INTERNATIONAL COMMISSION FOR THE NORTHWEST ATLANTIC FISHERIES

REDBOOK 1971 PART I

STANDING COMMITTEE ON RESEARCH AND STATISTICS

PROCEEDINGS

1971

ANNUAL MEETING

Note

REDBOOK 1971 appears in 3 books. The first book contains Part I, Proceedings of the Standing Committee on Research and Statistics. The second book contains Part II, Reports on Researches in the ICNAF Area in 1970. The third book contains Part III, Selected Papers from the 1971 Annual Meeting.

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Dartmouth, N. S., Canada

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PART 1. REPORT OF STANDING COMMITTEE ON RESEARCH AND STATISTICS (STACRES)

Chairman: A. S. Bogdanov   Rapporteurs: D. J. Garrod and A. W. May

STACRES met in Dartmouth and Halifax, Nova Scotia, Canada, from Thursday, 20 May to Tuesday, 25 May 1971 and on Thursday and Friday, 3 and 4 June 1971. The Subcommittee on Assessments held a mid-term meeting in Copenhagen, Denmark, 25 - 30 January 1971 (Comm.Doc. 71/1) which was preceded by a meeting of the Groundfish Survey Working Group, 21 - 23 January 1971 (Res.Doc. 71/34). The ICES/ICNAF Joint Working Party on North Atlantic Salmon met at Pitlochry, Scotland, 29 March - 1 April 1971 (Comm.Doc. 71/14). The major items dealt with at these meetings are summarized below:

1. ASSESSMENTS (APP.I)

(a) Nominal catches in 1970 from the Convention Area were about 3,100,000 metric tons. This represents a decline of about 400,000 tons compared to 1969, arresting the long term trend of annually increasing landings. Declines occurred in all the major species - cod, redfish, herring, haddock, flounders - which have over the last decade provided over 90% of the total catch. Although some of the decline may be attributed to reduced fishing effort, and to environmental conditions which have reduced recruitment, much is due to heavy exploitation which has, in many cases, exceeded the point of maximum sustained yield.

For the major species, reasonably accurate assessments are available for only a few stocks - cod in Subareas 1 and 2; haddock and yellowtail flounder in Subarea 5 and seals. Less complete assessments are available for most of the remaining haddock and cod stocks, and two flounder stocks in Subarea 3. Assessment of the herring stocks in the convention area is just now past the initial stages. Thus, although the rate of progress of assessment of fisheries is increasing, the status of stocks now producing over half the catch are unknown, or inadequately known, and the rate of increase of fishing intensity has far exceeded the rate of scientific studies to determine the effects of it.

(b) Status of Fisheries

HARP SEALS

The production of harp seal pups has decreased from about 400,000 in 1960 to 300,000 in 1970. The present population size is less than that giving maximum production. Estimates indicate the present catch is well in excess of the sustainable yield.

COD

Recent reductions in fishing effort have reduced landings in Subarea 1, and, to a lesser extent, in Subareas 2 and 3. At best it is probable, that over the long run, no more than a total catch of 1,300,000 metric tons (compared with about 1,100,000 in 1970) would be taken from the ICNAF area with increased effort. But it is possible, depending on the stock-recruitment relation, that increased effort might decrease long-term total catch. The Subcommittee stresses that immediate action to limit catches on all cod stocks in ICNAF would be most propitious.

HADDOCK

Stocks in Subareas 4 and 5 are very low at the present time - approximately 25% or less than that providing maximum sustainable yields. Fisheries in Subarea 5 and Div. 4X are now regulated to limit catches, but, due to very poor recent recruitment, the stocks will probably continue to decline unless more severe limitations are introduced. The 1970 catch of 41,000 tons from these areas exceeds the sustainable level, is less than half the maximum sustainable yield, and the stock will continue to decline unless very drastic measures are taken to reduce catch.

HERRING

Further progress toward the solution of the very complex problem of racial structure of stocks was made during the year. Nominal catch during 1970 was at least 810,000 tons, representing a reduction over the peak 1968 figures of 951,000 tons. All stocks have decreased in size in the last year, and the stock in Div. 5Z and Subarea 6 is extremely low - from 75-95% below the unfished abundance in 1960. Action should be taken to reduce catches to prevent further immediate decreases in stocks size, and, in the long run, to rebuild stocks to attain greater sustained yields.

Realizing the immediate importance of increased information on stock structure a coordinated set of cruises in Subareas 4 and 5 by several nations has been organized for the ensuing year.

FLOUNDERS

Yellowtail Flounder - Subarea 5. Assessments have shown that more severe restrictions in catch in 1972 than are now in effect are required to bring fishing intensity more in line with that producing the sustainable yield. An increase in mesh size is also desirable.

Yellowtail Flounder and Plaice - Subarea 3. The first preliminary assessments for these stocks have been completed and indicate full exploitation.

2. COORDINATED GROUNDFISH SURVEYS (APP.II)

Groundfish surveys conducted in recent years have been evaluated by the *ad hoc* Working Group on Coordinated ICNAF Groundfish Surveys (Res.Doc. 71/32). Noting the accuracy of estimates of stock abundance derived therefrom, STACRES concluded that such surveys provide a valuable adjunct to commercial fishery statistics for assessment purposes, especially with regard to the provision of advice to ICNAF concerning catch quotas. Indeed, owing to technical problems in utilising commercial fishery data from seriously depleted resources it is possible that in these instances further detailed assessments cannot be continued without quantitative research vessel survey data. STACRES therefore viewed with concern the absence of specific plans for coordinated multi-nation surveys of groundfish resources in Subareas 1 and 2 though noting that survey activity is planned for Subarea 3 and will be continued in Subareas 4 and 5. STACRES considers that an overall survey plan for the whole ICNAF area should be implemented as soon as possible. STACRES further

recommends (1)

(i) *that a meeting of the Groundfish Survey Working Group be held at the time of the 1972 Annual Meeting.*

(ii) *the Chairman of the 1970 Survey Working Group (Dr M. Grosslein (USA)) continue during the next year his attempts to organize ICNAF-wide surveys and attend the next Assessment Subcommittee meeting.*

STACRES also strongly urged that the vessel time, manpower and ADP facilities which would be required for an ICNAF-wide coordinated survey program be estimated so that member countries could provide for the necessary support.

3. INTERNATIONAL LOGBOOK SYSTEM (APP.III)

STACRES in accordance with the Commission's requirements studied the possibility of a uniform or standard fishing logbook (1970 ICNAF Meeting Proceedings No. 11). STACRES considers such a logbook should be concise and simple so that it is applicable to all areas and to all vessels, but that vessels less than 25 GRT which do not provide suitable conditions for completing logbooks would need to be covered by an alternative arrangement, *e.g.* pocket logbooks, interviews, *etc.* Recognising that some national agencies already operate a logbook system and that two books should not be required of any vessel, the basic logbook should not supersede any national system that already contains the basic requirements exemplified on the draft logbook format which is attached as Appendix III for consideration by the Panels. Such a standard form would simplify ADP analysis when collating international data. The logbook should be provided with duplicate sheets for retention by the vessel captain and for return to national agencies, to be held by them pending summary that would protect confidentiality prior to international exchange of the data. The size of the logbook should not exceed 8 1/2" x 14".

4. STATISTICS AND SAMPLING (APP.IV)

(a) *Sampling Yearbook*, Vol 13 has been published as Part I (Groundfish and Flounders, 1968) and Part II (Herring, 1961-1968). The two parts will be amalgated in Vol 14 and the herring data extended to include Subarea 6.

(b) *Statistical Bulletin*, Vol 19 for 1969 is ready for general distribution. Provisional nominal catch data for 1970 are tabulated as Res.Doc. 71/26.

(c) In the ICNAF *List of Common and Scientific Names* minor adjustments will be made to scientific names to bring it into conformity with those adopted by the American Fisheries Society.

(d) Following the advice of the ICES Special Meeting on Measurement of Fishing Effort, Copenhagen, 1970, and noting that ICES has decided to retain the statistic "days on grounds" only as a second priority, STACRES

recommends (12)

(i) that, in requesting effort data on STATLANT forms, "days on grounds" be deleted from such requests when these are made early in 1972 for 1971 data;

(ii) that the column "days on grounds" be deleted from Tables 4 and 5 in Vol 20 of the ICNAF Statistical Bulletin.

(e) Conversion factors: North Atlantic Species 1970 are now available in FAO *Bulletin of Fishery Statistics* Vol 25. STACRES therefore considers it no longer necessary to present these factors for the appropriate species in the ICNAF *Statistical Bulletin.*

(f) STACRES has recommended that the CWP secretary complete the draft joint ICES/ICNAF *List of North Atlantic Fishing Vessels* for submission to the 7th Session of CWP, 10 - 16 November 1971, Rome.

(g) International Commission for the Conservation of Atlantic Tuna (ICCAT) has expressed the desire to participate together with ICNAF, ICES and FAO in the activities of CWP. STACRES, in noting the common interest of all these agencies in a closely integrated statistical program,

recommends (17)

that the application of ICCAT to participate in the CWP activities be accepted by ICNAF and that ICCAT be welcomed as one of the participating agencies.

(h) The 7th Session of the CWP will take place in Rome, 10 - 16 November 1971. It will be preceded by the meeting of an *ad hoc* Working Group on Automatic Data Processing, 8 - 9 November. STACRES made certain suggestions on the draft prospectus and agenda submitted by the Secretary of the CWP and, noting the importance of the close collaboration in the fishery statistical field with ICES, FAO and now ICCAT,

recommends (18)

(i) that the Executive Secretary, the Assistant Executive Secretary and the Chairman of the Statistics and Sampling Committee attend the 7th Session of CWP, Rome, November 1971;

(ii) that the Governments of the United States and Denmark be invited to provide one expert from each of these two countries to attend and participate in the 7th Session of the CWP;

(iii) that the Secretary of the CWP, the Executive Secretary of ICNAF, the General Secretary of ICES and the Executive Secretary of ICCAT establish the list of CWP participants (attending the 7th Session) who would constitute the ad hoc Working Group on Automatic Data Processing.

(i) STACRES approved amendments to notes for the completion of STANA (now STATLANT) forms and their use. These adjustments will not affect ICNAF technical requirements.

(j) Various other statistical matters were considered and suggestions and recommendations made for action by the ICNAF Secretariat or the CWP Secretary. STACRES noted the progress made with respect to the development of a standard international statistical classification of gear and the need for further refinements of fishing unit and fishing effort concepts. It recognized a probable need for more detailed statistics by smaller fishing areas for some species and the need for information about the availability from national officers of more detailed area breakdowns than are now required by the Commission.

5. ENVIRONMENTAL (APP.V)

(a) The review of environmental conditions in the ICNAF area in 1970 showed a continued decrease in temperature and salinity in the upper layers at West Greenland and cooling of the offshore deeper water also has reversed the trend of earlier years. The fishery at West Greenland was adversely affected by ice conditions for the third year in succession. Summer temperatures in the inshore western branch of the Labrador Current were also cooler but in the deeper offshore branch temperature and salinity were at or above average. Water temperature conditions in Subarea 4 and 5 were more variable.

(b) The Integrated Global Ocean Station System (IGOSS), its aims and objectives were reported in STACRES plenary. The intention is to establish a synoptic marine service system comparable to that provided for meteorologists by World Meteorological Organisation (WMO) by the integration of national efforts where this is compatible with the programs of national agencies. The ultimate objective of IGOSS is to provide forecasts for marine users. In reviewing the progress of Cooperative Systemic Studies it was noted that Dr Campbell, Chairman of the Environmental Subcommittee, is also the Chairman of the Working Committee of IGOSS and the official liaison scientist between ICNAF and IGOSS under 1970 Recommendation 16 (*Redbook* 1970, Part I). STACRES, therefore,

recommends (20)

that ICNAF appoint a replacement for Dr Campbell in a liaison capacity to IGOSS to bring to the attention of IGOSS information concerning those properties and conditions which might be useful to fisheries and fishery research in the ICNAF area.*

(c) A successful Symposium on Environmental Conditions in the Northwest Atlantic 1960-69 was held in Dartmouth, Nova Scotia, 18 - 19 May 1971. STACRES

recommends (21)

that the papers and discussion presented to the ICNAF Symposium on Environmental Conditions in the Northwest Atlantic, 1960-69, Dartmouth, 18 - 19 May 1971, be published by ICNAF in the Special Publication Series and with a target date of December 1971.

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* Subsequently, Dr H. Bruce (USA) was appointed by STACRES to replace Dr Campbell.

(d) The beginning of systematic investigation by Canada and the United States on the distribution of heavy metals, pesticides, oil and other pollutants in marine organisms and materials over much of the southern part of the ICNAF area was reported. STACRES calls to the attention of ICNAF the importance of these studies of the quality of sea products and the possible effects of marine pollution on larval survival and year-class abundance.

(e) STACRES considered the proposal at present before IOC concerning a polar ice research project (Comm.Doc. 71/19, para 34). STACRES believes that ICNAF should support the proposal in principle and agree to participate in a group to study it, and

recommends (22)

that the Executive Secretary of ICNAF join the Secretaries of ICES and IOC at the time of the ICES meeting at Helsinki 1971, to give further study to the IOC proposal concerning a Polar Ice Research Project and follow it up at the IOC meetings.

6. GEAR AND SELECTIVITY

(a) In the review of the Report of ICES Gear and Behaviour Committee, it was noted that the Report of the ICES/ICNAF Working Group on Selectivity Analysis will be published in ICES Cooperative Research Report Series (*Redbook* 1970, Part I, Rec. 17).

(b) ICNAF mesh-size sampling data (Res.Doc. 71/29) indicates that, in some areas a wide range of mesh sizes is in use when compared to those designated for use in these particular areas and fisheries by ICNAF regulations.

(c) In relation to the construction of topside chafers, an experiment was reported which showed no significant difference between the selection properties of 'extra strong' and 'normal' polyamide codends (Res.Doc. 71/1). Further experiments in the same series concerning the selectivity of codends manufactured from netting yarn differing only in their elongation characteristics were inconclusive and reaffirm the need for further experiments to define the properties of netting yarn which are most important in determining its selectivity.

(d) In response to 1970 Recommendation 18 (*Redbook* 1970, Part I), the requirements for further selectivity experiments in relation to the adoption of the polyamide standard netting yarn were considered. It was noted that manila, the present standard, is now virtually unobtainable and that a new standard may be useful. Should a new standard netting yarn be adopted by the Commission it should not only be readily available and easy to use but should be relatively insensitive to the various factors causing variation in selective properties and should have selective properties close to the median value of those of currently used materials. It was noted that a polyamide netting material as defined in the report of the mesh selection working group (Comm.Doc. 70/14) appeared to be most likely to fulfill these requirements.

7. AGEING TECHNIQUES

(a) Progress in the validation of redfish ageing techniques was reviewed. STACRES noted the usefulness of this program and wishes to encourage continued exchange of materials and techniques between experts.

(b) STACRES noted that roundnose grenadier is a relatively slow growing, long lived species (Res.Doc. 71/89). This may limit the potential productivity of fisheries developing upon stocks of this species in the ICNAF area as it does for redfish.

(c) Comparisons of herring ageing techniques have shown otoliths to provide the most satisfactory material. An expanded program of study is being coordinated by the St. John's laboratory of the Fisheries Research Board of Canada and may be followed by a working group meeting at the appropriate time.

8. COORDINATION AND COLLABORATION WITH OTHER ORGANISATIONS

(a) ICES/ICNAF Joint Working Party on North Atlantic Salmon (Comm.Doc. 71/4)

STACRES took note of the Report of the Meeting of the ICES/ICNAF Joint Working Party on North Atlantic Salmon held in Pitlochry, Scotland, 29 March - 1 April 1971 (Comm.Doc. 71/14). It received a summary prepared by the Chairman, Mr B. B. Parrish (UK) which recorded that the Working Party had

1) reviewed the latest statistics on catch and fishing effort for the salmon fisheries at West Greenland, in the Norwegian Sea and in home-waters, and the results of the latest research on the composition, origin and destination of the salmon exploited in the West Greenland and Norwegian Sea fisheries;

2) made further assessments of the effects of the West Greenland and Norwegian Sea fisheries on total and home-water salmon catches; considered future research relevant to these assessments, with special reference to the proposed international tagging experiments at West Greenland in 1972 (*Redbook* 1970, Part I, rec. 27). The items in the report of special relevance to ICNAF are summarized below.

i) West Greenland Fishery

The catch at West Greenland in 1970, at about 2,150 tons, was approximately the same as in 1969. It was not possible to divide this catch into its offshore (drift-net) and inshore (set gill-net) components. As in previous years, the catch in both the drift-net and set gill-net fisheries was composed of salmon which had spent one winter in the sea and, therefore, if surviving, would return to home-waters as two or more sea-winter salmon.

The number of drift-net vessels, participating in the West Greenland fishery (excluding vessels registered in Greenland) in 1970 was approximately the same as in 1969. In addition to the main fishery at West Greenland, in the period January - April 1970 two Greenland vessels fished mainly by long-line in the northern Labrador Sea (between latitudes 58° - 60°N and longitudes 53° - 58°W). Seven tons of salmon were caught by one of these vessels (the catch of the other is not available) about two-thirds of which consisted of two-sea-winter salmon and the remainder of three-sea-winter salmon so they could be fish which occurred off Greenland in the previous autumn.

ii) Origin and Destination of Salmon at West Greenland

In 1970, further salmon, tagged as smolts in North America and a number of European countries were recaptured in the West Greenland fishery. These included, for the first time, records of fish tagged in south-west France. The data for 1970 and earlier years, therefore, indicates that salmon of European origin in the West Greenland stock come from rivers between latitudes 63°N and 44°N, the latter being close to the southern limit of the species. However, as indicated in previous reports, the major part of it originates from rivers in Canada and the UK.

The results of further Canadian studies in 1970 of biochemical characters of salmon at West Greenland and in the Labrador Sea suggest that salmon of North American and European origin were present in this area in approximately equal (50:50) proportions. Further investigations of these characters are in progress.

Thirteen recaptures in home-waters of the 444 salmon tagged in the West Greenland fishery in 1969 have so far been reported; one was recaptured later in 1969 in Canada (Newfoundland) and twelve in 1970, 5 in Canada, 4 in the UK, 2 in Ireland and 1 in Spain (see Table 5 of Comm.Doc. 71/14). The recapture in Spain, the information on which was received after the Working Party Meeting, was the first record from the southern part of the salmon's range in European waters. In addition to March 1971, four recaptures in home-water, 3 in Canada (from tagging in the Labrador Sea) and 1 in the UK (from tagging at West Greenland) were reported from further tagging experiments at West Greenland in 1970.

Of the total of 24 recaptures in home-waters so far reported from tagging experiments at West Greenland in the years 1965 - 1970, 10 have been taken in North America (Canada) and 14 in Europe (UK, Ireland, Spain) which again points to approximately equal proportions of North American and European salmon in the exploited stock at West Greenland.

iii) Assessment of Effects of West Greenland Fishery on Total and Home-Waters Salmon Stocks and Catches

Further information on the increase in weight of salmon between their occurrence in the West Greenland fishery and their return to home-waters indicated that the value of 50% used in previous assessments probably represented an upper limit, especially for those returning to North American rivers, and that the average increase probably lies between 25% and 50%. Since a lower growth rate would increase the "break-even" level of home-waters exploitation rate, below which the presence of the West Greenland fishery would lead to an increase in total (West Greenland plus home-waters) catch, these data provide no grounds for modifying the earlier conclusion that the West Greenland fishery has resulted in an increase in the total catch of salmon returning to European rivers and, with the possible exception of some Canadian river systems with high exploition rates, also of those returning to North American rivers.

