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THE NORTHWEST ATLANTIC FISHERIES

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1. Report of December 1958 Meeting of Scientific Advisers to Panels 4 and 5
(with Appendices)

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Minutes of December 1958 Meeting
of Scientific Advisers to Panels 4 and 5

The Scientific Advisers to Panels 4 and 5 met in Boston, Mass., on December 2-4, 1958. Dr. Herbert W. Graham acted as Chairman and Dr. J. L. Hart and Dr. R. L. Edwards were appointed reporters. A list of participants is presented in Appendix I.

RECENT ADVANCES IN HADDOCK BIOLOGY

Subarea 5

John B. Colton reported on the results of the Woods Hole Laboratory's larval fish surveys in the general area of the Gulf of Maine and surrounding banks. The main spawning concentrations of haddock (Melanogrammus aeglefinus (L.)) in the years 1953, 1955, and 1956 were in (1) the northeastern part of Georges Bank, (2) on Browns Bank, and (3) in South Channel. Northeast Georges larvae tended to drift south and southwest as they grew. Browns Bank larvae drifted counter clockwise around the Gulf of Maine, and the fate of the South Channel fish was uncertain. Young fish appear to drift in the same manner as drift bottles, and even more exactly as transponding buoys which may be followed day after day. Colton postulated that in the years of survey Georges Bank fish were recruited from Browns Bank. The years of survey were all years of poor recruitment on Georges Bank. Further surveys are needed during years of successful recruitment.

Most surveys were made with Hardy Plankton Recorders towed at the surface and at ten meters. In order to increase the depth of sampling in surveys over a large area in a limited time, it was necessary to devise new samplers. A new sampler was

developed and used experimentally in 1958 with several of these samplers being towed simultaneously at different depths. The collections so obtained demonstrated that young haddock tend to be concentrated between 10 and 20 m, day or night. Stratification was relatively marked in deeper waters but less so in shoal water perhaps due to differences in turbulence.

In 1956, extensive mortality of larval silver hake (Merluccius bilinearis (Mitch.)) and yellowtail flounder (Limanda ferruginea (Storer)) was observed off the southern edge of Georges Bank, apparently due to the incursion and mixing of warmer slope water with Georges Bank water. Because of the apparent prevailing drift of larvae of Georges Bank into this area, such phenomena may have an important bearing on the success of haddock year classes and requires further study.

Colton next discussed the results of the trawl surveys of young-of-the-year haddock made in the fall seasons of 1953, 1955, 1956, and 1958. The average fish per tow for each was as follows: 1953--0.7, '55--9.7, '56--1.7, and 1958--14.9. The greatest numbers of zero age group fish were found in depths between 60 and 90 fathoms. The concentrations differed significantly in 1958 when large numbers (up to 300 fish per tow) were found off the eastern edge of Georges Bank, off western Browns Bank and east of Cape Cod. Previously, zero haddock were usually found in the deeper, more central areas of the Gulf of Maine.

Since at least the first three of these surveys were made of poor year classes it is too early to draw any conclusions regarding the relation of the abundance and distributional pattern of young-of-the-year on the bottom to the eggs and larvae or to the commercial yield of the year class.

Clark presented evidence to support an hypothesis that haddock of the Gulf of Maine and contiguous waters are separable into three major stocks: (1) Browns Bank, (2) Georges Bank, east; and (3) Georges Bank, west. The haddock in the Bay of Fundy are considered a mixed group. This breakdown was based on vertebral numbers and tagging returns. The Woods Hole staff has tagged over 9,000 fish since 1953.

The St. Andrews staff, in 1957, tagged more than 2,200 haddock in the Browns-LaHave and Bay of Fundy areas. Returns to date suggest that haddock in the Browns-LaHave area are a relatively discrete stock. Haddock from the Bay of Fundy region were retaken in substantial numbers during winter from the southern Gulf of Maine and Channel regions. The results substantiate earlier conclusions of separate haddock stocks in Subareas 4 and 5.

Subarea 4

The St. Andrews group started a survey program on Nova Scotian (Sable Island, Western, and Emerald) banks in August and September 1953. By far the most abundant fish was the haddock. Smallest haddock, probably '57 year class, were found alone in shallow water (14-20 fathoms), in reduced numbers at intermediate depths, but occurred again along with large haddock in the deeper waters (45+ fathoms). Large numbers of baby haddock, probably '56 and '55 year classes, were caught along with larger fish on top of the banks in intermediate depths (20-45 fathoms).

Preliminary conclusions are that none of the year classes of haddock from '53-'57 are outstanding. Comparative data for other years are lacking, however, and support for this conclusion will have to depend on future measures of recruitment to the commercial fishery.

The cooperative exchange program was reviewed by Martin and Clark (Appendix II). It was agreed that satisfactory progress was being made and that any difficulties that come up could be handled direct.

Subarea 3

Hodder reviewed the history of the haddock fishery in recent years in Subarea 3. The 1949 year class, in the years subsequent to 1953, dominated the fishery, influenced the sizes of fish taken and discarded, and greatly modified Newfoundland's fishing industry. There is no evidence of a good year class in the immediate future on St. Pierre Bank, and, although the 1955 year class is dominant on the Grand Bank, it is actually relatively poor. The dispersal of moderate year classes of haddock in Subarea 3 in the summer months is so extreme as to make fishing unprofitable at this time.

Management of the Haddock Fisheries

Subarea 5

The status of the haddock fishery on Georges Bank is poor. The 1958 year class shows promise but there is no relief in sight until 1960 at the earliest. A 2-year cycle of abundance was a feature of the haddock fishery from 1947 to 1952. However, this pattern has broken down since then and there has been a series of poor year classes.

The present poor condition of the Georges Bank haddock fishery led to a discussion of the importance of knowledge regarding the factors that affect fish populations. For effective management the biologist has an obligation to do more than study the short-term effects of changes in the rate of fishing, for it is vital that he be able to explain and predict the environmental factors that so drastically affect the populations and the long-term influence of fishing on the biology of the stocks. It was accordingly agreed that we continue special efforts to study the effects of fishing and of the environment on recruitment and availability of fishes, especially haddock. It was recommended that an ad hoc committee be set up to consider methods of studying the effects of environment and fishing on recruitment especially of haddock. Taylor (Chairman), Dickle, Hodder, and Walford were appointed and instructed to report back at the June meeting.

Effects of Regulation

Taylor presented a paper on "Recent Variations in Haddock Growth", Appendix III, in which it was shown that the increase in average weight of 2- and 3-year-old haddock following regulation is not due to an increase in growth rate. Other aspects of this study showed that growth rates did differ significantly from one area to another on Georges Bank. It was agreed that growth rate work is basic to the study of the effects of regulation and should be continued.

Taylor presented a paper on "Some Effects of Undetected Trends in Estimating Mortality Coefficients", Taylor and Oberacker, which assessed the usefulness under various circumstances of the 2 methods (Beverton and Holt, and Paloheimo) in estimating the values of catchability (q) and mortality (M).

Dickie reviewed Holt's method for estimating benefits of a mesh regulation and pointed out that the method is not more useful in predicting the benefit than methods already being applied because the same assumptions must be made that have already been used.

Dickie presented a paper entitled "Effects of Possible Mistakes in Age Determination on Age-Composition and Mortality Estimates for Georges Bank Haddock", in which he showed that errors in age determination could lead to a levelling of apparent year class strength with age, especially in those cases where there are marked differences in year class strength. The Georges Bank data demonstrate a loss of dominance in strong year classes as the fish become older. This could be caused by differential emigration of the older fish of strong year classes, by relatively more intensive fishing on the stronger year classes, as well as by errors in age determination. A method was described for making the necessary adjustments to correct for such errors. Taylor described studies establishing the validity of scale readings during the time that haddock were producing alternately good and poor year classes.

The subject of a study boat fleet as it applied to assessment of the mesh regulation in Subarea 5 was discussed briefly, and it was agreed to leave the matter open for the present.

Administrative Problems

Medico discussed some of the variations resulting from the use of different synthetic yarns. The problems associated with pre-stretched manila cod ends were explained.

Brackett gave the latest report on the operation of the 10% annual exemption. The report is printed in Annual Proceedings, Vol. 9.

McCracken presented information that Canadian vessels had become dependent on the success of specific year classes for year-round haddock fishing. Recently they have been operating principally on the abundant 1952 year class. The '49 year class was also a dominant year class. The 1955 year class is entering the fishery now, but none of the year classes subsequent to 1952 appear to be outstanding. The proportion of discards varies greatly, depending upon where the fish are being landed and whether they are landed round or gutted. A general value for discards in the summer of 1958 is 9% by weight.

Mesh selection experiments with a 5-1/8 inch mesh gave a selection factor of 3.2. Sea trips on commercial trawlers during the summer of 1958 demonstrated that the large mesh nets (4-7/8") released fish under 30 cm in large numbers.

Martin reported on enforcement of the mesh regulation in Subarea 4. He pointed out the possible administrative needs for a general mesh regulation for haddock for all contiguous Canadian waters.

Subarea 3

Hodder reported on abundance of haddock on the Grand Bank. Catch per unit of effort fell 40 to 50% between 1957 and 1958 due to the diminished level of the 1949 year class which was still providing over 50% of the landings in 1957. There is wide variation in the growth rates of different year classes. The large 1949 year class had the slowest growth rate of all year classes investigated. The growth rate of all year classes in 1950 was significantly reduced, and this seemed to be due to the unusually low water temperatures on the Grand Bank at that time.

It was noted that some haddock vessels have been fishing in Subarea 3 with cod end mesh sizes as large as 4.6 inches. In general, 4-inch mesh sizes are used for Newfoundland haddock dragging in Subarea 3.

RECENT ADVANCES IN COD STUDIES

Subarea 5

Wise reported that scrod cod (Gadus callarias L.) landings at Boston and New Bedford have shown a marked increase in 1958 and appear to be due to one or more successful year classes of fish. The statement was made that Browns Bank and Georges Bank cod are apparently separate stocks. A tagging experiment is planned for March of 1959 to measure the discreteness of these stocks and to determine the degree of homing tendencies. Preliminary work on age of Georges fish shows extremely fast growth and agrees with Schroeder's data for southern New England fish.

Subarea 4

Powles reported on cod tagging at the Magdalen Islands. In July 1957, 1201 cod were tagged. Recaptures were made from the western side of the Laurentian Channel off Cape Breton during December to April following, while in June to November 1958, northeast to Gaspé and the Bay of Chaleur regions. In 1958, 910 cod were tagged earlier, in May. The pattern of returns was similar, but cod migrated north during this year of tagging. All cod were tagged with Petersen discs and Lea tags attached dorsally. Recoveries were of the order of 10% for both years.

Size at maturity, spawning season, and fecundity were determined in 1955 and 1956 for cod from Subdivision 4T. In 1955 and 1956, males were 50% mature at 50 and 53 cm, respectively; females for the same years were 50% mature at 52 and 57 cm, respectively. The spawning season lasted from May to September, with peak spawning at the end of June. The smallest mature cod of 51 cm produced 200,000 eggs, while the largest specimen of 140 cm in length carried 12 million ripening eggs.

In feeding studies, it was found that small cod selected a diet of pelagic crustaceans, namely mysids, euphausiids, and amphipods. With increase in size, cod adopted a more varied diet, in which fish and benthic invertebrates became increasingly important. At lengths over 70 cm pelagic and benthic invertebrates were taken in approximately equal volumes. Herring was the most important fish in the diet of a large cod.

Marcotte reported on the continuation of the survey in the Bay of Chaleur and environs. The survey consisted of 9 stations (3 transects) in the Bay and 6 stations (2 transects) off the tip of Gaspé (Grand River). During the first survey small numbers of cod

were rather evenly distributed over the area. Catches close inshore in July were mostly small fish. At the beginning of August cod were abundant at all stations, especially along the northern shore. In October, codfish were still abundant although emigration had begun. Cod move into the Bay as water temperatures rise in late spring. Cod in spawning condition were found throughout the summer, with a maximum in July.

Small codfish were less abundant in 1958 than in 1957. Lower temperatures were observed in 1958 as well as fewer small cod relative to large.

The catches taken with #14 and #17 hooks did not obviously differ in length composition, although these data need further analysis. To this end, it was recommended that Clark and McCracken cooperate with Marcotte in applying an analysis similar to that used in mesh selection experiments.

A detailed survey was made of the mesh sizes used in 85 codfish traps as a beginning of mesh selection experiments.

Lacroix presented the results of nine 24-hour cruises made near Grand-Rivière, Gaspé-Sud, Canada, to study daily vertical migrations of euphausiids.

A general pattern of migrations was described, consisting of (a) a dawn descending movement, (b) an absence in the upper 60 meters at mid-day, (c) an evening ascending movement, and (d) a scattering distribution at midnight leading to a stair distribution with a maximum concentration near the surface.

Physical factors causing or modifying migrations are light, temperature, and the state of sea surface. High thermal gradients (at least 1°C./m) were found to stop the animals in their migrations upwards.

Poulsen presented a report of the cod data recently supplied by Ruivo and Quartin. These data include age and size compositions as well as sex ratio information. A dominant 1950 year class appeared in recent Portuguese catches. The group expressed its appreciation for this useful and needed report. The report is printed in Annual Proceedings, Vol.9.

Martin discussed the work (of Yves Jean) carried out in the Gulf of St. Lawrence. Sizes and ages of cod caught and landed by Canada from the northern part of Sub-division 4T have been studied in varied ways. Commercial dragger studies during the period 1948-58 have shown increased landings, decreased catch per unit effort, decreased average age, and increased growth rate. The effects of changes in fishing and in the environment are being assessed. These draggers are now using cod end manila mesh sizes of 4-1/2 to 5 inches. Nine trips to sea on these boats in 1958 have shown that large quantities of small cod, which are observed in survey studies to be present in the area, are escaping from the net. However, discards at sea still amount to about 15% by number. A mesh selection experiment with a 5-3/4 inch manila cod end gave a selection factor of 3.3 for cod and 2.1 for plaice.

It was concluded that a 5-1/2-inch mesh would reduce discards to a minimum and that the variability of selection factor experiments makes it difficult to assess effects on the numbers and sizes of cod now landed. With such a mesh size, plaice discards would be greatly reduced with no immediate effect on sizes landed.

It was proposed by Martin that 5-1/2 inch nets be supplied to a few commercial draggers in 1959 in order to measure relative efficiency of various mesh sizes and to gain base-line experience with the use of larger mesh nets. Martin then asked the group for their ideas on a study boat program and the proposed program was discussed. The group endorsed the study boat program and suggested that more than one experimental mesh size be used if the practical difficulties involved could be met.

Subarea 3

Squires presented a preliminary study of the lower landings of cod in 1958 in the trap fishery of Newfoundland, which appeared to be related to hydrographic conditions. These conditions resulted in a short capelin (Mallotus villosus (Müller)) season. Cod follow capelin inshore where they are caught in the traps. Further difficulties developed when also the bait squid were not readily available. This handicapped the fall line fishery. Small (1-year) cod were abundant in 1956 and 1958.

An account of some exploratory fishing for shrimp (Pandalus borealis K.) in the Gulf of St. Lawrence and off the Newfoundland coast was presented.

SCALLOPS

Posgay reported on the U.S. scallop fishery and U.S. research on this shellfish. The 1958 catch will be about 2.5 million pounds below 1957 but this is due to decreased effort, not lowered abundance. The catch per unit of effort remains about the same as 1957. Some scallopers were diverted to exploitation of the unusually abundant yellowtail flounder in the area.

Investigation of the annual rings of scallops from the eastern half of Georges Bank, which provides about 70% of the total catch on Georges, the Hudson Canyon areas and Block Island, show that the growth rates in all the areas are almost exactly the same. The growth rate estimated by this method agrees very closely with the growth rate estimated from the recovery of tagged scallops.

An estimation of the natural mortality rate has been made using the ratio of clapper shells to live scallops presented in the fished population. These data give estimates of M ranging from .045 to .162 for the catchable sizes.

An attempt has been made to estimate total mortality rates by analyzing the relative abundance of successive year classes present in the population and by the catch per day of tagged scallops. The relative abundance method gives estimates of Z of about .7 (assuming little variation in year-class strength). The tag return method requires the elapse of more time and return of more tags before returns can be considered to reflect the rate of exploitation. Returns from a preliminary tagging on one of the less heavily fished areas have totalled about 20% in the 14 months since their release. A later more extensive tagging has yielded 9% returns in 6 months.

The method suggested by Holt (Serial No. 557) for predicting the effect of increasing the mesh size has been applied to the sea scallop data. These calculations predict that postponing the length at first capture from 85 mm, the present cull, to 105 mm (1.43 years) would lead to an 89% benefit if the present fishing mortality is .7 and a benefit of 21% if the fishing mortality is .4.

It was recommended that a report summarizing evidence for possible benefits of an increased ring size in scallop gear be prepared by the U.S. and distributed prior to the June meeting and that U.S. and Canadian biologists continue their close cooperation in this study.

Dickie reported on sampling on Georges Bank aboard Canadian vessels. Since June 1958, 3 of the 10-minute squares proposed as a basis for statistical reporting were sampled. Records of catch per haul or hour fished indicate differences in the abundance in neighboring areas. However, these differences were reflected largely in the amount of discards, landings per unit of effort varying little in total poundage. With lower catches, the size of 50% cull appears to decrease, landings apparently varying mainly with the numbers of different sizes shucked. If this situation is general, it could complicate estimates of abundance from commercial statistics.

The material presented by Dickie suggested that greater shucking power rather than improving the catch per unit effort is necessary to fully utilize the present scallop resource. Posgay pointed out that increasing the catch per unit of effort of larger scallops, by permitting them to grow up, would increase the landed catch per unit of effort with the same shucking power. There was further discussion about the interpretation of Posgay's tagging data and his experimental design for the tagging experiment.

STATISTICS

Clark pointed out that a division of Subdivision 5Z would present the haddock data of Georges Bank more adequately by stocks. It was agreed that a matter of principle was involved and that the question should be passed on to the Committee on Research and Statistics. United States biologists agreed to present the value of a division of Subdivision 5Z at the June meeting.

Clark reported that an annual series presenting the basic haddock data was being prepared, starting with 1956. The 1957 and 1958 data will be published as soon as finished, after which the basic data will be published at the end of each year. It is planned to publish the data prior to 1955 as soon as practical.

PLANS FOR FUTURE MEETINGS

1. It was agreed that two days would be required for the June meeting of Scientific Advisers to Panels 4 and 5. The Executive Secretary was asked to schedule this amount of time out of the week provided for scientific discussions at the annual meeting.

2. Kelly reviewed the work that has been accomplished to date in preparation for the Redfish Symposium, 1959.

3. Wise reported on the plans for the Marking Symposium in 1960. It was agreed that Dr. McGrocker should proceed with the publicity phase of the Marking Symposium.

APPENDIX IList of Participants

CANADA

St. Andrews

Dr. J. L. Hart
 Dr. W. R. Martin
 Dr. F. D. McCracken
 Dr. L. M. Dickie
 Mr. P. M. Powles

St. John's

Mr. V. M. Hodder
 Mr. H. J. Squires

Dept. of Fisheries, Quebec

Dr. A. Marcotte
 Mr. G. Lacroix

UNITED STATES

USFWS, Washington, D. C.

Dr. L. A. Walford
 Mr. J. P. Wise
 representing Mr. H. Eckles

Woods Hole

Dr. H. W. Graham, Chairman
 Mr. J. B. Colton, Jr.
 Mr. J. R. Clark
 Mr. J. P. Wise
 Dr. R. L. Edwards
 Mr. C. C. Taylor
 Mr. J. A. Posgay
 Mr. G. F. Kelly

Resource Management (Gloucester)

Mr. L. Brackett
 Mr. E. Medico

Observers

Mrs. R. R. Stoddard
 Mr. D. A. Oberacker

ICNAF Headquarters

Dr. E. M. Poulsen
 Mr. R. S. Keir

Co-Operative Haddock Program in ICNAF Subarea 4Data sent from St. Andrews to Woods HoleStatistics

Landings from Subdivision 4X by species, months, and type of gear, from January 1, 1956, to January 31, 1958.

Catch per Unit of Effort

Catch per tub for landings at the Lockeport Company from January 1, 1956, to January 31, 1958.

