°F (6.7°-11.1°C) in the general area between Cape Cod and Cape Hatteras.

Redfish (*Sebastes*)

The Fishery. The U.S. redfish landings in 1960 were about 139.5 million pounds, an increase of approximately 2.5 million pounds over the 1959 value, but well below the annual average of 178 million for the fishery since 1946. About 30 million pounds were landed from the Gulf of Maine, 71 million from the Nova Scotian banks, 31 million from the Grand Bank, and 7 million from the Gulf of St. Lawrence.

TABLE 2. Trends in the silver hake fishery Subarea 5. (Data for Gloucester Massachusetts only).

Year	Landings Subarea 5 (thousands of pounds)	Catch per day OTS[1]	Catch per day OTM[2]
1956	90,090	25.8	58.9
1957	126,312	44.0	69.6
1958	106,650	33.5	47.6
1959	110,144	35.8	51.0
1960	104,785	32.9	39.9

[1] Otter trawl — small [2] Otter trawl — medium.

TABLE 5. Trends in the Sea Scallop Fishery.

Year	Landings (millions of pounds)	Days Fished	Average Landings per day (pounds)
1951	12.4	7,626	1,626
52	12.1	7,742	1,563
53	16.3	10,031	1,625
54	15.5	9,343	1,659
55	18.3	11,619	1,575
56	17.5	12,246	1,429
57	17.3	10,500	1,651
58	14.4	8,775	1,637
59	18.7	8,556	2,189
1960	21.9	8,039	2,725

reduced to one-sixth of its previous abundance in one year on that ground. The 63-percent increase in the landings per day was the result of growth.

Studies of the cycle of gametogenesis have shown that sexual products are rapidly regenerated during winter and early spring, but that the animals remain fully ripe for almost six months before spawning in the fall. Data on the seasonal and areal variation in the length-weight ratio have been collected and are being analyzed.

Industrial Fishery.

The reduction of non-food trawl fish to meal and oil was almost completely stopped in September 1959 and was not resumed in 1960. Market sampling, of course, was terminated in the absence of landings. Previous data have been analyzed and the 1959 species composition report completed.

An analysis of the quantities and sizes of young haddock and other commercially important groundfish species taken by the industrial trawl fishery and its sister industry, the silver hake fishery, has been made. This study indicates that the small mesh industrial and silver hake fisheries may seriously influence the potential recruitment of haddock and other groundfish species. This research is continuing.

One of the important species in the industrial fishery is the red hake (*Urophycis chuss* Walb.) Some preliminary studies were initiated to determine the age and growth. Various structures were examined to determine which might be most suitable for age reading. The otoliths appear to be generally unsuitable, but the scales show some promise.

Benthos Investigations.

A study of relationships between bottom sediments, benthic invertebrate fauna, and the foods of groundfish is continuing. Results of an inventory of Georges Bank benthic fauna have revealed that pronounced differences in the haddock's diet from one locality to another are due largely to differences in available foods. Also, marked variations in species composition and quantities of benthic organisms were found to be correlated with sediment type. In this regard, benthic organisms were much more abundant in substrates composed of gravels and coarse sand than in fine-grained sediments.

Bottom sediments of Browns Bank and the southern Gulf of Maine are the subject of a report now in preparation. Analysis of sediment samples from these areas indicates that gravels and coarse sands are the predominant component on Browns Bank, whereas in the southern Gulf, silts and clay are most prevalent.

Evaluation of Mesh Regulation.

Studies of the effect of the mesh regulation in the Georges Bank haddock fishery continue. They show that the regulation has been beneficial in reducing the proportion of discards of small fish and in increasing the relative catch of larger fish. This results in easier handling of the catch on board the vessels and increases the efficiency of processing operations ashore.

Our principal concern is to demonstrate an increase in yield per recruit. Studies of this problem involve a comparison of the total yields of year-classes over their fishable life span. Year-classes after mesh change should yield more pounds of fish than year-classes of the same initial size before mesh change. Evaluation of regulation on this basis requires an accurate measure of the initial strengths of year-classes before and after regulation. Although values are available for many year-classes prior to regulation and values are available for post-regulation year-classes, the post-regulation values are not comparable to those for pre-regulation year-classes. To date, it has not been possible to find an entirely satisfactory method of adjusting the new values to make them comparable with the early ones.

As more large year-classes pass through the fishery more data will become available for this study. As data accumulate and more effort is devoted to developing new methods of evaluation, a more firm demonstration of the increase in yield per recruit should emerge.

B. BY DEAN F. BUMPUS

WOODS HOLE OCEANOGRAPHIC INSTITUTION, WOODS HOLE, MASSACHUSETTS

Hydrographic Research by the U.S.A. in the Convention Area was carried out by four agencies during 1960; the U.S. Coast Guard, U.S. Coast and Geodetic Survey, the Bureau of Commercial Fisheries, and the Woods Hole Oceanographic Institution.

A. The U.S. Coast Guard, as the agency operating the International Ice Patrol, examined the temperature and salinity distribution in four network surveys in the Grand Banks region. The first survey, 1-17 April, in addition to covering the southern and eastern slopes of the Grand Banks extended south to Latitude 37°30'N. in order to cooperate with the "Gulf Stream '60' " survey (see below). The second survey, 1-9 May, covered the eastern and northeastern slopes of the Grand Banks. This was followed by an evaluation of the wind effect on iceberg movements. Parachute drogues were employed during this phase of the study. The third survey, 3-6 June, covered the Bonavista triangle and the fourth survey, 17 June-1 July, covered the area immediately seaward of the southern and eastern slopes of the Grand Banks from just westward of the Tail of the Banks to the latitude of Flemish Cap. A post-season cruise, 5-13 July, included occupation of the Bonavista triangle and a section across the Labrador Sea from South Wolf Island, Labrador to off Cape Farewell, Greenland.

The report *in toto* will be published in U.S. Coast Guard Bulletin No. 46.

B. The U.S. Coast and Geodetic Survey set-up a bubbler-type tide gauge on Texas Tower L3 (on Nantucket Shoals) and ran 100 hours of simultaneous current observations at three depths at each of three buoys in the same general area. One hundred hours of current measurements were made off Point Judith.

C. The Bureau of Commercial Fisheries has collected a limited amount of temperature (bathythermograph) data in Subarea 5 in the course of the second cruise of the *Delaware* and along the coast of Maine during the latter part of the year through the efforts of the Biological Laboratory at Boothbay Harbor, Maine.

D. The twelve U.S.C.G. lightship stations from Maine to Georgia, equipped at the end of 1955 by the Woods Hole Oceanographic Institution under contract with the Fish and Wildlife Service, as observation posts to collect surface temperature and salinity observations daily, bathythermograms daily, and bottom water samples weekly, have continued in operation. Several of the lightships have also released drift bottles daily.

E. A cooperative study including the Fisheries Research Board of Canada, the Bureau of Commercial Fisheries, the Weather Bureau Atlantic Weather Project, the U.S. Coast Guard Ice Patrol, and the Woods Hole Oceanographic Institution has released 20,505 drift bottles in Division 4X and Subarea 5 during 1960 with over 7% returns to date.

F. The Atlantic Weather Project observers on board U.S. Coast Guard weather ships commenced during 1960 to release drift bottles in Subarea 3 following their departure from Cape Race for weather stations Bravo, Charlie and Delta.

G. A network of hydrographic stations, referred to as "Gulf Stream '60' ", (T, S, dissolved O_2—surface to bottom) in the area from the latitude of Bermuda to the continental shelf of North America between longitude 48°30′ and 68°30′W, including the southern parts of Subareas 3, 4 and 5, was occupied during April by *Atlantis*, *Crawford*, *Chain* and *Evergreen*. Thus, for the first time, a three-dimensional description of the Gulf Stream System and its environment from surface to bottom over approximately one-half million square miles may be forthcoming.

B. Summary of Research Reports by Subareas, 1960

BY ERIK M. POULSEN

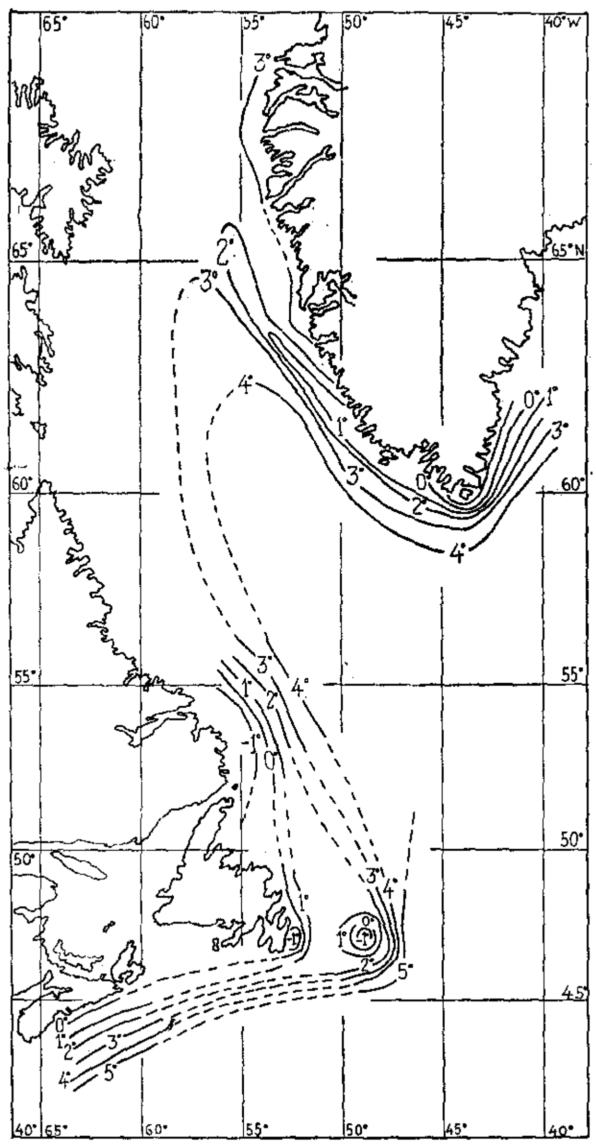

Fig. 1. **Isotherms (°C) in 50 m depth in the Convention Area, summer 1960. From observations reported by Canada, Denmark, Germany, Norway and USSR.**

Summaries of researches carried out in the Convention Area in 1960 are reported by all 12 member countries.

Summaries for each subarea of the reports by the different countries were this year prepared by the chairmen of Groups of Advisers to Panels, these summaries were circulated at the Annual Meeting and are reprinted in the 1961 Red Book as follows: Subarea 1 by Paul M. Hansen, Subareas 2 and 3 by W. Templeman, Subarea 4 by J. Ancellin, and Subarea 5 by Herbert W. Graham; they are referred to in the following as S 1-5. The following summary is in the main limited to comparisons from Subarea to Subarea and between years.

Hydrography.

The map Figure 1 shows isotherms (°C) in 50 metres depth for May-August, 1960, based on sections reported by member countries. Compared with 1959 the temperatures are somewhat higher off S. and W. Greenland, off Labrador and on the eastern slopes of the Grand Bank.

Figure 2 presents comparisons of sections (or part of sections taken in 1959 and 1960 (the temperatures in the surface layer are not shown). In A, Fylla Bank, W. Greenland, the temperatures on the bank and on its western slope are decidedly higher in 1960 than in 1959. Off Hamilton Inlet Bank (B) the warmer water at 200-300 m penetrates farther westward toward the Bank and farther up on its eastern slope in 1960 than in 1959; on the Grand Bank (C) the layer with below 0° water is of less extent in 1960 than in 1959 and does not reach so far down the slopes as in 1959. The Flemish Cap

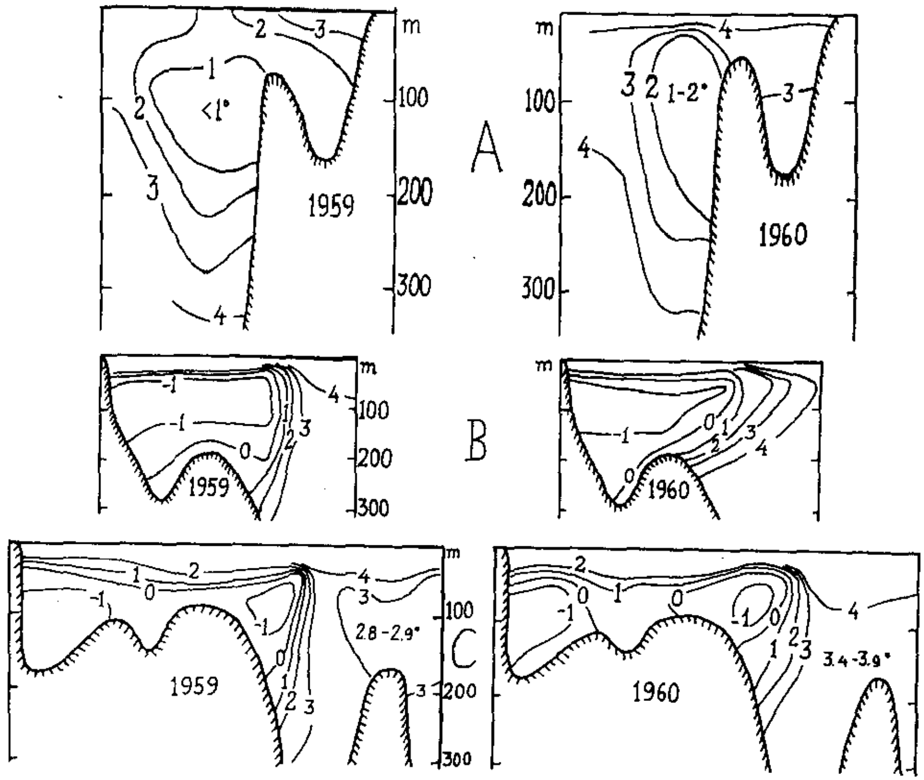

Fig. 2. Comparison of temperature 1959 and 1960. *A—Fylla Bank, B—Hamilton Inlet Bank and C—Grand Bank, Flemish Cap.*

is in 1960 covered by water of 3.4 to 3.9°C, in 1959 by water of 2.8 to 2.9°C only. This increase in temperature is also mentioned in the Summaries by the Chairmen for Subareas 1 and 2 (S1 and S 2). A similar increase in temperature is not noted farther south; for Subarea 4 "it is estimated that the cooling trend experienced during the last few years is continuing" (S 4).

Cod.

The largest concentrations of eggs in Subarea 1 (occurrence of eggs or larvae of cod are not reported from other subareas) were recorded from stations west of the banks. "There is good agreement between this large catch of eggs and the observation of the occurrence of spawning cod west of the (Fylla) Bank, as mentioned in the German and Norwegian reports." (S 1). Investigations of distribution of larvae later in the season was not this year extended sufficiently westwards to ascertain if the larvae occur most abundantly west of the banks; but from earlier years we know that this is the case (see the Summary, Ann. Proceeding vol. 10 p. 117). The observation this year of cod spawning west of the banks in Divisions C and D, and probably also in E and F (German research report) may explain, at any rate partly, the rich occurrence of larvae west of the banks. But we are still left with the great problem of the fate of these large concentrations of larvae far out in the Davis Strait: do they get an opportunity of settling at the bottom either on the Greenland banks or off the Labrador coast, or are they just a waste? It is to be hoped that the extensive study of larval distribution now under way in conformity with the Commission's environmental research program shall solve this question of importance for the understanding of the recruitment of the cod stocks of W. Greenland and Labrador and probably also further south in Subarea 3 (earlier research has shown an exchange of cod between Subareas 3 and 2).

The results of the samplings of the commercial stock of cod through the ICNAF area as reported by countries show the same length distribution as in previous years (Ann. Proc. vol. 9 p. 96): A decline in mean size from NE

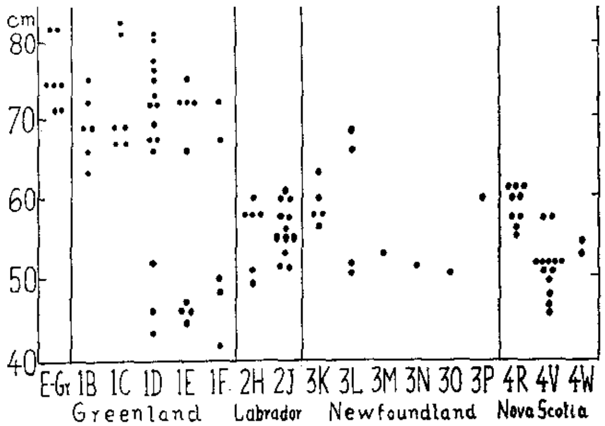

Fig. 3. **Cod, 1960. Variation in length of commercially caught cod from E-Greenland and through the Convention Area (by Divisions). The dots indicate mean length or peaks for samples as reported by countries.**

to SW, the largest cod being caught off E. Greenland the smallest in Subarea 4 (no reports from Subarea 5), see Figure 3 where the dots indicate for the individual samples mean length in cm or position of the peaks. Thus the stocks fished for the longest period of years (Subarea 3 and 4) show the smallest mean sizes, those fished for a considerably shorter period (Subarea 1 - ca. 30 years) present considerably higher mean sizes, and the East Greenland stock which has only been fished for a few years, provides the largest fish. Whether the smaller sizes actually result from the long and strong fishery is of course an open question; the small size of the Labrador cod and the mixed sizes of the South Greenland cod indicate that the fishery can only partly be blamed.

It is of interest to note the mixed sizes observed in Divisions 1D. 1E. 1F and 3L, where one part of the mean sizes or peaks are between 42 and 52 cm. another part between 66 and 80 cm. A consideration of the samples from 1959 (Sampling Yearbook vol. 4) shows the same spread for 1E, 1F and 3L. That this wide spread is not merely due to a fishery distributed over a wide range of area and depth (only otter trawl is considered) is shown by the fact that the length distribution curve of individual samples from these divisions often shows two widely separated peaks.

Redfish.

