INTERNATIONAL COMMISSION FOR THE NORTHWEST ATLANTIC FISHERIES

SELECTED

REPORTS OF

THE STANDING COMMITTEE

ON RESEARCH AND STATISTICS

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FOREWORD

The following recommendation was made by the Standing Committee on Research and Statistics at the 1958 Annual Meeting, and subsequently approved by the Commission in its final Plenary Session:-

> "The complete report of the Committee on Research and Statistics along with its accompanying appendices should be multilithed, bound together under a light cover, and distributed to those on the mailing list for the meeting documents."

Accordingly, the attached report has been reprinted and distributed to the appropriate persons.

Erik M. Poulsen,
ICNAF Secretariat.

REPORT OF THE STANDING COMMITTEE ON RESEARCH AND STATISTICS*

Chairman: Dr. L.A. Walford
Rapporteur: Mr. B.B. Parrish

The Committee met at the Administration Building, Dalhousie University, Halifax between 4th and 13th June, 1958.

In pursuing its very varied work during the meeting, the Committee set up a number of ad hoc subcommittees to examine specific topics within the framework of the Committee's overall programme, and to recommend to the Committee the most pressing needs for each.

The principal topics assigned to subcommittees were:-

(1) The collection and analysis of fishery statistics in the ICNAF area, and the Sampling Yearbook.
(2) The research requirements for Subarea 1.
(3) Age determination.
(4) Plans for an International Redfish Symposium in 1959.
(5) The chafing gear problem.
(6) The scope of and plans for an International Marking Symposium.
(7) The assessment of the effects of the 4 1/2 inch mesh regulation in Subarea 5.
(8) Sampling of eastern Subarea 4 cod stocks.
(9) Research on the sea scallop fishery of Subarea 5.
(10) The hydrographic and plankton research requirements in the ICNAF area.
(11) The collection of information on the incidence of cod ectoparasites.
(12) Problems of publication.

The reports of these subcommittees, containing the substance of the discussion and detailed recommendations were considered fully by the Committee; they are attached as Appendices I-XII to this report.

Important recommendations concerning the development, intensification and consolidation of research activities in the Commission Area were made on each of these topics. These fall under the following items:

Statistics Collection and Analysis

While many of the basic statistics are now provided for publication in the Statistical Bulletin, there are still important gaps in the statistical coverage which need filling. These apply particularly to the provision of statistics on fishing effort, by area/month subdivision and type of gear, and statistics on the quantities of fish discarded at sea.

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* Originally submitted to the 1958 Annual Meeting as Proceedings No. 10, Serial No. 570.

An investigation of fishing power factors, to permit the standardization of fishing effort, is urgently required. It was arranged that preliminary investigations of this problem would be undertaken in the coming year by the United States for the Georges Bank fishery and then Canada would report on a study of this problem for Subarea 4. Other countries are also urged to undertake investigations of this problem wherever possible and to report their findings to the Committee.

It was agreed that the biologist/statistician should undertake an analysis of the statistics now provided by the Commission to assess more precisely their value for current research needs, especially in population studies. The Committee recommends that he begin this work in the coming year which will necessitate visits to the countries concerned, both in North America and Europe. He should also attend the FAO meeting on North Atlantic Fishery Statistics, which will be held in northern Europe in 1959.

The need for further information on fish discarded at sea is particularly great for fisheries conducted in Subareas 1, 3 and 4. All countries not already doing so were urged to institute programmes of sea sampling using trained field workers for the purpose and to publish the data. Promises to commence or extend this collection service in the subareas in which their major fisheries operate were made by Canada, France, Portugal, and Spain.

Sampling

The routine sampling needs within the Commission Area are closely identified with the statistical needs outlined above. While great progress has been made in the provision of length and age data of catches and landings of countries fishing in the Commission subareas, there is a need for further extension of this coverage in all subareas in order that research requirements can be fulfilled. Collection of length and age data of the entire catches is especially required,including the fish discarded as well as those retained. Committments to undertake this work were made by Canada, France, Portugal and Spain. The Committee recommends that all countries should engage sea observers to accompany commercial vessels fishing in the ICNAF area to provide these data for each of the statistical regions fished.

Increased sampling by research vessels using covered trawls to provide information on the distribution and abundance of the pre-recruit sizes was especially requested for Subarea 1. The following countries undertook to increase their research vessel activities in this subarea in 1958-59: Denmark, Germany, Norway (East Greenland), and U.S.S.R., and to provide sampling data on the major species.

Age Determination

Major problems still exist concerning the accurate determination of age of species in parts of the ICNAF area. These immediate problems are greatest for redfish and cod, but difficulties also exist for other species. Provision for the detailed examination of redfish age determination is being made at the proposed redfish symposium in 1959, at which redfish workers will present material on age interpretation. In addition, cod workers in Subareas 1, 3 and 4, with the assistance of the ICNAF Secretariat, will conduct an exchange of otolith material from commercial-sized cod and,

if possible, pre-recruit sizes, to compare and improve age reading and spawning zone identification. Scientists from Canada, Denmark, Germany, Iceland, Norway, Portugal, Spain, United Kingdom, and U.S.S.R. will participate.

Redfish Biology

The growth in importance of redfish in the commercial fisheries in the ICNAF area has raised redfish research to a place of high priority. Problems of fundamental systematics and biology exist at present. The solutions of these are of major importance for accurate assessments of population dynamics of redfish stocks. The Committee recommends to the Commission that the symposium on Redfish Systematics and Biology approved at the Commission meeting in 1957, should be held in Copenhagen in the week commencing September 21st, 1959, immediately preceding the ICES annual meeting, and that ICES should be invited to co-sponsor the symposium.

Gear Selection

As requested at the 1957 Annual Meeting, a summary report of the results of Gear Selection research in the ICNAF area has been prepared by Mr. J.R. Clark, Dr. F.D. McCraken and Dr. W. Templeman. The Committee recommends that this report, suitably edited, should be published in the Annual Proceedings of the 1958 Meeting.

This report draws attention to gaps in our knowledge of gear selection in the ICNAF area. The Committee recommends that Gear Selection research should be placed on the agenda of the next meeting of the Committee to devise means for filling these gaps.

The Committee is also conscious of the growing need for a general document on Gear Selection. The Committee recommends that the Secretariat be instructed to enquire if FAO is able to undertake the preparation of such a document.

Little is known at present of the effect on codend mesh selection of topside chafing gears, rigged according to the prescribed regulations and in other ways. The following countries will undertake experimental work in the coming year to determine this effect and will report their results to the Committee:- Canada, Norway, Spain, United Kingdom, and the United States.

Marking Techniques

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 Committee considers that the stage has been reached for a collective assessment of the marking methods used in the ICNAF area and of the experiences of workers elsewhere. The Committee therefore recommends to the Commission that a symposium on marking should be held at the time of its next annual meeting in Europe. This symposium will be devoted to a detailed survey of all aspects of the marking technique, including parasite infestation studies, as applied to North Atlantic fishery investigations.

Assessment of Current and Possible Future Mesh Regulations

(i) Experiences since the introduction of the mesh regulations in the Subarea 5 haddock fishery have shown that the regulation has achieved its short term objectives and that most of the predictions of benefit made prior to the regulation have been realized. However, difficulties have arisen in measuring the actual size of the benefit in yield. The Committee recommends that U.S. scientists should continue to pursue this measurement using hitherto untries methods; that the licensing of small mesh study boats should be held in abeyance, and the the U.S. should consider increasing the size of mesh used in the Georges Bank haddock fishery to allow release of haddock to age 3.

(ii) Canadian investigations of cod in Subdivision 4T have indicated that introduction of a 5 1/2 inch codend mesh in the Gulf of St. Lawrence fishery should result in saving substantial quantities of the cod at present discarded, and would probably result in a long term increase in yield. The stock fished in the northwestern part of Subdivision 4T by Canada is also fished in the southeastern part of its range by European trawlers. At present little is known of the composition of the catch of the European fisheries. Therefore, the Committee recommends that France, Portugal and Spain should send observers to sea to sample and measure amounts of the fish discarded and retained from that area; that Canada should institute sampling of cod caught by trap in Subdivision 4S and that France and Portugal should submit to the Secretariat sampling data collected in this area since 1952.

The Committee further recommends that, Subdivisions 3P and 4V should be further subdivided into northern and southern sections respectively to assist in the measurement of the catch and effort for fisheries exploiting the Gulf of St. Lawrence stock. The proposed new boundaries are defined in Appendix VIII.

Research on Sea Scallops in Subarea 5

The sea scallop fishery in Subarea 5 has grown spectacularly since the war. This has necessitated a serious stocktaking of its potential productivity. Investigations by United States scientists have pointed to a possible increase in yield from a "mesh" regulation in the fishery. The Committee recommends that investigations of the population dynamics of the exploited scallop stocks, now in progress in the United States and Canada, be continued and expanded. It recommends in particular that: (1) catch and improved effort statistics for the Canadian and United States vessels fishing in the area be collected for as small time and area subdivisions as practicable; (2) consideration be given tc measuring catch and effort of a selected portion of the commercial fleet and to the use of a special research vessel to improve our understanding of factors influencing the catch per unit effort; (3) tagging experiments be undertaken for estimating mortality; (4) experimental fishing including underwater photography and television be conducted to measure catching efficiency of the gear and to estimate fishing mortality; (5) research on the biology of the scallop and on the environment to determine elements influencing occurrence, behaviour and survival be instituted.

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 stocktaking 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 co-ordinated ICNAF plankton programme; (iii) that present programmes of environmental studies should be continued, and if possible intensified, in anticipation of the development of a fully co-ordinated Commission programme.

Action Committee

The overriding conclusion which emerges from the Committee's deliberations this year is that the responsibilities of our Committee are growing. This development by necessity increases the importance of co-ordinating our research programmes in the ICNAF area. This is the whole Committee's responsibility, but to assist in this important task the Committee has established an Action Subcommittee to be appointed by the Chairman at the beginning of each Annual Meeting (see Appendix XIII).

Publications

The Committee approved the recommendations of the ad hoc Subcommittee set up to consider current publication problems. These recommendations are set out in Appendix XII.

The most important task of this Commission during these first seven years of its existence has been to institute among the member countries the systematic recording of their harvests from the sea and the effort spent in the harvesting, i.e. the species, the times and the areas of capture, the sizes of the fish caught, both of those discarded as unmarketable and of those saved, the characteristics of the vessels, the fishing gear used and data concerning its operation, and various other items of required information. The organization of such a programme of catch and biological statistics is exceedingly difficult, for the geography of the fishing areas is complex, the fishing methods and gear are diverse, and fishermen do not ordinarily keep records either of what they save or of what they discard. Consequently, it is necessary to send men to sea continually to sample their catches. The Committee has emphasized this point repeatedly: adequate comparable statistics by all of our member countries are prerequisite to devising any scientific programme of conservation and to following its effects. Although the Commission still has a long way to go towards this end, it has made creditable progress year by year. However, we must supplement commercial statistics with fishing by research vessels in order to insure representative sampling of the stocks of fishes. In this respect our programme is sadly deficient, for the number of research vessels working during 12 months of the year is grossly inadequate for the size of the Convention Area.

Until now the Standing Committee on Research and Statistics has concentrated a large part of its attention each year on the mesh regulation of the haddock fishery in Subarea 5, first to review the scientific basis of the regulation before it was imposed, and then to assess the evidence of its beneficial effects. The Committee will watch the accumulation of this evidence over the course of future years with much interest, for this is one of the few examples of fishery regulation based on a well-founded hypothesis, which is being so assiduously tested.

Our experience gained in the course of this study is guiding us in formulating similar measures for other species and in other subareas.

Mesh regulation is a technique which can be highly effective with the kind of gear that has been used, and within a certain range of fishing intensities, but we must not delude ourselves into a compacent idea that mesh regulation is the magic formula to solve all fishery conservation problems for all time. Men who earn their living from the sea look towards the day when fishing need no longer be the primitive blind hunting and gathering occupation that it has been, and indeed, technologists are continually raising it little by little above that level. Other kinds of gear, perhaps entirely different ways of exploiting the sea, will be invented, and other conservation measures will be necessary.

If people of our countries retain their present food habits there must be a sharp increase in fishing intensity even without any technological improvements; for, judging from the little we know about human population dynamics, there will probably be something in the order of 80 million more people in Europe in the next 40 years than there are now, and in America 50 million. Even now, for example, a sudden, severe intensification of fishing in Subarea 3 appears imminent. Hence, we who are concerned with the conservation of the sea fishery resources should be far-sighted enough in devising our research programmes so as to comprehend these new situations and be ready to deal with them as they arise.

This points to one important gap in our research. We need to make provision, quite apart from our conservative programmes which are well founded on the work of the past, for developing quite new concepts of exploitation and conservation of the sea resources. This calls for much more extensive fundamental research about fishes and their environment than has been carried on so far in the Northwest Atlantic.

We have experienced the favourable part of a climatic cycle, which has expanded the ranges of our sea fishes far to the north. We may now be witnessing the beginning of the downward part of the cycle in which the various species will be gradually forced to retreat southward; and the fishermen who have been harvesting the far northern waters will be forced to retreat also. It is obvious that these events will make for an intensification of fishing in our Convention Area.

Here again we must be ready to adapt to these events as they occur, studying closely the relation between climate and conditions of the sea environment and the ways in which the fishes adapt to them. Here again, we must re-emphasize the coverage of the Convention Area with research vessels.

In short, 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 acknowledges with thanks the continual and varied help of the Food and Agriculture Organization of the United Nations. This year our discussions have been greatly enriched by the expert advice of Mr. Sidney Holt, who has attended all of our sessions and has actively participated in the discussions of many of the ad hoc committee meetings and the production of their reports. For such dedicated service, our committee is deeply grateful.

Special Meeting. At a special meeting held during the afternoon of June 10th, Dr. Carl Sindermann, of the United States Bureau of Commercial Fisheries, delivered lectures to the Committee on The Place of Serology in Fishery Research and on The Significance of Diseases of Marine Organisms; and Dr. Ju. Ju. Marti, Polar Institute of Marine Fisheries and Oceanography, Murmansk, spoke on Research in the North Atlantic by U.S.S.R.