Earlier assessments of the effects of the West Greenland fishery on home-water stocks and catches have been based on estimating the change in weight (*i.e.* the resultant growth and natural mortality) between West Greenland and home-waters, which the salmon caught at West Greenland would have experienced had they not been caught. In the absence of accurate knowledge of the natural mortality rate, it was necessary to use limiting values within which the true value is likely to lie. In a new approach to this assessment, the home-waters catches of salmon were simulated, using the known West Greenland catch and a range of exploitation rates at West Greenland and of the other parameters involved (growth, the natural mortality occurring between West Greenland and home-waters and the exploitation rate in home-waters). The results of this analysis suggested that the exploitation rate of the exploited stock at West Greenland in recent years has been less than 30% but probably higher than 10% and that the natural mortality compatible with these exploitation rates lies within the range used in the earlier assessments. On the basis of this analysis, the loss in catch to all home-waters fisheries combined, for a West Greenland catch of 2,000 tons, was estimated to lie in the range of 500 - 1,900 tons, which is in reasonably close agreement with the range of 650 - 1,600 tons estimated in the previous assessments. It must be stressed, however, that these new estimates are based on the assumption that all of the salmon returning to home-waters as two or more sea-winter salmon were present inside the area fished at West Greenland and may, therefore, be overestimates. It must also be stressed, as indicated in previous assessments, that the estimates refer only to the immediate, direct losses and take no account of any possible indirect effects of the West Greenland fishery on smolt production and hence future recruitment, through a decrease in spawning stock size.

iv) Home-waters Catches

In 1970, the total catch of salmon and grilse combined was higher than in 1969 in Canada, England and Wales, Ireland and northern Ireland but substantially lower in Scotland and Norway. The salmon component of the Scottish catch in 1970 was lower than in 1969, and it was probably also lower in Ireland. It was higher in England and Wales and Norway, but in England and Wales the catch in the spring fishery was lower. Data on the breakdown of the Canadian catch into salmon and grilse are not yet available.

(b) International Salmon Tagging Experiment at West Greenland

1) STACRES considered preliminary plans prepared by an *ad hoc* Tagging Planning Group of the Joint Salmon Working Party (Appendix to Comm. Doc. 71/14). The principal objectives would be:

i) to provide information on home-water areas to which salmon present at West Greenland would subsequently return, including estimates of the proportions returning to each area.

ii) to estimate the fishing mortality and rate of exploitation in the West Greenland fishery.

iii) to estimate the size of the population exploited at West Greenland.

iv) to estimate the natural mortality during return migration of salmon from West Greenland fishery to their home-waters.

v) to study the movements of salmon within the West Greenland area. The opportunity would be taken to gather further information on the occurrence of salmon outside the area of the West Greenland fishery and to collect material relevant to studies on the origin of salmon at West Greenland.

2) It is proposed that the experiment take place in August - October 1972 and aim to release 3,000 tagged salmon widely distributed throughout the fishing area. Most tagging would be conducted from research vessels but also by personnel whom it is proposed should be carried on six commercial vessels to examine their catch for tags and to collect biological material.

3) If it is assumed that the costs of research vessels, fishing gear and salaries of staff involved are borne by the participating countries the balance of the total cost is estimated at £20,000 as detailed in the Appendix to Comm.Doc. 71/14.

4) STACRES, noting that the representative of Ireland had wanted the Working Party to meet in Dublin next

recommends (23)

that the ICES/ICNAF Joint Working Party on North Atlantic Salmon hold its next meeting during the week beginning 21 March 1972 in Dublin, Ireland.

5) In its consideration of the proposals set out above, STACRES recognised that, while some countries (Denmark, Canada, Ireland, UK) had intimated their intention to participate, and others (France, Norway, Iceland) had indicated that they hoped to, the form of their participation and contribution of funds to meet the extra costs have not yet been specified. In view of the need to proceed with planning, as soon as possible, STACRES strongly

recommends (24)

that countries intending to participate in the International Salmon Tagging Experiment at West Greenland indicate the form of their participation as soon as possible.

If the countries concerned decide to go ahead with the experiment STACRES endorses the proposal of the Joint Working Party that the *ad hoc* planning group should meet again to proceed with preparing plans for the experiment.

6) STACRES noted that the Third Report of the Working Party, presented at the 1970 meeting had been published as ICES Cooperative Research Report Series A, No. 24.

(c) The ICES/ICNAF/FAO Stock and Recruitment Symposium, Aarhus, Denmark 1970 provided a valuable opportunity to review the present knowledge of a problem which has an important bearing upon conservation problems at present being considered by ICNAF. It was agreed that because of the complexity of the stock and recruitment mechanisms, to await conclusive results of scientific study before management action is taken may be courting disaster. The rapid growth of major fisheries in recent years has presented a new urgency which necessitates very careful account of the balance between potential rewards and costs of alternative management actions (including no action) in situations where some of the biological determinants of productivity, particularly stock and recruitment relations are uncertain.

Contributions to the Symposium will be published by ICES in a special volume of Rapports et Procès Verbaux.

(d) Joint ICES/ICNAF Working Group on Cod Stocks in the North Atlantic

STACRES, supporting proposals by ICES, NEAFC and the Assessments Subcommittee to study the effects on fish stocks and fishery management in the North Atlantic of the increase and massive redeployment of fishing effort,

recommends (2)

(i) that the Commission accept the invitation of ICES to convene a meeting of a joint ICES/ICNAF Working Group on Cod Stocks in the North Atlantic, and

(ii) that the Executive Secretary and the Chairman of the Assessments Subcommittee consult with the Chairman of the ICES Liaison Committee concerning the composition of the Working Group so that appropriate experts are invited to meet at the time of the mid-term meeting of the Assessments Subcommittee.

In doing so, STACRES agreed that regulatory measures deemed to be essential for individual stocks in the ICNAF area should not be postponed or delayed while awaiting the findings of the Working Group.

(e) ICES/ICNAF/IBP Symposium on the Biology of the Seal

STACRES

recommends (25)

that the Commission support the ICES/ICNAF/IBP Symposium on the Biology of the Seal to be held at the University of Guelph, Guelph, Ontario, Canada, 14 - 17 August 1972 and that an amount of $5,000 be allocated to defray partial costs of publication or travel of specialists invited to present papers.

(f) ICES/FAO/ICNAF Symposium on Acoustic Methods

STACRES

recommends (26)

that the Commission support with ICES and FAO, a symposium on Acoustic Methods to be held in 1973 and that an amount of $5,000 be allocated to help defray the cost of publication of the papers and proceedings.

9. APPLICATION OF NEW CLOSURE PROCEDURE FOR CATCH QUOTAS

STACRES noted that the Assessments Subcommittee had devised a scheme whereby the ICNAF Secretariat could close regulated fisheries to more precisely achieve the target quota (App. I, Section VII) and considered the problem of providing advice to the Executive Secretary on short notice in connection with implementation of the new procedure in administering catch quotas, and for the immediate future,

recommends (27)

that advice to the ICNAF Secretariat, when requested, concerning the implementation of the new quota procedure, be provided by the Chairman of the Assessments Subcommittee and such experts as the Executive Secretary and the Assessments Subcommittee Chairman consider appropriate.

10. SPECIAL MEETINGS ON HERRING

(a) Sustainable Yields

STACRES met in special session on 3 June to consider a request from the Meeting of Joint Panels 4 and 5 (1971 ICNAF Meeting Proceedings No. 13) for advice on allowable levels of herring catch in the southern part of the Convention Area.

STACRES recognized that calculations of the desirable quota for a particular year may be approached in several ways, including (1) that catch which will result in a particular fishing mortality, *e.g.* as calculated for Subarea 1 cod, and (2) that catch which will result in a stock abundance at the end of a given year at the same level as it was at the beginning of that year. Where, as in the case of herring, there are large fluctuations in year-class strength, these calculated quotas may differ.

STACRES also emphasized that the figures given below for possible 1972 quotas will be subject to revision when more complete research and statistical data for 1970 and 1971 are available. In particular, better estimates should be available at the 1972 mid-term meeting of the Assessment Subcommittee. Also it should be emphasized that it is not possible now to establish the maximum sustainable yield for these stocks. With these reservations, the following estimates were produced:

1) Div. 5Z and Subarea 6

Stock abundance over the past 3 years has apparently decreased at a rate of 50% per year. The catch should be reduced by the same amount just to maintain fishing mortality at the current level, which appears to have been too high. It also seems that a reduction of at least this amount would be necessary to prevent a further decline in the stock. STACRES, there,

concludes

that the catch for 1972 should be no more than half the reported 1970 catch, i.e., should be no more than 108,000 tons.

2) Div. 5Y

The offshore fishery in this area is a very recent one. Little information on stock abundance is available, but the decline in inshore juvenile catches since 1968 suggests that recruitment to this stock is declining. STACRES

concluded

that, for the immediate future and until further assessments can be made, the catch in 1972 should not exceed the 1970 level of 40,000 tons, exclusive of fisheries for juveniles outside the Convention Area.

3) Div. 4WX (as defined in 1971 ICNAF Meeting Proceedings No. 11, App. I)

Catches in this area reached a peak in 1968 and have since declined. Available data point to a decline in stock abundance over the past several years. The total catch in 1970 in the defined area, exclusive of fisheries outside the Convention Area, was approximately 130,000 tons. STACRES

concluded

that this should be reduced, and advises that the allowable catch for 1972 be no more than 80,000 tons.

STACRES further

advises

that, in all three areas, the levels of catch suggested would not prevent further declines in abundance if recruitment to these stocks *is poor. If, on the other hand, recruitment is high, the catch limitations suggested would have the effect of increasing abundance of these stocks.*

STACRES also

pointed out

that the 1970 catch figures referred to above do not include catches taken by non-member countries.

(b) Research Program

STACRES met in special session on 4 June to specify a program of research which would, insofar as possible, provide by the time of the Special Commission Meeting on Herring, January 1972, the information necessary to formulate a scheme of rational management of the stock of herring in Subareas 4, 5 and 6.

STACRES noted that a program of research had been developed by the Assessments Subcommittee (App. I, Section IV, D. 4). It recognized that some acceleration of the research would be necessary and set out the following requirements:

1) The statistics of catch, effort, length and age composition for 1970 must be made available by menber countries by the end of August.

2) The statistics for 1971 must be available at the meeting scheduled below. If complete data are not available, countries should supply preliminary data including estimates of the total 1971 catch. Length frequencies of the catch would be very useful.

3) All available data for years prior to 1970 on catch, effort, age and length compositions will be summarized for distribution as follows:

   i) Germany (Schumacher) - Div. 5Z, Subarea 6 stock

   ii) Canada (Iles) - Div. 4X, 4W stock

   iii) USA (Ridgway) - Div. 5Y stock

   These should be distributed by the end of October.

4) The data for Div. 5Y and 4X should include juvenile stocks, but these are to be tabulated separately.

5) Data obtained from research vessel surveys should also be tabulated separately and distributed.

6) The USSR was requested to:

   i) Provide an analysis of its egg survey data, including data from 1971 surveys, if possible.

   ii) Provide the requisite catch data for analysis by the scheme presented in the Assessment Subcommittee report (Appendix I of *Redbook* 1971, Part I, p. 53-54).

7) Germany was requested to provide a virtual population assessment for the Div. 5Z-Subarea 6 stock.

8) The USA was requested to provide for studies of the Div. 5Y stock, and also to examine recruitment and distribution aspects of the Subareas 5 and 6 stocks.

9) Canada was requested to provide for studies of the Div. 4X-4W stock. Collaboration between USA and Canada for the Div. 5Y and 4X-4W stock studies will be required.

10) It was noted that Canada (Nfld) would continue to carry on its studies of the stock in the Gulf of St. Lawrence and off Newfoundland.

11) Progress reports of studies are to be circulated by the end of October. Completed studies should be circulated as early as possible.

12) All data or reports should be sent to the ICNAF Secretariat for duplication and distribution to the following:

i) Mr D. Iles
Fisheries Research Board of Canada
Biological Station
St. Andrews, New Brunswick, Canada

ii) Dr A. Schumacher
Institut für Seefischerei
Palmaille 9
2 Hamburg 50, Fed. Rep. Germany

iii) Dr F. Chrzan
Morski Instytut Rybacki
al. Zjednoczenia 1
Gdynia, Poland

iv) Dr A. Noskov
AtlantNIRO
5, Dm Donskogo Street
Kaliningrad, USSR

v) Dr A. S. Bogdanov
VNIRO
Verkhnaya-Krasnoselskaya 17
Moscow B-140, USSR

vi) Mr R. C. Hennemuth
National Marine Fisheries Service
Woods Hole, Massachusetts, 02543, USA

vii) Dr George J. Ridgway
National Marine Fisheries Service
Boothbay Harbour, Maine, 04575, USA

Data available in the ICNAF archives should be requested from L. R. Day if required.

13) The working group will meet in conjunction with the Assessments Subcommittee mid-term meeting which will be held 24 - 29 January 1972, probably in Rome.

11. PUBLICATIONS AND REPORTS

Following presentation of an analysis of comparative costs of a change in paper size used by the Secretariat for meeting documents, STACRES

recommends (28)

that the Commission continue to use 8 1/2" x 14" paper size.

12. FUTURE MEETINGS

(a) Mid-year Meetings

The Assessments Subcommittee will meet in late January 1972* at ICES, Copenhagen, or FAO, Rome, depending on the availability of space and facilities.

The ICES/ICNAF Joint Working Party on North Atlantic Salmon will meet in Dublin during the week beginning 21 March 1972.

The *ad hoc* Salmon Tagging Planning Group of the Joint Salmon Working Party will meet in Copenhagen late in 1971 or early in 1972 if the experiment is approved.

(b) Regular Meetings*

The STACRES and its Subcommittees and Working Groups will meet for 6 full days before the 1972 Annual Meeting of the Commission in Washington, D.C., USA.

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* The Commission in Plenary Session (1971 ICNAF Meeting Proc. 16) set the following dates:

24 - 25 January 1972	- Herring Assessments
26 - 29 January 1972	- Other Assessments
beginning 31 January 1972	- Special Commission Meeting on Herring
18 - 19 May 1972	- Assessments Subcommittee
20 and 22 - 24 May 1972	- STACRES & Subcommittees & Working Groups
25 May - 2 June 1972	- 22nd Annual Meeting of Commission

13. OFFICERS FOR 1971/72

Chairman of STACRES: Dr A. Bogdanov (USSR)
Chairman of Subcommittee on Assessments: Mr R. C. Hennemuth (USA)
Chairman of Subcommittee on Environmental Studies: Dr N. J. Campbell (Canada)
Chairman of Subcommittee on Statistics and Sampling: Dr A. W. May (Canada)
Chairman of Working Group on Coordinated Groundfish Surveys:
Dr M. D. Grosslein (USA)

Members of Steering and Publications Subcommittee:

USSR, Romania, Poland	- Dr F. Chrzan (Poland)
France, Portugal, Spain	- Mr J. Morice (France)
Iceland, Norway, Italy, Japan	- Mr G. Saetersdal (Norway)
Fed. Rep. Germany, Denmark, UK	- Dr A. Schumacher (Fed. Rep. Germany)
Canada	- Dr W. Templeman (Canada)
USA	- Mr J. A. Posgay (USA)

14. OTHER MATTERS

Dr J. M. Colebrook of the Oceanographic Laboratory, Edinburgh, reported on the progress in the development of an undulating plankton recorder (Redbook 1969, Part I, Rec. 18).

APPENDIX I - REPORT OF ASSESSMENT SUBCOMMITTEE

CONTENTS

APPENDIX I - REPORT OF ASSESSMENT SUBCOMMITTEE

Chairman: R. C. Hennemuth | Rapporteur: R. Halliday

I. Introduction

The Subcommittee met at ICES headquarters in Charlottenlund Slot, Denmark, 25 - 30 January 1971 (Comm.Doc. 71/1). Twenty-eight scientists from 12 member countries, two scientists from FAO and the Executive Secretary attended. A special session on seal assessment was convened on 25 January. The main work of the Subcommittee was divided between two working groups - one for herring chaired by Mr Derek Iles, and one for groundfish. The Subcommittee was materially aided by the accommodations and efficient service of the ICES secretariat.

The Subcommittee met again during the STACRES session at Dartmouth, 20 - 24 May, to review and up-date the mid-term report (Comm.Doc. 71/1) and to further plan and coordinate future herring research.

The report which follows reflects a satisfactory progress in assessments. This is due primarily to the activities of many scientists prior to the meeting, and the large attendance of appropriate biologists. We hope this report will reward member nations for their efforts, and encourage them to continue.

II. Review of the Latest Statistics of Nominal Catches and Fishing Trends in the ICNAF Area

The provisional data on landings for Subareas 1 - 5 in 1970, with comparative data from 1959 are presented in Tables 1 and 2. Landings of non-members, except for one, are included in 1969 and estimated for 1970.

Total landings of all species from the Convention Area declined from 3,500,000 metric tons in 1969 to 3,100,000 metric tons in 1970. Only in Subarea 4 did landings increase in 1970 over the 1969 level, and thus it remains the Subarea from which the highest quantity of landings are recorded. Of the most important species, cod, haddock, flounder and herring all showed declines in landings. Significant increases were observed in silver hake and mackerel.

A. Subarea 1

Total landings of cod from Subarea 1 in 1970 (approximately 112,000 tons) decreased to a level of only 55% of the relatively low 1969 nominal catch. The 1969 and 1970 cod catches are the lowest since reporting by ICNAF began in 1952, and the 1970 catch is only slightly more than one-quarter of the highest recorded catch - 451,000 tons in 1962.

The further decline in 1970 is thought to be due mainly to very low fishing activity, because of continued adverse ice distribution in the Subarea. This was especially the case on the southern fishing banks in the spawning season, when catch per day is normally at its peak. However, fishing effort is not attracted to the Subarea because heavy past fishing and poor recent recruitment has led to a relatively low stock abundance.

Redfish catches remained at the low level of 4,000 tons.

B. Subarea 2

As in previous years, the catch consisted almost entirely of cod. However, the cod catch in 1970 declined very greatly from the high levels of the two previous years (210,000 tons in 1970 against 412,000 tons in 1969 and 449,000 tons in 1968). Catches by some non-member countries are not available for 1969 and 1970, but amounted to 51,000 tons in 1968. The decrease may be attributed to a combination of severe ice conditions in spring and decline in abundance of the older age-groups. Inshore cod catches again exhibited a decline and in 1970 amounted to only 2,000 tons, less than 10% of the 1960-67 average.

Redfish catches remained very low in relation to those of the peak 1959-60 period, and catches of other species remained relatively insignificant.

C. Subarea 3

Provisional figures for 1970 indicate that total groundfish landings decreased by about 13,000 tons from the 1969 level of 822,000 tons, a decrease much less marked than between 1968 and 1969. A decrease in cod landings from approximately 570,000 tons in 1969 to 537,000 tons in 1970 was partially offset by a slight increase in landings of other groundfish, especially flounders and roundnose grenadiers. Most of the decrease in cod landings took place in Div. 3K and Div. 3L, the landings from Div. 3NO being at about the same level as in 1969.

Herring landings remained at about the same level as in 1969. Flounder landings remained at the high levels started in 1966.

D. Subarea 4

Provisional groundfish landings for 1970 rose to 648,000 tons, the largest yield so far recorded from this Subarea, and an increase of about 30% over the 1968-69 average.

A marked increase in silver hake catches from 46,000 to 169,000 tons, mainly from the Div. 4W stock, was largely responsible for this increase. However, cod catches also showed a substantial increase from 206,000 to 256,000 tons, reflecting expansion of the fisheries in Div. 4R and Div. 4Vn in particular. Redfish catches continued to show modest increase, whereas flounder and particularly haddock catches declined.

Herring landings declined slightly to 416,000 tons from the record 1969 value of 422,000 tons. Substantial increase in the Div. 4W fishery to 89,000 from 40,000 tons and moderate increase in the Div. 4T fishery to 175,000 from 154,000 tons does not totally compensate for marked decline in the Div. 4V fishery from 82,000 to 24,000 tons and moderate decline in the Div. 4X fishery from 142,000 to 123,000 tons.

