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Report of the ICNAF Working Group on Coordinated Groundfish Surveys January 1971

Chairman: M. Grosslein

Rapporteur: R. Halliday

I. Introduction

A mid-term meeting of the Working Group took place in Copenhagen through the courtesy of ICES, on 21-23 and 25 January 1971. The Working Group was set up in response to R&S Recommendation (21) at the 1970 Annual Meeting "to investigate problems related to the organization and conduct of coordinated groundfish surveys..."which stipulated that the main items for consideration be:-

"(1) Determination of accuracy of abundance indices derived from research vessels;

(2) Study of survey techniques with special emphasis on standardization of gear."

A total of 18 participants (Appendix I) representing 9 countries attended the Working Group meeting. Twelve papers and graphic contributions were presented, and these are listed by number in order of their presentation in Appendix II. The papers are referenced by number in the text.

II. Objectives and Methods of Current Groundfish Surveys

A principal objective common to most of the surveys discussed is to provide reliable measures of relative abundance and structure of major groundfish stocks on an annual (and seasonal) basis including pre-commercial sizes, and to obtain similar data on species not represented in commercial statistics. Such data are essential to help in assessing the effects of fishing on the major stocks as well as the groundfish community as a whole, and

to provide accurate recruitment predictions as a basis for efficient management. Perhaps equally important, by virtue of their comprehensive picture of groundfish communities, surveys are uniquely suited for monitoring long term changes which may be related to environmental factors. Surveys are also designed to provide a wide variety of other biological data, which are required for progress in understanding the critical population processes of growth, mortality and recruitment. Hydrographic data are routinely collected on the fishery surveys to help determine interrelationships between fish distribution and environmental factors.

A. Surveys in ICNAF Subareas 4, 5 and Statistical Area 6

The most extensive surveys developed so far are being carried out by Canada, US and USSR in Subareas 4, 5 and 6. Documents on these surveys were presented by Halliday (1) and Grosslein (2-4), describing the sampling design, gear used, and methods of collection and processing the catch data, and logistic requirements in terms of manpower and ship time.

Basically the same survey methods are being used by all three countries. Essentially two trawl types (Yankee No. 36 and Soviet 27.1 metre) have been used, all with 30 minute hauls at approximately 3.5 knots, and roughly the same sampling intensity of about 1 station per 300 square miles. The same stratified random sampling design is used by all 3 countries for selecting trawl stations, and operations are conducted on a 24-hour basis.

Minimum data recorded on each catch by all vessels are the weight and length frequency of each species. Scales or otoliths are collected routinely on 6-8 principal species on US and Canadian vessels, and other biological material (such as maturity observations, gonad samples, stomach contents, etc.) are collected on a more or less regular basis on all vessels.

Exchange of survey catch data among the three countries has facilitated the interpretation of their respective survey results.

Bathythermograph casts are made at each station by all countries, and in addition salinity observations are made in the Canadian surveys, and oblique plankton hauls from 50 metres (for fish eggs and larvae) are made at each station in US surveys.

With the above level of sampling, minimum scientific parties of 8-9 men are required for efficient 24-hour operations at sea. Sampling rates varied from 5-8 stations per day at sea, including time lost due to bad weather etc., depending upon vessel type and gear, season, and amount of data collected. In the summer 1970 survey of the Nova Scotian Shelf, the Canadian vessel "A. T. Cameron", a side trawler, completed an average of 6.5 stations per day, or 21 days at sea to cover 43,000 sq. nautical miles. Average sampling rate for the US stern trawler "Albatross IV", was 7.8 stations per day in autumn surveys of the area from Cape Hatteras to western Nova Scotia, or 34 days at sea to cover about 75,000 sq. nautical miles. The average sampling rate for summer and autumn surveys in Subareas 4-6 by USSR vessels (side trawlers) has been about 5.5 hauls per day. The lower sampling rates by the Canadian and USSR vessels probably reflect, in part, differences between side and stern trawlers as well as time required for salinity samples in the Canadian operation, and much larger trawl catches with the USSR gear.