It was agreed that the Committee should meet in the week preceding the 1959 Annual Meeting. Dr. Mario Ruivo, Portugal, was elected Chairman for the coming year.

APPENDIX I

Report of an Ad Hoc Subcommittee on the Requirements for the Redfish Symposium

Participants: Lundbeck (Chairman), Rollefsen, Sandeman, Tåning, Templeman, Trout, and Walford.

The following recommendations were agreed to and are put forward for consideration by the Standing Committee on Research and Statistics:- that

The topics of the Symposium will be:

1. Systematics problems
2. Distribution problems
3. Sex and maturity in relation to distribution and migration
4. Larval studies
5. Age determination problems
6. Natural marks useful for racial and migration studies
7. Bibliography

1. Systematics Problems

The group agrees that Dr. Giles Mead will be invited to lead the discussion on population definition.

Dr. Mead will be responsible for bringing to the meeting specimens of Pacific as well as of Western Atlantic forms at different stages of development from larvae to adults. The group particularly wishes to have on loan early stages of Pacific forms (including S. alutus) accompanied by data on place and time of collection.

All scientists concerned with this subject are invited to contribute papers and attend the meeting.

It was felt that there were many disadvantages in having a number of biologists attempting to make the many measurements specified by Messrs. Kelly and Kotthaus. Instead, it was agreed that the measurements should be undertaken in one laboratory and that samples of 100 fish of each type from the two main areas, Barents Sea and Iceland, should be sent to Mr. Kelly for measurement. Mr. Kelly should specify the size range required for comparison with the North West Atlantic material and determine the minimum number of characteristics that should be used in a further and more comprehensive study of populations. Mr. Trout will be responsible for sending the material from the Barents Sea. Dr. Magnússon will be responsible for sending the material from Icelandic waters.

2. Distribution Problems

Dr. Templeman will lead the discussion on distribution of the species. Contributors will be asked to accompany papers as far as possible with full supporting data permitting conversion into numbers of fish by depth.

3. Sex and Maturity in Relation to Distribution and Migration

Dr. Magnússon of Iceland will be asked to act as discussion leader on this topic.

4. Larval Studies

Dr. Tåning has agreed to submit contributions and to lead the discussion on this topic. The Committee asks that Mr. Kelly determine the critical spawning temperature of the Eastport fish and give a special report on this study.

5. Age Determination

Mr. Rollefsen will be asked to solicit papers and lead the discussion on this topic. Mr. Trout will review examples of the appearance of more than one annulus among various species of fishes, giving the circumstances associated with the annulus formation.

6. Natural Marks Useful for Racial and Migration Studies

Dr. Sindermann of the United States will be invited to solicit papers and lead the discussion on this subject. He will be further asked to make such preliminary observations on parasitism and serological characteristics of redfish as his time permits and to report his results to the meeting.

7. Bibliography

Mr. Trout is assembling a bibliography in preparation for the meeting. This will be restricted geographically to the North Atlantic, but will include important summary works dealing with Sebastidae in other regions.

Time

Before July 1, 1959, three copies of all contributed papers should be sent for duplication and subsequent distribution; one to the discussion leader, one to the Symposium Chairman and the original copy to a sponsoring organization.

North American discussion leaders will send their material for duplication to the ICNAF Secretariat, Europeans will send theirs to the ICES Secretariat.

It is proposed that -

The Symposium will take place in Copenhagen at Charlottenlund Slot (subject to agreement by ICES) the week beginning Monday, September 21, preceding the ICES Meeting.

It was urged that the Executive Secretary attend the meeting.

The Committee recommends that the Chairman of ICNAF invite ICES to co-sponsor the meeting and to provide facilities for the meeting.

The Committee recommends that the papers and proceedings be published jointly by ICNAF and ICES, the format to be determined later.

APPENDIX II

Report of the Ad Hoc Subcommittee on Marking

Participants: Martin (Chairman), Ancellin, Holt, Jean, Jónsson, McCracken, Marcotte, Olsen, Parrish, Posgay, Rollefsen, Taning, Trout, and Wise.

The primary purpose of this Committee, which met on the 5th of June, was to discuss the suggestions contained in the Secretariat's circular letter of February 18, which asked for views on the need for a symposium on marking, and also for suggestions for improving the return and interchange of marking data amongst ICNAF participating countries.

The Committee met on two occasions. At the first meeting the need for a marking symposium was agreed generally and a Steering Committee was appointed to produce (i) a draft agenda, (ii) an outline of the scope of the contributions required, and (iii) whether this symposium would be co-sponsored.

Publicity. Methods were discussed and in addition to the two memoranda produced as a result of the Secretariat's request, many novel practices were described and illustrated.

Mr. Holt stated that FAO would be interested in the result of such a symposium since a review of marking procedures was in course of preparation by his organization. Limnologists were also preparing a similar review.

In the discussion on topics for the symposium which followed, it was agreed that these should be limited to the marine environment and the North Atlantic. It was also agreed that there should be no exclusion of particular species but that the principal species, cod, haddock, redfish, would provide the bulk of the material.

Migrational papers were considered undesirable and it was agreed that these would not be solicited. It was agreed that the timing of the symposium should be after that of the redfish and could best take place at the next ICNAF meeting in Europe and would require four to five days. So that the total length of that Annual Meeting should not be unduly great it was suggested that the operations of the Standing Committee on Research and Statistics might be limited, so that their work and the symposium could occupy the week before the Plenary Sessions.

With these recommendations in mind the Steering Committee, Martin (Chairman), Rollefsen, Ruivo, Trout, and Wise, met at 9:30 on 6th June and reported to the full Committee on marking at 11:00 the same day. After further discussion the following recommendations were put forward:

1) That a marking symposium be held in Europe under the sponsorship of ICNAF.
2) Publication of suitable papers would be the responsibility of ICNAF (submission of publicity information should be excluded, to avoid congestion, and presented at the next Annual Meeting).
3) The title would be: North Atlantic Fish Marking Symposium. (A preamble to advance publicity to the meeting should define the aims more closely.)

4) The draft agenda with names of discussion leaders is as follows:

NORTH ATLANTIC FISH MARKING SYMPOSIUM

Chairman: Mr. G. Trout

Scope of Symposium and Draft Agenda

(1) Biological Marks -- Ruivo

Parasites
Other biological marks

(2) Artificial Marks -- Gunnar Dannevig

(3) Techniques -- Bertelsen

a. Catching (depth and gear, etc.)
b. Selection of fish (size, condition)
c. Handling -- Deck gear
Organization of labour
Tagging
Release methods and gear

(4) Publicity -- McCracken

a. Organization
b. Information required
c. Rewards

(5) Returns -- Wise

a. Commercial
b. Research vessel
c. Recording of data

(6) Design of Experiments -- Saetersdal

a. For stock definition and migrations
b. For population dynamics

(7) Analysis -- Gulland

APPENDIX III

Report of the Ad Hoc Subcommittee on Research on the Sea Scallop Fishery of Subarea 5

Participants: Posgay (Chairman), Ancellin, Dickie, Holt, Keir, Parrish, and Sandeman.

The Committee reviewed Serial No. 554, Document No. 28, and Appendix III to Serial No. 517, Document No. 2, and other information presented by Canadian and United States biologists.

The Committee agreed:

1. The fishery is of great and growing economic importance to Canada and the United States and, on this basis alone, deserves the serious consideration of the Commission.

2. This fishery offers an unusual opportunity for collecting the data on parameters required to demonstrate the need for and to test the effect of any regulation, provided sufficient effort is put into the preliminary research.

3. The rate of growth of sea scallops in relation to the likely mortality rate in the Georges Bank area seems to be so high in and above the present selection range of the gear that postponing the age of first capture is likely to increase the yield. Age determinations should continue as recommended in Appendix III, Serial No. 517, Document No. 2, since the growth rates may vary considerably from area to area or from year to year.

   Data on mortality rates are now insufficient to permit us to predict the order of magnitude of the possible increase in yield.

4. The present measures of effort may not be fully satisfactory to permit calculation of reliable indices of abundance, which are of central importance to population analysis.

5. The mesh selection data in Document No. 28 give a reliable estimate of the effect on size distribution of the catch which would result from increasing the ring size. The apparent deviations in selection by the 3-inch ring (page 12) might be explained by overlapping of its selection range with that of the 2-inch ring used as a standard in the experiments, but this needs further investigation.

The Committee believes that in addition to the work now in progress the following items are of major importance in continuing the research program on this fishery:

(i) Tagging experiments, designed to link tag returns with fishing effort in order to arrive at mortality estimates.

To predict and measure benefits accruing from a mesh regulation to release small individuals, the minimum, yet sufficient, basic information comprises knowledge of the fishing mortality within and between the

selection ranges of the small and large mesh and of the relative catches of animals smaller and larger than the mid-point of the selection curve for the larger mesh (Serial No. 557, Document No. 31).

This should be borne in mind when the design of tagging experiments and other observations are considered; thus, a tagging experiment may give reliable estimates for fishing mortality but far less reliable measures, or none at all, for natural mortality, yet this will not in any way reduce their value in either predicting or measuring the benefits of a mesh regulation, provided natural mortality does not change.

The scallop tagging program should emphasize those length groups which will be in the range of selection by the existing and any proposed saving gear, because evaluation of a regulation involves measurement of the mortality rate of the sizes saved.

The problem of how to distribute tags is of sufficient importance to the general designing of tagging experiments to justify consideration of results of a scallop study in the ICNAF symposium on tagging in the North Atlantic.

(ii) Collection of effort and catch statistics from Canadian and United States vessels which would be more useful in calculating measures of abundance.

Analysis of this fishery will require reporting of catch and effort statistics in smaller unit areas than are normally used in the ICNAF area.

Logbook records may be the best means for obtaining a breakdown of the commercial catch and effort statistics by area of capture.

Sampling of the commercial fleet for number of hauls per day and/or lengths of hauls will help improve the commercial effort statistics.

(iii) An independent estimate of the relation between fishing effort and fishing mortality by measuring the proportion of the scallop grounds which are swept by any amount of fishing.

This requires measurement of density by underwater photography or other means, measurement of the amount of area swept during a unit fishing time, and allocation of fishing effort to the different fishing areas.

(iv) Experimental fishing in association with photographic surveys to estimate the efficiency of the gear in catching scallops and measuring relative strengths of year-classes.

It is important to make an immediate attempt to measure the relative strengths of those year-classes which are about to enter the exploited phase so that we will be warned of any imminent natural changes in abundance which might effect catches.

(v) Fundamental research on the biology of the scallop and on its environment to determine the elements influencing occurrence, behaviour and survival. It is particularly important when assessing effects of a regulation to distinguish between natural and artefactual causes of changes in abundance.

(vi) An attempt should be made to measure natural mortality by direct methods as well as by analysis of catch statistics. This may be done by counting the relative numbers of live scallops and empty paired valves, together with measures of the rate of decomposition of the hinge ligament.

The Committee recommends:

1. That routine samples for abundance should be taken year after year with the same vessel or vessels and gear so that experimental measures of catch per unit of effort will not be affected by variations in fishing power.

2. That serious consideration be given to the need for use of a research vessel of fishing power similar to those now engaged in the commercial fishery. The Committee felt that the data required to support and follow up the effect of a regulation are sufficiently important to justify such a step.

APPENDIX IV

Report of the Ad Hoc Subcommittee on Statistics

Participants: Keir (Chairman), Ancellin, Dickie, Fleming, Holt, Jean, Marcotte, Martin, Olsen, Rodriguez M., Rojo L., Rollefsen, Ruivo, Sandeman, and Wise (Rapporteur).

Effort Statistics

At the first meeting the question of the measurement of the total effort expended on each species and on indices of abundance of fish in the Convention Area was considered to be the field in which our greatest difficulties lie and several particular problems were defined:

Landings — The breakdown of landing statistics of the inshore fisheries of Canada by kind of gear is essential basic information which should be available to the Commission scientists and recommended that, in spite of the difficulties involved, the work now in progress should be continued.

Effort — Because of the work of ICNAF in the past, the collection and compilation of effort statistics has now developed to the stage where it is necessary to pause for appraisal.

It was recommended that the analysis of statistics on efforts should be initiated at the ICNAF Secretariat, giving particular emphasis to the uses which are made of fishing statistics and to inquiring whether the statistics as published by ICNAF can be used for these purposes. The following subjects should be given special study.

(i) The problems associated with equating the efforts of different kinds of fishing vessels in order to calculate total effort on a stock.

(ii) The problems concerned in the calculation of the total effort expended in the capture of each species where several species are taken in the same ICNAF subdivision.

(iii) The problems associated with estimating correction factors to allow for changes in the fishing power of vessels over a series of years. For example, by

(a) The increase or decrease of the mean sizes of vessels within a tonnage class.
(b) New, more efficient gear, for example, the V D gear.
(c) Electronic gear, especially echo sounders and Loran.
(d) Radio.

Detailed records of the introduction of new kinds of gear or equipment should also be kept.

(iv) The choice of the best units of effort for fishery dynamics studies and ways and means found to compile them for ICNAF.

It was recommended that these studies should be made in the coming year in order that the next ICNAF meeting and the FAO meeting on fisheries statistics may be able to make definite and possibly far-reaching decisions or recommendations.

Mr. Holt called the Subcommittee's attention to the survey undertaken by FAO at the request of ICNAF on the statistical coverage of all of the North Atlantic nations, and it was agreed that the report of this survey would serve as a starting point for further investigations.

At a second meeting the subcommittee chose to consider the following questions proposed by the parent committee:

1. Does the Sampling Yearbook adequately meet the Commission's needs?
2. What prevents countries from using standard methods of measuring and reporting sampling data?
3. What data are currently being collected on discards? How are these collected? Should they be published?

Sampling Yearbook

The subcommittee agreed that it is too early to assess properly the value of the Sampling Yearbook, but that after a year or so of use by biologists, the values and weaknesses of the publication could be more adequately assessed. Attention was drawn to the somewhat varying methods of reporting data, particularly as regards age data and to the complete lack of any age data in the reports of some countries. The advantages of the various methods of presentation of age data were considered, as was the fact that the publication of age data which are seriously in disagreement with other published data may stimulate reconciliation of the disagreements. It was recommended to continue publication of age data in the form most convenient for the country reporting.