The USSR report data on length of commercially caught redfish from Subarea 2 and through the whole of Subarea 3. The figures show both for *marinus* and *mentella* a decrease in length from Subarea 2 to Subarea 3, and through this subarea from NE to SW and as follows: Mean length of *marinus* was off Labrador 49 cm, on the NE Grand Bank 44 cm and on the Flemish Cap only 42 cm. For *mentella* the average length is about the same in Subarea 2 as in 3K and L. The length is slightly smaller in 3M (♂ 33 cm and ♀ 35 cm); but from here and into 3O and 3P there is a considerable decrease in length, to ♂ 26 and 28 cm and ♀ 28 and 29 cm.

From the figures in the report appears another difference between the larger sized *mentella* in Subarea 2 and Divisions 3K and 3L and the smaller sized *mentella* in 3O and 3P, viz. a lower difference in size between the two sexes for the small sized than for the large-sized *mentella*:

	Subarea 2 Division 3K and L	**Divisions 3O and 3P**
Mean length ♀	38.3	28.5
Mean length ♂	33.7	27.0
difference in cm	4.6	1.5
difference in %	14%	6%

It remains to be confirmed by the investigation of a larger material if this constitutes an actual difference in the growth pattern of these two stocks of *Sebastes mentella*.

The difference in length distribution between the *mentella* stock in Division 2J- 3K, 3L (and 3M) mentioned above is a general feature confirmed by earlier years investigations. The mean lengths of samples by all countries from 1959 (Sampling Yearbook Vol. 4) are as follows:

Large	Intermediary	Small
2J - 34.3 cm	4S - 28.8 cm	3O - 25.5 cm
3K - 35.3 cm	3N - 26.5 cm	3P - 25.5 cm
3L - 33.9 cm	5Z - 27.3 cm	4V, W, X - 23.6 cm
3M - 34.4 cm		5Y - 24.5 cm
4R - 33.7 cm		

The rather large size of the redfish in 5Z compared to the size in the adjacent subdivisions 5Y and 4X is worth noting.

Haddock.

Canada reports for the southern part of the Subarea 3 that the rich 1949 year-class has almost disappeared and that the 1955 year-class is a fairly good one; also the 1956 year-class is reported as rather successful, whereas the 1957 1958, 1959 and 1960 year-classes are poor. For Subarea 4 the 1955, 1956 and 1957 year-classes are considered as average, and the 1958 and 1959 year-classes as small.

USSR has in 1960 started to fish haddock on concentrations found on the south-eastern part of the Grand Bank in the months January-September, with maximum concentrations in July; the main part of the haddock caught measured between 34 and 49 cm (in 3N).

For Subarea 5 USA reports the 1958 year-class of haddock as abundant.

PART 4

I. Continuous Plankton Records:

THE DISTRIBUTION OF YOUNG SEBASTES MARINUS (L.).

BY G. T. D. HENDERSON

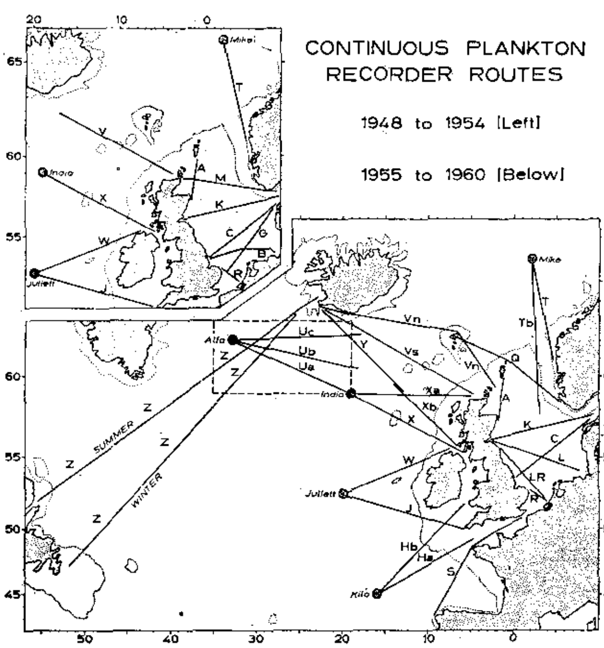

Fig. 1. **Chart showing the Continuous Plankton Recorder routes available during the years 1948 to 1954 (upper left) and 1955 to 1960. The letters identify the routes, and the names the weather ship stations. Some routes are alternatives, not always available concurrently. The rectangular area outlined in broken line is that used for comparisons of abundance in different years.**

INTRODUCTION

Regular sampling in the Atlantic with the Hardy Continuous Plankton Recorder was extended beyond the original western limit of 20°W longitude when British, Dutch and Norwegian weather ships took over Ocean Weather Station 'ALFA' (62°N, 33°W) in 1955 and subsequent years (see Fig. 1). The area sampled was increased in 1957 by the addition of a route from Iceland towards New York. This route originally sampled the first 450 miles southwest from Reykjavik, but was extended, first to 900 miles, and then as far as the Newfoundland Banks, in 1959 and 1960. Although it is convenient to plot the results in statistical rectangles particularly when records are combined, it must be emphasized that the records were obtained along lines followed by the towing vessels as illustrated in Figure 1.

DISTRIBUTION

Plankton Recorder Data.

The young stages of the large redfish, *Sebastes marinus* (L.), were found in relatively large numbers in Recorder samples to the west of 20°W longitude during the months April to July. A few young stages of the small redfish, *Sebastes viviparus* Kr., were taken off the coasts of Iceland and in the Norwegian Sea in June and July of some years. These occurrences are indicated by the open triangles in Figure 2, which shows the average abundance and distribution of all the young *Sebastes* taken by Recorder survey (at the standard depth of 10 metres) during the months April to July in the years 1955 to 1960. The largest numbers of *S. marinus* were found along a line over the western slope of the Reykjanes Ridge, over depths of from 500 to more than 1000 fathoms: there was no sampling to the southeast of this line except in the area close to Iceland. An apparently separate patch occurred off the eastern edge of the Newfoundland Banks in April, 1960; the first occasion on which sampling in this month extended as far.

The seasonal distribution of all *S. marinus* in the Recorder samples to the west of the British Isles is shown in Figure 3 for each of the months April to July. Results from all the years 1955 to 1960 were combined to construct these charts. In April the distribution appeared to be mainly along the western slope of the Reykjanes Ridge, and off the eastern edge of the Newfoundland Banks. In May the largest numbers still occurred along the western slopes of the Ridge, but there was some spreading of the distribution further north and east, with larger numbers on the whole than in April. Relatively few were taken in June, and the distribution was more scattered, mainly to the eastward of the Ridge. In July, although the total numbers were still low, there was a patch of these young stages south of Cape Farewell (Greenland) about which the Recorder sampling provided no antecedent information. The vessel on the Iceland-New York service took a more northwesterly track in July 1959 and 1960, using the Belle Isle Strait once this had opened for shipping. This patch of young *S. marinus* was composed of larger individuals only, none of the small post-extrusion stages being present.

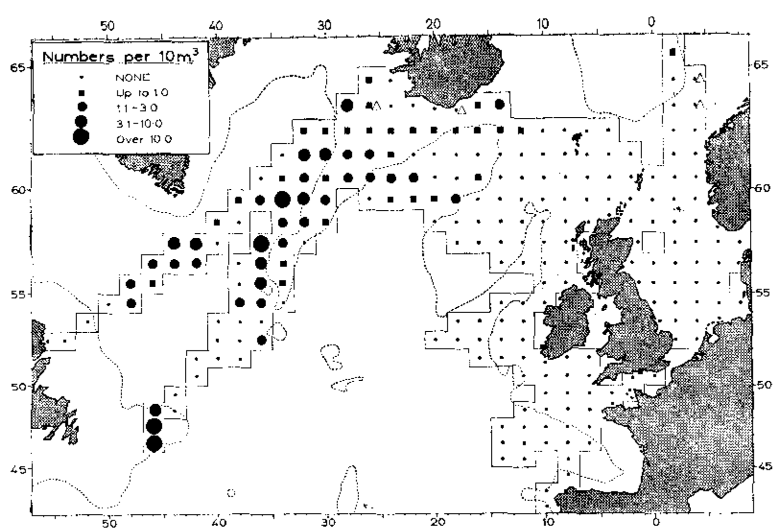

Fig. 2. Chart showing the average abundance and distribution of young *Sebastes marinus* taken by the Continuous Plankton Recorder survey at the depth of 10 metres during the months of April to July in the years 1948 to 1960. The symbols indicate the mean numbers of young stages per $10m^3$ in each statistical rectangle in which samples have been taken. Sampling west of 35°W longitude is limited to 1959 and 1960. The only depth contour shown is that for 1000 fathoms. Occurrences of *S. viviparus* are shown by open triangles.

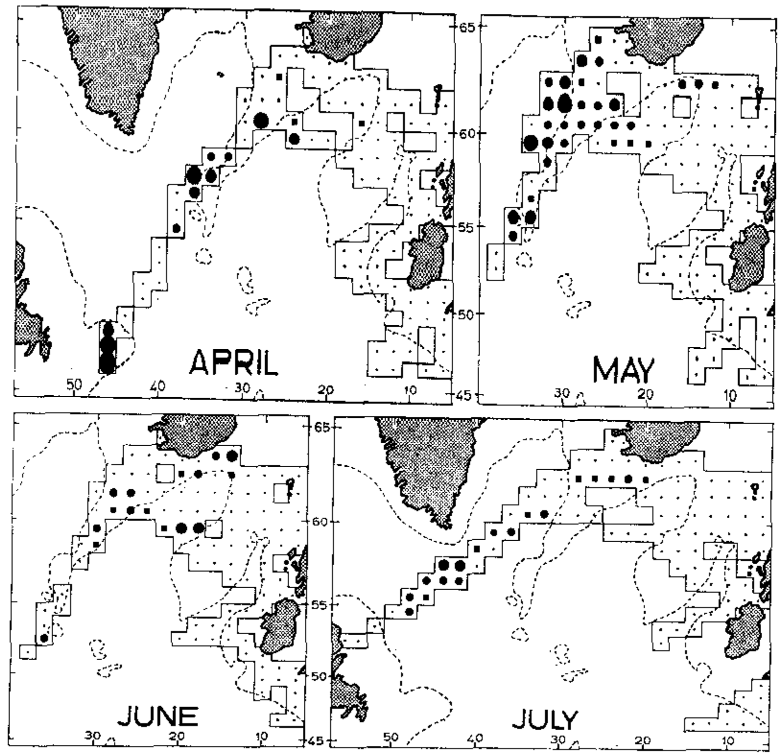

Fig. 3. Charts showing the average abundance and distribution of young *Sebastes marinus* taken by the Continuous Plankton Recorder survey at the depth of 10 metres in each of the months April to July. Results from all the years 1955 to 1960 were combined to construct these charts. The symbols indicate the mean numbers of young stages per $10m^3$ in each statistical rectangle in which samples have been taken. Recorder sampling to the east of 5°W longitude is not shown.

Other Data.

The period of occurrence of young redfish appeared to be generally similar in all the areas from which results were available, so the combination of Recorder material with that of other workers seemed permissible. Published results from United States, Canadian, British, Icelandic, Danish, Norwegian and Russian sources were combined to construct the chart of distribution of 'young redfish' shown in Figure 4. The Recorder results, along with those from Icelandic and Danish sources, were for *S. marinus*, and show three broad categories of abundance with blacked-in symbols (based on a conversion of the results to a common scale). Results from the other sources are shown by pen symbols, of no numerical significance, as uncertainty of specific identity, a mixture of species, or lack of numerical assessment precluded any more precise indication than the presence or absence of 'young redfish'. A mixture of *S. marinus* and *S. mentella* is to be expected in the north Norwegian Sea and Barents Sea, where the area of greatest abundance of early post-extrusion stages lies between the parallels of 70° and 75°N latitude, from 13°E to 17°E longitude (Corlett, 1961 *b*). Presumably (see Templeman 1959) *mentella* type young should be found among catches off the Newfoundland area, but the specific identity of 'young redfish' of the Gulf of St. Lawrence, the Nova Scotian Shelf, and the Gulf of Maine seems less certain. The eastern limit of the distribution in the Barents Sea is slightly further east than is shown in the figure. The impression conveyed by Figure 4 is that of a broad belt of young stages occurring all the way from the Gulf of Maine to the Barents Sea. There are extensions into the Davis Strait and Denmark Strait areas, and the continuity between the Atlantic and the Norwegian Sea distributions is narrowed, or possibly even broken, in the area round the Faroes. It is important to note, however, that the distribution shown is of all stages from extrusion to the end of the pelagic phase, so that drift and dispersal may have masked such boundaries between different populations as may be discovered by more detailed investigations. The areas of distribution of the young stages plotted by Tåning (1949) are outlined on Figure 4; the extension of the present records outside Tåning's boundaries (in the Norwegian and Labrador Seas) confirm his suggestions about the extent of the distribution, but there is a pressing need for further information in the central North Atlantic.

Hydrography.

A detailed comparison with hydrography has yet to be attempted, but there are superficial similarities between the distributions shown in Figures 3 and 4 and the long-term mean surface isotherms published by Krauss (1958). The majority of the young redfish in April and May were taken in areas with mean surface temperatures between 3° and 7°C. Rogalla (1959) reviews the hydrographic conditions in the open oceans in relation to fishery prospects, and shows an illustration (his Fig. 2, taken from Dietrich, 1958) which outlines the boundaries of the Gulf Stream and its branches. There is a superficial resemblance between the pattern of distribution of young redfish in April and May (Fig. 3) and the northwest boundary of the Gulf Stream system. This may be a reflection of the temperature limits for extrusion (Tåning, 1949, sug-

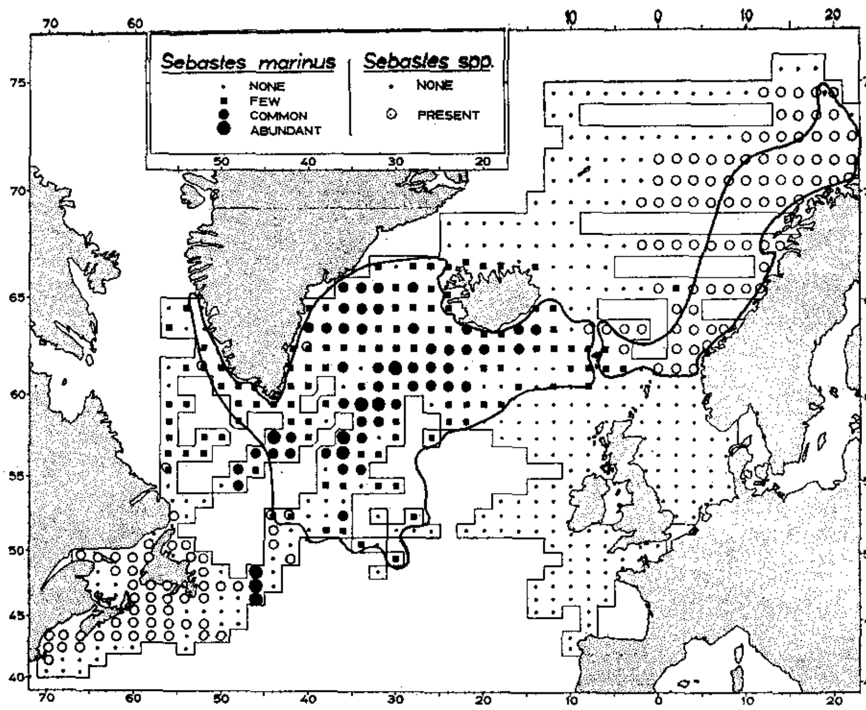

Fig. 4. **Chart showing the distribution of young stages of *Sebastes* spp. in north Atlantic and adjacent waters from the Gulf of Maine to the Barents Sea based on all available published material. The solid symbols (based on conversion of results to a common scale) show *S. marinus*. The open symbols (no scale of abundance) show *Sebastes* spp. excluding *S. viviparus*. Tåning's (1949) plotted area of distribution is shown in outline.**

gested a range of 3° to 8°C). Tåning's suggested distribution in this area, which was based on sampling in earlier years and in June and July also, corresponds less precisely, but this might be expected if the temperature requirements later in the season are less restricted, or may result from the dispersal of young in the later months. The occurrences of some of the June and July Recorder catches in areas with mean surface temperatures (Krauss 1958) exceeding 8°C points to this possibility.

EXTRUSION AND GROWTH

Plankton Recorder Data.

The earliest occurrences in the Recorder survey of apparently newly extruded *S. marinus* were on 2nd, 9th and 10th April, but very few were caught in the first half of this month. In the second half of April these early stages were numerous and were also taken, along with larger sizes, in fair numbers up to the end of May: none were taken in June or July. It seems probable that the period of extrusion in the area between Iceland and Newfoundland may last for six to eight weeks, but does not extend later than the end of May. The mean lengths calculated for catches of the young stages taken in different parts of the area appeared to fit into a common seasonal pattern of size distribution, so that it seemed reasonable to combine the Recorder material from the years 1955 to 1960 to examine the size distribution for all the catches between Faroe and Newfoundland. The percentage size compositions of these catches are shown as histograms in Figure 5, where the period April to July is split up into half months. The points to note are (a) the persistence of the recently extruded stages up to the end of May, and (b) the apparent acceleration in the rate of increment in length after the end of May.

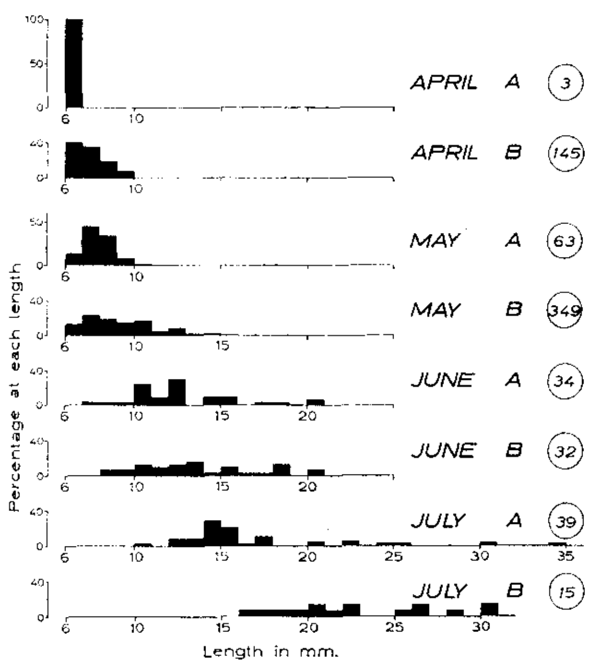

Fig. 5. **Histograms showing the percentage size composition of all catches of young *S. marinus* west of the British Isles in each half month period from April to July. The half month periods are indicated as A = 1st to 15th and B = 16th to 30th or 31st. The total number of young in each period is shown in a circle.**

Very few individuals exceeding 27 mm in length were caught; a finding in agreement with many other observations, where generally the maximum sizes taken in plankton nets have not exceeded 25 mm in length. The mean sizes of all specimens of *S. marinus* taken in the Recorder survey in each half month of the period April to July are plotted in Figure 6, and a smooth curve has been drawn through the points, showing the rate of length increment throughout the season.