Pre-cruise preparations and preliminary processing of data ashore in the US and Canadian surveys requires on the order of 3½-5 man-months respectively in terms of biologists and technicians' time. By preliminary processing is meant the necessary checking and coding of original field logs, plus punching the data onto cards, and performing the necessary computer audits; the results of this preliminary processing is thus a set of essentially

error-free cards containing the basic catch records and station data for each haul. This processing does not include any analysis time nor time for processing special samples such as age samples, stomach collections, etc. Note also this assumes that a data processing system (formats, computer programs, etc.) is already established.

B. Surveys in Subareas 1-3

Groundfish surveys conducted by Canada (St. John's Laboratory) in Subareas 2 and 3 were described by Pinhorn (5). Stations are located along line transects about 30-60 miles apart, generally lying perpendicualr to slopes of major fishing banks. Selection of station locations along these transects is according to depth, but it varies among areas depending upon specific objectives of individual cruises. The vessel currently used for these surveys is the "A. T. Cameron" and operations are conducted only during daylight hours. Hauls are 30 minutes long at 3.5 knots with a Yankee No. 41-5 trawl. Type of data collected is similar to that described for the Canadian survey in Subarea 4, except that length frequency is recorded only for the more abundant species which includes all major commercial species. During winter-spring months when daylight is minimum, up to 5-6 hauls per day are made in good weather. A scientific party of 4 technicians and 1 biologist is currently employed.

Mr. Letaconnoux gave a brief description of the trawl survey by the French research vessel "Thalassa" in 1969 in Subareas 4 and 5. He noted that on the average about 5½ sets per day were made, and he gave a brief indication of methods used in sampling catches. The St. Pierre Laboratory has plans for seasonal coverage (4 surveys a year) of the Laurentian Channel using their new research stern trawler "Cryos". The surveys are designed to provide a description of hydrographic conditions in relation to distribution of fishes and invertebrates, but schedules of

the cruises are not yet final.

Dr. Noskov noted that PINRO vessels have been conducting surveys in Subarea 3 for several years to obtain pre-recruit indices for cod. In May-July 1971 PINRO will conduct a general groundfish survey in Subarea 3 using a stratified random design similar to that used in Subareas 3-5, and collecting quantitative data on all species as in the Joint US-USSR survey program in Subareas 5-6. The vessel employed will be the R/V "Persey III", a 2000 ton stern trawler (BMRT) and a commercial trawl will be used at 3.5 knots.

Dr. Messtorff briefly described survey activities of the Federal Republic of Germany in Subareas 1-2, using the 2000 ton research stern trawler "Walther Herwig". A commercial trawl 43m groundrope) fitted with steel rollers is used in these surveys, and sampling is directed at assessing the abundance and distribution of cod in the entire region (whole of Subareas 1 and 2) as well as in areas where the commercial fleets are concentrated. Estimated composition of the commercial catches is based partly on samples by "Walther Herwig", chiefly in Subarea 2. Selection of stations is based partly on results of echo-sounder traces and hydrographic conditions. Trawling is conducted during daylight hours and hydrographic observations are made at night. The same areas cannot always be fished each year; an important variable is ice distribution.

Dr. Smidt (6) reported on the sampling of three standard trawl stations near Godthåb for abundance of prawn stocks and pre-recruit cod. A fine-meshed (36 mm) trawl was used and 1-hour hauls were made. Although catches of cod were not consistent, the standard stations will be continued, and attempts made to locate other suitable stations. Here also weather and ice conditions preclude a standard survey pattern in each year.

Professor Chrzan noted that the research vessel of the Polish Sea Fisheries Institute (1000 ton side trawler) makes occasional short surveys in ICNAF waters, and that it could be utilized in co-operative survey efforts within limitations of the schedule. The most suitable time and area for such a venture would be in autumn in Divisions 3K and 3L.

Mr. Garrod noted the possibility of UK taking part in future co-ordinated groundfish surveys. The new Lowestoft research vessel "Cirolana" will conduct a wide-scale survey in ICNAF waters in February 1971 to study blood groups in fishes. Later in the year the vessel will carry out an intensive trawl survey on the Faroese Banks, using a stratified random sample design to test the degree of accuracy obtainable with such a plan.

