

Northwest Atlantic



Fisheries Organization

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SCIENTIFIC COUNCIL MEETING - JUNE 1990

Final Report of the STACREC Working Group on
Survey Design and Procedures

by

STACREC Working Group

This document is a summary of the activities of the STACREC Working Group on Survey Design and Procedures and was prepared in response to a STACREC recommendation made in 1989. The Working Group was formed to consider documentation prepared in 1986 on survey design, vessel and gear used, sampling procedures, and other factors affecting results of surveys in the NAFO area. The Working Group was to "examine the reported data and recommend to STACREC appropriate measures for the future improvement of various time series of survey data and the most appropriate methods of analyzing historical data to derive abundance indices for stock assessment purposes." The Working Group consisted of W. Brodie, convener, J. Messtorff, V. Rikhter, J. Bertrand and D. Power and met on several occasions from 1987 to 1989. This paper presents a chronology of the relevant information from the Scientific Council Reports of 1985-89, and includes the documentation available to the Working Group, as well as material prepared by the Working Group in analyzing the survey information. With the exception of NAFO SCR Doc. 86/66 (Bulatova and Chumakov), the material in Appendix I was extracted from working papers considered at the various Working Group meetings.

Time Series of Survey Data

The Committee noted that Soviet surveys since 1981 are being done using the stratified-random sampling scheme. Future surveys for Greenland halibut and roundnose grenadier in Subarea 1 should be completed by using stratification charts provided by France (St. Pierre Laboratory).

Surveys by the Soviet Union over the 1959-80 period were conducted with a number of different vessels of comparable horse power and fishing gear. All survey results from the entire period were considered comparable by the Soviet scientists. However, in the case of several time-series of surveyed data, changes in vessel, gear and fishing design have likely been made by several countries and recorded at various times. The cumulative effect of these changes upon consistency of results should be examined. STACREC accordingly

recommends

that appropriate documentation of survey design, vessel and gear used, operation of gear, sampling procedures and other factors potentially affecting survey results be provided to STACREC at its June 1986 Meeting.

To assist in the reporting of such data, the Secretariat was requested to consult with relevant laboratories and prepare a draft format for consideration at the September 1985 Meeting of the Scientific Council. At the June 1986 Meeting, it is intended that a working group be formed to examine the reported data and recommend to STACREC appropriate measures for the future improvement of various time series of survey data and the most appropriate methods of analyzing historical data to derive abundance indices for stock assessment purposes.

Draft Format Regarding Documentation of Survey Procedures

At the June 1985 Meeting, the Council endorsed the recommendation that "appropriate documentation of survey design, vessel and gear used, operation of gear, sampling procedures and other factors potentially affecting survey results be provided to STACREC at its June 1986 Meeting". To assist in reporting of such data, the Secretariat solicited proposals from various laboratories which conduct surveys in the Northwest Atlantic, but the only response was from Canadian scientists.

A small *ad hoc* working group was requested to prepare a list of items (to be subsequently arranged in tabular format by the Secretariat) for documentation of materials and methods for conducting bottom trawl groundfish surveys in Subareas 2 and 3 (and surveys for Greenland halibut and roundnose grenadier in Subarea 0) to determine abundance and biomass. The following list of items was adopted as the basis for drafting the format to be used in soliciting information on complete time series of stratified-random, fixed-station and other transect surveys:

Item	Comments
1. Country and year	
2. Surveyed area	- NAFO division
3. Period of survey	-
4. Purpose of survey	- Species or species groups, adult or juvenile stages
5. Vessel used	- Name, length, tonnage, horsepower
6. Gear used	- Type (with appropriate scale diagram, if possible); floats and rollers; other rigging such as chafers; mesh size, especially of codend; presence of liner and mesh size
7. Speed and duration of tow	- Standard parameters
8. Distance towed	
9. Area swept by trawl	- How determined?
10. Trawl height when towing	
11. Survey design	- Stratified-random, transect, fixed-station, random station, etc.
12. Number of successful sets	- Criteria for rejecting invalid sets
13. Table of strata	- Sampling units and number of sets in each
14. Station selection procedure	- Fixed stations, method of selecting at random
15. Criteria for changing position	- Unexpected depth, rough bottom, etc.?
16. Criteria for determining number of sets in each stratum	- Equal sampling density or proportional to density?
17. Daily period of fishing	- Daylight hours or 24 hours?
18. Catch sorting procedures	- All species or selected species
19. Weighing procedures	- Individual specimens, standard baskets or containers, etc.
20. Enumeration procedures	- Measuring, counting, subsampling
21. Sampling larger catches	- To obtain total weight and total number of each species
22. Sampling for age material	- Random or stratified; specimens from each set or not; specified number of otoliths or scales for each length group; number in total for area adjusted to length frequency or not
23. Sampling for length	- Fork, total or partial length to cm below or to nearest cm or half-cm; length frequency for each successful set; adjustment or subsampled length frequency to total catch in the set
24. Other sampling activity	- List types of material collected (e.g. parasites, stomachs, fecundity, etc.)
Item	Comments
25. Oceanographic activity	- NAFO standard stations occupied; other observations (e.g. 50 BT casts, one at each fishing station)
26. Procedure to determine abundance	- E.g. catch-per-tow, catch-per-standard tow, abundance from contour plots or from raising to survey area; list chronology of changes to procedures used to obtain indices

Documentation of Survey Design and Procedures

The Committee noted that some material relevant to conducting bottom trawl groundfish surveys in Subareas 2 and 3, as recommended in June 1985, is now available. It was agreed that a working group be set up at the September 1986 Meeting to evaluate the submitted material. The group should also evaluate past survey results in order to derive more precise indices for assessment purposes. Stratis Gavaris (Canada) was nominated to be convener of the working group and to provide guidelines for the group on what information should be compiled from the documentation. Mr. Gavaris will confirm his ability to accept these duties before the September 1986 Meeting of the Scientific Council. The documentation was considered valuable and the Committee encouraged member countries to submit their ideas on the matter to the Scientific Council in September 1986.

Survey Design Procedures

The Council noted that the Secretariat had received, before the June 1986 Meeting, detailed information on survey procedures from Canada, Federal Republic of Germany, France and USSR. No additional information has been received.

Regarding establishment of a working group to evaluate the submitted material and to examine past survey results in order to derive more precise abundance indices for assessment purposes, the Council was informed that the nominated candidate for convener, S. Gavaris (Canada), was unable to accept the task due to other commitments. This then led to the nomination of W. Brodie (Canada) who agreed to undertake the work. Final composition of the *ad hoc* working group was deferred to the June 1987 Meeting, but J. Messtorff (EEC), V. A. Rikhter (USSR) and J. C. Poulard (EEC) were named as national contacts by correspondence, so that work can be initiated before the June 1987 Meeting.

Survey Design Procedures

STACREC noted that the *ad hoc* Working Group, which was set up to evaluate material that had been submitted to the June 1986 Meeting, relevant to conducting bottom-trawl groundfish surveys in order to derive more precise indices for assessment purposes than those presently available, met for the first time on 12 June 1987, with J. Messtorff (EEC), V. A. Rikhter (USSR), J. Bertrand (EEC), D. Power (Canada) and W. Brodie (Canada) in attendance. The meeting was convened by W. Brodie. Documents which outlined survey procedures, as requested by STACREC at an earlier date (NAFO Sci. Coun. Rep., 1985, pages 95, 104), were examined. These documents were SCR Doc. 86/66 by USSR and three working papers which were submitted by scientists from France, Canada and the Federal Republic of Germany at the June 1986 Meeting. It was noted that the series of French surveys in Subdiv. 3Ps, as well as the Federal Republic of Germany surveys in Div. 2J, were comparable over virtually all years. Differences in the Canadian and USSR surveys over time were briefly discussed.

STACREC noted that further work could not be carried out by this group at this meeting due to time constraints. The Convener agreed to prepare summaries of the available data for examination by the working group in September 1987. In addition to these summaries, the working group should also consider at that time what further survey data or analyses, if any, should be made available for consideration in June 1988.

Working Group on Survey Design Procedures

STACREC noted that the Working Group had met on 11 September 1987, with W. B. Brodie as Convener and representatives from Canada (D. Power), EEC (J. Bertrand, J. Messtorff) and USSR (V. A. Rikhter), and reviewed the available information on research vessel groundfish surveys conducted in Subareas 2 and 3 by Canada, Federal Republic of Germany, France and USSR. The following general points were noted from the Working Group's summary of survey documentation:

- a) Survey coverage was lower, often considerably so, both in terms of number of sets and strata fished, in the earlier years of many survey series compared to later years. Techniques such as multiplicative analyses are encouraged to maximize the amount of survey data which can be incorporated into abundance indices.
- b) The timing of surveys within a series often differed by as much as 5 months in some years. Such differences could have significant effects on the abundance indices for some species but these effects are virtually impossible to quantify.
- c) Users of research-vessel survey data should be aware of changes or peculiarities in series and their potential effects on abundance indices.

Several survey series conducted by France, Canada, Federal Republic of Germany and the USSR were examined. The following specific points were noted by STACREC:

- d) Surveys by France in Subdiv. 3Ps and Federal Republic of Germany in Div. 2J underwent little change over time. Both used a 12-hour (approximate daylight) fishing plan, which differs from the 24-hour operations used by Canada and the USSR. The two vessels used in the Federal Republic of Germany surveys are considered comparable in terms of the survey results which they provided. The Federal Republic of Germany surveys have been discontinued because the research vessel *Anton Dohrn* is no longer available.
- e) Some survey series conducted by Canada were affected by a change in vessel/gear from the side trawler *A. T. Cameron* up to the end of 1982 to the stern trawlers *Wilfred Templeman* and *Alfred Needler* from 1983 onward. Conversion factors exist only for catches of American plaice and yellowtail flounder, while cod catches were determined to be equal by both vessel/gear types. The survey series involved are Div. 3LNO (spring), Div. 3L (fall) and Subdiv. 3Ps.
- f) Two new strata were added to the Canadian surveys in Div. 3K from 1984 onward, covering the near-shore areas in the 101-200 m depth range.
- g) No surveys were done in Div. 3LNO by Canada in spring 1983, and coverage of certain divisions was minimal or non-existent in 1974, 1981 and 1984.
- h) Canadian surveys on the Flemish Cap (Div. 3M) during 1978-85 were done by the stern trawler *Gadus Atlantica* and are much more extensive than the 1977 survey carried out by the *A. T. Cameron*. These surveys were discontinued after 1985.
- i) Three series of USSR surveys, covering the 1961-70, 1971-82 and 1983-85 periods are distinctly different in terms of objectives, design, vessel/gear and operating procedures.
- j) The design and timing of the USSR young fish surveys of 1961-70 changed in 1967 and therefore the data for 1961-66 are not considered at this time to be comparable with the data for subsequent years. Abundance indices (number-per-tow only) are available for cod, haddock and redfish aged 1 to 3 years from the 1967-70 surveys, which were done with similar side trawlers.
- k) The 1971-82 USSR surveys, conducted by similar stern trawlers, operated on the same grid of fixed stations used in 1967-70. With comparative fishing indicating that the stern-trawler gear caught 1.4 times more fish than was caught by the side-trawler gear, the results from 1967-70 should be comparable with those for young fish in 1971-82. However, further examination of the distribution of sets in these years is necessary before specific conclusions can be reached concerning the comparability of the young fish estimates in each division sur-

veyed. Data, including catch weights, from fish other than young cod, haddock and redfish were collected in 1971-82 USSR surveys. Thus, abundance estimates in the form of number-per-tow and weight-per-tow only are available for several groundfish species from these surveys. However, no information on survey coverage by location was available to determine the comparability of the abundance estimates over the series.

- l) Stratified-random surveys in Subarea 3 were begun by the USSR in 1983, using the same call of vessel/gear used in the 1971-82 period. Tows were 1 hour in 1983 and 30 minutes in 1984-85. A smaller vessel, but with the same gear, was used in 1985 and the effect on catches was not considered to be significant, although no comparative fishing data exist. Comparability of these surveys with the fixed-station surveys of 1967-82 was not established.
- m) The USSR survey directed at Greenland halibut in Subareas 0 and 2 during 1980-85 were done using a stratification by depth zone (100 m intervals) rather than with a standard stratification scheme. The effects of this design on abundance and variance estimates are not known, although the indices for Greenland halibut from this series are affected significantly by annual variations in survey coverage.

In the light of the preceding points, STACREC makes the following recommendations:

- i) Techniques such as multiplicative analyses should be used to establish comparability among all years in abundance indices from a particular survey series.
- ii) Since changes in design, timing, coverage, vessel/gear, etc., in survey series can have significant effects on abundance indices, the documented information on survey design procedures should be included for future reference in a summary (SCS) document.
- iii) Comparative fishing results which exist for some survey series should be used on the appropriate species where necessary.
- iv) Recent results from comparative fishing experiments between Federal Republic of Germany research vessels fishing at random in a small suitable area should be examined by researchers planning comparative fishing tests. These results will be available in a paper from the 1987 ICES Meeting.
- v) Because comparability of the three USSR time series has not been satisfactorily established, more information on the distribution of sets as well as investigations into the comparability of fixed-station and stratified-random surveys are required. However, the surveys in 1961-66 are not considered to be comparable with other USSR surveys because of changes in design and timing.
- vi) Additional USSR survey data should be made available for consideration. For the 1967-82 period, this information should consist of a listing of the fixed stations by division and depth, indicating which stations were successfully surveyed in each of the years from 1967 to 1982. For the stratified-random surveys in 1983-85, tables of survey coverage by division and stratum, identical to those of other survey series reviewed by the working group, are required. For the Greenland halibut surveys of 1980-85, similar tables of coverage by division and depth zone are necessary. If possible, this information should be sent to the Convener of the Working Group so that analysis can begin sometime before the June 1988 Meeting.

NAFO Sci. Coun. Rep., 1988, p. 96.

Survey design procedures (Working Group Report)

A report on the recent activities of this *ad hoc* Working Group was tabled by the convener (W. Brodie), along with the recommendations made to the group by STACREC at the September 1987 Meeting. The main task remaining for the group, a review of the comparability of USSR surveys from 1967 onwards, will be started by the convener and presented to the working group for review at this September 1988 Annual Meeting, if possible.

NAFO Sci. Coun. Rep., 1988, p. 117.

Report from Working Group on Survey Design Procedures

The working group met in Ottawa, Ontario, Canada, on 15 September 1988 to discuss the comparability of USSR trawl surveys in NAFO Subareas 2 and 3 in the 1967-85 period. It was noted that the estimates of small fish from the young fish surveys of 1967-70 may not be comparable with the estimates of small fish from 1971-82, because of modifications to the grid of stations used in 1967-70. However, the surveys in this time period may provide valuable oceanographic data.

STACREC noted that a preliminary analysis had been conducted on the distribution of sets in the fixed-station surveys from 1971-82. It was noted that there was a great deal of information available from these fixed-station surveys conducted by the USSR and that it would be useful to have abundance estimates from these surveys which were comparable with those from the stratified-random surveys. To determine if such estimates could be derived, it was noted that further analyses were required. Such work should include:

- a) Comparison of results from the fixed-station surveys with the results from other surveys comparable in area and time.
- b) Further analysis of the distribution of the fixed stations.
- c) Application of other statistical techniques to determine their potential usefulness.

STACREC noted that the convener of the working group agreed to undertake this work initially and that the working group was to meet in June 1989 to discuss this work.

NAFO Sci. Coun. Rep., 1989, p. 128.

Survey Design Procedures (Working Group Report)

A report on the comparability of USSR surveys from 1983 onwards to those from 1971-82 was presented by the Ad hoc working group. After the examination of spatial coverage, sampling intensity and comparisons of abundance indices of yellowtail flounder in Div. 3LNO and American plaice in Div. 3L with those from Canadian surveys, the report concluded that the USSR surveys of 1971-82 should be considered comparable to the USSR surveys of 1983 to the present for the purpose of deriving indices of abundance for these species. STACREC noted that surveys from both these time periods were currently being used to derive an index of abundance for cod in Div. 3NO. Alternative approaches to produce indices of abundance from these surveys using a method known as kriging, was deemed inappropriate, mostly because of the mobility of the resources being measured and generally low sampling intensity. Other techniques such as contouring and spline approximation were not considered, mainly because such methods are not currently employed by STACFIS to derive abundance indices from surveys. As this working group's mandate has now been achieved, STACREC recommended that all survey documentation which were discussed by the Working Group on Survey Design Procedures be made available as a SCS document.

The Chairman recognized the valuable work done by this working group.

Appendix 1

Documents Reviewed by STACREC Working Group on
Survey Design and Procedures

Northwest Atlantic



Fisheries Organization

Serial No. N1183

NAFO SCR Doc. 86/66

SCIENTIFIC COUNCIL MEETING - JUNE 1986

USSR Trawl Surveys in NAFO Subareas 0, 2, 3

by

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ABSTRACT

Methods of the USSR trawl surveys in NAFO Subareas 0, 2, 3 are reviewed in the present paper. Principle objectives and sampling techniques applied during surveying of the NAFO Subarea 3 allowed to discern three periods of investigations: 1961-1970, 1971-1982 and 1983-1985.

Information from trawl surveys for Greenland halibut in Subareas 0 and 2 in 1980-1985 is presented.

It is concluded that coordinated efforts of NAFO member states are needed for joint surveying.

INTRODUCTION

NAFO Subareas 2 and 3 have been surveyed by PINRO since 1954. From 1954 to 1961 primarily scouting works were conducted, distribution of fish was studied, data on the size-age composition, feeding, sex composition and maturity, migrations of major commercial species were collected.

From December 1961 onwards the Polar Institute conducted annual trawl surveys which for principle objectives and sampling techniques may be divided into three periods: 1961-1970, 1971-1982 and 1983-1985.

The principle objective of the 1961-1970 surveys was to estimate the yearly recruitment to cod, haddock and redfish populations using a quantitative assessment of the young. The yearclass strength was estimated from the average number of fish in a catch per hour haul.

In 1971-1982 the total trawl surveys were conducted - a quantitative assessment of demersal fish of all species and size groups. Estimates of the relative abundance and biomass expressed as the average number and weight of fish in a catch per hour haul were derived for major commercial species (cod, haddock, redfish, American plaice, Greenland halibut, dab) (Konstantinov, 1981).

Since 1983 the surveys were conducted using the stratified-random method for fishing station selection (NAFO method). Estimates of the relative abundance and biomass of commercial fishes were derived for individual strata and for the whole area.

Trawl survey methodology

1961-1970 surveys - Table 1 presents information from trawl surveys in 1961-1970, which were made by side-trawlers. A typical side-trawler (BRT - large trawler) was 73.6 m in length, with the gross tonnage 1492 t, net tonnage 829 t, main engine power 1080 hp.

A bottom trawl, 24.9 m long (without bag), was used with a distance between wings 10-12 m and vertical opening 1.6-1.8 m. The bottom line was equipped with 500 mm diameter bobbins, the cable length was 90 m. Oval 5.5 sq.m three-slot boards were used. Cod-end mesh size was 110 mm. A fine-meshed 9 m long netting with 16-20 mm mesh bar was inserted in the codend. The trawl was towed at 3.2 knots for 1 hour. Observations were carried out on a 24-hour basis.

The number of fishing stations depended on the overall duration of the cruise and the time of work in the area under survey. In the beginning of investigations fishing stations covered a vast area, therefore, their number in each subarea was small. Positions of fishing stations were randomly chosen but so that to envelope different depths and the areas which seemed important for fisheries. Most successful fishing stations were occupied every year.

In 1967 to make the coverage of the survey area more complete a new grid of stations was devised using rectangles similarly to oceanographic sections intersecting the shelf latitudinally. In subsequent surveys positions of fishing stations were relatively fixed, within accuracy of the vessel position-finding. The grid

of stations was corrected - additional fishing stations located on the shelf and slopes were included, zones with irregular bottom topography were rejected. The survey was restricted to Divs. 3KLMNOP. By the end of the period (1969-1970) about 300 fishing stations were planned for the mentioned areas and completed (Table 1).