Standardization of Methods of Measuring and Reporting Sampling Data

Considerable improvement in standardization of methods of reporting length data was noted. The problem of centimeter grouping is well underway toward solution, with most countries reporting either in the requested 3-centimeter groups or in single centimeter groups which are easily converted without introduction of error. The recent ICES-ICNAF agreement on reporting measurements to the nearest centimeter rather than to the centimeter below will forward standardization in this respect. The question of fork length versus total length in not of the importance that it once was since the countries which are reporting in total length are doing so generally on species in which the fork length and total length are essentially the same.

Discards

With regard to the question of collection of information on discards, the subcommittee noted with pleasure that the collection of this information has been substantially stepped up in accordance with the recommendation of the Committee on Research and Statistics (Serial No. 413, 1956 Annual Meeting). However, coverage is far from adequate at present. The difficulties in assessment of the Subarea 5 mesh regulation would have been substantially decreased had discard information been collected systematically for several years prior to regulation. It was recommended that, while captains' estimates and estimates based on research vessel fishing are of value, it is essential that observers should be sent to sea to measure the quantity and sizes of fish caught, fish discarded, and fish retained.

With regard to this problem the subcommittee commended those countries which are now sampling at sea aboard commercial trawlers and recommended that the Secretariat, with the co-operation of member countries, should review the work now being done and the data now available.

APPENDIX V

Report of Ad Hoc Subcommittee on Chafing Gear

Participants: McCracken (Chairman), Ancellin, Clark, Parrish, and Rodriguez.

The Committee discussed the report on chafing gear use (Document No. 14) and concluded 1) that the use of topside protective material for codends is so widely used throughout the North Atlantic that the topside protected codend is virtually a fishing gear unit, and 2) that the information contained within the report did not provide a basis for devising a substitute type of topside chafing gear.

We agreed that no substitute method of protection is known which would more positively ensure that there is no interference with escapement of fish from the codend.

We wish to re-emphasize the conclusion reached at the 7th Annual Meeting that topside chafing gear should be eliminated if possible. We recognize, however, that this is not practicable in the immediate future.

Observations by Underwater Television (Clark, Document No. 26) of the type of chafing gear specified now by ICNAF were discussed, along with some previous information re chafing gear. We concluded that our information about such an important problem is weak, although it appears that chafing gear conforming to present ICNAF specifications probably does not reduce codend escapement appreciably. We strongly recommend that experimental trials of the effect of chafing gear on escapement be carried out. This work could proceed along the following lines:-

(a) Of greatest initial importance are trials of ICNAF type chafing gears using the covered codend method (currently being instituted by the Lowestoft Laboratory).

(b) Covered codend trials with chafing gear of other specifications, i.e. different mesh sizes than the codend or affixed more tightly or loosely.

(c) Comparative fishing trials for nets with and without topside codend chafing gear.

(d) Examination of lengths of fish taken by commercial vessels with and without chafing gear.

The Committee wishes to point out that much routine sampling is done with covered codends and that chafing gear trials could be most economically carried out during such sampling cruises.

The results of the Lowestoft trials will be of the greatest interest and value to others planning chafing gear research, and it is recommended that these results be forwarded as promptly as possible to all member countries through the Secretariat.

APPENDIX VI

Report of the Ad Hoc Subcommittee on Assessment of Benefits of Mesh Regulation

Participants: Graham (Chairman), Clark (Rapporteur), Dickie, Hodder, Holt, Jean, McCracken, Martin.

Others: Eckles, Fleming, Keir, Marcotte, Olsen, Parrish, Posgay, Rollefsen.

The committee had before it for discussion the following documents: Nos. 2, 15, 17, 21; and other material submitted by U.S. biologists.

The Subarea 5 haddock regulation continues to operate as in previous years. The 4 1/2 inch mesh nets which are now used by all vessels landing appreciable quantities of haddock are allowing small fish to escape in precisely the sizes and quantities predicted. The discard of undersized fish on Georges Bank has been nearly eliminated.

The above conclusion regarding selection has been reached through a comparison of data on abundances of sizes of haddock taken with the small mesh study boats with the corresponding data from the remainder of the fleet which uses the 4 1/2 inch mesh. The analysis of these data is now complete. This study corroborates the selection curves derived from mesh experiments conducted with covered codends.

Another conclusion reached from this comparison of study boats and regulated boat catches is a greater efficiency of the large mesh nets for sizes which are fully available to the net. It was shown that the 4 1/2 inch nets catch 9% more fish of the larger sizes than the small mesh nets.

It was agreed that the above conclusions are now well established and that there is no further need for a group of small mesh (pre-regulation size) study boats to provide data on abundance of smaller sizes of fish or on relative efficiency of gears on larger sizes of fish. At the 1957 Annual Meeting it was recommended that the licensing of small mesh study boats be suspended pending analysis of data. It now appears that this program need not be reinstated at present. With present data on mesh selection it is possible to calculate the catches of small mesh vessels over the selection range of the large mesh without, in fact, having them in operation.

The U.S. presented a study of the statistical variation in abundance indices. This is, of course, related to the number of vessels used in the calculations. For twenty-two vessels, the minimum number used in pre-regulation days and in the large mesh fleet, the possible error on an annual basis is 7.2%, with 95% confidence. With six vessels, the average number used in the small mesh study group at any one time, the error is 13.9% with 95% confidence. When the small mesh data are combined for several years as they were in the selection studies, the statistical variation is not more than that in the large mesh data. If the data are broken down by quarters or by year-classes the statistical variation is greatly increased.

It was agreed that these studies of statistical variation should be enlarged in order to provide information important to judging the efficiency of new methods of studying the mesh regulation listed below.

The assessment of the benefit of saving the small fish has been given a great deal of attention and remains a difficult thing to express quantitatively. Present methods still hinge upon relating the yield to the intial strength of the 1952 year-class which is the only large year-class which has entered the fishery since regulation. The sizes of fish landed from this year-class are larger than from previous year-classes. This situation is an effect of the large mesh net and is related to the selectivity of the net. Possibly it also results from saving the small fish.

The Committee engaged in considerable discussion centered about the question of obtaining a precise quantitative measure of the benefits of saving the small fish. It is obvious that saving the small fish is beneficial unless their growth is considerably retarded due to crowding or unless their natural mortality is considerably increased due to injury in passing through the net or for other reasons. We know that their growth is not retarded as we have measured the growth rate and found it as high or higher than average. An important point that remains to be proven is the question of natural mortality of the escaped fish.

Studies over the past year have been concentrated on attempting to establish this elusive parameter. The committee reviewed these studies and made many suggestions for new approaches to the problem. The problem is complicated by the fact that the fishing mortality may vary from age to age and possibly from year to year due to changes in availability. All these points must be recognized when setting up mathematical models to test the effect of saving the small fish.

Three new approaches to the study of the mesh regulation were suggested. The first is outlined in Document No. 17. It requires the use of a larger number of small mesh study boats than was used in the past. Theoretically this method would be useful in assessing the benefit of the regulation, but the committee considered it to be impractical.

A second method requires a study of the change in fishing mortality through the selection range of the large mesh nets. This method described by Beverton and Holt (1955) would provide measurements of natual and fishing mortality rates within the selection range of the large mesh, and from these it can be established whether or not saving the small fish is beneficial. Estimates can also be made of the size of the benefit by the method described in Document Serial No. 557.

A third possibility considered was advancement of age of capture to three years, an age which was originally recommended as the optimum for Georges Bank haddock (Annual Proceedings, 1952). The mesh size necessary for this is somewhat less than 5 1/2 inches.

Moving from 4 1/2 inch mesh to 5 1/2 inch mesh would provide better estimates of natural mortality rate than moving from 2 7/8 inch to 4 1/2 inch for the reason that data collected since the introduction of the present 4 1/2 inch mesh have been satisfactory for providing an accurate measure of early recruits. The 2 7/8 inch mesh did not provide so accurate a measure because of the large quantity of discards which were not sampled in earlier years. If mesh size is increased in Subarea 5 it should be done in steps, possibly starting with a few vessels, then to half the fleet, and lastly the entire fleet. Such a program would provide more precise estimates of effect than have been obtained heretofore.

Recommendations:

1) The licensing of small mesh study boats should be held in abeyance.

2) The study of statistical variations in abundance indices should be expanded.

3) The question of varying fishing mortalities at different ages and in different years should be given attention.

4) Holt's suggestion for assessing benefit (Serial No. 557) should be applies to the Georges Bank data.

5) The U.S. should give consideration to increasing mesh size to allow release of haddock up to age 3.

6) Scientists of Subarea 5 countries should continue their intensive study of the assessment of the regulation, exchanging information and arranging reciprocal visits of biologists to laboratories throughout the year.

APPENDIX VII

Report of the Ad Hoc Subcommittee on Plankton and Hydrography

Participants: Hart (Chairman), Eckles (Rapporteur), Lundbeck, Marcotte, Rodriguez M., Rojo, Ruivo, Tåning, Trout, and Walford.

The Committee considered Mr. Corlett's paper (Document No. 4, Serial No. 529) on plankton research in the ICNAF area, which he prepared following the request of the Committee on Research and Statistics which was made at the 1957 Annual Meeting. The group recognized the excellence of Mr. Corlett's report and recommends that it be received with due appreciation for his efforts.

Mr. Corlett's general discussion pointed out the difficulty of finding out what plankton work has been done in the area in recent years and suggested, as a means of finding gaps in research and knowledge, that a review of plankton research be made. Dr. Ruivo suggested that Dr. Walford's Fishery Oceanographic Research Center might be the appropriate group to make a survey of the present state of knowledge on plankton in the Convention Area, the status of present research efforts, and the potential for future, co-ordinated research. It is recognized that this is an extensive undertaking which could take longer than one year, yet a report on progress of the review should be prepared for the next Annual Meeting. If this recommendation is agreeable to the Committee on Research and Statistics, co-operation by member scientists by furnishing information to Dr. Walford for the proposed review would be expected.

Elaborating on Mr. Corlett's report, Mr. Trout told of success by the Lowestoft Laboratory in correlating plankton abundance and abundance of young cod in the Bear Island area. Data on plankton were sufficient to allow a reasonably good prediction of catches. Dry weights of plankton were used to reduce the effort in identifying species and in making volume computations. It was with this program in mind that Mr. Corlett prepared his suggested program for ICNAF. The Committee recognized that much work had been done in our area and that eventually plankton research might take the form described by Mr. Trout.

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 co-ordinated Commission plankton program and (2) that participating countries bring plankton specialists to the next annual meeting for the purposes 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 co-ordinated program for the ICNAF area, so that they could interest their plankton specialists in this research.

The further opinion was expressed that there is need for the recognition of plankton programs in the over-all Commission's research program which is now being revised and brought up to date for publication following the 1959 Annual Meeting.

The Committee considered hydrography only briefly, noting an interesting report by Mr. Trout that catches of cod in the Barents Sea area have definitely been influenced by water transport. Such examples again pointed out the benefits hydrographic research could have in the ICNAF area. The Committee noted that the Commission has adopted and is effecting a program of hydrographic research, as reported by the Committee's Hydrographic Committee in July 1952 and reviewed, together with later amendments, and circulated on August 14, 1953. This fact should be kept in mind when specialists assemble to consider the ICNAF plankton program, since the latter is dependent on hydrography for its success and effective execution.

APPENDIX VIII

Report of the Ad Hoc Subcommittee on Sampling of Eastern Subarea 4 Cod Stocks

Participants: Jean (Chairman), Ancellin, Fleming, Keir, Marcotte, Rodriguez M., Rojo, Ruivo (Rapporteur).

Consideration of 5 1/2 inch Mesh for Eastern Subarea 4

At an earlier meeting of the Committee on Assessment of Benefits of Mesh Regulations, Canadian studies of cod in Subdivision 4T were discussed. These studies show that there would be further release of small fish and negligible effect on Canadian landings if mesh size in otter trawls were increased from 4 1/2 to 5 1/2 inch mesh. Possible benefits from such a mesh size increase were presented in Document No. 31 of the 1957 Annual Meeting, in Fisheries Research Board of Canada Progress Report No. 69, 1958, and in a summary of the large sizes of haddock taken in this subdivision.

The Committee agreed that the evidence was sufficiently interesting to warrant further study of the effects of a 5 1/2 inch mesh on the fisheries of other countries fishing these stocks and on the fisheries of other subdivisions in the Gulf of St. Lawrence area.

The present Subcommittee was therefore appointed to determine what sampling for sizes and ages of fish caught with a breakdown by those retained and those discarded should be carried out by the countries concerned. The Subcommittee was also requested to study, in the light of recent information on the cod stocks of the subarea, ways of relating catch and effort statistics for the northern parts of 3P and 4V with those for the Gulf of St. Lawrence.

Cod Sampling in the Eastern Part of Subarea 4 by Canadian and European Vessels

The Subcommittee reviewed the sampling programs carried out in eastern Subarea 4 and Subdivision 3P by the various countries. Portugal, since 1955, and Spain since 1957, have taken regular samples of their trawler catches in 4T, 4R, 4V and 3P during the months of February, March and April. Both countries have collected data on the sizes of fish discarded at sea. France does not have observers on its trawlers. France, however, carried out sea sampling from its research vessels in Subdivisions 4T, 4R and 4S in 1951 and/or 1952 and 1954. Data on size composition of cod caught were compiled.

Canada, since 1947, has sampled landings from commercial vessels fishing in 4T and 4V. Canada has also collected data on size composition of cod caught by research vessels operating in Subdivision 4T since 1952. Data on size composition of fish caught and of fish landed by commercial vessels in Subdivision 4T have been collected for the years 1956 and 1957.

Considerable data on size composition of inshore cod (traps and lines) have been collected by Canada during recent years.

In 1957 a systematic survey of cod in Subdivision 4T was initiated by Canada, using a research vessel with covered codend.