It seems important to emphasize here that Figure 6 is not, in the strict sense, a growth curve for young *S. marinus*; it gives an indication of the changes in mean length of the young stages caught at 10 metres throughout the period of their occurrence. It includes, therefore, the cumulative bias resulting from continuing extrusion, natural mortality, drift, and dispersal. The mean sizes of individual catches at various times in the period 1955 to 1960 all group closely to the curve when examined separately, and it is believed that this curve may be more representative of the characteristics of the oceanic population than that shown by Einarsson (1960), whose rather low figure for June seems to be aberrant, possibly due to restricted sampling in this month, in which his samples were mainly coastal.

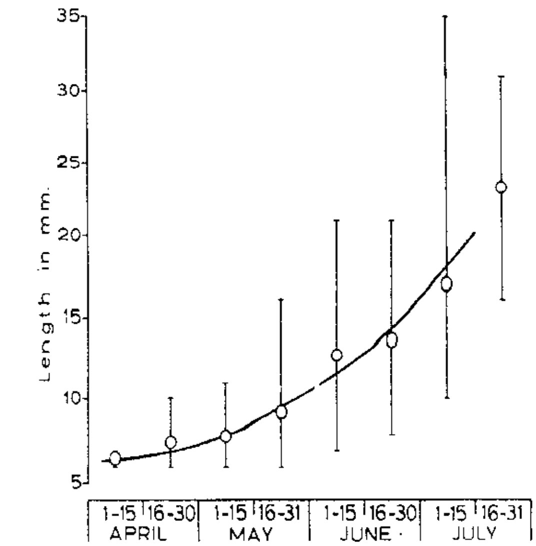

Fig. 6. Graph showing the mean lengths of ***S. marinus*** **in all Recorder samples in half months periods from April to July. The material from the years 1955 to 1960 was combined to determine the mean length for each period; the range of sizes is indicated by the vertical lines.**

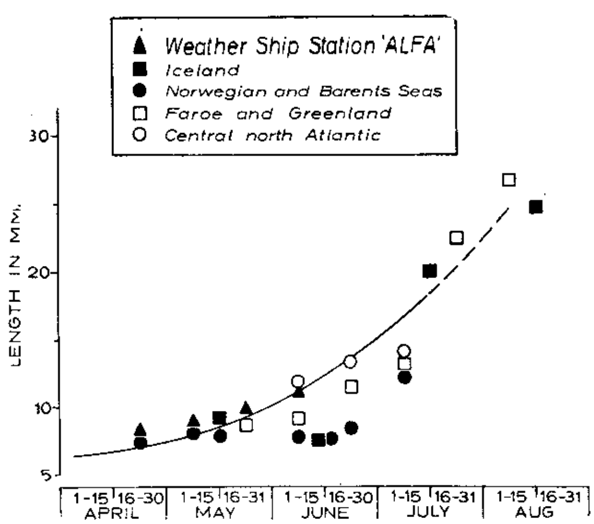

Fig. 7. Graph showing the mean lengths of young ***Sebastes marinus*** **from the Recorder results compared with observations from other areas for** ***S. marinus*** **and** ***Sebastes*** **spp. The symbols indicating the mean length in various areas are plotted on a common time scale. The curve for Recorder catches (Fig. 6) is extended by a broken line after mid-July. Data were obtained from Corlett (1961a, 1961b), Einarsson (1960), Baranenkova and Khokhlina (1961), Hansen and Andersen (1961) and Jensen (1922)**

Other Data.

Kelly and Barker (1961, Fig. 6) combined observations by other workers to show that the sizes of larvae and post larvae were similar, month by month, over a wide area of the western north Atlantic (Greenland, Newfoundland, the Gulf of St. Lawrence and the Gulf of Maine). It seemed desirable to make a similar combination of the published information now available from the central and eastern north Atlantic and the Barents Sea. This is shown in Text Fig. 7, where the curve for Recorder data, from Text Fig. 5, is repeated and other observations, with different symbols for each area, are plotted on the same time scale.

In May and June more observations lie below the curve than above it, but four of these points are results from the Norwegian and Barents Seas, where extrusion appears to commence somewhat later (see Corlett, 1961**b**), and one in June is the figure for Iceland (Einarsson, 1960) which it is thought may be unduly low. (See above). Some scatter in these observations should no doubt have been expected, as the mean sizes plotted are from areas widely separated in space and from many different years in which catches have been obtained by a variety of sampling techniques.

Despite these limitations, the majority of the observations group fairly closely about the curve postulated from the Recorder material, suggesting a uniformity and consistency in the characteristics of growth over a wide area and a long period of years. There is a general similarity between the curve of Text Fig. 7 and that shown by Kelly and Barker for Greenland, Newfoundland and the Gulf of St. Lawrence. Apparently differences between Text Fig. 7 and their curve for the Gulf of Maine result, probably, from the long spawning period suggested for this area (their Fig. 6) and not so far observed in the oceanic populations.

FLUCTUATIONS AND ABUNDANCE

Fluctuations in abundance from year to year were noted, and an attempt at assessing these was made by comparing the April and May catches within the rectangular area (see Figure 1) southwest of Iceland for each of the years 1955 to 1960. The rather limited results so far available seem hardly sufficient to support fine discriminations between years, especially in the light of sampling variations, but the year 1958, when exceptionally low numbers were caught, may perhaps be noted as a possible 'marker' for later studies on recruitment to the adult stock. The paucity of young stages everywhere in the central and western Atlantic in this year seems adequately confirmed (ICNAF Newsletter, 1958). The possibility that the 1958 brood was unsuccessful over the whole area of redfish distribution is supported by the results of studies on the abundance of various year-classes in the Barents Sea by Surkova (1960), who shows that the 1958 year-class was very poorly represented in comparison with those for 1959, 1957 and 1956.

The numbers taken by the Continuous Plankton Recorder appeared large in comparison with those of other species of young fish. In the area of their distribution as shown in Figure 2 the mean number of young *S. marinus* in April was 9.5 x 10^6 under each km.^{2} In May the figure rose to a mean level of 13.0 x 10^6, falling to 4.5 x 10^6 in June and to 2.5 x 10^6 in July. These figures are based on relatively conservative calculations derived from Recorder catches at 10 metres, on the assumption that the distribution extends only to a depth of 50 metres (Tåning, 1949), and a uniform distribution prevails over this depth range, although the only available study of depth distribution suggests that these young were 'many times more abundant at 20 metres than at all other depths combined' (Kelly and Wolf, 1959).

These assessments of abundance represent the mean conditions over the whole area of occurrence of young *S. marinus*, and may be compared with Tåning's suggestion (1949) of well over half a million per km.^{2} for the fringes of the area, and a figure of "several million" inferred from Einarsson's results (1960). Both these workers had only limited material from the Irminger Sea, and in April and May, so that the June and July figures from the Recorder material are in reasonable agreement. It is thought, however, that the Recorder figures for April and May may be in no respect unrealistic, when the distribution of the catches throughout the half month periods is inspected (see Figure 5). In those parts of the area where the largest numbers were caught in April and May the local abundance has been estimated to be of the order of 100 to 120 x 10^6 under each km.^{2} for that time and place. This figure is broadly comparable with the catch of 3795 young in a 10 minute haul with the Petersen young fish trawl in the Denmark Strait in 1903 (Schmidt, quoted by Tåning, 1949). It is difficult to estimate the volume of water filtered in this haul, but it seems likely that it represented between 100 and 200 x 10^6 young *Sebastes marinus* under each km.^{2}.

The impression which remains, however conservatively these speculative assessments of abundance are viewed, is of the presence of extremely large numbers of young stages, about which very little information appears to be available at present. In view of the apparent advantage conferred by the viviparous habit of *Sebastes*, it seems possible that mortality of the early stages may be less serious than it is in fish whose eggs hatch freely in the sea. However, there is a need for careful investigation of *Sebastes* during the early months of life, both by frequent quantitative sampling at sea and (because it would help to resolve most of the major problems of taxonomy, growth rate, and scale interpretation) by rearing experiments in laboratory tanks.

This paper is a condensed version of a detailed study of the distribution of young *Sebastes marinus* in the Recorder collection which is now in the press and is expected to be published shortly in the *Bulletins of Marine Ecology* (Henderson, 1961).

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PART 5

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

Canada

W. Templeman	Director, Groundfish-biology and distribution	Fisheries Research Board of Canada, Biological Station, St. John's, Nfld.
A. M. Fleming	Groundfish statistics, cod	,, ,, ,, ,,
A. W. May	Cod	,, ,, ,, ,,
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G. R. Williamson	Cod	,, ,, ,, ,,
V. M. Hodder	Haddock, mathematical statistics	,, ,, ,, ,,
E. J. Sandeman	Redfish	,, ,, ,, ,,
E. I. S. Rees	Redfish	,, ,, ,, ,,
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H. J. Squires	Invertebrates	,, ,, ,, ,,
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F. D. McCracken	Haddock, gear selection	,, ,, ,, ,,
L. M. Dickie	Population dynamics	,, ,, ,, ,,
Y. Jean	Cod	,, ,, ,, ,,
A. C. Kohler	Halibut, age and growth	,, ,, ,, ,,
P. M. Powles	American Plaice	,, ,, ,, ,,
D. H. Steele	Pollock	,, ,, ,, ,,
J. E. Paloheimo	Mathematical statistics	,, ,, ,, ,,
N. F. Bourne	Scallop	,, ,, ,, ,,
L. M. Lauzier	Hydrography	,, ,, ,, ,,
N. J. Campbell	Oceanographer-in-charge	Fisheries Research Board of Canada, Atl.Oceano. Group, Halifax, N. S.

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D. H. Loring	Geochemistry	
J. R. Chevrier	Hydrography	,, ,, ,, ,,
D. L. Peer	Marine biology	,, ,, ,, ,,
A. Marcotte	Director, Groundfish biology	Quebec Department of Fisheries
C. Lacroix	Zooplankton	Station de Biologie Marine,
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E. Smidt	Groundfish	,, ,,
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Frede Hermann	Hydrography	,, ,,
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Allain	Physical oceanography	,, ,,
R. Letaconnoux	Haddock	Laboratoire de l'Office des Pêches 74 Allée du Mail, La Rochelle.
J. Ancellin	Pleuronectidae, cod, haddock	Laboratoire d'Oceanographie, Boulogne
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J. Eggvin	Hydrography	" "
S. Olsen	Halibut	" "
E. Bratberg	Redfish	" "
Olav Aasen	Pelagic Fish	" "
E. Berland	Parasites	" "
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P. A. Moiseev	Gadoid fish	"
T. F. Dementjeva	Clupeidae and cod	"
A. I. Treschev	Fisheries Techniques	"
M. N. Fedosov	Hydrography	"
A. P. Kusmorskaya	Plankton	"
G. A. Semin		"
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V. P. Sorokin	Redfish	" "
E. I. Surkova	Redfish	" "
A. A. Elizarov	Hydrography	" "
K. P. Janulov	Gadoid fish	" "
I. G. Judanov	Clupeidae	" "
K. A. Nesis	Benthos	" "
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J. H. Fraser	Plankton	" " " "
B. B. Parrish	Population theory, redfish	" " " "
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R. J. A. Beverton	Population theory	,, ,, ,,
C. C. Trout	Cod, redfish	,, ,, ,,
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F. E. Lux	Flounder	,, ,,
J. C. McCann	Statistics	,, ,,
A. S. Merrill	Sea Scallops	,, ,,
J. A. Posgay	Sea Scallops	,, ,,
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APPENDICES TO THE ICNAF ASSESSMENT REPORT, SUPPLEMENT TO ANNUAL PROCEEDINGS, VOL II.

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APPENDIX II. Selectivity Data

APPENDIX III. Weight-length Data

APPENDIX IV

TABLE 4.1. Subarea I Cod: Landings (tons) by countries and gears, 1929-58.

YEAR	OTTER TRAWL DENMARK (Faroes)	FRANCE	GERMANY	ICELAND	NORWAY	PORT.	SPAIN	U.K.	TOTAL TRAWL	LINE PORT. Dory	DENMARK (Greenland)	DENMARK (Faroes)	NORWAY	U.K.	GRAND TOTAL
1929	-	8210	-	-	-	-	-	-	8210	15010	7080	-	-	1134	31434
30	-	46546	-	-	-	-	-	-	46546	10678	9658	-	-	2986	69868
31	-	81425	-	-	-	-	-	-	81425	7404	9054	-	-	3178	101061
32	-	59837	-	-	-	-	-	-	59837	13760	9232	-	-	1557	84386
33	-	18430	-	-	-	-	-	-	18430	23024	8238	-	-	275	49967
34	-	33664	-	-	-	-	-	-	33640	14600	9468	-	-	238	57946
35	-	34082	-	-	-	-	-	1181	35263	15800	7576	-	-	564	59203
36	-	87367	-	-	-	-	-	5884	93251	13200	7174	-	-	443	114068
37	-	45841	-	-	-	-	-	-	45841	24000	6961	-	-	723	77525
38	-	30627	-	-	-	-	-	-	30627	17800	5492	-	-	585	54504
39	-	-	-	-	-	-	-	-	-	26400	7161	(30562)	-	-	64123
1940	-	-	-	-	-	-	-	-	-	35000	8026	(16722)	-	-	59748
41	-	-	-	-	-	-	-	-	-	38600	8622	-	-	-	47222
42	-	-	-	-	-	2214	-	-	2214	47400	12027	-	-	-	61641
43	-	-	-	-	-	-	-	-	-	49000	13026	-	-	-	62026
44	-	-	-	-	-	2627	-	-	2627	45800	13385	-	-	-	61812
45	-	-	-	-	-	-	-	-	-	29600	14289	-	-	-	43889
46	-	-	-	-	-	-	-	-	-	35000	15262	(3259)	-	73	53594
47	-	-	-	-	-	-	-	-	-	36300	18029	(9480)	-	93	63902
48	-	-	-	-	-	-	-	13484	13484	44200	18675	(21035)	-	-	97390
49	-	-	-	-	-	-	-	20043	20043	51400	17050	(26171)	-	-	114664
1950	-	-	-	-	2053	14291	-	1883	18227	49200	21173	(42037)	36216	367	167220
51	-	-	-	15069	300	-	-	12883	32252	58000	15200	(47646)	53673	58	209829
52	18786	?	2072	64093	4369	15346	5855	55455	165976	48935	16726	32916	23948	-	288501
53	16930	23976	2099	13241	5392	11322	3510	52635	114444	57127	24468	16103	33976	-	246123
54	14245	64095	1475	3377	10746	43534	2202	17916	157639	65625	19417	17115	38508	-	298604
55	18437	34121	7248	9180	3900	42082	7451	5044	128293	60818	19787	17344	39076	-	265318
56	17871	30461	29052	8994	1709	57078	31550	1603	178343	68718	21028	13904	39257	-	321245
57	21172	27194	10537	9719	1668	37030	22875	9565	139810	74702	24593	11693	18237	-	269035
58	24267	23720	29910	9636	3195	43676	26995	9377	172483*	69078	25802	19285	33273	-	319921*

* Trawl Total and Grand Total for 1958 include: Italy 1100 tons and E.Germany 607 tons. Further notes on next page.

NOTES

Table 4.1. Subarea 1 Cod.

Trawl

Denmark (F)	- ICNAF Statistical Bulletin (1939-53 x 1.2.)
France	- 1929-38 from Stat. Pêches Maritimes (landings cod x 3.0). 1953-58 from ICNAF Statistical Bulletin (1953 x 1.2).
Germany	- ICNAF Statistical Bulletin (1952-54 not adjusted).
Iceland	- ICNAF Statistical Bulletin (1961-53 x 4/3).
Norway	- ICNAF Statistical Bulletin (1950-53 x 1.25).
Portugal	- From paper "Portugal" (Keir ICNAF).
Spain	- ICNAF Statistical Bulletin (1952-53 x 1.2). 1956 total 31550 includes 333 tons by pair trawlers.
U. K.	- 1929-51 from paper "Greenland Cod", Table 2. 1952-58 from ICNAF Statistical Bulletin. (Not adjusted).

Line

Denmark (F)	- ICNAF Statistical Bulletin ( ) = total of trawl, longline and handline. (1939-53 x 1.2).
Denmark (G)	- Small boats, from "The Greenlander's output of the cod fishery from 1924 to 1958", Table 1.
Norway	- ICNAF Statistical Bulletin. (1950-53 x 1.25).
Portugal	- From "Portugal" (Keir, ICNAF) (average of 1st and 2nd sets).

TABLE 4.2. Subarea 1 Cod: Landings (tons) by countries, gears and divisions, 1952-58. Notes (conversion factors) on back of Table 4.2. cont..