Samples (Sept. & Oct. 1958 samples will be sent to Woods Hole with others for last half of 1958.)

Month	1956			1957			1958		
	No. of Samples	Number Measured	No. of Scales	No. of Samples	Number Measured	No. of Otoliths	No. of Samples	Number Measured	No. of Otoliths
Jan.									
Feb.				1	200	40	1	202	40
Mar.	5	1100	220	4	800	160	3	1160	232
Apr.	1	300	60	1	200	40			
May							2	590	118
June							4	1508	300
July				3	1015	203	6	3327	665
Aug.									
Sept.				1	200	40	5	2600	520
Oct.				1	300	60	1	154	30
Nov.	2	400	80	2	875	175			
Dec.	1	600	120	3	600	120			
Total	9	2400	480	16	4190	838			

(continued)

APPENDIX II
(continued)

Data received by St. Andrews from Woods Hole

Statistics

Massachusetts landings by months from January 1, 1956, to June 30, 1958, with the exception of the month of December 1956.

Interview Records and Summaries - Subdivision 4W

Month	1956 - Number trips	1957 - Number trips	1958 ¹ - Number trips
January	2	4	2
February	-	1	2
March	2	1	-
April	6 Summaries only	7	1
May	5 Summaries only	-	2
June	4 Summaries only	6	-
July	1 Summaries only	2	-
August	-	1	
September	-	1	
October	-	7	
November	13	-	
December	6	6	

Samples - Subdivision 4W

Month	1956						1957				1958			
	Length Frequencies			Otoliths			Frequencies		Otoliths		Frequencies		Otoliths	
	Lg.	Scr.	Disc.	Lg.	Scr.	Disc.	Lg.	Scr.	Lg.	Scr.	Lg.	Scr.	Lg.	Scr.
	Number			Number			Number		Number		Number		Number	
Jan.	167	188		20	15		*102	*54	*20		101	112	20	15
Feb.							100	50	20	15	*96			*21
Mar.	*102			*19										
Apr.	166	219	564	20	20	20	176		35					
May														
June								*62		*15				
July														
Aug.														
Sept.														
Oct.														
Nov.	1013	595		214	124									
Dec.							*97	*118	*20	*14				
Total	1448	1002	564	273	159	20	475	284	95	44				

* Not used as both market categories not sampled or market categories from different areas. Age readings received from January to April of 1956. Otoliths received for all samples following this period.

Recent Variations in Haddock Growth (I)by C. C. Taylor and R. R. Stoddard

The average weight of haddock landed at ages 2 and 3 has increased about 15% since mesh regulation (Taylor, P-27, ICNAF, ICES, FAO, Lisbon, 1957). Our interpretation of this as a selection effect of the large mesh has been challenged on the basis that such increase in weight could be due to a change in growth rate.

From Georges Bank subareas G, H, J, and M, back-calculated sizes from 6,392 fish for 1931-1947 year classes were compared to back-calculated sizes of 259 fish taken in 1958. All these fish were taken in Season A and include 3- to 6-year-old fish. The results of these comparisons are summarized in Tables 1 to 3.

Prior to 1947, there were no substantial differences in growth rate in the subareas studied (Table 1).

The 1958 data indicate an increase in growth rate from 1 to 2 cm since 1952 in subarea G. Almost no difference in subarea H is evident. In subareas J and M, a slight decrease in growth rate is noted.

Conclusive evidence of variations in growth in recent years must await the reading of additional scale collections taken in the years 1953 to 1957. When this work is completed, it will be possible to trace the growth of individual year classes in the fishery prior to and following the mesh change. This study is expected to be completed prior to the 1959 annual meeting.

Table 1 -- Average calculated length in cm at each age for fish captured in Subareas G, H, J, and M, 1931-1947 (Season A).

Age at Capture	1 ₁	1 ₂	1 ₃	1 ₄	1 ₅	1 ₆	No. of fish	1 ₁	1 ₂	1 ₃	1 ₄	1 ₅	1 ₆	No. of fish
	<u>Subarea G</u>							<u>Subarea H</u>						
III	18.84	34.49	45.13				277	18.88	34.24	44.73				262
IV	18.08	31.91	42.52	50.53			304	18.73	32.15	42.47	50.02			188
V	17.96	30.84	41.33	49.08	55.10		158	17.94	31.43	41.70	49.34	55.32		146
VI	17.85	30.15	40.41	48.27	54.39	59.32	66	18.02	30.74	40.95	48.77	54.88	59.41	66
\bar{x}	18.18	31.85	42.35	49.29	54.74	59.32	805	18.39	32.14	42.46	49.38	55.10	59.41	662
	<u>Subarea J</u>							<u>Subarea M</u>						
III	19.50	33.90	44.10				719	19.80	34.10	44.30				1295
IV	18.60	32.30	42.30	49.60			740	18.90	32.70	42.80	50.10			1028
V	18.20	31.10	41.00	48.70	54.40		311	18.30	31.80	41.80	49.10	54.50		511
VI	17.70	30.50	40.00	47.80	53.50	57.70	140	18.20	31.30	41.10	48.60	54.20	58.50	181
\bar{x}	18.50	31.95	41.85	48.70	53.95	57.70	1910	18.80	32.48	42.50	49.27	54.35	58.50	3015

APPENDIX III
(continue^d)

Table 2 - Average calculated length in cm at each age for fish captured in subareas G, H, J, and M, 1958 (Season A).

Age at Capture	Subarea G						Subarea H						No. of fish	
	l ₁	l ₂	l ₃	l ₄	l ₅	l ₆	l ₁	l ₂	l ₃	l ₄	l ₅	l ₆		
III	16.40	29.80	40.90				17.28	34.43	44.86				7	
IV	18.75	34.95	46.30	53.20			19.91	36.43	46.87	54.61			23	
V	18.56	32.83	43.28	51.22	56.22		18.33	30.80	42.33	47.33	56.67		15	
VI	16.50	31.42	42.08	50.58	57.17	61.50	12	18.25	31.04	40.54	47.88	54.17	58.62	24
\bar{x}	17.55	32.25	43.14	51.67	56.70	61.50	60	18.44	33.18	43.65	49.94	55.42	58.62	69

Age at Capture	Subarea J						Subarea M						No. of fish	
	l ₁	l ₂	l ₃	l ₄	l ₅	l ₆	l ₁	l ₂	l ₃	l ₄	l ₅	l ₆		
III	20.94	35.94	44.82				21.83	35.33	45.17				6	
IV	19.27	30.51	41.14	47.27			18.36	31.21	41.64	49.07			14	
V	18.41	28.94	39.00	46.59	52.53		18.44	28.56	38.44	46.78	52.00		9	
VI	18.40	31.33	40.87	48.00	52.73	56.33	15	18.93	31.07	40.40	47.80	54.47	57.33	15
\bar{x}	19.26	31.68	41.46	47.29	52.63	56.33	86	19.39	31.54	41.41	47.88	53.24	57.33	44

Table 3 - Comparison of average calculated fork length in cm in 1958 to the 1931-1947 average, by subarea (Season A)

Age	Subarea G		Subarea H		Subarea J		Subarea M	
	1958	1931-1947	1958	1931-1947	1958	1931-1947	1958	1931-1947
1	17.55	18.18	18.44	18.39	19.26	18.50	19.39	18.80
2	32.25	31.85	33.18	32.14	31.68	31.95	31.54	32.48
3	43.14	42.35	43.65	42.46	41.46	41.85	41.41	42.50
4	51.67	49.29	49.94	49.38	47.29	48.70	47.88	49.27
5	56.70	54.74	55.42	55.10	52.63	53.95	53.24	54.35
6	61.50	59.32	58.62	59.41	56.33	57.70	57.33	58.50

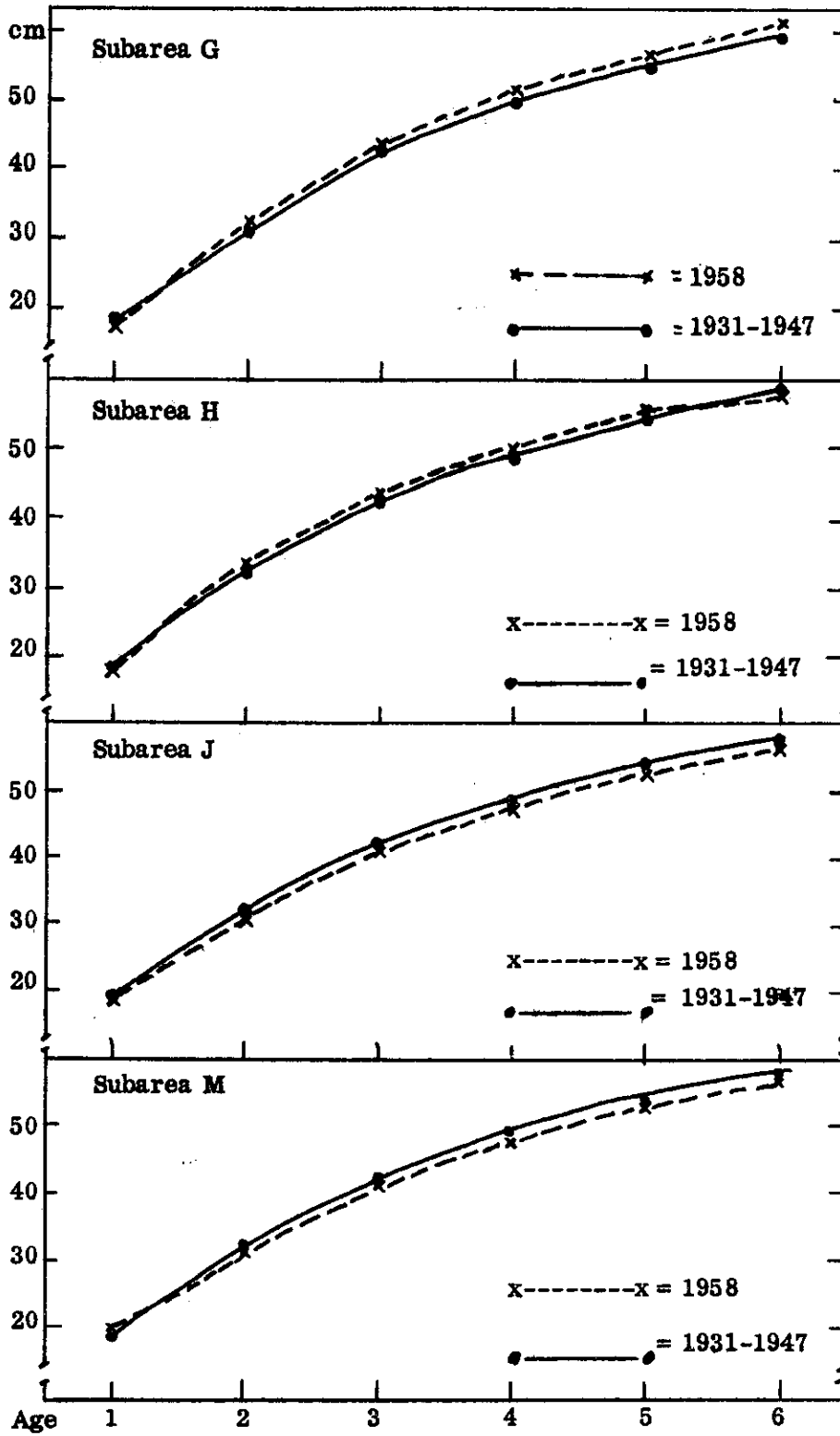


Figure 1

2.

Recent Variations in Haddock Growth (II)by C.C.Taylor, A.C.Jensen, and R.R.Stoddard

The preceding Appendix III compares back-calculated sizes of haddock captured in 1958 to average growth of the year classes 1931-1947 to determine if increases in the average weight of fish landed since 1953 by the regulation 4-1/2-inch mesh net might be accounted for by an increase in growth rate. We now compare the growth history of the 1952 year class to the average growth of the 1931-1947 year classes.

Material. A total of 387 haddock from the 1952 year class are represented in the scale collection of 1955, 1956, 1957, and 1958. In 1955 the only 3-year-old (1952 year class) fish in the collections were from Subarea J. In 1957 the scale samples of Subarea H were from scrod haddock only. The 8 fish from the 1952 year class in this sample are not considered representative of average growth, leaving a total of 379 fish.

Scales collected for back-calculation and comparative growth studies of haddock, 1931 to 1958, are collected during the months of February, March, and April. Total length is measured to the nearest millimeter.

Comparative growth. Table 1 shows the average back-calculated sizes by age of capture of the 1952 year class in Georges Bank Subareas G, H, J, and M. Figure 1 compares the average back-calculated size in each subarea to the average back-calculated size of year classes 1931-1947 at ages 4 to 6 (G, H, and M) and ages 3 to 6 (J).

Variations in average weight. Table 2 shows the average weight of fish landed from the 1948 to 1956 year classes at ages 1 to 5. These weights are determined from samplings of the commercial landings (1951, Schuck, Fish. Bull. Fish and Wildlife Service, 52: 151-176). The 1952 and subsequent year classes have been fished with the regulation (4-1/2-inch mesh) net.

Discussion. The deviations of the 1952 year class from average growth are rather less than those shown in Appendix III, but it is noteworthy that the deviations in each subarea are in the same direction as shown by the 1958 data. The data presented here and in Appendix III indicate no increase in growth rate since mesh regulation which could possibly account for the increases in weight shown in Table 2. It is perfectly clear that the increases result from the predicted selection effect of the regulation net in capturing larger fish and permitting the escape of the smaller. This effect, of course, is to be expected up to the 100% retention point, even if none of the smaller fish escaping survive to be caught at a later date. The persistence of the increase in weight to ages 4 and 5, however, was not predicted per se, but it is substantial evidence that the mortality rate on younger and smaller fish has been reduced by use of the large mesh and that larger numbers of them are surviving to older ages. This kind of benefit is taken account of in the yield-assessment calculations on which regulation was predicated and is implicit in the predicted 30% increase in yield from a given recruitment (1952, Graham, ICNAF, Second Ann.Rep., Part 3, pp.23-33).

Conclusions. Observed variations in growth of haddock on Georges Bank over the period 1953 to 1958 are not of sufficient magnitude to account for observed increases in the weight of landed fish over the same period.

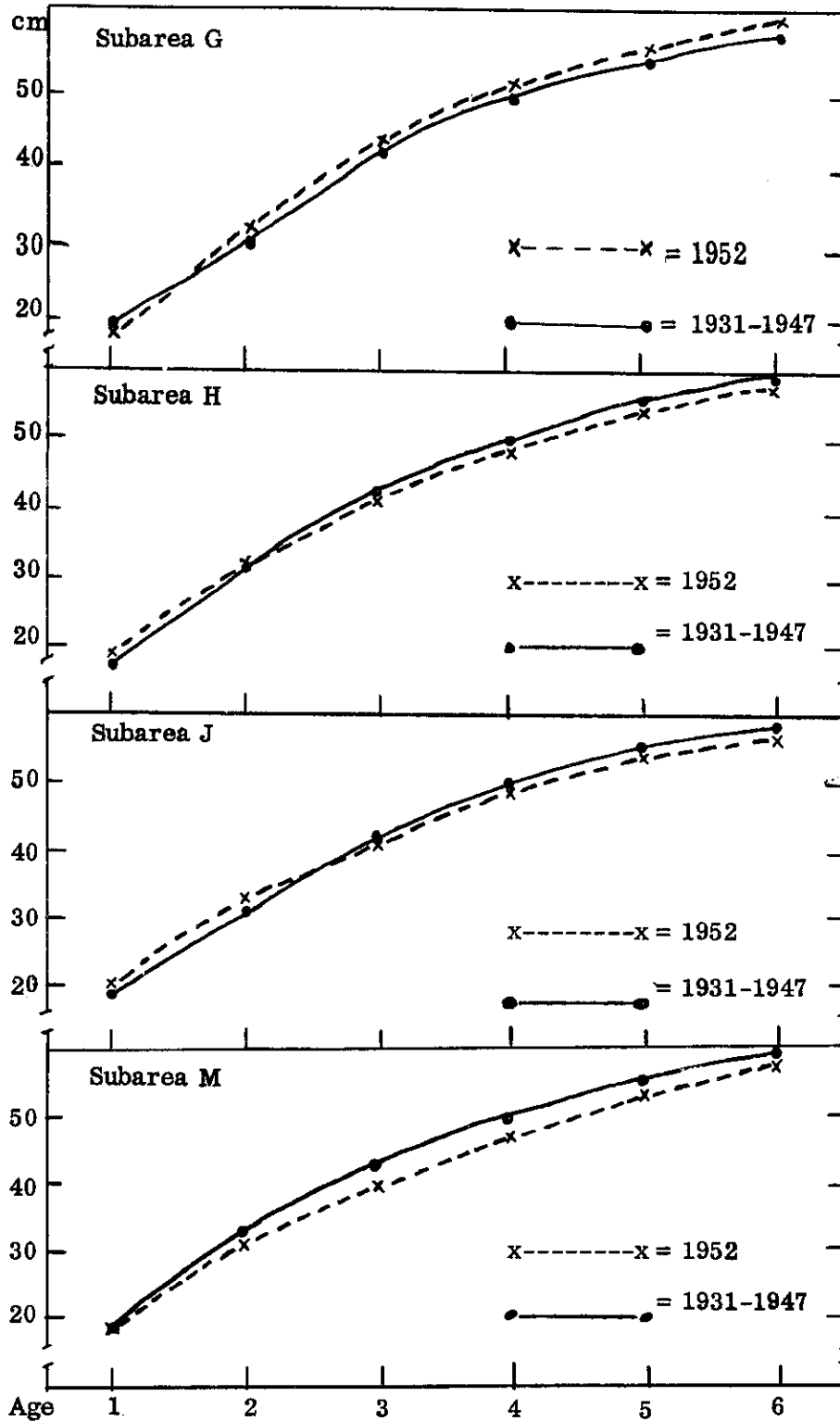


Figure 1 - Back-calculated Size, in cm (to the left) for Ages 1-6 (below), of the year class 1952 and of year classes 1931-47.

Table 1 - Average calculated length at each age of 1952 year-class haddock captured in Sub-areas G, H, J, and M (Season A), 1955 to 1958.

Age of Capture	l ₁	l ₂	l ₃	l ₄	l ₅	l ₆	
<u>SUBAREA G</u>							
IV	17.97	32.39	42.88	50.57			61
V	18.01	31.42	42.04	50.49	56.04		84
VI	16.50	31.42	42.08	50.58	57.17	61.50	12
\bar{X}	17.49	31.74	42.33	50.55	56.60	61.50	157
<u>SUBAREA H</u>							
IV	18.65	31.57	42.03	49.46			37
V	---	---	---	---			--
VI	18.25	31.04	40.54	47.88	54.17	58.62	24
\bar{X}	18.45	31.30	41.28	48.67	54.17	58.62	61
<u>SUBAREA J</u>							
III	19.71	33.18	41.76				17
IV	21.22	34.78	43.00	49.33			9
V	20.33	32.02	41.43	48.54	53.87		39
VI	18.40	31.33	40.87	48.00	52.73	56.33	15
\bar{X}	19.92	32.83	41.76	48.62	53.30	56.33	80
<u>SUBAREA M</u>							
IV	19.85	32.44	41.02	47.64			39
V	17.11	27.89	37.67	44.33	50.30		27
VI	18.93	31.07	40.40	47.80	54.47	57.33	15
\bar{X}	18.63	30.47	39.70	46.59	52.38	57.33	81
TOTAL							379

Table 2 - Average weight of haddock landed from year classes 1948 to 1956 at ages 1 to 5

Age	Pre-regulation				Post-regulation				
	1948	1949	1950	1951	1952	1953	1954	1955	1956
1	1.08	.94	1.02	--	1.06	.85	1.12	1.26	1.05
2	1.32	1.36	1.33	1.23	1.49	1.64	1.61	1.54	--
3	1.84	1.82	1.81	1.75	2.09	2.05	2.15	--	--
4	2.50	2.31	2.44	2.49	2.60	2.72	--	--	--
5	3.14	2.88	3.34	3.15	3.43	--	--	--	--

3. North Atlantic Fish Marking SymposiumObservations from Submissions on Tagging Publicity Methods

By F. D. McCracken
 Fisheries Research Board of Canada
 Biological Station, St. Andrews, N. B.