Sampling techniques and catch analysis in 1961-1970.

In this period the principle objective was to assess quantitatively young cod, haddock and redfish. Prior to 1967 when the surveys were conducted during the winter period cod and haddock up to 35 cm and redfish to 15 cm in length were believed to pertain to the young. Since 1968 observations have been carried out in the spring-summer period. Bearing in mind seasonality in the fish growth, cod and haddock to 40 cm and redfish to 20 cm long inclusive were assigned to the young.

Catches were processed following the procedure described below. For small catches all young fish were selected and their lengths were taken. In catches to 1 t only a portion of young fish was measured, all the rest were counted. In catches above 1 t (redfish predominantly) containers were used to count the fish: the average number of fish in one container was multiplied by the number of containers, which comprised the whole catch. The cod and haddock above 35 cm and redfish above 20 cm in length were measured, but the total number in the catch was not determined.

Prior to 1968 all young fish from small catches and only 100 individuals from large were taken for age determination. Later on only 300-500 young fish were taken from each area to determine age. The fish were taken from different tows so that they represented all size groups.

Samples containing larger-sized fish, 300 individuals from each area, were taken from one large catch. For this a part of the catch was separated with the fish not specifically selected by size.

The average number of the young aged 1, 2 and 3 years in the catch per hour haul was accepted as an index of the relative abundance of new yearclasses. The yearclass strength was estimated using the long term average norm. The long term average norm was

derived from the sum of mean indices of fish abundance for each age group and area divided by the number of years of observations (Konstantinov, 1983, Table 5).

1971-1982 surveys. From 1971 onwards the trawl surveys were carried out by stern-trawlers. In order to preserve the long term time series of data and to derive comparable data 141 comparative tows were made in 1971 by BRT "Rossiya" and BMRT-1202 "Persey-III" which sampled the same cod concentrations running at parallel courses. The comparison of catches made by vessels of different types using different gears indicated that the catches by the RV "Persey-III" were on the average 1.4 times larger than those by BRT "Rossiya". Owing to this, estimates of the young fish abundance derived in the previous years were multiplied by 1.4.

Table 2 presents data from summer trawl surveys in Divs. 2J, 3 KLMNOP in 1971-1982. The 31/27.2 m trawl with 4 m vertical opening, distance between wings at 14.3 m (Figs. 1, 2), 90 m long cables, 400 mm diameter bobbins, 5.0 sq.m trawl boards, 130 mm mesh in the codend was used. A 19 m long small-mesh netting with a mesh bar of 20-24 mm was inserted in the codend.

The trawl was towed at 3.5 knots for 1 hour. Observations were carried out on a 24-hour basis.

Fishing stations were made at fixed positions. In the course of surveying positions of fishing stations slightly varied depending on the accuracy of the vessel position-finding, availability of the depth to be sampled, bottom topography, ground, and other reasons. The number of fishing stations completed in each survey depended on the duration of the cruise, but commonly 300 fishing stations were planned for Divs. 3 KLMNO. In 1979-1980 surveying of the Flemish Cap was made twice - in spring and summer.

Sampling techniques and catch analysis in 1971-1982.

A quantitative assessment of bottom fishes both exploited and unexploited of all size groups was carried out since 1971.

Each catch was sorted by species and the fish were measured and counted. In the case of large catches of fish of some species 300-600 individuals were selected from any part of the catch and measured.

The fish were measured from the tip of the snout to the end of the caudal fin to the nearest 1 cm. For example, at 35.5 cm we put 36 cm, at 35.4 cm - 35 cm. For all fish sex was determined except cod and haddock.

The quantitative assessment was made following the procedure used in the previous surveys: counting of individual fish or counting with the use of containers.

The weight of fish of major commercial species was determined. For this purpose based on age data collected in the previous years the size-^{weight} keys were derived, which were revised in subsequent surveys. If the weight data for some species were not available every fish was weighed individually. The total weight of fish of each species in the catch was determined through multiplication of the average weight (estimated from the size frequency) by the number of fish caught.

To determine the age composition of fish 300 individuals of the following species were taken from each area: cod, haddock, redfish, American plaice, dab, witch, halibut, grenadier. Samples were taken from large catches, a portion of the catch was separated so that the size composition of fish in the sample corresponded to their size composition in the catch. Concurrent with sampling of adult fish (cod, sometimes redfish) samples of the young (100-300 individuals) were taken from each area.

The average number and weight of fish in the catch per hour haul were accepted as relative abundance and biomass indices, which were derived separately for each species and area by dividing the total number and weight of fish by the number of tows including those without catch (Konstantinov, 1983, Tables 3, 4).

Stratified-random trawl surveys in 1983-1985.

Since 1983 the trawl surveys are carried out following the NAFO method.

As in previous years surveys were conducted by BMRTs, however, in 1985 the survey was made by PST, a vessel of smaller tonnage (Table 3), which might to some extent affect the survey results. As previously the 31/27.2 m trawl with a small-mesh netting was used, which was towed at 3.5 knots. In 1983 the towing was made for 1 hour.

In 1984 to increase the number of fishing stations 30-min tows were used. Observations were made on a 24-hour basis.

The number of fishing stations depended on the duration of the cruise, usually 450 to 550 stations, out of which 120-130 were completed on the Flemish Cap, where the number of stations in each stratum depended on its area. In other parts commonly 3 fishing stations were occupied in each stratum. If the time permitted larger strata were covered with greater number of fishing stations.

Positions of fishing stations had been initially determined on the chart with strata divided into small rectangles (0°10' of latitude and 0°20' of longitude). The rectangles were enumerated and positions of fishing stations were determined from the random number table. The distribution of fishing stations over narrower strata with irregular configuration was relatively even. During surveying positions of fishing stations were corrected with regard for the availability of the given depth, bottom topography, ground, telephone cables location as well as with respect to fishing and buffer zone boundaries, different obstacles (long-lines, traps, vessels, rigs, floating stations, icebergs, ice fields).

The accident rate for fishing gears is higher when fishing at random stations. Tows with considerable damages of the trawl netting, especially those of the bag, and other defects were not counted, but if it was possible they were repeated in the same stratum at the site with more suitable conditions. Tows shorter 30 min. and longer 1 hour 10 min. for one hour hauls (in 1983) and below 20 min and above 40 min. for 30-min. hauls (1984-1985) were not counted. The catch made during the time period shorter or longer than the above range was used to calculate the catch which could have been taken per a haul time unit.

Sampling techniques and catch analysis in 1983-1985.

Methods of catch analysis, quantitative assessment and weighing were the same as in the previous years. Before 1985 sampling methods associated with age determination also did not change.

In 1985 samples to determine age were collected following the Canadian techniques. For age determination fish were selected from different catches, 15-20 individuals from each size group.

If the sex was determined, 20 males and 20 females from each size group were taken to determine age. Thus, cod, haddock, beaked redfish and halibut (Div. 3K) were sampled. American plaice and dab were not sampled for age determination in 1985, however, 20 males and 20 females were selected from each size group for individual weighing.

As indicated by calculations, at an absolute error in the mean age equal to ± 0.5 year, 15 cod, 38 redfish, 37 grenadier and 13 halibut should be taken from each size group for age determination. Then a relative error in the mean age will constitute $\pm 9-13.5\%$ for different species.

Methods of abundance and biomass estimation in 1983-1985.

Estimates of the relative abundance and biomass were derived using the NAFO methods. In each stratum the mean number and weight of fish in the catch captured in the area towed per a time unit (1 hour or 30 min.) were determined from a series of tows.

Further calculations were made using the formula:

$$n = \frac{S}{S_1} \cdot n_1$$

where n - abundance or biomass of fish in the given stratum

S - area of the stratum

S_1 - area towed

n_1 - mean number (or weight) of fish in the catch per a time unit.

The size of the towed area was determined through multiplication of the distance covered by the vessel towing trawl per 1 hour (or 30 min.) by the distance between wings. At the speed of 3.5 knots the vessel covered 3.5 miles per 1 hour, and 1.75 miles per 30 min. At such a speed the distance between wings constituted 14.3 m. The area towed during 1 hour was 0.027 sq. mile and 0.0135 sq. mile per 30-min haul. The trawl fishing efficiency was conventionally accepted equal to 1.

Estimates of the relative abundance and biomass for each stratum were then summed to derive the estimate for the whole area.

Estimates of the abundance and biomass presented in the USSR National Reports for 1983-1985 may be checked using initial survey data mailed to Canada every year in formats No. 1 and 2.

Trawl surveys for Greenland halibut in Subareas 0 and 2 and Div 3K in 1980-1985.

Trawl surveys for Greenland halibut in the Baffin Island and Labrador areas were initiated in late 1980. Table 4 presents information regarding vessels, survey area and number of fishing stations.

Similarly to southern areas a 31/27.2 m trawl which was towed at 3.5 knots per 1 hour was used. Observations were carried out on a 24-hour basis.

In all years positions of fishing stations in northern areas were randomly chosen. Major criteria for fishing station position were ground conditions and suitability of a site. Tows were made within 300-1300 m of depth in each 100 m interval.

Abundance and biomass estimates were derived separately for each 100 m depth interval. The mean number and catch of fish in a catch per hour haul (per 0.027 sq.mile) were determined from a series of tows at the given depth, then the density of aggregation over 1 sq.mile and that over the area of each of the given depth intervals throughout the whole survey area were found. The total for the survey area was determined by summing up estimates for individual depth intervals.

It should be noted that the number of fishing stations, size of the survey area and depth of towing varied markedly by years due to changing ice conditions in northern area, which undoubtedly affected stock estimates which should be considered approximate (Chumakov, Polstaev, 1985).

Methods of oceanographic observations in the period of trawl surveys.

Oceanographic observations were made to characterize environmental conditions and to evaluate their effect on fish distribution. They comprised: standard meteorological observations over air temperature and humidity, wind direction and velocity, wave, atmospheric pressure, clouds, ice; water temperature and salinity measurements at fishing sites and standard hydrographic sections at depths: 0, 10, 20, 30, 50, 75, 100, 150, 200, 250, 300, 400, 500, 600, 800, 1000, 1200, 1500 and 2000 m.

Hydrographic observations were performed using standard in-

struments. Water temperature was measured with deepwater reversing thermometers (TT), bathometers (BM-48) were used for water sampling. Salinity was measured with electric salinometer 601-MK ("Auto-lab", Austria). Water temperature in 0-200 m was measured with mechanical bathythermograph at 00 and 12 hours GMT.

Oceanographic measurements were made before or after towing. In some cruises to save the time they were made only at some stations selected with respect to the distance between stations, towing depth and expected state of water.

Observations at standard hydrographic sections were made if they had been included in the cruise programme.

Conclusions

At present enhancement of the reliability of estimates of demersal fish stock size is most complicated and urgent problem. A cooperation of NAFO member states in recent years indicated the need for both information exchange and calibration of fishing gears, development of standard techniques and instruments. Joint surveys within a relatively short period of time would allow to complete a required number of fishing stations and to attain an adequate coverage of the distribution area of major commercial fishes. Such cooperation is certainly feasible with research programmes well organized and coordinated and initial data exchanged on a broad scale.

References

- Chumakov A.K. and V.A.Poletaev. 1985. USSR research report for 1984. NAFO, SCS Doc. 85/14, Serial No. N1013 (mimeo).
- Konstantinov K.G. 1981. Methods and results of the total trawl survey of bottom fish in Subarea 3 in 1971-1980. NAFO SCR Doc. 81/VI/73 (mimeo).
- Konstantinov K.G. 1983. Report of USSR investigations in Subareas off Newfoundland, Labrador and Baffin Land in 1982. NAFO SCS Doc. 83/VI/16, Serial No. N698 (1) (mimeo).

Table 1. Information regarding trawl surveys conducted in 1961-1970

Year	Period	Area	Vessel	Cruise No.	Number of valid hauls	Principle objective
1961-1962	Dec - Mar	2J, 3KLMNOP, 4VWX, 5Z	BRT-95 "Pobeda"	I	181	Quantitative assessment of young cod and haddock (to 35 cm) and redfish (to 15 cm)
1962-1963	Dec - Jan	2GHJ, 3KLMNOP	BRT-95 "Pobeda"	4	180	- " -
1964	Jan - Mar	2J, 3KLMNOP	BRT-95 "Pobeda"	I	148	- " -
1964-1965	Dec - Feb	3KLMNOP	BRT-97 "Sevastopol"	22	153	- " -
1965-1966	Dec - Feb	2GHJ, 3KLMNOP	BRT-97 "Sevastopol"	24	118	- " -
1967	Jan - May	2J, 3KLMNOP	BRT-99 "Novorossiysk" BRT-97 "Sevastopol"	21 26	182	- " -
1968	Apr - June	3KLMNOP	BRT-96 "Rossiya"	10	222	Quantitative assessment of young cod and haddock (to 40 cm) and redfish (to 20 cm)
1969	Apr - Jul	2J, 3KLMNOP	BRT-96 "Rossiya"	11	276	- " -
1970	Mar, May - Aug	3K 3LMNOP	BMRT-1202 "Persey-III" BRT - 96 "Rossiya"	4 13	299	- " -

Table 2. Data from 1971-1982 trawl surveys

Year	Period	Area	Vessel	Cruise No.	Vessel length m	Gross tonnage/ net tonnage, t	Main engine power h.p.	Number of tows	Principle objective
1971	May-Aug	3 KLMNOP	BMRT-1202 "Persey-III"	6	83,6	3030/1091	1x2000	240	Quantitative assessment of bottom exploited and unexploited fishes
1972	Apr-Jul	3 KLMNOP	- " -	8	83,6	3030/1091	1x2000	241	Estimation of abundance and biomass of major commercial fishes (cod, haddock, redfish, American plaice, dab, halibut)
1973	June-Aug	3 KLMNOP	- " -	11	83,6	3030/1091	1x2000	291	
1974	Jun-Aug	3 KLMNOP	- " -	12	83,6	3030/1091	1x2000	266	
1975	June-Sept	3KLMNOP	- " -	14	83,6	3030/1091	1x2000	295	
1976	Mar-Jun	3 KLMNOP	- " -	15	83,6	3030/1091	1x2000	294	
1977	Apr-Jul	3 KLMNO	- " -	18	83,6	3030/1091	1x2000	227	
1978	May-Jul	2J, 3KLMNO	- " -	20	83,6	3030/1091	1x2000	262	
1979	Mar-Jun	3 KLMNO	BMRT-2645 "Suloy"	2	78,0	2947/1330	1x2400	309	
1980	Apr-Jul	2J, 3KLMNO	BMRT-0422 "Kononov"	2	83,1	2889/1345	1x2400	334	
1981	Jun-Jul	2J, 3KLMNO	- " -	4	83,1	2889/1345	1x2400	232	
1982	Apr-Jul	2J, 3KLMNO	BMRT-2645 "Suloy"	2	78,0	2947/1330	1x2400	324	

Table 3. Information regarding 1983-1985 trawl surveys conducted following stratified-random scheme

Year	Period	Area	Vessel	Cruise No.	Vessel length, m	Gross tonnage/net tonnage, t	Main engine power, h.p.	Haul duration	Number of hauls
1983	May-Jul	3KLMNO	BMRT-2645 "Suloy"	27	78,0	2947/1330	1x2400	1 hour	464
1984	Mar-Jul	3KLMNO	- " -	30	78,0	2947/1330	"	30 min	514
1985	Mar-Jun	3KLMNO	PST MG-1363 "Genichesk"	2	59,1	1140/348	1x2200	30 min	447

Table 4. Information regarding the trawl surveys for Greenland halibut in Divs. OB, 2H and 3K in 1980-1985.

Year	Period	Area	Vessel	Cruise No.	Vessel length, m	Gross/net tonnage t	Main engine power h.p.	Haul number	Haul duration
1980-1981	Dec-Jan	OB, 3K	BMRT-0422 "Kononov"	3/80	83,1	2889/1345	1x2400	69	1 hour
1981	Dec	OB	BMRT-1202 "Persey-III"	26	83,6	3030/1091	1x2000	11	1 hour
1981	Jul	3K	BMRT-0422 "Kononov"	4/81	83,1	2889/1345	1x2400	48	1 hour
1982	Jul	3K	BMRT-2645 "Suloy"	2	78,0	2947/1330	1x2400	53	1 hour
1982-1983	Nov-Jan	OB, 3K	BMRT-2645 "Suloy"	26	"	"	"	51 67	1 hour
1983	Jul	3K	- " -	27	"	"	"	94	1 hour
1983	Nov-Dec	OB, 2GH	- " -	29	"	"	"	125	1 hour
1984	Jul	3K	- " -	30	"	"	"	113	30 min
1984	Sept, Nov-Dec	OB, 2GH	BMRT-2645 "Suloy" BMRT-0023 "Kuropatkin"	31 6	" 93,7	" 3141/1117	" 1x5200	105	1 hour
1985	Jun	3K	PST-1363 "Genichesk"	2	59,1	1140/348	1x2200	53	30 min
1985	Nov-Dec	OB, 2GH	BMRT-0422 "Kononov"	33	83,1	2889/1345	1x2400	83	1 hour

Rigging of sampling trawl 31/27.2 m
Headline 31 m

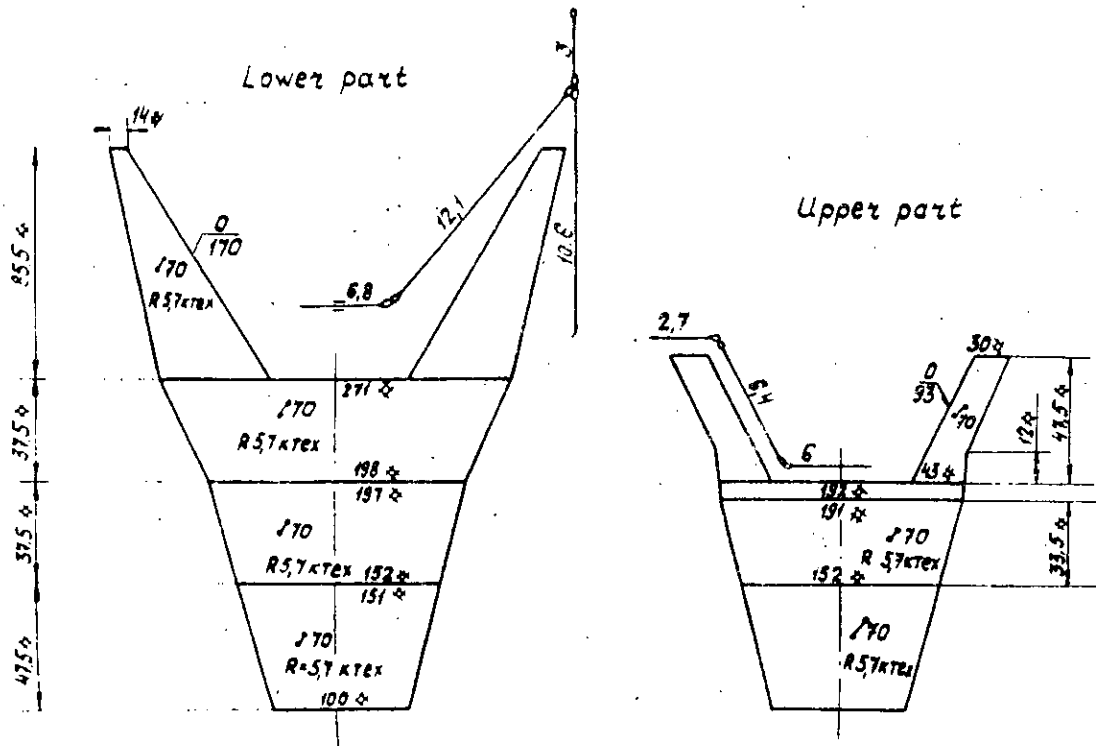


Fig. 1 Parameters of the 31/27.2 m bottom trawl
(1971-1985)

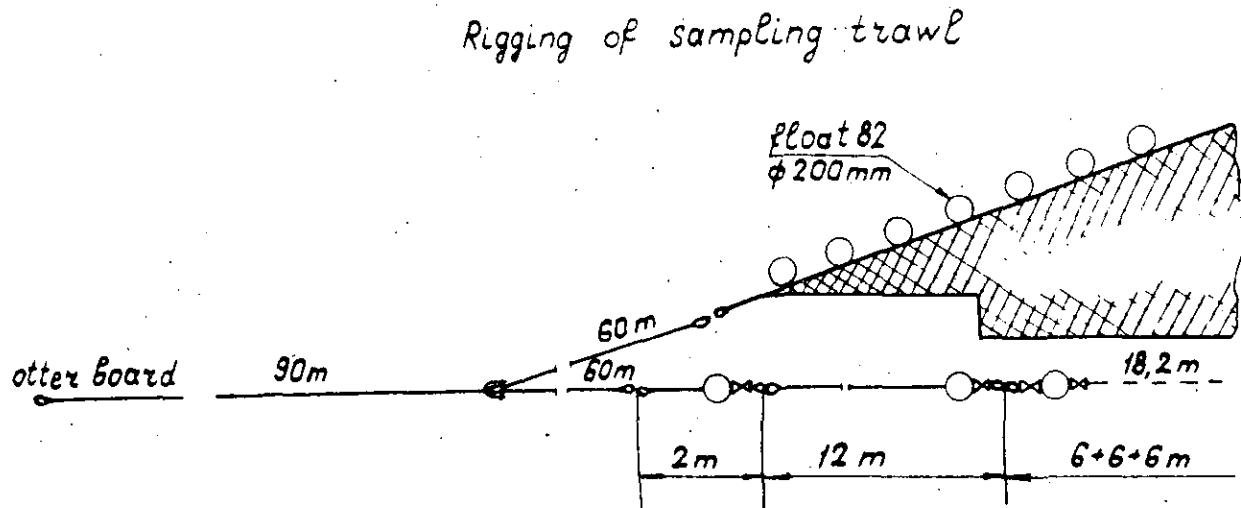


Fig. 2 Rigging of the 31/27.2 m bottom trawl (1971-1985)



Documentation of Survey Procedures

Saint-Pierre Laboratory
France

One complete set of these forms (i.e. Sections A-F inclusive) is to be completed for each major survey series. If there is insufficient space, insert supplementary sheets.