E. Subarea 5

The total catch for all species was 654,277 tons in 1970 down from 864,413 tons in 1969. The 1970 catch was the lowest since 1961. Herring, red hake, and silver hake landings each declined by about 40,000 tons; cod, haddock, yellowtail flounder, ocean pout and alewife declined between 10,000 and 20,000 tons and scallops, skates and butterfish declined between 5,000 and 9,000 tons. The only large increase was for mackerel (35,000 tons). Redfish landings increased by about 5,000 tons. Shellfish (other than sea scallop) dropped from 107,000 to 84,000 tons. Catches of herring by a non-member country which are not reported may be large.

The decline occurred from an interrelated combination of decreased stock abundance, decreased effort, and management measures. It has been generally agreed that cod, haddock, herring, silver hake, red hake, yellowtail flounder, and scallop populations have declined. There is also evidence for decline in skates from US survey cruises. Increased effort by the USSR produced greater catches of mackerel which has probably also shown increases in abundance in recent years. The same explanation also holds for the greater US redfish landings. A potential for future increases should be noted in the Japanese landings of squid (3,000 tons).

F. Subarea 6

The total finfish and scallop landings in 1970 were 406,000 tons, an increase from 304,000 tons in 1969. The 1970 catch of other shellfish is not yet fully reported. The change was almost entirely the result of an increase of 122,000 tons of menhaden (USA) and 42,000 tons of mackerel (USSR and Poland). Alewife, herring, silver hake, and red hake dropped 16,000, 13,000, 7,000 and 4,000 tons respectively.

The closed areas for silver and red hakes and the generally lower abundance of these species in recent years plus the current decline in herring abundance have caused a shift of effort from these species. The present levels of abundance of mackerel has attracted this effort. The menhadden catch resulted from the heavy exploitation of a good recruiting year-class.

Table 1. Landings (nominal catches) in 000's metric tons by main species from Subareas 1, 2 and 3, 1959-1970.

			1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969[a)]	1970[b)]	Add.[c)]
Subarea 1	All Gears	Cod	234	243	245	451	406	350	360	366	429	382	205	112	28
		Redfish	33	44	54	60	47	30	19	17	13	10	4	4	
		Total Groundfish	273	295	414	526	475	409	399	396	454	401	215	127	29
	Otter Trawl	Cod	110	101	171	247	244	250	209	188	269	299	123		
		Total Groundfish	143	147	236	318	306	290	238	209	288	312	128		
	Total groundfish landings relative to 1959		100	108	151	193	174	150	146	145	166	147	79	46	
Subarea 2	Cod	(Otter trawl	41	171	246	230	191	197	307	313	268	427	402		
		(Inshore (fishery	19	17	19	25	25	16	26	24	27	13	5	2	
		(Other Gears				+		+		1	3	9	6		
		(Total	60	188	265	255	216	213	333	338	298	449	412	210	51
	Haddock		+		+	+	+	+	+	+	+	+	+	+	
	Redfish		53	83	26	8	6	27	23	14	17	9	6	6	4
	Halibut (including Greenland halibut)		+	+	+	+	+	+	1	1	3	8	10	4	3
	Flounders		+	2	1	+	+	3	7	3	5	3	7	6	
	Other Groundfish		1	6	4	2	1	2	12	9	4	12	1	1	5
	Total Groundfish		114	279	296	265	223	245	376	365	327	481	437	229	63
	Other Fish		+	1	1	1	+	6	1	1	1	1	4	1	
	Total Fish		114	280	297	266	223	251	377	366	328	482	441	231	63
	Total Groundfish landings relative to 1959		100	245	260	233	196	215	330	320	287	422	383	201	
Subarea 3	Cod	(Otter trawl	160	186	235	175	223	307	261	283	473	424	247		
		(Inshore (fishery	180	184	136	150	155	144	114	112	102	114	118	84	
		(Other Gears	85	101	90	64	88	130	121	104	146	195	204		
		(Total	425	471	461	389	466	581	496	499	721	733	569	537	2
	Haddock		35	67	80	35	15	12	9	10	11	7	5	7	-
	Redfish		246	99	90	61	69	95	112	79	89	53	88	76	6
	Halibut (including Greenland halibut)		3	3	2	2	1	2	1	1	7	25	18	24	1
	Flounders		25	35	30	27	34	54	81	111	151	133	123	137	+
	Other Groundfish		19	17	11	8	7	7	17	11	23	41	18	28	+
	Total Groundfish		753	692	674	522	592	751	716	711	1,002	992	822	809	9
	Herring		5	5	4	5	6	3	8	23	78	145	145	135	+
	Other Pelagic Species		+	+	1	1	1	2	1	1	2	1	1	3	
	Total Pelagic Species		5	5	5	6	7	5	9	24	80	146	147	138	
	Other Fish		6	7	5	5	6	14	6	7	11	5	13	13	
	Total Fish		764	704	684	533	605	770	731	742	1,064	1,143	982	961	10
	Total Groundfish landings, relative to 1959		100	91	90	69	79	100	95	94	133	129	109	107	

a) Includes recent information from non-member country.
b) Estimated to include non-member countries.
c) Additional figures for 1969 and 1970 based on a non-member country's catch in 1968, for which subsequent data is not available.

Table 2. Landings (nominal catches) in 000's metric tons by main species is Subareas 4 and 5, 1959-1970.

		1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969[a]	1970[c]	Add.[d]
Subarea 4	Cod	214	218	212	219	218	229	225	215	204	247	206	256	
	Haddock	53	46	47	44	51	60	85	66	49	46	42	28	
	Redfish	42	50	42	43	59	53	68	106	87	104	111	120	
	Halibut	2	3	2	2	2	2	2	2	2	2	2	1	
	Flounder	20	26	27	25	30	34	48	55	41	72	52	42	
	Silver hake	-	-	-	9	123	81	50	10	2	3	46	169	
	Total Groundfish	395	406	387	412	586	548	565	541	419	512	493	648	
	Groundfish landings relative to 1959	100	103	98	104	148	139	143	137	106	130	125	164	
	Herring	102	105	81	116	111	140	180	236	261	370	422	416	8
Subarea 5	Cod	16	14	18	26	30	28	42	57	42	49	46	35	
	Haddock	41	46	52	59	60	70	155	127	57	44	25	13	
	Redfish	16	11	14	14	10	8	8	9	11	7	12	17	
	Flounders	25	27	29	38	48	58	57	54	49	53	78	55	
	Silver hake	50	47	42	86	147	220	323	162	101	81	88	48	
	Total[b]	276	221	228	300	391	475	728	613	389	401	502	352	
	Groundfish landings relative to 1959	100	80	83	109	142	172	260	222	141	145	182	127	
	Herring Inshore 5Y	48	69	27	71	70	28	34	29	31	63	47	40	
	Herring								250					
	Herring Offshore 5Z	-	-	68	151	97	131	40	137	213	364	211	179	67
	All species								866	732	906	864	655	70

a) Adjusted to include recent submission by non-member country.
b) Includes all species except shellfish and herring.
c) Adjusted to include estimated catch (1969) of non-member countries.
d) 1968 landings of a non-member country for which 1969 and 1970 data is not available. Should be added to both years.

III. Chairman's Synopsis

A. Introduction

The prime function of the Subcommittee is to evaluate and condense detailed studies which themselves summarize a large amount of data into concise information and advice to the Commission through STACRES. This process also provides a feedback to initiate needed research by pointing out the lack of knowledge for many critical problems.

The advice and conclusions frequestly go beyond the facts of a specific study when broader inferences and judgements seem valid and important. Validity is assured because of the experience and knowledge, the uninhibited exchange of ideas and criticism, and the objectivity of some of the best scientists of many nations.

B. State of Major Species

The perspective of the present report may be enhanced by some general comments. The catches of some major species taken from the ICNAF area in 1960 and 1969 are shown below:

	1960			1969		
	Landings (000's m.t.)	%	Rank	Landings[a)] (000's m.t.)	%	Rank
Cod	1,134	55	1	1,518	43	1
Redfish	288	14	2	220	6	4
Herring	180	9	3	954	27	2
Haddock	159	8	4	71	2	7
Flounders	90	4	5	287	8	3
Hake	63	3	6	201	6	5
Mackerel	7	-	-	91	2	6
		93			94	
Total all finfish	2,078			3,558		

a) contains estimates only of landings by non-member countries

The total landings increased by 71% over the period, but the seven species listed accounted for 93 - 94% in both years.

1) Cod

Relative importance dropped, but still ranked No. 1. Assessments indicate all cod stocks are fully utilized.

2) Redfish

Relative importance and rank dropped. No assessments of effects of fishing and potential yields available.

3) Herring

Relative importance and rank increased. The five-fold increase resulted from expansion of fishery to include all available stocks, and included the virtual decimation of one of the largest stocks (Div. 5Z-Subarea 6). Decreasing abundance and, hence, catch rate has and will cause further diversion of effort to other species. This is a case where the total stock was probably overexploited before an assessment could be made.

4) Haddock

Relative importance decreased. By 1970, the total catch will have dropped even further. The assessments now available indicate the following situation:

(all in thousands of metric tons, except stock size in millions of fish)

Stock	Probable maximum equilibrium yield	Maximum landing and year	1969 landing	Catch quota 1970-71	Estimated landing in 1971 at 1969 fishing rate	Stock size	
						at maximum equilibrium yield	in 1970
4V-W	25	38(1965)	11	none	12	60	33
4X	18	42(1966)	30	18	<12	50	15
5	50	155(1965)	25	12	<12	145	21
Total	93		66	-	<33	255	46

A maximum equilibrium yield for the ICNAF area (excluding Grand Banks which would be small) of 90,000 - 100,000 tons seems possible. The 1969 catch was two thirds of this; 1971 catches, even if the present fishing effort were maintained, would be one-third of this, and such landings in 1971-1972 would cause a reduction in stock from the very low 1970 level. It would require a period of no fishing for at least 5 years to rebuild the stocks to former levels, and there is no guarantee that it is possible. However, the investment required is probably about 100,000 tons of fish (5 years at an average of 20,000 tons) taken with ever decreasing catch rates. The pay-off is possible return to landings of 100,000 tons per year.

5) Flounders

Relative importance and rank increased. With one exception (cf. Section IV-E), very little information on potential yields and effects of fishing.

6) Hake (Silver and Red)

Increased importance and rank (in 1965 it was second rank and over 10% of total groundfish). Effort has decreased recently and perhaps allows time to assess the status of stocks.

7) Mackerel

From nowhere to sixth rank and 2% of landings. In 1970 landings may be double that in 1969. No assessments available, and very little data available.

8) Seals

An important resource within the ICNAF area. The Subcommittee was able this year to provide an assessment of the stock, and advise that sustainable yield was much less than present catch.

From the haddock example it is obvious that rectification of past mistakes is sometimes painful and slow. However, for several important stocks, *e.g.* cod, hake, mackerel, perhaps flounders, the productivity may be maintained and maximized with the immediate application of conservative mamagement schemes.

IV. Status of Fisheries

A. Seals

The following group of assessment and seal scientists participated in the harp seal assessment discussions:

R. C. Hennemuth (USA), Convener
G. F. M. Smith (Canada), Rapporteur
D. E. Sergeant (Canada)
T. Øritsland (Norway)
F. O. Kapel (Denmark)
E. Smidt (Denmark)
D. J. Garrod (UK)
J. A. Gulland (FAO)
A. T. Pinhorn (Canada)
B. E. Brown (USA)
H. A. Regier (FAO)

Dr Sergeant (Canada) presented his paper "Calculation of production of harp seals in the western-north Atlantic" (ICNAF Res.Doc. 71/7). The methods of collecting the data and various types of bias or possible bias and their effects on assessment were discussed in considerable detail.

Mr Øritsland (Norway) also presented his paper "Progress report on Norwegian studies of harp seals at Newfoundland" (ICNAF Res.Doc. 71/8). This paper along with that of Dr Sergeant supplied most of the basic information for subsequent discussion and the data from the two papers were partly complimentary and partly supplementary.

Mr Kapel (Denmark) reviewed the harp seal work in Greenland of which he has recently taken charge. The Greenland catch in recent years has been in the order of 10,000 or less.

The evidence at hand indicates the stocks fished on the Front and in the Gulf are from a single population. The analyses below refer to the total seal population.

Estimates of the annual production of young harp seals have been made by a number of methods, as follows:

Aerial survey	- 365,000 in 1959-1960
Capture-recapture	- 325,000 in 1966-1968
Index of survival and catch	- 360,000 in 1960-1969
Accumulated catch	- 292,000 in 1967
One-year-old percentage and catch	- 280,000 in 1967-1969

Bearing in mind the possible sources of error and bias in the different methods, the agreement is remarkable. A production of 300,000-400,000 pups annually during the 1960's also agrees with the highest level of annual catches during this period (280,000 in 1963 and 1968).

The figures also suggest that there has been a decrease in production, especially since the aerial survey method provides a lower bound to the production, which could be rather higher to the extent that seals were missed. Recent age-frequency samples also suggest a declining production since the 1950's because the younger animals are relatively less abundant. In round figures, the recent production of pups has probably been:

1960 - 400,000
1965 - 350,000
1970 - 300,000

In an earlier paper (ICNAF Res.Doc. 69/31), Dr Sergeant described a method to estimate the equilibrium catch of pups from a knowledge of adult and juvenile mortality, and the reproductive rate. For example, consider a stock of 300,000 adult females (the likely stock in 1971), if the adult mortality rate is 10%, 30,000 females will die during the year and the population will be in equilibrium if this is equal to the number of females reaching maturity.

The 300,000 females will produce 270,000 pups (assuming a 90% pregnancy rate) of which (270,000 - C) will survive the harvesting period, where C = catch of pups. If 40% of these survive to maturity, and half are female, the total number of females reaching maturity is 0.5 x 0.4 x (270,000 - C).

Therefore, the equilibrium catch is given by

$$\begin{aligned} 0.5 \times 0.4\ (270{,}000 - C) &= 30{,}000 \\ \text{or} \quad 270{,}000 - C &= 150{,}000 \\ \text{or} \quad C &= 120{,}000 \end{aligned}$$

The equilibrium catch was similarly calculated for other values of adult mortality and immature survival. These are set out in the table below:

Sustainable harvest of pups from an adult stock of 300,000 females

	Survival of pups to maturity			
Adult mortality	20%	40%	50%	60%
6%	90,000	180,000	198,000	210,000
8%	30,000	150,000	174,000	190,000
10%	-	120,000	150,000	170,000
12%	-	90,000	126,000	150,000
14%	-	60,000	102,000	130,000

The best estimate of adult natural mortality comes from analysis of the age-composition data collected in the early 1950's, just after a period of low exploitation during the 1940's. This gave a figure of 10% per year. The survival of pups to maturity at 5 years was believed to be around 40%. The natural mortality in the present depleted adult population may be less than 10%. However, considerable catches of both juveniles and adult animals are at present being taken at the rate of around 5% per year. The present total deaths of adults is probably at least 12% per year and possibly as much as 14%. If catching of seals other than pups continues at the present level, any catch of pups greater than 90,000 would further decrease the stock. However, if catching of all animals other than pups were stopped, then the adult mortality might be no more than 8% and also the survival of immature would improve, perhaps to 50%. In that case, catches of up to 174,000 pups could be taken without decreasing the stock. The Group believed that the choice between the alternative strategies of 174,000 pups and no older animals or 90,000 pups and unchanged harvest of older animals or any intermediate strategy would have to be made on economic and social grounds, on which they could offer no advice.

There was considerable discussion on the relation of the present population and sustainable yield to the maximum sustainable yield and the population producing it. This would depend on the proportion that the present stock is of the equilibrium, unexploited stock, and the extent to which the mortality and reproductive rates might change to compensate changes in abundance. It was noted that one important compensatory change - a decrease in average age at first maturity - had taken place in the 1950's. No further reduction in age at maturity had occurred in the 1960's - in fact, there is some evidence that it increased. Also the pregnancy rate is now so high (90%) that further increases in it are not likely. Thus, any further reduction in stock will likely result in a proportional decrease in sustainable yield.

The group believed that the present stock is less than that giving the maximum sustainable yield and that therefore action should be taken to increase the stock, *i.e.*, the quota should be set at less than the present sustainable yeild. It noted that the present ICNAF quota (200,000 plus landsmen's catch of approximately 40,000) is well in excess of the sustainable yield, even if the killing of all older seals were stopped. The effect of maintaining this quota will be a progressive decline in the population and in the possible catch from it. It may be pointed out that because of the long potential life-span of seals, any rehabilitation of a depleted seal stock will be a slow process.

B. Cod

1. Subarea 1

In the Assessment Report for 1970 (Redbook 1970, Part I, p. 40), predictions for the 1970 and 1971 catches were made on the assumption that 1969 catches were about 225,000 tons and F equalled 0.6 for fully recruited age-groups. The 1970 catches were predicted to be about 178,000 tons by an F value of 0.6 and 224,000 tons by an F value of 0.8. The provisional figure of nominal catches of 112,000 tons in 1970 is substantially below those predicted at the 1970 meeting and the preliminary estimates available to the mid-term meeting (Comm.Doc. 71/1). The shortfall has arisen from the scale of the reduction in fishing to about 50% of the 1969 level rather than poor estimates of stock abundance. This reduction in fishing activity in Subarea 1 has been caused primarily by severe ice conditions (Appendix 5) in conjunction with prospects for cod fishing elsewhere in the North Atlantic.

New assessments for Subarea 1 cod including predictions for the 1971-1972 catches have been made based upon the most recent catch statistics and age composition of landings and stock in 1968 and 1969 (Res.Doc. 71/9). There is a very close agreement between scientists engaged in this work as to the actual number of cod by age-groups present in the stock and landed, but the value of F in 1969-1970 and the size of the newly recruiting year-classes cannot yet be measured as accurately as desired. Concerning these new year-classes, 1965 and 1966, the former is thought to be the more abundant although new evidence indicate that the 1966 year-class is of some importance in Div. 1B, Div. 1C and the northern part of Div. 1D. However, neither seems to be comparable in size to the abundant year-classes of 1960, 1961 and 1963, so that generally, the stock has declined from the relatively high level in the mid-1960's, and the annual catches in the years 1971-1972 are, therefore, not expected to be more than roughly half the annual catch in the former period, even with increased effort (Fig. 1).