Division	Year	OTTER TRAWL DENMARK (F)	FRANCE	GERMANY	ICELAND	NORWAY	PORT.	SPAIN	U.K.	TOTAL TRAWL	LINE DENMARK (F)	DENMARK (G) Inshore	NORWAY LL	NORWAY HL	PORT. DL	TOTAL LINE	GRAND TOTAL
	1952	+	+	+	+	-	+	+	-	+	+	646	4239	-	+	4885	4885
	3	+	+	+	+	-	670	-	-	670	+	1179	2163	-	2002	5344	6014
	4	+	-	+	+	-	151	-	-	151	+	987	2471	10	-	3468	3619
1A	5	+	9	-	+	-	-	-	-	9	+	591	764	-	-	1355	1364
	6	+	-	-	+	-	-	-	-	+	+	475	15	-	-	490	490
	7	+	-	-	-	-	-	-	-	+	+	277	-	-	-	277	277
	8	+	-	+	-	-	1	-	-	1	+	19	165	-	2	186	187
	1952	+	+	+	+	1114	+	+	246	1360	+	4443	6251	-	+	10694	12054
	3	+	+	+	+	510	8077	3519	-	12106	+	5432	5147	-	33280	43859	55965
	4	+	37472	+	+	533	9088	899	-	47992	+	6401	3321	273	41981	51976	99968
1B	5	+	9163	-	+	-	2436	7	-	11606	+	5523	4126	641	33733	44023	55629
	6	+	10096	-	+	-	4990	4204	-	19290	+	5373	2007	2868	31846	42094	61384
	7	+	9614	2164	-	401	1677	4305	638	18799	+	6146	491	348	38937	45922	64721
	8	+	13529	+	-	609	4512	2716	1700	23066	+	6178	754	306	31500	38738	61804
	1952	+	+	+	+	388	+	+	2846	3234	+	2906	6409	-	+	9315	12549
	3	+	+	+	+	159	58	-	664	881	+	3956	6906	-	3070	13932	14313
	4	+	5083	+	+	-	1833	13	680	7609	+	3238	8622	26	1446	13332	20941
1C	5	+	6913	-	+	64	10540	2060	-	19577	+	3225	3781	121	9350	16477	36054
	6	+	6555	-	+	92	10850	12219	-	29716	+	3175	1132	250	7330	11887	41603
	7	+	4887	833	1790	49	5498	9017	-	22074	+	3282	50	-	10470	13802	35876
	8	+	5224	+	-	64	11071	15786	-	32145	+	3724	165	151	8613	12653	44798
	1952	+	+	+	+	2809	+	+	17270	20079	+	2437	863	-	+	3300	23379
	3	+	+	+	+	4319	1776	-	7666	13761	+	3794	4991	-	18606	27391	41152
	4	+	21540	+	+	7755	32506	1290	3032	66123	+	3401	3343	4	22198	28946	95069
1D	5	+	17590	6904	+	3653	29900	5384	1152	64583	+	4061	4972	37	17735	26805	91388
	6	+	13175	28403	+	1535	37673	13729	-	94515	+	5127	4168	35	29537	38867	133382
	7	+	7915	6383	6612	382	9876	3953	292	35413	+	5257	1872	8	24813	31950	67363
	8	+	4098	17228	5141	612	9450	5265	1222	43016	+	5456	1049	49	28953	35507	78523

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TABLE 4.2. (continued)

Division Year	OTTER TRAWL DENMARK (F)	FRANCE	GERMANY	ICELAND	NORWAY	PORT.	SPAIN	U.K.	TOTAL TRAWL	LINE DENMARK (F)	DENMARK (G) Inshore	NORWAY LL	NORWAY HL	PORT. Dory	TOTAL LINE	GRAND TOTAL
1952	+	+	+	+	-	+	+	671	671	+	2216	359	-	+	2575	3246
3	+	+	+	+	8	1041	-	323	1372	+	3340	282	-	179	3801	5173
4	+	-	+	+	31	-	-	-	31	+	1841	590	106	-	2537	2568
1E 5	+	446	-	+	183	6	-	-	635	+	2773	3118	-	-	5891	6526
6	+	635	-	+	82	3560	1065	-	5342	+	3292	3379	-	-	6671	12013
7	+	4446	-	1266	-	15215	3883	1854	26664	+	4380	1947	-	482	6809	33473
8	+	244	+	2703	1178	13180	1992	64	19361	+	3975	2064	189	10	6238	25599
1952	+	+	1250	+	58	+	+	34422	35730	+	4078	-	-	+	4078	39808
3	+	+	+	+	-	-	-	23981	23981	+	4602	383	-	-	4985	28966
4	+	-	+	+	-	6	-	14204	14210	+	3549	187	14	-	3750	17960
1F 5	+	-	344	+	-	-	-	3892	4236	+	3614	332	87	-	4033	8269
6	+	-	679	+	-	-	333	1603	2615	+	3586	1619	688	-	5893	8508
7	+	332	1157	51	836	4814	1717	6781	15688	+	5251	542	87	-	5880	21568
8	+	625	8020	1792	-	5462	1236	6391	23526	+	6450	3238	1	-	9689	33215
1952	18786	?	822	64093	-	15346	5855	-	104902	32916	-	5827		48935	87678	192580
53	16960	23976	2099	18241	396	-	-	-	61672	16103	2160	14104		-	32367	94039
54	14245	-	1475	3377	2426	-	-	-	21523	17115	-	19541		-	36656	58179
1NK55	18467	-	-	9180	-	-	-	-	27647	17344	-	21017		-	38441	66088
56	17871	-	-	8994	-	-	-	-	26865	13904	-	23096		-	37000	63865
57	21172	-	-	-	-	-	-	-	21172	11693	-	12892		-	24585	45757
58	24267	-	4662	-	732	-	-	-	29661	19285	-	25142		-	44427	74088
1952	18786	?	2072	64093	4369	15346	5855	55455	165976	32916	16726	23948		48935	122525	288501
53	16960	23976	2099	18241	5392	11622	3519	32635	114444	16103	24463	33976		57137	131679	246123
54	14245	64095	1475	3377	10745	43584	2202	17916	157639	17115	19417	38508		65625	140965	298604
55	18467	34121	7248	9180	3900	42882	7451	5044	128293	17344	19787	39076		60818	137025	265318
56	17871	30461	29082	8994	1709	57073	31550	1603	178343	13904	21028	39257		68713	142902	321245
57	21172	27194	10537	9719	1668	37080	22875	9565	139810	11693	24593	18237		74702	129225	269035
58	24267	23720	29910	9636	3195	43676	26995	9377	172483**	19285	25802	33273		69078	147438	319921**

*Trawl Total and Grand Total for 1958 include: Italy (trawl) 1100 tons, and E. Germany (trawl) 807 tons from unknown Division.

6

NOTES

TABLE 4.2. Subarea 1 Cod:

CONVERSION FACTORS TO ROUND FRESH

	Conversion Factors Used		Factors to convert original data to Conversion factors used.						
	Green Salt (wet)	Gutted Head on	1952	1953	1954	1955	1956	1957	1958
DENMARK F	3.0		1.2	1.2	-	-	-	-	-
DENMARK G	2.7		?	1.08	27/26	-	-	-	-
FRANCE	3.0		1.2	1.2	-	-	-	-	-
GERMANY	3.0	1.2	?	?	?	-	-	-	-
ICELAND	3.0		4/3	4/3	-	-	-	-	-
NORWAY	3.0		1.25	1.25	-	-	-	-	-
PORTUGAL			-	-	-	-	-	-	-
SPAIN	3.0		1.2	1.2		-	-	-	-
U.K.	3.0	1.2	-	-	-	-	-	-	-

\+ No reference to division

\- No fishing reported

1NK Division not known

PORTUGAL Data from "Portugal" paper (Keir ICNAF)

OTHER COUNTRIES Data from ICNAF Statistical Bulletin.

(8)

TABLE 4.3. Subarea 1 Cod: catch (tons) per unit effort by countries, gears, and divisions, 1952-58.

Division	Year	GERMANY OT catch/ day fshd.	NORWAY OT catch/ hour	NORWAY LL catch/ 1000 hooks	NORWAY HL catch/ day fshd.	PORTUGAL OT catch/ hour	PORTUGAL DL catch/ dory hr.	SPAIN OT catch/ hour	U.K. OT catch/ hour
1A	1952	-	-	+	-	+	+	+	-
	1953	+	+	.71	-	+	+	-	-
	1954	+	-	.41	10.00	.77	-	-	-
	1955	-	-	.40	-	-	-	-	-
	1956	-	-	(.22)	-	-	-	-	-
	1957	-	-	-	-	-	-	-	-
	1958	-	-	.35	-	.20	.67	-	-
1B	1952	+	+	+	-	+	+	+	1.37
	1953	+	.56	.59	-	+	+	1.44	-
	1954	+	.68	.52	4.96	1.22	4.43	2.30	-
	1955	-	-	.50	8.43	1.04	3.70	(.78)	-
	1956	-	-	.46	10.78	1.07	3.79	1.03	-
	1957	17.31	1.31	1.10	10.88	1.29	3.72	1.02	1.99
	1958	-	.59	.55	9.27	1.09	2.81	.84	1.36
1C	1952	+	+	+	-	+	+	+	2.26
	1953	+	1.22	.82	-	+	+	-	1.9
	1954	+	-	.66	(8.67)	2.80	4.17	(.57)	2.69
	1955	-	1.19	.52	6.72	5.60	4.85	4.10	-
	1956	-	5.75	.46	11.90	5.67	4.88	5.74	-
	1957	2.27	.75	.46	-	2.60	5.24	2.46	-
	1958	-	1.07	.63	6.57	3.23	2.92	2.79	-
1D	1952	+	+	+	-	+	+	+	2.91
	1953	+	3.01	.85	-	+	+	-	1.31
	1954	+	3.37	.69	(4.00)	6.80	3.97	1.02	1.79
	1955	11.72	7.31	.65	(9.25)	5.00	4.86	2.88	+
	1956	31.38	3.43	.57	(5.30)	4.65	4.62	4.14	-
	1957	12.74	.96	.70	(8.00)	2.31	3.85	1.37	1.39
	1958	14.79	.93	.65	(5.56)	2.11	2.74	1.45	1.46
1E	1952	+	-	+	-	+	+	+	4.76
	1953	+	(2.00)	.64	-	+	+	-	.63
	1954	+	(2.38)	.57	(6.24)	-	-	-	-
	1955	-	2.58	.78	-	(1.20)	-	-	-
	1956	-	20.50	.80	-	5.79	-	3.01	-
	1957	-	-	.79	-	3.50	3.77	2.32	2.94
	1958	-	2.43	.83	5.73	3.69	(1.42)	2.46	.30
1F	1952	+	+	-	-	+	+	+	2.82
	1953	+	-	.85	-	-	-	-	1.54
	1954	+	-	.57	(4.67)	(.67)	-	-	1.56
	1955	16.38	-	.54	5.44	-	-	-	2.09
	1956	9.98	-	.76	7.91	-	-	-	1.80
	1957	18.19	2.80	.68	(9.67)	3.90	-	2.91	1.49
	1958	19.47	-	.79	(1.00)	2.49	-	1.21	1.09
I	1952	+	+	+	-	1.63	1.42	+	2.79
	1953	14.35	2.03	.74	-	1.56	3.87	1.44	1.53
	1954	21.45	2.57	.60	5.60	3.33	4.36	1.31	1.57
	1955	11.88	6.24	.58	7.63	4.2	4.1	3.1	1.36
	1956	19.9	3.65	.60	10.08	3.74	4.21	3.17	1.80
	1957	9.92	1.43	.74	10.54	2.79	3.93	1.76	1.75
	1958	15.57	1.10	.72	7.03	2.45	2.79	1.91	1.22

NOTES: - No fishing, + No effort data, ( ) Based on little fishing, ≙20 hours to Norway OT, ≙10 days to Norway HL, ≙10 hour to Portugal OT, ≙70 (1000 hood) to Norway LL, ≙10 dory hrs to Portugal OT, ≙23 hours to Spain OT.

OT - Otter trawl, LL - long-line, HL - Hand-line, DL - Dory-line .

TABLE 4.4. Subarea 1 Cod: Estimates of total fishing effort based on the catch per unit effort values of Table 4.3.

Division	Year	GERMANY OT Days fished	NORWAY OT Hours fished	NORWAY LL '000 of hooks	NORWAY HL Days fished	PORTUGAL OT Hours fished	PORTUGAL DL Dory Hours	SPAIN OT Hours fished	U.K. OT Hours fished
1A	1952			+					
	53			8063					
	54			9263					
	55			3410					
	56			(2227)					
	57			-					
	58			534					
1B	52			+	-	+	+	+	
	53			88966	-	+	+	36451	
	54			199437	20909	75150	23410	45090	
	55			111258	6599	53489	15035	(71319)	
	56			133443	5694	57368	16196	59596	
	57			58837	5949	50171	17398	63452	
	58			111831	6635	56428	21889	73225	
1C	52			+		+	+	+	
	53			17916		+	+	+	
	54			32470		6980	4859	(37596)	
	55			69335		6438	7434	8794	
	56			90441		7337	8525	7248	
	57			77991		13798	6847	14584	
	58			71108		13869	15342	16054	
1D	52	+	+	+		+	+	+	
	53	+	14055	49771		+	+	+	
	54	+	28177	137617		15001	21779	93094	
	55	7798	12502	140597		18278	18804	31732	
	56	4251	38887	234004		28684	28871	32218	
	57	5288	70170	96233		29161	17497	49170	
	58	5309	84433	120805		37215	28658	54154	
1E	52			+					
	53			7102					
	54			4505					
	55			8367					
	56			15016					
	57			42371					
	58			31205					
1F	52	+		+					14116
	53	+		34078					18809
	54	+		31502					11510
	55	505		15313					3956
	56	853		11195					4727
	57	1186		31718					14475
	58	1706		42044					30472
I	52	+	+	+	+	199817	191877	+	103848
	53	17037	120433	330378	+	228486	62848	169778	159791
	54	14083	117538	503455	53942	92377	68653	230590	192403
	55	22333	42519	457445	34773	63171	64712	55586	195087
	56	10744	88012	535408	31870	85894	76305	101339	178469
	57	27160	188410	364089	25562	96568	68556	153083	153958
	58	20475	289811	442767	45347	130119	114262	166907	261305

TABLE 4.5. Subarea 1 Cod: Percentage age compositions of samples for the years 1952-57.

Year \ Age	No. of Samples	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
All Gears																						
1952	25	-	1.4	20.6	4.7	20.4	5.7	6.6	17.2	4.3	4.2	3.2	0.8	0.9	4.2	1.3	3.6	0.1	0.2	-	-	-
1953	28	-	0.7	4.1	34.4	4.7	17.0	3.7	4.7	16.2	2.5	2.9	1.7	0.7	0.9	3.1	0.7	1.6	0.5	0.1	-	-
1954	26	-	5.6	4.1	7.6	44.2	4.2	12.4	2.2	2.7	9.0	1.5	1.7	1.0	0.3	0.5	1.3	0.5	1.0	0.1	-	-
1955	70	-	1.4	4.1	6.5	7.0	35.0	3.6	10.9	3.4	3.7	10.3	1.9	2.2	0.5	0.3	0.3	0.6	0.2	0.5	-	-
1956	81	-	3.2	3.5	23.9	10.1	6.7	28.6	2.7	6.6	1.5	1.6	4.5	0.5	1.3	0.3	0.1	-	4.1	0.7	0.1	-
1957	61	0.7	15.0	12.3	12.7	20.7	6.9	5.7	12.7	1.5	3.7	0.9	1.0	2.9	0.6	0.9	0.1	-	-	0.1	-	0.1
Mean		0.1	4.5	8.1	15.0	17.8	12.6	10.1	8.4	5.8	4.1	3.4	1.9	1.4	1.3	1.1	1.0	0.4	1.0	0.2	-	-
Otter trawl																						
1956	22	0.3	3.6	9.9	30.7	13.3	7.3	25.0	1.7	4.9	0.7	0.7	1.7	-	0.1	-	-	-	-	-	-	-
1957	13	1.6	11.7	10.1	13.7	27.6	9.1	5.6	14.6	1.5	2.7	0.7	0.8	0.8	0.5	0.2	0.1	0.1	-	-	-	-

TABLE 4.6. Subarea 1 Redfish: Landings (tons) by countries and gears, 1935-58.

Year	TRAWL GERMANY	TRAWL ICELAND	TRAWL U. K.	TOTAL TRAWL	LINE DENMARK (G)	LINE NORWAY	LINE U.K.	GRAND TOTAL
1935	-	-	-	-	-	-	8	8
36	-	-	-	-	-	-	2	2
37	-	-	-	-	-	-	10	10
38	-	-	-	-	-	-	13	13
39	-	-	-	-	-	-	-	-
/								
46	-	-	-	-	-	-	-	-
47	-	-	-	-	-	-	1	1
48	-	-	112	112	-	-	-	112
49	-	-	82	82	-	-	-	82
50	-	-	1	1	-	-	3	4
51	-	27	124	151	12	-	-	163
52	-	-	159	159	-	-	1	160
53	-	12406	1057	13463	-	2	-	13465
54	174	14689	654	15517	-	3	-	15520
55	14161	17983	53	32197	52	-	-	32249
56	6639	7349	20	14008	-	27	-	14035
57	14874	13095	103	28072	55	10	-	28137
58	13180	4055	379	17936*	-	9	-	17945*

*Totals include 322 tons reported by Germany (E) from Subarea 1.
Source: ICNAF Statistical Bulletin.

TABLE 4.7. Subarea 1 Redfish: Effort and catch per unit effort for Icelandic, German and U. K. trawl fisheries, and estimated total redfish effort in Icelandic and German trawler units, 1948-58.

Year	ICELAND Effort Days absent	ICELAND Catch/ day's absence	GERMANY Effort Days absent	GERMANY Catch/ Day's absence	U.K. Effort Hours fishing	U.K. Catch/ 100 hrs. fishing	Estimated Total effort: Days absent Icelandic units	Estimated Total effort: Days absent German units
1948	-	-	-	-	4610	2.2	-	-
49	-	-	-	-	10025	0.7	-	-
50	-	-	-	-	828	0.1	-	-
51	-	-	-	-	8157	1.3	-	-
52	-	-	-	-	19529	0.9	-	-
53	+	+	-	-	22393	4.7	-	-
54	901	16.3	135	1.3	11049	5.9	952	11938
55	983	18.3	2103	6.7	2790	1.9	1759	4806
56	799	9.2	2950	2.3	889	2.1	1526	6102
57	1067	12.2	2434	6.1	5701	1.5	2302	4604
			(1601)*	(9.1)*				(3086)*
58	+	+	4196	3.1	8156	4.7	+	5789
			(1121)*	(8.4)*				(2136)*

* Figures in brackets refer to effort, catch per unit effort and estimated total effort for vessels fishing specifically for redfish.