SECTION A - GENERAL

Country: FRANCE

Laboratory: Saint-Pierre

Purpose of Survey: (i.e. give title of this survey series e.g. summer groundfish bottom trawl survey in Div. 3NO)

Winter groundfish bottom trawl survey in Subdivision 3Ps

<u>Times conducted</u>			<u>Vessel Name¹</u>	<u>Gear used²</u>	<u>No. of successful sets</u>
<u>Year</u>	<u>Dates</u>				
1. 19 77	21/03 to 31/03		CRYOS	Lofoten	39
2. 19 78	21/02 to 25/03		"	"	69
3. 1979	21/02 to 20/03		"	"	66
4. 1980	03/03 to 12/03		"	"	40
5. 1981	24/02 to 31/03		"	"	104
6. 1982	05/03 to 02/04		"	"	79
7. 1983	10/02 to 19/03		"	"	105
8. 1984	15/02 to 19/03		"	"	85
9. 1985	09/02 to 10/03		"	"	98
10. 1986	03/02 to 12/03		"	"	92
11.					
12.					

¹For each vessel used give:

Vessel Name:	1. <u>CRYOS</u>	2. <u> </u>	3. <u> </u>	4. <u> </u>
Length (LOA)m:	<u>48.70</u>	<u> </u>	<u> </u>	<u> </u>
Tonnage (GRT):	<u>598</u>	<u> </u>	<u> </u>	<u> </u>
Horsepower:	<u>1380</u>	<u> </u>	<u> </u>	<u> </u>

²For each gear provide a description on a separate sheet, and provide a scale diagram if possible, which specifies no. and type of floats and rollers, chafers, mesh sizes, liners and their mesh sizes, etc.

SECTION B - VESSEL OPERATING PROCEDURES

For each of the following, describe procedures for each period that they apply and give precise dates of a change from one procedure to another.

<u>PROCEDURE</u>	<u>SPECIFICATIONS</u>	<u>DATES APPLICABLE</u>
Vessel speed during tow:	4 knots	since 1977
Duration of tow:	30 minutes	"
Distance towed:	About 2 nautical miles	"
Area swept by trawl: (as used in abundance estimation)	0.015 square nautical miles	"
How was area swept determined:	Assumed to be constant = trawled distance (2 nautical miles) by distance from wing to wing (13.50 m)	"
Trawl height when towing:	3.20 m	"
How was trawl height determined:	From specifications of the gear	"
Survey design (i.e. random, fixed stn., etc.):	stratified	"
Station selection procedure:	Random	"
Criteria used for changing position of a selected station:	Rough bottom and damages to gear observed in sets at same location in previous surveys	"
Criteria used for determining number of sets in each stratum:	Two to seven sets are chosen for each stratum, depending on its surface	"
Daily period of fishing (i.e. daylight only or 24 hrs?):	From 07:00 AM to 07:00 PM	"
Criteria for rejecting invalid sets:	- Serious damages to the gear - Set duration less than 20 minutes or more than 40 minutes	"

SECTION C - STATION DISTRIBUTION

For stratified surveys, complete the following table.

Is stratification used the NAFO scheme described in NAFO Studies No. 2 (Groundfish Surveys Manual) Yes x No .

If no, provide a map showing stratification scheme.

Stratum No.	No. of Sampling Units in Stratum	No. of valid sets in each stratum in each year											
		1977	1978	1979	1980	1981	1982	1983	1984	19 85	19 86	19	19
306	120		3	3	3	3	2	3	3	3	3		
307	110		2	3	3	3	3	3	3	3	2		
308	30		3	2	2	2	2	2	2	2	2		
309	80		4	3	3	3	3	3	3	3	3		
310	50	2	3	3	3	3	4	6	3	2	2		
311	90	2	2	3	3	3	5	4	3	4	4		
312	80	2	2	3	2	3	4	3	3	3	3		
313	50	2	2	3	1	4	5	3	3	4	5		
314	280	3	4	1		6	3	3	3	4	2		
315	240	4	4	4	1	4	4	4	6	2	3		
316	50	2	1	3	1	4	3	3	3	6	6		
317	50	2	2	3		4	3	3	3	5	5		
318	30	2	2	2		3	1	3	3	3	3		
319	280	5	5	5	3	5	6	8	5	6	6		
320	390	4	5	3		3	3	3	3	2	2		
321	340	6	4	4	3	6	4	7	5	5	3		
322	450	3	8	4	2	7	5	7	4	6	6		
323	200		3	4	3	4	3	4	4	4	3		
324	140					1		3	2	2	2		
325	280					4		4	3	4	2		
705	50		2	2	1	3	3	3	3	5	4		
706	140		3	1	1	5	3	4	3	4	4		
707	30			2		1	3	3	3	5	4		
708	30					5	2	1	3	3	2		
711	260					2		2					
712	270					2		2					
713	230					3							
714	340					3		2					
715	40		2	2	2	2	2	4	3	5	5		
716	150		3	3	3	3	3	5	3	3	6		
Total		39	69	66	40	104	79	105	85	98	92		

SECTION D - CATCH SAMPLING PROCEDURES

For each of the following, describe procedures for each period that they apply and give precise dates of a change from one procedure to another.

<u>PROCEDURE</u>	<u>SPECIFICATIONS</u>	<u>DATES APPLICABLE</u>
Catch sorting (all species or selected species?):	All species	since 1977
Weighing - by species for each catch? scales used? standard containers used? etc.:	by species for each catch, scale 0-50 kg used	"
Fish enumeration - how are numbers caught derived?:	measuring or counting and subsampling for big catches	"
Sampling for length		
a) measurement used i.e. FL or TL?:	TL	"
- to nearest cm or cm below?:	5cm below	"
b) subsampling procedures:	random	"
c) weighting up procedures from subsample to total catch:	weighting of total catch, except for very big catches more than 10 tons where estimation by volume is made	"
Sampling for age material		
a) subsampling method?:	stratified	
b) how many samples required by species/area?:	many small samples spread over the total area studied	"
c) for which species/areas are samples collected?:	cod, american plaice and witch flounder	"
Other sampling material routinely collected		
eg. individual fish weights, etc.:	/	

SECTION E - OCEANOGRAPHIC ACTIVITY

Describe standard procedures at each station and/or for each cruise.

Temperature profile for each set (XBT or Richardsons BT)

SECTION F - ANALYTICAL PROCEDURES FOR DETERMINATION OF ABUNDANCE INDICES

Provide example calculations for each of the standard abundance indices which have been used i.e. provided in SCR Docs. and in National Research Reports in the past. Give precise dates when each method was used.

This example should be in sufficient detail that STACREC could duplicate the procedure and, given the same input data, derive precisely the same output.

For cod, strata 306 to 323, 705 and 706, 715 and 716 were selected for calculation of a standard abundance indice.

The following formulae (Pennington and Grosslein, 1978) are used for the calculation of the stratified mean \bar{Y}_{st} (weight or number per tow and its variance $V(\bar{Y}_{st})$):

$$\bar{Y}_{st} = \frac{1}{A} \cdot \sum_h A_h \cdot \bar{y}_h$$

$$V(\bar{Y}_{st}) = \frac{1}{A^2} \cdot \sum_h A_h^2 \cdot S_h^2 / N_h$$

where: A_h = area of the h th stratum

A = the total area

\bar{y}_h = sample mean catch per tow in the h th stratum

N_h = number of tows in the h th stratum

S_h^2 = sample variance in the h th stratum

The minimum trawlable biomass B is calculated by summing the biomass values obtained in each individual stratum by the swept-area method:

$$B = \sum_h B_h = \sum_h \frac{\bar{y}_h \cdot A_h}{b}$$

where: B_h = minimum trawlable biomass in the h th stratum

b = mean area swept per tow

The variance V_B of this estimate is given by:

$$V_B = \sum_h \frac{A_h^2 \cdot S_h^2}{b^2 \cdot N_h}$$

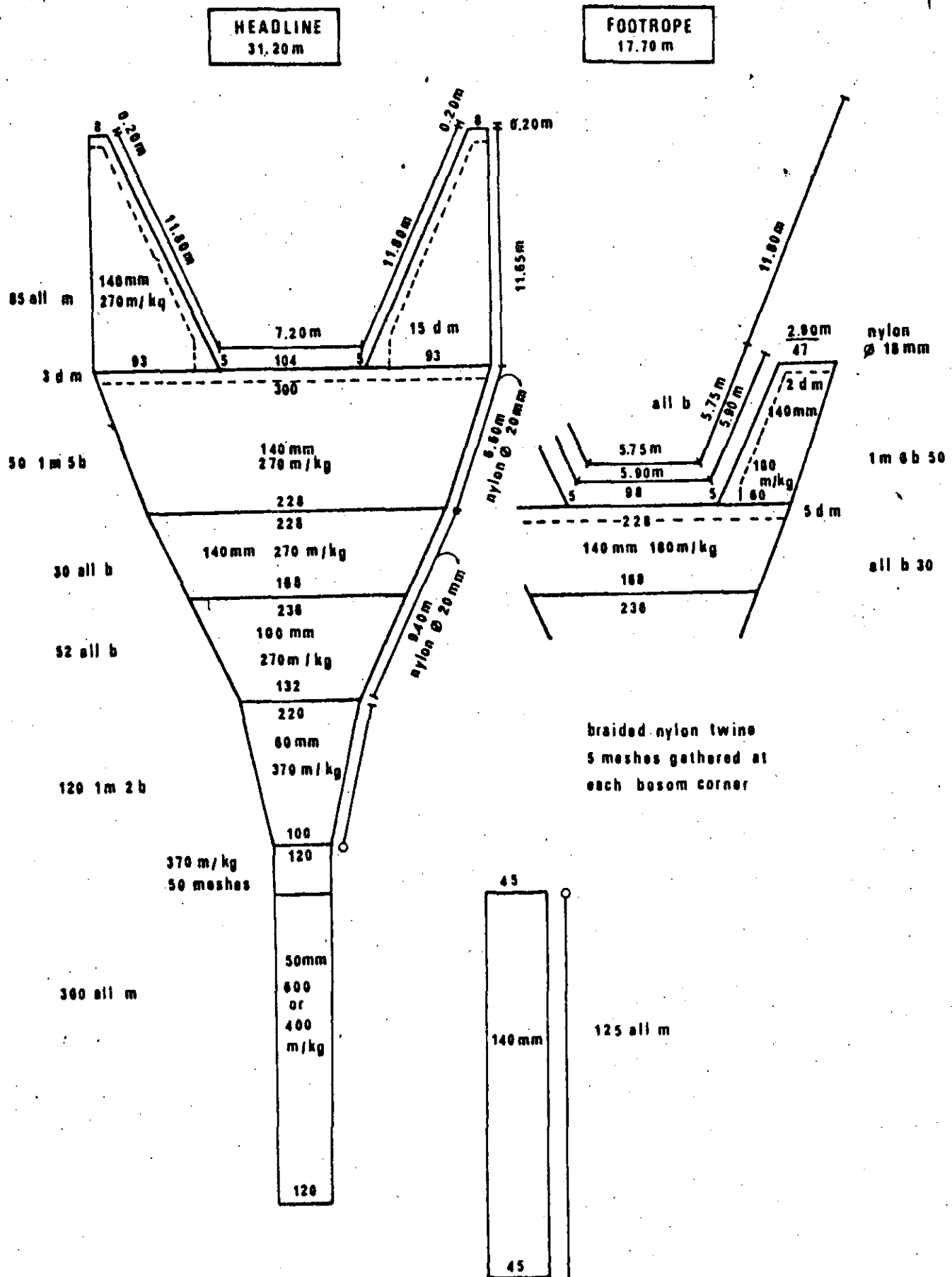
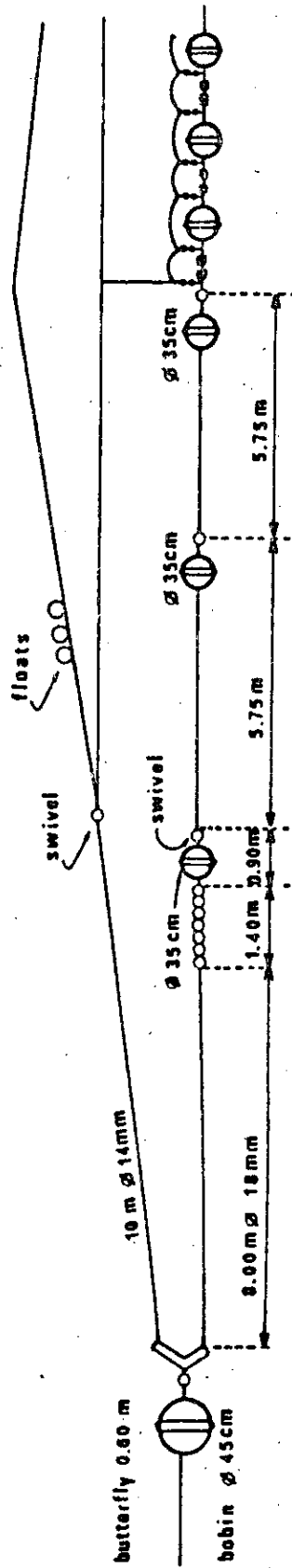


Fig.1 - Diagram of the standard trawl gear "Lofoten" used during the French research surveys on board the R/V CRYOS.



50 floats

plane oval trawl boards 3.10 = 1.80 m 1100 kg

opening : 5 m at 2.5 knts
3.20 m at 4 knts

sweepline : 50 m Ø 18 mm

Fig.2 - Rigging of the standard trawl gear "Lofoten" used during the French research surveys on board the R/V CRYOS

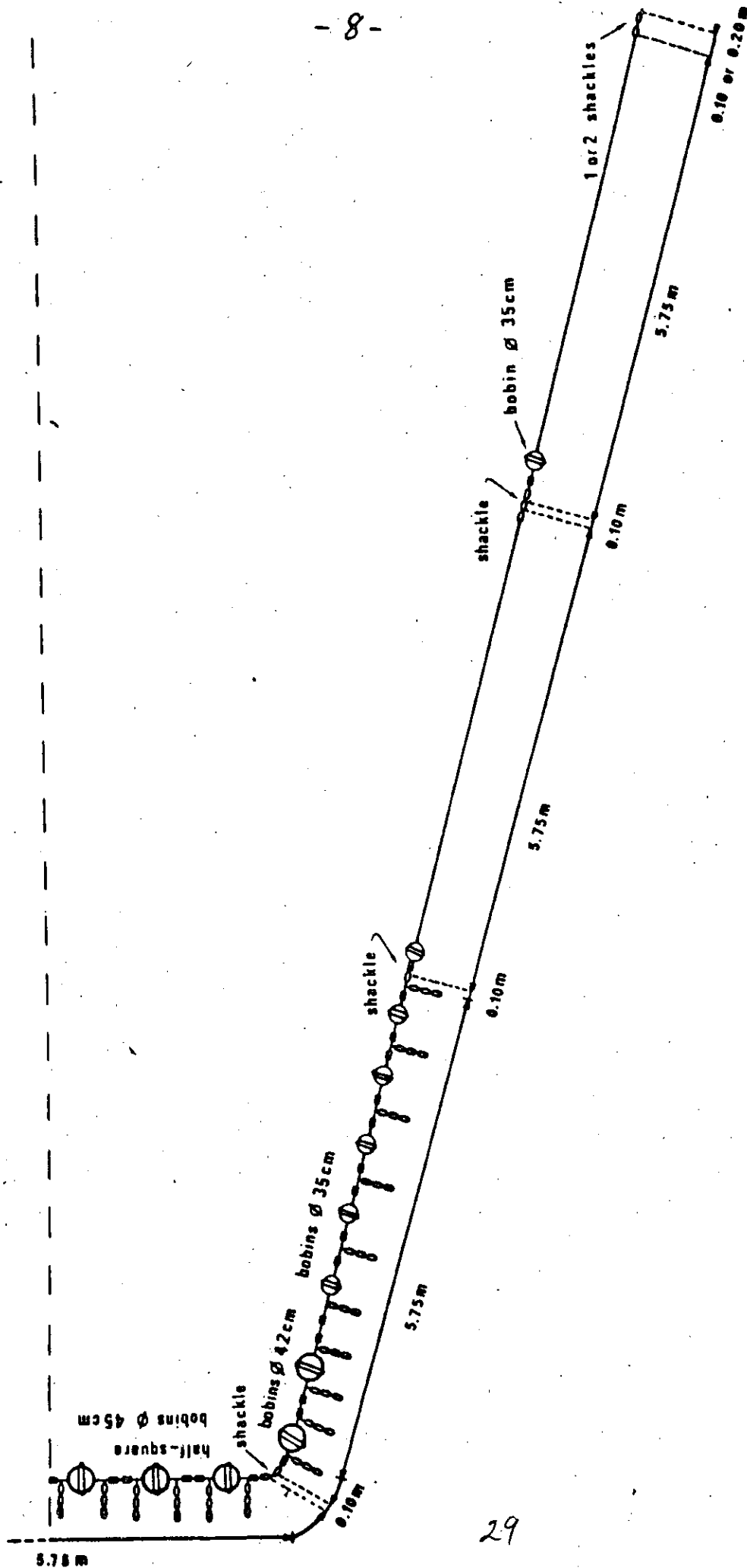


Fig.3 - Groundrope of the standard trawl gear "Lofoten" used during the French research surveys on board the R/V CRYOS



Documentation of Survey Procedures

Northwest Atlantic Fisheries Centre
St. John's, Nfld., Canada

One complete set of these forms (i.e. Sections A-F inclusive) is to be completed for each major survey series. If there is insufficient space, insert supplementary sheets.

SECTION A - GENERAL

Country: Canada

Laboratory: NAFC, St. John's, Nfld.