In the light of this review of past sampling by various countries, the following needs were recognized:

a) Co-ordination of the various sampling programs and methods;
b) Emphasis of the fact that the whole of the Gulf of St. Lawrence be treated as a unit, taking into account the biological characteristics of the various cod stocks in eastern Subarea 4;
c) Sampling at sea on trawlers by trained observers rather than crewmen;
d) Sampling at sea by research vessels using covered codends.

It is therefore recommended that:

a) The data collected by France in 1952 and 1954 and by Portugal since 1955 on the size composition of fish caught and of fish discarded (or landed) in Subarea 4 be submitted to ICNAF as soon as possible.
b) The countries concerned send observers to sea at the time their fishing vessels are operating in the area. It is essential that observations on the size of fish caught and of fish retained for landing be repeated over a period of years.
c) Sampling of trap-caught cod in 4S be carried out as proposed at the meeting of the Scientific Advisers to Panels 4 and 5 in Quebec, 1957 (Serial No. 517, Document 2, Appendix IV).

Statistics of Catch and Effort in 4V and 3P

Results of tagging experiments indicate that the stocks of cod fished in the northwestern part of Subdivision 3P and in the northern part of Subdivision 4V in winter are parts of the stocks of the Gulf of St. Lawrence.

For the purpose of collecting statistics on catch and effort from the countries fishing in these areas, it is therefore recommended that:

1) Subdivision 3P be divided into two portions: a northwestern and a southeastern portion, defined as follows:

   a) Northwestern portion - that portion of Subdivision 3P lying northwest of a line extending from Burgeo Island, Newfoundland, approximately southwest to a point 46°50' Lat. North and 58°50' Long. West.

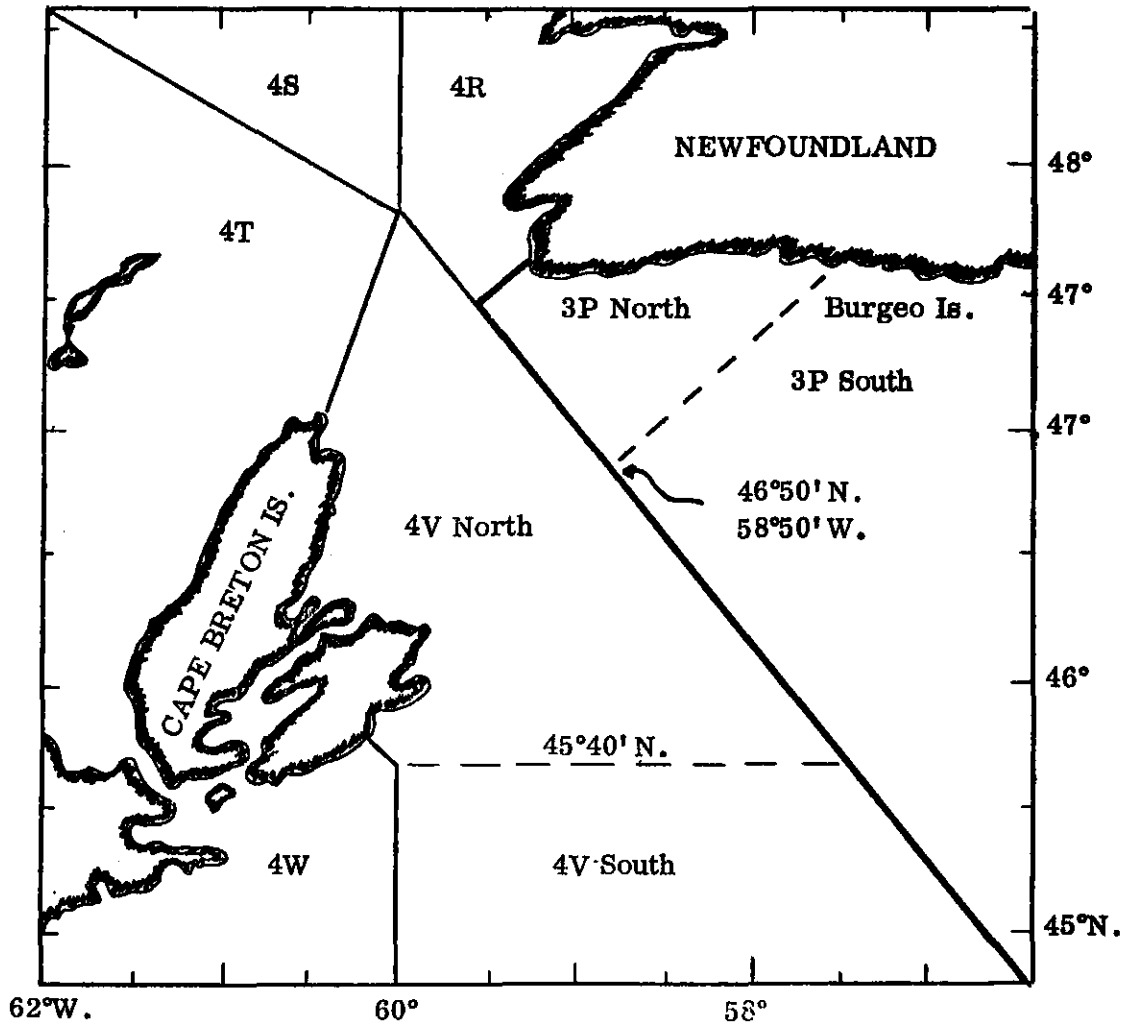
   b) Southeastern portion - that portion of Subdivision 3P lying southeast of the line defined in paragraph 1)a.

2) Subdivision 4V should be divided into two portions: a northern and a southern portion, defined as follows:

a) Northern portion - that portion of Subdivision 4V lying north of parallel 45°40' North.

b) Southern portion - that portion of Subdivision 4V lying south of parallel 45°40' North.

The positions of the recommended dividing lines of Subdivisions 3P and 4V are indicated by dashed lines in the following chart.



APPENDIX IX

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

Participants: Ruivo (Chairman), Lundbeck, Olsen, Rojo, Rollefsen, Tåning, Trout.

Problems concerning cod, halibut and redfish were discussed. Redfish problems were reserved for the working group dealing with this species. The main questions selected to be discussed by the Committee were as follows:

Cod

(1) Owing to the inter-relationship of the cod population of this subarea with the cod of the Icelandic region it appears necessary for those areas to be studied more closely as one biological unit. As it is impracticable to integrate the East coast of Greenland into the ICNAF area, can the Committee suggest other means whereby the research work in East and West Greenland and Iceland can be integrated, in addition to more intimate collaboration amongst scientists working in these areas?

(2) a) Some differences have been observed in the length and age frequency curves due to the different selectivities of gears used. In order to obtain a more accurate picture of the state and structure of population in the subarea two lines of investigation seem useful. First, more intensive sampling of research vessel catches should be made using a small meshed trawl or covered codend. Second, in addition to the sampling at present being carried out, we should attempt to identify a group of otter trawlers, of various countries, which are similar with regards to selectivity, and use them as a standard, and attempt to make certain that samples are taken from the catches of this fleet in each month/subdivision. Can the Committee help implement these suggestions?

b) Great progress would be made if the Secretariat were able to prepare and publish yearly a general picture based on the sampling carried out by all countries.

What difficulties would this introduce for the Secretariat?

(3) Hydrographic background is essential to the interpretation of the biology and dynamics of cod populations. The annual pattern of mass transport is particularly relevant to this purpose. Lack of data in this field is particularly evident during the winter (October-March).

a) Would it be possible to obtain more intensive collaboration of research vessels in that subarea during the winter?

b) Monthly surface isothermic charts are considered desirable. Would it be possible to organize collections of data for these from thermographs installed on commercial ships and from daily temperature data from engine room sampling on fishing vessels? Who would prepare such charts?

(4) Forecasting of fisheries is one of the main aims of research. Observed correlation between meteorological factors or plankton and fisheries can be used, especially to forecast the strength of year-classes.

a) Are the indications obtained from productivity methods (Carbon 14) equivalent to those obtained using the dry weight or fat content of plankton? What is the most significant, most practical and cheapest method?

b) Are surveys of larvae really useful to forecast year-class strength in all areas?

c) What are the best methods of sampling larvae and other plankton? And can ICNAF adopt a standard net and method which can be accepted generally?

(5) Age determination is an essential tool to the work of scientists engaged in the area. Different criteria of interpretation of otolith readings are apparently used especially in the interpretation of spawning rings.

a) What measures can be adopted to make these readings and criteria of interpretation more accurate? Should a special workshop meeting be organized for this purpose or should it be recommended that collection of otoliths with individual determinations be circulated among scientists engaged in this work? Can the Committee organize this?

b) What devices or gadgets are available or can be adopted to facilitate simultaneous observation of otoliths?

c) Abnormal increase of growth rate is observed in growth curves at older ages. What is the real meaning of this phenomenon? Is it the result of misinterpretation of the otoliths of older fish, or is it the result of physiological or ecological changes?

Halibut

(a) Material for age assessment is urgently necessary. How can the collaboration of observers on fishing vessels catching this species incidentally be obtained and best used.

(b) There is evidence of relatively important migrations between Labrador and Greenland. A complex programme of tagging would seem to be the best method of investigating this problem. Does the Committee recommend this?

Wolffish

(a) Material for age assessment is necessary.

(b) Very little is known about the spawning migration. Will it be possible to design a tagging programme for this species?

APPENDIX X

Report of the Ad Hoc Subcommittee on Age Determination

Participants: Trout (Chairman), Fleming, Holt, Keir, and Ruivo.

The primary aims of this Committee were to devise and set up an exchange machinery for small samples of cod otoliths between countries which felt the need for checking and later improving the accuracy of their age determinations.

Four main areas of sampling were considered:

I Subarea 1, subdivided into the (a) Store Hellefiske Bank and (b) Cape Farewell regions.

II East coast of Newfoundland (3K and 3L).

III Grand Bank (containing two populations).

IV St. Lawrence (Subarea 4 containing two populations, one in 4T and 4V north, the other in 4R and 3P north).

It was agreed that only small samples of twenty otoliths covering the commercial size range should be exchanged. If, in addition, research vessel material could provide samples of the smaller fish below commercial size, a further ten otoliths should be included.

Otolith sample sheets will be prepared by Mr. Keir and sample distribution will also be the responsibility of the Secretariat. Once a sample has been read the sample sheet and the otoliths will be returned to Halifax for review at the next meeting.

The countries taking part in this exchange of material are: Portugal, Spain, Canada, France, Denmark, Germany, Iceland, Norway, United Kingdom, and U.S.S.R.

For Subarea 1, it was decided that the primary problem was related to interpretation of spawning zones.

The Secretariat will communicate with each country asking for the appropriate samples.

APPENDIX XI

Report of the Subcommittee on Collection of Information on the Incidence of Cod Ectoparasites (copepods)

Participants: Ruivo (Chairman), Jean, Templeman, and Wise.

At the meeting of the committee on Research and Statistics on June 11, 1958, a working group was appointed to study methods of collection of data on ectoparasites of cod in the Northwest Atlantic area. Attention was focussed on cod and its copepod ectoparasites because these are the species for which most data have been collected and about which most is known at present.

The data collected may help in the identification of cod stocks in the area. In view of the proposed symposium on fish marking (see report of the Ad Hoc Committee on Marking) a co-operative program is desirable.

Considering that such studies should cover a wide area and that the data should be collected in a uniform manner for the sake of comparison, it is recommended that:

1. The incidence and number of Lernaeocera branchialis, Clavella adunca (C. uncinata) and, when possible, Caligus, be recorded during the usual sampling operations.

2. Such records should be made by biologists or properly trained observers because the observations and counts require more careful observation than more routine measurements.

3. Samples should be identified as to date, location, and depth of fishing.

4. The minimum information about the host fish to be recorded is its length.

5. Location and number of Clavella on the host should be recorded by individual fish according to the following zones of attachment:
   a) Anal region
   b) Gills
   c) Mouth
   d) Internal mucosa of the operculum
   e) Fins

6. The size of the sample and the percentage of infected fish and average number of parasites per fish should be indicated for each sample.

APPENDIX XII

Report of the Ad Hoc Subcommittee on Publications

Participants: Graham (Chairman), Hart, Holt, Keir, Lundbeck, Travin, Wise (Rapporteur).

The Committee considered a great many problems related to the publication and distribution of reports relating to the Commission's work and to research conducted in the Convention Area. As a result of its deliberations it makes the following recommendations:-

1. The complete report of the Committee on Research and Statistics along with its accompanying appendices should be multilithed, bound together under a light cover, and distributed to those on the mailing list for the meeting documents.

2. Commission documents should be distributed regularly only to members engaged in the Commission's work and to other international fishery organizations. The Secretariat will use its discretion in replying to other requests for such documents.

3. The Secretariat should request member countries to review their mailing lists for Proceedings, Statistical Bulletins, and Sampling Yearbook, and occasional papers. When countries receive quantities in a block and make distribution within their countries, they should supply the Secretariat with their mailing lists in order that duplication may be avoided.

4. ICNAF should make use of the FAO bibliographic service. The Secretariat should select out from the FAO bibliography a list of papers pertaining to the Northwest Atlantic, adding other papers which may not have been included. This list should be prepared as a document for the 1959 meeting when it can be reviewed and considered for publication in the Proceedings.

Member countries should submit one reprint to the Biology Branch of the Fishery Division of FAO and one reprint to the ICNAF Secretariat of each publication pertaining to the ICNAF area.

5. The Committee reviewed the suggestion of the Action Committee that the Commission assemble annually collections of reprints of papers published by member countries and pertinent to the ICNAF area. It was the opinion of the majority of the Committee that the use to which such a special collection would be made would not justify the time and expense involved. The Secretariat will, in any case, compile one volume of such reprints and present this to the Committee on Research and Statistics for review.

6. ICNAF should publish in its Proceedings abstracts of meeting documents which will be published outside the Commission. References should be included when possible.

7. The Secretariat should canvass member countries to determine the number of reprints required for each paper which the Commission publishes.

8. The report on a long-term research program for the Commission prepared at the Sixth Annual Meeting but never documented should be treated as an appendix to the 1958 report of the Committee on Research and Statistics and so distributed.