Finally, Mr. Mimura of Japan noted that as yet there were no Japanese research vessels in ICNAF waters. However, he noted their interest in possible co-operative efforts in the future.

III. Accuracy of Survey Abundance Indices

Grosslein (7) reviewed the statistical characteristics of trawl catch data and how these characteristics affect the choice of sample design and methods of analysis. He noted the principal advantages of the stratified random sampling design in groundfish surveys in terms of 1) flexibility and control in distribution of stations, 2) unbiasedness in the sense that all trawlable habitats have equal probability of being sampled, 3) valid estimates of statistical presision (variance) required for an objective measure of the significance of differences between abundance indices. Note that item 2) is important if an accurate picture of relative biomass is desired for an entire survey region, or any specific part of the region (a single sampling stratum, say). For example

if the same standard stations were occupied on each survey, then we would have a picture of abundance and species composition representative of only those particular locations. While this might reduce variation somewhat among successive estimates of abundance for a given species in a given area, it would be at the risk of getting a biased picture of abundance, distribution, and composition of the groundfish community as a whole.

Examples of precision for cod, haddock and yellowtail abundance indices were presented for US surveys on Georges Bank. Approximate 95 percent confidence limits about a mean catch per haul for a single cruise (approximately 65 hauls over the Georges' Bank area) suggest that with present sampling methods and intensity we cannot detect with high probability proportional differences in abundance which are less than about one-half or double. Increasing the number of hauls would increase precision but not proportionally.

It was noted that possible improvements in accuracy might be gained by further stratification according to time of day for those species exhibiting strong diurnal changes in variability. Also it was noted that the precision of an estimated change based on a time series of points tends to increase with the number of data points in the series; therefore, even the present sampling intensity could be expected to provide more sensitive measures of trends in fisheries than indicated by the confidence limits about a single mean.

Another indication of the relative accuracy of research vessel abundance indices was provided by comparisons between US survey and commercial data. Research and commercial indices for cod, haddock and yellowtail on Georges Bank were fairly well correlated from 1963-69, although in the case of cod and haddock, probable bias in the commercial indices in some years confounded

the comparisons somewhat (Doc. 7). Abundance trends for haddock off western Nova Scotia were likewise similar for both US research and commercial indices.

Comparisons of research and commercial abundance indices for cod and haddock in Subarea 4 were presented by Halliday (8). In Division 4X, overall trends in abundance from 1965-69 were similar for the two sets of indices, with the best correspondence appearing in the cod data which showed a high correlation among survey and corresponding quarterly commercial indices. In Division 4T an extremely high correlation was observed for comparisons of research and commercial indices for cod from 1957-65. Finally, a significant correlation was observed between summer research vessel indices of 1-3 year old haddock in Division 4W and commercial abundance at age 4 for the 1954-59 year-classes.

Pinhorn (9) compared research (standard line transects) and commercial abundance data for cod on St. Pierre Bank and found generally consistent agreement among estimates of relative year-class strength between the two sets of data.

Comparisons of US research indices and USSR commercial abundance data for red and silver hake in Subarea 5 were presented by Noskov (10). Good correspondence was observed between the two series for red hake in the southern New England area with both indices showing a steady prominent decline from 1965-68, followed by an increase in 1969. The correspondence was not good, however, for the two sets of silver hake indices in either southern New England or on Georges Bank. It was suggested that the US survey trawl may have underestimated silver hake abundance when the fish were densely aggregated on Georges Bank. On the other hand part of the discrepancy may be due to bias in the commercial indices

within each area; the main Soviet fishery shifted from Georges Bank to Southern New England when silver hake abundance declined on Georges Bank. Further study will be required to clarify these possibilities.

The Working Group was in general agreement that there was rather convincing evidence of the ability of research vessel surveys to measure groundfish abundance with sufficient accuracy to indicate major trends in abundance. Thus it is now clear that surveys can provide a valuable supplement to commercial statistics, and in particular they can fill critical gaps in those cases where commercial statistics are poor or lacking altogether.