Purpose of Survey: (i.e. give title of this survey series e.g. summer groundfish bottom trawl survey in Div. 3NO)

Autumn groundfish bottom trawl surveys (stratified-random) in Division 2J.

<u>Times conducted</u>				<u>No. of</u>
<u>Year</u>	<u>Dates</u>	<u>Vessel Name</u> ¹	<u>Gear used</u> ²	<u>successful sets</u>
1. 1977	<u>Nov. 11 to Dec. 1</u>	GADUS ATLANTICA	Engel - 145	118
2. 1978	<u>Aug. 3 to Aug. 20</u>	" "	" "	61
3. 1978	<u>Nov. 10 to Nov. 27</u>	" "	" "	53
4. 1979	<u>Sept. 29 to Oct. 14</u>	" "	" "	44
5. 1979	<u>Nov. 22 to Nov. 30</u>	" "	" "	54
6. 1980	<u>Oct. 4 to Oct. 19</u>	" "	" "	48
7. 1980	<u>Nov. 25 to Dec. 3</u>	" "	" "	56
8. 1981	<u>Nov. 15 to Nov. 27</u>	" "	" "	102
9. 1982	<u>Oct. 31 to Nov. 15</u>	" "	" "	157
10. 1983	<u>Oct. 28 to Dec. 4</u>	" "	" "	129
11. 1984	<u>Oct. 28 to Nov. 14</u>	" "	" "	99
12. 1985	<u>Oct. 23 to Nov. 17</u>	" "	" "	131
13.				

¹For each vessel used give:

Vessel Name:	1. <u>GADUS ATLANTICA</u>	2. _____	3. _____	4. _____
Length (LOA)m:	<u>73.76 m</u>	_____	_____	_____
Tonnage (GRT):	<u>2351</u>	_____	_____	_____
Horsepower:	<u>4400</u>	_____	_____	_____

²For each gear provide a description on a separate sheet, and provide a scale diagram if possible, which specifies no. and type of floats and rollers, chafers, mesh sizes, liners and their mesh sizes, etc.

SECTION C - STATION DISTRIBUTION (Div. 2J)

For stratified surveys, complete the following table.

Is stratification used the NAFO scheme described in NAFO Studies No. 2 (Groundfish Surveys Manual) Yes X No

If no, provide a map showing stratification scheme.

Stratum No.	No. of Sampling Units in Stratum	No. of valid sets in each stratum in each year										
		1977	1978	1979	1980	1981	1982	1983	1984	1985	19	19
201	480	2	3	2	3	5	6	6	3	6		
202	150	2	4	4	4	2	2	2	2	2		
203	160	2	2	2	4	2	3	3	2	3		
204	120	2	2	2	1	2	3	3	2	2		
205	610	4	4	2	4	8	12	8	8	8		
206	860	11	7	8	7	11	18	14	11	14		
207	750	5	4	5	5	9	15	10	7	13		
208	150	4	5	4	4	2	3	2	3	3		
209	540	7	6	7	6	6	11	7	7	9		
210	260	6	7	4	5	3	6	2	4	4		
211	110	2	4	4	5	2	2	2	2	3		
212	220	4	2	2	2	2	5	3	3	4		
213	570	8	7	7	8	6	10	10	5	9		
214	390	6	7	6	5	5	8	8	4	6		
215	420	4	8	6	4	5	9	8	3	6		
216	130	2	2	4	4	2	2	3	2	2		
217	90	3	2	2	2	2	2	2		2		
218	140	2	2		2	2	2	2		2		
219	70		1			2		2		2		
220	110		2									
221	90											
222	150	4	5	4	4	2	3	3	3	2		
223	60	2	2	2	2	2	2	2	2	2		
224	90	2	2	2	2	2	2	2	2	2		
225	60	2										
226	60		2									
227	230	4	2	2	2	2	5	4	3	4		
228	480	8	3	6	5	6	10	6	7	7		
229	190	4	4	4	4	2	4	4	3	3		
230	80	3	2		2	2	2	2	2	2		
231	60	2	2		2		2	2	2	2		
232	80	2	2	1								
233	60											
234	170	2	5	4	4	2	3	3	2	3		
235	140	5	2	2	2	2	3	2	3	2		
236	40	2				2	2	2	2	2		

SECTION A - GENERAL

Country: Canada

Laboratory: NAFC, St. John's,
Nfld.

Purpose of Survey: (i.e. give title of this survey series e.g. summer groundfish
bottom trawl survey in Div. 3NO)

Autumn groundfish bottom trawl surveys (stratified-random) in
Division 3K.

Times conducted		Vessel Name ¹	Gear used ²	No. of successful sets
Year	Dates			
1. 1978	July 30 to Aug. 25	GADUS ATLANTICA	Engel-145	88
2. 1978	Nov. 4 to Nov. 27	" "	" "	70
3. 1979	Sept. 29 to Oct. 14	" "	" "	58
4. 1979	Nov. 15 to Dec. 4	" "	" "	69
5. 1980	Oct. 4 to Oct. 19	" "	" "	57
6. 1980	Nov. 22 to Dec. 8	" "	" "	78
7. 1981	Nov. 14 to Dec. 13	" "	" "	121
8. 1982	Oct. 30 to Dec. 8	" "	" "	146
9. 1983	Nov. 16 to Dec. 7	" "	" "	126
10. 1984	Oct. 27 to Dec. 5	" "	" "	163
11. 1985	Nov. 7 to Dec. 2	" "	" "	180
12.				
13.				
14.				
15.				

¹For each vessel used give:

Vessel Name:	1. <u>GADUS ATLANTICA</u>	3. _____	4. _____
Length (LOA)m:	<u>73.76 m</u>	_____	_____
Tonnage (GRT):	<u>2351</u>	_____	_____
Horsepower:	<u>4400</u>	_____	_____

²For each gear provide a description on a separate sheet, and provide a scale diagram if possible, which specifies no. and type of floats and rollers, chafers, mesh sizes, liners and their mesh sizes, etc.

SECTION C - STATION DISTRIBUTION (Div. 3K)

For stratified surveys, complete the following table.

Is stratification used the NAFO scheme described in NAFO Studies No. 2 (Groundfish Surveys Manual) Yes X * No .

If no, provide a map showing stratification scheme.

*Strata 618 and 619 added during 1984 (See Attached Map).

Stratum No.	No. of Sampling Units in Stratum	No. of valid sets in each stratum in each year											
		1978	1979	1980	1981	1982	1983	1984	1985	19	19	19	19
618	420							4	6				
619	480							7	7				
620	860	12	10	12	10	9	10	13	14				
621	900	12	11	13	11	14	12	14	15				
622	200	2	3	2	2	3	2	4	4				
623	320	3	4	6	4	5	6	5	6				
624	210	7	4	4	2	4	4	4	4				
625	270	6	5	6	4	2	3	5	5				
626	290	6	5	5	5	5	4	6	5				
627	380	6	3	2	6	7	6	8	7				
628	340	7	5	6	6	6	6	7	6				
629	160	6	2	5	3	2	3	4	4				
630	170	2	4	4	2		2	3	4				
631	380	2	3	3	5	2	5	5	7				
632	140	7	4	4	2	3	3	1	3				
633	690	9	10	10	8	7	12	10	12				
634	510	9	8	7	7	11	5	7	9				
635	400	9	8	6	5	5	6	8	7				
636	460	7	7	7	6	10	6	8	8				
637	360	9	7	6	6	7	5	6	7				
638	650	8	9	9	8	15	11	10	11				
639	460	9	4	6	6	10	7	8	8				
640	60	2		2	2	2		2	3				
641	180	2	2	2	2	4	3	3	4				
642	290	2	1	2	3	6		6	5				
643	400	2	2										
644	300	2	2										
645	60	2		2	2	3	2	2	3				
646	110	2	2	2	2	2	2	2	3				
647	130	2	2	2	2	2	1	1	3				
648	70	2											
649	80	2											

SECTION A - GENERAL

Country: Canada

Laboratory: NAFC, St. John's, Nfld.

Purpose of Survey: (i.e. give title of this survey series e.g. summer groundfish bottom trawl survey in Div. 3NO)

Spring groundfish bottom trawl surveys (stratified-random) in Division 3L.

Times conducted			Vessel Name ¹	Gear used ²	No. of successful sets
Year	Dates				
1. 1971	June 3 to June 18		A. T. CAMERON	Yankee #41-5	58
2. 1972	May 10 to May 18		" "	"	38
3. 1973	April 7 to May 6		" "	"	31
4. 1974	May 7 to May 21		" "	"	70
5. 1975	May 9 to May 25		" "	"	55
6. 1976	April 23 to May 3		" "	"	64
7. 1977	May 4 to May 18		" "	"	102
8. 1978	May 6 to May 17		" "	"	95
9. 1979	May 17 to June 4		" "	"	141
10. 1980	May 10 to June 2		" "	"	115
11. 1981	April 6 to May 7		" "	"	78
12. 1982	May 6 to May 17		" "	"	103
13. 1984	May 17 to May 21		ALFRED NEEDLER	Engel-145	37
14. 1985	April 17 to May 26		WILFRED TEMPLEMAN	" "	221
15.					

¹For each vessel used give:

Vessel Name:	1. A. T. CAMERON	2. WILFRED TEMPLEMAN	3. ALFRED NEEDLER	4. _____
Length (LOA)m:	51.21 m	50.29 m	50.29 m	_____
Tonnage (GRT):	753	925.03	925.03	_____
Horsepower:	1000	2000	2000	_____

²For each gear provide a description on a separate sheet, and provide a scale diagram if possible, which specifies no. and type of floats and rollers, chafers, mesh sizes, liners and their mesh sizes, etc.

SECTION C - STATION DISTRIBUTION (3L Spring)

For stratified surveys, complete the following table.

Is stratification used the NAFO scheme described in NAFO Studies No. 2 (Groundfish Surveys Manual) Yes X No .

If no, provide a map showing stratification scheme.

Stratum No.	No. of Sampling Units in Stratum	No. of valid sets in each stratum in each year													
		1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1984	1985
326	300							3		5		2	3	2	4
341	440			1				4	4	6	6	2	5	4	9
342	170							2	2	4	4		3	4	3
343	150							2	3	4	4	2	4		3
344	450						4	4	4	2	3	5	4		5
345	430						4	4	2	4	5	4	4		5
346	260					2	2	3		4	3	3	3		2
347	300	2			2	2	3	3	4	4	5	4	2		5
348	630	3	3		6	4	6	6	6	6	7	7	4		18
349	610	3	4		4	2	3	6	6	7	9	4	6	6	14
350	610	3	2	4	3	3	4	4	6	9	10	3	7	6	12
363	520	3	3	4	4	3	4	5	5	8	5	3	5	5	8
364	820	4	3		4	2	3	7	6	8	6	2	6	5	17
365	310	3	2		3	2	3	3	2	4	4	1	3		7
366	410	3			3	4	4	4	1	4	4	3	5		6
368	100	2			2	2	3	3		4	2	2	2		2
369	290	3			3	3	4	3	2	4	3	2	2		5
370	400	2	3		3	3	3	3	3	4	3	2	2		8
371	320	3	2		3			3	3	3	3	2	4		7
372	720	4	3	3	3	3	3	6	7	9	6	4	6	5	12
384	320	3	2	3	3			2	3	4	2	2	2		6
385	660	4	4	3	2	4	2	6	6	7	4	3	3		15
386	290	2			3	3	2	3	3	4	3	2	3		5
387	210	3		1	3	2	3	2	3	4	2	2	3		6
388	100	2		2	3	2	2	2	2	3	2	2	2		2
389	230	3	2	2	3	2	2	3	3	4	3	2	2		5
390	420	3	3	3	3	3		2	4	5	3	2	4		9
391	80		2	2	3	2		2	2	4	2	2	2		2
392	40			3	4	2		2	3	3	2	2	2		2
729	30														2
730	30														2
731	30														2
732	30														2
733	80														3
734	50														2
735	50											2			2
736	30														2

SECTION A - GENERAL

Country: Canada

Laboratory: NAFC, St. John's
Nfld.

Purpose of Survey: (i.e. give title of this survey series e.g. summer groundfish
bottom trawl survey in Div. 3NO)

Autumn groundfish bottom trawl surveys (stratified-random) in
Division 3L.

<u>Times conducted</u>		<u>Vessel Name¹</u>	<u>Gear used²</u>	<u>No. of successful sets</u>
<u>Year</u>	<u>Dates</u>			
1. 1978	<u>Aug. 16 to Aug. 29</u>	GADUS ATLANTICA	Engel - 145	44
2. 1981	<u>Oct. 3 to Nov. 18</u>	A. T. CAMERON	Yankee #41-5	97
3. 1982	<u>Oct. 30 to Dec. 6</u>	" "	" "	121
4. 1983	<u>Oct. 13 to Nov. 14</u>	WILFRED TEMPLEMAN	Engel - 145	126
5. 1984	<u>July 26 to Sept. 3</u>	" "	" "	209
6. 1985	<u>Oct. 9 to Nov. 18</u>	" "	" "	231
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				

¹For each vessel used give:

Vessel Name:	1. <u>GADUS ATLANTICA</u>	2. <u>A. T. CAMERON</u>	3. <u>W. TEMPLEMAN</u>	4. _____
Length (LOA)m:	<u>73.76 m</u>	<u>51.21 m</u>	<u>50.29 m</u>	_____
Tonnage (GRT):	<u>2351</u>	<u>753</u>	<u>925.03</u>	_____
Horsepower:	<u>4400</u>	<u>1000</u>	<u>2000</u>	_____

²For each gear provide a description on a separate sheet, and provide a scale diagram if possible, which specifies no. and type of floats and rollers, chafers, mesh sizes, liners and their mesh sizes, etc.

SECTION C - STATION DISTRIBUTION (3L Autumn)

For stratified surveys, complete the following table.

Is stratification used the NAFO scheme described in NAFO Studies No. 2 (Groundfish Surveys Manual) Yes X No .

If no, provide a map showing stratification scheme.

Stratum No.	No. of Sampling Units in Stratum	No. of valid sets in each stratum in each year										
		1978	1981	1982	1983	1984	1985	19	19	19	19	19
328	380					4	8					
341	440		3	4	4	5	7					
342	170		3	3	4	2	3					
343	150		4	1	3	4	3					
344	450	3	4	3	6	6	9					
345	430	2	4	6	8	7	9					
346	260	2	3	4	5	6	5					
347	300	3	3	4	6	6	4					
348	630		6	5	11	11	14					
349	610		7	5	9	14	10					
350	610		6	2	8	12	9					
363	520		4	3	3	8	10					
364	820		9	11	11	10	18					
365	310		4	4	5	4	8					
366	410	3	3	6	4	11	9					
368	100	2	2	2		2	2					
369	290	3	2	4	6	7	6					
370	400		4	6	6	7	9					
371	320		4	5	5	7	7					
372	720		5	7	4	13	17					
384	320		1	4	3	6	3					
385	660		8	8	5	12	12					
386	290	3	3	4		8	5					
387	210	2	2	3		3	4					
388	100	2		3		2	2					
389	230	3		4		6	5					
390	420		3	4	3	3	7					
391	80	2		2	2	2	2					
392	40			2	2	2	2					
729	30					2	2					
730	30	2				2	2					
731	30	2				2	2					
732	30	2				2	2					
733	80	2				4	3					
734	50	2				3	2					
735	50	2		2	1	3	2					
736	30	2			2	1	2					

SECTION A - GENERAL

Country: Canada

Laboratory: NAFC, St. John's,
Nfld.

Purpose of Survey: (i.e. give title of this survey series e.g. summer groundfish
bottom trawl survey in Div. 3NO)

Winter groundfish bottom trawl survey (stratified-random) in
Division 3M.

Times conducted		Vessel Name ¹	Gear used ²	No. of successful sets
Year	Dates			
1. 1977	Feb. 4 to Feb. 14	A. T. CAMERON	Yankee #41-5	36
2. 1978	Jan. 27 to Feb. 12	GADUS ATLANTICA	Engel - 145	134
3. 1979	Jan. 29 to Feb. 18	" "	" "	95
4. 1980	Jan. 6 to Jan. 21	" "	" "	130
5. 1981	Jan. 7 to Jan. 22	" "	" "	142
6. 1982	Jan. 28 to Feb. 14	" "	" "	109
7. 1983	Feb. 5 to Feb. 21	" "	" "	142
8. 1984	Feb. 2 to Feb. 14	" "	" "	129
9. 1985	Feb. 1 to Feb. 13	" "	" "	129
10.				
11.				
12.				
13.				
14.				
15.				

¹For each vessel used give:

Vessel Name:	1. A. T. CAMERON	2. GADUS ATLANTICA	3. _____	4. _____
Length (LOA)m:	51.21 m	73.76 m	_____	_____
Tonnage (GRT):	753	2351	_____	_____
Horsepower:	1000	4400	_____	_____

²For each gear provide a description on a separate sheet, and provide a scale diagram if possible, which specifies no. and type of floats and rollers, chafers, mesh sizes, liners and their mesh sizes, etc.

SECTION C - STATION DISTRIBUTION (3m)

For stratified surveys, complete the following table.

Is stratification used the NAFO scheme described in NAFO Studies No. 2 (Groundfish Surveys Manual) Yes X No .

If no, provide a map showing stratification scheme.

Stratum No.	No. of Sampling Units in Stratum	No. of valid sets in each stratum in each year										
		1977	1978	1979	1980	1981	1982	1983	1984	1985	19	19
501	100	-	4	4	4	5	5	5	4	4		
502	250	5	11	6	11	11	11	11	10	10		
503	180	4	10	6	8	8	8	8	8	8		
504	100	2	6	4	4	5	5	5	4	4		
505	200	3	10	6	8	9	9	9	8	8		
506	150	3	8	6	6	7	7	7	6	6		
507	240	2	8	6	10	11	11	11	10	10		
508	190	4	9	6	8	9	9	9	8	8		
509	90	2	4	4	4	4	4	4	4	4		
510	280	4	14	6	12	13	13	13	12	12		
511	240	4	11	6	10	11	11	11	10	10		
512	200	-	5	6	8	9	4	9	8	8		
513	70	-	4	4	3	3	3	3	3	3		
514	170	2	8	6	7	8	8	8	7	7		
515	200	1	7	4	8	9	-	9	8	8		
516	190	-	4	6	8	9	-	9	8	8		
517	60	-	4	3	3	3	1	3	3	3		
518	60	-	2	3	3	3	-	3	3	3		
519	120	-	5	3	5	5	-	5	5	5		

SECTION A - GENERAL

Country: Canada

Laboratory: NAFC, St. John's,

Nfld.

Purpose of Survey: (i.e. give title of this survey series e.g. summer groundfish bottom trawl survey in Div. 3NO)

Spring groundfish bottom trawl surveys (stratified-random) in Division 3N.

Times conducted		Vessel Name ¹	Gear used ²	No. of successful sets
Year	Dates			
1. 1971	Feb. 28 to March 8*	A. T. CAMERON	Yankee #41-5	45 (sets ATC 183)
	June 9 to June 13			
2. 1972	May 4 to May 12	" "	" "	45
3. 1973	April 9 to May 4	" "	" "	49
4. 1974	May 8 to May 13	" "	" "	37
5. 1975	May 21 to May 24	" "	" "	22
6. 1976	April 8 to April 13	" "	" "	30
7. 1977	May 26 to June 2	" "	" "	48
8. 1978	June 2 to June 7	" "	" "	39
9. 1979	April 21 to May 5	" "	" "	82
10. 1980	May 1 to May 10	" "	" "	81
11. 1981	May 4 to May 21	" "	" "	55
12. 1982	April 17 to April 26	" "	" "	61
13. 1984	April 30 to May 6	ALFRED NEEDLER	Engel-145	60
14. 1985	April 18 to May 5	WILFRED TEMPLEMAN, ALFRED NEEDLER	" "	85
15.				