Taking into account the evident reduction in fishing activity from 1968 to 1969 and especially to 1970, it seems likely that F for fully recruited age-groups has declined from the estimated value of 0.8 in 1968 to a value of not more than 0.6 in 1969 and possibly 0.3 in 1970. Considering also the generally agreed variation of F between age-groups predictions for 1971-1972 catches have been made as follows:

<table>
<tr><th>1968</th><th>1969</th><th>1970</th><th>1971</th><th>1972</th></tr>
<tr><td rowspan="4">382
(0.80)</td><td rowspan="4">230
(0.60)</td><td rowspan="4">112
(0.30)</td><td rowspan="2">206
(0.50)</td><td>186
(0.50)</td></tr>
<tr><td>242
(0.70)</td></tr>
<tr><td rowspan="2">240
(0.60)</td><td>179
(0.50)</td></tr>
<tr><td>233
(0.70)</td></tr>
</table>

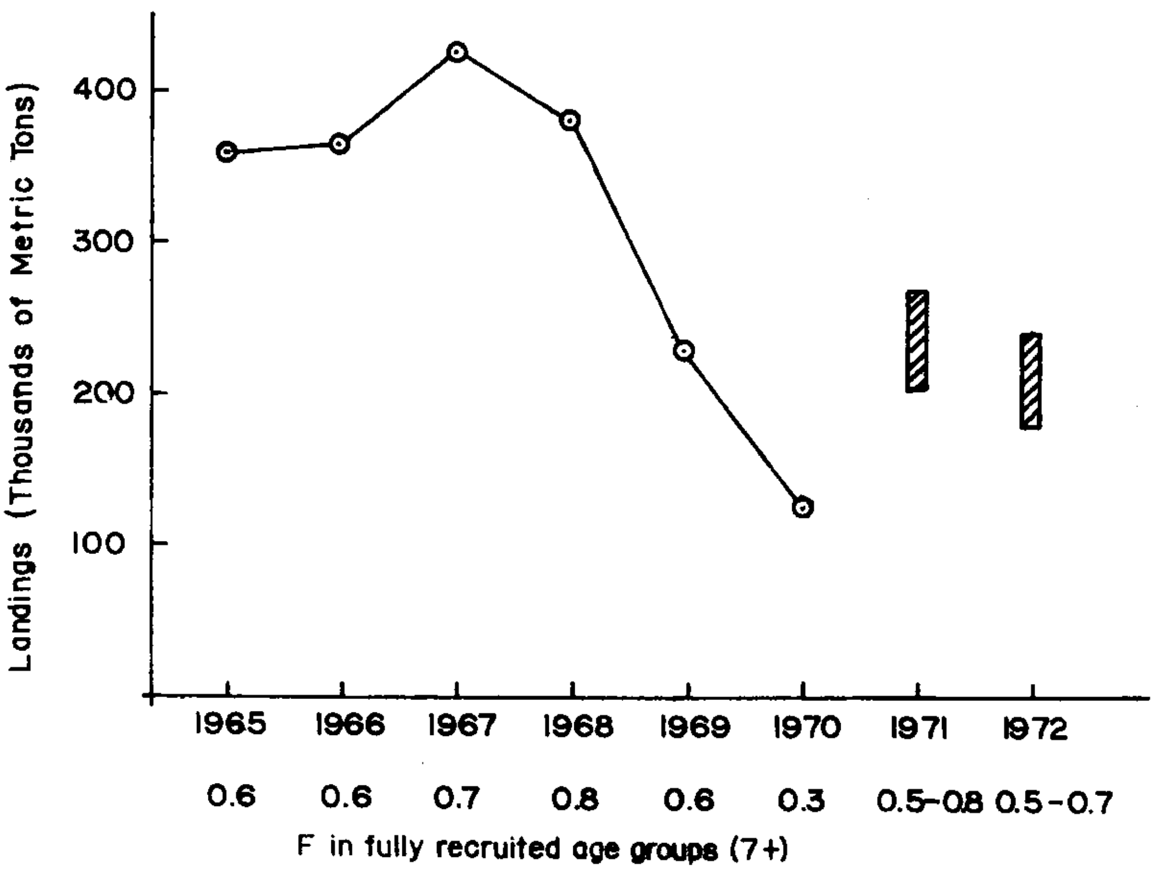

Fig. 1. Subarea 1 Cod: nominal catch.

As will be seen from the table the catches in 1972 depend not only on the F value in that year but also on F values in preceding year. The reduction in F in 1970 caused mainly by the ice conditions has had exactly the same effect as could have been achieved by a quota regulation, and has enhanced the exploited stock that will be available to the fishery in 1971-1972. For example, if effort in 1971-1972 returns to the 1969 level catches will be some 10% higher than they would have been had fishing in 1970 remained at the level estimated at the mid-term meeting. In Fig. 2 the prediction for the 1972 catch can be readily seen for any likely variation of F values in 1970-1972.

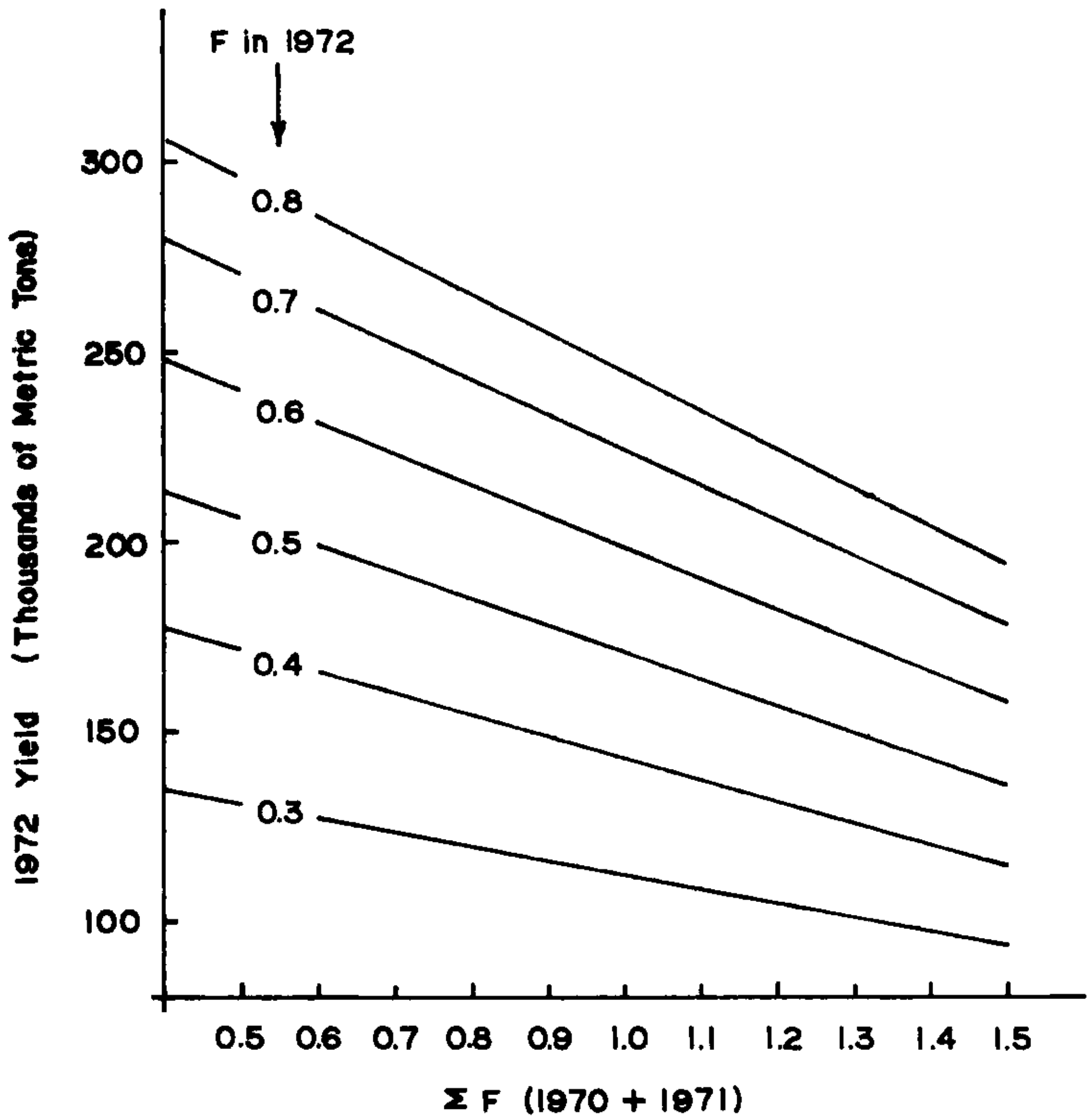

Fig. 2. Subarea 1 Cod: yield in 1972 at different levels of F in 1970, 1971 and 1972.

The Subcommittee wishes to emphasize again that, although the 1970 level of F was substantially below the value of F of 0.6 (which would provide an estimated yield of 240,000 in 1971, for example) corresponding to the level giving the maximum sustainable yield-per-recruit (Fig. 3), a sufficient improvement of ice conditions or reduced stock abundance in other fishing areas will again attract effort to Subarea 1. The desirability of being able to control such expansion of effort is obvious.

It has been known for a long time that a proportion of the mature cod at Greenland migrate to Iceland although no return migration has yet been observed. At its meeting in December 1970, the ICES Northwestern Working Group made a quantitative estimate of this migration based upon Danish tagging experiments. These experiments have also been used by the Assessment Subcommittee as one of the means to estimate F in Subarea 1. For their purpose the Northwestern Working Group pooled experiments carried out in the years 1946-1964 (the period during which F in Subarea 1 is known to have increased) so their estimate of F in Div. 1E and Div. 1F is not directly comparable to that reported by the Assessment Subcommittee which applies throughout Subarea 1 in particular years. It was noted that the proportion of mature (70 cm+) cod migrating from Greenland to Iceland varies considerably between regions at Greenland, being about 45% from East Greenland and about 15% from Div. 1E and Div. 1F; the emigration to Iceland from Div. 1A-1D is thought to be much less. The net emigration from Subarea 1 is thus only about 5% and this is included as a natural mortality factor in the calculations of yield from West Greenland given above.

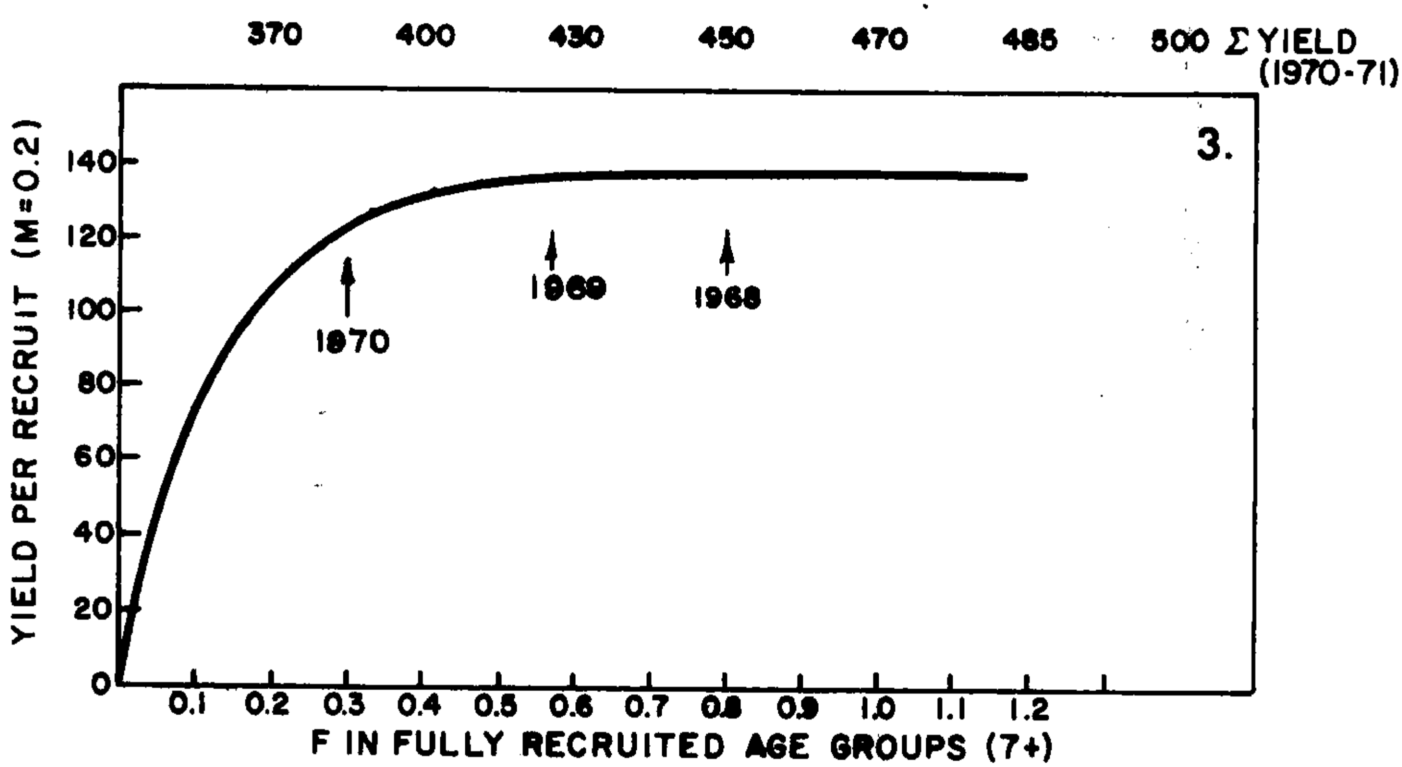

Fig. 3. Subarea 1 Cod: yield per recruit (M = 0.2).

The effect on yields from the Iceland fisheries has been reported by the Northwestern Working Group.

2. Subareas 2 and 3

a) Div. 2J

Catch/effort assessments presented to the 1970 Annual Meeting (Res.Doc. 70/67) indicated that the level of fishing in the area during 1964-68 generated a fishing mortality close to that providing the long-term maximum of yield-per-recruit. A new assessment (Res.Doc. 71/10) using the virtual population technique on age-composition data from 1959-1969 indicates that fishing mortality (F) in fully recruited age groups increased from about 0.07 in 1959 to an average of 0.4 in the 1963-67 period, about six-fold. Ottertrawl landing at the same time increased from 39,000 tons in 1959 to 212,000 tons in 1967, 320,000 tons in 1968 and 361,000 tons in 1969. The increased fishery has caused a marked reduction in the proportion of older age-groups in the population and the fishery has become increasingly dependent on younger age-groups recruiting to the fishery. The total number of cod in the exploited population has fluctuated only moderately in the period with no trend being evident, because recruitment has been somewhat better in recent years. These trends are confirmed by USSR and Polish data on age compositions of the commercial fishery and young fish surveys in Div. 3K, the area from which cod are believed to be recruited to the northern area (Res.Doc. 71/11 and 71/104).

Data presented by USSR and Poland indicated that the increased catches in 1968-69 were made possible by improved recruitment for year-classes of the early 1960's and this is also indicated from the virtual population analysis. USSR young fish surveys indicate that the 1964 and 1965 year-classes are less abundant, although 1965 year-class was of importance in the 1970 Polish catches (Res.Doc. 71/104).

The 1966, 1967 and 1968 year-classes are relatively stronger and will contribute to the catches in 1971 and 1972. However, it must be stressed that at Labrador actual catches in some years may be as much influenced by peculiarities of cod distribution in relation to temperature variations as by abundance of recruiting year-classes, especially since year-class fluctuations seem to be only on the order of 3-4 times in this area. In any case, the total yield from these recent year-classes is likely to be reduced if the increased fishing pressure is maintained.

The total cod catch in Div. 2J decreased sharply from 361,000 tons in 1969 to about 194,000 tons in 1970. This decrease seems to be a combination of decreased effort and decreased catch-per-unit of effort caused by the fact that the better-than-average year-classes of the early 1960's have passed beyond the age of their maximum contribution to the fishery.

Cod are fully recruited to the fishery at 8 years of age, while very few 3-year-olds are caught, the 50% recruitment age being about 6 years. A revised yield-per-recruit calculation incorporating these partial recruitment estimates produced a curve similar to that from the previous assessments and substantiates the conclusion that further increases in fishing mortality will not give a long-term increase in yield-per-recruit and increased catches will further reduce the abundance of the stock. However, because of the marked effect on fishing success of year-to-year variations in distributions of the stock caused by the hydrographic conditions the trend has been to concentrate fishing more and more in periods when cod concentrations are most dense. Thus, the reduced abundance may not be immediately reflected as reduced overall catch-per-unit of effort in this stock although in this respect it is to be noted that Polish data indicated that the catch-per-unit of effort by Polish trawlers in Div. 2J has decreased from 3.5 tons/hr in 1968 to 2.4 tons/hr in 1970 (Res.Doc. 71/104).

b) Subarea 3

No new assessments are available for Subarea 3 but previous assessments presented to the 1970 Annual Meeting indicated that the fishing effort on some stocks is probably beyond that generating the maximum sustained yield-per-recruit. In view of the relationship between the present and previous assessments for Subarea 2 given above, it is unlikely that planned virtual population assessments for some of these areas will greatly alter the conclusion that the level of effort is at least near the point of maximum sustained yield and perhpas beyond it.

The reduction of the cod catch in Div. 3NO from the high 1967 level of 222,000 tons to 110,000 tons in 1969 reflects probably a decreased population as well as a reduction in effort in this area. The 1970 catch is approximately the same as the 1969 catch. The very strong 1964 year-class which was primarily responsible for the marked increase in landings from Div. 3NO in 1967 has almost disappeared from the landings, even though the fish were only 5 years old in 1969. As a result the fishery in this area is now heavily dependent on the youngest year-classes recruiting to the fishery. Since the fluctuations in year-class strength are great in Div. 3NO, and to a lesser extent in Div. 3Ps, an increased variability in stock abundance and catches can be expected, especially if the increased effort were sustained.

USSR research surveys on the southern Grand Bank (Div. 3NO) area indicate that the 1967 year-class was poor, followed by a stronger 1968 year-class but a poorer 1969 year-class. Surveys by Canada (Nfld.) indicated similar relative strength of the 1967 and 1968 year-classes. The fishery in this area in 1971 is, therefore, expected to be less productive than in the 1967-1968 period and landings will probably remain at a level close to that prevailing just prior to the entrance of the strong 1964 year-class (80,000 - 100,000 tons) unless there is a significant change in effort. There may be some improvement in catches in 1971-72 because of the relatively stronger 1968 year-class, but, in relation to maximizing yield-per-recruit. Fishing on such young fish is highly undesirable. Maintaining or increasing fishing mortality will not improve yield-per-recruit, and may result in lower yields over the long run.

3. Subarea 4 (Div. 4X)

Cod landings from Div. 4X increased from less than 15,000 tons in 1961 to over 35,000 tons in 1968. This was largely due to the rapid expansion of otter and pair trawling on the offshore banks of Browns and La Have. In 1969 landings declined slightly to 32,720 tons, due to a decrease in landings from the inshore fishery. The stocks supporting the inshore and offshore fisheries are believed to be independent.

Inshore Fishery Landings from the inshore fishery (mainly Bay of Fundy and within 12 miles of southwest Nova Scotia coast) prosecuted almost entirely by Canadians handlining and longlining from small boats, probably averaged about 14,000 tons in the 1947-1958 period. Total mortality rate (Z) at this time averaged 0.45. Inshore landings in the period 1958-1969 also averaged 14,000 tons. Effort in the line fisheries off southwestern Nova Scotia, from where the bulk of the inshore landings come, has either remained constant, or more probably, decreased whereas effort by otter trawlers in the Bay of Fundy has increased. However, total inshore effort between 1958 and 1969 may not be much different from that in 1947-1958. Landings in 1970 were again about 14,000 tons. Therefore, Z in the inshore stocks is probably still close to 0.45.

Offshore Fishery (Res.Doc. 71/12) Expansion of otter trawling started in the early 1960's and annual landings from the offshore fishery increased from less than 3,000 tons prior to 1963, to 17,623 tons in 1969, averaging 15,000 tons in the 1965-1969 period. The average value of Z in 1965-1969 was estimated at 0.90. Assuming $M = 0.20$ implies $F = 0.70$. The constant parameter yield-per-recruit model indicates that maximum yield-per-recruit from this stock is obtained at $F = 0.35$. The model predicts that a 13% long-term increase in yield-per-recruit would accrue from a 50% reduction in F from 0.70 to 0.35. F in 1969 may have increased to 0.90, assuming it was proportional to the observed increased fishing effort.

In 1970, landings declined 50% to about 8,600 metric tons, of which Canada took about 55%. As the Canadian fishery in 1970 concentrated on considerably younger fish than in previous years, the current status of the stock is particularly difficult to assess. However, the catch per hour (by weight) of Canadian otter trawlers continued to decline, the 1970 value being 23% lower than that for 1969. Research vessel survey data also show a marked decline in stock abundance from 1965 through 1970, and indications are that strong year-classes will not enter the fishery over the next few years. The effort deployed in 1970 probably generated a mortality nearly as high as in 1969. Concentration of a substantial part of this effort on young age-groups, which has lowered the mean age of capture, is likely to have added to the deleterious effects of this high fishing rate. Thus, a considerable reduction in catch below the 1970 level is required to obtain maximum yield-per-recruit from this fishery. Because of poor expected recruitment, the stock abundance will continue to decline unless the catch is reduced.

4. Subarea 5 (Res.Doc. 71/125)

Cod landings from Subarea 5 and fishing effort have increased greatly since 1964. There is no indication from *Albatross IV* surveys of increased population size or recruitment. Some abundance indices from commercial fleets, in fact, indicate a decrease in abundance through 1970. There is a slight decrease in mean size of cod captured in survey cruises since 1963. Preliminary yield and yield-per-recruit studies indicate that overfishing has occurred in recent years. Judging from analysis of a long-term catch and effort of the USA fleet, maximum sustained yield is probably between 30,000 and 40,000 tons. From 1965 through 1969 landings ranged from 42,000 to 57,000 tons dropping to 35,000 tons in 1970. The fishery is judged fully exploited at the present time and increases in effort should be avoided until a more complete assessment can be made.