At the 1958 Annual Meeting of ICNAF it was agreed that a North Atlantic Fish Marking Symposium would be sponsored by ICNAF. An item about Publicity is included in the outline of the scope of the symposium and in the draft agenda. It was agreed that submissions for this item should be solicited for the 1959 Annual Meeting and presented at that time.

Submissions by Canada, Denmark, Germany, Norway, Portugal, Spain, United Kingdom, and the United States were received. Titles of these reports, names of their authors, and a brief listing of their contents are presented in the Appendix. Copies of the reports and the supporting material, including posters, maps, letters, etc., have been deposited with the ICNAF Secretariat. Some additional verbal information was presented at the 1959 Annual Meeting.

This note attempts to summarize briefly the similarities and differences indicated by these submissions.

Propaganda Dissemination

The submissions list the laboratories and government agencies concerned with tagging and recaptures. Generally there are one or two in each country and close co-operation within countries is indicated. Laboratories carrying out tagging generally enlist the aid of other agencies within the country in obtaining and sometimes in processing recapture data.

Most countries use a variety of schemes to publicize their taggings and help ensure recaptures. The following general information about these schemes seems worth noting.

Tagging lists.

Lists of tagging (release lists) or similar summary information have been issued by all countries carrying out tagging in the ICNAF area. These summaries present information about type of tag, tag number series, general location of tagging, etc. It appears that countries associated with both ICES and ICNAF issue lists which show such information in much greater detail.

Posters, handbills, etc.

All countries indicate that this type of material is distributed widely to landing ports and/or fishing vessels. Those countries with fleets making long voyages and landing at central ports tend to concentrate on distribution within the fleet. Countries with scattered fishing ports and processing establishments emphasize wider shore distribution of this type of material. One novel development noted is an attempt to

include circulars in pay envelopes for crews and fish market personnel (UK submission).

Generally these posters and circulars are designed to publicize the type of tag, reward, information required, and agency collecting tags. They may also attempt to explain why tagging is carried out. Only two countries (Canada and Spain) indicate that the poster designed through ICNAF is being used.

Radio Broadcasts and Press Releases.

Generally, broadcasts are made near the time of tagging. Mainly they appear to be included on other broadcasts beamed at fishermen. It may be noted that Portugal transmits information through the H.S. Gil Eannes. Press release methods in advance of tagging are noted particularly by Denmark, Germany, and USA. It appears that these radio and press releases are not regularly recurring but are instigated usually at the beginning of new tagging experiments.

Reward payment methods are also used to publicize tagging experiments; these will be summarized under the reward section of this document.

Information Required

All countries request quite similar information which includes some or all of: tag number, date, position, depth, and method of recapture, either length of fish or its return, scales or otoliths, weight, sex of fish, name of vessel and finder. Those countries with fleets landing fish in a fresh condition usually stress the return of the fish. Officers of salt fishing vessels are asked to measure the fish and collect other biological data (submissions: Portugal and Spain).

Most countries do not vary the reward with the amount of information reported. Exceptions are Spain, where rewards are scaled according to information obtained; and within the UK, Scotland reduces the reward paid for tags returned without details of capture.

Most countries landing fish head on, fresh, make special attempts to recover the fish. They use various port officials, laboratory technicians, and local merchants. Plastic bags issued in the UK for return of fish is a novel idea.

Payments for the return of the fish itself are quite variable. For example, in the UK the value of the fish is refunded if requested by the legal owner; in Canada the value of the fish is refunded automatically; and in the US a flat rate of one dollar is paid for each fish returned.

Rewards

Two types of rewards are used; one is monetary; the other provides some form of personal satisfaction to the individual returning the tag.

Monetary rewards.

It seems generally accepted that each country in ICNAF pays rewards to its own nationals for all tags turned in regardless of the country from which the tag

originated. None of the submissions indicate dissatisfaction or failure to carry through with this procedure.

One form of variation in monetary reward (related to information obtained) is noted above. In addition, the actual reward also varies between countries. Translation of the rewards into standard monetary units would be interesting but probably not particularly meaningful without a variety of other considerations.

Norway has introduced a system such that, in each year, the finders of three tags chosen at random will receive greatly augmented rewards.

Other reward types.

Within this category occur the greatest variations and examples of ingenuity. These methods are difficult to summarize but all are based on providing information and satisfaction to the individual returning the tag. All countries make special efforts to send out information about the recaptured fish. When possible the returnee is given information about where and when the fish was tagged and its growth by the person collecting the tag. Tagging lists are important for this purpose. The submission by the US notes that they give particular emphasis to this personal touch and also to the personal touch in paying the monetary reward. Also noteworthy are the map-letter overlay forms submitted by Canada and the US, for use where personal contact is not possible.

Publication of the names of nationals returning tags is reported by Germany and Portugal. A somewhat similar form of award is made by the US in placing tag recapture display boards at major fishing ports, showing movement of tagged fish, finders' names, and vessel names.

Appendix

List of submissions concerning tagging publicity methods for a North Atlantic Fish Marking Symposium (originals and supporting material on file at ICNAF Secretariat):

- (1) Canada -- "Canadian Tagging Publicity Methods" by F.D. McCracken.

Contains a listing of laboratories doing groundfish tagging and describes use of posters, letters, broadcasts, and special collections. The report lists information required, reward payment, and methods of releasing information about recaptured fish. Of particular interest is a chart-overlay form letter.

Supporting material includes posters, chart letters, and circular letters.

- (2) Denmark -- "Notes on Tagging" by Paul Hansen.

Describes publication of release lists, posters, newspaper accounts, and other methods of publicizing tagging. Lists information required, amounts and methods of paying reward to both Greenland and Faroese fishermen.

- (3) Germany -- "Notes on Tagging, Especially Publicity and Rewards in the Federal Republic of Germany" by Gerhard Krefft.

Mentions species tagged, release lists, and the use of newspapers and magazines to present advance information about tagging. Describes information required, collection of fish, and methods of paying rewards. States that vessel names and names and addresses of tag finders are published quarterly.

Supporting material includes release list forms, sample postcards for distributing and collecting information, and a copy of published list of recaptures.

- (4) Norway -- "Note on Extra Rewards for Returned Tags" by G. Rollesen

Besides a standard reward for each returned tag, Norway has introduced a scheme for extra rewards. Extra rewards of about 200, 500, and 50 times the standard reward are paid each year to the finders of three randomly-chosen tags.

- (5) Portugal -- "Notice about the System Adopted in Portugal for the Collection and Distribution of Information on Tags Recovered in the ICNAF Area" by Mario Ruivo.

This report lists the organization for handling tag returns and describes methods of publicity with posters and radio broadcasts directed at large salt fishing vessels. The information required is listed and the use of posters showing measuring methods, instructions to captains, and distribution of special envelopes to simplify information collection are described. The steps taken to compile tags and information, photostat, and return the original to the country of origin are described in detail. Monetary rewards are supplemented by publication of finders' names and addresses in the fishing industry journal.

Supporting material includes posters, stamped envelopes, photostats of compiled tags, and a copy of the "Jornal do Pescador" containing finders' names and details of recaptures.

(6) Spain -- "Information on Tagging, Spain" by Manuel Sunico.

Contains a description of publicity application directed toward large salt fishing vessels. Posters (ICNAF design) are distributed to each vessel along with written instructions of procedure in collecting and reporting tags. Captains are responsible for recording and reporting tag recaptures by their vessels, along with detailed information. Rewards are scaled according to amount of information obtained from the finder. Details of reward system are included in the submission.

Supporting material includes a poster of the type designed through ICNAF.

(7) United Kingdom -- "Notes on Tagging in the United Kingdom" by C.E. Lucas and G. Trout.

With some exceptions, English and Scottish laboratories use similar procedures. Detailed release lists, including lengths, sexes, locations, etc., are circulated to countries fishing the stocks tagged. This report lists methods of collection, payment of rewards, and payment for fish. Posters, circular letters, and handbills are used to publicize the tagging. Handbills inserted into fishermen's pay envelopes is a novel idea as is also the distribution of plastic bags in which fish can be returned. The latter are distributed to likely finders in small ports. Form letters are used to distribute information to finders of tags.

Supporting material includes release lists, various coloured posters, and handbills.

(8) United States -- "Publicity, Information and Rewards in the US ICNAF Tagging Program" by S.L. Cogswell.

This report emphasizes the "personal touch" in handling tag returns. It is usually possible to pay rewards on the spot and inform finder about tagging by using a variety of government personnel and responsible volunteers. Emphasis on collection of fish for measurement and biological information has led to paying reward for the fish as well as the tag. Press releases and posters are used for publicity in advance of tagging. Form letters with tinted overlay chart are used to inform finders about tagging information. Names of finders are published and a tag display board showing up-to-date results of particular taggings is displayed at major landing ports.

Supporting material includes posters, special chart letters, and pictures of fish movement display board.

(Note): Additional verbal information was presented at the 1959 Annual Meeting by France, Iceland and USSR.

4. Collaboration Between FAO and ICNAF, 1958/59

The following notes report action taken by FAO Fisheries Division in response to recommendations in the report of the Eighth Annual Meeting of ICNAF and other aspects of the current work of the Division of interest to the Commission.

1. Follow-up of Joint Scientific Meeting of ICNAF/ICES/FAO, Lisbon, 1957

1. 1 Publication of Report and Contributions

Unfortunately progress with this work has been slower than we expected, but the editing of the reports has now been completed, financial provision made for their printing and distribution, and the authors of contributions have returned corrected copies of their manuscripts.

1. 2 Standard Notation and Terminology for Fishery Dynamics

The small Committee established to finalize the notation has finished its work by publication of a report (J. Cons. Int. Expl, Mer 24:239-242, 1959), containing proposed standard notation, with terms in English, Japanese and German. Nearly one thousand reprints of this paper are being distributed to research institutions and editors of periodicals with the request that they consider whether they can act on the recommendations contained therein. Scientific colleagues in many countries have now been asked to supply corresponding lists of terms in other languages in which papers on this subject are published. The response to this request has been most encouraging.

1. 3 An International Journal of Fishery Dynamics

Publication of such a journal has now been discussed with publishers having experience with international scientific periodicals. Negotiations are now in progress with one publisher regarding the details of format, financing, and selection of editorial board, and it is hoped to begin publication early in 1960.

1.4 Mathematical Tables for simplifying stock assessments are being prepared at Lowestoft Fisheries Laboratory, and FAO is discussing with that Laboratory the question of their publication. Mr. Beverton has used the draft tables in an assessment of fish stocks in African lakes in connection with an FAO Technical Assistance Project in Uganda.

1. 5 Comparative Population Studies

Some progress has been made in compiling and summarizing such data. A study has been made by Mr. Beverton and Mr. Holt of the relations between growth and mortality rates in more than fifty fish species. Within several taxonomic orders there is a highly significant correlation between these parameters, which we hope will be useful in simplifying the work of stock assessment. Following the publication by C.C. Taylor of a relation between water temperature and growth rate of cod, a comparative study was made of the growth rates of several scombroid species, and a small advance in understanding of mackerel population dynamics has been made.

2. Methodological Manuals

2. 1 Sampling Methods

Mr. Gulland has visited sampling sites in some countries of the Middle and Far East, and this experience of varied conditions is proving useful in preparing the draft of this manual. An outline of it was used for instructional purposes at the FAO International Training Centre on the Methodology and Techniques of Research on Mackerel (*Rastrelliger*), held last autumn in Bangkok.

2. 2 Stock Assessment Methods

Draft chapters of this manual, based on the lectures given at the course held in Lowestoft, 1957, were also used for the Bangkok Training Centre. It is expected that a complete draft will be given limited distribution for comment in 1960.

2. 3 Field and Laboratory Methods

The first of these has been distributed in mimeographed form to chosen experts for comment and advice on how it could be improved. Canadian research workers have used it experimentally and they and Norwegian and British workers have given us helpful and encouraging opinions; assistance is now coming also from other countries. The second manual will similarly be distributed shortly. They will be revised and printed in 1960.

2. 4 Gear Selectivity

At the suggestion of ICNAF, we have undertaken to prepare a manual of methods of studying selectivity. Material for this is now being assembled, and we expect, as for the other manuals, to employ a consultant to prepare a draft. An FAO consultant, Mr. Akyuz, is to participate, on the invitation of the Norwegian participants, in the international experiment to be conducted by several European countries this August in the north-east Atlantic. We hope that some standard methods will be agreed on for that experiment and we will take account of that experience in preparing the manual of this subject.

2. 5 Fish Marking

Correspondence has been exchanged with authors designated by the International Association for Limnology to prepare a review on fresh-water fish marking, with a view to preparing a joint manual on experimental design; types of tags and their application; analysis of results. We are awaiting the completion of the IAL draft and then propose to ask consultants to complete the study for marine fish. It is hoped that a first draft will be ready in time for the ICNAF meeting on tagging in the North Atlantic (see also Section 7).

3. Co-ordination of fisheries statistics

In September this year a meeting, jointly sponsored by ICES, ICNAF and FAO, is to be held in Edinburgh, at which it is hoped that agreement will then be reached leading to co-ordination of commercial statistics relating to the fisheries of the North Atlantic.

4. Other Meetings

4. 1 Four hundred copies of ICNAF Special Publication No.1 (Report of Biarritz Meeting) have been given a wide distribution to research workers and institutions outside the ICNAF area, and correspondence shows that it has been most enthusiastically welcomed.

4. 2 A joint paper on "The Measurement of Fishing Power" by Messrs. Holt, Keir and Parrish was prepared for the Second FAO Fishing Boat Congress. (The paper will be printed in Annual Proceedings Vol.9 - Secretariat).

4. 3 Manuscripts of experience, background, and methodologica' papers are being steadily received for the FAO World Meeting on the Biology of Sardines and Related Species, being convened in Rome in September. A strong participation from the ICNAF member countries is expected. Mr. Donald L. McKernan of the US Fish and Wildlife Service, and Dr. Mario Ruivo of Portugal, and Chairman of ICNAF Committee on Research and Statistics, have accepted our invitation to act as Chairman and Vice-Chairman respectively.

4. 4 FAO Biology Branch is collaborating with SCOR in convening a meeting on fish food populations in connection with the Oceanographical Congress being held in New York in August.

4. 5 Protection of Marine Resources

FAO Fisheries Biology Branch is represented on the Ad Hoc Inter-governmental Panel, established by the International Atomic Energy Agency, on the Disposal of Radioactive Wastes in the Sea and is there keeping fisheries interests to the fore. A report from this panel, which has already had two meetings, is expected at the end of this year. The IAEA is organizing, in collaboration with FAO, a Conference on the Disposal of Radioactive Wastes at Monaco in November 1959. The fisheries and oceanographic aspects of this matter will be considered there.

The Branch is also participating in the International Conference on the Pollution of the Sea by Oil, being convened at Copenhagen in July.

5. Compilation of biological data on commercial fish species

First attention this year has been given to the clupeoids, in preparation for the Sardine Meeting, which has occupied most of the time of the staff concerned with this. We hope, however, to prepare in due time a synopsis on the biology of the species and stocks of redfish, using the contributions to, and conclusions from, the ICES/ICNAF Redfish Symposium. If the sponsors would find it useful and feasible, the draft of our synopsis could be submitted for revision to scientists studying the biology of this group and publication with the proceedings of the symposium.

A large contribution of compiled data has been received from the US National Research Council, and as those synopses are revised, brought up to date, and put into a standard form, we expect to issue them as supplements to our "Current Bibliography".

6. "Current Bibliography for Aquatic Sciences and Fisheries"

As announced at the 1958 ICNAF meeting, this monthly periodical is being distributed in mimeographed form. It now reaches over one thousand fisheries institutions, research units and libraries. The coverage has been increased, with the assistance of many collaborators, and sets of reprints have been received from some member countries of the Commission. We hope for further assistance during the next year, when we expect the Bibliography will be issued in printed form, and on a subscription basis. We search regularly the ICNAF "Annotated List of Pertinent Papers", include all the references therein, and list most of them under "Northwest Atlantic" in the monthly and annual geographical indexes of the Current Bibliography.

7. Analysis of Tagging Results

A method of using all the information concerning growth rate derived from the marking experiments has been worked out with Mr. J. A. Gulland. An account of the method is given by Gulland & Holt in J. Cons. Int. Expl. de la Mer, 1959 (in press).

8. Other Matters

Questions connected with the use of nylon gill-nets are being considered by the two organizations. Bottom-set nets of non-rotting fibres, if lost, continue to fish. In view of the increasing use of such nets throughout the world, we are interested to know whether scientists working in the ICNAF area are aware of, and concerned about, the possible effects of the accumulation of lost nets on the fish stocks.

5. Report of the Standing Committee on Research and Statistics, 1959 Annual Meeting

Chairman: Dr. Mario Ruivo
 Rapporteur: Mr. Geoffrey Trout

The Committee met in Montreal, Canada, 26th May to 5th June, 1959.

Ad hoc subcommittees were set up to discuss and report on problems contained in the Committee's programme. This report summarizes their discussions and recommendations, whilst their fuller reports, upon which action will be taken, are attached as appendices. From time to time the Action Committee met to advise the Chairman.

The following topics were discussed in subcommittees -

(1) Statistics and sampling	- Appendix X	- p.73
(2) Statistical areas	- Appendix XI	- p.79
(3) Assessment of mesh regulation	- Appendices VII, XIII	- p.56, 83
(4) Gear selectivity	- Appendices VIII, XIV	- p.59, 86
(5) Sea scallops	- Appendix V	- p.52
(6) Halibut	- Appendix IV	- p.51
(7) Research requirements for Subarea 1	- Appendix VI	- p.54
(8) Redfish symposium, Copenhagen, October 1959	- Appendix I	- p.44
(9) Marking symposium, Bergen, June 1960	- Appendix II	- p.45
(10) Cod otolith exchange program	- Appendix III	- p.48
(11) Environmental studies	- Appendix IX	- p.63
(12) Publications	- Appendix XII	- p.80

I

At the conclusion of the report of the Committee on Research and Statistics last year, its Chairman, Dr. Walford, emphasized the increasing scope of research in the ICNAF area. The primary task of organizing the collection of statistics, upon which wise regulation of a fishery depends, is being consolidated, though it must continue to be improved and unified still further.

Assessment of the benefit of the regulations first imposed has engaged our attention for several years past and continues to be one of the most important tasks of the Committee. Although the accuracy of assessment methods is constantly being improved, it will be apparent that unless compliance with the regulations can be ensured, then the full advantages of such improved methods and theoretical provisions will be diminished.

Concurrently with the adoption of conservation methods, other events have been taking place in the Convention Area. Landings have increased, largely as a result of increased effort. The yield per unit effort has, however, shown irregularities and further certain species in some subareas have shown decreases - a trend also observed in the North Eastern Atlantic.

Profitable fishing depends upon a state of equilibrium between fishing effort - which man can control - and the size of stock. After a major reduction of stock size, the fleets become more dependent upon the results of natural fluctuations - which man cannot control - and even upon single year classes. With increased pressure on a stock - and the stocks in the ICNAF area are being subjected to increasing effort - the more rapidly these changes appear and the sooner does the well known sequence of events show itself.

A study of environmental factors which control the distribution of a fish population will lead to the knowledge of what alternative species, or sizes of a given species, will be available to ships finding unsuitable conditions on their traditional grounds.

In recent years the Committee on Research and Statistics has called for a number of Symposia: the Biarritz meeting on methodology; the Lisbon meeting on fundamental investigations into the action of fishing gears; the Redfish Symposium, due to take place in October 1959 and the Tagging Symposium in June 1961. All of these may be considered as preparatory stages on the way to the solution of conservation problems. Superficially, many of the topics discussed have little bearing on conservation, but in our constant review of the fisheries still unregulated, it is necessary to have the same pattern of data for all commercial species and many problems are uncovered which must be solved before the data can be obtained. For example, the growth in importance of the redfish has led to the realization that this fishery is based on two different species and possibly a third. Different opinions exist concerning age determination of redfish from different areas and even from the same area. It is essential to separate species with certainty in a mixed fishery and to obtain estimates of recruitment, growth rates and mortalities based upon accurate age determinations, before regulation can be contemplated. Difficulties experienced in arriving at wise regulation have already been demonstrated and a thorough knowledge and understanding of the overall biology and behaviour of each species contributes to solution of assessment of problems.