¹For each vessel used give:

Vessel Name:	1. A. T. CAMERON	2. ALFRED NEEDLER	3. W. TEMPLEMAN	4. _____
Length (LOA)m:	51.21 m	50.29 m	50.29 m	_____
Tonnage (GRT):	753	925.03	925.03	_____
Horsepower:	1000	2000	2000	_____

²For each gear provide a description on a separate sheet, and provide a scale diagram if possible, which specifies no. and type of floats and rollers, chafers, mesh sizes, liners and their mesh sizes, etc.

*ATC 183, Feb. 28-March 8, 1971. Line survey which was post-stratified.

SECTION C - STATION DISTRIBUTION (D.W. 3N)

For stratified surveys, complete the following table.

Is stratification used the NAFO scheme described in NAFO Studies No. 2 (Groundfish Surveys Manual) Yes X No .

If no, provide a map showing stratification scheme.

Stratum No.	No. of Sampling Units in Stratum	No. of valid sets in each stratum in each year													
		1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1984	1985
357	40	3		2				2		3	3	2	2	2	2
358	50	3	4	3				2		2	3	3	2	2	2
359	110	5	3	3			3	2		4	4	3	2	2	2
360	840	4	4	1		4	4	4	4	9	11	6	7	7	16
361	480	2	3	4	4	4	5	3	4	8	7	1	6	5	7
362	720	2	4	5	4	3	5	5	3	12	11	5	8	7	11
373	720	4	4	4	4		5	4	4	11	8	5	5	7	9
374	240	2	2	4	2	2		3	3	4	3	3	4	3	4
375	420	3	3	3	3	3		4	5	5	4	4	5	5	8
376	400		2	3		2	3	3	2	4	3	4	7	4	7
377	30	4	2	2	3	2		2	2	3	4	3	2	2	2
378	40	3	2	2	3			2	2	3	2	2	2	2	2
379	30	2		2	3			2	2	3	3	3	2	2	2
380	30		2	3	3			2		2	3	3	1	2	2
381	50	3	4	3	3	2		2	3	3	4	3	2	2	2
382	180	3	4	3	3		2	3	3	3	4	2	2	3	4
383	190	2	2	2	2		3	3	2	3	4	3	2	3	3
723	50														
724	40														
725	30														
726	20														
727	50														
728	40														

SECTION A - GENERAL

Country: Canada

Laboratory: NAFC, St. John's, Nfld.

Purpose of Survey: (i.e. give title of this survey series e.g. ~~summer~~ groundfish bottom trawl survey in Div. 3NO)

Spring groundfish bottom trawl surveys (stratified-random) in Division 30.

Times conducted		Vessel Name ¹	Gear used ²	No. of successful sets
Year	Dates			
1. 1973	<u>March 22 to May 1</u>	A. T. CAMERON	Yankee #41-5	46
2. 1975	<u>May 17 to May 24</u>	" "	" "	35
3. 1976	<u>April 2 to April 13</u>	" "	" "	46
4. 1977	<u>June 2 to June 7</u>	" "	" "	40
5. 1978	<u>May 26 to June 5</u>	" "	" "	51
6. 1979	<u>May 5 to June 25</u>	" "	" "	90
7. 1980	<u>April 11 to April 23</u>	" "	" "	59
8. 1981	<u>May 6 to May 22</u>	" "	" "	22
9. 1982	<u>March 27 to April 21</u>	" "	" "	75
10. 1984	<u>April 27 to May 8</u>	ALFRED NEEDLER	Engel-145	56
11. 1985	<u>April 11 to April 22</u>	" "	" "	93
12.				
13.				
14.				
15.				

¹For each vessel used give:

Vessel Name:	1. <u>A. T. CAMERON</u>	2. <u>ALFRED NEEDLER</u>	3. _____	4. _____
Length (LOA)m:	<u>51.21 m</u>	<u>50.29 m</u>	_____	_____
Tonnage (GRT):	<u>753</u>	<u>925.03</u>	_____	_____
Horsepower:	<u>1000</u>	<u>2000</u>	_____	_____

²For each gear provide a description on a separate sheet, and provide a scale diagram if possible, which specifies no. and type of floats and rollers, chafers, mesh sizes, liners and their mesh sizes, etc.

SECTION C - STATION DISTRIBUTION (Div. 38)

For stratified surveys, complete the following table.

Is stratification used the NAFO scheme described in NAFO Studies No. 2 (Groundfish Surveys Manual) Yes X No .

If no, provide a map showing stratification scheme.

Stratum No.	No. of Sampling Units in Stratum	No. of valid sets in each stratum in each year											
		1973	1975	1976	1977	1978	1979	1980	1981	1982	1984	1985	19
329	450	2	1	2	3	5	6	2	2	6	5	8	
330	540	6	3	3	3	6	7	2	4	7	4	10	
331	120	2	2	2		2	3	2		4	3	3	
332	280		2	3	3	3	4	2		4	2	5	
333	40		2	2	2	3	2	2		4	2	2	
334	20			2	2	3	3	2		4	2	2	
335	20	2		3	1	2	2	3		2	2	2	
336	30	3	2	2	2	2	4	2		2	2	2	
337	250	3	3	2	2	2	4	3		3	2	5	
338	500	5	2	3	4	5	7	5		5	5	9	
339	170	2	2			2	3		2	4	2	3	
340	490	1	3	6	3	3	7	2	3	6	4	9	
351	720	5	4	4	5	6	11	10	4	9	6	9	
352	720	5	4	4	5	4	12	11		7	7	11	
353	340	3	3	2	3	3	5	4	1	3	2	6	
354	130	3		3	2		4	3	2	2	2	3	
355	30	2	2	2			4	2	2	2	2	2	
356	20	2		1			2	2	2	1	2	2	
717	30												
718	30												
719	20												
720	30												
721	20												
722	30												

SECTION A - GENERAL

Country: Canada

Laboratory: NAFC, St. John's,
Nfld.

Purpose of Survey: (i.e. give title of this survey series e.g. summer groundfish
bottom trawl survey in Div. 3NO)

Spring groundfish bottom trawl surveys (stratified-random) in
Division 3Ps.

Times conducted		Vessel Name ¹	Gear used ²	No. of successful sets
Year	Dates			
1. 1972	March 21 to March 29	A. T. CAMERON	Yankee 41-5	44
2. 1973	March 16 to March 22	" "	" "	55
3. 1974	April 20 to April 30	" "	" "	81
4. 1975	June 3 to June 12	" "	" "	62
5. 1976	May 12 to June 6	" "	" "	117
6. 1977	April 16 to April 25	" "	" "	102
7. 1978	Feb. 23 to April 13	" "	" "	106
8. 1979	Feb. 20 to March 5	" "	" "	81
9. 1980	March. 20 to April 2	" "	" "	81
10. 1981	March 9 to March 26	" "	" "	71
11. 1982	May 29 to June 8	" "	" "	92
12. 1983	April 23 to May 8	ALFRED NEEDLER	Engel - 145	171
13. 1984	April 10 to April 17	" "	" "	95
14. 1985	March 8 to March 25	WILFRED TEMPLEMAN	" "	112
15.				

¹For each vessel used give:

Vessel Name:	1. <u>A. T. CAMERON</u>	2. <u>ALFRED NEEDLER</u>	3. <u>W. TEMPLEMAN</u>	4. _____
Length (LOA)m:	<u>51.21 m</u>	<u>50.29 m</u>	<u>50.29 m</u>	_____
Tonnage (GRT):	<u>753</u>	<u>925.03</u>	<u>925.03</u>	_____
Horsepower:	<u>1000</u>	<u>2000</u>	<u>2000</u>	_____

²For each gear provide a description on a separate sheet, and provide a scale diagram if possible, which specifies no. and type of floats and rollers, chafers, mesh sizes, liners and their mesh sizes, etc.

SECTION C - STATION DISTRIBUTION (Div. 3Ps)

For stratified surveys, complete the following table.

Is stratification used the NAFO scheme described in NAFO Studies No. 2 (Groundfish Surveys Manual) Yes X No .

If no, provide a map showing stratification scheme.

Stratum No.	No. of Sampling Units in Stratum	No. of valid sets in each stratum in each year													
		1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
306	120			6	4	6	6	9	5	2	3	3	4	2	2
307	110	3	5	7	4	4	4	7	4	2	3	4	4	2	3
308	30		2	2	4	2	4	2	4	2	2	2	3	2	2
309	80	2	3	4	6	7	6	9	6	2	2	2	3	2	3
310	50	1	1	3	6	5	6	9	6	2	2	3	3	2	3
311	90	4	9	8	4	6	4	8	4	2	2	3	3	2	4
312	80	2	1	2	3	5	4	2	3	1	2	2	3	2	2
313	50	2	2	5	3	6	10	5	5	2	2	2	3	2	2
314	280	2		2		2	4	3	1	2	5	5	7	4	7
315	240	2	2	2		2	4		3	4	2	3	8	5	7
316	50	2	3	6	1	4	6	6	3	2	2	1	4	2	3
317	50	4	7	8	4	4	4	4	3	2	2	3	3	2	2
318	30	1	2	2	4	7	6	2	2	2		2	3	2	
319	280	4	5	2	4	4	6	4	2	4	2	7	7	6	2
320	390		2	1		3			1	6	2	4	14	8	5
321	340	2	2	1		2		3		5	2	4	10	6	7
322	450		1			4		2	2	8	2	8	11	8	13
323	200	3	1			4	2	3		3	2	2	6	4	3
324	140					2			2	2		2	4	3	2
325	280		1			2		2	2	4	2	5	8	5	3
326	50							2	2	2	2	2	3	2	
705	50	2	2	4	2	5	4	5	4	2	2	2	3	2	2
706	140	2	2	7	1	4	4	2	3	2	2	4	5	2	4
707	30	2		2	4	6	4	2	2	2			3	2	
708	30				3	3	4	1	2	2			2	2	
709	30					2							2	2	
710	10												3	2	2
711	260					2				2	2	2	8	5	8
712	270					2			2	2	2	3	7		6
713	230				3	2				2	6	2	7		8
714	340					2		2	1	2	8	6	10		1
715	40	2	1	4	2	5	4	6	3	2	2	2	3	2	1
716	150	2	1	3		3	6	6	4	2	4	2	4	3	5

SECTION B - VESSEL OPERATING PROCEDURES (Common for all series)

For each of the following, describe procedures for each period that they apply and give precise dates of a change from one procedure to another.

<u>PROCEDURE</u>	<u>SPECIFICATIONS</u>	<u>DATES APPLICABLE</u>
Vessel speed during tow:	3.5 knots	
Duration of tow:	30 minutes	
Distance towed:	1.75 nautical miles	
Area swept by trawl: (as used in abundance estimation)	45' x 1.75 nautical miles	
How was area swept determined:	The wing spread of the trawl times the distance towed, calculated by the speed of the vessel and the duration of the tow.	
Trawl height when towing:	About 8 feet. Not considered in abundance estimation.	
How was trawl height determined:	Based upon specifications of otter trawls reported by Carrothers (1974).	
Survey design (i.e. random, fixed stn., etc.):	Randomly selected stations within the strata.	
Station selection procedure:	As per "Manual on Groundfish Surveys in the Northwest Atlantic" by W. G. Doubleday, 1981.	
Criteria used for changing position of a selected station:	As per "Manual on Groundfish Surveys".	
Criteria used for determining number of sets in each stratum:	As per "Manual on Groundfish Surveys".	
Daily period of fishing (i.e. daylight only or 24 hrs?):	24 hours.	
Criteria for rejecting invalid sets:	As per "Manual on Groundfish Surveys".	

SECTION D - CATCH SAMPLING PROCEDURES (Common for all series)

For each of the following, describe procedures for each period that they apply and give precise dates of a change from one procedure to another.

<u>PROCEDURE</u>	<u>SPECIFICATIONS</u>	<u>DATES APPLICABLE</u>
Catch sorting (all species or selected species?):	All species.	
Weighing - by species for each catch? scales used? standard containers used? etc.:	By species for each catch using hanging scales and all standard fish baskets.	
Fish enumeration - how are numbers caught derived?:	By actual count. If catch large, then a random subsample is taken and adjusted up to total catch.	
Sampling for length		
a) measurement used i.e. FL or TL?:	Fork length to nearest centimetre.	
- to nearest cm or cm below?:	(For grenadier, snout to insertion of anal fin to nearest half centimetre.)	
b) subsampling procedures:	As per "Manual on Groundfish Surveys"	
c) weighting up procedures from subsample to total catch:	" "	
Sampling for age material		
a) subsampling method?:	" "	
b) how many samples required by species/area?:	" "	
c) for which species/areas are samples collected?:	" "	
Other sampling material routinely collected		
eg. individual fish weights, etc.:	Special samples are frequently frozen and brought back to the laboratory for detailed biological analysis.	

SECTION E - OCEANOGRAPHIC ACTIVITY (Common to all series)

Describe standard procedures at each station and/or for each cruise.

The standard hydrographic and meteorological data are collected as per the procedures outlined in the "Manual on Groundfish Surveys in the Northwest Atlantic". (Doubleday 1981).

SECTION F - ANALYTICAL PROCEDURES FOR DETERMINATION OF ABUNDANCE INDICES

Provide example calculations for each of the standard abundance indices which have been used i.e. provided in SCR Docs. and in National Research Reports in the past. Give precise dates when each method was used.

This example should be in sufficient detail that STACREC could duplicate the procedure and, given the same input data, derive precisely the same output.

Generally, 3 types of indices have been used: mean number per tow, mean weight per tow, and mean number at age per tow, where all means are calculated on the basis of strata. These 3 indices can be expanded to reflect total abundance/biomass by multiplying the stratum means by the number of trawlable units in that stratum, and summing over all strata.

Mean number and weight per tow are calculated by the same method. The number and weight from each valid tow is standardized to represent the amount caught in 30 minutes. These are then averaged on a stratum by stratum basis. Each average is multiplied by the stratum weight (number of units in the stratum divided by the total units in all surveyed strata). These calculations are summed to give a final mean number/weight per tow.

Mean number at age per tow requires length frequency and age information. Length frequencies are adjusted, set by set, to represent the total catch in a 30 minute tow. Numbers at age are then obtained by applying an age length key, which combines otoliths over the NAFO Division in question or over several NAFO Divisions. Once the average number per tow at age has been calculated for each stratum, the process continues as described above.

For a description of the stratification schemes used, see Doubleday 1981. For detailed information on the methods used in calculating stratified abundance indices, see Smith and Somerton, 1981.

Carrothers, P. J. G. 1974. Descriptions of trawl-gear used for demersal species by the Canadian fleet in Subarea 5 and Statistical Area 6 during the period 1969 through 1972. ICNAF Res. Doc. 74/28, Ser. No. 3175, 12 p.

Doubleday, W. G. (editor). 1981. Manual on Groundfish Surveys in the Northwest Atlantic. Sci. Coun. Studies Number 2, NAFO, 55 p.

Smith, S. J., and G. D. Somerton. 1981. STRAP: A user-oriented computer analysis system for groundfish research trawl survey data. Can. Tech. Rep. Fish. Aquat. Sci. 1030, iv+66 p.

Specifications of the Standard (Yankee #41.5) net used by the
Canadian research vessel A. T. CAMERON during 1958-83

Headrope: Total length 24.1 m

Wing 9.9 m, 13 18 cm Phillips pat. deep sea aluminum floats

Bosom 7.3 m, 24 " " " " " " "

Wing 9.9 m, 13 " " " " " " "

Footrope: Total length 30.5 m

Wing 4.3 m Rounding footrope fibre bound wire

4.3 m Rubber discs

Bunt 3.4 m 5 36 cm steel bobbins

Bosom 6.1 m 6 53 cm steel bobbins

Bunt 3.4 m 5 36 cm steel bobbins

Wing 4.3 m Rubber discs

4.3 m fibre bound wire

Sections joined by 10 cm shackles (total of 6 shackles)

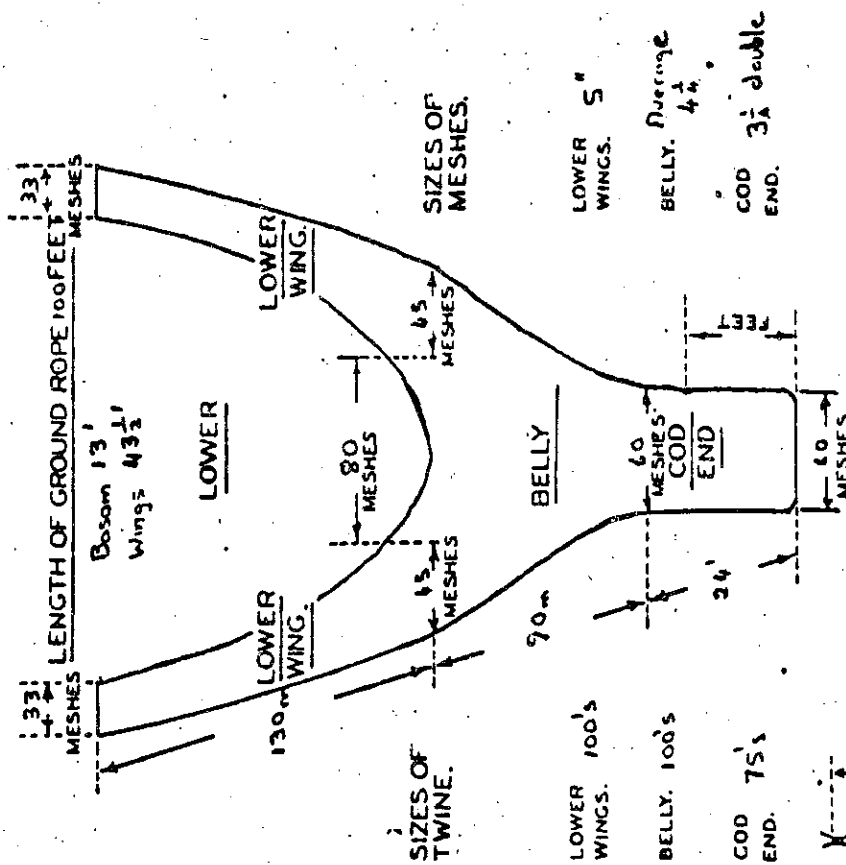
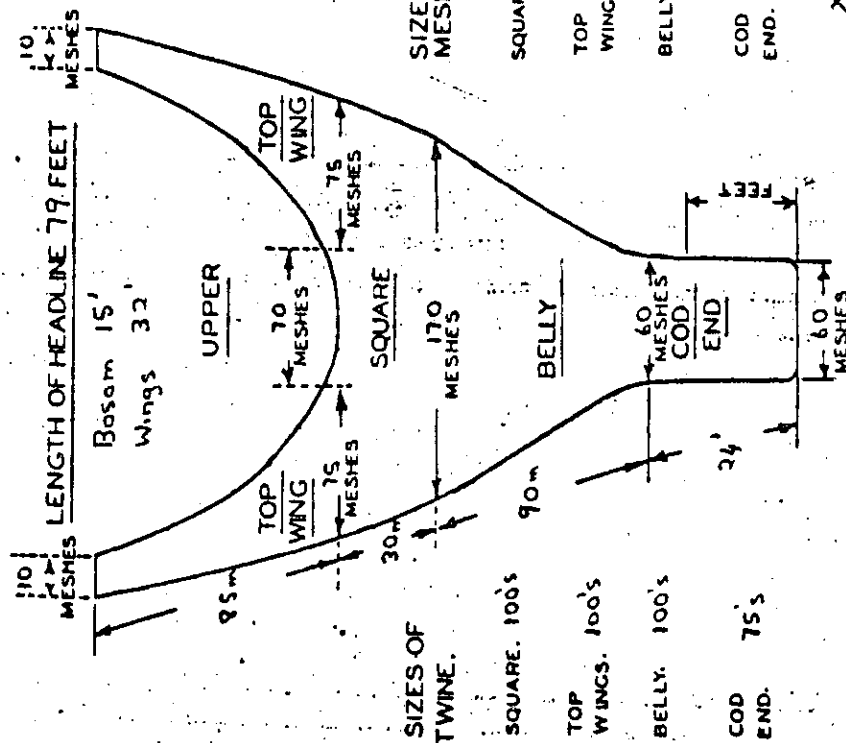
Danlenos: A 61 cm danleno ball (weight 113.4 kg) and danleno butterfly
(weight 39.9 kg) is used between each wing and the groundwarp.