9. After the customary editing by the editorial board the following documents of the 1958 Meeting should be published in the Proceedings: Nos. 1,5,6,7,8,9,10,12,13,19,20, 22,23,24,29,33, and 34.

Document No. 11 should be greatly condensed and added to the U.S. Research Report.

Document No. 14 should be treated as an appendix to the report of the Committee on Research and Statistics and so distributed in multilith form.

Document No. 16 should be reduced to about one-half page and printed in the Annual Proceedings.

The statistics submitted as Documents Nos. 25 and 32 will be published in the Statistical Bulletin.

Document No. 26 should be considerably condensed and published in the Annual Proceedings. Figures 1 and 2 should be retained.

Document No. 27 should be summarized and the summary published in the Proceedings. The entire paper should be treated as an appendix to the report of the Committee on Research and Statistics and so distributed.

Document No. 31 should appear as an abstract in the Proceedings, since its contents will be published by FAO.

10. At the next Annual Meeting an *ad hoc* committee on publications should be appointed early in the sessions in order that early consideration can be given to the broad publication problems with which the Commission is faced.

APPENDIX XIII

Report of the Ad Hoc Action Subcommittee

Participants: Walford (Chairman), Martin, Parrish, Poulsen, Rollefsen, and Ruivo.

This group recommends that an Action Committee should be appointed each year by the Chairman of the Standing Committee on Research and Statistics. It should be composed of the Chairman of the Committee on Research and Statistics, the Exectuve Secretary of the Commission and two North American members, one from Canada and one from the United States; and three European members selected from each group of countries as follows: one from Spain, France, Portugal, Italy; one from Denmark, United Kingdom, Germany; one from U.S.S.R., Norway and Iceland.

The duties of this committee will be as follows:

(1) To study the reports of the ad hoc subcommittees each year after they have been reviewed by the Committee on Research and Statistics.

(2) To assign priorities to recommendations made in these reports.

(3) To determine ways of implementing the recommendations.

(4) To assist the Chairman of the Standing Committee on Research and Statistics in preparing the Committee's report to the whole Commission.

(5) To advise the Chairman of the Standing Committee on Research and Statistics on the next year's annual meeting.

(6) To initiate questions (in addition to those initiated from other sources) for consideration in the annual meeting of the committee.

The Action Subcommittee will be appointed at the beginning of each annual meeting and will remain in existence until the beginning of the next.

REPORT TO THE STANDING COMMITTEE ON RESEARCH AND STATISTICS RE TOPSIDE CODEND CHAFING GEAR *

by F.D. McCracken and J.R. Clark

At the 1957 ICNAF Meeting, the Committee on Research and Statistics (ICNAF Ann. Proc., Vol. 7, p. 13, Section 14B, 3 and 4) decided:

(a) to solicit information about the forms of chafing gear used by trawlers fishing in regions outside the ICNAF area;

(b) to study the problem of devising a substitute method of protection for the top of the codend.

Having been asked to undertake these tasks, we decided that (a) preceded (b) since from the information received it should be possible to:

(1) find out how extensively topside chafing gear is used;

(2) get leads to proceed with (b) if various forms of chafing gear were used; and

(3) begin assessment of how effective chafing gear protection is.

Accordingly, in September, 1957, we sent copies of the attached request to research laboratories or other sources in fourteen countries. The specific questions asked were aimed to provide answers to (a) and leads to (b). Information has been received from eight sources and acknowledgement fromone (copies of all replies are filed with the Secretariat). Information has been extracted from these replies and tabulated in the accompanying table. Some of the replies apparently refer to fishing practices both inside and outside the Convention Area. We have accordingly included information about Canadian and United States fishing practices for more complete coverage, even though they were not included within the terms of reference in item (a).

Briefly summarized, the replies indicate:

(1) Chafing gear, usually netting of mesh size similar to the codend, is used extensively on top of the codend by otter trawlers over 500 gross tons. Many trawlers in the 151-500 gross ton class also use topside chafing gear, but smaller trawlers do not. Systems of codend protection seem similar both inside and outside the Convention Area.

(2) Usually the topside chafing gear (generally used netting) covers most of the posterior part of the codend. It extends slightly in front of

* Orignally submitted to ICNAF as Document No. 14 (Serial No. 540) for the 1958 Annual Meeting.

the splitting strap (halving becket) and terminates at varying distances in front of the codline mesh. Usually it is attached along its forward and lateral edge but is open at the posterior end. Most often the chafing gear is about the same width as the codend (an old codend is used).

(3) The basic reason given for using topside chafing gear is protection of the codend, to increase codend life and decrease the chances of losing fish through bursting from a combination of heavy loads and abrasion. In order of apparent importance, chafing occurs

(i) underneath splitting strap (halving becket);
(ii) against ship's side and rail when hauling in;
(iii) before trawl has straightened out in setting (this only happens occasionally).

(4) Protected and unprotected codends used by large otter trawlers are indicated to be of similar mesh size, material and twine size. There were no reports of substitute methods of protection in use. In one instance it was mentioned that a system of cables used for protection had been ineffective.

We believe that experimental testing of any system of protection would be a long-term job. Laboratory tests could probably give preliminary results, but final assessment of wear, for different materials, unprotected and protected codends, etc., would require field testing. Suggestions of substitute methods of protection have not been received through our inquiries. There are cases reported, however, in which topside chafing gear is not used. Preliminary consideration suggests that vessels using protected codends and others using unprotected codends may operate in the same region. Under these conditions, essential basic comparisons would be possible.

After carrying out instructions under item (a) and giving some thought to possibilities under item (b), we should like to suggest:

(1) that a detailed comparison be made between vessels or fleets of vessels fishing similar areas with and without chafing gear on top of the codends. This detailed comparison should aim to establish factual quantitative information about the protection afforded by topside chafing gear. Details of the analysis could be developed in committee by representatives of laboratories from those countries asked to undertake the work (we believe the survey should include analysis of average range of catches, measures of twine and mesh size, records of codend life, estimates of loss resulting from split codends and details of methods used in hauling codends aboard).

(2) that experimentation be undertaken to determine how much double codends and topside chafing gear interfere with fish

escapement. Except for preliminary experiments, we have very little data on their effects (since the posterior portion of the cod-end is believed to be so important in allowing fish to escape, the knowledge of protective material action may be as important as mesh selection information).

(3) that the desirability and necessity for developing substitute methods of protection for the top of the codend be reviewed in relation to results from (1) and (2). Design and testing of substitute methods, if necessary, might be speeded up by underwater observations.

The following is a copy of the letter sent requesting information on chafing gear:

Use of Chafing Gear on Top of Codends

"At the request of the International Commission for the Northwest Atlantic Fisheries, we are attempting to obtain information about the types of 'chafing gear' (protective material on top of the codend of otter trawls) used in the Northeast Atlantic. Continued investigation has led to the conclusion that some form of protective material on top of codends is commonly used by the large trawlers of most countries fishing in the Northwest Atlantic.

"At the 1957 Annual Meeting, the Research and Statistics Committee (Ann. Proc. Vol. 7, p. 13) recommended that:

(a) 'The use of chafing gear on the top of the codend is not desirable in principle, but because of the practical problem involved, chafing gear should be permitted on the top of the codend so long as' .... it conforms to certain specifications.

(b) 'Studies should be carried out to determine if some substitute method of protection for the top of the codend can be devised.'

(c) 'The Committee on Research and Statistics should solicit information on the forms of chafing gear which are used in regions of the North Atlantic outside the Convention Area.'

"As we have been asked to undertake the tasks outlined in (b) and (c), we should appreciate obtaining any information you can give us in answer to the following questions:

A. Is chafing gear or double layers of netting on top of the codend used in fishing for cod, haddock, redfish and/or flat-fish by otter trawlers of any size category?

(i.e.) Trawlers up to about 50 gross tons
" " " " 50-150 gross tons
" " " " 150-500 gross tons
Trawlers over 500 gross tons

B. If chafing gear is used on top of the codend:

(1) What type is used (i.e. loose netting, double layered codends, other material)?
(2) What area of the top of the codend is covered?
(3) Why is chafing gear used?
(4) Describe how chafing gear is attached.
(5) Is chafing gear used with all types of codend materials?
(6) Other descriptive details.

C. If chafing gear is not used on top of the codend:

(1) Do vessels attempt to protect the codend in any other way while it is being hauled over the side of the vessel?
(2) What type and size of twine is used for codends?
(3) What size of mesh is used in codend (state dimension measured)?
(4) How long do codends last?
(5) Give some estimate of average catch per haul."

STATISTICS OF TOPSIDE CHAFING GEAR IN USE IN THE NORTHEASTERN ATLANTIC AND IN THE ICNAF AREA

Countries	Is Topside Chafing Gear Used?	Type of Gear Used Netting over bag: Open Aft	Closed Aft	Purpose of Chafing Gear To prevent abrasion against: Side of Ship	Splitting Strap	Sea Bottom	Codend Materials 1) Natural Fibres	Synthetic Fibres	Mesh Size mm	Average Catch Per Haul-tons
Canada 2)	Yes	Yes	No	Yes	Yes	–	Manila 7) 50-75/4	Nylon 7) 80 yd.	100-114	1
Faroe Is. 3)	No	–	–	–	–	–	–	–	–	–
France	Yes	–	Yes 4)	Yes	Yes	Some	Manila 7) 165 kg.	Nylon 7) 106 kg.	120	2
Germany	Yes	Yes	No	Yes	Yes	Some	–	–	–	–
Holland	Yes	Yes	No	Yes	Yes	–	–	–	–	–
Iceland	Yes	Yes	No	Yes	Yes	–	–	–	–	–
Italy	–	–	–	–	–	–	–	–	–	–
Norway	No	–	–	–	–	–	Manila 4 ply	–	110	4?
Poland	No 5)	–	–	–	–	–	–	–	–	–
Portugal 2)	Yes	Yes	Some	Yes	Yes	–	Manila 7) 3 ply	–	114+	3-5?
Russia 3)	Yes	–	–	–	–	–	–	–	–	–
Spain 3)	Yes	–	–	–	–	–	–	–	–	–
Sweden 3)	No	–	–	–	–	–	–	–	–	–
U.K. 6)	Some	Yes	No	Yes	Yes	–	Manila 7) 50-75/4	–	110+	2
U.S.A. 2)	Some	Yes	No	–	–	–	Manila 7) 45-60/4	Nylon	114	1

1) With reference to large otter trawlers. 2) Information for ICNAF area. 3) From replies given during previous ICNAF meetings. 4) Pre-regulation. 5) Not used for groundfish fishing. 6) Precise answer to extent of chafing gear use deferred. 7) Double.

COLLABORATION BETWEEN FAO AND ICNAF, 1957/58*

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

1. Standardization of Fishery Statistics

At the Lisbon meeting the Commission decided to give encouragement to FAO to convene a meeting of experts to develop a plan of standardization and to prepare for this by studying methods used in the various countries concerned. The Committee on Research and Statistics recommended that such a meeting should include expert representatives of national fishery statistical institutions, including particularly the nations fishing in the North Atlantic, and made some suggestions regarding the subject matter to be discussed. It also considered it desirable that FAO should send one or more experts to as many of the countries concerned as possible to study and prepare a report upon the problems and methods of collecting fishing statistics. Accordingly, FAO Fisheries Division contracted with Mr. F. Rashley of the Dominion Bureau of Statistics, Ottawa, Canada, and Mr. J.B. Rutherford of the Economics Service of the Department of Fisheries of Canada, to conduct a survey of fishery statistics in the North Atlantic area. The following countries were visited by one or other of the two experts:- the United States, Iceland, Norway, Sweden, Denmark, the Federal Republic of Germany, the Netherlands, France, the United Kingdom, Spain, and Portugal. In addition, a study of Canadian fishery statistics was included in the survey. The Division now has in its hands a draft report based on this survey. The second part of this report describes the systems in each country, one by one, and these descriptions will be sent to each of the countries concerned for their comment. The final draft of the whole report will be circulated to prospective participants in the meeting on fisheries statistics which FAO intends to convene in the autumn of 1959. We are at present corresponding to determine a suitable venue for this meeting, which will preferably be in a European member country of both ICES and ICNAF, immediately preceding or after the 1959 Statutory Meeting of ICES, though not necessarily at the same place. Suggestions for working and background papers for this meeting would be welcome and it is hoped that participation will be obtained from the Secretariats of ICNAF, the ICNAF Research and Statistics Committee, the ICES Committee on Statistics, users of international statistics in both the biological and economic fields, and - particularly important - those who are responsible for collecting and compiling statistics in each of the participating countries.

2. Sampling Manual

At Lisbon the Research and Statistics Committee affirmed the need for a manual of statistical methods for fishery workers and encouraged FAO as sponsors to pursue this project. The draft of the paper on "Sampling problems and methods in fishery research" by J.A. Gulland, which was distributed during the Lisbon meeting, has now been revised

* Originally submitted to ICNAF as Document No. 27 (Serial No. 553) for the 1958 Annual Meeting.

and published in English, French and Spanish in the FAO "Fisheries Bulletin" (reprints of this paper are available). Mr. Gulland has now been commissioned by FAO to prepare a more comprehensive manual on this subject and has submitted to FAO the first outline of it. We have approached the United Kingdom Government with a view to obtaining Mr. Gulland's services as instructor during the International Training Center on methodology of mackerel investigations, to be held under the Expanded Technical Assistance Programme at Bangkok during the last quarter of this year. We propose that Mr. Gulland should on his way to the Center visit fish landing places in the Indo-Pacific region to study conditions there under which market sampling would be undertaken and also the conditions of sampling at the fishing sites. The outline notes of the manual, which will be largely based on those prepared for the course on stock assessment held at the Fisheries Laboratory, Lowestoft in February 1957, will be used during the Bangkok Training Center and revised on the basis of experience gained there with a view to completing the manuscript during 1959. In this connection, the Commission may also be interested to know that a manual on methods in fishery population dynamics is also in preparation and this work will include a review of the methods of age determination of fish and of the methods of conducting and interpreting tagging experiments.