Thus, it comes about that a step towards the goal of conservation may involve, for example, a study of the pigment spots of planktonic redfish larvae, a few millimetres long, in order that the species difference may be investigated. It may include analysis of fish slime or parasite infestations as means of determining the geographic limits of a species. Such apparently academic studies play a truly vital role in the preliminary stages of conserving newly exploited fish stocks and in the future extension of fishing to other species.

One step which must be taken very soon is the investigation of environmental factors which affect fish shoals at all stages of growth and at all seasons. The field of environmental studies embraces the identification of water masses and the speed of their daily and seasonal movements; studies of the biological environment - the plankton, fish foods and bottom living animals. In this field formulation of problems and working hypotheses relating directly to commercial fish stocks is difficult in the extreme. The Committee has given considerable time and thought to discussion of this wide subject but, as with other topics, has been hampered by the lack of scientists present at its meetings. Interests and needs of some countries may differ from those of others and if these interests are not represented during the discussions and planning of a research programme, the effectiveness of the Commission is reduced.

Because of the vast area involved, problems of planning a workable program and implementing it by co-ordinating research vessel sea-time, have become very apparent. The exploration of this aim has been one of the main tasks of the ad hoc committee concerned. Whilst the deliberations of the environmental studies group were continuing, evidence from several sources within the Convention Area underlined the correctness of the decision, made last year, to set up this Subcommittee. From the north of Greenland came reports of a continuing invasion of cold water species into waters previously inhabited by cod. From the southern grounds it was apparent that biological data were needed to help explain varying year-class strengths. Environmental studies would cover factors responsible for both these and similar occurrences.

With the expansion and diversification of the scientific needs of the Commission's work, it is for consideration whether some reconstruction of the Committee on Research and Statistics may be necessary in the near future. Furthermore, the problem of lack of time available for discussion of scientific matters should be borne in mind.

This latter problem was raised by Chairmen of most Subcommittees. It aggravated further the difficulties of participation experienced by countries not being fully represented by scientific advisers, and it is felt that the effectiveness of the Committee's work, upon which the Commission ultimately depends, suffered in consequence. It is realized that this reflects, in some measure, the increasing demands made upon small scientific staffs to undertake the work resulting from international commitments.

Below are summaries of the reports of the ad hoc Subcommittees appointed during the previous week.

- II -

(1) Statistics and Sampling (Appendix X)

Investigation of the major commercial fisheries in the ICNAF area depends on the collection and distribution of adequate statistics and sampling data. Although the Commission has achieved remarkable progress in its statistics and sampling publications, there are still gaps in the data received by the Commission, which must be drawn to the attention of member governments.

Second only in importance to having statistics and sampling data submitted in the detail requested by the Commission is the need to have them published promptly. Increases in fishing, and in the detail of statistics required, impose a heavy burden on the small Secretariat. Standardized and concisely tabulated data should be submitted promptly.

With these aims in mind a series of recommendations on the collection and submission of statistics on landings, efforts and discards were agreed. Because of the importance of mesh regulations in the Commission's work, it is necessary to have accurate data on the quantities and sizes of fish discarded at sea.

To standardize and interpret fishing effort statistics it is necessary to understand the factors affecting the fishing power of vessels. Their study requires detailed data on the characteristics of the vessels and gears used in the Convention Area. Such data are collected in a "List of Vessels of over 50 Gross tons Fishing in the Convention Area". Several new characteristics will be included in the 1959 list. Recommendations for action are also made concerning comparative fishing experiments and the standardization of fishing efforts.

Specifications are given for the way in which sampling data are to be reported by member countries and published in the Sampling Yearbook.

In September 1959 an important meeting on fisheries statistics will be held in Edinburgh, Scotland. This meeting has been sponsored jointly by FAO/ICNAF/ICES and it is strongly urged that all member countries of ICNAF be represented by at least two participants, one a biologist, the other a fishery statistician. Certain special problems of concern to ICNAF will be brought to the attention of the Joint Meeting.

(2) Statistical Areas (Appendix XI)

Biological studies require precise information on area fished. To this end consideration was given by the Scientific Advisers to Panels 4 and 5 when they met in December, 1958, to further division of Subdivision 5Z, on the basis of new knowledge of haddock stocks.

It was agreed that the smallest practicable unit area should be used for the collection of statistics.

It was recommended that:

1. the Secretariat canvass member countries to ascertain which small unit areas they are now using for collecting statistics.
2. the U.S. review present knowledge on the division of stocks of the four principal species of fish in the Convention Area. (Canada has done this for cod and haddock in Subareas 3 and 4. The Redfish Symposium should provide information for redfish in the Convention Area).
3. action be deferred on divisions of 5Z until the above studies are completed.

(3) Assessment of Mesh Regulations (Appendix VII, XIII)

The 4 1/2 inch codend mesh in use on Georges Bank is permitting the escape of small haddock in accordance with predictions based on gear selectivity experiments. For this reason the study-boat programme was discontinued last year.

The average size of landed fish at each age is greater than before regulation. This phenomenon has been observed over two years and its possible causes examined in detail.

There is now virtually no discarding of small haddock by US trawlers, but sometimes fish smaller than marketable size are caught. Samples of these are occasionally brought to port for measurement. Discarding may increase in 1960 when the 1958 year class - which promises to be large - is recruited.

Discarding has also been low in the Canadian fisheries for haddock on the Scotian shelf (Subarea 4) and on the southwestern slope of the Grand Bank (Subarea 3) and for cod in the Gulf of St. Lawrence (Subarea 4). This is attributed to the larger mesh size and, in the case of the haddock, also to a reduction in the culling size to meet changes in market demand. In Subarea 3 reduction of haddock discards is partly due to the meagre recruitment in recent years. In this subarea the selection by regulation meshes approximates the sizes of haddock now retained for landing.

Introduction of a still larger mesh for the above cod and haddock fisheries would therefore result in rather smaller initial catches.

Knowledge of growth and mortality of haddock and cod in Subarea 4 is still insufficient to predict the long-term effects of further increases in mesh size.

Verifying predictions of long-term benefits from mesh increases is not just a matter of comparing catches obtained before with those obtained after regulation. The catches actually taken have to be contrasted with those that would have been taken by the same effort if there had been no regulation. The problem is thus essentially one of deductive inference rather than of experimental proof. The question is whether any post-regulation changes in growth and mortality have occurred, which tend to nullify the predicted benefits.

The observed increases in size of haddock at each age are such as to enhance, rather than to reduce, the benefit, but changes in mortality have not yet been detected.

A rate of mortality cannot be measured exactly. In comparing estimates of mortality before and after regulation, it is therefore possible only to measure the likelihood that they do not differ by more than a given amount. The statistical error of estimates of Georges Bank haddock mortality are such that we are unlikely to be able to reach the conclusion that it has probably not changed, and that the expected benefit from regulation has been realized. It may, however, be possible to prove that if the mortality has changed at all, at least it has not changed sufficiently to nullify the benefit, due allowance being made for the improved size of fish at each age.

Assessments of long term effects, both direct and indirect, of changes in mesh size depend on how much an observed mortality is caused by fishing and how much by natural causes. The ability to distinguish between these causes, and hence to make predictions and to verify them, often depends rather heavily on the existence of variations from time to time in the amount of fishing with a given mesh size. Ways of resolving the difficulties which arise when such variations are small were discussed.

Recommendations:

1. The growth rate of Georges Bank haddock should be calculated for each calendar year before and after regulation for which adequate data are available.
2. It is again stressed that information on the species, quantities and sizes of fish discarded at sea is essential both for valid prediction, and for verification of the effects of mesh regulation. This can be obtained by sending observers to sea on commercial vessels. Countries should also be ready to send observers when, as in the case of the Georges Bank haddock, it is expected that discarding may again increase through recruitment of a large year class.

Countries are urged to make available essential data for compositions of catches and discards by all fleets fishing the regulated stocks.

3. An attempt should be made to test whether mortality of Georges Bank haddock from natural causes could have increased, following regulation, sufficiently to nullify the expected benefit. Studies should continue on the basic methods of predicting and verifying the effects of regulations.
4. Canadian scientists should study the merits of Subarea 4 as an area in which to verify predicted benefits of future regulations.
5. Studies should be continued on scientific aspects of the theoretical possibilities of controlled changes in the mesh size used by a part of the fleet in case their application becomes necessary at some future time for the estimation of mortality rates.

(4) Gear Selectivity (Appendix VIII, XIV)

Gear selection matters have always occupied much of the attention of the Commission. Progress in recent years has been good, but important gaps in knowledge remain.

Satisfactory progress on urgent problems has been made in the past year. Results on selection by hooks, traps and trawls were reported by Canada. Portugal is also conducting research on selection by hooks. Studies of chafing gear by Canada, Norway and the United Kingdom are giving promising results. The following additional work is proposed for the coming year: studies of scallop gear selectivity by Canada and/or the United States, and of chafing gear effects by the United Kingdom and Canada; preparation of a Gear Selectivity Manual by FAO, and of a report on problems of net certification by the United States.

Specific recommendations for priority research projects are:

1. chafing gear investigation, with particular reference to:

- (a) the effects of chafing gears of various widths;
 - (b) the effect of chafing gears of various mesh sizes;
 - (c) the development of improved types of chafing gear; and
 - (d) the results of experiments with covers outside the chafing gear in comparison with results obtained by other means, such as by parallel or alternative hauls.
2. further investigations of the selectivity of large-ring scallop gear.

The following items are brought to the attention of the Commission.

- 1. Selectivity results from one area are not always applicable to another. This is of particular importance in considering extension of existing mesh regulations.
- 2. Information needed on gear selectivity might best be obtained by placing observers aboard various trawlers fishing the same grounds in order to determine the size composition of catches.

(5) Sea Scallops (Appendix V)

The data now available give precise estimates of growth rate and approximate estimates of natural and fishing mortality rates in Subdivision 5Z. On this basis it is predicted that a delay in the age at first capture is likely to increase the yield. The data available do not yet permit a precise prediction of the amount of benefit that would result from any given increase in mesh size. It is believed that data collected during the coming year will substantially improve the precision of prediction. It was recommended that:

- 1. the United States and Canada consider experimental fishing with larger rings during the coming year. This should permit early implementation of any regulation that further studies show to be desirable.
- 2. tagging experiments and research vessel sampling should be carried out immediately after, as well as before, any mesh regulation is implemented. Such a program seems to be the best method for providing comparable pre- and post-regulation mortality estimates.

(6) Halibut (Appendix IV)

The problems of the halibut fisheries have been apparent for some years. Following discussion of these it was recommended that:

- 1. a bibliography of extant papers and reports on halibut be assembled.
- 2. tagging and collection of biological information be continued.

(7) Research Requirements for Subarea 1 (Appendix VI)

Southerly withdrawal of cod from the most northerly region of Greenland and its replacement by Arctic species has been reported. To keep in touch with these important changes there is need for a fuller seasonal coverage of environmental factors.

Falling yields per unit effort have been experienced over the past four years. Observations of such changes in an important fishery raised the question of the need for a panel of scientific advisers to Panel 1.

Several reports described research in the sea areas of East Greenland which contain related fish stocks.

The following recommendations were therefore made:

1. Environmental studies should be expanded in Subarea 1 during all practicable seasons.
2. A panel of scientists should be appointed to review and advise on the status of the fisheries in the subarea.
3. Research reports for east Greenland should continue to be submitted. They could include statistical data on the fishing in the area.

(8) Redfish Symposium (Appendix I)

In view of the relatively small number of contributions expected - between 40 and 45 - it was recommended that:

1. papers could be accepted up to August 1st for duplication by the Secretariat.
2. all material would be discussed, under the topic headings, by the full meeting of specialists.
3. the edited papers and proceedings should be printed in Copenhagen as an ICNAF Special Publication, in a form to be decided at the Symposium.

(9) Marking Symposium (Appendix II)

Publicity material submitted was reviewed and a digest prepared. A display was arranged to facilitate interchange of that material after the meeting.

Arrangements for the Symposium were discussed and it was recommended that:

1. the geographical scope be restricted to the marine environment.

2. the subjects to be considered should be the theory of experiments for purposes other than qualitative migration studies; liberation and retrieval programs; evaluation of results; types of mark (including natural marks); techniques of marking; conditions of marking, and the relations of the above to the results obtained.
3. Four days should be spent in the presentation of material, leaving one day for demonstrations of marking methods at sea.
4. The proceedings of the Symposium be published by the Commission as a Special Publication.

In a later session of the whole Committee, these arrangements were revised (see Section IV, 1, p. 42).

(10) Cod Otolith Exchange Program (Appendix III)

Analysis of the results showed a high degree of comparability between estimates by participating countries. Where differences occurred, they were related to differences in interpretation of structural details. Our knowledge of the internal and external factors affecting otolith structure is restricted, and field studies, experimental work in tanks and marking are required to advance this knowledge. Attention was again directed to the valuable contribution made to stock assessment and prediction by the use of otolith spawning zones. It is recommended that:

1. age readers be given opportunity to meet when preparatory work has been done. They should also be given sufficient time to study the age reading techniques used by different countries and to discuss the introduction of a standard terminology and symbol system. More attention should be paid to the use of spawning zones.
2. the Secretariat request from the institutes in member countries data on otolith terminology and symbols and photographs of otoliths and scales with interpretations. This material should be distributed as soon as possible to age readers concerned, and treated at the proposed meeting of otolith specialists.
3. the Secretariat and otolith specialists take advantage of other fisheries meetings in North America and Europe for informal discussions on age reading methods.

(11) Environmental Studies (Appendix IX)

On many previous occasions the Committee has urged that research on oceanography and plankton and their effects on fisheries be carried on throughout the Convention Area. This is necessary to determine the key factors of environment which influence the occurrence, abundance and habits of commercially important

Since conditions in the sea, i.e. the courses of currents, the temperature regime and the biological productivity, are continuously changing, it is necessary to study the sea environment to cover the whole of the area with a system of standard observations to understand the interaction of events in different parts of it.

The Committee explored ways in which a beginning can be made towards achieving comprehensive coverage. It is recommended that:

1. programs of research vessels be exchanged and adjusted to avoid overlapping in space and time;
2. certain standard data be collected in a uniform manner;
3. instruments for continuous recording of sea surface temperatures and the frequent sampling of the surface water be installed on non-research vessels and that a pilot study to gain experience on the use of Hardy plankton recorders be started;
4. to accomplish these objectives, each country appoint a scientist working in environmental research to correspond with the 1960 chairman of the Subcommittee on Environmental Research, Dr. L.A. Walford.
5. a preliminary research vessel planning meeting be held at Copenhagen in October under the chairmanship of Dr. Ruivo.

The Subcommittee further recommended that a study be made of the operation of the ICES hydrographic data centre, that the labour required to prepare and send data to such a centre be estimated, and that a special planning session of hydrographic and plankton specialists be scheduled for the 1960 Annual Meeting.

(12) Publications (Appendix XII)

Each year the complete report of the Committee on Research and Statistics and its appendices, shall be made available as a "Red Book" for use at meetings.

Publication of the Proceedings of the meeting shall be determined by an Editorial Board to be made up of the Chairman of the Research and Statistics Committee, who will be the Editor, with assistance as described in the report.

Member countries are requested to supply the Commission with two copies of all papers relating to research in the Convention Area, with a third copy to be sent direct to Biology Branch of FAO, Fisheries Division.

In response to many needs, careful consideration shall be given at the meeting in 1960 to the possibility of the Commission establishing a Journal or Bulletin for publication of relevant papers.

III

As decided last year, an interim report was presented by the Chairman of the Committee to a Special meeting of Commissioners. This opportunity was taken to inform the Commissioners of the scope of the work undertaken by the ad hoc Subcommittees and the general policy adopted. In this way it was hoped to facilitate collaboration in planning and adjusting research programmes to the needs of the Commission between those primarily responsible for administration and management and the scientists carrying out the research.

The Commissioners' reception of the report was both encouraging and stimulating. In particular their appreciation of problems raised by lack of research staff for work in the Commission Area was noted. Their ready acceptance of the proposal to give more emphasis to environmental studies in the work of the Commission as a necessary step towards conservation was appreciated.

The discussion which followed led the Chairman of the Commission to ask the Committee on Research and Statistics to consider three ways of extending regulation in the Convention Area while simplifying their enforcement. These were the introduction of:

1. minimum mesh sizes in the remaining Subareas (1 and 2).
2. a uniform minimum mesh size for the whole Convention Area, and,
3. a uniform minimum mesh size for the whole of the North Atlantic.

It was stressed that a uniform mesh size should not be introduced for simplification of control unless the results of research showed that benefits would accrue to the stocks and the fishermen.

In addition to these priority tasks, the Committee on Research and Statistics was asked to explore other conservation measures, such as minimum size limits of fish, closed areas and closed seasons.

These matters were discussed in an ad hoc Subcommittee on Fishery Assessment in Relation to Regulation Problems appointed for this purpose and composed of Messrs. Lucas (Chairman), Hansen, Holt, Martin, Marti, McHugh, Rollesen and Ruivo. This Subcommittee met three times on June 1, 2 and 3, and submitted a report (Appendix XIII).

After discussion in full committee, it was agreed that the report be adopted in toto, as set out below. In brief, the groups of scientists concerned would be commissioned to consider -

the immediate and long-term effects of mesh sizes from 4 inches to 6 inches on the various fisheries for cod, haddock, redfish, and, wherever possible, other groundfish species, in the ICNAF area.

It was agreed that the Chairman has full authority to take any necessary decisions regarding this project. He then nominated Mr. Rollefsen for the task of drafting the poster mentioned at the end of this special report. Other Commission scientists would be called upon to help in this task when required.

IV

Other matters dealt with in Committee at the latter part of its sittings were:

1. Priority of work:

In view of the extra tasks allotted to the Committee it was decided that the scope of the Tagging Symposium in Bergen would be restricted to the field work planned for the demonstration of techniques, but that papers and data would not be discussed until the following Annual Meeting, i. e. in 1961. Dir. Rollefsen will arrange the details of this demonstration and call upon the scientists participating to provide the necessary material.

2. Redfish Selection and Chafing Gear in Relation to Fishery Assessment Problems:

The report of an ad hoc Subcommittee, set up to review this matter is attached as Appendix XIV.

3. FAO's Letter Concerning Nylon Gill Nets:

A discussion of this request for collaboration led to the recommendation that the Secretariat solicit information from all member countries. Information from areas outside the Convention Area would also be welcome.

4. Reports of Scientific Advisers to Panels:

The Chairman of Advisers to Panels 2 and 3 (Dr. Templeman) and to Panels 4 and 5 (Dr. Hart) commented upon their reports. As all the points raised in them had been covered in the ad hoc Subcommittee's discussions no further research was requested. (See Proceedings Nos. 6, 9 and 7.)

The proposal that Mr. Sidney Holt attend the December meetings of Panels 4 and 5 was strongly supported by the Committee.

5. Appointment of Chairman of ad hoc Subcommittee on Environmental Studies

It was agreed that the first task of the newly elected Chairman of the Committee should be to appoint the Chairman of the ad hoc Subcommittee before the meeting was concluded.

6. Participation of Dr. Julius Phillips in Redfish Symposium

It was agreed that Dr. Phillips' knowledge and experience of the related Pacific species would be invaluable to the elucidation of the redfish problems in the North Atlantic. The Committee, therefore, asked the Secretariat to invite Dr. Phillips to attend the Symposium in Copenhagen.

7. Extension of Mr. Keir's European Travel

The Committee agreed that it would be of value to the Redfish Symposium if the Biologist-Statistician's European travel, in connection with the statistical meeting in Edinburgh at the end of September, could be adjusted so that he could be in Denmark in time for the Redfish Symposium.

V

Special Meetings

Talks by Mr. R. I. Jackson, Executive Secretary of the International North Pacific Fisheries Commission, on the structure and operation of the Commission; by Dr. A. W. H. Needler, Director of the Biological Station, Fisheries Research Board of Canada, Nanaimo, on the salmon stocks of the North Pacific; a film by Dr. Paul Hansen of the Greenland Fishery Investigations, Copenhagen and a talk by Mr. John Corlett of the Fisheries Laboratory, Lowestoft, on "Environmental Studies of the Barents Sea Cod Fishery", enlivened and stimulated the Committee's evening sessions. The institution of these specialist talks, begun last year, has proved extremely valuable and they will be continued at the next Annual Meeting.