TABLE 5.1. Subarea 2 Cod: Landings (tons) by countries and gears, 1936-58.

Year	CANADA (M) OT	CANADA (Nfld) Inshore	FRANCE Otter Trawl	GERMANY Otter Trawl	ICELAND Otter Trawl	PORTUGAL Otter Trawl	SPAIN Otter Trawl	U.S.S.R. Otter Trawl	U.K. Otter Trawl	TOTAL Otter Trawl	TOTAL
36	-	73362	-	-	-	-	-	-	-	-	73362
37	-	61234	-	-	-	-	-	-	-	-	61234
38	-	77659	-	-	-	-	-	-	(1)	-	77660
39	-	66328	-	-	-	-	-	-	-	-	66328
40	-	50853	-	-	-	-	-	-	-	-	50853
41	-	33723	-	-	-	-	-	-	-	-	33723
42	-	39970	-	-	-	-	-	-	-	-	39970
43	-	52530	-	-	-	-	-	-	-	-	52530
44	-	53724	-	-	-	-	-	-	-	-	53724
45	-	35450	-	-	-	-	-	-	-	-	35450
46	-	38509	-	-	-	-	-	-	-	-	38509
47	-	31826	-	-	-	-	-	-	-	-	31826
48	-	35434	-	-	-	-	-	-	-	-	35434
49	-	36110	-	-	-	-	-	-	-	-	36110
50	-	29697	-	-	-	-	-	-	(2)	-	29699
51	-	28128	-	-	-	-	-	-	-	-	28128
52	574	16701	-	-	-	30455	658	-	1001	32686	(49389)
53	19	11085	32992	-	-	48236	17630	-	787	99664	110749
54	2	11693	4117	-	-	3021	269	-	-	7409	19102
55	-	10501	7622	-	-	7718	-	-	-	15340	25841
56	-	8646	12348	-	-	13001	288	-	-	25637	34283
57	1	11692	12721	-	-	6963	769	-	-	20454	32146
58	383	11089	17756	618	83	8223	1553	456	-	29072*	40205*

* Totals include 44 tons reported by Germany (E) in 1958.

NOTES: Canada - ICNAF Statistical Bulletin; France - ICNAF Statistical Bulletin (1953 x 1.2); Germany - ICNAF Statistical Bulletin; Iceland - ICNAF Statistical Bulletin; Portugal - From paper "Portugal Cod" (Keir, ICNAF).; Spain - ICNAF Statistical Bulletin, (1952-53 x 1.2); U.S.S.R. - ICNAF Statistical Bulletin; U. K. - ICNAF Statistical Bulletin.

No French statistics prior to 1953 and no Portuguese and Spanish before 1952.

U. K., 1938 includes 1 ton by line
" , 1950 " 2 tons "
" , 1952 " 2 tons "

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TABLE 6.1. Subarea 3 cod: Landings (tons) by countries and gears, 1935-58.

Year	CANADA (M)		CANADA (Nfld.)			(M) France	(St.P.&M) France		Denmark (F)	Germany (E)	Germany (W)	Iceland	Norway
	OT	DV	OT	DV	Inshore	OT	OT	Misc.	~~LL~~ OT	OT	OT	OT	LL
1935		15252		18852	211038	+			-	-	-	-	-
1936		14566	2682	34823	177229	+			-	-	-	-	-
1937		19047	7734	37992	112710	+			-	-	-	-	-
1938		19724	1449	41162	146827	+			-	-	-	-	-
1939		11865	-	36908	138482	+			-	-	-	-	-
1940		9960	-	38594	129838	-			-	-	-	-	-
1941		13335	-	31438	146232	-			-	-	-	-	-
1942		10668	-	9591	131121	-			-	-	-	-	-
1943		11158	-	20442	162876	-			-	-	-	-	-
1944		17145	-	19707	195924	-	No reports	No reports	-	-	-	-	-
1945		12546	-	21335	226306	+			-	-	-	-	-
1946		19223	118	24488	222473	+			-	-	-	-	-
1947		22344	490	28850	235284	+			-	-	-	-	-
1948		18341	1361	28360	184398	+			-	-	-	-	-
1949		22905	2722	24385	191070	+			-	-	-	-	-
1950		15425	3266	8671	198507	+			-	-	-	-	-
1951		18346	4354	1067	203428	+			-	-	-	-	-
1952	5704	19017	4890	315	179427	+			-	-	-	-	-
1953	9865	16150	6191	-	154432	26898	1045	4327	-	-	705	-	-
1954	15479	13381	9532	-	208099	44836	864	4760	-	-	-	-	-
1955	9548	15179	7357	-	173922	60828	415	4430	-	-	-	-	-
1956	6886	9819	6254	-	189758	27252	804	4198	-	-	-	-	1178
1957	8722	7786	6721	-	178050	54480	1330	3308	2956 –	-	369	-	16172
1958	4731	3104	3798	-	130695	35345	923	2572	3939 –	5	349	374	6301

Year	PORTUGAL		SPAIN		USSR	UK	US	GRAND TOTAL	TOTAL BY GEARS		
	OT	DV	OT	PT	OT	OT	OT	ALL GEARS	TRAWL	LINE	INSHORE
1935	-	14200	(29472)	-	-	605	275	(289694)	(30352)	48304	211038
1936	(3031)	22500	(13261)	-	-	-	1414	(269506)	(20388)	71889	177229
1937	(4454)	19200	-	-	-	-	1271	(202408)	(13459)	76239	112710
1938	(2260)	23500	-	-	-	-	2434	(237356)	(6143)	84386	146827
1939	(5267)	26300	(7607)	-	-	-	120	(226549)	(12994)	75073	138482
1940	(8669)	18000	(15294)	-	-	-	47	(2[illegible]0402)	(24010)	66554	129838
1941	(10298)	13400	-	-	-	-	3	(214706)	(10301)	58173	146232
1942	(7244)	5900	-	-	-	-	9	(164533)	(7253)	26159	131121
1943	(13218)	6200	(7109)	-	-	-	-	(221003)	(20327)	37800	162876
1944	(17134)	8500	(9992)	-	-	-	-	(268402)	(27126)	45352	195924
1945	(26575)	28400	(32268)	-	-	-	-	(347430)	(58843)	62281	226306
1946	(31570)	25700	(39792)	-	-	-	-	(363434)	(71550)	69411	222473
1947	(37430)	26000	(43840)	-	-	-	-	(394238)	(81760)	77194	235284
1948	(40151)	20500	(30092)	-	-	567	53	(323823)	(72224)	67201	184398
1949	(65468)	15200	(25627)	-	-	444	-	(347821)	(94261)	62490	191070
1950	(67812)	23100	(37538)	32585	-	213	35	(387152)	(141449)	47196	198507
1951	(73640)	15600	(33558)	44371	-	63	83	(394510)	(156069)	35013	203428
1952	44082	21427	(39214)	30054	-	-	64	(344194)	(124008)	40759	179427
1953	40485	26514	(46832)	27307	-	277	116	361144	(159721)	42664	158759
1954	50713	22488	(75310)	28773	-	948	36	475219	226491	35869	212859
1955	43699	34799	48358	29449	-	1053	3	429040	200710	49978	178352
1956	31329	40076	30562	37186	3001	1390	15	389708	144679	51073	193956
1957	35451	40763	34690	37715	18041	2239	22	448815	199780	67677	181358
1958	19589	20423	24004	29802	5370	1472	-	292796	125762	33767	133267

Notes to:

Table 6.1. Subarea 3 Cod: Landings by countries and gears, 1935-58.

Canada (M)	- ICNAF Statistical Bulletin. 1935-51 not reported by gears but mainly dory vessels salt-fishing. 1952-58 DV are mainly dory vessel and some longliner landings.
Canada (Nfld.)	- The total landings for 1935-51 are given in ICNAF Statistical Bulletin except for corrections to the 1949 and 1950 totals; the breakdown into gears estimated from data available at the St. John's Biological Station. The inshore landings are by small boats using cod-traps, handlines, jiggers, linetrawls, longlines, etc.
Denmark (F)	- ICNAF Statistical Bulletin. No reports prior to 1951 and presumably no fishing prior to 1957.
France (M)	- ICNAF Statistical Bulletin. Landings in the Convention Area prior to 1953 are not allocated by subareas or divisions as indicated by the symbol (+). (1953 landing X 1.2).
France (St.P&M)	- ICNAF Statistical Bulletin. No reports prior to 1953. Miscellaneous gears mean mainly inshore fishing by small motor dories.
Germany E	- ICNAF Statistical Bulletin. No reports and presumably no fishing prior to 1958.
Germany W	- ICNAF Statistical Bulletin. No reports prior to 1952.
Iceland	- ICNAF Statistical Bulletin. No reports prior to 1951 and presumably no fishing prior to 1957.
Italy	- Landings for 1948-58 range from about 2000 to 13000 tons but these are not allocated by subareas and consequently are not given in the Table.
Norway	- ICNAF Statistical Bulletin. No reports prior to 1951 and presumably no fishing prior to 1956.
Portugal, OT	- From paper "Portugal" (Keir ICNAF). Prior to 1952 the landings are bracketed because they are reported as from the Newfoundland area, although it might be assumed that most of the fish were obtained from subarea 3. Otter-trawlers started operating in the Convention Area in 1936.
Portugal, DV	- From paper "Portugal" (Keir ICNAF) (average of first and second sets). Dory vessel landings for 1935-51 are also reported as from the Newfoundland area, but, since these vessels do not generally fish in subareas 2 and 4, these landings are considered to be from subarea 3.
Spain, OT	- 1935-50 landings (Keir ICNAF) are not allocated by subareas but are considered mainly from subarea 3. However, the landings are bracketed since small quantities probably came from subareas 1,2 and 4. - 1951-58 (ICNAF Statistical Bulletin). 1951 includes 20,625 tons and 1952 includes 8424 tons reported as from subareas 3 and 4 but mainly from 3. (1935-53 landings X 1.2).
Spain, PT	- ICNAF Statistical Bulletin. Pair trawlers started fishing in the Convention Area in 1950 and then only in subarea 3. (1950-53 landings X 1.2).
U.S.S.R.	- ICNAF Statistical Bulletin. No report and presumably no fishing prior to 1956.
U.K.	- ICNAF Statistical Bulletin.
U.S.A.	- ICNAF Statistical Bulletin.

TABLE 6.2. Subarea 3 cod: Landings (tons) by countries, gears and divisions, 1953-58.

Division	Year	Trawl: Canada (M)	Canada (Nfld.)	France (M)	France (St.P)	Germany (E)	Germany (W)	Iceland	Portugal	Spain OT	Spain PT	UK	US	USSR	Trawl Total
3K	1953	-	-	+	-	-	+	-	1050	+	+	+	-	-	1050
	1954	-	-	18530	-	-	-	-	5414	659	-	-	-	-	24603
	1955	-	1	15837	-	-	-	-	5906	13	11	-	-	-	21768
	1956	-	-	6595	-	-	-	-	2203	3	281	-	-	-	9082
	1957	-	-	13589	-	-	-	-	1701	62	-	-	-	-	15352
	1958	-	-	22200	-	-	-	374	7168	9268	6	+	-	746	39762
3L	1953	2060	945	+	-	-	+	-	39121	+	+	+	-	-	42126
	1954	4198	1822	19724	-	-	-	-	29365	9860	1	948	-	-	65918
	1955	4145	2643	15945	-	-	-	-	15300	3679	1291	-	-	-	43003
	1956	2401	2289	17433	-	-	-	-	25427	9152	5881	-	-	-	62583
	1957	1060	1574	19421	-	-	-	-	26115	9654	578	666	-	1609	60677
	1958	1811	903	8828	-	-	-	-	11262	6070	1996	+	-	486	31356
3M	1953	-	-	+	-	-	+	-	54	+	+	+	-	-	54
	1954	-	-	189	-	-	-	-	-	-	31	-	-	-	220
	1955	-	-	780	-	-	-	-	-	-	12	-	-	-	792
	1956	-	-	-	-	-	-	-	-	1	5	-	-	3001	3007
	1957	-	1	12	-	-	-	-	298	-	52	-	-	16432	16795
	1958	-	-	-	-	5	-	-	59	-	-	+	-	4138	4202
3N	1953	1169	590	+	+	-	+	-	226	+	+	+	+	-	1985
	1954	888	1314	574	+	-	-	-	3517	38044	28706	-	+	-	73043
	1955	212	355	8052	+	-	-	-	10240	27373	27873	-	-	-	74105
	1956	282	210	109	+	-	-	-	116	8069	30906	971	1	-	40664
	1957	150	378	136	+	-	-	-	577	11296	35408	-	-	-	47945
	1958	316	932	11	+	-	-	-	28	1680	23240	+	-	-	26207
3O	1953	5075	3504	+	+	-	+	-	34	+	+	+	+	-	8613
	1954	7568	4216	2459	+	-	-	-	12393	21889	35	-	+	-	48560
	1955	1886	1156	5606	+	-	-	-	4542	9487	254	595	3	-	23529
	1956	2938	1598	308	+	-	-	-	60	3609	40	-	1	-	8554
	1957	4762	3774	1849	+	-	-	-	333	3871	1415	219	-	-	16223
	1958	1693	1449	42	+	-	65	-	9	1304	3212	+	-	-	7774
3P	1953	1561	1129	+	+	-	+	-	-	+	+	+	+	-	2690
	1954	2825	2170	3360	+	-	-	-	24	4858	-	-	+	-	13237
	1955	3305	3202	14391	+	-	-	-	7711	7806	8	458	-	-	36881
	1956	1265	2157	2807	+	-	-	-	3523	9728	73	419	13	-	19985
	1957	2750	994	19192	+	-	369	-	6427	9807	262	1354	22	-	41177
	1958	911	514	4264	+	-	125	-	1063	5682	1348	64	-	-	13971
3NK	1953	-	23	26898	1045	-	705	-	-	46832	27307	277	116	-	103203
	1954	-	10	-	864	-	-	-	-	-	-	-	36	-	910
	1955	-	-	217	415	-	-	-	-	-	-	-	-	-	632
	1956	-	-	-	804	-	-	-	-	-	-	-	-	-	804
	1957	-	-	281	1330	-	-	-	-	-	-	-	-	-	1611
	1958	-	-	-	923	-	159	-	-	-	-	1408	-	-	2490
3	1953	9865	6191	26898	1045	-	705	-	40485	46832	27307	277	116	-	159721
	1954	15479	9532	44836	864	-	-	-	50713	75310	28773	948	36	-	226491
	1955	9548	7357	60828	415	-	-	-	43699	48358	29449	1053	3	-	200710
	1956	6886	6254	27252	804	-	-	-	31329	30562	37186	1390	15	3001	144679
	1957	8722	6721	54480	1330	-	369	-	35451	34690	37715	2239	22	18041	199780
	1958	4731	3798	35345	923	5	349	374	19589	24004	29802	1472	-	5370	125762

TABLE 6.2. Continued.

		Offshore Line Gears					Inshore Gears			GRAND TOTAL ALL GEARS
		Can. (M)	Den. (F)	Nor-way	Port-ugal	Total	Canada (Nfld.)	France (St. P.)	Total	
	1953	-	-	-	-	-	52292	-	52292	53342
3K	1954	-	-	-	-	-	82594	-	82594	107197
	1955	-	-	-	-	-	59237	-	59237	81005
	1956	23	-	+	-	23	70281	-	70281	79386
	1957	-	+	108	376	484	67524	-	67524	83360
	1958	-	+	+	42	42	33711	-	33711	73515
	1953	7092	-	-	13794	20886	76600	-	76600	139612
	1954	7354	-	-	12107	19461	93153	-	93153	178532
	1955	8434	-	-	21325	29759	85075	-	85075	157837
3L	1956	6333	-	95	24711	31139	93322	-	93322	187044
	1957	1179	+	+	19036	20215	80297	-	80297	161189
	1958	37	+	+	6466	6503	68038	-	68038	105897
	1953	-	-	-	-	-	-	-	-	54
	1954	-	-	-	378	378	-	-	-	598
3M	1955	-	-	-	-	-	-	-	-	792
	1956	-	-	+	-	+	-	-	-	3007
	1957	-	-	969	35	1004	-	-	-	17799
	1958	-	-	73	340	413	-	-	-	4615
	1953	3727	-	-	12261	15988	-	-	-	17973
	1954	291	-	-	7087	7378	-	-	-	80421
	1955	222	-	-	8447	8669	-	-	-	82774
	1956	-	-	-	9722	9722	-	-	-	50386
3N	1957	2	-	-	10235	10237	-	-	-	58182
	1958	53	-	-	5157	5210	-	-	-	31417
	1953	4930	-	-	22	4952	-	-	-	13565
	1954	3110	-	-	2773	5883	-	-	-	54443
3O	1955	2222	-	-	4482	6704	-	-	-	30233
	1956	335	-	-	5607	5942	-	-	-	14496
	1957	575	-	-	10595	11170	-	-	-	27393
	1958	369	-	-	6414	6783	-	-	-	14557
	1953	401	-	-	437	838	25540	4327	29867	33395
3P	1954	2626	-	-	143	2769	32350	4760	37110	53116
	1955	4301	-	-	545	4846	29610	4430	34040	75767
	1956	3128	-	-	36	3164	26155	4198	30353	53502
	1957	6030	-	-	486	6516	30229	3308	33537	81230
	1958	2645	-	-	2004	4649	28946	2572	31518	50138
	1953	-	-	-	-	-	-	-	-	103203
3NK	1954	-	-	-	-	-	-	-	-	910
	1955	-	-	-	-	-	-	-	-	632
	1956	-	-	1083	-	1083	-	-	-	1887
	1957	-	2956	15095	-	18051	-	-	-	19662
	1958	-	3939	6228	-	10167	-	-	-	12657
	1953	16150	-	-	26514	42664	154432	4327	158759	361144
	1954	13381	-	-	22488	35869	208097	4760	212857	475217
	1955	15179	-	-	34799	49978	173922	4430	178352	429040
3	1956	9819	-	1178	40076	51073	189758	4198	193956	398708
	1957	7786	2956	16172	40763	67677	178050	3308	181358	448815
	1958	3104	3939	6301	20423	33767	130695	2572	133267	292796

NOTES TO:
Table 6.2. Subarea 3 Cod: Landings by countries, gears, and divisions, 1953-58.