3. Joint Scientific Meetings

The Commission will be interested to know that, as a result of some publicity given to the 1956 Biarritz meeting of the Research and Statistics Committee and of correspondence since then with workers in the field of population dynamics, we have received a large number of requests for copies of the published proceedings. That meeting has, in fact, aroused very considerable interest outside the North Atlantic area.

With regard to the publication of the reports and proceedings of the Joint Scientific Meeting of ICNAF/ICES/FAO held at Lisbon in 1957, we can report good progress in the editing of manuscripts of contributions to the workshop on the effects of fishing on stocks. The Steering Committee of the meeting convened in Bergen at the time of the last Statutory Meeting of ICES and made detailed arrangements for the preparation of the final manuscript and its publication. FAO will undertake the latter task and we hope that the final proceedings will be published during the first half of next year.

The Joint Meeting in Lisbon recommended that steps should be taken to ascertain the need for an international Journal of Fishery Dynamics. A small committee was appointed with representatives from each major area of the world and questionnaires were sent out. The replies were analysed and a report on them considered by a meeting of those members of that committee who attended the UN Conference on the Law of the Sea at Geneva earlier this year. As a result of their consideration, it has become clear that there is indeed a desire for such a journal and recommendations were made for definite action to be taken to establish the Journal. FAO is considering the possibility of underwriting such a journal for a short initial period and will approach possible publishers, as well as initiate action to establish an appropriate international editorial board.

The Joint Lisbon meeting also made certain recommendations regarding the standardization of mathematical notation for fishery population dynamics. Action on this recommendation has been taken as far as submission of a joint note by S.J. Holt, FAO, Clyde C. Taylor, ICNAF, J.A. Gulland, ICES and Susumu Kurita, Japanese Notation Committee,

for publication in the forthcoming issue of the Journal of the International Council for the Exploration of the Sea. Reprints of this paper will be distributed widely to editors of journals, other international organizations and institutes regularly publishing papers of a kind to which the proposed standards refer.

In addition to this paper on notation we have begun work on the indexing of the papers for the Lisbon meeting and on the extraction of terms and definitions from those papers. This is part of our work on the definition of concepts and terms, and on classification, which has been rather slowed down over the past eighteen months; however, we are very alive to the importance of this work and intend now to give it high priority.

The report of the Joint Lisbon meeting recommended further studies of the use of high-speed computers in the assessment of fish stocks and other fisheries research problems. In addition to correspondence between the convenor and scientists in various parts of the world concerned with this problem, arrangements have been initiated for collaboration between FAO and the International Computation Center recently established by UNESCO with its Headquarters in Rome. It is hoped that it will be possible to make arrangements both for the computation of tables of functions important in fisheries population studies and also evaluation of comparative compiled data relating to the parameters of exploited stocks.

4. Other Scientific Meetings

Apart from the Second Fishing Boat Congress and the International Meeting on Costs and Earnings of Fishing Enterprises, to which publicity has already been given, two scientific symposia on subjects of some interest to the Commission are planned by FAO for the near future. In December this year FAO is collaborating with the Indo-Pacific Fisheries Council in a Symposium on Fish Behaviour, for which contributions will be obtained from outside the Indo-Pacific area. In September 1959 we are convening at Rome a world meeting on the biology and fluctuations of sardine stocks and it is hoped at this meeting to review the whole field of the analysis and interpretation of fluctuations in stocks and catches of the commercially important pelagic fishes.

The Commission may recall that at its 4th Meeting, in 1954, we gave a preliminary account of our plans for work relating to the data and methods of resources appraisal. Those plans included the holding of a series of subject meetings the results from which, associated with the results of consultations with regional councils and commission, were to be considered at a world colloquium on fishery resources at which a stocktaking of these resources might be attempted. Such a stocktaking, it was thought, would revise and bring up to date the conclusions reached at the UNSCUUR Conference of 1948. The Commission will be interested to know that the plans are developing with reasonable success, even if on a timetable sustantially longer than was contemplated in 1954. The Division collaborates closely in this work with UNESCO chiefly through its International Advisory Committee on the Marine Sciences. The following table shows the tentative plan being followed by FAO and UNESCO in this collaborative effort. The Commission will recognize that this series seeks to deal with the several aspects of fish populations and their environments in a constructive and cumulative way to permit at the end a reappraisal of fishery resources. The schedule is by no means fixed; nor is it exclusive: the Commission will note that supplementary meetings will be organized to consider special groups (for example the sardine meeting) and limited subjects.

A copy of the prospectuses for the behaviour and sardine symposia are available at this meeting for examination by interested persons.

(1) Methods of measuring basic production; Bergen 1957; ICES, UNESCO
(2) Fish behaviour and its determinants; Colombo or Bangkok; 1958; IPFC, FAO
(3) Methods of measuring fish food populations and their processes; New York, U.S.A.; 1959; AAS, UNESCO, FAO
(4) Fish mortality and its determinants; Tunis; 1960; GFCM, FAO
(5) Fish nutrition and its determinants; Latin America; 1961; FAO,UNESCO
(6) Fish reproduction and its determinants; East Africa; 1962; CCTA, FAO
(7) Productivity and the inventory of production of the seas; Rome; 1963; FAO, UNESCO

5. Bibliographic Work

Some members of the Commission may know that Fisheries Division Biology Branch began in January this year the publication of a monthly "Current Bibliography for Fisheries Science", copies of the first two issues of which are available. This cumulative, annotated bibliography is being given a limited distribution to other international organizations and collaborating persons and institutes and taxonomic and geographic indexes are being prepared. The subject classification is being revised and it is hoped during next year to introduce cumulative subject indexing. We are exploring the possibilities of practical collaboration with other bodies interested in this project, especially, at present, the International Council for the Exploration of the Sea, and are making arrangements with institutions in Japan and the USSR to furnish translated contents lists of journals and annotations ready for immediate publication. The FAO observer will be happy to discuss with the ICNAF Secretariat possible ways in which practical collaboration may be started between the two organizations.

6. Research Methods: Standardization and Mechanization

A major objective of the Bangkok Training Centre mentioned above in section 2 is to promote the standarization of field and laboratory operations and techniques. In proposing the organization of this centre, the IPFC and its Rastrelliger sub-committee strongly emphasized the desirability of basing the co-ordination of national research programmes on methods that had been statistically tested and standardized and considered that the centre would give an opportunity to test methods and to formulate a common plan of studies. It is intended to submit a report of the centre and a set of recommendations on these matters, to the IPFC 8th Session in Colombo, immediately after the Training Centre.

At the same time efforts are being made through the GFCM to initiate similar work on the standarization of clupeoid measurements. Mr. Ruivo's paper on this question, written under contract with FAO and submitted to the last session of the GFCM, has been widely disseminated and comments on it have been sought. It is hoped that this work may be carried a step further at the next GFCM session in Rome, in October this year.

Our plan to make a through survey of biological methods in use throughout the world, and to appraise the practicability and desirability of mechanizing some of these operations,

has had to be deferred because of the pressure of work on other commitments. We hope to be able to make an energetic attack on this question in the near future and, of course, the results of the Bangkok Centre, and of the GFCM discussions should here be of considerable assistance.

7. Data and Methods of Resource Appraisal

Our work in this field stands firmly on three broad foundations: the bibliography and documentation, terminology and classification, and methodology. Establishment of these foundations has occupied much of our time since we first described these plans to the Commission; some of our activities in connection with them are mentioned in the preceding sections.

The substantive resources work is being pursued along four lines between which there is constant communication. The first approach obviously must be by way of examination of current exploitation and extraction from this of evidence as to the nature and magnitude of exploited resources. For this purpose we are systematically storing information on current production and on all factors whose operation influences production and for which allowance must be made in deducing anything about resources from the evidence of production. This information is being reduced into country and regional synopses, of which nineteen have now been made. These synopses are at present in only draft form, serving as working papers for us. We hope that before long they will assume a definitive form worthy of distribution to interested workers.

The second approach is by way of analysis of the characteristics and properties of species of present or potential economic importance. For this purpose we have made extensive lists of species, accumulating for practical purposes also their common names. Next we are accumulating data concerning each species and for selected species, genera or groups we assemble the information according to a special pattern which gives, we believe, an ecological specification of the species. Five of these species synopses have been prepared (for Rastrelliger, Hilsa, Whales, Tinca tinca, and Trichiurirodei), and have been submitted to specialists throughout the world for comment and modification. A synopsis for sardines is being made at present, and one for gadids is planned. Many methodological advances in the treatment and reduction of data, must be made before these synopses will be satisfactory for our purposes.

The third approach is by way of examination of the characteristics of the environment of the species of economic interest, taking here the broader definition of resource as embracing the entire system whose working has the economic species as end-product. Again information is being accumulated and reduced into synoptic statements. One set of information related to oceanic areas, the other to river systems and basins. Synoptic statements for ten marine areas have been prepared, and others are in course of preparation; synoptic statements for the Ganges-Brahmaputra and for the Mekong basins are in preparation.

Copies of the outlines employed for these synoptic statements are available for examination by interested persons.

The Commission will recognize that many of these papers will come before meetings of regional councils and commissions (as for example, the paper on the resources of the ICNAF area) and before the subject meetings referred to above; the Commission will also recognize that if preparation of these papers is successful the operation will result in a set of authoritative documents to serve as working papers for the eventual world appraisal meeting which we contemplate.

AN OUTLINE OF PRESENT RESEARCH AND LONG RANGE NEEDS IN THE CONVENTION AREA*

COD

Cod is by far the most important species in the Convention Area. It is the species of greatest interest to nine of the ten** ICNAF member countries. For these reasons, it is essential that the greatest emphasis in ICNAF research should be placed on cod.

The following problems require increased study in order that scientists may recommend the means of obtaining maximum sustained yield from the cod stocks:

1. The Population Structure of the Cod Species in the Convention Area.

   How can the stocks be distinguished? The cod of the ICNAF Area are divided into a number of populations which show different characteristics of behaviour, growth and migrations. Some intermingling of populations has been observed from studies of tagging and vertebral counts. Our knowledge of divisions of populations is well advanced in the Convention Area, but the work must be continued. Since classical methods of investigation have been expensive and laborious, it is proposed that further studies should follow new methods of distinguishing populations wherever possible. Serological and chromatographic techniques are suggested.

2. Population Dynamics

   At what age should the cod in different areas be taken? With what intensity should the stocks be fished?

   To answer these questions it is necessary to have the growth rates and mortality rates of each stock. In order to compute these rates, it is necessary to have extensive data on the quantities, sizes, and ages of cod taken. Most of these data can be obtained from commercial fishing vessels at relatively low cost. However, since large quantities of cod may be discarded at sea, adequate sampling cannot be obtained from the landed catch. Observers must go to sea on commercial vessels to sample the discarded portion of the catch. Each country taking substantial quantities of cod should have two observers at sea collecting the needed information and they should, as far as practical, move from vessel to vessel in the fleet. The landed portion of the catch can be sampled ashore.

   Sampling of the commercial catch of cod in the Convention Area is very inadequate for all countries and for some, such as France and Italy, is entirely lacking.

   If sampling by member governments cannot be so expanded, the Commission should set up a joint program of sampling commercial catches. This would involve

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* Originally submitted as a report of the Standing Committee on Research and Statistics at the 1956 Annual Meeting. ** There are now (1958) twelve member countries.

employment of observers and charter of vessels. It should be avoided until other methods of sampling are fully explored.

Portugal and Spain have already taken steps to meet this requirement. Other countries, such as Denmark, with substantial exploitation in any particular subarea should carry out proportional amounts of sampling.

Valuable information on changes in abundance of cod can be determined from studies of log book records of past fishing. Landings can be allocated by area of capture and by fishing effort. It is noted with satisfaction that the United States and Spain (PYSBE) are contributing historical catch-effort data. Other sources of such information should be investigated and summarized wherever possible.

3. Effects of Mesh Regulations

It will be important to assess the effects of mesh regulations on landings of cod. This will be particularly true if larger mesh sizes are proposed in the future. It is important now to lay the basis for assessing the effects of mesh regulations. Adequate statistics and sampling of the commercial fishery is the key to evaluation of mesh regulations.

Problems of lower priority will be solved by following long-term programs of research at sea. These include:-

4. Horizontal and vertical distribution of cod by ages and sizes

Distribution is poorly known for small cod below commercial sizes. Systematic experimental fishing with available research vessels or by chartered commercial fishing vessels is needed to study this problem.

5. Tagging

The tagging of fish at sea is needed to determine migration and mortalities of cod. Much has been done in this field, particularly in inshore waters. Information is still weak for cod of offshore banks and tagging should be pursued further there.

Tagging of cod just outside the Convention Area (e.g. E. Greenland and Iceland) should be encouraged by the Commission.

The Commission should give close attention to recaptures of tagged cod. Large differences in the numbers of tags found by different vessels and by different countries show that a great many tags are not returned by fishermen. Member governments can contribute to these costly investigations by organising the collection and handling of all tags recaptured by their fishermen.

Tagging techniques should be improved wherever possible.

6. Spawning

The spawning seasons and places of the cod are only superficially known in the Convention Area. Examination of gonads for state of maturity and systematic plankton sampling for concentrations of cod eggs will contribute the required information on spawning. Studies of fish gonads can be carried out quickly, and at low cost, and this approach should have priority.

7. Effects of Environment

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

8. Gear Selection

The selectivity of each of the many gears used to catch cod must be studied as background for management of cod stocks. Mesh selection by North American otter trawls has been studied extensively, but almost nothing is known to date about the selective properties of other fishing gear used extensively in the Convention Area.

For all these problems, investigations at sea are required on commercial and research vessels. The number of offshore research vessels operating in the Convention Area is small. Offshore research is particularly weak in Subareas 2, 3 and 4 and research vessels should be provided for work in these areas.

HADDOCK

Expanded research does not appear to be required since haddock research has been emphasized during the early life of the Commission, and since haddock landings are very much less than cod. It is recommended that haddock research programs should be continued at the present level.

The Subarea 5 haddock fishery is a model for the Convention Area, and haddock research should be continued intensively there.