VI

The continuing and sustaining help of the Food and Agricultural Organization of the United Nations is gratefully acknowledged yet again. Mr. Sidney Holt's participation during all the scientific meetings has been invaluable and the thanks of the entire Committee are extended to him for his great and varied help and wise counsel.

VII

The next meeting of the Committee on Research and Statistics will begin on 23rd May, 1960, i.e. on the Monday of the week preceding the Tenth Annual Meeting.

Dr. Mario Ruivo was unanimously re-elected Chairman.

Report of the ad hoc Subcommittee on the Redfish Symposium

Participants: Lundbeck (Chairman), Graham, Hansen, Jean, Jonsson, Kelly, McHugh, Norris, Rollefson, Templeman and Trout (Rapporteur). The Executive Secretary also attended.

The three main topics for discussion were (1) the format of the Symposium, due to take place from October 12th-16th, inclusive, (2) duplication of contributions and (3) final publication.

1. Owing to certain necessary changes of leaders of discussion groups the present arrangements are as follows:-

Systematic studies:	- Dr. Mead
Distribution problems:	- Dr. Templeman
Sex and maturity in relation to distribution and migration	- Dr. Magnusson
Hydrography and redfish distribution:	- Dr. Dietrich
Larval studies:	- Dr. Einarsson
Natural marks for racial and migration studies:	- Dr. Sinderman
Age determination:	- Dir. Rollefson
Bibliography	- Mr. Trout

It was appreciated that overlap of topics was inevitable in some papers.

The bibliography was discussed and its method of compilation was agreed.

~~Subject groupings will be used rather than annotation.~~

A review of the number of papers likely to be submitted showed that between 40 and 45 were in course of preparation. In view of this relatively small number it was decided that all papers would be presented to the full meeting.

Facilities required for handling and viewing specimens and sample otoliths were discussed and arranged.

2. Dr. Poulsen offered the services of the ICNAF Secretariat to European contributors who required duplication of papers after the end of June. Furthermore, he agreed that redfish papers could be accepted up to August 1st, compared with the previous deadline of July 1st. This extension was greatly appreciated. Papers completed after August 1st should be duplicated by the contributors.

3. Discussion on the final publication of papers and proceedings of the Symposium led to the recommendation that the edited work be printed in Copenhagen, where costs were known to be lower than those current in Halifax. It was anticipated

APPENDIX IIReport of the ad hoc Subcommittee on Marking Symposium

Participants: McCracken (Chairman), Clark, Fleming, Hodder, Holt, Kelly, Lundbeck, Marcotte, Martin, Poulsen, Rollefson, Ruivo, Trout, Wise (Rapporteur).

Observers: Jackson, INPFC; Saalfeld, Great Lakes Fisheries Commission.

The subcommittee met to consider material pertaining to marking publicity which had been submitted to the Chairman and to the Commission, and to plan for the Fish Marking Symposium to be held in conjunction with the next Annual Meeting in Europe.

1. The chairman drew to the attention of the members recommendations on page 16 of the Recommendations of the Committee on Research and Statistics during the 1958 Annual Meeting (the "Red Book"). In addition he pointed out that the submission of material on publicity as outlined in these recommendations has been completed by several countries. A digest of this material together with appendices, consisting of the reports from the countries, is contained in Document 39 of the 1959 Annual Meeting; a summary of this document is included in this publication (p.22).

A request for corrections or additions to this document elicited a few corrections and additional items.

In particular, Norway has instituted a system of augmented rewards. This is described in greater detail in an appendix to Document 39. The UK has adopted a chart-letter showing locations of tagging and recapture similar to that now in use by the US and also adopted by Canada.

The exhibits of posters, etc., submitted with the reports from the various countries were circulated and it was decided that the best way to present this material to the Committee on Research and Statistics would be to make a display in the meeting rooms. Each item in this display will be identified with the name and address of a scientist and/or laboratory where samples may be obtained.

Some consideration was given to the standard ICNAF tagging poster designed several years ago, and it was agreed that experience now shows that such a standard poster is no longer sufficient. This poster has been of great use in the past and has served as a working model for many posters now used, but most biologists now feel that specially designed posters are often needed for separate experiments.

Methods of radio publicity were discussed and most countries reported that they used radio publicity on "Fisherman's Hour" broadcasts or along with weather forecasting.

The subcommittee agreed that the discussion, begun at the last Annual Meeting, has been eminently worthwhile and that the material submitted on publicity will

be extremely useful to the Commission's biologists in handling such problems in their tagging experiments. It was recommended that the chairman, with the assistance of the rapporteur, summarize the material now contained in Document No.39, along with additions and suggestions arising from this meeting, as a paper for the forthcoming symposium.

2. In considering the forthcoming symposium the subcommittee noted with regret that Mr. Trout will be unable to serve as chairman but that the Commission is fortunate indeed in securing Mr. Ray Beverton to fill this important job.

The terms of reference of the symposium were reviewed. Attention was directed to the fact that the symposium is primarily to assess design of experiments, marking techniques and results. Papers on migration per se should not be considered.

In reviewing the draft agenda contained in the "Red Book" it was agreed that very few papers will fit into any one of the categories when defined in their strictest sense. The consensus was that the sessions should be arranged so that there is no overlap and that all participants will be able to attend all sessions. The discussion leaders will solicit papers with this in mind and papers will be submitted in duplicate to the appropriate discussion leader(s) and to the chairman.

A tentative schedule for the symposium is for the five days following the next Annual Meeting in Europe, four days for the presentation of papers and one day to be spent at sea in demonstration of tagging methods.

April 1, 1960 is the deadline for the submission of papers to be duplicated by ICNAF for circulation at or preceding the symposium. Participants submitting papers to the chairman after this date should arrange for duplication.

3. The subcommittee recommends that the proceedings of the marking symposium be published by the Commission in its special publication series.
4. The chairman appointed a small drafting committee consisting of himself, Holt, Rollefson, Trout, and Wise to prepare a preliminary version of a statement of the aims and purposes of the symposium for Mr. Beverton's guidance. This committee prepared the following statement which has been approved by the members of the subcommittee:

"Marking is a research technique used widely throughout the ICNAF area. In the course of the development of the technique a number of different types of tags and marking methods have been applied, together with the use of biological marks. The Research and Statistics Committee has agreed that the stage has been reached for a collective assessment of the marking methods used in the ICNAF area and of the experience of workers elsewhere.

"It is proposed that ~~the~~ geographical scope of the symposium for this collective assessment be generally restricted to the marine environment of the North Atlantic. The subjects to be considered should be the theory of experiments for purposes other than qualitative migration studies, liberation and retrieval programs, evaluation of results, types of mark (including natural marks), techniques of tagging, conditions of tagging, and the relations of the above to the results obtained."

These considerations should be borne in mind when discussion leaders for the symposium solicit papers (see p.17, the 'Red Book' for the 1958 Meeting).

N.B. [In a later session of the whole committee, the planning of the Marking Symposium was revised, see Section IV, 1, p.42].

Report of the ad hoc Subcommittee on the ICNAF Cod Otolith Exchange Program

The group met on 27th May with the following persons in attendance:

Rollefsen (Chairman), Clark, Dickie, Fleming, Hansen, Jean, Jonsson, Kelly, Keir, Lundbeck, Marcotte, Martin, Ruiivo, Trout, Wise.

1. The exchange of otolith samples has been carried out according to the program, and the Secretariat has tabulated the different age readers' estimates so the results can be compared. The tables show that the estimates to a very high degree are in accordance, and it is permitted to draw the conclusion that age estimates made by the countries concerned can be directly compared. (See Documents No. 37 and 38)
2. In general we have for many years accepted otoliths, and scales, as certificates echoing the normal annual changes in the life of the fish caused by normal external influences (light, depth, temperature, food, etc.) and internal influences (hormones affecting the metabolism, etc.).
3. There are, however, differences in the zone pattern which may differ from area to area and from one population to another and also from one fish to another. Some of these differences can be used for the definition of stocks, others can be used as a means of locating the area in which the fish have spent periods of their life. Our knowledge in this field is, however, very restricted.
4. There are also other irregularities in the zone pattern which require study. Some of them may be due to special or abnormal influences such as "narrow escapes" with or without damage to the body - parasites, bacteria or due to abnormal functions of the tissue responsible for the growth of otoliths and scales. On this point our knowledge is nil.
5. Correct age estimates and correct interpretation of the zone pattern and its variances are fundamental for stock assessments and calculations of yield.
6. The working group points out three ways to improve and facilitate the interpretation of the variances in the zone pattern of cod otoliths.
 - a) Field studies, e.g., by sampling the youngest year group throughout a year.
 - b) Experiments in connection with tagging of cod - and with cod kept in tanks where certain conditions can be introduced and controlled.
 - c) Improving and standardizing techniques - introduction of a standard terminology, and a symbol system which could describe certain characters of the zone pattern.

7. The group gave special attention to the appearance of so-called "spawning zones" in the cod otolith. The onset of maturity is followed by a characteristic change in the zone pattern so that it is possible to determine from an otolith the age at first spawning, and the number of spawnings performed. Such data are of the greatest value for recruitment - mortality - and growth studies. Determination of spawning zones is undertaken by Denmark, Germany, Iceland, Norway and Portugal but has up to now only been used by Iceland and Norway for stock assessment and stock prediction. The method can possibly be of value for other areas.
8. The group recommends:
- a) That age readers should be given opportunity to meet when preparatory work has been done and be given sufficient time to study the age reading techniques used by different countries, to discuss the introduction of a standard terminology and symbol system. The possibility of using spawning zones as a means for stock assessment, and stock prediction, should be given attention.
 - b) That the Secretariat should approach the proper institutes in ICNAF member countries and request data on otolith terminology and symbols, and photographs of otoliths and scales with interpretations. This material should be distributed as soon as possible to age readers concerned, and treated at the proposed meeting of otolith specialists.
 - c) That ICNAF Secretariat and otolith specialists should take advantage of other fisheries meetings in North America and Europe for informal discussions on age reading methods.

Addendum

Guide for the Secretariat in the Collection of Data on Age Reading

1. Name of Institutes using age denomination on scales and otoliths.
2. Name of persons responsible for age estimates.

Questionnaire Techniques

1. How are otoliths sampled? What data are collected (length, sex, etc.)?
2. In which way are they removed from the fish head? How are they preserved?
3. How are they treated before reading?
4. If they are not read whole, how are they cut or broken?
5. What kind of binoculars or microscopes are used?
6. How is the broken surface treated before reading?
7. How is the otolith fixed on the microscope table?
8. Is the otolith read submerged or in air?
9. What light source is used?

11. How is the light beam directed and on what part of the otolith?
12. What magnification is used (objectives, oculars)?
13. When counting the zones, is the hyaline or the opaque zone used, and along which axis or direction?
14. Are special devices used to facilitate the reading?
15. Is staining or sectioning used?
16. Are scales and otoliths from the same individuals compared? How are otoliths stored? (envelopes, boxes or special devices when collected by one person).

Interpretations

1. Are otoliths used for definition of stocks?
2. Can otolith types be defined?
3. What features are used for segregation of otolith types?
4. Can special types of zones be defined?
5. What features are used to define special zones?

Terminology

1. Are special expressions used to point out characteristics of certain parts of the otolith or certain features of patterns of the zones?

- Definitions of
- (1) Check ring
 - (2) Nucleus
 - (3) Intermediate zone
 - (4) Secondary zone
 - (5) Opaque edge
 - (6) Hyaline edge
 - (7) Spawning marks
 - (8) Certain, uncertain, unreadable otoliths.

Symbols

1. When otoliths are read and data tabulated, are certain symbols used to characterize certain features?

APPENDIX IVReport of the ad hoc Subcommittee on Halibut

Participants: Hansen (Chairman), Hodder, Marcotte, McCracken, Rollefson, Wise (Rapporteur).

This subcommittee met on the morning of May 26 to discuss the Commission's requirements with regard to halibut. The meeting opened with a brief review by the chairman on our present knowledge of halibut biology.

The members reported for their countries on the collections of data now going on. The only nations doing work directed at halibut are Denmark (see Document 28) and Norway, which has a continuing program for collection of biological information in the West Greenland and Newfoundland areas. Norway has tagged considerable numbers of halibut in these areas and will continue the program this year; most other countries reporting are tagging halibut incidentally with other programs.

The subcommittee recommends:

1. That the Secretariat request biologists of all member nations to send to Dr. McCracken any lists now available and any pertinent reprints so that he may assemble a bibliography on halibut for inclusion in the documents of the next annual meeting.

2. That the nations now tagging halibut be commended for this work and that insofar as possible the other member nations institute such programs. This seems particularly feasible where there are observers on otter trawlers fishing primarily for salt fish.

3. That routine collections of biological information as suggested on page 56 of the review of recommendations of the 1956 and 1958 annual meetings (the "Red Book") be continued, particularly where observers are sent to sea on commercial vessels.

4. That information be collected for determination of growth rates. To facilitate this, the biologist-statistician should initiate an otolith exchange program, with interested laboratories sending in a sample of 10 otoliths complete with the usual associated data. (Dr. Rollefson emphasized the need for careful preparation of the otoliths and will make available information on the method that he has found most useful.)

5. That statistics of the halibut fishery be improved insofar as possible and that data be collected on discard of both small and large halibut.

Report of the Ad Hoc Subcommittee on Sea Scallop Research in Subdivision 5Z

Participants: Dickie (Chairman), Brackett, Eckles, Graham, Hart, Holt, Keir, McHugh, Martin, Norris, Posgay (Rapporteur) and Squires.

The Subcommittee reviewed Documents 10 and 17, 1959 Annual Meeting, and other data presented by Canadian and United States scientists.

1. United States studies on growth rates and natural mortality rates were reviewed. Precise measures of growth rate are now available. There is also sufficient information on differences in growth rate throughout the geographical range of the species to permit limits to be placed on the variation in growth from place to place and from year to year within Subdivision 5Z. Results to date indicate that natural mortality is sufficiently low relative to growth rate in and above the selection range of the gear and the fishing mortality is sufficiently high to confirm the conclusion of the 1958 subcommittee on sea scallop research that some delay in age at first capture is likely to lead to an increase in yield from the present amount of fishing.
2. The mean size of culling by the sea scallop fishery is considerably above 70 mm, the mean size at first capture by the 3-inch ring now used. The United States fleet culls at about 85 mm and the Canadian fleet at between 95 and 100 mm, approximately equivalent to the mean size at first capture by 3 1/2 and 4 inch rings respectively. Mortality among discards in Subdivision 5Z appears, however, to be negligible so that increasing the mesh just enough to eliminate discarding will not in itself produce an increase in yield. That is, unless there should be an increase in gear efficiency with ring size, a mesh regulation could increase yield only if it increased the size at first capture to beyond the cull size.

To study effects of increases in ring size on efficiency and to permit early implementation of any relatively large changes in ring size if further studies show them to be desirable, the subcommittee recommended to the United States and Canada that they give consideration to experimental fishing with larger rings during the coming year. Representatives of both countries agreed to begin such tests as soon as they can be worked into current research programs.

3. Since precise measures of growth rate are available, reliability of the estimate of benefit depends only on the accuracy of measurements of natural and fishing mortalities in the fished stock. Estimates of natural mortality have been based on the ratio of living scallops to empty shells in catches (i. e. those having the two valves of the shell still joined by the hinge ligament), together with results of tank experiments which give estimates of the rate of separation of the valves of empty shells. These estimates might profitably be checked by calculating the ratio of living scallops to empty shells and to the separated valves returned from past tagging experiments, or by special tagging experiments in which some of the tagged scallops would be killed at the

The order of magnitude of the fishing mortality has been provisionally estimated from tag returns and fishing effort in one unit area. The estimate obtained is believed to be a minimum one for the unit area. Application of this estimate to the average fishing effort in the 25 most intensely fished unit areas gives an instantaneous fishing mortality of about 0.3. If the estimate is applied only to the 13 most intensely fished unit areas, it gives a fishing mortality value of about 0.4. These values can be refined by further detailed study of the returns from the first tagging experiment and by analysis of another experiment which was begun in 1958 in seven unit areas. Returns from this latter experiment are not yet sufficient to give reliable estimates. United States scientists will report next year on the further analysis of all these experiments.

It may be possible to obtain estimates of total mortality from other sources, in particular from the length composition of commercial and research catches. Such additional information will be used to check estimates of parameters derived from the tagging experiments. Present statistics of commercial catches and landings per unit of effort cannot give estimates of mortality rates as good as those from tag returns and research vessel samples.

It is confidently expected that the analysis of past data and those to be collected during the coming year will lead to a more precise prediction of the benefit from a mesh regulation for this fishery.

4. Estimates of pre-regulation growth and mortality rates are based on the results of tagging experiments and research vessel sampling. But assessment of the effect of a mesh regulation depends on measuring any changes which occur in these rates, therefore, similar tagging and research vessel sampling should be carried out after the implementation of a mesh regulation if we are to assess its effect. The United States and Canadian representatives agreed to examine the administrative practicability of this method of assessing the effects of any proposed regulation.
5. The 1958 report on sea scallop research (REPORT OF THE STANDING COMMITTEE ON RESEARCH & STATISTICS 1958, APPENDIX III) stated: "This fishery offers an unusual opportunity for collecting data on parameters required to demonstrate the need for and to test the effect of any regulation, provided sufficient effort is put into preliminary research". The scientific program has taken advantage of this opportunity by carrying out the tagging and sampling programs and the results tend to substantiate this earlier statement. The subcommittee felt, however, that it is too early to state categorically that data collected on the sea scallop fishery will be precise enough for it to recommend that the study will serve as a definite test of prediction of benefit and of the reactions of the stock to changes in fishing.

Report of the Ad Hoc Subcommittee on Research Requirements for Subarea 1

Participants: Hansen (Chairman), Almeida, Jonsson, Lundbeck, Poulsen, Rollefson, Ruivo, Trout.

1. Paul Hansen reported a number of observations of changes in the marine fauna of West Greenland waters, indicating a southern movement of Arctic species; he also reported for the last year a reduction of the size of the cod stock in the most northern region of Subdivision 1A. These observations suggest a reversion towards the climatic conditions prevailing before the recent warmer period. A comparison of the variations in age distribution of cod in the three periods 1930-40, 1940-50 and 1950-58 also suggested a reversion during recent years to the conditions of the 1930-40 period.

The other participants commented on the observations and it was agreed that the problem should be studied closely, and in connection with hydrographic researches.

2. The need for the establishment of a group of scientific advisers to Panel 1 was considered and it was unanimously agreed to recommend that such a group be appointed by the Panel.
3. It was noted that investigations in waters off East Greenland were dealt with in the research reports from Denmark, Germany and Iceland. It was the consensus of the subcommittee that the research results from the East Greenland area were essential for a proper interpretation of the research results from Subarea 1. Therefore, it was recommended that researches carried out in East Greenland waters be included in the research reports of the member countries; further that statistical data on the fishing in East Greenland waters could be recorded in the research reports.
4. The hydrographic requirements were considered and it was agreed that more extensive research work was needed in fall, winter and spring. A section across the Labrador Sea, from Kap Farvel to Hamilton Inlet Bank would be of special interest.
5. Forecasting for fisheries - It was agreed that variations in the numbers of cod post-larvae (preferably based on surveys in July) offered possibilities of forecasting the strength of the corresponding year-classes in the commercial fishery. Surveys of the strength of the year-classes, as one or two year olds, offered even better possibilities for forecast.
- 4-5. Further consideration of the items 4 and 5 were postponed until after the report from the ad hoc subcommittee on Environmental Research had been made available.
6. It was noted that the problems related to the reading of otoliths for age and for age at first maturity were under consideration by the ad hoc subcommittee on Cod Otolith Exchange Program.

7. It was noted that research problems relevant to the halibut had been considered by the ad hoc subcommittee on Halibut Research.
8. Wolffish and other species - Otoliths of spotted wolffish were collected by Denmark and tagging had been carried out. Also tagging of Greenland shark, Greenland halibut and herring had been carried out. It was agreed that these researches should be continued.