Groundwarp: Each groundwarp is 40.2 m in length.

Doors: 3.2 m x 1.4 m Brampton Patent doors with two shoes, weight 680 kg
each.

STANDARD NET USED BY A.T. CAMERON 1958-1983 YANKEE # 41-5

DIAGRAM OF OTTER TRAWL



Trawling gear specifications used onboard the research vessel Wilfred Templeman and chartered vessel Gadus Atlantica with the Engel, s 145 foot bottom trawl.

	Wilfred Templeman	Gadus Atlantica
Type of trawl door	Oval polyvalent	Oval polyvalent
Size of door	2.8 m long x 1.7 m high 3.8 m ² 9'-3" long 5'-7" high	3.4 m long x 2.1 m high 5.6 m ² 11'-0" long x 7'-4" high
Weight of trawl door (in air)	1250 kgs 2756 lbs	1500 kgs 3307 lbs
Size of main warp	29 mm, 1 1/8" dia. 6x19	29 mm, 1 1/8" dia. 6x19
Size of ground warp	22 mm, 7/8" dia. 6x19	22 mm, 7/8" dia. 6x19
Length of Ground warp	9.14 m, 30 ft	9.14 m, 30 ft
Size of top bridle	16 mm, 5/8" dia. 6x19	16 mm, 5/8" dia. 6x19
Length of top bridle	39.92 m, 131 ft	39.92 m, 131 ft
Size of bottom bridle	22 mm, 7/8" dia 6x19	22 mm, 7/8" dia. 6x19
Length of bottom bridle	50 m, 164 ft	50 m, 164 ft
Type and size of headline	22 mm, 7/8" dia. comb. wire	22 mm, 7/8" dia. comb. wire
Length of headline	29.3 m, 96 ft. 2-38', 1-20'	29-3 m, 96 ft, 2-38', 1-20'
No. of floats on headline	100	100
No. of floats on each wing	35	40
No. on bosom	30	20
Type of floats	Deep sea aluminum	Plastic
Size of floats	203 mm, 8"	203 mm, 8"
Weights of floats	1.43 kgs, 3.15 lbs.	1.36 kgs, 3.0 lbs
Static Buoyancy	2.84 kgs, 6.25 lbs	
Max. working depth	1300 m, 720 fms	980 m, 530 fms.
Cod-end material	dbl knit 6 mm nylon	dbl knit 6 mm nylon
Liner material	29 mm, 1 1/8" mesh knotless nylon	29 mm, 1 1/8" mesh knotless nylon
Belly, wings and square material	Single knit 4 mm courlene twine	Single knit 4 mm nylon twine

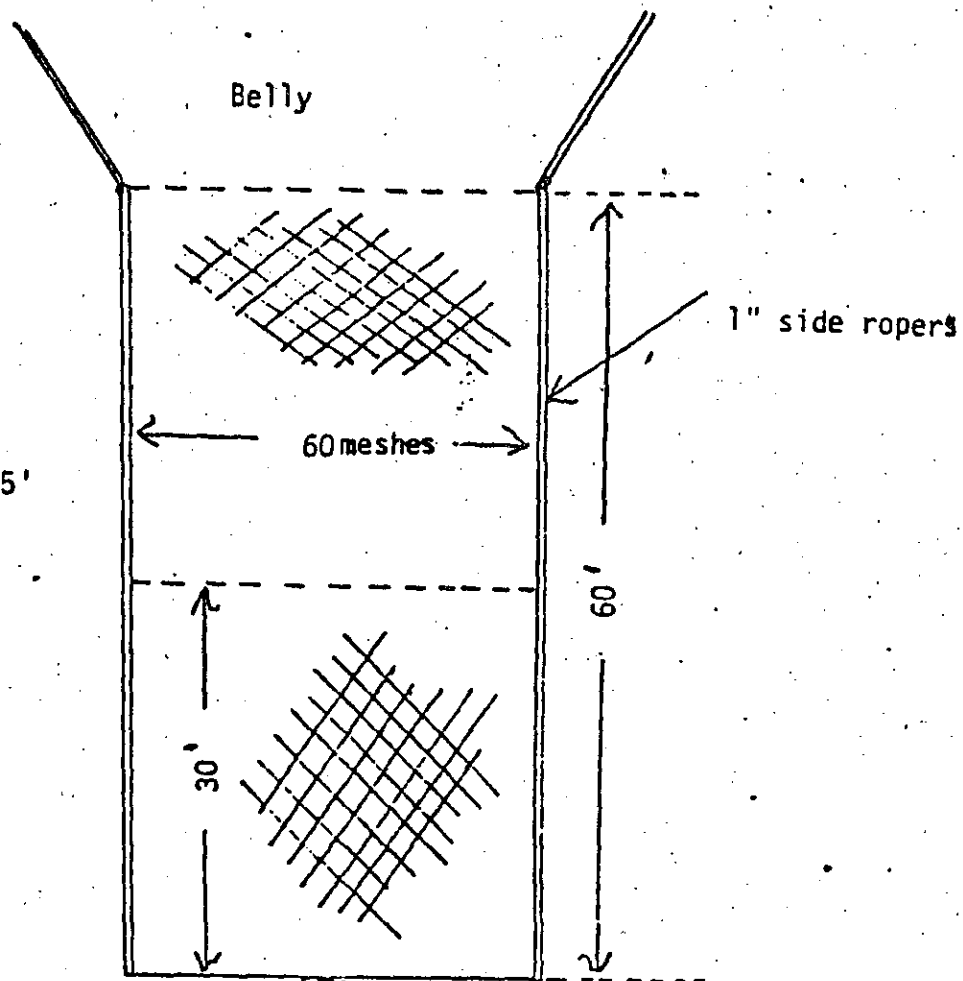
P.S. Previous to April 1984, the Wilfred Templeman used identical doors as the Gadus 1500 kgs. Polyvalent.

Cod-End

For Engels 145'
Otter Trawl

5 1/8" mesh double
knit nylon twine

This is the cod-end
Specifications to be
used on the Engels 145'
Trawl onboard the
Gadus Atlantica and
W. Templeman.

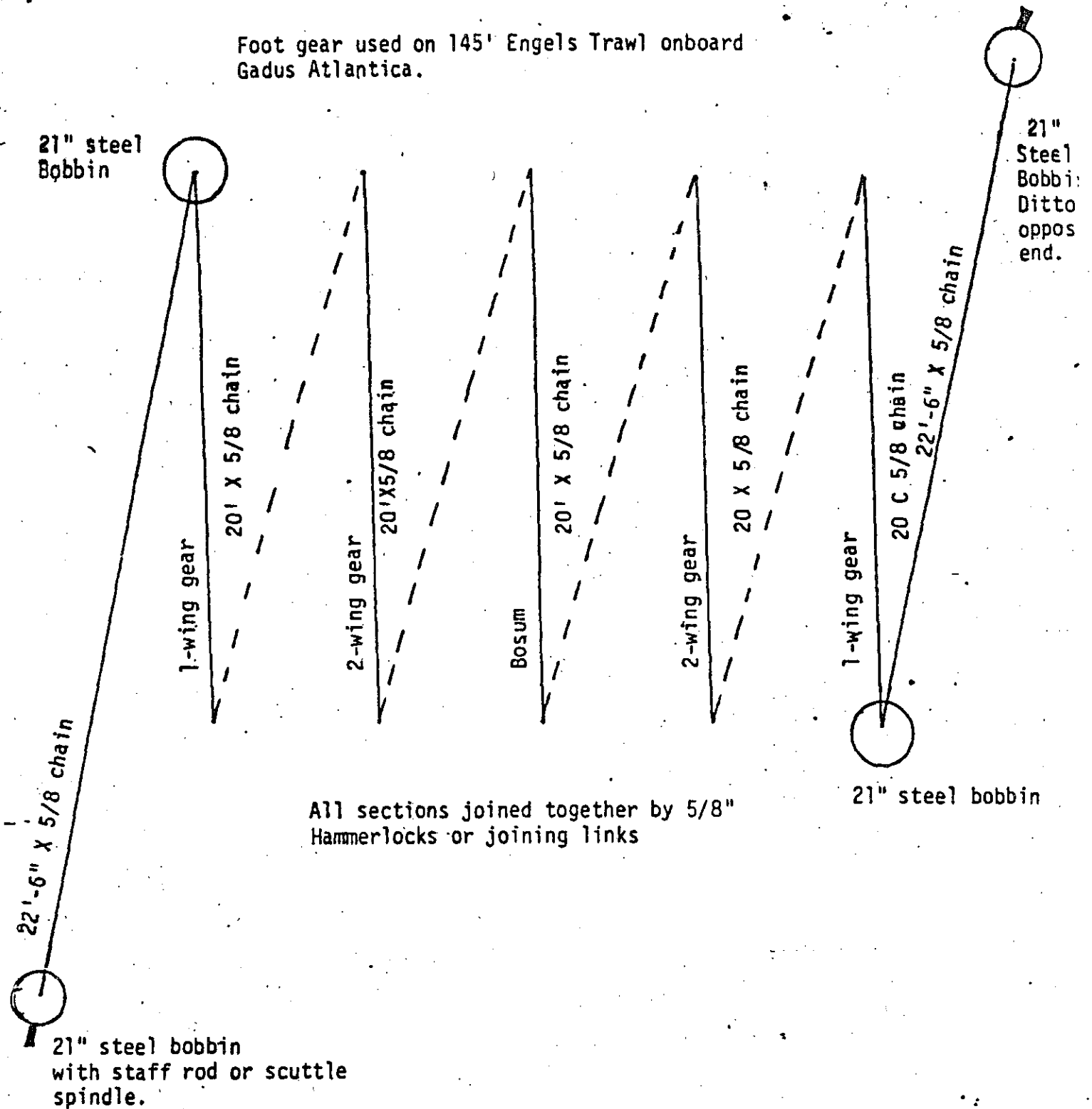


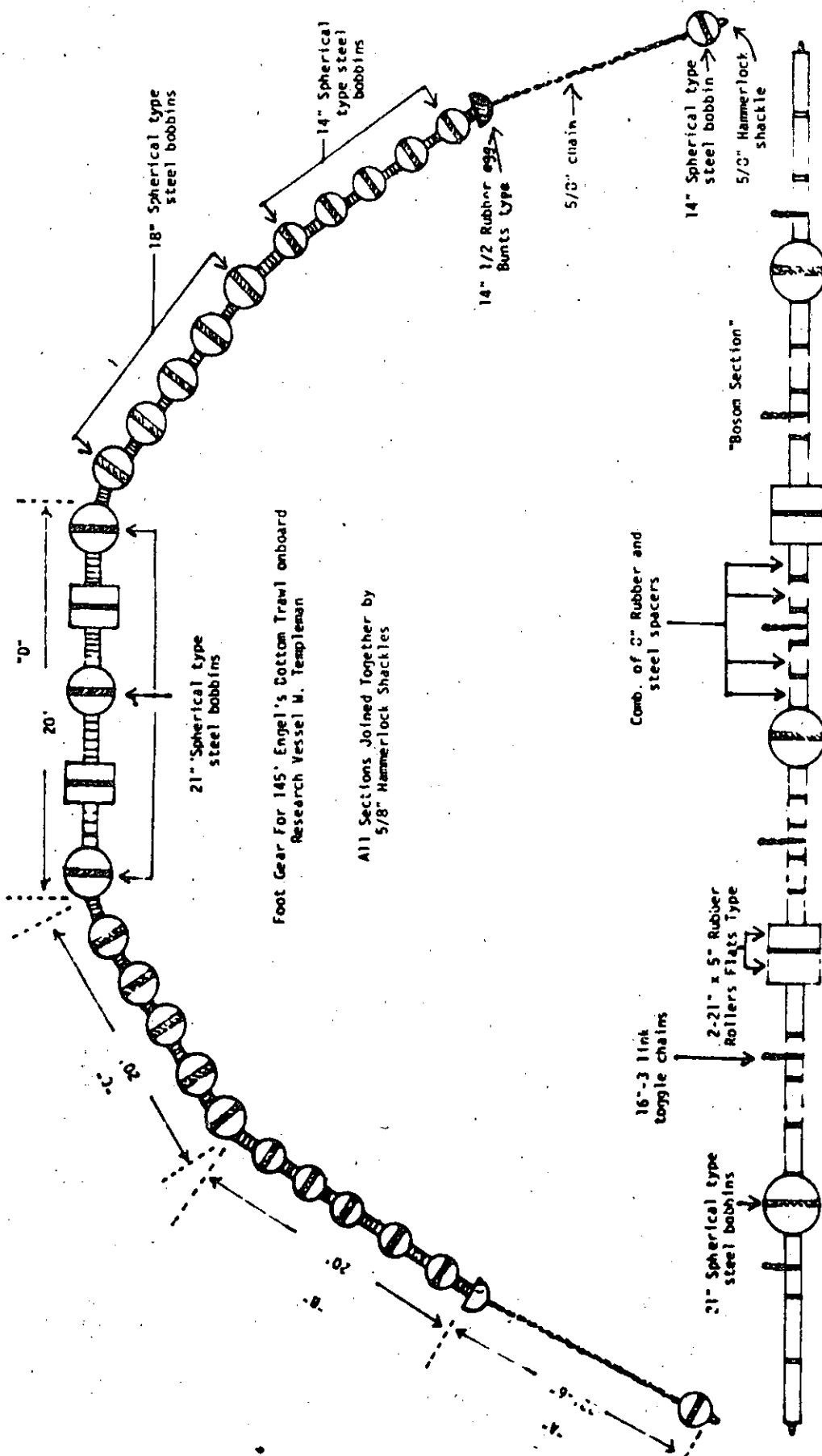
Cod-end one piece 60 ft long, instead of using extension
piece and cod-end.

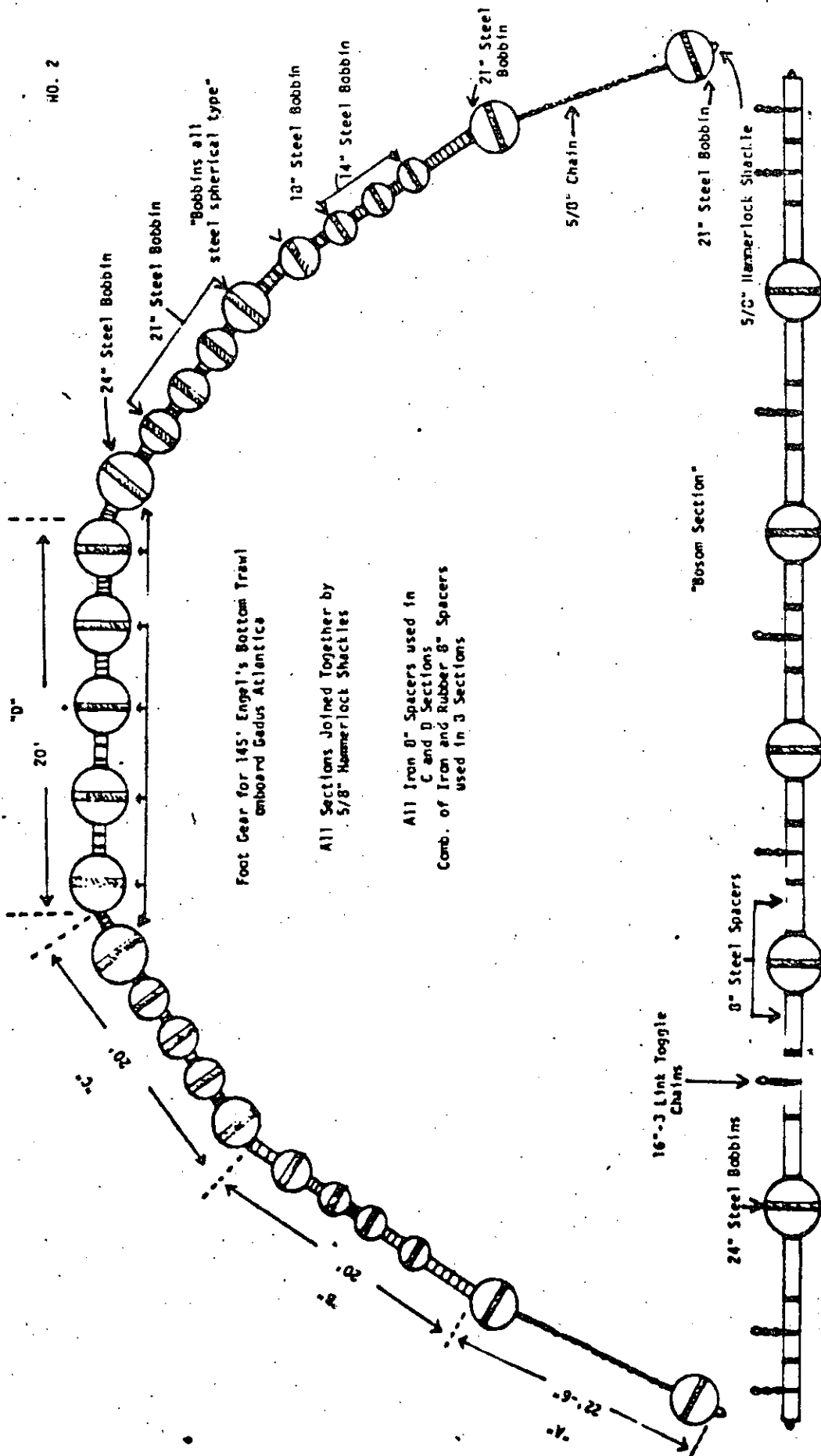
Liner 1 1/8" knotless nylon 35 ft long sewed in 30 ft up cod-end.

The Gadus Atlantica uses a shredded coulene rope chafer on bottom of cod-end.

Foot gear used on 145' Engels Trawl onboard
Gadus Atlantica.









Documentation of Survey Procedures

Federal Republic of Germany

SECTION A - GENERAL

Country: Federal Republic of Germany

Laboratory: Institut für See-
fischerei

Purpose of Survey: (i.e. give title of this survey series e.g. summer groundfish
bottom trawl survey in Div. 3NO)

Autumn groundfish bottom trawl survey in Div. 2J

Times conducted			Vessel Name ¹	Gear used ²	No. of successful sets
Year	Dates				
1. 19 72	21 Nov	to 26 Nov	AD	140' OTB	17
2. 19 73	17 "	to 23 "	WH	"	41
3. 74	29 "	07 Dec	AD	"	38
4. 75	27 "	08 "	AD	"	44
5. 76	28 Oct	11 Nov	WH	"	48
6. 77	25 Nov	06 Dec	AD	"	41
7. 78	27 "	02 "	AD	"	21
8. 79	27 "	10 "	WH	"	64
9. 80	03 "	17 Nov	AD	"	62
10. 81	23 "	09 Dec	AD	"	69
11. 82	29 Oct	13 Nov	AD	"	76
12. 83	24 "	08 "	AD	"	72
13. 84	no survey !				
14. 85	27 Oct	13 Nov	AD	"	72

¹For each vessel used give:

Vessel Name:	1. <u>ANTON DOHPN</u>	2. <u>WALTHER HERMIG</u>	3. _____	4. _____
Length (LOA)m:	<u>83.23</u>	<u>77.45</u>	_____	_____
Tonnage (GRT):	<u>1986.71</u>	<u>2250.52</u>	_____	_____
Horsepower:	<u>2400</u>	<u>4600</u>	_____	_____

²For each gear provide a description on a separate sheet, and provide a scale diagram if possible, which specifies no. and type of floats and rollers, chafers, mesh sizes, liners and their mesh sizes, etc. - Provided in M. KROEGER and K.H. KOCK, 1982
(Reference in Section B)

*) Reference

M. KPOEGER and K.H. KOCK, 1982: First Attempts to Quantify Variations in Behaviour of Groundfish Otter Trawls Used by the Federal Republic of Germany in North Atlantic Surveys. NAFO SCR Doc.82/VI/51.