5. General Conclusions

Reasonable assessments for cod in Subarea 1, Div. 2J and Div. 4X are now available. Assessments are also available for Subareas 3 and 5, but they are less complete. The additional studies conducted during the past year substantiate the Subcommittee's 1970 conclusions that:

i) the available fishing capacity capable of being deployed on cod stocks is greatly in excess of that required to secure the maximum yield-per-recruit,

ii) the high yields of 1967-1968 were achieved by decreasing the stocks accumulated under previously lower levels of exploitation and because of a period of good recruitment,

iii) increases in effort on any of the cod stocks except possibly Subarea 1 will cause a deterioration in the fisheries and the stocks. At best, it is probable that over the long run, no more than a total catch of 1,300,000 tons (compared with 1,860,000 tons in 1968, 1,263,000 tons in 1969, and 1,100,000 tons in 1970) would be taken with increased effort, but it is possible, depending on the stock-recruitment relation, that there might be a decrease in total catch.

The apparent decrease in effort on cod in the Northwest Atlantic in 1969-1970 to a level near the maximum yield point was caused by decreased availability and stock size; a large part of the effort was shifted to cod stocks in the Northeast Atlantic. The stocks of cod in the latter area are declining and it is likely that the effort will be shifted back to the Northwest by 1973.

The Subcommittee wishes to stress that immediate action to limit fishing on all cod stocks in the Northwest Atlantic would be most propitious.

C. Haddock

1. Div. 4VW

The 1970 assessment indicated that the fishery exploited the adult stock close to the level giving maximum yield-per-recruit in the period 1948-68. A substantial fishery for juveniles in 1965-66 considerably reduced the abundance of the 1962-64 year-classes prior to their entry to the traditional fishery. This, in combination with recruitment to the adult fishery of a series of naturally poor year-classes, has resulted in a drastic decline in stock abundance in recent years. Commercial catch-per-unit-effort data indicate that a further sharp decline in abundance occurred in 1970 to the lowest value on record. Landings also declined in 1970 to about 9,500 tons from 11,146 in 1969.

Quantitative research vessel surveys undertaken in July of 1969 and 1970 provide two independent estimates of the strength of the pre-recruit 1967 and 1968 year-classes which are in good agreement, and provide a first estimate of the strength of the 1969 year-class. These year-classes, which will make their first substantial contributions to the fishery at age 4 in 1971, 1972 and 1973, respectively, are all estimated to be poor and will probably number less than 10 million fish at recruitment.

Previously presented population estimates, based on commercial statistics and the above recruitment predictions, indicated that population would decline from about 33 million adult fish in 1970 to about 22 million in 1972-73 if F remained at the 1970 level. However, major discrepancies were found between estimates of population derived from the 1969 and 1970 commercial statistics which probably reflect major changes in the catchability coefficient because of changes in the distribution of fishing effort and of the fish stock in response to the very low population abundance. Most probably, the stock density in 1970 was overestimated.

As independent estimate of total mortality, $Z = 1.32 (F = 1.12)$ has recently been made from data collected on research vessel surveys in July of 1969 and 1970. This value is considerably higher than the value of $Z = 0.66$ obtained from commercial statistics. The estimate of initial population in 1970 obtained by applying the survey value of $F = 1.12$ to the 1970 catch data is only 10 million fish. If fishing mortality remains at or increases above the 1970 level, implying catches of about 9,000 tons, through 1971-73, the stock will not increase and may well decrease further. This high level of fishing mortality provides yields-per-recruit very much less than maximum. More importantly, keeping the stock at this very low level reduces the probability of good recruitment and delays or prevents recovery to former, better levels of productivity.

2. Div. 4X

In the assessment presented last year (Redbook 1970, Part I, p. 45-46), it was estimated that total mortality (Z) on fully recruited age-groups (age 6+) averaged about 0.8 in 1967-1968. Analysis of groundfish survey data from 1963 to 1968 provided an estimate of M = 0.2, so that F = 0.6. These latter data also provided estimates of the relative strength of the year-classes 1961-1967. Estimates of the available stock were derived from landings data, and combined with the estimates of pre-recruit strength from the survey cruises, catches in 1969 and 1970 were predicted.

Thus, if F remained constant at 0.6 through 1969 and 1970, it was estimated that the available stock would yield 23,000 tons in 1969 and 12,000 tons in 1970.

Actual catches of haddock in Div. 4X in 1969 and 1970 were about 30,000 and 18,125 tons, respectively, indicating that F in both years probably exceeded the high 1968 value of 0.60. Recent surveys of pre-recruit year-classes indicate that those of 1968-1970 are equally as poor as those of 1964-1967. This indicates that no significant improvement in recruitment to the fishery is likely prior to 1975 at the earliest, and stock abundance will continue to decline unless F is reduced considerably below current levels. Thus, an annual quota of 18,000 tons is ineffectual in maintaining stock abundance and quotas should be reduced to considerably less than 12,000 tons.

3. Subarea 5

The reported catch in 1970 was 12,831 tons compared to the quota of 12,000 tons. The fishery was closed 13 October 1970 when 80% of the quota had been reached.

The age composition of USA landings in 1970 substantiates the prediction of low recruitment. The 1962 and 1963 year-classes are now very much reduced, but still accounted for a large share of the catch.

AGE	2	3	4	5	6	7	8	9+
Nos. per thousand	-	.038	.114	.043	.226	.367	.102	.105
Nos. per days fished	5	37	110	43	220	357	99	102

The average weight per fish in USA landings was 2.41 kg (60.8 cm) and the average age was 6.6 years. Assuming the average weight of 2.4 kg applies to total landings, a total of about 5.3 million fish were removed from the population.

Landings-per-day of the USA fleet has been recalculated for the last ten years to eliminate the closed seasons of 1970. This new index of relative abundance was 2.1 tons in 1970 compared to 2.5 in 1969.

Previous estimates (Table 3) had indicated that additions to the stock in 1970 would be about equal to the 12,000 ton quota. The autumn USA groundfish survey indicates no significant change in population between 1969 and 1970. No young-of-the-year haddock were caught on the survey. Thus, the 1970 year-class is very poor and recruitment in 1972 is expected to be very low.

The Subcommittee stresses that continuing the fishery at 12,000 tons will not allow for improvement of stock abundance. It is likely, in fact, that the stock will be further decreased by the end of 1972.

Table 3. Estimates of available population and recruitment for Subarea 5 haddock (in millions of fish).

	1935-1960	1968	1969	1970	1971	1972
Available Pop. (age 2+) incl. recruits	145	52	20	21	28	19+ recruitment
Removals:						
Total	63	33	15	9	9	
Fishing	41	28	12	6*	6*	
Natural	22	5	3	3	3	
Recruits (age 2)	54	16	1	16	16	

* under regulation, 2 kg per fish

D. Herring

1. Current Fishery Trends (Tables 4 - 6), Res.Doc. 71/26, 71/121)

In 1970 the total herring landings from the ICNAF statistical area declined to 810,000 tons from the 1969 level of 878,000 tons; these figures do not include landings which are not available from some non-member countries. Landings in Div. 4T (Gulf of St. Lawrence) increased following increased effort in 1970 but in nearly all other areas reduced landings were reported.

The decline in Subarea 3 (south coast of Newfoundland) for 1970 was not marked but high catches in early 1970 were followed by low catches in the last quarter of the year and the stock situation has undoubtedly deteriorated. On the Nova Scotian Shelf (Div. 4VW), where fisheries have only recently developed a marked fall-off in landings from the Banquereau area, the decline was partly compensated for by increased landings from the Emerald-Middle Bank area (Div. 4W) and from an inshore fishery in the Chedabucto Bay-Canso Bank area (Div. 4W).

The fishery on the fall spawning stocks off the southwest coast of Nova Scotia (Div. 4X) produced lower yields in 1970 despite a substantial contribution from the strong 1966 year-class. There was a marked reduction in landings from the juvenile fisheries along the New Brunswick shore (Div. 4X) and the USA coast (Div. 5Y), but catches of adult herring in Div. 5Y were increased over the 1969 level.

Both Poland and the Fed. Rep. Germany reported higher landings from Div. 5Z and Subarea 6 but these were more than offset by much lower landings from the USSR fleet and the total declined to 217,000 tons from the 1969 level of 264,000 tons.

Table 4. Herring landings (in thousands of tons) by area (stock), 1960-70. Juvenile catches are in parentheses where known.

Year	Subarea 3	Div. 4RS	Div. 4T	Div. 4VW	Div. 4X	Div. 5Y	Div. 5Z Subarea 6	Total
1960[a)]	6	...	...	...	...	70(69)	...	180
1961	4	1	19	3	58	26(24)	68	179
1962	5	2	34	12	68	72(71)	151	344
1963	6	2	40	5	65	70(69)	97	285
1964	3	5	39	3	93	29(28)	130	302
1965	8	5	44	7	124	34(32)	41	263
1966	23	7	37	3	189	29(26)	143	431
1967	79	6	63	2	190	36(29)	219	595
1968	145	7	112	24	227	63(32)	373	951
1969	145	3	155	122	142	47(24)	264	878[c)]
1970[b)]	135	5	175	113	123	40(15)	217	810[c)]

a) Subarea 4: 105
b) from Res.Doc. 71/26
c) Non-member catches not available

Table 5. Herring landings (in thousands of tons) in Subareas 1-5 and Subarea 6 by year and country (juvenile catch in parentheses where available).

Year	Canada	USA	USSR	Fed.Rep. Germany	Iceland	Norway	Romania	Poland	Japan	Non-member	Total
Subareas 1-5											
1960	110	70(69)	-	-	-	-	-	-	-	-	180
1961	85	26(25)	68	-	-	-	-	-	-	-	179
1962	112	72(71)	160	-	-	-	-	Ø	-	-	344
1963	115	70(69)	100	-	-	-	-	Ø	-	-	285
1964	141	28(28)	133	-	-	-	-	Ø	-	-	302
1965	183	35(32)	42	-	-	-	2	1	-	-	263
1966	256	31(26)	119	-	-	-	3	15	-	1	425
1967	345	32(29)	124	28	-	-	2	38	-	21	590
1968	528	42(32)	130	81	-	-	2	64	-	75	922
1969	482	31(24)	166	96	13	1	Ø	37	-	NK	826
1970	477	30(-)	111	94	-	-	1	56	1	NK	769
Subarea 6											
1966	-	3	3	-	-	-	-	-	-	-	6
1967	-	1	3	-	-	-	-	-	-	1	5
1968	-	Ø	16	Ø	-	-	-	12	-	1	29
1969	-	1	38	-	-	-	-	13	-	NK	52
1970	-	Ø	22	Ø	-	-	-	16	-	NK	38

Table 6. Herring landings ('000 tons) by country and area (stock) in 1970. (from Res.Doc. 71/26)

Country	Subarea 3	Div. 4RS	Div. 4T	Div. 4V	Div. 4W	Div. 4X	Div. 5Y	Div. 5Z	Subarea 6	Total
Canada (M)	-	+	161	2	29	123	5	+	-	320
Canada (N)	135	5	15	3	+	-	-	-	-	158
Germany	-	-	-	5	+	-	6	82	+	94
Japan	-	-	-	-	-	-	-	1	-	1
Poland	+	-	-	1	+	-	+	55	16	72
Romania	-	-	-	-	+	-	-	+	-	+
USSR	-	-	-	13	59	+	-	39	22	134
USA	-	-	-	-	-	-	29	1	1	31
Non-member	?	?	?	?	?	?	?	?	?	?
Total	135	5	176	24	89	123	40	178	39	810

In Div. 5Z and Subarea 6 the diversion of effort to mackerel during periods when herring concentrations were scarce was a significant feature of the 1970 fishery.

2. Identity of Stocks (Res.Doc. 71/6, 71/40, 71/92, 71/98, 71/100 71/107, 71/108, 71/120)

a) Subarea 3 (south coast of Newfoundland) and Div. 4T (southern Gulf of St. Lawrence)

The movement of herring into and out of the Gulf of St. Lawrence has been demonstrated by tagging experiments. The stocks supporting the south coast of Newfoundland fishery in the fall and winter are now known to be exploited also in the summer Gulf fishery. It has also been shown that spring-and autumn-spawning stocks in the Gulf are distinct and can be recognised as intermingled components in the Newfoundland fishery. It has been estimated that, for the last five years, at least two thirds of the herring landed in the Newfoundland fishery were autumn spawners.

b) Div. 4V and 4W (Nova Scotian Shelf)

Evidence is accumulating that two distinct stocks overwinter on the Nova Scotian Shelf, one in the Banquereau area (Div. 4V) and the other in the Emerald Bank - Middle Bank area (Div. 4W). Recent studies suggest that the Banquereau fish are related to those caught inshore in the Chedabucto Bay - Canso area (Div. 4W) and that they do not migrate to the Gulf of St. Lawrence.

It is possible that the herring exploited in the Emerald-Middle

Bank area are over-wintering concentrations of the stock spawning off the southwest coast of Nova Scotia and this possibility is being investigated.

c) Subareas 5 and 6

The distinction between adult stocks in Subarea 4 on the one hand and Subareas 5 and 6 on the other is supported by more recent information but this evidence does not entirely exclude the possibility of some degree of mixing. Biochemical analysis indicates that adults spawning on Jeffreys Ledge (Div. 5Y) are distinct from the Georges Bank stock (Div. 5Z) despite similarities in meristic characteristics, and that progeny from Jeffreys Ledge spawners contribute to juvenile stocks in the Gulf of Maine.

d) Juvenile Herring (Div. 4X, Subareas 5 and 6)

It is still not possible to define with any certainty the sources of all of the juvenile herring concentrations off the Canadian and USA coasts and the adult stocks to which they subsequently recruit. Studies show that three distinct adult stocks occur in the area (on Georges Bank, Jeffreys Ledge and off the southwest coast of Nova Scotia); thus three genetically distinct juvenile populations should exist but they may be intermingled. It has been found that overwintering larval concentrations occur near the major spawning sites on Georges Bank, in the coastal Gulf of Maine waters and the Bay of Fundy, but post-larval movements, which would determine the racial composition of populations fished as yearling or two-year-old herring, are not known in detail.

Similarities of certain meristic characters between Gulf of Maine juvenile herring year-classes of the early 1960's and the same year-classes as adults on Georges Bank have not been confirmed for subsequent year-classes and no firm conclusions can be drawn, particularly as biochemical studies had indicated that two distinct stocks were involved.

A significant difference in mean vertebral count between juvenile herring of the same year-class on the Nova Scotia and the New Brunswick sides of the Bay of Fundy suggested that the New Brunswick juveniles may be related to the Gulf of Maine juveniles and Nova Scotia juveniles to the Nova Scotia fall-spawning stock and this possibility should be investigated further.

While recent research on stock identity has clarified some issues for some areas it has emphasized the complexity of stock interrelationships in others.

3. Assessment of State of Stocks

a) Subarea 3 and Div. 4T

The 1969/1970 landings from the fall/winter Newfoundland fishery were maintained at their 1968/1969 level, but catch-per-unit of effort declined by an estimated 15% from 1968/1969. Data for the last quarter of 1970 and the first of 1971, which cover a fishing season, show a 50% decline in catch for 1970/1971 compared to 1969/1970 (with only a slight decrease in fishing effort).

Estimates of stock size of 400,000 tons for the beginning of the 1969/1970 season and 250,000 tons for the beginning of the 1970/1971 season have been made from analysis of the data from tagging experiments. The annual exploitation rate was estimated at 40-50 percent.

The fishery has depended for many years on pre-1960 year-classes and in 1970 these still contributed 50-60 % of the catches. Post 1960 year-classes which have been recruited to the fishery are all relatively small and unlikely to support the 1970 level of harvest. The strength of pre-recruit year-classes is not known, but unless recruitment in the next year or two is increased substantially, continuation of the high exploitation rate will further reduce stock size. The probability of good year-classes in subsequent years is likely to be reduced thereby.

b) Div. 4XW

Declining catches from the Banquereau area (Div. 4V) led to diversion of USSR effort to Emerald and Middle Bank in 1970 (Div. 4W), but effort by the Fed. Rep. Germany in the latter area declined.

The Canadian fishery on fall spawners off the southwest coast of Nova Scotia (Div. 4X) gave lower yields in 1970 despite a substantial contribution made by the 1966 year-class and what little information there is available on catch per effort indicated a decline from the 1969 level which itself was 30% lower than that of 1968. There is not enough data from which to estimate mortality rates or stock sizes but the 50% decline in catches since 1968, following a period of rapidly increasing effort and catch indicates that a rapid removal of accumulated stock occurred. It is likely that the sustainable yield would be considerably lower than the peak level of 147,000 tons recorded in 1968 and that, as with the Newfoundland fishery, maintenance of effort at even moderate levels will result in further reduction in stock size.

c) Div. 4X and 5Y (Bay of Fundy, New Brunswick and Gulf of Maine)

In 1970 the coastal juvenile fisheries of both New Brunswick (Div. 4X) and the Gulf of Maine (Div. 5Y) declined from the already low 1969 level. The New Brunswick weir fishery produced 13,000 tons compared with 25,000 tons in 1969 and the fall-winter purse seine fishery 15,000 tons compared with 19,000 tons. The USA juvenile fishery produced 15,000 tons as against 24,000 tons in 1969, continuing a decline which began in 1964. The indications are that both the 1967 and 1968 year-classes (which were the dominant year-classes in these fisheries in 1969-70) are small, as there has been little change of effort over the last six years.

Since 1968 exploitation of adult stocks in the western Gulf of

Maine (Div. 5Y) has increased; landings in 1969 and 1970 were about 30,000 tons. Research to date indicates that these stocks contribute to juvenile fisheries in the Gulf of Maine so that this increased exploitation of adults at a time when recruitment prospects as inferred from juvenile stock abundance are poor is bound to have a cumulative effect in reducing stock size.

d) Div. 5Z and Subarea 6 (Tables 7 and 8, Res.Doc. 71/105, 71/124, 71/126)

Total landings in 1970 declined to 217,000 tons from the 1969 figure of 264,000 tons, primarily because of markedly reduced USSR landings. Increases were reported for the Polish and Fed. Rep. Germany fleets.

The age-structure of catches shows that the very large 1960 and 1961 year-classes are now much reduced in numbers and make only a small contribution. They were followed by the weak year-classes of 1962 through 1964. The relatively good 1965 year-class and the larger one of 1966 now primarily support the fishery; the 1966 year-class accounted for almost half and the 1965 year-class for almost a quarter of the numbers caught in 1970.

Table 7. Data from USSR herring fishery on Georges Bank, 1963-1970. Catch-per-unit-effort data are from the month of spawning, September, and relate to medium-sized trawlers and to only those catches in which at least 70% of the catch consisted of herring.

		Data from egg surveys		
Year	Catch-per-unit-effort in September (kg x 10^{-2}/hr fishing)	Spawning area km^2	Eggs 10^{-6}kg	Spawning population 10^{-6}kg
1963	62.7	no data	no data	no data
1964	78.3	38.8	427.8	1,180
1965	no fishing	24.3	299.5	530
1966	no fishing	19.1	76.5	150
1967	50.0	no data	no data	no data
1968	32.5	5.7	46.1	130
1969	18.6	4.0	25.7	60
1970	no data	1.9	6.9	12

Determination of mortality rates and of the extent of the decline in stock size has been difficult but the general picture to emerge is of a severe decline in abundance and a high rate of exploitation. USSR grab-sample surveys have indicated a large decline in spawning area and a 99% decline in stock size between 1964 and 1970, although the latter must be an overestimate.