Report of the ad hoc Subcommittee on Assessment of Mesh Regulation

1. Present were - Canada: Dickie, Fleming (Rapporteur), Holder, Jean, Martin, McCracken.
 France: (St. Pierre) Percier
 Portugal: Ruivo
 United States: Brackett, Clark, Graham (Chairman), Kelly, Norris, Posgay.
 Secretariat: Keir
 Great Lakes Fisheries Commission: Saalfeld
 FAO: Holt
2. The Subcommittee met first at 11:15 a.m. and continued at 2:30 p.m., May 26.
3. Last year in reporting on the Georges Bank haddock regulation, it was pointed out that "the 4 1/2 inch mesh was allowing the escape of small fish, precisely as had been expected on the basis of studies of selection of cod ends". It was then agreed that no further studies of this aspect of the regulations are required and that small mesh study boats were no longer necessary for validation of the selectivity of the 4 1/2-inch mesh.

Last year it was also reported that the landed fish of the 1952 year-class, the only large year-class to enter the fishery since regulation, are larger at age than fish of previous year-classes.

The subcommittee of last year was not completely satisfied that the larger sizes were not the result of increased growth rate of the 1952 year-class. Subsequently, Taylor and Stoddard (Document No.3, Appendix III, this publication p.16) at the December meeting of Scientific Advisers to Panel 5, compared back calculated sizes of haddock collected in 1958 from different areas to average growth of year-classes 1931 to 1947. This study showed an increase in growth rates of 1 to 2 centimeters since 1952 in one United States subdivision, almost no difference in another subdivision, and a slight decrease in two other subdivisions.

In a paper presented at the present meeting (Document No.5, this publication p.19), Taylor, Jensen and Stoddard demonstrate a definite increase in size at age of landed fish: one to five years of age for the 1952 to 1956 year-classes, as compared with the 1948 to 1951 year-classes. After comparing the back calculated sizes of the 1952 year-class with the average growth of the 1931 to 1947 year-classes, they conclude that observed variations in growth of the 1952 year-class on Georges Bank over the period 1953 to 1958 are not of sufficient magnitude to account for observed increases in weight at age of landed fish.

The Subcommittee discussed other methods that might be used in comparing growth rates. It was pointed out that growth rates could be compared by calendar years as

It is the opinion of the Subcommittee that the increase of weight at age of landed fish may well represent a benefit of the regulation. The effect may have been brought about by the larger mesh delaying the selective capture of the larger fish of a year-class.

4. As in past regulation years, the discarding of small haddock during 1958 has been almost non-existent. For this reason, the United States is not now sending observers to sea on commercial haddock vessels. Fishermen are bringing to port occasional baskets of discards for analysis. It was recognized that discards might increase when new, large year-classes enter the fishery. It was pointed out that this might occur next year, since the 1958 year-class promises to be substantial and is expected to be recruited in 1960. The United States is ready to send observers to sea to record the characteristics of discards as soon as this becomes a problem. The Subcommittee further stressed the need for discard information in other subareas.
5. The paper "Method for measuring benefits of the Georges Bank mesh regulation", Document No.3, Appendix V, was discussed with reference to the proposal for predicting benefit from mesh regulation contained in Document No.31, 1958 Annual Meeting. This approach suggests that in measuring the effects of a regulation, priority be given to demonstrating that there had been a change in fishing mortality rate in the sizes lying between the selection ranges of the pre-regulation and post-regulation nets, and that assessment of possible secondary effects, such as changes in growth rate and natural mortality rate, are the subject of a special study. Since the evaluation is a question not of measuring changes in yields "before and after" but relating yields obtained to those that would have been obtained in the same time if there had been no regulation, the problem is essentially one of deductive inference rather than experimental proof. Since it is in principle impossible to obtain exact estimates of population parameters of growth and mortality, it is not possible to demonstrate rigorously that these parameters are the same before and after regulation. However, if our data permit reasonably precise estimates of these parameters it may still be possible to demonstrate that no change has taken place which is in a direction and is of sufficient magnitude to nullify the predicted benefit from the mesh change. Work should continue on the development of theoretical models for evaluating regulation and for assessing future regulations.
6. In discussing how experience with the mesh regulation on Georges Bank can be applied to assessment of the effects of future regulations, need was found for the precision of estimation of direct effects or of growth and natural mortality proportional to the variation in fishing mortality during the study period. When there is no considerable change in the activity of the fishing fleet from time to time, the possibility of varying fishing mortality might be achieved by varying the mesh size of either the entire fleet or some significant part of it. The scientific aspects of these theoretical possibilities should continue to be studied in case their application should at some time become necessary.
7. For Subarea 4 (Gulf of St. Lawrence) Jean reviewed Document No.13, "Selection studies on Subdivision 4T Cod". Observations of the small dragger fishery for cod in the area showed that the mesh catching small cod (20-30 cm) was

Advancing mesh sizes in this area to 5 1/2 inches may result in considerable initial loss of commercial-sized fish. Since we do not have precise knowledge of growth rates, and mortality rates for this area, further study is required before consideration can be given to increasing mesh sizes.

8. For Subarea 4 (Scotian Shelf), McCracken reviewed Document No.20, "Sizes, Catches and Landings of Haddock by Canadian Otter Trawlers from Subdivisions 4V and 4W". This paper described the size distribution of haddock discarded as well as landed by Canadian vessels operating in this area. This information is augmented by records obtained by Canadian research vessels operating in the general area since the summer of 1958.

Since regulation, the discard has been greatly reduced. During the period 1951 to 1952 discard by weight was 40 to 60 percent; during 1958 it was 3 to 7 percent. This reduction is attributed to the increased size of mesh and to a somewhat lower cull point, due to an increased market for smaller fish. The present cull curve corresponds closely to the selection curve of the 4 1/2-inch net.

The summer fishery in this area depends heavily upon small fish. This summer fishery would be seriously affected if mesh size were further increased. As in the case of Gulf of St. Lawrence, our knowledge of growth and mortality rates of the haddock stocks in this area is insufficient to support a proposal for larger mesh size at this time.

9. The subcommittee raised the question whether Subarea 4 might not be as good an area for assessing benefit of future regulations as Subarea 5. It was agreed that Canada should give some thought to this matter.
10. Templeman reviewed the present status of the Canadian haddock fishery in Subarea 3. Round haddock as small as 30 centimeters are now being landed in Newfoundland. The main haddock fishery occurs in spring, when the haddock are concentrated by hydrographic conditions on the southwest slope of the Grand Bank (Subdivision 30). Discards have been quite low since regulation, due in part to the increase in mesh size, in part to the landing of small fish in the round, and because only relatively small numbers of younger fish have been available. The last strong year-class in the area was that of 1955. It was also reported that the 1949 year-class and subsequent year-classes have been relatively slow-growing.
11. Dr. Ruiivo reviewed Document No.24, "Portuguese research report", and was complimented by the subcommittee on the valuable contribution being made by Portugal's sampling program. The hope was expressed that upon their arrival, delegates from France and Spain could make available similar information.

APPENDIX VIIIReport of the Subcommittee on Gaps in Gear Selection

1. Participants: Clark (Chairman), Hodder, Lucas, Marcotte, McCracken, Ruivo, Trout, Templeman.
2. Meetings were held May 27th at 9:30 a.m. and May 28th, at 10 a.m. and 9:15 p.m.
3. Terms of reference were listed as follows:

Annual Proceedings, 1957-1958, p.13
 Red Book ("Selected Reports....") pp.9, 41-42, 52, 55, 65-67.

4. Reference material was listed as follows:

Annual Proceedings, 1957-58, pp. 83-98, 101-102.
 Red Book, pp. 40-43.
 Meeting Documents: No.2, 7, 12, 13, 14, 19, 21, 35.

5. The group considered adequacy of gear selection data in relation to existing mesh regulations for cod and haddock in Subareas 3, 4, and 5 and reached the following conclusions concerning the four gear types which take the majority of catches in these Subareas:

Otter Trawls: Sufficient data on cod end selection are available for cod and haddock.
 Hooks: Data at hand are not sufficient to appraise the selective action of hooks.
 Traps: Data at hand are insufficient to appraise the selective action of traps.
 Pair Trawls: Nothing is known of the selective effort of pair-trawls.

6. Progress was reported by Canada on tests of the selection of cod by No.14 Mustad hooks. The results are too limited to be conclusive but they suggest a 50% selection point at about 50 cm. This indicates that hooks presently used are taking even larger fish than 4 1/2-inch mesh trawls. Considerably more data are required, however, to permit an adequate understanding of hook selection. Portugal reported extensive hook selection experiments being carried out from a dory schooner. Number 14 1/2 Mustad hooks were compared with both smaller and larger sizes and an accurate record of bait sizes maintained. Since the experiments are still continuing results will be presented at the next Annual Meeting.

7. Canada reported new selection data for otter trawls which confirm previous results for cod in Subarea 4. Some results of German researches at Greenland (contribution No.27 to ICES, 1958) were reported. These gave higher selection factors than those reported for Subarea 4 (e.g. 3.7 for manila) but about the same as

differences in length/girth relation. The group agreed that such differences could be very important and concluded that:

Selection results from one area should not be applied directly to another one. Therefore regulation of meshes in any new area should be preceded by selection tests in that area.

Dr. Lucas mentioned that work in the Northeast Atlantic has shown that differences in speed of tow may have important effects upon escapement from otter trawls. A general discussion of otter trawl selection revealed that insufficient information is available to appraise the following important points -

- a) Selective effects of stern trawls relative to side trawls.
- b) The effects of very large catches upon escapement.
- c) Difference in selection by the nets of large and small trawlers.
- d) Effects on escapement of long extension pieces.
- e) Effects of novel types of trawl doors and other innovations on selective action of trawls (e.g. oval doors of Russian trawlers).

Dr. Ruivo suggested that needed information on selection might best be obtained by placing observers aboard various trawlers (fishing upon the same grounds) for the purpose of determining the size composition of the catch.

It was also suggested that much valuable information might be obtained from analysis of the sampling data for various gears which are submitted to ICNAF.

Mr. Hodder mentioned that selectivity experiments would be carried out during the coming year in Subarea 3 by the St. John's Laboratory. These will be mostly for haddock and will be concerned primarily with relative efficiencies of nets of different mesh sizes.

In a brief discussion of problems of selectivity related to sampling the group's attention was drawn to the fact that US experiments have shown considerable escapement of small haddock from the forward parts of trawls. It was pointed out that the rather low mortality indicated for young haddock on Georges Bank, in the pre-regulation period, as indicated by discard estimates, could result partially from escapement through forward parts of the trawl.

8. Encouraging progress in trap selection investigation was reported by Dr. Marcotte. Where traps are fished near the shore by Canadians in Subdivision 4S, primarily during June and July, considerably smaller cod are taken by the traps than

"back" of the trap but insufficient data have been obtained so far to provide for definite selection estimates. Further work on trap selection will be carried out in the coming year.

9. In considering the problem of mesh measuring the group's attention was drawn to Dr. v. Brandt's preliminary report Document No. 12 of a series of recent tests (requested by ICNAF at Lisbon meeting) in which the Scottish type gauge was shown to be superior to other gauges including the ICNAF type. Dr. Lucas mentioned that the Scottish type gauge is being modified to eliminate its two major disadvantages, i. e., binding of the sleeve and lack of a blocking device for pressure.

A new hydraulic gauge developed by the United States (requested by ICNAF at Lisbon meeting) was examined. This gauge appears to offer some advantages but consideration should be given to decreasing its weight and bulkiness. No information on price of "production" models was available but it is believed that because of its complicated nature the expense would be rather great.

It was concluded that further consideration of matters relating to mesh measuring should be deferred until detailed results of Dr. v. Brandt's tests are made available and the modified Scottish gauge can be examined.

10. Encouraging progress in preliminary chafing gear research was reported by Canada, Norway and the United Kingdom. The Canadian results (Doc. 21) showed that chafing gear of ICNAF specification did not reduce escapement of haddock from the codend. The results suggested that chafing gear of somewhat lesser width than 1 1/2 times that of the codend could be used without detrimental effect.

Norwegian results in the Northeast Atlantic have also indicated that ICNAF type chafing gear does not reduce escapement (Contr. No. 72 ICES 1958).

The United Kingdom tests gave the following results:

- a) A tightly fitting chafer considerably reduced escapement;
- b) A chafer of smaller mesh (95 mm) than the codend (105 mm) but attached loosely as in ICNAF specifications reduced escapement to about what would be expected for a 95 mm codend without chafer;
- c) A chafer made to ICNAF specifications appeared to reduce escapement somewhat;
- d) A chafer of larger mesh size (150 mm) than the codend (130 mm) attached in accord with ICNAF specifications did not reduce escapement.

The United Kingdom is planning further research to confirm these results and to investigate other aspects of chafing gear problems.

The group concluded that:

Insufficient evidence is available upon which to base suggestions for changes in chafing gear regulations but consideration should be given to

It was agreed that urgent priority should be given to chafing gear work in the coming year in respect to:

- (i) the effects of chafing gears of various widths;
- (ii) the effect of chafing gears of various mesh sizes;
- (iii) the development of improved types of chafing gear;
- (iv) the effects of experimental covers used outside the chafing gear.

The group wishes to point out that workers should, in their reports, detail all factors necessary to permit adequate evaluation of results of the various tests (e. g. , depth, level of catch, area, number of hauls, speed of tow, etc.). Furthermore, the reported differences in results suggest a need for standardization of methods for rigging topside chafing gears.

11. Mr. Holt discussed plans of FAO to produce a manual of Gear Selection Methodology as requested by the last Annual Meeting of ICNAF. This manual would deal with methods of studying the selectivity of all types of fishing gear but would be based largely on experience in the North Atlantic. It would be prepared with the help of consultants and would be intended primarily for the guidance of those just embarking on particular selectivity studies. It was hoped that a draft would be prepared in time for the 1960 ICNAF meeting.
12. The group's attention was drawn to recent advances in scallop studies which suggest that yield might be increased by increasing ring size in the dredges. It was recognized that there are gaps in selection information for scallop dredges. The matter was considered by the Subcommittee on Sea Scallop researches which recommended that experimental fishing studies using large mesh scallop gear be started in 1959/60.
13. The group's attention was drawn to the valuable experience that the United States has gained in its mesh certification program. It was concluded that preparation of a document on the subject by the US for presentation at a subsequent meeting would be of great value.

APPENDIX IXReport of the ad hoc Subcommittee on Environmental Research

Participants: Walford (Chairman), Corlett (Rapporteur), Eckles, Hansen, Hart, Jonsson, Lucas, Marcotte, Martin, McHugh, Rodriguez, Rollefson, Ruivo, Squires, Travin, Trout.

I. Exploratory Sessions

1. The Subcommittee changed its name from "Plankton and Hydrography" because it wished to emphasize that these are not unrelated subjects. Each of them concerns part of the environment in which fish live. Changes in the numbers of fish in any area from season to season, from year to year and from decade to decade, and changes in the sizes of fish caught depend not only on the amount of fishing, but also to a large and varying extent on the changes in the environment of the fish. We need to understand these changes and adjust our fishery to them. It is necessary to study the fish in relation to its environment, including the physical and chemical characteristics of the water in which it lives, the movement of that water by currents and tides, the food of the fish (and often the food of the food of the fish), and the other animals and plants of all sizes which occupy the same water mass as the fish. The key to understanding any particular change in a fishery may be found to be only one or two of the environmental factors, but the finding of the key may involve studies of many more factors to begin with.
2. The Subcommittee began its meeting by hearing reports from some of its members on the part environmental research has played in the study of fishery problems in several areas.
 - a) Corlett spoke of the work of the Arctic team of the Lowestoft Fisheries Laboratory and showed how environmental studies in the Barents Sea have helped in the understanding of the distribution of shoals of cod throughout the year and led to predictions of availability to the fishermen; and also how such studies have led to predictions of the size of the year-classes of cod at an early stage in their life history. The environmental studies began with measurement of temperature and salinity, the measurement of transport and the abundance of plankton, but led further on the one hand to a consideration of meteorology, and on the other to a study of the capelin which is an important fish food of cod.
 - b) Corlett also spoke of the work of Shelbourne at Lowestoft who has shown how the survival of plaice larvae in the southern North Sea depends on the abundance of suitable planktonic food. This work is leading to pilot scale experiments in fish farming.
 - c) Lucas described the Plankton Recorder survey carried out by the Scottish Marine Biological Association's Oceanographic Laboratory at Edinburgh, telling of its history and reporting some recent results. Limited at first to the North Sea it has developed into a survey of the Northeast Atlantic, with a recent extension towards the ICNAF area, thanks to the co-operation of Icelandic colleagues. One recent result showed that the relative importance of the two main herring fisheries in the northern

North Sea varied with the amount of mixed oceanic water flowing in from the north. The extent of the oceanic and mixed water could be detected most readily from the communities of plankton animals which they contained. This work was done in collaboration with the Aberdeen Fisheries Laboratory. Another recent result related the numbers of copepod Calanus caught on a recorder line across the North Sea to the size of the 3-year old herring in the southern North Sea, and he pointed out that this environmental relation was first observed in other plankton data by Cushing and Burd at Lowestoft. Yet a third example concerned the regular recording of redfish larvae in the waters of the west and south of Iceland. An extension is being made to Newfoundland in June to improve this service. The possible value to ICNAF of further extensions was briefly discussed.

d) Jonsson spoke about the relation between the distribution of herring shoals north of Iceland and the abundance of Calanus. Special vessels equipped with Asdic, map the distribution of Calanus, the temperature and the herring shoals. They broadcast this information to the fishing fleet at twelve-hour intervals. This service has greatly enhanced the production of the fishery. In addition, many fishermen have used plankton indicators for locating Calanus to shorten the time required to scout for herring.

e) Rollesen described how the position of the herring as they approach the Norwegian coast in winter to spawn is related to the main current systems and to the water temperature, and pointed out that special vessels keep the fishing fleet informed as to the position and speed of approaching spawning shoals.

f) Eckles described the California Co-operative Oceanic Fishery Investigations, which began as a consequence of the catastrophic decline in abundance of Pacific sardines in the mid-1940's. From 1948 to 1956 most spawning took place off Baja California, in the more southerly of two major spawning areas. Return of most of the spawning stock in 1957 to the more northerly area, off southern California, was associated with unusually high water temperatures along the coast. Plankton decreased considerably in 1957, principally through a large reduction in abundance of salps.

3. The discussion which followed these examples led the committee to the statement of several principles which should guide environmental research in relation to fisheries. These are:-

- a) Sudden changes in fisheries do occur and they cannot be explained after the event unless there is an adequate basis of environmental knowledge built up before the event.
- b) The most profitable method of attacking fishery environmental problems is the setting up of hypotheses based on present information.
- c) The quickest results will be obtained when workers with training in different sciences work together as a team testing these hypotheses.

- d) Such a team should consider the fish in relation to its environment and biology throughout its life history, including such matters as the identity of populations, behaviour, physiology, feeding, and the possibility of capture or escape from capture by man. Observations at all seasons of the year are necessary.
- e) The study of early development and survival are particularly important for the understanding of year-class variations and in these studies experimental work is particularly valuable.
- f) Environmental studies in fisheries laboratories should be directed towards the ability to predict both the availability of fish to the fishermen and the size of the stock.
- g) Unless sufficient effort is put into a program the program is not likely to be effective. The staff and ship time should be adequate and the working up of data should keep pace with the collection. (For example, the Arctic team at Lowestoft consists of four to six scientists and about as many assistants, and the "Ernest Holt" has made over 60 cruises to the Barents Sea in the last 10 years.)
- h) After some time of detailed study, short-cut methods of evaluation of the environment, (e.g., measurement of plankton by dry weight, observation of water transport at key seasons) may be adequate to answer particular problems. In this connection it may be feasible to transfer experience already gained on one side of the Atlantic to similar fish or fisheries on the other side.
- i) One must be prepared to wait several years for some studies to bear fruit and series of observations must be continued unbroken for several years to test some hypotheses. Only thus can we detect the long-term changes which happen in fisheries.

4. These principles led to a discussion of practical measures whereby we may increase the knowledge of the environment in the ICNAF area. It is essential to assess the environmental information now available and then to plan our work so as to maintain the record of essential data and to plan means of filling the most serious gaps. Among the things we will consider, on which we will report further in Part II of this statement, are the possibilities of co-ordinating the planning of research vessel programs to give the maximum seasonal coverage of environmental data, the collection of more systematic surface temperature information by the use of recording thermographs in selected ships such as research vessels, hospital ships and Ocean Weather ships, and the consideration of using Plankton Recorders to make a survey of plankton in the Western North Atlantic.