TRAWL

France (M)	- Not given by divisions in 1953.
France (St. P.)	- Not given by divisions but presumably from 3N-O-P.
Germany	- Not given by divisions in 1953 and some from unknown divisions in 1958.
Italy	- Not reported by divisions or subareas and not included in Table.
Portugal	- Revised data obtained from ICNAF records.
Spain (OT) (PT)	- Not reported by divisions in 1953.
U.S.A.	- Not reported by divisions in 1953 and 1954 but presumably from 3N-O-P.

OFFSHORE LINE

Can. (M)	- Mainly dory vessels but includes the following - longliners, 1954, 30 (1 ton), 3P (26 tons); 1955 3P (32 tons); 1956, 30 (2 tons), 3P (67 tons); 1957, 3N (2 tons), 3P (168 tons); 1958, 3L (37 tons) 3N (29 tons), 30 (4 tons), 3P (379 tons) - and Danish seiners, 1958, 3P (1 ton).
Denmark (F)	- All fishing by longliners. Not reported by divisions but known to have fished in 3K and 3L.
Norway	- All longliners. Only small parts of the landings reported by divisions.
Portugal	- Dory vessels. Revised data obtained from ICNAF records.

INSHORE GEARS

Can. (Nfld.)	- Mainly small boats fishing near the coast using codtraps, handlines, linetrawls, etc., but small quantities from Danish seiners as follows - 1953, 3P (5 tons); 1954, 3P (14 tons); 1955 , 3P (14 tons) ; 1956, 3P (8 tons); 1958, 3P (10 tons).
France (St. P.)	- Mainly inshore fishery by motor dories and considered from 3P, although landings given in ICNAF Statistical Bulletin under division not known.

GENERAL NOTES:

1) The French (M), Portuguese and Spanish landings reported for 1953 have been multiplied by 1.2 to bring them in line with subsequent statistics due to the change in 1954 from 2.5 to 3.0 of the factor used in converting wet salted cod to round fresh weights.

2) + in Table indicates that fishing presumably occurred, but that the landing has not been allocated by divisions but placed in 3NK (= division not known).

3) Except where noted all landings are taken from ICNAF Statistical Bulletins.

TABLE 6.3. Subarea 3 cod: Trawl landings (tons) per unit effort and effort by the major cod-fishing countries, 1952-58.

	Division / Year	Effort for cod					Landings per unit effort (tons)				
		Canada	France (M)	Portugal	Spain OT	Spain PT	Canada	France (M)	Portugal	Spain* OT	Spain* PT
		Hours fished	Days fished	Hours fished	Hours fished	Hours fished	L/hr fished	L/day fished	L/hr fished	L/hr fished	L/hr fished
3K	1954	-	+	3652	345	-	-	+	1.48	1.91	-
	1955	-	+	4564	28	13	-	+	1.29	(0.46)	(0.88)
	1956	-	+	1587	16	240	-	+	1.39	(0.19)	(1.17)
	1957	-	+	1457	102	-	-	+	1.17	0.61	-
	1958	-	+	5369	7397	9	-	+	1.34	1.25	(0.67)
3L	1954	4506	±	19019	6777	1	1.34	+	1.54	1.46	(0.86)
	1955	5135	+	10146	3020	954	1.32	+	1.51	1.22	1.35
	1956	3045	+	14757	6542	3703	1.54	+	1.72	1.40	1.59
	1957	2854	+	16220	7811	546	0.92	+	1.61	1.24	1.06
	1958	2860	+	9141	6451	2749	0.95	+	1.23	0.94	0.73
3M	1954	-	+	-	-	9	-	+	-	-	(3.56)
	1955	-	+	-	-	8	-	+	-	-	(1.50)
	1956	-	+	-	3	4	-	+	-	(0.33)	(1.25)
	1957	-	+	235	-	41	-	+	1.27	-	(1.26)
	1958	-	+	74	-	-	-	+	(0.80)	-	-
3N	1954	2128	±	2958	17811	27816	1.04	+	1.19	2.14	1.03
	1955	864	+	7956	13680	26445	0.66	+	1.29	2.00	1.06
	1956	715	+	188	4490	22859	0.69	+	0.62	1.80	1.35
	1957	735	+	569	7622	26563	0.72	+	1.01	1.48	1.33
	1958	1750	+	31	1567	25455	0.71	+	(0.90)	1.07	0.91
3O	1954	12148	+	6794	12944	22	0.97	+	1.82	1.69	(1.56)
	1955	2356	+	2934	5509	280	1.29	+	1.55	1.72	0.91
	1956	4775	+	54	2323	35	0.95	+	(1.11)	1.55	(1.16)
	1957	8892	+	302	2859	831	0.96	+	1.10	1.35	1.70
	1958	3893	+	140	1142	3537	0.81	+	0.64	1.14	0.91
3P	1954	3747	+	25	2525	-	1.33	+	(0.97)	1.92	-
	1955	4998	+	3681	3428	32	1.30	+	2.10	2.28	(0.25)
	1956	6177	+	1953	6860	17	0.55	+	1.80	1.42	(4.29)
	1957	2800	+	2797	6164	241	1.34	+	2.30	1.59	1.09
	1958	1608	+	829	4779	1358	0.89	+	1.28	1.19	0.99
3.	1952	+	+	24047			+	+	1.83	+	+
	1953	+	+	21550	27071	23642	+	+	1.88	1.73	1.15
	1954	22529	1466	32448	40402	27848	1.11	30.6	1.56	1.86	1.03
	1955	13353	1847	29281	25665	27732	1.27	32.9	1.49	1.88	1.06
	1956	14712	774	18539	20234	26858	0.89	35.2	1.69	1.51	1.38
	1957	15281	1803	21580	24558	28222	1.01	30.2	1.64	1.41	1.34
	1958	10111	1495	15584	21336	33108	0.81	23.6	1.26	1.13	0.90

NOTES

Canada - ICNAF Statistical Bulletin. . Special effort data for Canada (Nfld.) trawlers.

France (M) - ICNAF Statistical Bulletin. Based on landing and effort data for vessels of the 68- metre class.

Portugal - Based on adjusted landing and effort data obtained from ICNAF records.

Spain* - ICNAF Statistical Bulletin. Since Spanish effort data are not given for cod and haddock separately, the L/hr fished for both pair and otter-trawlers include both cod and haddock but the effort is that estimated for cod only.

* = No effort data ( ) = less than 100 hours fished .

NOTES TO: Table 6.4. Subarea 3 Haddock: Landings (tons) by countries and gears, 1935-58.

CANADA (M)	- ICNAF Statistical Bulletin. Not given by gear prior to 1952. - 1952-58, line., mainly by dory schooners, but longliners landed 1 ton in 1955, 6 tons in 1956 and 3 tons in 1958.
CANADA (Nfld)	- ICNAF Statistical Bulletin. Not given by gear prior to 1952. - 1952-58, line., by small inshore boats including occasional small quantities by longliners.
FRANCE (St. P.)	- ICNAF Statistical Bulletin. No report prior to 1953. - 1954-55 line., by small inshore motor dories.
GERMANY	- ICNAF Statistical Bulletin. No report prior to 1952.
PORTUGAL	- ICNAF Statistical Bulletin (X1.2 up to 1953) - 1952 dory vessels, 240 tons, subarea not indicated, put in subarea 3 since dory vessels fished only in subareas 1 and 3. - 1953 dory vessels, 222 tons put in subarea 3 for the same reason. - 1953 otter-trawl, 173 tons reported from subarea 2 but included in subarea 3, since haddock do not occur in quantities in subarea 2. - No report prior to 1935; otter-trawlers started fishing in Convention Area in 1936.
SPAIN (OT)	- 1930-50 (ICNAF records); 1951-58 ICNAF Statistical Bulletin (X1.2 for 1930-53). - 1930-50 landings not reported by subareas, but since Spain fished primarily in subarea 3 and since statistics during 1953-57 indicate that only very small quantities of haddock (less than 3%) were reported from subarea 4, it has been assumed that all haddock were landed from subarea 3. - In 1951 23,348 tons and in 1952 14,357 tons of haddock reported from unknown subareas but mainly from subarea 3 have been assigned to subarea 3 on the basis of the very small amount of fishing time (less than 10%) and very small quantities of haddock (less than 3%) in subarea 4 during the 1953-57 period. - 1953 includes 192 tons reported from subarea 2 but likely to be from subarea 3; 1954 includes 1 ton from subarea 2.
SPAIN (PT)	- 1950 (ICNAF records); 1951-58 ICNAF Statistical Bulletin (X1.2 for 1950-1953). - Pair trawlers started fishing in Convention Area in 1950 for the first time and up to 1953 fished only in subarea 3.
UNITED KINGDOM	- ICNAF Statistical Bulletin. Otter-trawls only.
UNITED STATES	- ICNAF Statistical Bulletin. Gear prior to 1950 presumably otter-trawl.

TABLE 6.4. Subarea 3 haddock: landings (tons) by countries and gears, 1935-58.

Year	Canada (M)		Canada (Nfld.)		France (St. P.)		Germany	Portugal		Spain		U.K.	U.S.	Grand
	OT	Line	OT	Line	OT	Line	OT	OT	D.V.	OT	PT	OT	OT	Total
1935	-		538			-			-	1385		-	-	1923
36	-		473					-	-	235		-	3	711
37	-		856					-	-	-		-	123	979
38	-		782					-	-	-		-	41	823
39	552		-					23	210	1367		-	194	2346
1940	258		2					61	372	1818		-	29	2540
41	155		162					85	439	-		-	-	841
42	108		15					-	-	-		-	-	118
43	129		24					-	-	425		-	-	578
44	1344		239					-	-	2174		-	-	3757
45	150		551					-	-	7770		-	-	8471
46	616		2642					-	-	14963		-	27	18248
47	1507		4756					-	-	17440		-	7	23710
48	4406		10187					-	-	41652		-	790	57035
49	2282		12573					-	-	63656		-	-	78511
1950	1586		10598					445	59	47747	1158	-	148	61741
51	939		3214					595	143	43322	3065	-	8	51286
52	2871	77	4504	192			-	347	240	34134	4158	-	4	46527
53	6401	159	7566	-	-	-	309	538	222	22840	4230	236	334	42835
54	9045	245	22044	935	1628	408	-	449	83	16886	2465	757	390	55335
55	13910	230	28570	443	2122	235	-	778	-	51843	3940	2386	14	104471
56	13387	89	34620	300	3846	-	-	307	-	27418	2930	1195	190	84282
57	9866	23	24556	158	3623	-	59	40	-	24747	4382	622	10	68086
58	6456	3	16815	131	3235	-	254	7	-	8949	8289	192	6	44337

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TABLE 6.5. Subarea 3 haddock: landings (tons) by countries, gears and divisions, 1953-58.

Division	Year	OTTER-TRAWLS										LINE					GRAND TOTAL
		Can. (M)	Can. (Nfld.)	France (St. P.)	Germany	Port-ugal	Spain OT	Spain PT	U.K.	U.S.	Total	Can (M)	Can. (Nfld.)	France (St. P.)	Portugal Dory V.	TOTAL	
	1953	-	-	-	-	-	+	+	-	-	+	-	-	-	-	-	+
	1954	-	-	-	-	-	10	-	-	-	10	-	-	-	-	-	10
3K	1955	-	-	-	-	-	-	3	-	-	3	-	-	-	-	-	3
	1956	-	-	-	-	-	-	78	-	-	78	-	-	-	-	-	78
	1957	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1958	-	-	-	-	-	3	-	-	-	3	-	-	-	-	-	3
	1953	41	101	-	-	265	+	+	+	-	407	-	-	-	-	-	407
	1954	230	23	-	-	13	76	-	757	-	1099	39	-	-	-	39	1138
3L	1955	42	83	-	-	3	65	48	-	-	241	1	-	-	-	1	242
	1956	32	60	-	-	16	40	23	-	-	171	1	-	-	-	1	172
	1957	65	-	-	-	4	61	113	147	-	390	-	-	-	-	-	390
	1958	150	35	-	-	1	231	275	+	-	692	-	-	-	-	-	692
	1953	-	-	-	-	-	-	+	-	-	+	-	-	-	-	-	+
3M	1954	-	-	-	-	-	-	33	-	-	33	-	-	-	-	-	33
	1955	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1956	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1957	-	-	-	-	-	-	6	-	-	6	-	-	-	-	-	6
	1958	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1953	58	42	-	-	-	+	+	+	+	100	-	-	-	+	+	100
	1954	66	629	+	-	120	9206	2408	-	+	12429	-	-	-	83	83	12512
3N	1955	50	270	+	-	630	21965	3832	-	6	26753	-	-	-	-	-	26753
	1956	179	1484	+	-	-	21046	2812	368	3	25892	-	-	-	-	-	25892
	1957	286	1435	+	-	-	20394	4053	-	-	26168	-	-	-	-	-	26168
	1958	1765	4752	+	-	-	7923	7159	+	2	21601	-	-	-	-	-	21601

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TABLE 6.5. Continued.

		OTTER-TRAWL										LINE					GRAND TOTAL
		Can. (M)	Can. (Nfld.)	France (St.P.)	Germany	Portugal	Spain OT	Spain PT	U.K.	U.S.	Total	Can (M)	Can. (Nfld.)	France St.P.	Portugal D.V.	Total	
	1953	2919	5058	-	+	100	+	+	+	+	8077	1	-	-	+	1	8078
	1954	1518	3254	+	-	312	6908	24	-	+	12016	-	-	-	-	-	12016
3O	1955	943	1816	+	-	28	14183	50	291	8	17319	-	-	-	-	-	17319
	1956	5866	15597	+	-	-	2801	17	-	73	24354	-	-	-	-	-	24354
	1957	6706	21840	+	-	-	2883	145	236	10	31820	-	-	-	-	-	31820
	1958	4386	11949	+	140	-	578	573	+	4	17630	-	-	-	-	-	17630
	1953	3383	2308	-	+	-	+	+	+	+	5691	158	-	-	+	158	5849
	1954	7231	18118	+	-	4	685	-	-	+	26038	206	935	408	-	1549	27587
	1955	12875	26401	+	-	117	15630	7	2095	-	57125	229	443	235	-	907	58032
3P	1956	7310	17479	+	-	291	3531	-	827	114	29552	88	300	-	-	388	29940
	1957	2809	1281	+	59	36	1409	65	239	-	5898	23	158	-	-	181	6079
	1958	155	79	+	19	6	214	282	67	-	822	3	131	-	-	134	956
	1953	-	57	-	309	173	22840	4230	236	334	28179	-	-	-	222	222	28401
	1954	-	20	1628	-	-	1	-	-	390	2039	-	-	-	-	-	2039
3NK	1955	-	-	2122	-	-	-	-	-	-	2122	-	-	-	-	-	2122
	1956	-	-	3846	-	-	-	-	-	-	3826	-	-	-	-	-	3846
	1957	-	-	3623	-	-	-	-	-	-	3623	-	-	-	-	-	3623
	1958	-	-	3235	95	-	-	-	125	-	3455	-	-	-	-	-	3455
	1953	6401	7566	-	309	538	22840	4230	236	334	42454	159	-	-	222	381	42835
	1954	9045	22044	1628	-	449	16886	2465	757	390	53664	245	935	408	83	1671	55335
	1955	13910	28570	2122	-	778	51843	3940	2386	14	103563	230	443	235	-	908	104471
3.	1956	13387	34620	3846	-	307	27418	2930	1195	190	83893	89	300	-	-	389	84282
	1957	9866	24556	3623	59	40	24747	4382	622	10	67905	23	158	-	-	181	68086
	1958	6456	16815	3235	254	7	8949	8289	192	6	44203	3	131	-	-	134	44337

NOTES TO TABLE 6.3: Haddock Landings by country and subdivision, Subarea 3, 1953-58.

FRANCE (St.P.)	OT - It is assumed that landings, 1954-58, from unknown subdivisions came from 3-N-O-P as indicated by (+). Line - From small inshore motor dories and assigned to 3P.
GERMANY	OT - 1953 and 1958 unknown subdivision assumed caught in 3O and 3P.
PORTUGAL	OT - 1953, 173 tons reported from subarea 2 included in 3NK since haddock do not occur in subarea 2. DV - 1953, 222 tons from unknown subarea included in 3NK since dory vessels fished only in subareas 1 and 3.
SPAIN	OT - 1953 not reported by subdivisions, see 3NK, but probably caught in all subdivisions. - 1953, 192 tons reported from subarea 2 included in 3NK. - 1954, 1 ton reported from subarea 2 included in 3NK. PT - 1953 not reported by subdivisions, see 3NK, but some probably caught in all subdivisions.
U.K.	OT- 1953 (3NK) probably came from 3L-N-O-P. - 1958 (3NK) probably came from 3L-N-O-P.
U.S.	OT - 1953 and 1954 not reported by subdivisions, See 3NK, but probably came from 3-N-O-P in conjunction with redfish fishery.
CANADA (M)	Line - Mainly dory vessels salt fishing and halibut fishing.
CANADA (Nfld.)	Line - Mainly small inshore boats including occasional small quantities by longliners.

\+ indicates that fishing possibly occurred, but quantities are given in 3NK.

TABLE 6.6. Subarea 3 redfish: Landings (tons) by countries, 1940-58.

Year	Can. (M) OT	Can. (Nfld.) OT	France (St. P.) OT	Germany (E) OT	Germany (W) OT	Ice-land OT	UK OT	US OT	USSR OT	GRAND TOTAL
1940	-	-					-			-
1941	-	-					-			-
1942	-	5					-			5
1943	-	12					-			12
1944	-	37					-			37
1945	-	144					-			144
1946	-	264					-			264
1947	-	1741					-			1741
1948	25	4572					2			4599
1949	33	7437					-			7470
1950	261	11716					-	282		12259
1951	1096	16211				-	-	13562		30869
1952	2140	12582			-	-	-	31464		46186
1953	2104	10377	-		5	-	-	33114		45600
1954	1918	3999	32		-	-	1	31269		37219
1955	763	3306	128		-	-	-	13406		17603
1956	603	2941	88		-	-	3	13304	12908	29847
1957	426	3377	273		2	-	33	4748	48805	57664
1958	772	6751	567	596	87	43668	-	10211	96046	158698

NOTES

All statistics from ICNAF Statistical Bulletin.