With respect to short term assessment needs, an important advantage of surveys is that they represent the only means of determining the current status of stocks. Also they can provide longer lead time for recruitment predictions. Both of these kinds of data are necessary if proper management actions are to be accomplished in time to accomodate changes in stock levels.

On the other hand it was noted that for assessment purposes the reliability of the abundance index for a single survey appeared to just about at the level of acceptability. Even here however it was suggested by Mr. Garrod that even though a single point estimate of abundance may not be a sufficiently accurate index of stock size for precise assessment purposes, the relative abundances of various year-classes might prove to be more reliably indicated; and in this case a reliable recruitment prediction would be possible by appropriate ranking of pre-recruit year-classes through comparisons between research and commercial year-class structure.

In summary, although the data on accuracy of survey abundance indices is basically encouraging, greater accuracy is desirable and ways and means of achieving it were considered next.

IV. Trawl Performance Studies

One source of error in trawl catch data is variability in performance of trawls. Data were presented by Canada (St. Andrews) (11) on the towing performance in terms of headrope height, wingspread, total drag, and average warp tension, of a variety of otter trawls commonly used by the Canadian commercial fleet. Measurements on headrope height and wingspread of a variety of USA and USSR trawls were also presented (12). The data described variations in these parameters in relation to vessel speed and scope ratio (USA and USSR nets) and speed of gear through the water (Canada), and to variations in gear rigging. The trawls tested were: Yankee No. 35, No. 36, No. 41, No. 41-45; Skagen; Granton; Atlantic Westerns IIA, III, IV; US "Base"; US Universal; USSR 23.5 m, 24.6 m, 27.1 m.

Two general points became apparent from these data which are of particular significance. First, the performance of any given trawl proved to be rather variable even for fixed operational parameters (rigging, scope, speed through the water), and thus it appears that there are other factors which significantly affect trawl performance but which are not well understood. Second, small differences in gear rigging can have major effects on performance and yet go undetected. These results indicate that variation in gear performance probably is an important contributing factor to variation in survey catches. The experiments also give some indication of the difficulties to be faced in maintaining a standardized gear for use by all countries in co-ordinated surveys. It was suggested (USA - Grosslein) that ideally trawl performance should be monitored on each haul during a survey. At the very least, a newly rigged trawl should be tested before use in a survey.

It is quite clear that the resolution of these problems will require closely coordinated efforts of both biologists and trawl experts.

V. Standardization of Survey Methods

Major potential benefits which can be achieved by pooling resources in a properly coordinated survey, lie in the greater accuracy and completeness of information on fish stocks which would be available to all countries. However in order to obtain these benefits it will be necessary to standardize certain key elements of the sampling methods, so that the survey data from various countries may be pooled efficiently.

One of the most important aspects of survey sample design is the manner in which trawl stations are selected. Equally important are the methods used in sampling individual trawl catches and the types of data recorded for each catch. Standardization of these basic features of sample design obviously would simplify the pooling of data, and also enhance their utilization and significance. The Working Group considered that prospects were good for achieving necessary standardization of these factors.

Potential gains from the use of standard survey gear also appear to be considerable. In particular, significant gains in the statistical precision of abundance indices could be achieved by pooling results of different vessels using the same gear on a given survey. However, choosing a standard trawl is a more difficult problem than standardizing aspects of sampling design noted above. While there was general agreement within the Working Group as to the nature of potential benefits from standardizing gear, there were also unresolved questions about theoretical and practical difficulties associated with a single standard trawl. These problems are explored in more detail in the following sections.

Selecting Trawl Stations

Several different sampling designs (grid pattern, line transects, stratified random) have provided meaningful series of abundance indices from survey operations. However the theoretical advantages of a stratified random design are high in providing valid estimates of the variances associated with abundance indices, while at the same time providing an unbiased estimate of the relative biomass of groundfish over the whole of the trawlable area. These are important features whether we are interested only in a few priority species or in the entire groundfish community.