Other practical measures to be considered by the committee are standard methods of collecting, measuring and reporting plankton.

a) Studies on primary production in the sea were discussed. It was emphasized that the whole of the life in the sea is related to the basic productivity and that we cannot necessarily expect to find a simple relation between measurements of primary production and the measurements of stocks of commercial species of fish. Research on primary production may follow from environmental studies of the fish but it should not be the starting point of those studies.

5. In order to plan a co-operative environmental program in the ICNAF area it is necessary to know where are the main gaps in present knowledge and in present continuing observations. Walford reported on the review of the status of plankton research in the ICNAF area, which was assigned to him at the 1958 Annual Meeting. He is now engaged in assembling and annotating literature, and expects to have the review ready for the 1960 Meeting.

He also informed the Subcommittee that the research group with which he is associated is launching an analysis of all available oceanographic data for the years 1953 and 1954. These will include sea surface temperatures as recorded by commercial vessels, bathythermograph records and classical hydrographic data. The area to be covered extends from southern Florida to the Grand Banks inclusive.

6. Discussion on the availability of hydrographic data was stimulated by a letter from Lumby from the World Data Centre for the IGY (at Texas A. and M. College) asking for the views of the Committee on whether the Centre should become permanent. The Subcommittee recommended that if the centre does become permanent, hydrographic observations from the ICNAF area should be sent there, but they were not convinced that this would be the most useful service available for ICNAF scientists. They recommended further that Dr. Ruivo study the Hydrographic Service of ICES and report to the next annual meeting of the Committee on the usefulness of that service to biologists and hydrographers in the ICES area and of the possibility and desirability of ICNAF using the same service or setting up a similar one of its own.

7. The Subcommittee had a most useful discussion with Professor Dunbar on the proposed marine biogeographical journal for the North Atlantic which is being sponsored by the American Geographical Society. The Subcommittee agreed that this would be a valuable medium for the publication of knowledge of the environment in the ICNAF area, and will also show up the gaps in that knowledge.

8. On many occasions since the beginning of the Commission's existence, the Committee on Research and Statistics has shown that research on environment must be carried on along with that directed towards formulating and testing the effects of regulations. This is essential to assessing properly the natural causes of changes such as have affected fishery stocks in parts of the Convention Area in recent years - changes in abundance, distribution and the size of year broods.

9. In an area as large as ICNAF, research on environment, perhaps more than on any other phase of fishery science, requires collaboration of all countries and research institutions in planning and executing sea programs. This is necessary in order to minimize gaps, obviate duplication, insure the full use of vessels, and to take advantage of every possible facility for collecting pertinent data. Collaboration is

desirable also for processing the data so that they will be fully available for research purposes and not be wasted in storage files.

10. The Subcommittee regards it as unfortunate that so few countries were able to send to this meeting scientists experienced in fishery environmental research. This made it less easy to learn what information is available and what difficulties beset the member countries in undertaking environmental research. It also means that in some instances there is no appropriate scientist to return home with the benefit of contacts made at this meeting with other workers.
11. In order to bring together oceanographers and other scientists engaged in environmental research, and to stimulate work in this field, the Subcommittee recommends that a symposium on the sea environment in relation to fishery fluctuations in the ICNAF area be held in 1962.

II. Planning Sessions

Ships

12. The programs of research vessels should be scheduled so as to avoid overlapping of effort in space and time.
13. Even with the most careful co-ordination there will be large gaps, because the total research facilities are not adequate to cover the whole ICNAF area throughout the year.
14. The best way to fill these gaps is to take advantage of other ships that traverse the area, such as weather ships, hospital ships, passenger liners, freighters, and fishing boats. Since scientists are not on board these vessels, it is necessary to install simple recording instruments. Several kinds are available and are relatively cheap.

Instruments for Use on Non-Research Vessels

15. For continuous recording of sea surface temperature, recording thermographs are available. These cost about \$200.00.
16. For periodic collection of samples of sea water at the surface for salinity determinations an instrument referred to here as the Lowestoft water sampler, which was developed at the Lowestoft Fisheries Laboratory, can be installed in the intake system. The temperature can be taken at the same time with a thermometer. This apparatus costs about \$20.00.
17. The Hardy plankton recorder samples plankton continuously in the upper 10 meters. This instrument can be modified so that its course will undulate to deeper levels. Together with winch and towing wire, this instrument costs about \$1600.00.
18. The Hardy plankton indicator can be used to take small spot samples from fishing vessels. This costs about \$25.00.

The above prices are exclusive of installation costs.

Material and Data to be Collected

19. Research vessels should do the following things routinely:
- (a) Record sea surface temperatures continuously.
 - (b) Make standard hydrographic stations.
 - (c) In addition to any special plankton sampling that is carried on as part of the vessel's schedule program a vertical haul at each hydrographic station is desirable from the bottom on the continental shelf or from 500 meters beyond the shelf. This net should be made of number 6 gauze; it should have a one-half meter ring at its upper end, to which is attached a canvas reducing cone 140 cm long, whose mouth opening is 35 cm in diameter. The collection should be divided into two equal parts. One of these should be saved for laboratory studies, the other should be used for measurement of details of volume and for determination of dry weight.
20. Individual countries will always be required to make local studies to solve special problems. At times two or more countries having common interest in a problem will no doubt make arrangements for coordination. In any case special studies should include the agreed upon standard observations.

Reporting

21. Each country should send a listing of hydrographic stations occupied during the year, their times and the kinds of data that were collected.
22. For the next annual meeting a study should be made of the labour required within countries and at the Commission Secretariat, to send hydrographic data to a data centre.
23. At the 1960 meeting a special planning session of hydrographic and plankton experts should be included in the agenda of the Committee on Research and Statistics.
24. The member countries are asked to send to the Secretary the schedules and plans of their vessel operations in the ICNAF area for 1960, as these plans are determined. The Secretary will circulate these immediately to all countries.
25. Delegates who attend the 1959 ICES annual meeting at Copenhagen when the redfish symposium will be held, will hold a special conference under the Chairmanship of Dr. Ruivo, to discuss co-ordination of such plans as are known at that time. Any further coordination will be arranged by correspondence between the Chairman of the 1960 Subcommittee on Environmental Research and correspondents of other countries whom their delegates will designate and who will be referred to in this document as correspondents on Environmental Research.
26. The present chairman of this subcommittee is asked to prepare immediately a map showing lines traversed and points occupied by non-research vessels on which recording instruments could be placed. He will send this to the Secretary for duplication and circulation among the correspondents for Environmental Research.

27. Each member country is asked to install within the next twelve months recording thermographs and, if possible, Lowestoft or other kind of water samplers, on at least two vessels travelling along courses where surface temperatures are most likely to relate to conditions on ICNAF fishing grounds. The lines will be selected from the map referred to in paragraph 26 and arrangements will be made for servicing the instruments at terminal points of the selected vessels by exchange of letters between the 1960 Chairman of the Environmental Sub-committee and the correspondents on Environmental Research.
28. The subcommittee believes it worthwhile to explore the possibilities of developing a plankton recorder program similar to that carried on by the Oceanographic Laboratory at Edinburgh. The committee believes that such a program should begin on a modest scale and evolve by experience. In order to learn the kind of information recorders can yield in the western Atlantic when towed by commercial liners, and to learn the difficulties that must be encountered in arranging their installation, in servicing them, and in studying the collections, the group urges that two or three member countries undertake to install Hardy recorders on appropriate vessels. In this connection the subcommittee notes that the Edinburgh Oceanographic Laboratory is extending its program to Newfoundland. It is probable that recorders which are not now in use can be found in some of the member countries. If so, these should be put into service for the suggested pilot scale study. The 1960 Chairman of the Environmental Subcommittee will exchange letters with the correspondents on Environmental Research to determine which countries are able to share in the beginning of this work, and what arrangements can be made for servicing the instruments at terminal or stop-over ports, and for working up the collections.

Addendum

Excerpts from Previous Reports regarding Environmental Research

The Committee on Research and Statistics has often affirmed the importance of studying environment to illuminate fishery problems. Concerning this subject, the Biarritz symposium concluded that, "In addition to recommended research programs on particular species which involve acquiring certain classically prescribed information, - - such as rate of growth, for example - - certain lines of study must be pursued which apply to all fishes sharing the same environmental system. For example, oceanographic research is necessary to delineate the currents, follow their fluctuating courses, and determine how they and the various properties of the water affect the dispersal and survival of eggs, larvae and adults. Trans-Atlantic oceanographic research for the specific purpose of increasing our understanding of fishery matters has been largely neglected in the past. To collect necessary information on this subject requires the full use of every available facility, including research vessels, commercial fishing vessels, trans-oceanic passenger and freight liners, weather ships, Texas Towers, drifting buoys, etc. Sorting and identifying plankton, and analysing the data collected from all these sources, for fishery purposes, required adequate shore staff, for which hardly more than token provision is now made" "Since research vessel operations are costly and scarce, every opportunity should be taken to make use of fishing vessels, patrol ships and any other ships which tra-

on water temperatures and, where possible, data on the fish stocks. Automatic collecting devices and recording instruments should be used wherever possible so as to minimize the need of technical personnel".

The Outline of Present Research and Long-Range Needs in the Convention Area, prepared by a special ad hoc working party in 1956 makes the following statements:

"Effects of Environment (on cod)

It is important to distinguish between effects of fishing and effects of the environment of cod. Distribution, growth, year-class strength, and mortality are all greatly affected by differences in the environment with the time and place. These relationships must be understood in order to make best use of cod stocks.

. . . "Problems requiring special research on haddock are:

Abundance of zero or one year old fish by quantitative surveys at sea.

Follow the movements of eggs, larvae and young haddock from their origin to their appearance in the fishery.

"Spawning (of redfish)

Where do redfish spawn? What are the routes of drift of the larvae?

Make systematic plankton surveys with research vessels.
Explore possibility of using commercial vessels, weather ships, etc.

"Effects of Environment (on redfish)

It is important to determine the factors of the environment influencing survival of young redfish.

Rear young redfish in aquaria, experimenting with such factors as temperature, pressure, food, etc.

Measure environmental factors in the sea where larvae and young redfish are found to learn the normal conditions sought. Collate these findings with results of experimental research.

. . . "Determination of the total distribution and abundance of Atlantic halibut.

Tabulate quantities of halibut eggs and larvae taken in plankton surveys

Each of the countries (making plankton surveys) should examine its plankton samples for halibut eggs and larvae. So few of these are found in the plankton that no additional help is required for this aspect of the study.

. . . "Young fish (studies on mortality):

In the early stages causes of mortality are often non-uniform and catastrophic so as to affect the total strength of a year-group throughout life in a recognizable way. Some of these causes are listed below:

- (a) Unfavourable course of drift related to environmental factors such as temperature, physical and chemical conditions.
- (b) Predation - association with predatory organisms, such as salps, pelagic coelenterates, arrow-worms, etc.
- (c) Starvation - possible drift of larvae into areas of low food abundance. This requires detailed plankton study and larval food study by planktologists.

These subjects might best be studied by conducting cruises with research vessels which would be used to follow bodies of water by means of deep drogues (drag buoys) taking repeated plankton tows, water samples for chemical observations, continuous temperature, wind and other observations which might be pertinent. The course of the drift should be followed until the fate of eggs and larvae is known, describing the environment as completely as possible in all respects. Such studies should be repeated by area and time so as to establish the normal, and variations in successive production of year-groups".

During the 1957 Annual Meeting at Lisbon, the Committee observed:

"Since stocks of fish harvested throughout the Convention Area may be contiguous and the free exchange of young may occur through drift of pelagic stages, there is need for total distributional studies of eggs and larvae of the several species of interest to the Commission. Differences in distribution by area and numbers from year to year are one of the important questions on which information is needed. Knowledge of water circulation and characteristics should be obtained. Areas of potential productivity should be defined . . .

"What is needed now is a coordinated plan of plankton and hydrographic study which will meet the Commission's needs and which will make use of existing ship time and scientific personnel.

"This plan can be developed best by a committee of specialists who are familiar with the research needs in each subarea together with specialists in plankton research. They would prescribe the collections needed by time and area to describe the

"Available ship time should be compared with that necessary for a complete plankton-hydrographic survey and recommendations made to the Committee on Research and Statistics for co-ordination of present research and for increasing observations where necessary.

"Personnel for processing and analysis of plankton and hydrographic data are in short supply, and this fact may limit the extensiveness of sea collections until such time that the numbers of scientists can be increased. Special study should be given the plan of data analysis in a plankton-hydrographic program of the Commission".

And again during the 1958 meeting:

"Environmental Studies

"The identification and measurement of the effects of fluctuations in plankton and hydrographic factors on the distribution and abundance of exploited fish stocks are fundamental facets of applied fishery biology investigations. Hitherto, the extent of plankton and hydrographic studies in the ICNAF area has been limited and generally inadequate for achieving these aims.

"The Committee considers that there should be a serious stock-taking of current progress and future requirements in these studies. It recommends that: - (i) A survey should be made by Dr. L.A. Walford of present information on plankton in the Convention Area; (ii) that participating countries bring plankton specialists to the next annual meeting to plan a coordinated ICNAF plankton program; (iii) that present programs of environmental studies should be continued, and if possible intensified, in anticipation of the development of a fully coordinated Commission program . . .

". . . we are entering a new phase of the work of this Commission. Now we must shift the focus of our attention from one technique of conservation, and the demonstration of the effects of its application on one fishery to a much broader complex of problems. The recognition of this fact is reflected in the scope of our discussions this year and in our planning for future meetings, in which we look forward to giving increasing attention to the marine environment, particularly to the study of hydrography and its relation to the production of the food of fishes . . .

"The Committee recognized the importance of plankton studies to an understanding of fisheries problems of the ICNAF area and recommends (1) that present programs be continued and, if possible, intensified, in anticipation of the development of a fully coordinated Commission plankton program and (2) that participating countries bring plankton specialists to the next annual meeting for the purpose of study and planning an ICNAF plankton program, possibly leading to more extensive consideration of plankton research at the next meeting held in Europe, when it would be possible for more planktologists to attend.

"The Committee members, particularly those from Portugal and Spain, expressed the need for a well-designed and coordinated program for the ICNAF area, so that they could interest their plankton specialists in this research.

APPENDIX XReport of the ad hoc Subcommittee on Statistics and Sampling

Participants: Martin (Chairman), Clark, Dickie, Fleming, Graham, Holt, Hodder, Jean, Jonsson, Keir (Rapporteur), Lundbeck, McHugh, Posgay, Ruivo, Trout, Wise.

1. Introduction

Investigation of the major commercial fisheries in the ICNAF area depends on the collection and distribution of adequate statistics and sampling data. Although the Commission has achieved remarkable progress in its statistics and sampling publications, there are still gaps in the data received by the Commission, which must be drawn to the attention of member governments.

Second only in importance to having statistics and sampling submitted in the detail requested by the Commission is the need to have them published promptly. Increased fishing in the Convention area, and the growing demands for detailed statistics and sampling are making it more difficult for the small Secretariat to produce timely reports to the Commission. It is important, therefore, that scientists regularly review Commission statistics in order that concise tables may be prepared in the most useful way, using efficient collection and tabulation procedures.

With these aims in mind, the Subcommittee reviewed the status of essential catch statistics, requirements for effort statistics, proposals for changes in the compilation of statistical tables, arrangements of tables and other details in the Sampling Yearbook, and finally preparations for the Edinburgh Statistics meeting.

Quantity, effort, size and age data are of highest priority in ICNAF statistical requirements. Statistics on quantities and sizes are improving each year, but assessment of fish discarded at sea is still very weak. Effort statistics are available by gear and by time units, but knowledge of relative fishing powers is inadequate for measurement of total fishing effort. The increased reporting of age sampling by most member countries is improving the usefulness of Commission statistics. Proposals for further improvement in these essential statistics are included in the following sections.

The Subcommittee reviewed the statistics now received by ICNAF in relation to present requirements. For this purpose, Document 19 was used for reference.

2. Landings:

Statistics for most inshore fisheries are not available by gear. Canada expects to be able to report 1959 statistics for inshore mainland fisheries by gears, but there are no prospects for an early similar breakdown for Newfoundland and Greenland inshore fisheries.

2.1 It is recommended that member countries use a sampling scheme to obtain

2.2 It is further recommended that landings and fishing effort statistics for the Faroes and Italy, and fishing effort statistics for French otter trawlers, all now reported by subareas, be broken down by statistical subdivisions.

2.3 The Subcommittee recommended that the amount of cod, haddock and redfish included in United States industrial fish landings should be reported to the Commission.

2.4 The reporting of haddock landings from Subareas 1 and 2 during the past few years appeared to be inconsistent with biological information available on the distribution of haddock. It was therefore recommended that biologists review the statistical submissions by their governments in order that possible errors may be drawn to the attention of their statisticians.

3. Discards:

Especially because of the importance of mesh regulations in the Commission's work, it is essential to have accurate data on the quantities and sizes of the fish discarded at sea to supplement the data now collected on catches and landings. In spite of the repeated emphasis on the importance of this matter at recent Annual Meetings, most countries have not yet introduced adequate programs to measure both the sizes and quantities of discards. In considering ways and means to meet this situation the Subcommittee noted that special logbooks to record discards by individual tows are placed on board some commercial vessels of Canada, Germany, Portugal, and the United Kingdom. Similar data collected by France and Spain have not yet been reported to the Commission.

3.1 It was recommended that where possible special logbooks should be placed on board vessels by all member countries for the collection of discard statistics by weight and species.

The Subcommittee also expressed interest in the scheme used by Germany and United States whereby samples of the fish which would otherwise have been discarded are brought ashore for scientific analysis. The Subcommittee requested that these countries should keep the Commission informed on the success of this scheme.

3.2 However, to obtain the essential data on the sizes of discards, and to check the estimates on quantities given in logbooks, the Subcommittee reconfirmed the Commission's earlier recommendations that observers must be sent to sea on commercial trawlers.

3.3 It was recommended that the Secretariat, in consultation with scientists of member countries, prepare a definitive document describing methods of measuring the sizes and quantities of fish discarded at sea.

In addition to information on the discards of undersized fish it is necessary that the quantities of redfish, halibut, flounders and other groundfish discarded by the cod-fishing vessels be known before the status of the fisheries for these species can

- 3.4 It was therefore recommended that as precise estimates as possible of the quantities of redfish, halibut, flounders, and other groundfish discarded by the cod-fishing fleets be reported to the Commission.

4. Fishing Power:

Investigations on fishing power factors proposed at the last Annual Meeting were reported in Documents 18, 19, 23 and 33 and in a paper "Biologisch - Statistische Untersuchungen über die deutsche Hochseefischerei" by Dr. Lundbeck of Germany.

These analyses and earlier ones clearly demonstrated the importance of correcting effort data by fishing power factors before the effort data of individual vessels are compiled. Further, where vessels are grouped into various classes, the classification should be such that each class is as uniform as possible with respect to fishing power and selectivity.

- 4.1 It was therefore recommended that increased attention be given to the study of fishing power in relation to various characteristics of gear, electronic equipment, the design and size of fishing vessels, etc.

5. List of Vessels Fishing in the Convention Area

- 5.1 Following its discussion of the factors affecting the fishing power of vessels the Subcommittee recommended that information on the following new items be added to the "List of Vessels Over 50 Gross Tons Fishing in the Convention Area in 1959".

1. Name and size of net or other gear.
2. Controllable pitch propellor.
3. Automatic navigator.
4. Automatic pilot.
5. Radio Direction Finder (D/F)
6. Newly developed types of equipment.
7. Range or fuel capacity.

- 5.2 The Subcommittee recommended that the Secretariat should consult with Mr. Traung of FAO concerning classification and definition of the various characteristics of fishing vessels contained in the vessel list; and on this basis provide simple instructions for submission of these data.

- 5.3 It was further recommended that the List of vessels should be published in a form similar to the Red Book.

6. Comparative Fishing Experiments

- 6.1 There is a need for comparative fishing experiments in the Convention Area. Two things must especially be measured -the relative fishing power and the relative selectivities. To this end the Subcommittee recommended: (1) that an effort be made

nationalities, are fishing together, to measure relative fishing power and selectivity.