Can. (M) - 1958 includes 2 tons from Danish seiner.

Can. (Nfld.) - 1940-51, gear not given but mainly OT.
1952 to 1958 include the following small quantities by Danish seiners and inshore boats: 26,297,26,81,62,31 and 22 tons.

France (St. P) - No report prior to 1953.

Germany (E) - No report prior to 1958.

Germany (W) - No report prior to 1952.

Iceland - No report prior to 1952. Apparently started fishing in subarea in 1958.

US - No report prior to 1950, when fishing for redfish apparently started.

USSR - No report prior to 1956 when fishing apparently started.

TABLE 6.7. Subarea 3 redfish: Landings (tons) by countries and divisions, 1953-58.

		OTTER TRAWL									
		Can. (M)	Can. (Nfld.)	France (St.P.)	Germany (E)	Germany (W)	Iceland	UK	US	USSR	GRAND TOTAL
	1953	-	-	-	-	-	-	-	-	-	-
	1954	-	-	-	-	-	-	-	-	-	-
3K	1955	-	-	-	-	-	-	-	-	-	-
	1956	-	-	-	-	-	-	-	-	-	-
	1957	-	-	-	-	-	-	-	-	-	-
	1958	-	-	-	-	-	43668	-	-	29204	72872
	1953	25	1751	-	-	-	-	-	-	-	1776
	1954	4	392	-	-	-	-	1	-	-	397
3L	1955	12	5	-	-	-	-	-	100	-	117
	1956	-	16	-	-	-	-	-	-	-	16
	1957	13	50	-	-	-	-	33	-	17232	17328
	1958	42	339	-	-	-	-	-	-	12947	13328
	1953	-	-	-	-	-	-	-	-	-	-
	1954	-	-	-	-	-	-	-	-	-	-
	1955	-	-	-	-	-	-	-	-	-	-
3M	1956	-	-	-	-	-	-	-	54	12908	12962
	1957	-	1	-	-	-	-	-	-	31573	31574
	1958	-	9	-	596	-	-	-	32	53895	54532
	1953	977	5062	-	-	-	-	-	+	-	6039
	1954	451	712	+	-	-	-	-	+	-	1163
	1955	84	258	+	-	-	-	-	3903	-	4245
3N	1956	102	160	+	-	-	-	3	7226	-	7491
	1957	28	1225	+	-	-	-	-	2502	-	3755
	1958	258	1524	+	-	-	-	-	5959	-	7741
	1953	879	632	-	-	+	-	-	+	-	1511
	1954	748	339	+	-	-	-	-	+	-	1088
	1955	274	68	+	-	-	-	-	8080	-	8422
3O	1956	401	50	+	-	-	-	-	5564	-	6015
	1957	238	78	+	-	-	-	-	2031	-	2347
	1958	246	1786	+	-	2	-	-	4037	-	6071
	1953	223	2932	-	-	+	-	-	+	-	3155
	1954	714	2447	+	-	-	-	-	+	-	3161
3P	1955	393	2975	+	-	-	-	-	1323	-	4691
	1956	100	2715	+	-	-	-	-	460	-	3275
	1957	147	2003	+	-	2	-	-	215	-	2387
	1958	226	3093	+	-	8	-	-	183	-	3510
	1953	-	-	-	-	5	-	-	33114	-	33119
	1954	-	109	32	-	-	-	-	31269	-	31410
3NK	1955	-	-	128	-	-	-	-	-	-	128
	1956	-	-	88	-	-	-	-	-	-	88
	1957	-	-	273	-	-	-	-	-	-	273
	1958	-	-	567	-	77	-	-	-	-	644
	1953	2104	10377	-	-	5	-	-	33114	-	45600
	1954	1918	3999	32	-	-	-	1	31269	-	37219
3.	1955	763	3306	128	-	-	-	-	13406	-	17603
	1956	603	2941	88	-	-	-	3	13304	12908	29847
	1957	426	3377	273	-	2	-	33	4748	48805	57664
	1958	772	6751	567	596	87	43668	-	10211	96046	158698

NOTES TO:

Table 6.7. Subarea 3 Redfish: Landings (tons) by countries and divisions, 1953-58.

All statistics from ICNAF Statistical Bulletin.

Can. (M) - 30 (1958) and 3P (1958) include 1 ton each from Danish seiners.

Can. (Nfld.) - 3P (1953-58) include 297, 26, 81, 62, 31, and 22 tons landed by inshore boats and Danish seiners.

France (St.P.) Not allocated by divisions but possibly from 3N-O-P.

Germany (E) - Apparently no fishing prior to 1958.

Germany (W) - Small quantities from unknown divisions, possibly from 3O and 3P.

Iceland - Apparently no fishing prior to 1958.

U. S. - 1953-54 not given by divisions but fishing probably occurred mainly in 3N and 3O.

USSR - No fishing prior to 1956.

TABLE 6.8. Subarea 3 redfish: Landings per unit effort and effort for the trawl fleets by countries and divisions, 1954-58.

	Division Year	Landing per unit effort (m.t.)				Effort			
		Can. (Nfld.)	Ice-land	USSR	USA	Can.	Ice-land	USSR	USA
		L/hr fished	L/day fished	L/hr fished	L/day fished	Hours fished	Days fished	Hours fished	Days fished
3K	1954	-	-	-	-	-	-	-	-
	1955	-	-	-	-	-	-	-	-
	1956	-	-	-	-	-	-	-	-
	1957	-	-	-	-	-	-	-	-
	1958	-	67.6	2.64	-	-	720	11058	-
3L	1954	1.87	-	-	-	212	-	-	-
	1955	+	-	-	-	+	-	-	-
	1956	+	-	-	-	+	-	-	-
	1957	1.23	-	1.72	-	51	-	10013	-
	1958	1.33	-	2.56	-	288	-	5067	-
3M	1954	-	-	-	-	-	-	-	-
	1955	-	-	-	-	-	-	-	-
	1956	-	-	2.17	-	-	-	5943	-
	1957	+	-	1.53	-	+	-	20634	-
	1958	+	-	1.82	-	+	-	29575	-
3N	1954	1.23	-	-	+	943	-	-	+
	1955	1.14	-	-	+	299	-	-	+
	1956	1.19	-	-	+	220	-	-	+
	1957	1.55	-	-	+	808	-	-	+
	1958	1.99	-	-	+	895	-	-	+
3O	1954	1.30	-	-	+	836	-	-	+
	1955	+	-	-	+	+	-	-	+
	1956	+	-	-	+	+	-	-	+
	1957	+	-	-	+	+	-	-	+
	1958	1.30	-	-	+	1559	-	-	+
3P	1954	0.76	-	-	+	4154	-	-	+
	1955	0.80	-	-	+	4205	-	-	+
	1956	0.68	-	-	+	4146	-	-	+
	1957	0.60	-	-	+	3571	-	-	+
	1958	0.53	-	-	+	6322	-	-	+
3	1954	0.95	-	-	17.5	6261	-	-	1786
	1955	0.82	-	-	11.9	4938	-	-	1126
	1956	0.71	-	2.17	14.1	5127	-	5943	943
	1957	0.78	-	1.60	16.6	4863	-	30647	288
	1958	0.83	67.6	2.10	15.6	9075	720	45700	653

NOTES

Can. (Nfld.) - ICNAF Statistical Bulletin. Landings per unit effort from Newfoundland Special Effort Data, which were used to estimate the Canadian effort.

Iceland - Icelandic Research Report for 1958: ICNAF Annual Proceedings, 1959.

USSR - ICNAF Statistical Bulletin for 1956 to 1958.

USA - Submission from Woods Hole Laboratory, November, 1959.
- = No fishing, + = Effort data lacking or inadequate.

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TABLE 7.1. Subarea 4 cod: Landings by countries, gears and divisions, 1947-58.

Year	OTTER TRAWL						Other Gears	All Gears
	Canada	France	Portugal	Spain	U.S.	Total	(Mainly Line-Can.)	Total
	Division 4X							
1947	(1890)				2260	4150	16374	20524
1948	62				1999	2061	17699	19760
1949	130				1799	1909	14152	16061
1950	32				1581	1613	19056	20669
1951	321				1639	1960	16222	18182
1952	64				1651	1715	16506	18221
1953	198				1461	1659	12705	14364
1954	181	19			2523	2723	14433	17156
1955	184				1378	1562	13107	14669
1956	267				1663	1930	14388	16318
1957	601				1083	1684	12943	14627
1958	665				1110	1775	10069	11844
	Division 4VW (except 4V-Spring)							
1947	(9126)				6074	15200	26153	41353
1948	13072				7522	20954	36204	56798
1949	8871				2968	11839	30988	42827
1950	12061				5976	18037	30802	48849
1951	10063				3124	13187	28982	42169
1952	12077	-	-	-	5797	17874	25701	43575
1953	5446	-	-	-	3524	8970	17828	26798
1954	9990	2125	299	2017	672	15103	16959	32062
1955	10764	-	254	370	579	11967	16640	28607
1956	12902	16	103	2561	216	15798	19346	35144
1957	8379	544	160	3362	478	12921	19387	32308
1958	10895	-	-	4595	118	15608	15103	30711
	Division 4T (and 4V-Spring)							
1947	(641)					641	37298	37939
1948	5059					5059	33187	38246
1949	7398					7398	41030	48428
1950	6446					6446	37577	44023
1951	9960					9960	24867	34827
1952	10420		99	5169		15688	26268	41956
1953	11590	21541	3647	1969		38747	20164	58911
1954	15752	20819	4512	3080	295	44458	19443	63901
1955	19443	11889	3896	10174	199	45601	19626	65227
1956	23704	28072	5779	8140	20	65715	38754	104469
1957	26002	8456	2839	10448	7	47752	41379	89131
1958	21931	12093	2865	14400		51289	35242	86531

APP. Table 7.1. continued

Cod Landings, continued.

Year	OTTER TRAWL						Other Gears	All Gears
	Canada	France	Portugal	Spain	U.S.	Total	(Mainly Line-Can.)	Total
	Divisions 4 R S							
1947								
1948								
1949								
1950								
1951								
1952								
1953	-	(21541)	(3648)			25189	17338	(42527)
1954	194	14050	1598		7	15849	19305	35154
1955	273	20672	10345	46	35	31371	20098	51469
1956	1470	10887	8737	14	32	21140	20570	41710
1957	1519	13766	7371	-	1	22657	31028	53685
1958	3549	30075	15354	314		49292	30324	79616
	Sub Area 4							
1947	11657				8334		100713	
1948	18193				9521		110493	
1949	16399				4747		100556	
1950	18539				7557		108634	
1951	20344				4763		91179	
1952	22561		99	5169	7448		97805	
1953	17234	43082	7295	1969	3523	73103	75294	148397
1954	26117	37013	6409	5097	3653	78289	70488	148777
1955	30664	32561	14922	10585	2228	90960	68539	159489
1956	38343	38975	14619	10720	1856	104513	93563	198076
1957	36497	22766	10370	13810	1553	84996	102781	187777
1958	37040	42168	18460	17387	1283	116338	96992	213330

NOTE: All landings taken from ICNAF Statistical Bulletins except as noted below.

Canada: Landings for 1947 to 1952, inclusive, have not previously been published in this form. Data were taken from original records. * Data for 1947 are probably incorrectly apportioned to Division of capture.

France: Landings not allocated by subarea in 1952. Total cod assigned to subarea 3. Landings in 1953 not allocated to Division. Half of Division 4 assigned to 4 R and half to 4 T (4 V Spring).

Portugal and Spain: Landing for Subarea 4 in 1952 assigned to Division 4 T (4 V Spring). Portuguese landings for 1953 divided equally between 4 R and 4 T (4 V Spring). Spanish landings for 1953 assigned to 4 T (4 V Spring).

United States: Landings for 1947 to 1952 inclusive taken from U. S. Dept of Interior, Fish and Wildlife Service, "Maine Landings" and "Massachusetts Landings", converted to Metric Tons Round Fresh. Totals are slightly higher than those given in ICNAF 2nd Ann. Report, 1952, Part 4.

TABLE 7.2. Subarea 4 Haddock: Landings (tons) by countries, gears and divisions, 1947-58 .

Year	OTTER TRAWLS						Other Gears	All Gears
	Canada	France	Portugal	Spain	U.S.	Total	(Mainly line-Can.)	Total
	Division 4 X							
1947	778				8587	9365	6920	16285
1948	39				8963	9002	10558	19560
1949	271				9100	9371	7585	16956
1950	175				11621	11796	8441	20237
1951	750				8522	9272	11113	20385
1952	248				12283	12531	8673	21204
1953	743				10343	11086	7302	18388
1954	1109				14097	15206	6121	21327
1955	1768				12075	13843	6667	20510
1956	1781				12090	13871	7404	21275
1957	3979				7114	11093	5781	16874
1958	4129				11766	15895	4976	20871
	Division 4 V W							
1947	3631				8634	12265	3175	15440
1948	5079				10137	15216	7828	23044
1949	8403				4855	13258	5564	18822
1950	7955				14497	22452	6149	28601
1951	8259				10359	18618	6708	25326
1952	9537		56	959	12965	23517	4693	28210
1953	8318		13	416	9603	18350	4586	22936
1954	13312		24	1075	2138	16549	4963	21512
1955	12262		13	1183	1496	14954	4085	19039
1956	17688		12	1704	1943	21347	5182	26529
1957	22474		9	879	1483	24845	3488	28333
1958	17241		6	3048	403	20698	2268	22966
	Division 4 T							
1947	16					16	74	90
1948	10					10	134	144
1949	8					8	109	117
1950	93					93	205	298
1951	378					378	225	603
1952	1814					1814	328	2142
1953	3450					3450	500	3950
1954	5670		40		1053	6763	232	6995
1955	2967				31	2998	130	3128
1056	2846					2846	13	2859
1957	1697				1	1698	65	1763
1958	2414			245		2659	145	2804

NOTES: See App. Table 7.1 Cod Landings.

TABLE 7.3. Divisions 4R, S and T: redfish: Landings (tons) by countries and divisions, 1953-58.

Division/Year		OTTER-TRAWL			
		Can. (M)	Can. (Nfld.)	USA	Total
	1953	4906	1075	+	(5981)
	1954	7382	2825	2660	12867
	1955	4163	3580	30770	38520
4R	1956	4060	4645	16990	25695
	1957	3858	1578	12541	17977
	1958	3324	1208	5184	9716
	1953	10	38	+	(48)
	1954	1189	257	1602	3048
	1955	4277	932	3530	8739
4S	1956	7949	2202	7749	17900
	1957	6538	1907	4920	13365
	1958	6226	2671	2179	11076
	1953	1087	1250	+	(2337)
	1954	2215	1672	12966	16853
	1955	1903	263	432	2598
4T	1956	2940	233	86	3259
	1957	2569	342	78	2989
	1958	1744	33	1	1778
	1953	6003	2363	+	(8366)
	1954	10786	4754	17228	32768
4R-S-T	1955	10343	4775	34739	49857
	1956	14949	7080	24825	46854
	1957	12965	3827	17539	34331
	1958	11294	3912	7364	22570

NOTES

1. All statistics from ICNAF Statistical Bulletin. Not given by divisions prior to 1953 (USA prior to 1954).

2. Canada (M), 4T, 1954 includes 181 tons misc.

3. + = not reported by divisions
( ) = incomplete totals.

TABLE 7.4. Divisions 4R-S-T redfish: landing per unit effort and calculated effort for the trawl fleets by countries and divisions, 1953-59.

Division/Year		Landing per unit effort (m.t.)			Calculated effort		
		Can.(M) L/hr fished	Can. (Nfld.) L/hr fished	USA L/hr fished	Can. (M) Hours fished	Can. (Nfld.) Hours fished	USA Days fished
	1953	1.21	1.06	+	4068	1013	+
	1954	1.22	1.23	+	6033	2304	+
	1955	1.10	1.52	+	3791	2360	+
4R	1956	0.73	0.95	+	5569	4879	+
	1957	0.74	0.73	+	5214	2174	+
	1958	0.49	0.62	+	6798	1942	+
	1959	+	0.54	+	+	2455	+
	1953	0.67	0.83	+	15	46	+
	1954	1.14	1.21	+	1044	212	+
4S	1955	1.23	1.30	+	3487	717	+
	1956	0.85	0.99	+	9352	2236	+
	1957	0.68	0.71	+	9671	2678	+
	1958	0.58	0.76	+	10790	3505	+
	1959	+	0.52	+	+	845	+
	1953	+	0.99	+	+	1265	+
	1954	+	1.04	+	+	1602	+
4T	1955	+	0.67	+	+	390	+
	1956	+	0.88	+	+	265	+
	1957	+	0.64	+	+	534	+
	1958	+	0.55	+	+	60	+
	1959	+	0.44	+	+	9	+
	1953	1.20	1.02	+	4986	2324	+
	1954	1.21	1.15	11.4	8907	4118	1517
4R-S-T	1955	1.16	1.38	14.5	8916	3467	2397
	1956	0.81	0.96	12.3	18570	7380	2024
	1957	0.70	0.71	8.9	18574	5386	1960
	1958	0.54	0.71	8.9	20800	5507	824
	1959	+	0.54	+	+	3309	+

NOTES

Can. (Nfld.) - ICNAF Statistical Bulletin. Special Effort Data.

Can. (M) - Landings per hour fished based on landing and effort statistics extracted from table 8, ICNAF Statistical Bulletin, pertaining to redfish effort.

USA - Landing per unit effort data from a submission by the Woods Hole Laboratory, November, 1959.

\+ Not separated by divisions or imcomplete data.

TABLE I. Selection ogives used in the assessments for cod.