A further important advantage of the stratified random design is that it provides (by virtue of random sampling within strata) a statistically valid and intuitively straight-forward method for combining data over sets of strata (i.e. stratified means weighted according to areas of sampling strata). Given a standard set of sampling strata this will greatly facilitate the interpretation and pooling of results from different surveys. Still another advantage of the stratified random design is its flexibility, which permits efficient use of information on fish distribution without sacrificing control of sampling. For example there can be major changes in emphasis of a survey program resulting in different stratification and allocation of trawling effort depending on priority species, but without disruption of a long-term data series.

Thus the stratified-random design appears to be the most efficient general method for obtaining groundfish abundance indices of known reliability, and hence there are strong arguments for adopting it as a standard. However it must be emphasized that the details of sampling need not - and indeed cannot - be the same in all areas even though the general principles are the same. For

example, in Subareas 1 and 2 fixed stratum boundaries are not possible because of variable ice conditions, and they are not desirable because fish distribution is closely controlled by hydrographic conditions which can vary significantly from year to year. In such cases the optimum strategy probably will involve a rapid hydrographic pre-survey the results of which may then be used to establish stratum boundaries for the following trawl survey. The problem would be more difficult for species whose aggregations were not closely correlated with easily measured hydrographic factors. In that case a reconnaissance trawl survey might be required to locate major aggregations and to establish stratum boundaries, after which a more intensive trawl survey would be conducted. In any case, once the stratum boundaries are set, the basic advantages of stratified random selection of trawl stations will still be applicable.

While it may be necessary and desirable to move stratum boundaries at times (particularly in the northern Subareas where interest lies principally in one or two species), it must be remembered that a reconnaissance survey costs money too, and depending upon conditions it may or may not improve the cost-benefit ratio of the survey program. Another important factor is the choice of priorities relative to species. If we want information on more than one or two species then we must be prepared to make compromises on the degree to which sampling is concentrated in any one time and place; and in fact if our aim is to study the whole groundfish community, then stable stratum boundaries and rather uniform coverage such as now employed in Subareas 4-6, probably will be the optimum sampling strategy.

Regardless of the basic sample design there are some important practical problems which must be considered in the choice of stratum boundaries and selection of trawl stations, particularly

in areas with rough bottom. Some areas cannot be fished at all, and other areas have varying (and usually unknown) amounts of trawlable and non-trawlable ground depending upon the type of trawl used and the experience and judgement of the ships' officers. By pooling available information on trawling experience in rough areas it should be possible to agree on boundaries of trawlable grounds. For example, the US, USSR and Canada already have reached tentative agreement on survey boundaries in Subareas 4 -6, although Dr. Noshov presented further information to the Working Group on USSR trawling experiences in SA 4. The problems may be more severe in Subareas 1 and 2. In any case the feasibility of standard survey boundaries would depend to a considerable extent on the type of trawl used, and herein lies one advantage of a standard trawl.

Even more important than standard boundaries however is the manner of selecting trawl stations within a given set of boundaries. Unless some strictly objective method is used to select specific trawling locations (such as randomly pre-selected stations) then we risk unknown bias arising from subjective judgements of ships officers, and these biases could vary substantially from one survey to another with changes in crew on survey vessels. Obviously some compromise between the theoretical and the practical may be required here, but we should not dismiss the possibility of significant bias in existing practices until we have demonstrated otherwise.

In conclusion then, there appear to be major benefits to be derived from adopting the general principles of the stratified random sample design for coordinated groundfish surveys in the entire ICNAF area. The details might be quite different in different regions according to circumstances and priorities but at least there should be standardization of basic elements of sampling design within regions.

Benefits will be in the form of unbiased estimates of abundance accompanied by valid measures of sampling error, which will greatly enhance our confidence in the results of surveys. Comparisons among countries and for time-series of data will of course be facilitated by adopting standard stratum boundaries, and this appears desirable and feasible for Subarea 3 as well as Subareas 4-6. Standard strata may not be possible in Subareas 1 and 2, but the possibilities for developing a reasonably standard two-stage approach (hydrographic pre-survey followed by stratified random trawl survey) should be explored.