Catch-per-day data from the Fed. Rep. Germany and from Poland do not show a decline in relative abundance over recent years and USSR catch-per-day data (computed from statistics in Table IV of the ICNAF *Statistical Bulletin*) show only a moderate decline between 1968 and 1969. However catch-per-day data does not accurately reflect relative abundance for several reasons notably the inability of vessels to process more than a fixed amount each day and the difficulty in assigning a correct degree of effort to herring in a mixed fishery. In an attempt to overcome these problems, the USSR have provided information on a catch-per-hour basis for the Georges Bank September fishery when effort is directed almost entirely towards herring. Even these data may overestimate abundance at low stock levels, but they show a 75% decline from 1964 through 1969; information has been given that 1970 estimates of relative abundance are lower than those of 1969.

The results of the USA *R/V Albatross IV* spring surveys also provide abundance data for the stock spawning on Georges Bank. They indicate a 75% decline in Div. 5Zw and a 93% decline in Subarea 6 from 1968 to 1970.

Table 8. Numbers of herring caught per tow by *R/V Albatross IV* from USA spring surveys.

Year	Div. 5Zw	Subarea 6
1968	120.6	17.4
1969	45.8	6.4
1970	34.7	1.2

Estimates of F by virtual population analysis have been carried out and suggest values of from 0.6 to 0.8 which give estimates for E of 0.55 and 0.75. Other estimates of mortality rates indicate even higher values of F although these have a less satisfactory scientific basis. A continuing high effort on a declining stock would result in both F and E increasing still further.

The prospects for the 1971 Div. 5Z and Subarea 6 fisheries (and for the years immediately following) could not be determined because some of the length and age data for the latter part of 1970 were not available. Polish data suggest that the 1966 year-class is large only in comparison with the weak year-classes preceding it and that it does not compare in size with the 1960 and 1961 year-classes which until recently have supported the fishery. It is important to determine whether or not the 1966 year-class had fully recruited in 1970, but, in any case, it appears that landings are likely to decline even if present levels of effort are maintained.

The Gulf of Maine - Bay of Fundy sardine year-classes are small so that even if they do recruit to the Georges Bank adult stock, increased recruitment rates from this source cannot be expected to provide for recovery of stock abundance in 1971 and 1972.

There is not enough data on which to base a stock-recruitment relationship for the Georges Bank stock (or indeed for any other herring stock in the ICNAF area) but the possibility cannot be ignored that recruitment could be adversely affected by the reduction of stock size indicated by the presently available information. If the fishery remains unregulated it is likely that a further decrease in stock size will result and a reduction in effort is needed to allow a reasonable chance of spawning stocks recovery to levels at which increased recruitment is more probable. At the recent Stock Recruitment Symposium, it was agreed that to await the final results of scientific study of stock-recruitment relations before management action is taken, may be courting disaster.

It should also be pointed out that because of our lack of knowledge of details of the inter-relationships between exploited juvenile populations and adults stocks in the Gulf of Maine, Bay of Fundy and Georges Bank area, any measures aimed at reducing effort to allow an increase in stock sizes must consider all of the possible inter-relationships and involve both the adult and juvenile fisheries.

4. Research Requirements - Programs and Priorities

a) Larval and Young Fish Surveys

Arrangements were made for a coordinated larval survey of the Gulf of Maine - Georges Bank to include the major spawning grounds in the area. A series of four cruises is planned over the period 7 September to 8 November 1971. Vessels from France, USSR and USA will take part and it is possible that the Fed. Rep. Germany will also contribute vessel time. The herring working group considered it necessary for similar coverage of the Bay of Fundy area and hope that Canada will be able to provide this coverage.

The Boothbay Harbour laboratory agreed to organize and supervise the detailed planning, including such items as standardization of gear and sampling procedures and the preparation of cruise tracks and station positions, by corresponding with participating countries. The USA also agreed to provide the necessary sampling gear if this was considered necessary to achieve uniformity. The need for comparative hauls between vessels where overlap in time coverage occurs is also to be considered. It was agreed that at the beginning of each cruise scientists from participating vessels would meet with Canadian and USA scientists at a convenient port to finalize plans for the cruise.

Such surveys as these will give valuable information on the relative sizes of spawning groups in the area and on the immediate dispersion of larvae from spawning grounds. But they represent only a first step towards the solution of stock interrelationships. Studies on post-larvae and juvenile populations, their distribution abundance and movements should be intensified. These could also provide information on future prospects for recruitment which are of great importance for all herring stocks in the ICNAF area. Preliminary studies on post-larval and juvenile herring are planned by Canadian scientists for the summer of 1971 in the Gulf of St. Lawrence.

The USA will extend their quantitative surveys of young stages of herring along the USA coast in the spring of 1972 and it is desirable that such studies should be carried out also in the Bay of Fundy by Canada and that techniques and procedures be compared and programs be coordinated.

b) Otolith Exchanges

The Fishery Research Board's Station at St. John's, Nfld., agreed to organize and coordinate a regular and more comprehensive program of otolith exchange between experts from member countries engaged in routine age-determination and other otolith studies. Canada, France, Fed. Rep. Germany, USA, USSR and UK have agreed to participate. A decision on the need for a special herring workshop will depend on the results of this regular exchange program.

c) Tagging Experiments (Res.Doc. 71/95, 71/108, 71/109)

The Canadian tagging experiments carried out in 1970 provided valuable information on stock interrelationships and seasonal migrations in the Gulf of St. Lawrence - Newfoundland area besides giving estimates of stock abundance and exploitation rates. It was considered desirable that this technique be used in other areas but, whereas Canadian experiments used internal tags in adult herring, such experiments in the Gulf of Maine, Georges Bank and the Scotian Shelf area would involve the use of external tags on both adult and juvenile herring. There are both technical and practical difficulties which would have to be solved and no major plans can be made for 1971. It is proposed that preliminary studies to determine the feasibility of using external tags be undertaken at the earliest opportunity (see also *Redbook* 1970, Part I). A particular aim would be to explore the likelihood of recapturing tagged juvenile fish as adults in the Gulf of Maine - Bay of Fundy area.

d) Statistics and Sampling

The herring working group agreed that the present system of reporting herring statistics and sampling data is not adequate for research and assessment purposes. The subareas and divisions into which the ICNAF area is divided are too large and a breakdown into areas so that individual stocks can be dealt with is desirable. While this was agreed to in principle, it was difficult to decide on the type of breakdown that would be both desirable and practicable. It was suggested that in the next year, member countries should attempt to record catch and effort data (including main species sought) for areas of 1 degree longitude by 1/2 degree latitude and should report on progress in 1972. This presupposes the existence of a log-book system recording catch location. The Fed. Rep. Germany reported that such a system is to be introduced for the ICNAF area this year for their vessels.

The need for such information on a sufficiently accurate level is of particular importance in connection with regulatory measures and quota allocations, besides being essential for detailed analysis to detect and reduce bias in abundance estimates from simple catch-per-effort data. This problem is discussed in Section 6 below.

5. Biochemical Genetics

Results of most recent work in this field are being discussed at an informal workshop to be held on 3 June 1971 at the Halifax Laboratory of the Fisheries Research Board of Canada. It is expected that this will lead to a full evaluation of the present situation and standardization of techniques and methodologies. A report of the results of this meeting will be made available to members of the herring group.

6. Catch-per-unit-effort as a Measure of Relative Abundance in the Herring Fishery

Catch and effort statistics for a particular stock are conventionally stratified by national fleet, class of ship within a national fleet, months, division and year-class. When data from corresponding cells are compared from year to year, they provide a measure of the decrease in abundance over that time interval, and thus a measure of the total mortality rate.

One of the ways in which a "simple" catch-per-unit-effort index, as described above, becomes unreliable is when the spatial and temporal distributions of the stocks or of the fleet or of both change markedly from year to year. In the herring fishery of Georges Bank, the area in which adequate catches have been made has decreased noticeably from year to year, with a result that the ships have fished herring only while suitable catches could be made and have then shifted to other species when herring were not sufficiently abundant. The simple catch-per-unit-effort index only provides a measure of relative abundance or fish density in areas and time intervals fished, but does not give any measure of the extent of area over which this density was obtained and thus does not provide an unbiased measure of total stock abundance.

Perhaps the simplest way to include the area variable into the model is to stratify the total area in which the stock is distributed into equal area units, tabulate catch and effort data (by time interval, national fleet, ship class, etc.) separately for each area unit, calculate a catch-per-unit-effort index of each, and then sum them to provide an overall index of total stock abundance. This method of further stratifying the data may not, however, fully correct for the practice of shifting ships from one species to another when - say - preset weekly catch quotas are not met. If there are one or more months within the year in which catches are always adequate to prevent reassignment of ships to another species, then the corresponding data should provide relatively unbiased indices of total stock abundance, when catch-per-unit-effort indices within area units are all summed.

E. Yellowtail Flounder

1. Subarea 3

Landings were negligible before 1965 when approximately 3,000 tons were landed by Canadian trawlers primarily from Div. 3N. Precise estimates of total landings during 1966-69 are not available because most of the European flounder landings were reported as "unspecified flounder". However, assuming yellowtail to have occurred in these unspecified flounder landings in the same proportion as in total Canadian flounder landings, the estimated landing increased to 9,000 tons in 1968 and 13,000 tons in 1969. Provisional figures for 1970 in which European landings were separated into species indicate landings of approximately 27,000 tons.

Estimates of total mortality (Z) from both research and commercial data indicate an increase in the late 1960's during the period of the rapid increase in landings. Although there is evidence for an increase in the abundance of yellowtail on the Grand Banks since 1962, total mortality estimate indicate that fishing mortality has nevertheless increased in recent years.

2. Subarea 5

The assessment of this stock has been revised to include data on magnitude and age composition of the 1969 catch. Generalized production models have been rerun using catch data (as opposed to landings). Preliminary 1970 catch statistics and data from research vessel surveys from 1963 to 1970 have been included in determination of the status of the fishery as of 1970. Predictions through 1972 of the changes in status considering the 1971 catch quotas and groundfish survey cruise data have been made.

a) Yield-per-recruit

Evidence from application of the Beverton and Holt yield model, Ricker simulation model and a Gulland-type mesh selection study indicates that yield-per-recruit would increase with a decrease in effort of 33% and an increase in age-at-first-capture of about one year. A combination of both measures gives the greatest improvement. Current USA fishing practices result in approximately 37% of the catch being discarded because the fish are too small to market. A reduction in effort and an increase in mesh size will allow much of this discard to escape. With a low natural mortality rate (M = 0.2) a significant proportion will later enter the landings at greater weight. Thus, in addition to the expected benefits to catch from measures to increase yield-per-recruit, the benefits to landings will increase by an even greater percentage as the proportion of the catch which would be discarded is less. Estimates of the percent long-term gains to landings are given below:

Mesh size (mm) (synthetic)	Percent long-term gains 1965-1968 F = 1.2	33% red. F = 0.8
114	-	8-11
129	10-25	17-31
145	17-40	57

The upper range in probably higher than can be obtained because of difficulties in accounting for discards in the knife-edge selection assumption of the Beverton-Holt model.

b) Southern New England

Preliminary estimates of the catch in 1970 indicate a reduction from the 35,600 tons in 1969 to about 24,000 tons. Catch-per-day fished in the USA food fishery has remained about the same in 1969-1970 (3.3 tons) which is well below the 5.7-ton peak in 1964. The proportion of fish in the catch which were discarded increased in 1970 and the actual fish landed per days fished decreased from 1969 (2.8 tons) to 1970 (2.5 tons). Standard effort decreased from 10,800 days in 1969 to about 7,000 in 1970 which is comparable to the 6,500 to 8,400 range occurring from 1965 to 1968.

Analysis of data on catch and effort since 1943 and age composition for 1943-1947 and 1960-1969 indicate that the fishing mortality coefficient (F) has increased from 0.6-7 in 1943-1947 to 1.0-1.2 in the period 1960-1968 and possibly increasing to 1.3-1.4 in 1969. Comparison of estimates of total mortality between the 1940's and 1960's in relation to changes in fishing effort for the same years indicate that natural mortality is less than 0.2.

Survey cruise data from both USA and USSR surveys indicate a decrease in abundance from 1969 to 1970 as shown below:

Year	No. fish/tow USA	No. fish/tow USSR	Wt. fish/tow USA	Wt. fish/tow USSR
1969	54.3	62.7	31.7	33.5
1970	39.2	39.6	23.9	28.4

Length frequencies obtained on the surveys from 1963 to 1970 reveal a severe reduction in relative abundance of the age 1 fish (first mode in frequencies) and a contraction of the length range of the second mode (age 2+ fish) indicating more dependence of the fishery on fewer year-classes. Indices of year-class strength estimated in the autumn at age 1 show the 1967-1969 year-classes to be considerably below the 1962-1966 average (see below). Examination of data from spring 1971 survey cruises of the USA, and analysis of USSR survey data confirm the trends.

Year-class	Index (Nos. of fish)
1962-1966 Av.	20.2
1967	9.0
1968	7.9
1969	8.3

The 1971 quota of 13,000 tons would reduce F to 0.6 if the population was at the 1968 level of abundance. However, the F achieved in 1971 will be higher than this because recent estimates indicate a decreased population; achievement of the 1971 quota may, in fact, increase F above the optimum of 0.8. In 1971, the catch mainly will be composed of the 1966-1969 year-classes. Based on the estimated population size in 1972, and assuming recruitment in 1972 will be the average of the last three years, a quota of 8,000 tons will be required to reduce F to the desired level. If the quota is to apply to all grounds west of 69° rather than just southern New England, a quota of 10,000 tons is recommended to allow for the catch from the Cape Cod population.

c) Georges Bank

Preliminary estimates of the catch in 1970 indicate it to be essentially the same (21,000 tons) as in 1969. Catch-per-day fished of USA vessels increased from 3.1 tons to 3.3 tons which is still considerably below the 1964 level of 5.6 tons. The USA catch-per-day of fish large enough to be landed, however, dropped from 2.7 tons to 2.5 tons. Effort was almost the same in the two years, being 6,700 days fished in 1969 to 6,400 in 1970.

Survey cruise data for USA and USSR surveys indicate a decline in stock abundance in 1970 from fall 1969 as shown below:

	No. fish/tow		Wt. fish/tow	
Year	USA	USSR	USA	USSR
1969	23.1	62.7	15.9	41.4
1970	12.2	28.7	8.3	17.8

However, past year-to-year changes in survey indices have been more variable for Georges Bank than for Southern New England. Indices of year-class abundance at age 1+ indicate that the 1967-1968 year-classes are about average when compared to those from 1962 to 1966, although the 1969 index is lower.

Year-class	Index (No. of fish)
1962-1966 Av.	6.8
1967	9.7
1968	6.0
1969	4.5

The length frequency distribution from survey cruises have remained about the same from 1963 to 1970, but there is a slight indication of a lesser proportion of larger size fish in 1970.

Based on estimated 1968 stock size, the 1971 quota of 16,000 tons would reduce F to about 1.0-1.1 if F was 1.2 in 1968 but if F was 1.0, then the reduction would be to 0.8-0.9. It is likely that in 1968 the F was perhaps closer to the 1.0 figure as the effort was about 30% less than the 1969-1970 values. The estimates of maximum equilibrium yield from the Generalized Production Models range from 9,000 to 18,000 tons which bracket the quota value. Estimates of stock size on Georges Bank based on survey cruises are less than the corresponding estimates for Southern New England. Thus, any change in quota would be expected to be in a downward direction for the immediate future, but this depends on recruitment rate expected in 1972. An estimate of the latter is not yet available. Although the population size appears to have decreased through 1970, a continuation of the 16,000-ton quota level is suggested.

d) Subarea 6

The relationship between the stock in Southern New England and in Subarea 6 is not known. Since the latter area will not be regulated one effect of the quota may be to redirect effort to Subarea 6. Survey cruise indices for yellowtail flounder in that area are down in the autumn of 1970 from 1969. If there is a significant intermixing of the fish in Southern New England and Subarea 6, then heavier fishing in Subarea 6 could abrogate the desired effect of the quota in the former area.

F. American Plaice

Div. 3L and 3N (Res.Doc. 71/111)

Tagging and growth characteristics indicate that for assessment purposes the resource on Grand Bank should be divided in two separate stocks, one in Div. 3L, the other in Div. 3N. Since 1954 the majority of the catch in Div. 3L has been taken by Canada, increasing from 15,000 tons in the late 1950's to 25,000 tons in 1965 and then to 40,000 tons in 1970. The catch in Div. 3N, taken predominately by Canada, amounted to 5,000 tons per year until 1963. The yield in more recent years is less certain because of increased participation by the countries (USSR, Poland) which until 1970 have included American plaice in landings of unspecified flounders. Presuming the species to have occurred in unspecified flounder landings in the proportion observed in Canadian landings, it is estimated that catches reached 45,000 tons in 1966 and have since fallen back to 20,000 tons in 1970. In both stocks there has been a drastic decline in Canadian catch-per-unit-of-effort in recent years.

Assessments based on these figures show an increase in fishing mortality in the mid-60's, and that by 1967 both stocks were fully exploited. A further increase in fishing in Div. 3L in 1967 suggests that for this stock, for which the catch data are reliable, a slight reduction in fishing would not impair the sustainable yield estimated to be not more than 40,000 tons in 1970. In Div. 3N it is unlikely that any further increase in sustainable yield would follow increased fishing, but firm advice on the magnitude of this yield cannot be given until the precise estimates of the American plaice landings from this division become available for a longer period.

G. Scallops

Subarea 5

Scallop landings reached a peak of 15,000 tons of meats (130,000 tons whole weight) in 1962 following the recruitment to the fishery of the abundant 1955 year-class in 1959. They declined to 6,000 tons of meats by 1965 and landings have remained near that level since, being about 5,500 tons meats (46,000 tons whole weight) in 1970. While landings have remained relatively stable since 1965, catch-per-effort has been in almost continuous decline.

During 1970 a research vessel survey using dredges and underwater photographs outlined an area of about 274 sq km on the northern edge of Georges Bank where young scallops were concentrated. Most were between 50-100 mm in length, with 3-ring scallops of 72 mm modal length predominating in the area of highest concentration.

Estimates of fishing activity and examination of meat size for scallops landed from this area during 1970 showed that these young scallops were being exploited at sizes well below that of the early 1960's. Assessments from some years ago indicated that exploitation at such a small size was wasteful of potential yield. Consideration should be given to achieving effective conservation of the scallop resource by limiting fishing on age-groups younger than 6-7 years.

V. Groundfish Surveys

The Subcommittee discussed the work of the Working Group on Coordinated Groundfish Surveys with its Chairman and noted the conclusions of the Working Group in its evaluation of the accuracy of abundance estimates from research vessel surveys. These results indicated that such data would provide for adequate assessments.

While regretting that the Subcommittee had not had time to fully study the examples of survey abundance data presented to it on the data forms developed at the mid-term Working Group meeting, it was agreed that both some of these and other survey data had played an integral part in many of the assessments considered by the Subcommittee at this meeting. Indeed, due to the problems arising in utilising commercial abundance data for a number of seriously depleted stocks, it is possible that further detailed assessments cannot be made without quantitative research vessel survey data. Because of this urgent requirement the Subcommittee viewed with concern the fact that, although survey activities in Subareas 4 and 5 and Statistical Area 6 are being continued at about their present level and that some survey activity is planned for Subarea 3, there are no specific plans for coordinated, comprehensive surveys of the very important groundfish stocks in Subareas 1 and 2. The Assessments Subcommittee continued to feel that an overall survey plan for the whole ICNAF Area should be completed and implemented as soon as possible, and

<u>recommended</u> (1)

that the Chairman of the Working Group on Coordinated Groundfish Surveys continue his attempts to organize such surveys during the ensuing year and attend the next Assessments Subcommittee meeting.

The Subcommittee also strongly urged that the vessel time, manpower, and data processing facilities, which would be required for an ICNAF area-wide coordinated survey program be estimated so that member countries could provide for the necessary support.

VI. <u>The Mixed Fishery Problem</u>

Proposals for limiting the catch of haddock in Div. 4W made at the 1970 Annual Meeting included a closure of spawning grounds to all trawling during the peak spawning season. The proposal was deferred largely because of objections that the closed area would interfere with fisheries for other species, particularly cod. Panel 4 requested that the Subcommittee examine the actual potential conflict to assess the magnitude of the problem.