Length 3-cm groups	COD: percentage retention (mesh size in inches)									
	Subareas 1 and 2[(a)]				Subareas 3, 4, and 5[(b)]					
	41/2"	5"	51/2"	6"	3"	4"	41/2"	5"	51/2"	6"
12-14					4					
15-17					9					
18-20					17	1				
21-23					30	3	1			
24-26					44	7	2			
27-29	4				60	14	5	1		
30-32	10				75	25	11	4	1	
33-35	20	2			86	40	20	9	2	1
36-38	33	8	1		93	53	34	17	5	2
39-41	49	15	6	1	97	70	50	30	11	4
42-44	64	26	13	5	99	83	66	45	21	9
45-47	78	41	22	11	100	91	79	61	34	17
48-50	88	57	35	20		96	89	76	50	30
51-53	94	72	51	34		98	95	87	66	44
54-56	98	84	66	50		100	98	94	79	60
57-59	100	92	79	65			99	98	89	75
60-62		97	88	79			100	99	95	86
63-65		99	94	89				100	98	93
66-68		100	97	95					99	97
69-71			100	99					100	99
72-74				100						100
Selection factor	3.6				3.5					
Quartile sel. span	5 cm				5 cm					

(a) Prepared from data of von Brandt, I.C.E.S. Meeting, 1958, Document No. 23.

(b) Prepared from data given by Clark, McCracken and Templeman (1958). The ogives are for the otter trawl, double manila codend.

TABLE 2. Selection ogives used in the assessments for haddock

Length 2 cm groups	Haddock: percentage retention [a] (mesh size in inches) Subareas 3,4, and 5					
	3"	4"	41/2"	5"	51/2"	6"
10-11	2					
12-13	5					
14-15	10					
16-17	18					
18-19	28	1				
20-21	40	3				
22-23	54	6	1			
24-25	66	10	3			
26-27	77	18	5	1		
28-29	86	28	11	2		
30-31	92	41	18	4	1	
32-33	96	54	28	8	2	
34-35	98	67	40	14	3	1
36-37	99	78	54	22	6	2
38-39	100	87	68	34	11	3
40-41		93	79	47	18	6
42-43		96	81	60	28	11
44-45		98	93	73	40	18
46-47		99	97	83	54	28
48-49		100	98	90	67	41
50-51			99	95	78	54
52-53			100	97	87	67
54-55				98	92	78
56-57				100	96	87
58-59					98	93
60-61					99	96
62-63					100	98
64-65						99
66-67						100
Selection factor	3.1	3.1	3.2	3.2	3.3	3.3
Quartile sel. span	4 cm.					

(a) Prepared from data given by Clark, McCracken and Templeman (1958). The ogives are for the otter trawl, double manila codend.

TABLE 3: Selection ogives used in the assessments for redfish.

Length 1 cm groups	REDFISH: Percentage retention (mesh size in inches) Subarea 1 and 2 [a]				Subareas 3,4, and 5 [b]					
	41/2"	5"	51/2"	6"	3"	4"	41/2"	5"	51/2"	6"
15					22	1				
16					33	2				
17					45	3				
18	2				58	5	1			
19	6				70	8	2			
20	11				80	12	4			
21	17	1			88	18	6	1		
22	22	3			93	26	9	2		
23	26	7			96	35	13	4		
24	30	10	2		98	44	18	6	1	
25	33	13	3		99	54	25	8	2	
26	38	17	8		100	64	33	12	3	1
27	42	20	11	3		73	41	17	5	2
28	46	25	16	6		81	50	23	7	3
29	52	30	20	9		87	59	30	10	4
30	55	34	24	12		92	67	37	15	6
31	59	38	28	16		95	75	45	20	8
32	63	42	32	20		97	82	54	26	11
33	68	47	36	24		98	87	62	33	15
34	72	50	40	28		99	91	70	40	20
35	77	55	44	32		100	94	76	48	26
36	82	59	48	36			96	82	56	32
37	86	63	52	41			98	87	64	39
38	89	68	57	45			99	91	71	46
39	92	72	62	50			100	94	77	53
40	95	77	66	54				96	83	60
41	97	82	70	58				98	88	67
42	98	86	74	62				99	91	73
43	100	89	78	66				100	94	79
44		92	82	70					96	84
45		95	85	75					97	88
46		97	88	77					98	91
47		98	91	82					99	94
48		100	93	86					100	96
49			95	88						97
50			97	90						98
51			98	93						99
52			99	95						100
53			100	97						
54				98						
55				99						
Selection factor	2.6				2.3	2.4	2.5	2.5	2.5	2.5
Quertile sel. span	6 cm				2.1	2.7	3.0	3.2	3.4	3.7

(a) Prepared from data by von Brandt, I.C.E.S. Meeting, 1960, Document No. 10.

(b) Prepared from data given by Clark, McCracken and Templeman (1958). The ogives are for the otter trawl, double manila codend.

TABLE 4. Selection ogives used in the assessments for the flounders in Subarea 5 .

	Percent retention (mesh size in inches)									
1-cm groups	Witch, winter and summer flounders [a]					Yellowtail [b]				
	4"	41/2"	5"	51/2"	6"	4"	41/2"	5"	51/2"	6"
15	5	1								
16	7	2								
17	11	3								
18	16	5	1							
19	22	8	2							
20	30	13	4			10				
21	36	18	6	1		20	1			
22	46	25	9	2		50	3			
23	55	30	13	4		60	10			
24	62	40	18	6	1	80	25	1		
25	70	50	25	9	2	96	50	5		
26	78	57	30	14	4	98	70	14		
27	84	66	40	19	6	100	85	27	1	
28	89	75	50	25	10		93	50	5	
29	92	80	58	32	15		98	70	15	
30	95	86	66	42	20		100	85	30	1
31	97	90	75	50	27			95	50	5
32	98	94	80	60	35			98	75	15
33	99	96	86	68	44			100	90	35
34	100	97	90	76	54				96	60
35		98	94	82	62				99	80
36		99	96	88	70				100	94
37		100	97	92	78					98
38			98	94	84					100
39			99	96	89					
40			100	97	93					
41				98	95					
42				99	97					
43				100	98					
44					99					
	Selection factor 2.2 Quartile sel. span 3.0 cm					Selection factor 2.2 Quartile sel. span 1.2 cm				

(a) Percent retention values for the winter, witch and summer flounders were obtained from the Woods Hole Laboratory and are based on selection information given by Clark, McCracken and Templeman (1958) .

(b) Percentage retention values for the yellowtail were obtained from the Woods Hole Laboratory and are based on information on the European plaice.

TABLE 5. Selection ogives in the assessments for silver hake, red hake, eelpout and spiny dogfish in Subarea 5.

Percent retained (mesh size in inches)

1-cm groups	Silver hake (a) 4"	41/2"	5"	51/2"	6"	Red hake (b) 4"	41/2"	5"	51/2"	6"	Eelpout (c) 4"	41/2"	5"	51/2"	6"
18	1														
19	1														
20	2														
21	3														
22	5														
23	6														
24	9														
25	10	1													
26	15	1													
27	20	2				1									
28	25	3				2									
29	30	5				3									
30	35	6				5					10	1			
31	40	10	1			10	1				13	2			
32	50	12	1			16	2				19	4			
33	55	15	2			24	3				25	6			
34	60	20	3			33	5				34	9	1		
35	70	25	4			42	9				44	13	2		
36	75	30	6	1		54	14	1			50	18	3		
37	80	35	8	1		64	20	2			62	25	5		
38	85	40	11	2		75	30	4			70	34	7		
39	90	50	15	3		82	40	7			78	42	10	1	
40	91	60	20	5		88	50	11	1		84	50	15	2	
41	93	65	25	7		93	62	17	2		89	60	20	4	
42	95	70	30	10	1	96	72	25	3		93	68	28	6	
43	97	75	37	12	1	98	80	34	6		95	75	36	9	1
44	98	80	42	15	2	99	87	45	9		97	84	45	13	2
45	98	85	50	20	3	100	92	56	15	1	100	87	54	18	3
46	99	88	56	25	5		95	66	22	2		91	62	25	5
47	99	90	63	30	6		97	75	30	4		94	70	32	7
48	99	94	70	40	10		98	83	40	7		96	78	40	10
49	99	95	75	45	12		100	89	50	11		98	83	50	16
50	100	97	80	50	15			93	60	18		99	88	59	22
51		98	85	55	20			96	70	26		100	92	66	30
52		99	88	60	25			98	80	36			95	75	36
53		99	91	70	30			99	86	47			97	82	46
54		99	94	75	35			100	91	58			98	87	56
55		99	95	80	40								99	91	64
56		99	97	85	50								100	94	72
57		100	98	88	60									96	80
58			99	90	65									97	85
59			99	93	70									99	90
60			99	95	75									100	94
61			99	97	80										97
62			99	98	85										99
63			100	99	88										100
64				99	90										
65				99	93										
66				99	95										
28	Spiny dogfish (b)					3									
31						60	1								
34						100	44								
37							98	20							
40							100	90	40						
43								100	75	3					
46									100	56					
49										100					

NOTES TO TABLE 5. Selection ogives in the assessments of silver hake, red hake, etc.

(a) Silver Hake - The selection ogives are based on information summarized by Clark, McCracken and Templeman (1958).

(b) Red hake and spiny dogfish -
- The selection ogives were estimated from unpublished data of the Woods Hole Laboratory.

(c) Eelpout - The selection ogives are based on data given by Olsen and Merriman (1946).

TABLE 1. Mean weights (kilograms, round fresh) used in the assessments for Cod in the ICNAF Area.

Length 3-cm groups	Subarea 1(a)	Subarea 3(b)	Subarea 4(c)	Subarea 5(d)
21-23		0.09	0.11	
24-26		0.13	0.17	
27-29		0.18	0.22	
30-32		0.25	0.29	
33-35		0.33	0.40	
36-38		0.43	0.51	0.62
39-41	0.6	0.54	0.62	0.77
42-44	0.8	0.68	0.74	0.91
45-47	1.0	0.84	0.91	1.13
48-50	1.1	1.02	1.14	1.36
51-53	1.4	1.23	1.36	1.63
54-56	1.6	1.46	1.54	1.91
57-59	1.8	1.72	1.76	2.18
60-62	2.1	2.01	2.04	2.54
63-65	2.4	2.32	2.32	2.95
66-68	2.7	2.68	2.66	3.31
69-71	3.1	3.07	3.11	3.77
72-74	3.5	3.49	3.46	4.26
75-77	3.7	3.95	3.91	4.72
78-80	4.3	4.45	4.42	5.26
81-83	4.7	4.99	4.99	5.90
84-86	5.2	5.58	5.58	6.49
87-89	5.7	6.22	6.18	7.12
90-92	6.5	6.89	6.80	7.89
93-95	7.1	7.62	7.65	8.66
96-98	8.2	8.40	8.22	9.48
99-101	9.3	9.22	8.90	10.30
102-104	10.3	10.11	9.64	11.20
105-107		11.05	10.49	12.16
108-110		12.04	11.62	13.11
111-113		13.09	12.48	14.20
114-116		14.21	13.61	15.33
117-119		15.39	15.31	16.51
120-122		16.63	17.00	17.69
123-125		17.93		18.87
126-128		19.31		20.23
129-131		20.75		21.59
132-134		22.28		

(a) From samples taken by the research vessel "Adolf Jensen" in Aug.-Sept., 1956, and in April and June, 1957 (Courtesy of Dr. P. Hansen, Denmark).

(b) Unpublished data of the St. John's Biological Station, Nfld, Canada.

(c) Unpublished data of the St. Andrew's Biological Station, N. B., Canada.

(d) Unpublished data of the Woods Hole Biological Laboratory, Mass., U. S. A.

TABLE 2. Mean weights (kilograms, round fresh) used in the assessments for haddock in the ICNAF AREA.

Length 2-cm groups	Subarea 3(a)	Divisions 4 TVW (b)	Division 4X(c)	Subarea 5(c)
20-21	0.07			
22-23	0.10			
24-25	0.13			
26-27	0.16	0.20		
28-29	0.20	0.24		
30-31	0.25	0.30		
32-33	0.31	0.36	0.42	0.38
34-35	0.37	0.44	0.49	0.46
36-37	0.44	0.58	0.57	0.54
38-39	0.52	0.60	0.67	0.63
40-41	0.61	0.71	0.79	0.74
42-43	0.71	0.82	0.90	0.85
44-45	0.81	0.94	1.01	0.97
46-47	0.93	1.05	1.12	1.10
48-49	1.06	1.22	1.25	1.25
50-51	1.20	1.39	1.42	1.40
52-53	1.35	1.56	1.58	1.57
54-55	1.51	1.76	1.74	1.74
56-57	1.70	1.95	1.91	1.91
58-59	1.89	2.15	2.13	2.13
60-61	2.10	2.39	2.34	2.36
62-63	2.32	2.61	2.56	2.60
64-65	2.55	2.84	2.78	2.83
66-67	2.80	3.09	3.02	3.09
68-69	3.07	3.38	3.30	3.41
70-71	3.36	3.62	3.57	3.66
72-73	3.67	3.98	3.84	3.96
74-75		4.31	4.17	4.30
76-77			4.50	4.64
78-79			4.82	

(a) Unpublished data of the St. John's Biological Station, Nfld, Canada.

(b) Unpublished data of the St. Andrew's Biological Station, N. B., Canada.

(c) Data submitted by the Woods Hole Biological Laboratory, Mass., U. S. A.

TABLE 3. Mean weights (kilograms, round fresh) used in the assessments for redfish in the ICNAF Area.

Length cm	Subarea 3 and Divisions 4RST (a)	Divisions 4VWX (b)	Subarea 5(b)
15	0.05	0.062	0.055
16	0.06	0.077	0.060
17	0.07	0.090	0.065
18	0.08	0.102	0.075
19	0.10	0.110	0.090
20	0.12	0.133	0.100
21	0.14	0.154	0.120
22	0.16	0.163	0.140
23	0.18	0.185	0.170
24	0.20	0.209	0.195
25	0.23	0.240	0.230
26	0.26	0.262	0.260
27	0.29	0.296	0.300
28	0.32	0.328	0.340
29	0.35	0.396	0.390
30	0.39	0.413	0.450
31	0.43	0.444	0.500
32	0.47	0.485	0.550
33	0.52	0.543	0.575
34	0.57	0.565	0.625
35	0.62	0.610	0.700
36	0.68	0.680	0.750
37	0.74	0.790	0.800
38	0.80	0.900	0.850
39	0.86	1.000	0.900
40	0.93	1.050	
41	1.00		
42	1.08		
43	1.16		
44	1.24		
45	1.33		
46	1.42		
47	1.52		
48	1.65		
49	1.72		
50	1.82		

(a) Unpublished data of the St. John's Biological Station, Nfld., Canada.

(b) Data submitted by the Woods Hole Biological Laboratory, Mass., U. S. A.

TABLE 4. Mean weights (kilograms, round fresh) used in the assessments for the flounders in Subarea 5.

Length 2-cm groups	Flounders: Yellow-tail	Summer	Winter	Witch
26-27	0.165	0.190	0.240	
28-29	0.207	0.220	0.305	
30-31	0.255	0.260	0.375	
32-33	0.315	0.325	0.465	
34-35	0.380	0.395	0.560	0.285
36-37	0.452	0.487	0.665	0.320
38-39	0.540	0.575	0.770	0.375
40-41	0.640	0.680	0.895	0.420
42-43	0.760	0.790	1.040	0.490
44-45	0.905	0.910	1.210	0.585
46-47	1.075	1.060	1.375	0.680
48-49	1.310	1.210	1.550	0.790
50-51	1.600	1.390	1.725	0.900
52-53		1.580	1.925	1.010
54-55		1.790	2.150	1.140
56-57		2.025		1.280
58-59		2.275		1.460
60-61		2.555		1.680
62-63		2.870		1.900
64-65		3.210		2.110
66-67		3.590		
68-69		4.010		
70-71		4.465		
72-73		4.940		
74-75		5.400		
76-77		5.990		

TABLE 5. Mean weights (kilograms, round fresh) used in the assessments for silver hake, red hake, eelpout, and spiny dogfish in Subarea 5.

Length 1-cm groups	Silver hake	Red hake	Eel-pout
20	0.048	0.045	
21	0.056	0.050	
22	0.065	0.060	
23	0.075	0.074	
24	0.086	0.075	
25	0.098	0.090	
26	0.100	0.105	
27	0.125	0.120	
28	0.140	0.135	
29	0.156	0.150	
30	0.174	0.170	0.080
31	0.194	0.190	0.120
32	0.214	0.210	0.140
33	0.236	0.235	0.180
34	0.260	0.260	0.210
35	0.285	0.285	0.230
36	0.311	0.310	0.250
37	0.340	0.335	0.270
38	0.370	0.365	0.300
39	0.402	0.390	0.320
40	0.435	0.420	0.340
41	0.471	0.455	0.370
42	0.508	0.490	0.400
43	0.548	0.525	0.430
44	0.589	0.570	0.460
45	0.633	0.615	0.500
46	0.679	0.660	0.520
47	0.727	0.705	0.560
48	0.777	0.755	0.600
49	0.830	0.810	0.640
50	0.885	0.865	0.700
51	0.942	0.925	0.720
52	1.000	0.990	0.740
53		1.050	0.800
54		1.115	0.840
55			0.900
56			0.960
57			1.000
58			1.050
59			1.100
60			1.160
61			1.240
62			1.300
63			1.350
64			1.400
65			1.500

Length 3-cm groups	Spiny dogfish
30-32	0.090
33-35	0.110
36-38	0.140
39-41	0.180
42-44	0.230
45-47	0.310
48-50	0.390
51-53	0.470
54-56	0.570
57-59	0.680
60-62	0.790
63-65	0.920
66-68	1.050
69-71	1.200
72-74	1.370
75-77	1.550
78-80	1.780
81-83	2.000
84-86	2.250
87-89	2.550
90-92	2.850
93-95	3.200

NOTES

Flounders, hakes and spiny dogfish - Lenth-weight relationships were taken from unpublished records of the Woods Hole Laboratory, Mass., U. S. A.

Eelpout - Lenth-weight relationships are based on data given by Olsen, and Merriman (1946).

APPENDIX IV

Table of equivalent mesh sizes, in inches and millimetres

Inches	Millimetres
3	76
3 1/2	89
4	102
4 1/3	110
4 1/2	114
4 3/4	120
5	127
5 1/2	140
6	152