Sampling Catches

In order to reap the full benefits referred to above it will also be necessary to achieve a certain minimum level of standardization in the types and formats of data collected, as well as in the methods of sampling catches. For a knowledge of changes in the groundfish community as a whole, minimum biological data required are the numbers and weight caught, and length-frequency of each species in the catch. Hopefully this may be adopted as a minimum requirement by those participating in co-ordinated surveys. Standardization of species names, code numbers, length measurements, etc., are important details, but they should not present any serious obstacles.

Trawl standardization

In addition to the gains in precision of abundance indices which could be derived from adopting a standard trawl, another advantage is that results from surveys by different vessels and in different regions would be directly comparable and could be pooled directly. Also, if there was overlap of survey areas, this would provide a ready means of detecting unusual performance of one of the survey units. The latter would seem to be rather important in view of the considerable effects on trawl

performance of small differences in gear rigging.

Although these are important advantages there are also some theoretical and practical difficulties involved with a standard trawl. The most important question involves the potential accuracy of abundance indices derived from different trawls. Among the principal trawl characteristics related to accuracy are catchability coefficients and fishing power. It has been suggested that the lower the catchability coefficient for a species, the greater the risk that real changes in abundance may be confounded by factors independent of true abundance, e.g. behavioral changes. However, it does not necessarily follow that the optimum trawl has maximum fishing power, because accuracy is also related to overall survey efficiency in terms of numbers of hauls, which in turn is related to durability and time required to process catches.

Ideally a standard trawl should be just large enough to provide abundance data sufficiently accurate to meet assessment needs, and sufficient material for biological sampling, thus minimizing cost of operations. Large trawls on average make larger catches than do small trawls, increasing time required to handle catches and consequently reducing sampling intensity and amount of biological sampling.

Experience of USA (Woods Hole) and Canada (St. Andrews) Laboratories with Yankee No. 36 trawls over a long series of years in Subareas 4, 5 and 6 indicates that this gear gives suitable catch sizes for survey operations. Data presented above indicate that meaningful abundance indices are also obtainable with the Yankee No. 36 for groundfish species such as cod, haddock, yellowtail and red hake. However, it cannot be established to the satisfaction of the Working Group at this time that the Yankee No. 36

provides sufficiently accurate abundance indices of semi-pelagic species such as silver hake, and of semi-pelagic young stages of cod. The need to use a larger trawl with higher headrope than the nine feet provided by the Yankee No. 36 for such species requires further consideration.

Practical arguments against using small trawls such as the Yankee No. 36 also exist. Several of the research vessels operated by member countries, particularly in Subareas 1 to 3, are larger than 1000 tons and it was suggested that gear damage is likely to be frequent when operating with small trawls. This is especially true in the northern Subareas where hard bottom unsuitable for trawling is widespread and heavy footropes with large rollers are essential.

Thus there are obvious advantages and some potential disadvantages in the use of a single trawl for all survey operations in the ICNAF area. We can gain some insight into the nature of the possible disadvantages, and at the same time aquire some valuable information on catchability coefficients, by conducting coordinated surveys or trawl comparison experiments with different trawls. For example, the importance of variations in fish behavior on the accuracy of abundance indices can and should be explored through studies of fishing power differentials (relative "catchability coefficients") in relation to trawl design, time of day, season, etc. Experiments which are restricted in time and space can provide the most precise estimates of differentials. Equally valuable however are time series of differentials which can be generated by joint surveys (such as the US-USSR series) with different trawls. We are particularly concerned with potential non-cyclical variations in behavior and especially if they are related to population abundance, since these could seriously affect the accuracy of our abundance indices.

All of these problems are relevant to the question of adopting a standard trawl of known and acceptable reliability. Thus there appears to be much to be gained by proceeding with trawl comparison experiments and with surveys which are comparable in methods and design, but using different trawls with overlap in time and space. Close cooperation between gear experts and biologists will be essential.

Combination of abundance indices for a particular area derived from different gears, should pose no serious limitation to the value of a time series for assessment purposes, since it is the relative changes and the relative consistency of trawling operations, which are of primary significance there. The statistical problems of combining results of different trawls should be quite manageable given consistent handling of each individual gear and adequate standardization of sampling design.