7. Standardization of Fishing Effort

7.1 The Subcommittee also recommended that the Biologist/Statistician continue his study on factors to convert the fishing efforts of all fleets to a standard and that gross estimates of the total standardized fishing effort on cod, haddock and redfish should be prepared for the next annual meeting.

7.2 Although the Subcommittee recognized that the precise standardization of the effort data within fleets would take time it recommended that improved effort data should be reported as soon as it is available, and that the present requirement regarding gross tonnage classification of vessels might then be relaxed.

7.3 It was recommended that, as an experiment the United States calculate total standardized effort statistics for cod, haddock and redfish from the indices of abundance currently available. A supporting working paper should be presented at the next Annual Meeting.

7.4 Following its assessment of the Commission's present position with respect to the interpretation of fishing effort data the Subcommittee recommended that data on number of trips, days absent and drags be retained in Table 9 but not in Table 8 of the Statistical Bulletin. It was felt that these data are of value in summary table 9 to show the average length of trips, number of drags per day, etc., but that they were not necessary for calculation of indices of abundance obtained from table 8.

8. Prescribed Forms

8.1 Since specially designed standard forms will speed up reporting and processing as well as ensure that all requirements are met by member countries, the Subcommittee recommends that prescribed forms should be prepared by the Secretariat and sent out to member countries when requesting statistical and sampling submissions.

9. Sampling Yearbook

The Subcommittee noted the substantial progress made in the production of the Sampling Yearbook and commended the Secretariat and contributing scientists for their joint efforts.

A request was made by the Secretariat at the 1958 Annual Meeting for advice on how the data for the Sampling Yearbook should be submitted and published. The Subcommittee considered this request, and recommend that:

9.1 The Secretariat should arrange data on length frequencies of catches, landings and discards in the Sampling Yearbook by species, subdivisions, country, gear, months much as in the Statistical Bulletin, Table 8.

- 9.3 In submitting statistics to the Secretariat countries should give, for each length and age frequency, the number of samples, number of fish in the samples, mean weight, and total estimated number of fish in the landings from the ICNAF statistical unit to which the frequencies refer together with mesh or hook sizes. Redfish data should be presented by sexes; and depth zone should be recorded.
- 9.4 Countries should report length and age frequencies in numbers per thousand.
- 9.5 Cod length frequencies should be published in 3-cm groups (39-41, 42-44 cm, etc.), haddock in 2 cm groups (34-35, 36-37 cm etc.) and redfish by centimetres. Countries should report data in these standard groupings or by centimetres.
- 9.6 Useful length/weight keys, age/length keys, and other specialized data should be published by the Secretariat as they become available.

10. Joint FAO/ICNAF/ICES Meeting on Fisheries Statistics

The FAO delegate summarized the preparations which have been made for this meeting. It will be held in Edinburgh from Tuesday, 22 September through Wednesday, 30 September, 1959. Extension to 2nd October may be arranged. It will be attended by participants from the countries fishing in the North Atlantic and from the Secretariats of FAO/ICNAF/ICES. Observers will also be present from other interested countries and international organizations.

The Subcommittee noted the report prepared for the joint meeting by Rashley and Rutherford under the sponsorship of FAO. It was thought that this comprehensive paper describing how fisheries statistics are collected and compiled by many of the countries fishing in the North Atlantic would be of the greatest value in attempts to standardize methods.

- 10.1 The Subcommittee urged that ICNAF countries should strongly support this meeting and recommended that each ICNAF member country should be represented at the Edinburgh Statistics meeting by at least two participants. One should be a biologist, the other a fisheries statistician.
- 10.2 The Subcommittee recommended that the Executive Secretary should write to all ICNAF countries to inform them of the importance of the meeting to ICNAF, and to draw their attention to the above recommendation. He should also send a copy of the Meeting Prospectus and Agenda to each member country.
- 10.3 It was recommended that the attention of Committee I (Edinburgh Meeting) be drawn to certain special problems of concern to ICNAF. These problems are given in the Addendum, classified according to the agenda for the Edinburgh meeting given in the Prospectus and Program.

11. The Subcommittee noted with regret the lack of representation at its meetings of many member countries.

AddendumComments on the Agenda of the FAO/ICNAF/ICES Expert Meeting on
Fishery Statistics in the North Atlantic Area

The agenda of the above meeting meets the Commission's basic requirements and interests. Problems of concern to ICNAF would come within the scope of the deliberations of Committee I (Fishing Industry Statistics).

The request in the "Prospectus and Program" for amplification of suggested agenda items was noted and it was recommended that the attention of Committee I be drawn to the following problems of most immediate concern to ICNAF:

Paragraph NumberSpecial Problems of Concern to ICNAF

- 3.322 (1a) Collection of statistics from inshore fisheries, particularly in respect to allocation to gear.
- Inadequacy of sampling data on size composition of landings.
- (1c) Collection of statistics on sizes and species of discarded fish with respect to marketable sizes of various species as well as undersized fish.
Species allocation of industrial (trash) fish landings.
- (1e) Non-allocation of landings to species because of certain catch handling operations. (i.e., boxed landings, "shack", etc.)
- (2a) Non-uniformity and incompleteness of certain aspects of statistics reporting (which could be improved by use of standard forms.)
Extra work load imposed on agencies by unnecessary or duplicated conversions or other calculations.
- (2b) Non-uniformity of conversion factors used by various agencies.
Inadequacy of present conversion factor data.
Non-uniformity of form of presentation of data (ICNAF favours round fresh in metric tons).
- (2e) Non-uniformity of species groupings, size categories and area divisions for statistical reporting.
Non-uniformity of the length groupings used in reporting compositions of landings.
Non-standardization in weighting and pooling of statistical data (including fish length sampling data).
- (2f) Establishment of standard deadlines for submission of data and of standard time periods for classification of data.

APPENDIX XIReport of the ad hoc Subcommittee on Statistical Areas

Chairman: H.W.Graham

Rapporteur: R. Keir

The committee met to consider the broad question of further breaking down of Commission statistical subdivisions. Last year Subdivisions 3P and 4V were divided each into two parts. At the December meeting of Scientific Advisers to Panel 5, the US suggested a division of 5Z into east and west portions on the basis of new knowledge of haddock stocks.

The subcommittee discussed at some length the whole broad problem of statistical areas and considered the principles and objectives of reporting in relation to size of area. It was pointed out that for biological studies very precise information as to point of collection is required but that for management purposes the records of landings, effort, etc., could be allocated to rather large areas. In general, it is desirable to have statistical areas compared with individual stocks of fish but this ideal cannot always be fulfilled since the stocks of different species may have different patterns of distribution. Furthermore, in the case of a migratory stock it may be necessary to obtain information on the same stock as it occurs in different subdivisions.

It was agreed that the collection of statistics should be made in as small unit areas as possible. The combining of such data can then be made in various ways. In this connection reference was made to the small unit area of ICES, of the US system in Subarea 5, and to the system used by Canada off Newfoundland.

The following recommendations were made:

1. That the Secretariat canvass member countries to ascertain what small unit they are now using in the collection of statistics.
2. That the US compile present knowledge on the division of stocks of our four principal species of fish in the Convention Area. (Canada has already done this for cod and haddock in Subareas 3 and 4. The Redfish Symposium should provide information on this for redfish in the Convention Area).
3. Action should be deferred on divisions of 5Z until above studies are completed.
4. The question of ICNAF subdivisions should be discussed at the Edinburgh meeting on statistics.

Report of the ad hoc Subcommittee on Publications

Participants: Lucas (Chairman), Hart, Holt, Lundbeck, McHugh, Poulsen, Squires, Walford.

The Subcommittee met on Thursday and Friday, 28th and 29th May. It was agreed to base the Agenda on the Proceedings of the 1958 meeting together with consequential points arising. The following recommendations were made:

- (1) Each year 400 copies of the complete report of the Committee on Research and Statistics, along with its accompanying appendices, shall be multilithed and bound in red as in the 1958 "Red Book", for distribution to those on the mailing list for the Commission's meeting documents.
- (2) The meeting documents shall be distributed before the Annual Meeting, as far as possible, to those who have -
 - (a) contributed to them,
 - (b) recently attended the Commission's meetings,
 - (c) been nominated by their Governments as delegates and/or advisers.

Further distribution shall be subject to any special decision made by the Commission during the course of that meeting, but shall normally include the other international fisheries organizations, with permission for the Secretariat to respond at its discretion to other requests for such documents.

- (3)
 - (a) Subject to those recommendations regarding publication already standing, publication of the Proceedings shall be determined by an Editorial Board.
 - (b) This Board shall comprise the Chairman of the Research and Statistics Committee who shall be the Editor, the Executive Secretary and the Chairman of the Publications Subcommittee, with power to co-opt.
 - (c) The Board shall be empowered to edit the current Proceedings and to decide on any condensations that may be necessary; the Board's authority and responsibility in these respects shall extend after the Annual Meeting until these tasks are completed.
 - (d) Each author shall be provided with a copy of his contribution as edited, for return to the Secretariat who shall supply him with a further "proof" copy after the "master" copy has been taken; authors must return these copies with their corrections as soon as possible and, if they have not been returned on each occasion within two months, it shall be assumed by the Secretariat that the copies may be regarded as in good order.
 - (e) In the event of any document being published outside the Commission, an abstract of that document shall be requested for publication in the

- (4) With the aid of the FAO bibliographic service and assistance from member countries, the Secretariat shall compile each year a list of all papers relating to Fisheries Research undertaken in the ICNAF area, for review at the next Annual Meeting concerning publication in the "Red Book". In addition to the references, this list shall also include brief abstracts, as provided by FAO unless the authors concerned wish to provide their own brief abstracts for this purpose.
- (5) Member countries shall be requested to supply to the Executive Secretary, as soon as they are published, two copies of each of their contributions mentioned in this list (para. 4) for filing in the Commission's office, with a third copy to be addressed direct to the Biology Branch of Fisheries Division of FAO.
- (6) Subject to competent editing, the Commission shall plan to publish the contributions to -
- (a) the Redfish Symposium planned for 1959, and
 - (b) the Tagging Symposium planned for 1960,

financial provision being made accordingly, arrangements shall be made so that these papers are edited by the officers responsible for the symposium, subject to the general coordinating authority of the Editorial Board.

(Meanwhile, it was reported that editing of the papers given at the ICNAF/FAO/ICES Conference in Lisbon was proceeding along the lines of the Biarritz report. It is expected that publication of at least the Chairman's Introduction and the three main reports will be possible during the present financial year; if the individual papers are not published in that year, they will be published in the following year).

- (7) In view of -
- (a) the increasing scope of the Commission's work,
 - (b) the consequent increase in the number and quality of scientific papers already being offered, and
 - (c) the desire being expressed in several quarters for a more conventional form of publication than that now available,

careful consideration shall be given at the meeting in 1960 to the possibility and the value of the Commission establishing a Journal or Bulletin, for the publication in the first place of fisheries papers relevant to the Commission's area and its work. So that discussion shall be well informed, the Secretariat shall be empowered to ascertain during the year the views of Commissioners and Advisers as to the general desirability of such a step, the likely bulk of contributions which it would attract, etc., etc.

- (8) The Publications Subcommittee shall be established each year, by the process of a Chairman being nominated by the Chairman of the Research and Statistics Committee in advance of the Annual Meeting and the members of the Subcommittee being appointed during the first Session of the Research and Statistics Committee.
- (9) The Editorial Board reported that, after the usual editing -
- (a) the following documents of the 1959 Meeting should be published in the Annual Proceedings, Nos.1, 4, 6, 7, 8, 9, 11, 12, 14, 15, 16, 18 (if not published by FAO), 21, 22, 24, 25, 27, 29, 36 and 40. In addition, an abstract of Document 28 should be included in Document 29, and Document 31 should be condensed to about half-size,
 - (b) the following documents would be published in the 1959 Red Book - 3, 5, and 35, together with a resumé of 39.
- (10) The Editorial Board also had advance opportunity to study the recommendations on publication of the Report on Statistics and Sampling and, subject to their approval by the Research and Statistics Committee, support their adoption.

APPENDIX XIIIReport of the ad hoc Committee on Fishery Assessment in Relation to Regulation Problems

Participants: Lucas (Chairman), Hansen, Holt, Marti, Martin, McHugh, Rollefson, Ruivo.

During the first part of the meeting a widely-ranging discussion centred on the nature of the problem with which the Research and Statistics Committee was presented by the Commissioners, and what information would be required for its solution. The problem primarily concerned the need and the possibility of applying uniform minimum mesh regulations to the whole Convention Area, and indeed to the whole North Atlantic. The need to consider the possibilities of other conservation measures was also noted (see Part III, the Report of the Chairman of the Research and Statistics Committee on his meeting with the Commissioners). It has to be recognized that different species of commercial fish in the same subarea, and the same species in different subareas, were likely to require different minimum mesh sizes for effective conservation. This is true even at the present rates of fishing, and we know that these rates are increasing. For such reasons, the assessment of the immediate and the long-term effects of any system of uniform mesh regulation throughout the ICNAF subareas would involve the careful balancing of losses and gains, in comparison with the present situation.

It is not certain at this moment how many of these assessments can be made by next year's meeting with reasonable precision. In some instances estimates can probably be set only between upper and lower limits, while in Subarea 2, for example, our information is so scanty that possibly none can be made. To a large extent, the results would depend on whether sufficient and suitably skilled staff can be made available for the task.

It was agreed, however, that in order to be able to make such assessments, the best thing would be to follow the plan adopted by the ad hoc and Lienesch Committee of the Permanent Commission when given similar tasks.

This consisted essentially in requiring from each member country all the available data of certain kinds, which would be reviewed and processed locally by appropriately skilled staff, with a final assessment made by a small group of scientists experienced in investigating practical fishery population problems.

It was recommended therefore, that the Commission request from member countries all information of the following kinds already tabulated but which has not already been supplied:

1. Information on subdivision and mingling of stocks.
2. Their representative growth rates and mortality rates.
3. Data on the length and age composition of the catches.
4. The gears used and fishing efforts being (and expected to be) exerted on the stocks.
5. The selection factors for the fish (or length, girth and weight measurements).
6. Any information on the species and amounts and sizes of fish discarded in the different fisheries.
7. Any other information known to be relevant to this problem.

Limited supplementary information may be requested later regarding certain critical features of the project.

The immediately important species would be cod, haddock and redfish. In the case of Subarea 2, almost any data relevant to the fish stocks would be valuable.

It was further recommended that this information should be requested as soon as possible, so that it should reach the Secretary by October 31, 1959, after which it should be duplicated and sent to the scientists concerned (see below) for their assessment and report. Although necessarily preliminary, if such a report could be prepared by the next Annual Meeting, it would be invaluable in giving the Commission the first assessment of stocks in relation to contemporary fishing for the area as a whole. It would also provide such information as cannot be made available for considering the questions posed by the Plenary. It must be emphasized that such a report could in no sense be a final one, and that in important instances lack of data might prevent a useful answer being obtained. The Committee considered, however, that sufficient relevant and vital information would be obtained to justify the considerable work involved.

In seeking a suitable plan for this process, it was noted that (a) the scientific advisers to Panels 4 and 5 are already due to meet in December to resolve certain fish stock problems, (b) Canadian scientists have already undertaken to obtain and analyze the essential haddock data for Subarea 3 during 1959-60 and (c) the United Kingdom scientists have already undertaken during that year to analyze the material at present available from Subarea 1 and make such population assessments as are possible.

It is recommended that these three projects be co-ordinated by the Commission in order to provide such answers as can be given to the present problems. The advisers to Panels 4 and 5 would do this for Subareas 4 and 5, the Canadian scientists for Subarea 3, and the United Kingdom, Portugal and Denmark for Subareas 1 and 2. In each case the prime objectives would be to obtain the best estimates of the immediate and the long-term effects of enforcing minimum meshes of, say, between 4 inches and 6 inches, on a "per recruit" basis for each of the three species in each of the five subareas. The results should include determinations of the minimum fish sizes appropriate to the minimum mesh sizes postulated. These estimates should be made first in relation to the present rate of fishing, and preferably also, in relation to a hypothetical (or if possible, "expected", as determined by national forecasts provided) future rate of fishing. The results should be formulated so as to permit comparison of the individual values with the results of applying overall any particular minimum mesh. They would desirably include preliminary evaluations of greater benefits to be expected in any instance where the data suggested that increases beyond 6 inches were likely to be more beneficial for that stock. The possible consequences of these minimum mesh regulations for other fisheries should be borne in mind, although the priorities will be on cod, haddock and redfish. At the same time the scientists should refer to the possible benefits to be obtained by other conservation measures. Their reports should be available some five months before the next Annual Meeting.

It was recognized from past experience that such a three-pronged attack on these problems, with the best will in the world, would almost inevitably reveal important differences in approach, while each set of results would undoubtedly produce evidence

reflecting on the others. These points could only be resolved by personal contact between scientists and review of these first assessments.

It is further recommended, therefore, that a small group of say, 4 to 6 of the population workers concerned meet in Europe or North America two to three months before the Plenary to do the final processing and evaluation, these scientists to be nominated by the Chairman of the Research and Statistics Committee as soon as possible. Their meeting might well last for a week or 10 days. Their report should be drawn up and sent to the Secretariat one month before the Plenary for distribution to those scientists expected to be attending the preliminary meeting of the Research and Statistics Committee in Bergen, for a final review and amendment of the report to be given to the Plenary. This Research and Statistics meeting would provide full opportunity for scientists of all countries to study the report and comment on it in the light of their special local and technical knowledge before it is finalized.

In making this recommendation for a meeting of a small group in Europe or North America, the Subcommittee realizes that it is proposing the loan to the Commission of the time of scientists belonging to particular countries for a common problem. The travel and subsistence expenses of these scientists have to be considered if their countries can make them available. In the instances of the Subcommittees set up by the Permanent Commission, these expenses were paid by that Commission and it is now recommended for consideration that such a course be adopted by this Commission. [The Commission in its Plenary decided to appropriate \$3,000 to meet expenses of a meeting of 4-6 scientists in Europe.]

In conclusion, and in no sense counter to these recommendations, the Subcommittee wishes to endorse the views expressed in these meetings, as elsewhere during this Conference, that a vital factor in ensuring observance of mesh regulations lies in the timely education of fishermen in the objectives of the regulations.

It is, therefore, recommended that the Research and Statistics Committee nominate a scientist to draft a poster showing the manner in which mesh regulations benefit the fisheries, for consideration at the meeting in 1960.

APPENDIX XIVReview of Redfish Selection and Chafing Gear in Relation to Fishery Assessment Problems

Discussion Group: Arambarri, Brackett, Clark, Corlett, DeZuestre, Jonsson, Lundbeck, McCracken, Percier, Pike, Rodriguez, Rosen, Sapanadze, Templeman.

Redfish:

In a discussion of the adequacy of mesh selection data for the ICNAF area it was noted that the fishery is carried out exclusively by otter trawls, most of which are constructed of natural fibers (manila or hemp). The group concluded that:

1. Data for selectivity of natural fiber codends is adequate to meet immediate needs.
2. Future selectivity work should be carried out, when possible, under conditions of heavy abundance where large catches may be expected.
3. Because synthetic twines are now being introduced into the fishery (particularly by the US) future selection work should include testing of synthetic codends, since these have been shown to permit relatively higher selection than those of natural fibers for many species.

It was noted that Germany proposes to carry out redfish selection work in 1961.

A preliminary examination of length composition of catches showed that use of 4-inch mesh in the fishery could result in a substantial loss of catch, particularly in Subareas 3 and 5 and in parts of Subarea 4. Use of 4 1/2-inch mesh would have even more serious consequences in these Subareas.

Chafing Gear:

The group noted with approval the interest taken by member countries in the chafing gear problem. Most countries concerned with this problem are actively engaged in research on the effect of chafing gear upon escapement or upon testing new types of chafing gear and/or codend construction. The group emphatically endorsed proposals for extension of this work in the coming year. Much of this work will be concerned with testing chafing gear of lesser width or larger mesh size, which could lead to improvements in chafing gear usage.

The group was encouraged to learn that, in the opinion of many experts, development of stronger codends could eliminate the need for chafing gear in many fisheries.

In conclusion the group wishes to point out present ICNAF chafing gear requirements are sufficient to meet the immediate situation but that improvements suggested by results of future tests may be helpful in effecting even better solutions to the problem.