Measurement of quantities, sizes and ages of haddock caught and landed by commercial vessels has high priority. Increased sampling at sea is required, especially in Subareas 3 and 4.

Assessment of the effects of mesh regulations must continue to receive high priority in Subarea 5, and, if possible, similar programs should be developed for Subareas 3 and 4.

Problems requiring special research are:-

1. Definition of populations, with emphasis on new techniques.

2. Effects of selective fishing, temperature, food and population density on growth and yield.

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

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

REDFISH

1. The horizontal and vertical distribution of redfish by sizes and ages

   a. Systematic experimental fishing with available research vessels or by chartered commercial vessels.
   Present Status: The U.S. and Canada are conducting limited surveys.

   Additional Resources Required: The U.S. should expand its surveys and collect more information on sizes, ages, and sex in relation to depth and time of day. Canada should expand its surveys when its new research trawler comes into operation and earlier if it is possible.

   b. Observation by underwater television. An attempt should be made to use this device in redfish problems. If some attractant could be used in conjunction with the camera, valuable information on vertical distribution might be obtained. The camera might also be used in conjunction with development of detachable hooks.

   c. The rapid development of echo-sounding equipment, especially of the cathode-ray-tube type, gives hope that this type of equipment will be very useful for the study of vertical distribution and such equipment should be used and developed.

   d. Records of redfish sounds can possibly be used in the study of vertical distribution and studies of these sounds could be carried out.
   Present Status: The U.S., Canada and U.K. now have underwater television cameras.

   Additional Resources Required: Since the use of underwater television is still in a developmental stage, no recommendation is made for other countries to invest in this equipment. Countries having these devices are urged to use them on redfish problems.

2. The population structure of redfish

   How is S. marinus divided into stocks? How can these stocks be distinguished?

   a. Study morphological characteristics of samples of fish taken from the commercial fishery and by experimental fishing; analyze these statistically.

Present Status: U.S. is conducting such studies on stocks from Subareas 3, 4, and 5. Canada is conducting studies in Subareas 2, 3, and 4. Germany is doing this type of work from Western Greenland to Norway.

b. Study of distribution and life history of parasites.
Present Status: U.S. is completing study of incidence of Sphyrion lumpi. Canada is doing similar work in Subareas 2, 3, and 4.

c. Development of serological distinctions.
Refer to general committee recommendations.

3. Spawning

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.
Present Status: U.S. is making regular surveys in late winter and spring in Subarea 5. These surveys are essentially for haddock and are relatively unimportant for redfish whose spawning is considerably later. Canada is carrying out plankton surveys in Subareas 4, 3, and 2, and Denmark in Subarea 1.

Additional Resources Required: U.S. should expand its surveys to include at least the summer and early autumn period and should attempt to get plankton samples from commercial and Coast Guard vessels. Canada should expand its activities when the new research trawler is ready and earlier if possible.

4. Growth rate

Determine the growth rates of the various stocks of redfish.
Present Status: It is agreed that the method used by ICNAF countries for validation of otolith rings is correct. However, more precise methods of age determinations are needed for definite allocation of fish to the correct year-classes. Every advantage should be taken of the appearance of large year-classes of small fish, such as is now being studied by Canada in Hermitage Bay in the south west of Newfoundland. In some cases in which year-classes immediately later have very poor survival, it should be possible to follow ages by a study of length frequencies, and also by otoliths or scales and concurrently distinguish differences between winter checks on the otoliths and checks at other seasons.

Additional Resources Required: In U.S. a greater attack should be made on devising a rapid means of age determinations and on obtaining age compositions and growth rates for many populations in Subareas 3, 4 and 5.

5. Tagging

What are the routes of migration of redfish? Where, when and to what extent do the stocks from the various banks intermingle? What are rates of mortality? These questions can be studied together by tagging experiments. For this a practical method of tagging must be devised.
Present Status: Inactive.

Additional Resources Required: A tag should be developed which can be attached to redfish at their natural level in the sea and other methods of tagging investigated.

6. Effects of environment

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

a. Rear young redfish in aquaria, experimenting with such factors as temperature, pressure, food, etc.
Present Status: Inactive.

Additional Resources Required: When aquarium facilities become available, U.S. should emphasize this research. Norway also will in due course have facilities for this work.

b. 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.
Present Status: U.S. is collecting data on temperature and food relations.

Additional Resources Required: More intensive work should be carried out by all countries fishing substantially in the ICNAF area for redfish.

7. Gear selection

Determine relation between mesh size and sizes and ages of redfish caught.
Present Status: U.S. and Canada have conducted some experiments on this problem.

Additional Resources Required: The U.S. should conduct further tests on other sizes of mesh and the experiments should be repeated in other areas by other countries.

8. Population dynamics

What are the most probable relations between mortality rates and yield of redfish? This problem can best be solved by construction and testing of mathematical models. In this connection also consideration should be given to the effect that gear selection has had on the derived growth rates.
Present Status: See Sampling and Population Dynamics, page 61.

HALIBUT

It seems unlikely that a full scale research programme could be undertaken on halibut, comparable to those proposed for cod, redfish and haddock. A minimal programme that could provide the practical information required for increasing the yield of this resource follows:

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

   a. Tabulate quantities of halibut eggs and larvae taken in plankton surveys for cod, haddock and redfish. Relate these quantities to probable size of spawning populations. Where possible, take deep and very deep tows.
   Present Status: U.S. is making regular plankton surveys in Subarea 5.
   Canada is making plankton surveys in certain parts of Subareas 3 and 4.
   Denmark is making regular tows in Subarea 1 for cod eggs and larvae.
   Spain is making regular tows from commercial vessels in Subarea 3.
   Portugal has taken some plankton tows in Subarea 3.

   Additional Resources Required: Each of the above countries 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.

   b. Record quantities, sizes and sexes and collect otoliths (only otolith from blind side are very useful) from all halibut caught during fishing voyages on which sea samplers are present.
   Present Status: Several countries are now sending observers on commercial trips regularly for study of other species. (See reports on Cod and Haddock, page 50 and 52 respectively.)

   Additional Resources Required: The collection of these data could be effected without additional cost.

2. What changes in abundance of halibut have occurred in the past?

   Collect and study records such as log books of fishing vessels and accounts of shore companies.
   Present Status: Inactive, except for Norway and Denmark.

   Additional Resources Required: The service of one man for a year.

3. Population dynamics

   From knowledge of growth rate of Atlantic halibut, and with various assumed mortality figures, construct isopleth models for judging possible effects of modifying fishing rates.
   Present Status: Inactive.

   Additional Resources Required: See report on Sampling and Population Dynamics, page 61.

4. Statistics

A real effort should be made to obtain more accurate records of total catch. Changes in fishing effort and fishing methods should be recorded.
Present Status: Catch records are good for countries landing halibut in quantity. Records, or at least estimates, for the salt cod fleet are required.

Additional Resources Required: Probably none, if port agents are already examining log books.

5. Definition of stocks - tagging

A tagging programme covering the entire Convention Area and the region about Iceland should be conducted.
Present Status: Denmark is conducting limited tagging in Western Greenland. Norway is tagging in Davis Strait and Labrador. Iceland is tagging small halibut in the Iceland waters.

Additional Resources Required: Tagging is expensive because of the value of the fish, but an extended programme is needed, especially in the area of Iceland and East Greenland to determine the relation of the Icelandic and Greenland stocks. Canada and the United States should tag in Subareas 4 and 5. Observers on the salt cod fleets should tag in Subareas 1 and 3. These fish are not considered valuable and, although some are in poor condition, many survive. Denmark and Norway should continue their programmes. U.K. should initiate a programme in East Greenland.

STATISTICS

1. The Reporting of Catch and Fishing Effort by Gear, Month and Subdivision

Present Status: Most countries are now reporting landings and fishing efforts of their fleets fishing for groundfish in the North West Atlantic in the detail required by the Commission. However, more information is required on the fisheries of Canada (inshore fishery), Denmark, France, Iceland and Italy.

Canada: The Canadian inshore fisheries land about half the cod caught in Subareas 3 and 4.

Additional Data Required: Further information should be collected on the gears used in this fishery and landings should be allocated according to the type of gear used in each month and subdivision of capture.

Proposed Action: (1) As a first step estimates could be made now, on the basis of the report of fisheries officers, scientists and others, and these estimates should be published in the next Statistical Bulletin. (2) In order to evaluate the problem, rough summaries (as accurate as present knowledge permits) of the numbers and kinds of vessesl (boats) engaged in this fishery should be prepared (see Item 11).

Denmark:

Additional Data Required: (1) The landings of the Greenlanders' fisheries and the Faroese small boat fisheries in Subarea 1 should be reported by month, subdivision and gear. (2) The detailed reporting of the landings and efforts of the large Faroese vessels by month and subdivision of capture is required. This should present no unusual difficulties.

Proposed Action: (1) Estimates should be made now as a first step by scientists and fisheries officers and published in the next Statistical Bulletin. (2) A start should be made now too on the analysis of log-book records and on interviews with the captains of fishing vessels.

Iceland: The otter trawlers fishing from Iceland form a homogeneous fleet of vessels whose effort and landings data would be particularly useful in studies of indices of abundance. The total number of trips to West Greenland (58) is not large and it should be possible to obtain data on efforts and landings by month and subdivision of capture.

Proposed Action: (1) Estimates should be made now for the 1955 fishery and included in the next Statistical Bulletin. (2) A programme using bog-books and personal interviews with the captains of fishing vessels (or any other method) should be begun now to obtain the required data on the area of fishing operation and the fishing effort.

France: Landings are now submitted in the detail required but fishing effort data are reported only by subareas.

Additional Data Required: Effort data should be collected and reported by month and subdivision.

Proposed Action: Detailed data need not be collected from all vessels. The log-books of the fifteen vessels for which effort data are now submitted by subareas could be re-examined to give fishing effort data by months and subdivisions. If this could be done for the 1955 fishery, the data would be published in the next Statistical Bulletin.

Italy: Only total landings from the Convention Area are reported. As this fishery is carried out by three large otter trawlers, the collection and reporting of the required statistical data on efforts and landings should present no major problems.

Proposed Action: A start should be made now by the analysis of log-book records.

2. Fish Discarded at Sea

It is essential that accurate estimates of the weight and size of fish discarded at sea should be obtained.
Present Status: Occasional estimates by observers have been reported by Canada.

Proposed Action: Two observers should be sent with each major fleet to make observations on the quantity, species and size of fish discarded at sea.

3. Definition of Fishing Effort

It is probable that the meanings of the terms used for fishing efforts such as 'days fished' or 'hours fished' vary between countries.

Proposed Action: Precise definitions of the terms used to describe fishing effort should be obtained from all countries and published in the Statistical Bulletin.

4. Size Categories

In many of the member countries fish landed are divided into size categories. These size categories vary from country to country and cannot be compiled internationally.
Present Status: Several member countries report their landings to the Commission broken down by size categories and they are so published in the Statistical Bulletin.

Proposed Action: Landings published in the Statistical Bulletin should not be broken down by size categories but countries reporting such data should continue to do so when they are of value when combined with size composition data based on sampling.

5. Conversion Factors

Landings are reported to the Commission in terms of the condition first weighed. These landings are then converted to round fresh weight by the use of a conversion factor.
Present Status: Different conversion factors are used by the Commission for converting landings of the same species landed in the same condition from the same area. This inconsistency is undesirable.

Proposed Action: The same conversion factor should be used for landings of the same species landed in the same condition. In general the principle should be to use the same conversion factors until experiments have shown that different conversion factors are justifiable. A conversion factor of 1.2 should be used for converting the fresh gutted head on (drawn) weight to round fresh for cod, haddock, cusk, pollock, silver hake and wolffish.

6. Presentation of Statistics in ICNAF's Statistical Bulletin

Present Status: The detailed statistics received by the Commission are classified by countries, gears, areas and months and printed in that order (refer to Tables 8-20, Statistical Bulletin, Vol. 4).

Proposed Action: The detailed data should be reorganized and classified for publication by areas, months, gears and countries (in that order).

7. Mechanization of the Handling of Statistics

A large quantity of statistical data is now received by the Secretariat for processing and publication and even more will be received next year.
Present Status: All data is hand-tabulated using desk calculating machines where necessary. This method is too slow to handle the analyses required with the Commission's statistics with the present staff.

Proposed Action: The Secretariat should continue with its preparations for mechanizing data handling and, when a suitable system has been prepared, introduce it. A sum of $1,000 should be appropriated for this purpose.

8. The Accuracy of the Commission's Statistics

To determine the accuracy of the yield per unit of effort statistics submitted to the Commission requires analyses of the catches and efforts of individual vessels working in the same area supplemented by comparative fishing experiments. The Secretariat cannot undertake this work. It could be done on a country basis i.e. it would not require international action.
Present Status: Individual vessel data has been reported from France and Spain but is not yet fully worked up.

Proposed Action: All countries should undertake an analysis of their own data to determine the order of accuracy of the figures they are annualy submitting to the Commission. Results should be submitted to the Secretariat for appraisal and compilation.

9. Past Data

The past history of the fishery in the Convention Area is contained in the old log-books of the captains of the fishing vessels and in the records of statistical offices.
Present Status: A considerable quantity of this data has already been submitted but is not yet fully published.

Proposed Action: Member countries should list all early log-books, statistical reports, etc. which refer to their fisheries in the Convention Area in the past, and report this list to the Commission. The Secretariat should compile and publish summaries of these lists and should also publish suitable summaries of all past data which have been received.

10. Effort Data Allocated by Species

Catch and effort statistics are summarized by month/subdivisions. In some cases this results in the combination of data from trips devoted to separate species, e.g. cod or redfish. The catches per unit of effort based on such summaries may be misleading if used as indices of the abundance of these species. In the case of the United States and Canada, this results in a great loss of detailed information.
Present Status: Effort data are separated by species for the Newfoundland otter trawlers.

Proposed Action: Canada and the United States should attempt to suppy catch per unit of effort data (mainly for the large otter trawlers) by separate species. It would probably be necessary in mixed fisheries to tabulate data for single species trips only.