SECTION B - VESSEL OPERATING PROCEDURES

For each of the following, describe procedures for each period that they apply and give precise dates of a change from one procedure to another.

<u>PROCEDURE</u>	<u>SPECIFICATIONS</u>	<u>DATES APPLICABLE</u>
Vessel speed during tow:	4.5 kn	whole time series
Duration of tow:	30 minutes	"
Distance towed:	2.25 nm	"
Area swept by trawl: (as used in abundance estimation)	0.0267 nm ²	"
How was area swept determined:	$\frac{\text{wing spread} \times 22 \text{ m}}{1852 \text{ m}} \times 2.25 \text{ nm}$	"
Trawl height when towing:	3.5 m	"
How was trawl height determined:	wing spread and Hydroacoustically by means of a multi-netsonde monitoring several recorders on headline and tips of the wings. Measurements were taken by turns each minute and for vessel speeds ranging from 3.0 - 5.0 knots. *	
Survey design (i.e. random, fixed strn., etc.):	Stratified-random, strata boundaries given by latitude and/or longitude and 100 m depth contours (level 1).	
Station selection procedure:	Strata divided into units of equal area equivalent to 5' latitude and 10' longitude (abt. 35 nm ²); level 2); each unit divided into 10 fishing or random units (abt. 3.5 nm ² , level 3) consecutively numbered within each stratum. Depending on the number of sets assigned to one stratum one or an equal number of random units per level 2 unit are selected at random. fishing positions are finally chosen so that the whole trawling track lies inside the selected random unit.	
Criteria used for changing position of a selected station:		
a) incorrect depth: next random unit within stratum depth range		
b) untrawlable ground: next trawlable random unit		
Criteria used for determining number of sets in each stratum:		
A given total number of sets, practicable according to vessel time available, distributed in proportion to strata areas.		
Daily period of fishing (i.e. daylight only or 24 hrs?):	daylight (dawn to dusk, abt. 10-12 hrs)	

Criteria for rejecting invalid sets: tows of less than 10 minutes duration and incidents seriously affecting fishing properties of the gear (net damage, incorrect gear performance,

SECTION C - STATION DISTRIBUTION

For stratified surveys, complete the following table.

Is stratification used the NAFO scheme described in NAFO Studies No. 2 (Groundfish Surveys Manual) Yes X No .

If no, provide a map showing stratification scheme.

Stratum No.	No. Sampl. Units/Strat.	No. of valid sets in each stratum in each year												
		AD 1972	WH 1973	AD 1974	AD 1975	WH 1976	AD 1977	AD 1978	WH 1979	AD 1980	AD 1981	AD 1982	AD 1983	AD 1985
m 201 101-200	480	-	2	2	2	2	1	-	4	2	5	4	4	2
205	580	1	4	5	5	4	4	-	6	5	5	4	4	2
206	860	4	6	5	6	6	5	4	8	8	8	7	8	6
207	750	2	3	3	3	4	1	5	5	3	7	1	-	4
201-300	150	-	-	-	1	2	1	-	2	2	2	2	3	2
209	540	3	4	3	4	4	3	3	5	4	3	4	5	8
210	260	-	1	-	2	3	2	2	3	5	2	3	5	2
213	570	2	3	2	3	4	3	-	5	5	4	5	3	4
214	390	-	2	4	2	3	3	-	3	2	4	9	10	11
215	420	3	2	2	1	3	3	-	4	4	4	10	6	8
228	480	-	4	6	5	4	4	4	4	7	3	5	5	5
234	170	-	-	-	2	2	2	-	2	3	2	-	2	1
301-400	160	-	-	-	-	-	-	-	-	-	2	2	3	2
208	150	-	-	-	-	-	-	-	-	-	1	2	3	3
211	110	-	1	-	-	-	-	1	-	-	2	2	1	-
216	130	1	2	2	4	2	2	-	2	1	2	1	3	2
222	150	-	2	2	1	-	2	-	2	2	2	2	2	2
229	190	-	2	-	1	2	2	2	2	2	1	3	1	1
204	120	-	-	-	-	-	-	-	-	-	2	2	3	-
217	90	-	1	-	-	-	1	-	2	2	2	1	-	2
223	60	-	1	1	-	1	2	-	2	2	2	2	-	1
227	230	1	1	1	2	2	-	-	3	3	3	3	-	3
235	140	-	-	-	-	-	-	-	-	-	1	2	1	1
Total		17	41	38	44	48	41	21	64	62	69	76	72	72

SECTION D - CATCH SAMPLING PROCEDURES

For each of the following, describe procedures for each period that they apply and give precise dates of a change from one procedure to another.

<u>PROCEDURE</u>	<u>SPECIFICATIONS</u>	<u>DATES APPLICABLE</u>
Catch sorting (all species or selected species?):	all species	throughout time series
Weighting - by species for each catch? scales used? standard containers used? etc.:	by species for each catch, scales; only in case of large catches of certain species at least weighing of 10 standard containers and applying av. weight to remaining number of standard containers.	
Fish enumeration - how are numbers caught derived?:	via length frequencies by species of total catch; via subsample length frequency in case of large catch:	
Sampling for length	Total n = $\frac{\text{Total weight} \times n \text{ sampled}}{\text{sample weight}}$	
a) measurement used i.e. FL or TL?: - to nearest cm or cm below?:	TL to cm below, TL to nearest cm (Grld. halibut and Am. Plaice by Canadian participants)	
b) subsampling procedures:	Random selection of weighted standard containers (50-60 kg each); one subsample consists of at least 200 fish.	
c) weighting up procedures from subsample to total catch:	already explained above!	
Sampling for age material	at least 10-15 fish per cm-group, stratified sampling distributed over whole survey area.	
a) subsampling method?:		
b) how many samples required by species/area?:		
c) for which species/areas are samples collected?:	routinely cod and redfish, occasionally (By Canadian participants) Grld halibut and Am. Plaice; grenadiers	
Other sampling material routinely collected		
eg. individual fish weights, etc.:	indiv. fish weights, especially cod; sex; maturity stages, etc.	



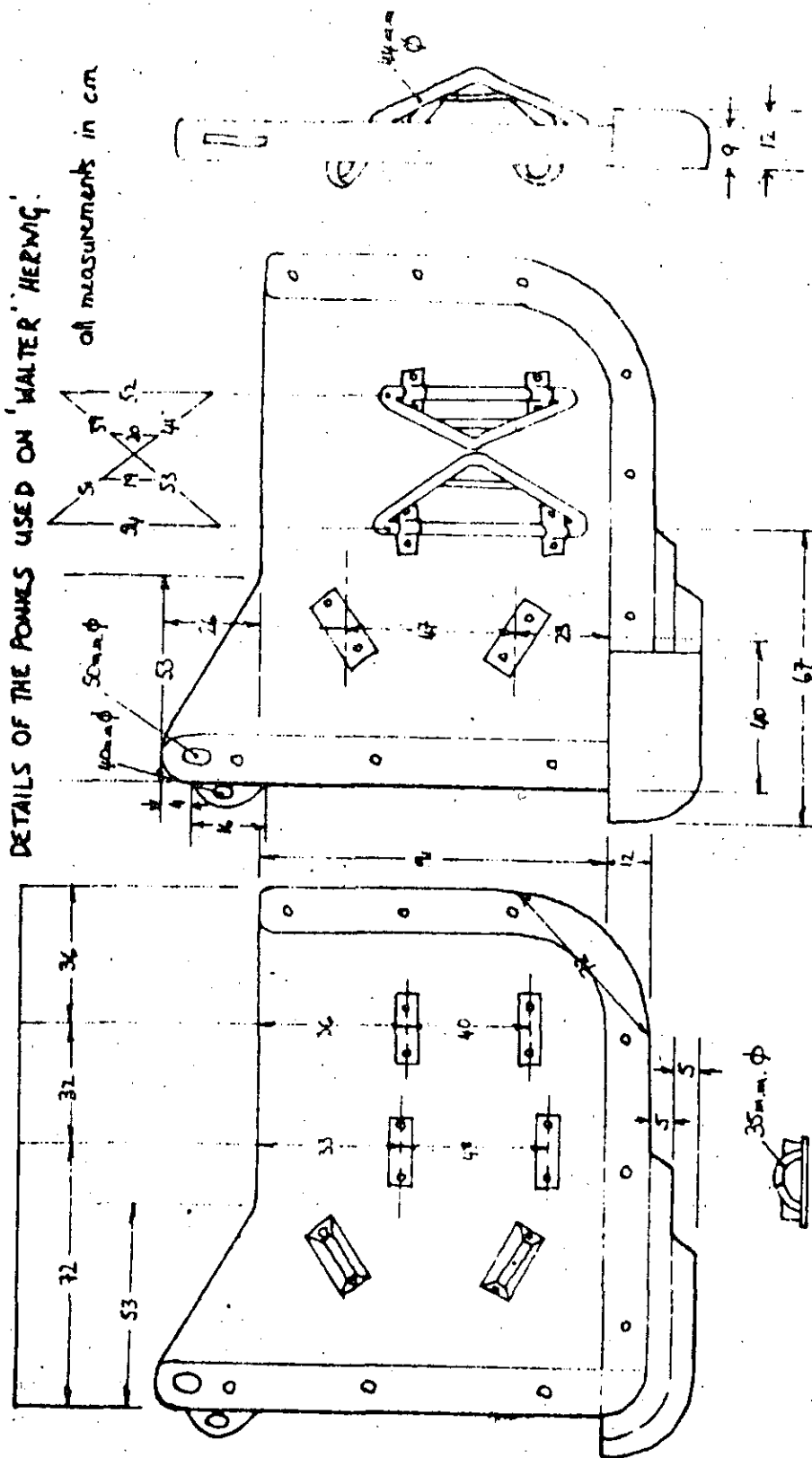


Fig. 3: Details of Ponies used on "Walther Herwig"

SECTION E - OCEANOGRAPHIC ACTIVITY

Describe standard procedures at each station and/or for each cruise.

*Temperature profiles for almost each
fishing station + NAFO standard sections
(Seal Island) obtained by BT, Vanner bottles
or CTD.*

SECTION F - ANALYTICAL PROCEDURES FOR DETERMINATION OF ABUNDANCE INDICES

Provide example calculations for each of the standard abundance indices which have been used i.e. provided in SCR Docs. and in National Research Reports in the past. Give precise dates when each method was used.

This example should be in sufficient detail that STACREC could duplicate the procedure and, given the same input data, derive precisely the same output.

will be submitted later.

SCIENTIFIC COUNCIL MEETING - SEPTEMBER 1987

Summary of Survey Documentation for Consideration of STACREC WG on Survey Procedures

by

W. B. Brodie

Science Branch
Department of Fisheries and Oceans
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St. John's, Newfoundland A1C 5X1

Introduction

In 1986, information on research vessel surveys conducted by France, Federal Republic of Germany, USSR, and Canada was presented to NAFO. This documentation covered surveys in Subareas 0, 2, and 3 and was prepared along the guidelines set forth by STACREC in September 1985. The working group established to review this documentation met briefly in June, 1987, at which time it was recommended that a summary be prepared for the working group to examine in September, 1987.

It is the purpose of this paper to summarize briefly the contents of the four survey documentation papers (1 Res. Doc, 3 working papers) presented to NAFO at an earlier date. This review will concentrate on pointing out differences which have occurred in the survey series over time, including changes affecting vessels, gear, survey design and coverage, and data collection. A brief account of the use of the relevant survey data in the 1986 stock assessment will also be included where possible. This material should be reviewed by the working group for the purpose of "recommending to STACREC appropriate measures for the future improvement of various time series of survey data and the most appropriate methods of analyzing historical data to derive abundance indices for stock assessment purposes" (NAFO Redbook 1985, p. 95).

Surveys conducted by France

A) NAFO Subdivision 3PS

Stratified-random surveys on the research vessel CRYOS were conducted in the February-March period, from 1977 to 1986, using the stratification scheme outlined in NAFO studies #2 (Groundfish Surveys Manual). All vessel operating procedures and survey designs/operations were identical over this period. Survey coverage was lower in 1977-80 (average 54 sets) than in 1981-86 (average 94 sets). Several strata were chosen to provide an index of abundance for cod, and all were surveyed in 1981-86, but a few were omitted in some of the 1977-80 surveys.

Of the survey series examined, this is probably the one which has undergone the fewest changes. Virtually all aspects of the survey have remained constant, with the exceptions of slight changes in the number of sets per stratum over time, and small differences in the timing of the surveys within February and March. It is noteworthy that these surveys have been conducted on a 12-hour a day basis (fishing 7 AM to 7 PM), which is different from most other survey series examined, which are carried out on a 24 hour basis.

In the most recent NAFO assessment of the 3Ps cod stock (Redbook 1986, p. 55) data from this survey series was examined and compared with Canadian survey data. STACFIS recommended that the data from the two sources be re-examined to account for differences in the results and that the surveys be co-ordinated to facilitate comparisons. Much of this work has been carried out in 1987.

Surveys conducted by Federal Republic of Germany

A) NAFO Division 2J

Stratified random surveys were conducted in the October to December period, from 1972 to 1983 and in 1985. Two vessels, the ANTON DOHRN and the WALTHER HERWIG were used at different times for these surveys, with the latter being utilized in the years 1973, 1975, and 1979. These vessels are somewhat similar in length and tonnage, although the W. HERWIG has about twice the horsepower. Given that the 2 vessels fished the same bottom trawl gear and that all other aspects of fishing were kept standard where possible over the entire time series, results from the surveys are considered to be unaffected by the change in vessel. Standard survey designs and operations were maintained throughout the survey series, with the exception of vessel.

The surveys in 1972 and 1973 were done using a preliminary stratification scheme, but were later post-stratified using the scheme outlined in the Groundfish Survey Manual. Survey coverage was minimal in 1972 and 1978 at 17 and 21 sets respectively, averaged 42 sets from 1973 and 1978 and increased to an average of 69 sets from 1979 onward. Most strata were surveyed in the recent time period, although 1 or more strata were omitted in all surveys except 1981.

Although no specific information on calculation of abundance indices was provided, the data from this survey series has been used to provide indices of abundance for at least one species (cod) based on the usual stratified mean methods. Like the French surveys discussed previously, these surveys were conducted only during daylight, or about 10-12 hours per day.

In the 1986 assessment of cod in Div. 2J, 3K, and 3L, the data from the Federal Republic of Germany surveys in Div. 2J was used to derive an index of abundance for cod aged 4 and over (Redbook 1986, p. 47). This was used in the assessment along with data from Canadian and USSR surveys.

This series of surveys was discontinued after 1985. Therefore no proposed improvements to future surveys will be offered and efforts should be concentrated on recommendations concerning methods of analysis of the historical data.

Surveys conducted by Canada

A) General

The vessel operating procedures, catch sampling methods, oceanographic activity and analytical procedures outlined in the Canadian documentation are identical for the 8 survey series in Div. 2J, 3K, 3L, 3M, 3N, 3O and Subdiv. 3Ps. Virtually all survey procedures, including the stratification schemes, were those outlined in the Groundfish Surveys Manual. In all cases, surveys were designed to operate on a 24-hour per day basis. In several of these series, a change in vessel occurred, from the side-trawler A. T. CAMERON in the 1971-82 period to the stern-trawlers ALFRED NEEDLER or WILFRED TEMPLEMAN after 1982. The latter vessels are identical in design, tonnage, and horsepower and used the same Engel 145 trawl when conducting the surveys in Subareas 2 and 3. The A. T. CAMERON used a Yankee 41-5 trawl in the surveys, and comparative fishing experiments resulted in establishment of conversion factors for American plaice and yellowtail between the A. T. CAMERON and W. TEMPLEMAN. Catches of cod were considered to be the same by each vessel/gear, and no other species besides these 3 were examined. All the surveys listed in this section, except that in Div. 3M, have continued in 1986 and some in 1987, however, the survey documentation available extends only to the 1985 surveys.

B) NAFO Div. 2J and 3K

Stratified random surveys were conducted, mainly in October-December, by the GADUS ATLANTICA from 1977 to 1985 in Div. 2J and 1978-85 in Div. 3K, subsequently continued in 1986. Although the Divisions are stratified separately, the surveys have usually been done by 2 or 3 consecutive trips of the vessel to the area of Div. 2J+3K over a 6 week period. Survey coverage in Div. 2J has ranged from 53 sets in 1978 to 157 in 1982, with an average of 110. In Div. 3K, coverage ranged from 70 sets in 1978 to 180 in 1985, averaging 134 sets. A separate 1978 survey conducted in August in Div. 2J and 3K is not usually included in the fall series.

Stratum by stratum coverage (down to depths of 1000 m) has been good in most years, with only a few strata missing in some surveys.

In 1984, 2 new strata were added to Division 3K to include near-shore areas less than 200 metres deep. Consequently, surveys from 1978-83 do not include any estimates for these strata.

Species of primary importance in these surveys are cod, Greenland halibut, American plaice, and redfish, and the survey data has been used in most of the recent assessments of the stocks of these species which occur in Div. 2J and 3K.

C) NAFO Div. 3LNO (spring)

Stratified random surveys were conducted, mainly during April and May, from 1971 to 1985 in Div. 3L and 3N and from 1973 to 1985 in Div. 3Ø. There was no survey in 1983, during the time of change-over of the vessels which was noted previously. In Div. 3L, survey coverage averaged 53 sets from 1971 to 1976 and 112 sets from 1977 to 85. The 1984 survey, consisting of only 37 sets, covered only a few strata and is generally considered to be of limited use. In Div. 3N, coverage averaged 38 sets from 1971 to 76 and 64 sets afterward. In Div. 3Ø, there was no survey in 1974 and with the exception of 1981 (22 sets), coverage was greater in the 1979-85 period (56-93 sets) than in the 1973-78 period (35-51 sets).

On a stratum by stratum basis, survey coverage varied widely in all 3 Divisions over the series. In Div. 3L, most strata were surveyed in 1977-82 and 1985, with several strata being omitted in the 1971-76 surveys, particularly 1973. In Div. 3N, coverage is virtually complete in most years, with 1974-76 having the most omitted strata. For Div. 3Ø, the 1981 survey covered less than half of the strata, with coverage being relatively good in most other years. For all 3 Divisions it is important to note that this series of surveys was designed to fish depths down to 200 fathoms, and therefore only a very few sets can be found in the strata covering the 201-400 fm range.

There are some important points to consider when examining data from these surveys. First, there is a difference of up to 2 months in the timing of the surveys in some years. Second, coverage is very poor in certain surveys, and the number of strata surveyed in some years is very low. This has resulted in the use of techniques such as selected strata and multiplicative models to derive abundance indices which are more appropriate than those derived from surveys with missing strata. Third is the change in vessel noted previously. Comparisons exist and are used for cod, American plaice and yellowtail, which are 3 of the major species encountered in the Div. 3LNO surveys, and three species for which these data are used in the assessment processes. Other species for which the survey data are used in stock assessment include witch, redfish and Greenland halibut.

D) NAFO Div. 3L (autumn)

Stratified-random surveys were conducted, mainly in October and November, from 1981 to 1985. A survey by the GADUS ATLANTICA in August 1978 consisted of only 44 sets and is not usually included with this series. The 1981 and 1982 surveys, by the A. T. CAMERON, consisted of 97 and 121 sets respectively, while the coverage in 1983, 84, and 85 by the W. TEMPLEMAN was 126, 209 and 231 sets respectively. Coverage was complete to 400 fathoms in 1984-85, and relatively good to depths of 200 fathoms in the other 3 surveys. Again, the change in vessel must be noted in this survey series as must the timing of the 1984 survey (August) compared to the others (generally October-November).

Data from this series are important for the assessment of cod in Div. 2J3KL in that the surveys in Div. 2J and 3K are also conducted in the autumn, providing a measure of abundance for the entire stock at the same time of the year. Data for other species, particularly American plaice, are also used, but at present are not important in the assessments because the fall series in Div. 3L is considerably shorter than the spring series.