VI. Conclusions and Recommendations

It is apparent from data presented to the Working Group concerning the extent and nature of present and proposed groundfish surveys by member countries that quantitative surveys of virtually all groundfish stocks of importance to ICNAF could become possible in the near future. There is every indication that such surveys are capable of providing abundance information invaluable for current stock assessment purposes. There are major advantages to be gained in efficient utilization of our survey efforts by co-ordination of activities and standardization of sampling methods and design.

The Working Group considers that not only is a comprehensive co-ordinated ICNAF quantitative groundfish survey highly desirable, but that it is also feasible. As a further step to attaining this objective the Working Group recommends (1):-

that member countries mounting survey operations in the ICNAF Area in 1972, co-ordinate these activities and standardize as fully as possible their sampling methods and design, and explore the possibilities of data exchange for areas of mutual interest to further clarify sources of error and levels of accuracy attainable.

Information presented to the Working Group on past and future work indicates that the following countries may be undertaking surveys in the following Subareas and seasons in 1972:

Subarea 1	Summer-Autumn	- Denmark (Greenland) and (so far as the main objective of salmon tagging allows) all countries involved in cooperative salmon tagging experiments in Autumn 1972.
Subarea 2	Spring or Autumn	- Federal Republic of Germany, Canada (Newfoundland).
Subarea 3	Spring-Summer	- Canada (Nfld.), USSR (PINRO), and Poland (in autumn) France (St. Pierre)
Subarea 4	Summer-Autumn	- Canada (Maritimes), USSR (ATLANTNIRO), USA, France (St. Pierre)
Subarea 5	Autumn	- USA, USSR (ATLANTNIRO)

These, and any other, possibilities for co-operation should be explored in detail by the Working Group during the 1971 Annual Meeting of ICNAF with the aim of developing a firm proposal for a co-ordinated ICNAF survey in 1972, with at least some activity in all Subareas. Should such a survey program receive sufficient support from member countries and the approval of the Commission, Working Group members should note that detailed planning will be necessary at a third meeting of the Working Group in January 1972.

The desirability of overlap in survey areas should be kept in mind in future survey planning to define fishing power differentials for different gears. Should extensive surveys be impossible for particular countries in 1972, preliminary work in the form of controlled comparative fishing experiments in localised areas should be considered.

To further the development of a co-ordinated survey program members of the Working Group and other interested scientists are urged:

(1) to submit to the 1971 Annual Meeting in document form detailed information on present and proposed survey methods and design, paying particular attention to points covered in Item 1 of the Appendix to ICNAF Circular Letter No.70/22;

(2) to submit to the Chairman of the Working Group in advance of the 1971 Annual Meeting details of proposed 1972 survey activities, including objectives and type, season, and area of operations, allowing him to prepare a composite chart of the extent of such operations for presentation at the Meeting;

(3) to submit stratification (or other sampling design) proposals for Subareas 1-3 to the 1971 Annual Meeting as a basis of discussion of optimum sampling design;

(4) to further document the accuracy of abundance indices based on surveys in terms of statistical precision (sampling errors) and in terms of comparisons with commercial and other survey abundance indices, or other abundance measures;

(5) to document information on areas characterized by rough bottom unsuitable for trawling or by other factors such as ice, which have a bearing on decisions

concerning sampling design and the nature of sampling errors.

To further co-operation of member countries interested in surveying the same areas in 1971 and as a preliminary to more detailed co-operation in 1972, such countries are urged:

(6) to immediately exchange 1971 survey plans including data on objectives, season and area of coverage, survey design, and station allocation.

To further the usefulness of groundfish survey data to the Commission, the Assessments Subcommittee is requested:

(7) to provide guidance to the Working Group, on the most suitable format for submission of survey data to the Assessment Subcommittee, whereupon the Working Group's Chairman will prepare a sample format for a standardized submission for consideration at the 1971 Annual Meeting.