11. List of Vessels Fishing in the Convention Area

Proposed Action: Each country is requested to submit a list of its vessels of over 50 gross tons fishing in the Convention Area in 1956. Fleets of smaller vessels should be dealt with in a more summary fashion, giving the number and average size of the various types. The list of vessels should give for each vessel of over 50 gross tons, fishing in the Convention Area, the name, registration number, gross tonnage, overall length, type of engine and fuel, horsepower, kind of fishing gear used, subareas of operation and whether such gears as wireless telephone, Loran, radar, vertical echo-sounder or echo-ranger are carried. A printed form for the reporting of this data is to be sent out from the Secretariat. This list of vessels should be supplemented by information on the size of gear used by the various sizes and types of vessels.

SAMPLING AND POPULATION DYNAMICS

These subjects are of central importance to the task of the Commission, and research on them should be encouraged by all possible means. The general analysis of the situation set out in the draft report of the Biarritz meeting of the Committee (Sections I, III and part of VII) is endorsed and the following courses of action are recommended as the next steps for the Commission to take.

1. Measurement of Fishing Effort

Present Status: This is fundamental to all quantitative studies of stocks in the Commission area. The ICNAF Statistical Bulletin for 1954 contains effort statistics, tabulated by countries, that seem to be adequate for analysis to give approximate estimates of the relative fishing powers of the different types of vessels operating in the area.

Proposed Action: It is recommended that the Secretariat be asked to make a preliminary analysis of the data in hand, with a view to providing supplementary tables in future issues of the Bulletin giving total annual effort in some

standard unit, by areas and subdivisions, and perhaps with reference to the particular species sought. In doing this, it should become apparent what - if any - additional detail of effort data (such as breakdown by individual vessels, or comparative fishing experiments) would be necessary for regular compilation of synoptic tables adequate for the needs of the Commission.

2. Sampling

Present Status: There are at present quantities of sample data, such as length measurements, sex ratios, etc. in fish catches or landings, that are not fully accessible to workers studying particular stocks, either because they are not published, or because they are not in a form comparable as between countries. To overcome these difficulties, the first requirement is a schedule of the sampling being carried out in the various countries - the size and frequency of samples; fleet and area coverage; sampling system; types of measurements being taken and the methods by which they are taken and presented. The Secretariat has made a survey of the methods of measurement being used (Document No. 11, Serial No. 370, ICNAF 6th Meeting) and while these remain varied, it will be necessary to establish factors for conversion of one kind of measurement to another.

Proposed Action: Countries should submit to the Commission a schedule of their sampling operations, together with a set of tables of the 1955 sample data. This procedure would be in effect a rational development of the present practice of including frequency distributions, etc., in the Research Reports. Each government should also supply the Secretariat as soon as possible with all the available data on conversion factors and immediately undertake any special studies that may be required as a result of that government not adopting for its own program the standard form of measurement. The Secretariat should then prepare these tables for publication, and a draft of a combined table of the kind that might be published in future issues of the Statistical Bulletin should be submitted for study at the next meeting of the Commission.

3. Mechanization of Statistical Work

Acceptance of recommendations in 1 and 2 above would impose a considerably increased load on the Secretariat, and it would therefore be necessary either to increase the assistance given to the Biologist/Statistician or to reduce the work required to produce the Statistical Bulletin with its present contents. The latter might be achieved by mechanizing the tabulating operation, perhaps by the use of IBM machines, and if this proved possible the burden of the proposed additional compilations might also be greatly lessened.

Proposed Action: A full examination be made of the ways in which the present statistical work may be carried out more easily. In doing this the Secretariat should consult the Dominion Bureau of Statistics in Ottawa, and also should maintain contact with ICES and FAO who are collaborating in an assessment of the value of using IBM machines in the preparation of catch and effort statistics for the ICES area. The aim should be standardization in methods and presentation of statistics in the two areas, and the Secretariat should take such steps as are necessary to bring this about.

4. Population Dynamics

The problems requiring research, listed in the draft report of the Biarritz meeting, are spread over the whole of this subject, cut across species and area interest, and are common to ICNAF and other regional fisheries councils and commissions. The question of implementing the various recommendations may be resolved into three parts:

(a) Manpower and Training

Present Status: In general there are too few workers engaged in these studies, and those that are tend to be pre-occupied with immediate local problems and to have inadequate assistance.

Proposed Action: Member governments should be asked to take steps to remedy this situation, and, in connection with the training of biologists in stock evaluation methods, attention is drawn to the fact that Members of the Permanent Commission of the International Fisheries Convention (1946) at its last meeting asked the U.K. government to arrange some kind of training course at Lowestoft. An approach might be made to see if the organizers of this course would be willing to extend the invitation to member countries of ICNAF.

(b) Consultation

Proposed Action: Benefit would come from more frequent informal consultations between small groups of workers and discussions on the interpretation of particular sets of data. The member governments should be recommended to encourage and assist such collaboration.

(c) Implementation of Biarritz Proposals

Present Status: There is need to ensure that the recommendations, made in the Biarritz report, for particular items of study, are brought to the attention of those research workers who might be in a position to act on them. It is necessary to stimulate and co-ordinate their activity. FAO is considering the possibility of organizing a meeting in conjunction with the proposed Fishing Gear Congress in mid-1957, at which the intention would be to discuss the methods of appraising the effects of fishing on stocks, and which would therefore cover the whole range of problems discussed in the Biarritz report. The report should be published and widely distributed.

Proposed Action: That the Committee should appoint a convenor who would solicit contributions on the various items to another meeting of the Population Dynamics Working Party, which might well convene at the time of the 1957 Annual Meeting of the Commission. It is expected that some of these contributions would report solutions of specific problems raised in the Biarritz report; others would be progress reports on some of the wider issues. To ensure success in the next stage of our work, it is most desirable that there should be only one meeting on this subject in the next year or so, and therefore, FAO should be approached with a view to arranging a joint meeting with the ICNAF Working Party at which the Permanent Commission IFC (1946) and ICES (the Comparative Fishing Committee of which is working on some of these problems) might also be represented. The publication of papers and discussion of such a meeting, especially if accompanied by the lectures of the training course in stock analysis, would be invaluable in the development of work on this subject.

5. Natural Mortality

Adult Fish: Precise definition of the identity of the stocks which are to be dealt with is essential before any appraisal of natural mortality or its causes can be made. Without such a definition it would be impossible to make any valid estimate because variation in natural conditions both in space and time would take the stock out of range of the investigation.

Present Status: Rates of natural mortality are extremely difficult to measure, and it is necessary to develop every possible method of doing this. Information as to the various causes of mortality would be valuable in this task, but the scattered data that are available as to predators, incidence of disease and parasites, competitors, etc. are inadequate and not easy to evaluate.

Proposed Action: In addition to estimating natural mortality by methods involving the subtraction of fishing mortality from total mortality using catch and marking returns, more use should be made of the age composition of the immediate pre-recruitment stock. This should be done from research ships using a cover over the codend on all trawl hauls where this is possible. To obtain indications on the significance of various causes, the abundance and survival of stocks or parts of stocks subject to heavy and light incidence of predation, diseases, parasitism and competition should be compared, although some difficulties are expected in separating the effect of other variables. Apart from an appraisal of information already available on this head new material should be obtained from the cruises mentioned above.

Special mortalities due to diseases affecting fish should be studied by the appropriate specialists.

Young Fish:

Present Status: 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.

Proposed Action:

(a) Work at Sea: These problems might be attacked 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.
(b) Laboratory Work: Experiments in tanks should seek to determine the effect of unfavourable chemical and physical conditions of the water and the relation of favourable food organisms to survival. Research would be best conducted in an experimental centre which has complete equipment, including facilities of a chemical laboratory.

STANDARDIZATION OF MEASUREMENTS

Present Status: Methods of measuring fish and dimensions measured vary widely among the member countries. Standardization is desirable in principle. However, the adoption of a standard measurement for the ICNAF area is complicated by the difficulty of demonstrating the superiority of any one of numerous long-established methods.

Poposed Action:

(1) The Secretariat should assemble available information on differences in various methods of measurement and collect such additional data as may be necessary to establish a table of conversion factors for relating the various methods of measurement.

(2) In reporting statistics to the Secretariat on size of fish (i.e. length and weight), each country should define precisely the dimensions measured. For compilation and publication, the Secretariat should convert these measurements in terms of fork length to the nearest centimeter.

(3) All available material should be assembled on the question of which length measurement provides the most valid results. Additional data should be collected and analyzed where needed. A complete report on this study should be submitted to the Committee on Research and Statistics. Dr. Ruivo of Portugal has volunteered to undertake this project.

GEAR SELECTION AND MESH MEASURING

1. Selectivity of Different Gears

A survey to determine the size selectivity of different kinds and sizes of fishing gear.

Present Status: Selectivity of the catching gear is unknown for about 80% of the cod taken in the area. More adequate knowledge is available for about 75% of the present haddock catch.

a. Otter trawl selectivity - much research has been carried out with single, large mesh codends by several countries. Selection experiments with multiple codends have not been attempted.
b. Pair trawl selectivity - inactive.
c. Hook selectivity - Canada has compared the selectivity of various sizes of hooks. Norway has compared the sizes of fish caught by hooks with the sizes of fish caught by other gears.
d. Trap selectivity - inactive.

Additional Resources Required:

a. Mesh experiments with traps should be carried out by countries using these gears to determine what effect mesh size has on the size of the fish caught.

b. Selective properties of otter trawls with multiple codends should be obtained by the countries using these gears. Covered net experiments and comparative fishing experiments are recommended.
c. Present knowledge about hook selection should be assembled and considered in relation to mesh selection. This would provide a basis for planning further hook selection experiments.
d. Length composition samples of cod and haddock taken by different gears should be compared to help assess the general problem of selectivity. For each sample a complete description of the catching gear must be included.

2. Factors Affecting Selectivity

Determine which parts of the trawl and which sections of the codend contribute most significantly to the release of fish. Determine what factors cause variation in mesh selectivity, such,for example,as effect of catch size, towing time, towing speed, differences between material, etc.
Present Status: In the ICNAF Area a number of mesh selection experiments have been carried out by Canada and the U.S. Experiments are continuing on the differences in selection for different materials. Many of the experiments carried on by other countries outside the ICNAF Area are applicable.

Additional Resources Required: Most of the mesh selection experiments carried out in the ICNAF Area have been only summarily analyzed. All extant mesh selection data should be analyzed with emphasis given to determining the causes for variation in selection results and amount of escapement in forward parts of the trawl. Results of the analysis should be presented as a basis for determining what further mesh selection experiments are needed. Because future planning is so dependent on the consideration of these past experiments, this should be carried out as soon as possible. Publication of the results by ICNAF should be considered.

3. Standard Mesh Gauge

Design a "longitudinal" pressure gauge for measuring meshes, which can be recommended for standard use in the ICNAF Area.
Present Status: The U.S. is attempting to machine such a gauge.

Additional Resources Required: The U.S. should,if possible,intesify its developmental work. Any gauge developed must be evaluated in comparison with existing gauges. Developing such a gauge would probably involve expenses and time of designing, drafting, machinery and testing. Such a gauge might be produced within a gear. Standardization of the gauge recommended by ICNAF and ICES is desirable.

4. Conversion Factors for Different Kinds of Gauges

Determine factors for inter-converting mesh measuring procedures. Determine what longitudinal pressures are appropriate for measuring meshes of various materials.

Present Status: Countries carrying out mesh selection experiments have been collecting material of this type for existing gauges.

Additional Resources Required: Intensive work on these problems should await development of a satisfactory longitudinal pressure gauge. The group developing a gauge will have to carry out experiments on both these problems. However, these aspects of the mesh measuring problem should also be studied by some European country, extensively engaged in otter trawling, where different materials and different conditions of use exist. Past performances suggest that these are relatively long-term projects. It is believed that most of the work could be carried out on shore.

5. Dimensions Used in Mesh Measurement

Determine whether the dimensions now used in measuring meshes should be replaced by more satisfactory dimensions.
Present Status: Inactive.

Additional Resources Required: Research on this problem involves both theoretical and practical problems. Selectivity tests and mesh dimension measurements with a wide variety of materials, types of gear and sizes of gear would be necessary. It is a problem common to both ICNAF and ICES. Because of its common nature and because the variety of materials and gears in general use are much greater in European waters, it is suggested that if such research is to be carried out a country associated with both ICNAF and ICES should be involved. It is suggested that this problem be drawn to the attention of Mr. B. B. Parrish of the United Kingdom.

SPECIAL PROJECTS

Special short-term studies will be required to test the feasibility of several recommendations made at the Biarritz Meeting which would, if found practicable, save much time in obtaining basic data. The Committee suggested that responsibility for these studies be as follows, the research to be done during the coming year:

1. To follow changes in condition (length-weight relation). Can bulk weighing of samples plus measurements of individual fish be used to indicate weight? Dr. Ancellin of France. The Chairman will correspond with Dr. Ancellin requesting that he undertake a study of this question.

2. Determine for stocks on which there are good past data the practicability of using age-length keys in order to save time on age determination. Mr. Wimpenny, Mr. Beverton of the United Kingdom, and Mr. Paloheimo of Canada.

3. For the same stocks, investigate how length and weight compositions might be used instead of age compositions for assessing fish stocks. Study of this item is not recommended since it is known that studies of this are being made elsewhere.

4. How are rates of mortality and growth interdependent? This item is now being studied by Mr. Taylor of the United States.

5. Take an inventory of all means for collecting plankton, making oceanographic observations in the places, at the times, and by the methods that such material is needed. Develop a plan for working up the data collected. How can such a program be designed for the best interests of the ICNAF? How could the equipment be standardized? Who would furnish it? Where would the plankton be sent for sorting and identification? Who would process the oceanographic data? How would the analyses and interpretations be conducted?

Mr. Eckles of the United States will correspond with Dr. Lauzier of Canada and Mr. Corlett of the United Kingdom, who will act as the European correspondent, to take stock of ship operations, such as weather ships, ice patrol and similar operations to determine what opportunities are available for obtaining collections from the ICNAF Area. Stock will also be taken of research vessel operations planned in the Convention Area. Suggestions will be made for analysis of interpretations of data.