Data on species mixture in Canadian catches (Res.Doc. 71/15 and 71/16) in the area of concern indicated that cod and haddock, particularly, were mixed in trawl catches to a significant degree. Some flounders and other species also occurred in the catches. The proportion of cod and others in the catches was less by about half when haddock was the main species sought, but still the quantities of haddock in trips when cod was the main species were rather high. Canadian line trawl catches were less mixed than otter trawl and this type of gear presents less of a conflict. Examination of data on catches in the subarea as a whole for other countries indicated that catches of haddock were a small proportion of landings, but this broad type of data does not provide the required information. Scientists of several countries indicated that this specific closure would interfere with other fisheries which were of more importance. Analysis of survey catches would provide a measure of the potential mixture. In any case, additional data on mixture in individual trawl hauls in the area and time concerned, must be analyzed to provide a more exact answer.

In general, such closures will create problems in the southern areas of ICNAF because of the many species. Closure of spawning areas would not be expected to result in any direct significant biological benefits. It is utilized primarily to prevent catches from being concentrated in a short time span. The consequences of closures are thus primarily related to economic or administrative factors. They could be negative in the sense that the period of highest catch rate is closed. Also because fishermen are able to adjust their fishery strategy, such closures may not in fact achieve even the desired result. For example, the closed area in Subarea 5 was supposed to reduce the haddock catch rate by 20% over the two-month period. In fact, the accumulated catch rate decreased only by 10%. The problem of spreading catches over the year is better solved by more direct methods such as seasonal quotas. Because of the lack of evidence of biological significance, any administratively convenient method should be utilized which minimizes the adverse effects of regulation of one species on another. Where the species mixture is not too great, exemptions for fisheries on non-regulated species which allow a nominal percent of regulated species catch, might provide a solution. All such catches should, of course, be included in the quota.

VII. Implementation of Catch Quotas

The present regulations for catch quotas for haddock and yellowtail flounder require that the Executive Secretary notify countries when 80% of the quota has been reached, and that countries then prohibit fishing for the regulated species within 10 days. The balance of 20% allows for:

a) unregulated catches taken between the time 80% of the quotas is actually reached, and the time these statistics have been reported to ICNAF and the Executive Secretary can notify governments;

b) unregulated catches taken between the time of notification by the Executive Secretary and the closing date; and,

c) incidental catches taken after the closing date by ships fishing for other species.

The Div. 4X haddock quota was reached but no closure occurred. The first test of this procedure, thus, was the 1970 haddock regulations. Eighty percent of the reported Subarea 5 quota was reached in the last few days of September 1970. This was notified to governments by the Executive Secretary on 13 October and closure was effected by 23 October. The actual catch was 97.5% of the quota; the excess over the 80% was made up as follows:

a) catches taken before 13 October..........7%

b) catches between 13 October and closure...3%

c) incidental catches after closure.........7%

In this case, the procedure was successful in getting very close to the target for the annual catch, but this was to some extent a matter of chance. If, for instance, the 80% level had been reached earlier in the year, or at a time of high catches, the incidental catches, or the catches during the reporting and notification period could have been much higher, and the target quota considerably exceeded. Conversely, if the 80% level had been reached later, the incidental catches would have been lower and the total catches for the year would have fallen further below the target quota.

These effects are in themselves significant disadvantages to the present system. A further disadvantage is the difficulties they may cause for certain types of national regulations. For instance, fishermen may object to a system that would spread fishing more evenly through the year because this would result in a reduction in their catch for the year (*e.g.* 90% of the quota instead of 105%). The Subcommittee therefore believes that consideration should be given to a more flexible system, which would allow a closer approach to the target quota. The closing date may be chosen without any reference to a fixed proportion of the quota. Instead it would be based on real time estimates of the present catches, the quantity likely to be taken before closure could be introduced and likely incidental catches after closure. Essential information would be the time taken to effect closure (1970 experience suggests a period of about a month for the complete procedure of collection of national statistics, reporting to ICNAF, processing at ICNAF, notification to countries, and introduction of national closures), the probable catch rate during this period and the rate of incidental catches. With this information, the date on which closure should be applied to ensure that the quota should be reached by the end of the year, can be calculated. The Commission might frame its recommendations so that the decision on the closing date can be made by the Executive Secretary, without specifying in detail in the recommendations the exact percentage upon which the decision would be taken. To reduce uncertainty about the procedure a tabulation should be made and circulated in advance of the assumed unrestricted catch rates and incidental catch rates to be used in calculating the closing date. A possible procedure and example is set out below. It should be noted that the values in the table are hypothetical. If desired, it would be possible for STACRES to make fair estimates of the rate of unregulated catches for the haddock and flounder fisheries. Estimates of incidental catches in the Subarea 5 haddock fishery may be based on experience during 1970.

In this table the first four columns would be set out before the beginning of the season. Columns 1 and 3 give the amount of catches which would be expected to be taken during the remainder of the year if the procedure for closure was started on the first of the month concerned. For the purposes of this example it was assumed that the closure procedure would take a month. For example, the figures for August are the expected unrestricted catches in August (6% of the target quota) and the expected incidental catches in September-December (10% of the target). Column 5 would be completed during the year as catches are reported. Column 6 gives the expected total annual catch if the closure procedure is started at the beginning of the month concerned. This reaches 100 percent around the middle of October; closure procedure would therefore be started when the catch statistics for the first half of October are available, hopefully with the result that closure would be effective by the middle of November. The final column, 7, gives the accumulated catch at which closure proceedings should start (and = 100 - (a) + b) + c)) for the next month. The symbols a), b), and c) refer to the first paragraph of text of this section.

Example of calculation of closing date. Catches are expressed as a percentage of the quota.

	1	2	3	4	5	6	7
	Expected catches during month prior to closure	Incidental catches after closure		Expected total catch after decision to close	Accum. rpt'd catch to first of month	Total expected catch for year	Accum. catch value for closure decision
Month		Per month	Accum.				
	a) & b)		c)	a) & b) & c)			
Jan	9		27.5	36.5	0	36.5	65.5
Feb	10	2.5	25.0	35.0	10.6	45.6	66.5
Mar	11	2.5	22.5	33.5	22.1	55.6	69.0
Apr	11	2.5	20.0	31.0	35.2	66.2	72.5
May	10	2.5	17.5	27.5	46.3	73.8	77.0
Jun	8	2.5	15.0	23.0	57.0	78.0	80.5
Jul	7	2.5	12.5	19.5	66.2	85.7	84.0
Aug	6	2.5	10.0	16.0	73.5	89.5	86.5
Sep	6	2.5	7.5	13.5	80.1	93.6	89.0
Oct	6	2.5	5.0	11.0	87.2	98.2	91.5
Nov	6	2.5	2.5	8.5	94.1	102.6	94.0
Dec	6	2.5	-	6.0	-	-	-

VIII. Joint ICES/ICNAF Working Group on Cod Stocks in the North Atlantic

The Assessments Subcommittee considered the proposal by ICES that a Joint ICES/ICNAF Working Group on Cod Stocks in the North Atlantic be convened to study the effects on fish stocks and fishery management in the North Atlantic of the increase in and massive re-deployments of fishing effort (Res.Doc. 71/17). Noting that NEAFC regards this proposal as a matter of some urgency, the Assessments Subcommittee

recommends (2)

(i) that the Commission accept the invitation of ICES to convene a meeting of a Joint ICES/ICNAF Working Group on Cod Stocks in the North Atlantic.

(ii) that the Executive Secretary and the Chairman of the Assessments Subcommittee consult with the Chairman of ICES Liaison Committee concerning the composition of the Working Group so that appropriate experts are invited to meet at the time of the mid-term meeting of the Assessments Subcommittee.

In doing so, the Subcommittee wishes to stress that regulatory measures deemed to be essential for individual stocks in the ICNAF area should not be postponed or delayed while awaiting the findings of the group.

APPENDIX II - REPORT OF THE WORKING GROUP ON COORDINATED GROUNDFISH SURVEYS

Chairman: M. Grosslein

Rapporteur: R. Halliday

1. Introduction

A second meeting of the Working Group was held in Halifax on 20 May 1971, to review progress since the mid-term meeting, January 1971 (Res.Doc. 71/32) on several aspects of the development of a coordinated groundfish survey program. Current plans for survey activity in 1972 were reviewed including a proposal for a sampling scheme on Grand Bank. In addition some survey abundance indices (and data formats) were evaluated in relation to the development of stock biomass estimates from research vessel surveys. Eight countries were represented as follows:

Canada	- R. Halliday, A. Kohler, A. May, V. Hodder, D. Iles, G. Smith, L. Dickie
USA	- M. Grosslein, R. Hennemuth, B. Brown, B. Griswold, A. Posgay, H. Bruce, G. Ridgway
Denmark	- S. Horsted, E. Smidt
USSR	- A. Bogdanov, V. Yakovlev, A. Nikolaev
UK	- H. Cole, D. Garrod, A. Lee
France	- R. Letaconnoux, J. Morice
Spain	- M. Larrañeta, J. Rucabado
Fed. Rep. Germany	- A. Schumacher

2. Proposed Groundfish Surveys in 1972

At the mid-term meeting in January it was agreed that the Working Group should try to develop a firm proposal for a coordinated ICNAF survey in 1972, with at least some activity in all Subareas. Definite surveys are still planned in Subareas 3 - 5 according to the approximate schedule shown on page 19 of the report of the first meeting (Res.Doc. 71/32). However, no substantial groundfish surveys appear likely in 1972 for Subareas 1 and 2. Mr Horsted (Denmark) noted that Danish vessels will be fully occupied with salmon tagging, and Dr Schumacher (Fed. Rep. Germany) noted that Germany would have only one research vessel and probably could not conduct a groundfish survey. There is a possibility of limited surveys in Subarea 2 by Canada (Nfld) but vessel availability is not certain.

It was again the consensus of the Working Group that establishing groundfish surveys in Subareas 1 - 2 should get high priority, but definite commitments are not possible at this time. The point was made by several members of the Working Group that ships are not likely to be made available without a firm proposal from ICNAF. In order to give substance to any recommendation for action along this line by STACRES, it would seem quite important for the Working Group to continue its activity particularly in the development of specific groundfish survey sampling designs in Subareas 1 and 2.

Toward this end it was suggested that individual scientists communicate their ideas for a significant survey program to the Chairman of the Working Group, so that he may begin formulating a definite sampling plan for Subareas 1 and 2. In addition by informing the Chairman of any future cruises which are not now scheduled, some benefits may be achieved from coordination of what resources are presently available.

3. Stratification Scheme for Grand Bank

Mr Pinhorn (Canada) presented a proposed stratification plan for the Grand Bank (chart in Res.Doc. 71/128) involving five depth zones out to 200 fathoms. This plan will be compared with the plan for USSR (PINRO) surveys in Subarea 3 prepared by Dr Konstantinov (USSR) when he arrives in Halifax, and the possibilities for adopting a standard design will be explored. Mr Pinhorn also called attention to a document showing rough grounds encountered on trawl surveys by the St. John's laboratory in Subareas 2 - 4 (Res.Doc. 71/112).

4. Data Formats

Dr Grosslein and Mr Pinhorn presented survey abundance data on cod and haddock for Subareas 3 - 5, on the data forms developed at the mid-term meeting of the Working Group. A brief evaluation of the potential value of these data for assessing stock abundance is presented in Res.Doc. 71/128. Mr Garrod (UK) noted that, in addition to the abundance indices in terms of numbers-per-ton at each length interval, it would be most useful to the Assessments Subcommittee to receive estimates of total biomass, in terms of pre-recruit and recruited components. The possibility of submitting current survey results in the above form to the 1972 mid-term Assessment meeting was discussed. Messrs Halliday, Pinhorn and Dr Grosslein indicated that such analyses were possible and that attempts would be made to supply these data as indicated, at least in terms of numbers per haul at length.

5. Continuation of Working Group

It was agreed that the work of the Group should continue along the lines indicated in the report of the first meeting. However, it was considered unnecessary to have a mid-term meeting of the Working Group. Instead, the Chairman agreed to assume the duty of contacting individual scientists by correspondence and to report on progress to the Assessments Subcommittee at their mid-term meeting. It is recommended (by the Chairman) that the Working Group meet again at the 1972 Annual Meeting.

APPENDIX III - PROPOSED FORMAT FOR AN INTERNATIONAL LOGBOOK
(1970 ICNAF MEETING PROCEEDINGS NO. 11)

1. Information that should be included in all logbooks is considered below and illustrated on the accompanying draft format.

<u>Vessel identification</u>: including vessel name, registration number, nationality and captain's name.

<u>Trip details</u>: including dates and ports.

<u>Date of daily observations</u>.

<u>Position</u>: latitude and longitude or radionavigation bearings (Decca or Loran) typical of the days position with instructions to complete a new line should the vessel change position significantly.

<u>Type of gear</u>: this should be completed daily as modern vessels may fish two or three types during one trip.

<u>Effort</u>: number of sets (or hooks) x time gear on the bottom (otter trawl) or fishing (midwater trawl, lines, other gear).

<u>Catch</u>: daily totals by species in lbs, kg, baskets, crans or specified units, measured wet on deck. The species column heading to be completed according to catch, from a list supplied.

<u>Discards</u>: as above by major components. Similarly catch reduced.

<u>Remarks</u>: could include weather, damage, etc. but see below.

2. Other information that will be required by national research agencies that might be included in the log but which are not directly required by the aims of a standard system are:

<u>Course</u>: general direction during the day from the position given

<u>Water temperature</u>.

<u>Water depth</u>.

<u>Bottom type</u>.

<u>Weather</u>.

<u>Fate of retained catch</u>: whether iced, frozen, filleted, etc.

<u>Depth of gear</u>.

DRAFT STANDARD LOGBOOK

Vessel Name:________ Registration No:________ Nationality:________ Captain's Name:________

Sailed from:________ On:________ 19__ Landed at:________ On:________ 19__

Date	Position or Bearing	Type of Gear	Sets x Hours	lbs, kg, baskets, crans or (specify) wet wt.								Remarks (or other data columns *e.g.* Temperature, depth, gear depth, weather, damage).
				Catch for human consumption				Reduction		Discards		
				species	names	species	names	species	names	species	names	

APPENDIX IV - REPORT OF THE STATISTICS AND SAMPLING SUBCOMMITTEE

Chairman: A. W. May

Rapporteur: L. P. D. Gertenbach

The Subcommittee met during the morning and afternoon of 22 May. The following documents were reviewed during the meeting: Res.Doc. 71/17, 71/18, 71/19, 71/20, 71/21, 71/23, 71/26, 71/27, 71/28, 71/30, 71/31, 71/34, 71/44, 71/62 and 71/106. The Subcommittee also reviewed Parts I and II of Vol. 13 of the *Sampling Yearbook* and the advance copies of ICNAF *Statistical Bulletin* Vol. 19 (1969).

1. *Sampling Yearbook* Vol. 13 (Part I, Groundfish and Flounders for 1968; Part II, Herring for 1961-68)

   The Subcommittee noted that herring will be included with the groundfish and flounder species in Vol. 14 of the *Sampling Yearbook* which will become available later in 1971. Improvements in the herring tabulations might be suggested by scientists working on this species but action will be postponed until more work has been carried out on the northern stocks. Following these discussions the Subcommittee, however,

   recommends (3)

   that sampling data on herring catches from Subarea 6 also be included in future issues of the Sampling Yearbook.

2. Statistical Reporting

   a) The Subcommittee was informed that preliminary copies of the *Statistical Bulletin* Vol. 19 (with data fro 1969) have been distributed in advance on a limited scale and that this volume would be released in the near future as soon as certain late alterations have been completed.

   b) 1970 nominal catch data by species and countries for the ICNAF divisions and subareas were reviewed (ICNAF Res.Doc. 71/26). These tabulations have been prepared from the STANA 2 submissions and, in two instances, from the national research reports. The Subcommittee noted that the late receipt by the Secretariat of national submissions seriously affects the timely preparation of this very essential document. Revised versions of the tables in this document, incorporating amendments and corrections subsequently submitted by the national reporting offices, will be published in the ICNAF *Statistical Bulletin* Vol. 20 for 1970.

   c) The CWP Secretary pointed out that FAO very often receives additional corrections and amendments to the annual nominal catch series relating to the Northwest and Northeast Atlantic species listed in FAO *Yearbooks* and *Bulletins of Fishery Statistics*. It appears that quite often it is not possible to reconcile these revised totals of particular species to the data published in the ICNAF *Statistical Bulletins* and the ICES *Bulletins Statistique*.

   The Subcommittee expressed concern about this situation and accordingly

recommends (4)

that the question of national revision of long-term statistics be considered by the CWP at its 7th Session (November 1971) and that this body prepare suggestions for ensuring that all revisions affecting North Atlantic species statistics are reported to ICNAF as well as the other intergovernmental bodies concerned.

d) On reviewing the advance copies of the *Statistical Bulletin* (Vol. 19 for 1969) the Subcommittee approved the Secretariat's action in leaving out, for reasons of space limitation, the columns, previously marked "NK" (for "divisions, not known") in Table 1.

e) Following discussions on the contents of this volume the Subcommittee

recommends (5)

that the column "main species sought" be retained in Table 4 of the ICNAF Statistical Bulletin.

f) Noting that for some users of the *Statistical Bulletin* it would be convenient to extract aggregates of "fin fish" separately from "invertebrates" the Subcommittee

recommends (6)

that, at the end of Table 1 of the ICNAF Statistical Bulletin, an entry, broken down by country, be added to cover "Other shellfish, etc." to provide for the catches of all species, other than "sea scallop", appearing in the ICNAF List of Species under the ICNAF group "Shellfish, etc. (SF)".

3. ICNAF *List of Species*

The Subcommittee noted that a new third edition, 1970, of the American Fisheries Society's *List of Common and Scientific Names of Fishes* has been released. It reviewed the results of a comparison of the common and scientific names appearing in this edition and in the ICNAF *List of Species*. The Subcommittee considered the need for a close relationship between these lists and decided that the common names as now used in the ICNAF publications are well known to all users and that changes should be kept to a minimum.

Accordingly, the Subcommittee

recommends (7)

(i) that the common names as now used in the ICNAF List of Species and published in the Statistical Bulletin be left unchanged;

(ii) that the scientific names and authorities in the ICNAF list be amended to conform to those used in the 1970 edition of the American Fisheries Society's "List" for the following species:

(a) 47 - Cusk (Tusk)
(b) 31 - Northern puffer

(c) 38 - Ocean pout
(d) 17(c) - Bigeye tuna
(e) 22 - Butterfish
(f) 25 - Black Sea bass
(g) 5 - Eel
(h) 113 - Frigate mackerel
(i) 91 - Gizzard shad
(j) 81 - Northern harvestfish
(k) 12 - Salmon
(l) 23 - Striped bass
(m) 82 - Thread herring
(n) 24 - White perch
(o) Any other species of which the scientific names and authorities, as given in the ICNAF List, do not conform with those of the AFS publication (third edition, 1970).

The Subcommittee, in making this recommendation with respect to ICNAF's List and the names used in the ICNAF *Statistical Bulletin* and other publications, noted, however, that, in preparing lists of species for statistical reporting, the CWP Secretary might, to avoid ambiguities in his requests to national offices, add "Atlantic" and other terms to ICNAF names.

4. Statistics on "Industrial Fish" and "Discards"

The Subcommittee, in reviewing Res.Doc. 71/27, confirmed that it is both the ICNAF and FAO practice to include "industrial fish" (quantities used for reduction to meal and oil, *etc.*) as part of the "nominal catch" even when "industrial fish" is also obtained separately on special forms. "Discards", however, are excluded from the "nominal catches".

The Subcommittee noted that for several countries, *e.g.*, Germany and the USSR, the quantities reported as "disposed of as industrial fish" exceed the figures shown for the "nominal catch". Accordingly, the Subcommittee

recommends (8)

(i) that the ICNAF/FAO procedures with respect to "nominal catches", "industrial fish" and "discards" should again be explained to the reporting offices, e.g.,

(a) "industrial fish", even when reported separately, is also to be included in the quantities reported as "nominal catches"

(b) "discards" should not be included in the nominal catches.