APPENDIX I

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APPENDIX II

List of Documents Presented

ICNAF Res.Doc.			
71/35	(1)	Halliday, R. G. and Kohler, A. C.	Groundfish survey programs of the St. Andrews Biological Station, Fisheries Research Board of Canada- objectives and characteristics.
---	(2)	Grosslein, M. D.	Groundfish survey program of NMFS Woods Hole. Commercial Fisheries Review, vol. 31, pp. 22-30, 10 figs.
71/57	(3)	Grosslein, M. D.	Groundfish survey methods. NMFS Woods Hole. Laboratory Reference No. 69-2.
	(4)	Grosslein, M. D.	Data processing methods for groundfish surveys. NMFS Woods Hole. Laboratory Reference No. 69-3.
71/36	(5)	Pinhorn, A. T.	Objectives and characteristics of existing and proposed groundfish surveys by the Fisheries Research Board of Canada, Biological Station, St. John's, Newfoundland.
71/58	(6)	Smidt, E.	Standard trawl stations for controlling pre-recruit West Greenland cod.
71/59	(7)	Grosslein, M. D.	Some observations on accuracy of abundance indices derived from research vessel surveys.
71/37	(8)	Halliday, R. G., Grosslein, M. D. and Kohler, A. C.	Comparisons of abundance indices from research vessel surveys and commercial statistics for cod and haddock in ICNAF Sub-area 4. (Comparisons of Canadian and USSR survey results on Scotian Shelf. Table and figure only).
71/38	(9)	Pinhorn, A. T.	Accuracy of abundance indices for cod from St. Pierre Bank (ICNAF Division 3Ps) based on Canada (Nfld) research vessel surveys in terms of comparisons with commercial abundance indices.
71/60	(10)	Noskov, A. S.	Comparisons of survey and commercial abundance indices for silver and red hake in Sub-area 5. Figures and table only.
71/39	(11)	Carrothers, P. J. G. and Foulkes, T. J.	Draft report on the measured towing characteristics of Canadian east coast otter trawls.
71/61	(12)	Grosslein, M. D.	Performance of trawls used for joint U.S.-USSR groundfish studies.

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ANNUAL MEETING - JUNE 1971

Report on 2nd Meeting - ICNAF Working Group on Coordinated Groundfish Surveys

Chairman: M. Grosslein
Rapporteur: R. Halliday

INTRODUCTION

A second meeting of the Working Group was held in Halifax on 20 May 1971, to review progress on several aspects of the development of a coordinated groundfish survey program. Current plans for survey activity in 1972 were reviewed including a proposed new sampling scheme on Grand Bank. In addition some survey abundance indicies (and data formats) were evaluated in relation to the development of stock biomass estimates from research vessel surveys. Eight countries were represented and a list of participants is attached.

PROPOSED GROUNDFISH SURVEYS IN 1972

At a 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. However, no comprehensive groundfish surveys appear likely in 1972 for Subareas 1 and 2. Horsted noted that Danish vessels will be fully occupied with salmon tagging, and Schumacher noted that West 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 comprehensive annual groundfish surveys in Subarea 1-2 should get high priority, but definate 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 R. & S., it would seem quite important for the Working Group to continue its activity particularly in the development of specific 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 this region. In addition by informing the Chairman of any future cruises which are not now scheduled, we may achieve some benefits from coordination of what resources are presently available.

STRATIFICATION SCHEME FOR GRAND BANK

Mr. Pinhorn presented a proposed stratification plan for the Grand Bank (see Res.Doc. 71/128 for chart) 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 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).

DATA FORMATS

Grosslein and 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 noted that, in addition to the abundance indices in terms of numbers per haul at each length interval, it would be most useful to the Assessment Committee 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. Halliday, Pinhorn and 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.

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 Assessment Subcommittee at their mid-term meeting. It is recommended (by the Chairman) that the Working Group meet again at the 1972 Annual Meeting.

LIST OF PARTICIPANTS

Canada	- Pinhorn, Halliday, Kohler, May, Hodder, Iles, Smith, Dickie
USA	- Grosslein, Hennemuth, Brown, Griswold, Posgay, Bruce, Ridgway
Denmark	- Horsted, Smidt
USSR	- Bogdanov, Yakovlev, Nikolaev
UK	- Cole, Garrod, Lee
France	- Letaconnoux, Morice
Spain	- Larraneta, Rucabado
West Germany	- Schumacher