(ii) that the ICNAF Secretariat enquire from the national offices about their procedures and the data submitted where it appears that the "industrial fish" is greater than the "nominal catches".

5. Selected Types of Effort Data by Subareas (ICNAF Statistics Form 3)

a) On reviewing Res.Doc. 71/28 containing 1969 fishing effort data, it was queried whether these data are really useful. It was felt that the detailed effort reported on the STANA 1W forms becomes available only at a later date and that these effort data summaries do provide an "early" indication of the direction and trends in fishing effort. The Subcommittee noted that the 1970 data were not available in time for the present meeting, and that at the time of the 1972 meeting would be available in more detail in the *Statistical Bulletin*. In the light of its discussions and review of the material, the Subcommittee, therefore,

recommends (9)

that the Assessment Subcommittee be requested

(i) to review in 1972 the documents containing the 1969 and 1970 fishing effort summaries (ICNAF Statistics Form 3 - number of vessels, number of trips, days absent by ICNAF Subareas), and

(ii) to decide whether the Secretariat should continue to request similar data for 1971 on ICNAF Statistics Form 3.

b) In reviewing the 1969 fishing effort data presented in Res.Doc. 71/28, the Subcommittee noted that not all countries provided a breakdown by the six subareas of the number of vessels and accordingly, the Subcommittee

recommends (10)

that, should it be decided to continue with requests for fishing effort data on ICNAF Statistics Form 3, that countries should provide breakdowns of the different effort data required, by subareas, and not only give aggregate data for the ICNAF Statistical Area as a whole.

6. Estimates of Fishing Effort Data

The Subcommittee noted that Res.Doc. 71/31 was prepared in response to the 1970 Recommendation "that the Secretariat prepare a tabulation from the 1969 submissions of the proportion of effort data derived by means of estimates by species, division, country, gear and tonnage category". Only a limited number of countries reported information of their estimation procedures and the tables in the document before the Subcommittee were limited to the Canadian submissions.

Following a lengthy discussion on the usefulness of data inserted under the two columns "days estimated" and "% estimated", the Subcommittee felt that it would be better to obtain periodically brief descriptions from national offices on their recording and estimating procedures. Accordingly, the Subcommittee

recommends (11)

that no provision be made for inserting the amounts of fishing effort estimated in Table 4 of the Statistical Bulletin in future.

7. ICES Special Meeting on Fishing Effort, Copenhagen, September 1970

The Subcommittee reviewed the advance report released as Res.Doc. 71/34, on the ICES Special Meeting on Measurement of Fishing Effort, Copenhagen, September 1970. It decided to postpone further consideration of this until the final report is available but noted that some of the conclusions and recommendations of this meeting are covered by other agenda items assigned to the Subcommittee. In the meantime, the Subcommittee stressed the need for close collaboration of biologists, economists, technologists, *etc.* in the field of effort statistics, concepts, analyses, *etc.*

8. The Effort Concept "Days on Ground"

The Subcommittee noted that the Special Meeting suggested that "days on ground" be deleted from the effort concepts appearing on both forms STANA 1W and 1E. However, it appeared that ICES, subsequent to the Special Meeting, decided not to delete "days on ground" from 1E but instead to transfer it from the first priority to the second priority level of effort data to be reported.

The Subcommittee took into account that in 1970 it studied a paper presenting comments from countries on the concept "days on ground" and noted that the CWP has already pointed out that, with the exception of the Faroes, all countries reporting "days on ground" also report either "days fished" or "hours fished". The Faroes apparently are not yet in a position to give anything in this field but "days absent".

In view of these aspects, the Subcommittee

recommends (12)

(i) that, in requesting effort data on STANA 1W (STATLANT 21B) forms, the "days on ground" be deleted from such requests when these are made early in 1972 for 1971 data,

(ii) that the column "days on ground" be deleted from Tables 4 and 5 in Vol. 20 of the ICNAF Statistical Bulletin.

9. The Concept "Days Fished"

The Subcommittee reviewed the notes on the USA method of recording, estimating and reporting "days fished". It took note of these matters and suggested that as part of the periodic review of national procedures of recording, estimating and reporting, countries should, *inter alia*, comment on these effort questions.

10. FAO Statistical Tabulations

The Subcommittee obtained from the FAO Observer an explanation of the new design and layout of tables in future "Catch and Landings" volumes of the *FAO Yearbook of Fishery Statistics*. It was concluded that these new tabulations (in which the species entries are arranged, within the standard groups, in taxonomic order and followed by a breakdown in terms of the major fishing areas) represented a significant step forward, enhancing greatly the value of the FAO *Yearbooks* for fishery workers.

11. Conversion Factors

FAO *Bulletin of Fishery Statistics* No. 25 ("Conversion factors: North Atlantic Species, 1970"), distributed as Res.Doc. 71/21 was welcomed by the Subcommittee. It noted that it is the intention of FAO, with cooperation of ICNAF and ICES Secretariats, to keep this Bulletin under constant review. FAO hopes to issue from time to time *Fisheries Circulars* presenting revisions and additions, and to incorporate these in revised issues of the FAO *Bulletin* every few years.

The Subcommittee, on reviewing the contents of the FAO *Bulletin*

recommends (13)

(i) that the ICNAF list of conversion factors be dropped from the ICNAF Statistical Bulletin and that in a suitable place in this publication reference be made to FAO Bulletin of Fishery Statistics No. 25 (Conversion factors: North Atlantic Species, 1970).

(ii) that the Secretary of the CWP distribute this FAO Bulletin (No. 25) to all countries fishing in the Northwest and Northeast Atlantic, requesting, at the same time, that all national offices scrutinize and compare their conversion factors with those shown for other countries; wherever there appear significant discrepancies, national offices should have these examined and if verified establish explanations for incorporation by the CWP Secretary in supplementary Circulars and eventually, in revised issues of the Bulletin of Fishery Statistics on Conversion Factors to be released by FAO.

12. Fishing Gear Statistics

The Subcommittee was informed that an *ad hoc* CWP Working Group on the International Standard Statistical Classification of Fishing Gear met in Rome, 21 - 23 April 1971. It welcomed the statistical list of gear presented in Res.Doc. 71/20, and noted that a more detailed provisional report will be released and followed by a final report containing illustrations. It noted that such a gear classification provides the basis for standardization of fishing unit concepts (used in reporting catch/effort data) and accordingly, the Subcommittee

recommends (14)

that the CWP at its 7th Session (November 1971) examine the new CWP Working Group's statistical classification of fishing gear and report on its implications and use in preparing requests to national offices for effort and catch data.

13. Joint ICNAF/ICES List of North Atlantic Fishing Vessels

The CWP Secretary reported on the difficulties encountered in obtaining and preparing the manuscript of the proposed experimental "Joint ICNAF/ICES List of North Atlantic Fishing Vessels" and alternative proposals for developing a possible World Register of Fishing Craft (a) in operation, (b) laid-up and (c) under construction.

The Subcommittee noted the possible need for fleet information on a North Atlantic basis, and the time factor for preparing and establishing a world-wide register of craft of 100 GRT and over, and

recommends (15)

that the Secretary of the CWP

(a) continue working on the material on North Atlantic fishing craft now available to him,

(b) continue his efforts to obtain missing data, and

(c) try to complete the experimental compilation in time for the 7th Session of the CWP (November 1971).

14. The ICNAF *List of Vessels 1971*

The Subcommittee noted its previous decision in this respect that the 1971 list would be prepared as in the past.

15. Notes for the Completion of STANA (Now called "STATLANT" Forms)

The CWP Secretary presented Res.Doc. 71/23 (FAO *Fisheries Circulars* 273, 274, 235 (Rev. 1), 248 (Rev. 1), 260 and 277), as the material providing information for the completion of

(i) STATLANT Form 21A (STANA 2 - ICNAF Summary) and

(ii) STATLANT Form 21B (STANA 1W).

He explained that these have been modified as part of the overall attempt to standardize the notes used in various regions throughout the Atlantic. Close consultation was maintained with ICNAF's Executive Secretary and no material changes have been caused by these rearrangements and rephrasings. FAO also hopes to arrange the production of improved maps and an equal area map for the North Atlantic will be prepared in close collaboration with the Executive Secretary of ICNAF and the General Secretary of ICES. The CWP Secretary also pointed out that *Fishery Circular* No. 277 follows the new standard pattern in listing of fish names (common and scientific) adopted by FAO and that the order of the species items, within the standard group, follow the taxonomic order (followed also in the FAO *Bulletin* on Conversion Factors and to be used also in the FAO *Yearbook of Fishery Statistics* No. 30 and future issues). The CWP Secretary also pointed out that all these documents would receive a final scrutiny during the 7th Session of the CWP (November 1971).

The Subcommittee welcomed these attempts at further clarification and standardization in reporting procedures and accordingly,

recommends (16)

that the new statistical reporting procedures proposed by the Secretary of CWP and detailed in Res.Doc. 71/23, after review by the CWP, be introduced in the Notes for the Completion of STATLANT Forms when requests *for 1971 catch and effort data are made by the CWP Secretary early in 1972.*

16. <u>The 7th Session of the CWP (Coordinating Working Party on Atlantic Statistics)</u>

The Secretary of the CWP presented as Res.Doc. 71/19 a draft Prospectus, including draft agenda, for

(a) the *ad hoc* CWP Working Group on Automatic Data Processing (Rome, 8 and 9 November 1971);

(b) The 7th Session of the CWP (Rome, 10 - 16 November 1971).

He also reported that ICCAT has asked to participate in the activities of the CWP and that FAO's Committee on Fisheries (COFI) has recommended to FAO's Council to approve the ICCAT application. The Subcommittee welcomes ICCAT application. The Subcommittee welcomes ICCAT's interest in the CWP and its desire to cooperate in the joint interagency ICNAF/ICES/FAO statistical program (STATLANT), and accordingly

<u>recommends</u> (17)

that ICCAT's application to participate in the CWP activities be accepted by ICNAF and that ICCAT be welcomed as one of the participating agencies.

The Subcommittee on reveiwing the draft prospectus also

<u>recommends</u> (18)

(i) that the Executive Secretary, the Assistant Executive Secretary and the Chairman of the Statistics and Sampling Committee attend the 7th Session of the CWP, Rome, November 1971.

(ii) that the Governments of the United States and Denmark be invited to provide one expert from each of these two countries to attend and participate in the 7th Session of the CWP,

(iii) that the Secretary of the CWP, the Executive Secretary of ICNAF, the General Secretary of ICES and the Executive Secretary of ICCAT establish the list of CWP participants (attending the 7th Session CWP) who would constitute the ad hoc Working Group on Automatic Data Processing.

The Subcommittee in reviewing the agendas for both the *ad hoc* Working Group and the 7th Session of the CWP, expressed its satisfaction with the items covered. It pointed out that the CWP Secretary should arrange for the inclusion under the appropriate agenda items of the following:

(a) the development of STATLANT forms in a format suitable for ADP print-out;

(b) after inquiring from national offices, the feasibility of reporting "searching time" separately from "number of days fished" even though "searching time" is considered as part of "fishing time";

(c) the development of more standardized concepts and classifications of "fishing units" to be used when reporting catch and effort data by fishing areas and species.

17. More Detailed Catch/Effort Reporting

It was brought to the attention of the Subcommittee that for both assessment and regulatory purposes, it may be necessary that catch and effort data for some species be reported by smaller statistical areas than those used at present. After some discussion the Subcommittee

recommends (19)

(i) that the ICNAF Secretariat solicit from the national offices information on the feasibility of their reporting of catches (and effort) of major groundfish species and herring by smaller statistical areas than those now in use;

(ii) that scientists from countries fishing in the ICNAF area, and now using smaller statistical areas, provide maps of such area breakdowns in time for consideration by the 1972 ICNAF meeting.

APPENDIX V - REPORT OF ENVIRONMENTAL SUBCOMMITTEE

Chairman: Dr N. J. Campbell   Rapporteur: Dr W. Templeman

The Subcommittee met at 1045 hrs, 20 May 1971 under the Chairman, Dr N. J. Campbell (Canada). Dr W. Templeman was appointed Rapporteur.

1. Environmental Conditions in the ICNAF Area

National Research Reports and some of the other pertinent documents were reviewed.

In West Greenland waters (Subarea 1), there was a strong influx of polar water from the East Greenland Current, causing decreases in temperature and salinity in the upper layers. On the western slope of Fylla Bank, in the upper 400 m, the mean temperatures were between 1° and 2°C lower, and the mean salinities between 0.30°/oo and 0.60°/oo lower than the mean values for the period 1950-66. A striking change in 1970 was the occurence of negative temperature anomalies in the deep water, whereas, in previous years there had been a warming of the deep water.

Off Labrador and eastern Newfoundland (Subareas 2 and 3), in July and August core temperatures in the colder shoreward part of the Labrador Current were generally below average, but in the deep water of the continental slope in the outer West Greenland Current contribution to the Labrador Current, both temperatures and salinities were often similar to or higher than the highest previously recorded.

In Subarea 4, water temperatures in Cabot Strait were higher than in 1969 and those in the Sambro Deep and Emerald Bank areas of the Scotian Shelf were close to or lower than the 1969 values.

In Subarea 5, in the Gulf of Maine, the Eastern Passage and in the northern Georges Bank area, subsurface temperatures at all seasons were lower than in 1969, whereas on the southern slopes of Georges Bank the summer and autumn temperatures were higher than in 1969. The mean sea surface temperature in 1970 at Boothbay Harbour was the same as that of 1969, breaking the upward trend that began in 1967.

2. Environmental Changes in Relation to Fisheries

A positive relationship was found by Soviet workers between the landings in Div. 1B in November and December relative to the landings in all divisions of Subarea 1 in the same month, and the temperature of the upper water layers in the previous July, and similarly between relative landings in October and temperature in June.

The fishery at West Greenland was for the third year in succession adversely affected by ice but the ice situation in 1970 had improved somewhat over that of 1969.

3. ICNAF Georges Bank-Gulf of Maine Environmental Survey

Mr Posgay (USA) reported that all plankton collections and data from the cooperative cruises of the USSR, Canada and the USA have not yet been analyzed. The icthyoplankton phase of the new United States Marine and Aquatic Resources Monitoring, Assessment and Prediction (MARMAP) program would very likely begin in the autumn of 1971. This includes a program of greatly increased efforts to study and monitor environmental factors in relation to fisheries.

4. Cooperative Systematic Studies - North Atlantic Oceanography, ICES/ICNAF/IOC (Comm.Doc. 71/2)

Mr Lee (UK) reviewed the main items of the document and drew attention to:

(a) the effort being made by ICES to publish oceanographic data collected at Ocean Weather Stations I, J, K, M in the eastern Atlantic in the same way as the US Coastguard now publishes the data for the weather stations of the western Atlantic;

(b) a newly proposed ICES study of the overflows across the Greenland-Iceland-Faroes-Scotland ridge areas;

(c) the fact that IOC is looking for some fisheries input to IGOSS and that ICES and, to some extent ICNAF, have this in hand.

The Chairman noted that under Recommendation 16 of *Redbook* 1969, Part I the Chairman of the Environmental Subcommittee was appointed in a liaison capacity to IGOSS to bring to the attention of IGOSS those properties and conditions which might be most useful to fisheries and fishery research in the ICNAF area.

As he (Dr Campbell) was now also Chairman of the Working Committee for IGOSS, it is desirable that there be another liaison scientist to IGOSS for the above purpose.

The Environmental Subcommittee therefore

recommends (20)

that STACRES appoint a replacement for Dr Campbell in a liaison capacity to IGOSS to bring to the attention of IGOSS those properties and conditions, information concerning which might be useful to fisheries and fishery research in the ICNAF area.

5. ICES Hydrographic Committee Report, October 1970

Mr Lee mentioned the main recommendations and discussions of the Committee:

(a) the above-mentioned overflow expedition;

(b) because in the hydrographic section of the *Annales Biologiques*, temperature and salinity anomalies are given by different authors from averages for different base periods, a small group has been set up to try to obtain a standard system for the reporting of anomalies;

(c) ICES is to sponsor a symposium on "Physical Processes Responsible for the Dispersal of Pollutants in the Sea with Particular Reference to the Near-shore Zone". This 4-day symposium will be held at Aarhus, Denmark in the first week of July 1972;

(d) ICES has carried out with SCOR as intercalibration exercise of methods of analysis for mineral salts;

(e) ICES will be holding, during its 1971 meeting at Helsinki, a half-day meeting on the subject of analysis of metals in the marine environment.

6. Report on Symposium on Environmental Conditions in the Northwest Atlantic 1960-69, Dartmouth, 18 - 19 May 1971

The Chairman noted the success of the symposium and said that a tentative target has been set by the Executive Secretary to publish the Symposium papers in a Special Publication before the end of 1971.

The Subcommittee

recommends (21)

that the papers and discussions presented to the ICNAF Symposium on Environmental Conditions in the Northwest Atlantic, 1960-69, Dartmouth, 18 - 19 May 1971, be published by ICNAF in the Special Publication Series and with a target date of December 1971.

7. Other Matters

(a) Mr Lee called attention to a new temperature profiling device developed in the Fisheries Institute in Hamburg and Dr Meyer (Fed. Rep. Germany) was asked by the Chairman to try to have a description of the instrument and of its operation provided in an ICNAF document in 1972.

(b) Mr Lee noted the very different numbering of apparently the same standard sections along the west coast of Greenland. Mr Horsted (Denmark) said that Dr Hermann (Denmark) informed him that there was an earlier agreement for a standard numbering system. The Chairman (Dr Campbell) for the ICNAF side, and Mr Lee for the ICES side, will try to trace whether and what agreements were made for standard sections and for a uniform numbering method and will report the results to the Committee at the 1972 ICNAF meeting. Dr Dickie (Canada) was asked to provide a summary of the "Halifax Section" data for the 1972 meeting.

(c) The Chairman said that ICNAF has not hitherto addressed itself to the study of man-made changes in the environment. Dr Dickie (Canada) and Mr Posgay (USA) reported the beginning of systematic investigations by Canada and the United States on the distribution of heavy metals, pesticides, oil and other pollutants in marine organisms and materials over much of the southern half of the ICNAF area. The Subcommittee calls the attention of STACRES and the ICNAF Commissioners to the importance of these studies of the quality of sea products and to the possible effects of marine pollution on larval survival and year-class abundance.

(d) The Subcommittee was interested in Mr Lee's report on present planning to carry out under ICES an international investigation of marine pollution in the North Sea and its effect on the fisheries resources of the area and their exploitation. This has been approved by the Bureau of ICES. Some planning for action has already been done. The program will probably begin at the end of 1971.

(e) The Chairman mentioned the IOC attempts at developing and promoting the ROSCOP (Report of Observations Collected by Oceanographic Programs) oceanographic inventory forms, now adopted by ICES but still open for improvements. This form provides a useful summary of what was done on a cruise (hydrography, plankton, *etc.*). There was general agreement that ICNAF should encourage the use of the ROSCOP form for reporting northwestern Atlantic hydrographic and related biological data to some center such as ICES. The USA has a somewhat similar but less detailed form which is not, however, sent to ICES but is available at the World Data Centres.

(f) The Subcommittee considered the proposal at present before IOC concerning a Polar Ice Research Project (Comm.Doc. 71/19, para. 34).

The Subcommittee believes that ICNAF should support the proposal in principle and agree to participate in a group to study it and

recommends (22)

that the Executive Secretary of ICNAF join the secretaries of ICES and IOC at the time of the ICES meeting at Helsinki 1971, to give further study to the IOC proposal concerning a Polar Ice Research Project and follow it up at the IOC meetings.

(g) The Chairman requested that the members of the Subcommittee should consider what important environmental matters should be on the agenda for 1972 and pass the subjects to him or to Mr Day.

The meeting adjourned at 1240 hrs.

INDEX OF RECOMMENDATIONS