E) NAFO Div. 3M

Stratified random surveys were conducted during January-February each year from 1977 to 1985. All except the first, which was done by the A. T. CAMERON, were conducted on the GADUS ATLANTICA. Survey coverage ranged from 36 sets in 1977 to 142 sets in 1981 and 1983, and was at least 95 sets in all surveys after 1977. All strata were surveyed each year except

1977 and 1982, when 7 and 4 strata respectively were omitted. Cod and redfish were the most important species in these surveys, which were discontinued after the 1985 cruise.

No conversion factors exist for the A. T. CAMERON vs GADUS ATLANTICA comparisons, although factors for some species exist for the A. T. CAMERON vs W. TEMPLEMAN comparison, and the W. TEMPLEMAN is a stern trawler which tows the same survey gear that the GADUS ATLANTICA uses. Therefore it may be possible to include the 1977 survey data with the 1978-85 series.

F) NAFO Subdiv 3Ps

Stratified random surveys were carried out, between February and June, in each year from 1972 to 1985. Coverage was slightly lower in the first 4 years of the series (44 to 81 sets) but averaged 103 sets from 1976 to 1985. Most of the strata were surveyed in recent years, although some gaps do exist. Several strata were omitted in some of the earlier surveys, particularly 1972 and 1974-75.

The surveys from 1972-82 were done by the A. T. CAMERON while the 1983-85 surveys were carried out by the W. TEMPLEMAN and A. NEEDLER. The previously discussed conversion factors have been used in this series of surveys. The difference in timing in some years should be noted, as it is often as much as 3-4 months between some years.

The major species in these surveys are cod, American plaice, and redfish. As noted earlier, data from French surveys in Subdiv. 3Ps have been used along with the Canadian data in the cod stock assessment.

Surveys conducted by the USSR

A) 1961-1970

These surveys were begun in December, 1961 and usually were done mainly in the December to February period from 1961-66 and usually in the April-June period after 1966. Conducted by side-trawlers and extending over most of Subareas 2 and 3, these surveys were aimed at quantitatively assessing the numbers of young cod, haddock, and redfish.

Apart from the change in timing which occurred in 1967, other changes also took place in the survey at that time. The design used in the earlier surveys was randomly chosen sets covering different depth ranges and the important fishery areas. The most successful fishing stations were occupied every year. From 1967 to 1970, a grid of fixed stations was surveyed, and the coverage was reduced substantially in Subarea 2. As well, with the change in timing, "young" cod and haddock were considered to be 40cm from 1967 on, compared to 35 cm in previous years while the "young" redfish category went from 15 to 20 cm.

There was also a change in the sampling procedure from 1968 on, when 300-500 young fish were taken from each Division over the survey for ageing. This compared to sampling all young fish in small catches and 100 individuals from large catches in the earlier surveys.

The average number per tow of the young fish aged 1, 2, and 3 years was used as an index of the abundance of these ages. Beyond these ages, use of these survey data was limited, as the total numbers of larger cod, haddock and redfish were not determined for each of the fishing sets.

The total coverage in these surveys ranged from 118 to 299 sets, extending in some years from Subarea 2 to 5. A breakdown by Division was not available. Four side-trawlers were involved in the surveys, excluding the stern-trawler PERSEY III which made a few sets in Div. 3K in 1970.

All side-trawlers fished the same gear and were approximately equal in size. Important factors to consider in this series are the changes in survey timing as well as the change in design. The impact of these factors on the abundance indices may be very difficult to quantify.

B) 1971-1982

These surveys were carried out by stern trawlers, usually between April and August, mainly in Subarea 3 with coverage of Div. 2J in some years. Unlike the previous series, which was aimed at young fish, these surveys were designed to measure abundance of all size groups of groundfish. The PERSEY III was used in 1971-78, the SULOY in 1979 and 1982, and the KONONOV in 1980-81. These vessels are generally similar in length, tonnage, and horsepower, and all used the same trawl gear. Comparisons between the PERSEY III and one of the side-trawlers used in the 1961-70 surveys showed that the stern-trawler caught about 1.4 times as much fish as the side-trawler. This conversion factor was therefore used to adjust the estimates of young fish abundance from the earlier surveys.

Fishing was done at fixed stations, although it is not clear if these were the same stations surveyed in 1967-70 in the earlier series. Survey coverage was fairly consistent and averaged 276 sets per year. No complete breakdown by Division is available, although Div. 3M was surveyed twice (spring and summer) in both 1979 and 1980.

Sampling procedures remained constant in these surveys and, unlike the earlier series, catch weights of major species were taken. Otoliths were taken from more species in the 1971-82 surveys, including several flatfish species and grenadier. In addition to the otolith sampling of the entire size range, further otolith samples of young cod and sometimes redfish were taken from each Division.

The average numbers and weights per tow for several species are available as abundance indices from this survey series. These surveys appear to be relatively constant in terms of design and procedures over time. However, their compatibility with the earlier series needs to be established.

C) 1983-85

Stratified random surveys were conducted between March and July in Div. 3KLMNO. These were conducted using the guidelines in the Groundfish Surveys Manual. Because of the large area to be surveyed in the limited time available, strata were not always sampled in proportion to their size, with 3 sets per stratum being a common occurrence. Coverage was 464 sets in 1983, 514 in 1984, and 447 in 1985, with no divisional breakdown available. However, it should be noted that the sets in 1983 were of 1 hour duration, while those in 1984 and 1985 were 30 minutes. This difference has been taken into account in the stratified estimates of abundance calculated from these surveys. In 1985, the survey was carried out with a vessel which was much smaller than those used in the surveys from 1971 to 1984. Although the vessel used in 1985 (GENICHESK) had similar horsepower and used the same trawl gear as the vessel used in 1983-84 (SULOY), the differences in catches, if any, have not been quantified.

Sampling procedures and techniques in 1983-84 were similar to those of the earlier surveys. However, in 1985 otolith samples for cod, haddock, beaked redfish, and Greenland halibut were collected using a standard stratification scheme based on fish length.

Estimates of abundance and biomass from this series have been examined in many assessments of the stocks covered by the surveys.

D) Greenland halibut surveys, 1980-85

These were conducted in Div. 0B in each year from 1980 to 1985, with coverage expanding in Div. 2GH in 1983-85. Div. 3K was surveyed only in the first and third surveys in the series. The surveys were usually conducted in November-December of each year, by the larger class (BMRT) stern trawlers. Coverage in most years consisted of 69-125 sets total for all areas, but only 11 sets, all in Div. 0B, were completed in 1981. Breakdowns by Division or stratum were not available. It is noted in the survey documentation that the number of stations, size of the survey area, and depth ranges covered vary markedly in some years because of changing ice conditions, and that these factors affect the abundance estimates of Greenland halibut.

From the documentation available, it would appear that these surveys were not conducted using a standard stratification scheme. Rather, it appears that sets were chosen at random in 100 m depth zones from 300 m to 1300 m and abundance and biomass estimates calculated in the usual (stratified) manner for each of the depth zones. Further evaluation of this survey design and the affect on abundance estimates may be necessary. The abundance indices for Greenland halibut from these surveys have been examined in recent assessments of the stocks in Subarea 0+1 and Subarea 2+3KL.

Information was also presented for Div. 3K separately, from 1981 to 85, but appears to be the results from the groundfish surveys in these years. These surveys were discussed in previous sections and therefore will not be reconsidered here.

SCIENTIFIC COUNCIL MEETING - SEPTEMBER 1988

A Brief Review of Some Data from USSR Research Vessel

Surveys in the NAFO Area from 1967-85

by

W. B. Brodie

Introduction

At the NAFO meeting in September 1987, STACREC recommended that the research vessel survey data from USSR surveys from 1967-85 be examined to determine comparability over this time period. At the meeting in June 1988, it was noted that data from USSR surveys from 1972-87 were available at the Fisheries Centre (NAFC) in St. John's, and that a review of this material was to be conducted for presentation to the STACREC Working Group on surveys. This paper contains some of the findings of the analysis of the USSR survey data.

Methods and Materials

Much, if not all of the background material on the USSR surveys in question came from Bulatova and Chumakov (1986). Actual data from the surveys, such as catches, locations of sets, etc. were taken from material provided by Soviet scientists to scientists at the NAFC in St. John's, where they were put into a computer-accessable database. Data from the fixed-station surveys (1972-82) were coded with a stratum number corresponding to the stratified-random design used in many surveys in Subareas 2 and 3 (Doubleday, 1981). Additional information on these surveys was also available from previous discussions of the Working Group.

Results and DiscussionResults from 1967-70

In 1987, STACREC concluded that the USSR surveys from 1961-66 were not considered to be comparable with other USSR surveys because of changes in design and timing. Further examination of

Bulatova and Chumakov's (1986) description of the survey procedures from 1967-70 suggests that in these years, some refinements were taking place to the grid of stations used in conducting the surveys. The authors state that "by the end of the period (1969-70) about 300 fishing stations were planned for Div. 3KLMNOP and completed".

The surveys prior to 1971 were aimed at determining the abundance of young cod, haddock, and redfish and therefore the results cannot be compared directly with those from the surveys from 1971 onward, at least in terms of an index of abundance for the entire stocks surveyed. Given the changes which were occurring in the surveys from 1967-70, it may be the case that the young fish results from these surveys are not comparable with those from 1971 onward. The data for surveys prior to 1972 were not available at the St. John's laboratory, so no analysis was possible at this time. However, there appears to be sufficient information to suggest that the estimates of young fish derived from the 1967-70 surveys should be treated with caution when compared to young fish estimates from 1971 onwards.

1971-82

From 1971-82, trawl surveys were conducted at fixed fishing stations, as described by Bulatova and Chumakov (1986). Table 1 shows a breakdown of the sets, by year and NAFO division, for 1972-82. The totals are close to 300 in most years and are in general agreement with the figures in Bulatova and Chumakov (1986). With the exception of Div. 3M, which was surveyed more than once in some years. The number of sets in most Div. (3K, 3L, 3N, and 3O) is relatively stable from year to year. Div. 3P was not surveyed after 1976, and Div. 2J was surveyed only from 1978-80.

As was noted previously, the sets from these surveys were post-stratified at the St. John's lab to allow comparison of these survey results with those from other stratified random surveys in the same areas. This post-stratification allowed a comparison between areas and years of the survey coverage in greater detail.

An example of this can be seen in Table 2, where the number of sets in post-stratified areas (strata) 372 (Div. 3L), 362 (Div. 3N), and 352 (Div. 30) can be seen. These strata are all located on the Grand Bank in 31-50 fathoms and are all virtually the same size (Doubleday, 1981).

As can be seen from Table 2, coverage appears to vary from year to year in each Stratum, although it is not possible to determine from this analysis whether or not each station in each year is part of the grid of fixed stations used to determine abundance. Although it would be reasonable to expect the number of stations in each Stratum to be approximately equal, some differences would be expected based on the reasons for selecting a fixed grid of stations initially.

While Table 2 shows that there can be differences in the total number of sets in an area from year to year, a more detailed examination of the location of sets in Stratum 362 proved to be interesting.

In all years, a set was carried out at the same location (always within a few miles of the same spot) and in all years from 1973-82, 2 such stations were fished. From 1977-82, these were the only stations conducted in the area of Stratum 362 in Div. 3N. It is not evident from this analysis or from Bulatova and Chumakov (1986) whether the abundance indices are calculated only from the results of the sets common to all or most years, or if the extra sets conducted in some years are also used in the calculations. This information would be of critical importance in comparing the results from year to year.

Comparison of 1971-82 with 1983-85

In 1983, the design used in USSR surveys in the NAFO areas switched from fixed station to stratified random. This change, and the subsequent refinements in the

surveys after 1983 have been discussed previously by the Working Group and by STACREC. A major point concerning these surveys is their comparability with those from the 1971-82 period. While it is possible to post-stratify the earlier results and thus obtain stratified abundance estimates which correspond with those from the surveys in 1983 onward, the difficulties with such an approach are perhaps not fully known. Although the results of the fixed station surveys should be comparable for years in which the same stations were surveyed, the comparability of these abundance estimates and associated statistics (variance, etc.) with those from the stratified random surveys is not known. While there may be some material on the comparison of results from fixed-station and stratified-random surveys from other areas, the applicability of this information to the surveys examined here is unknown. To conduct an analysis to determine comparability of the 2 sets of survey results would require extensive computations for several species and areas, and was beyond the scope of this paper. Further guidance from STACREC can be requested to see if such an analysis will be required of this working group.

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- Bulatova, A. Yu, and A.D. Chumakov. 1986. USSR Trawl Surveys in NAFO Subareas 0, 2, 3. NAFO SCR Doc 86/66, Ser. No. N1183, 13p.
- Doubleday, W.G. (ed). 1981. Manual on Groundfish Surveys in the Northwest Atlantic. NAFO Sci. Coun. Studies Number 2, 55p.

TABLE 1. Distribution of sets by year and division from U.S.S.R. surveys 1972-85. Results for 1984 and 1985 are from stratified random surveys

FREQUENCY										
ROW PCT	CGL PCT	10B	12J	13K	13L	13M	13N	13O	13P	TOTAL
72	0	0	0	28	53	19	52	49	40	240
	0.00	0.00	0.00	0.71	1.32	0.48	1.32	1.24	1.01	6.09
	0.00	0.00	0.00	21.67	21.67	7.92	21.67	20.42	16.67	
	0.00	0.00	0.00	3.97	6.04	3.13	7.04	7.02	20.73	
73	0	1	53	63	20	65	64	38		303
	0.00	0.03	1.34	1.90	0.51	1.65	1.62	0.96		7.69
	0.00	0.03	17.49	20.46	9.50	21.45	21.12	12.54		
	0.00	0.73	7.52	7.20	3.29	8.80	9.17	19.69		
74	0	0	48	57	20	57	50	36		268
	0.00	0.00	1.22	1.45	0.51	1.45	1.27	0.91		6.80
	0.00	0.00	17.91	21.29	7.46	21.27	18.66	13.42		
	0.00	0.00	6.81	8.52	3.29	7.71	7.16	18.65		
75	0	0	49	64	18	68	57	40		296
	0.00	0.00	1.24	1.62	0.46	1.73	1.45	1.01		7.51
	0.00	0.00	16.55	21.62	6.08	22.97	19.26	13.51		
	0.00	0.00	6.95	7.43	2.96	9.20	8.17	20.73		
76	0	0	54	53	19	55	52	39		277
	0.00	0.00	1.37	1.47	0.48	1.40	1.32	0.99		7.03
	0.00	0.00	19.49	20.94	6.96	19.86	18.77	14.08		
	0.00	0.00	7.66	6.74	3.13	7.44	7.45	20.21		
77	0	0	51	64	25	44	44	0		228
	0.00	0.00	1.29	1.62	0.63	1.12	1.12	0.00		5.78
	0.00	0.00	22.37	28.07	10.96	19.30	19.30	0.00		
	0.00	0.00	7.22	7.42	4.11	5.95	6.20	0.00		
78	0	50	52	58	24	45	43	0		272
	0.00	1.27	1.32	1.47	0.61	1.14	1.09	0.00		6.90
	0.00	18.38	19.12	21.32	8.82	16.54	15.81	0.00		
	0.00	36.50	7.38	6.74	3.95	6.09	6.16	0.00		
79	0	56	45	60	60	46	44	0		293
	0.00	0.91	1.14	1.52	1.52	1.22	1.12	0.00		7.43
	0.00	12.29	15.36	20.48	20.48	16.38	15.02	0.00		
	0.00	26.28	6.38	6.97	9.87	6.50	6.30	0.00		
80	0	50	53	61	50	41	46	0		301
	0.00	1.27	1.34	1.55	1.27	1.04	1.17	0.00		7.64
	0.00	16.61	17.61	20.27	16.61	13.62	15.28	0.00		
	0.00	36.59	7.52	7.00	8.22	5.55	6.59	0.00		
81	0	0	48	55	33	43	42	0		221
	0.00	0.00	1.22	1.40	0.84	1.09	1.07	0.00		5.61
	0.00	0.00	17.91	21.65	14.03	16.46	19.00	0.00		
	0.00	0.00	6.81	6.39	5.43	5.82	6.02	0.00		
82	0	0	56	63	70	50	43	0		282
	0.00	0.00	1.42	1.69	1.78	1.27	1.09	0.00		7.15
	0.00	0.00	15.86	22.34	24.82	17.73	15.25	0.00		
	0.00	0.00	7.94	7.32	11.51	6.77	6.16	0.00		
84	1	0	113	105	124	86	85	0		514
	0.03	0.00	2.87	2.66	3.15	2.18	2.16	0.00		13.04
	0.19	0.00	21.98	20.43	24.12	16.73	16.54	0.00		
	100.00	0.00	16.03	12.20	20.39	11.64	12.18	0.00		
85	0	0	55	102	126	85	79	0		447
	0.00	0.00	1.40	2.59	3.20	2.16	2.00	0.00		11.34
	0.00	0.00	12.30	24.82	28.19	19.02	17.67	0.00		
	0.00	0.00	7.80	11.85	20.72	11.56	11.32	0.00		
TOTAL	1	137	708	801	608	739	698	193	3942	
	0.03	3.48	17.88	21.84	15.42	18.75	17.71	4.90	100.00	

TABLE 2. Comparison of the number of fishing sets in 3 strata on the Grand Bank from U.S.S.R. surveys, 1972-82

YEAR	Stratum		
	352	362	372
1972	5	1	5
1973	6	4	5
1974	7	4	4
1975	6	8	4
1976	8	4	4
1977	5	2	4
1978	6	2	2
1979	5	2	4
1980	8	2	3
1981	2	2	4
1982	2	2	4

SCIENTIFIC COUNCIL MEETING - JUNE 1989

Further consideration of USSR survey data for the years 1972-82

by

W. B. Brodie

The data from fixed station surveys conducted by the USSR from 1971-82 have been available for some time in a post-stratified format, corresponding to the standard stratification schemes used in NAFO Subareas 2 and 3. The survey coverage was such that in most years, most existing strata were fished with at least one set. This makes it possible to compare the results of these surveys with the random-stratified surveys conducted by Canada over the same period. For this comparison, data for yellowtail flounder in Div. 3LNO and American plaice in Div. 3L were chosen for the years 1972-82.

In the USSR surveys in Div. 3L, strata 328, 341, 342 and 343 in the western part of the division were not fished in most years, and were deleted from the analysis for American plaice. For yellowtail flounder, only the strata ≤ 50 fathoms were included, corresponding to the Canadian analysis. To provide estimates of abundance from the USSR surveys, multiplicative models were used, using as input data the mean number-per-tow in each stratum in each year. The models are regression based and estimate values for strata not fished in a year.

For American plaice, there were no surveys which missed many strata, and therefore few strata were estimated. The total estimate of abundance, plotted against the estimate from Canadian surveys, is shown in Fig. 1. The correlation coefficient for this linear regression is 0.56. Although the

Canadian surveys generally had more sets, there are many strata missed in some years, and in particular, some of the earlier years are poorly estimated. Overall, both series are in general agreement showing the 72-73 points to be low and the 77 point to be highest.

For yellowtail flounder, much the same is true. The USSR surveys generally have fewer strata missed, but usually have fewer sets per stratum. Fig. 2 shows the abundance estimates from both series. With the exception of the 1972 point, which is very poorly estimated in the Canadian survey and is clearly an outlier, the relationship is quite good. With the 1972 and 74 points omitted (74 is also very poorly estimated in the Canadian series), the correlation coefficient is 0.82.

Given the variability inherent in surveys in general, these 2 relationships should be considered acceptable, and the USSR post-stratified surveys should be acceptable as a survey series.

In examining other possibilities for analyzing the USSR data, a technique known as Kriging was investigated. This is essentially a geostatistical tool, but has been applied to some biological data, notably crab surveys. The technique has recently been investigated by Canadian scientists in CAFSAC and essentially rejected for analysis of groundfish survey data at this time. While acknowledging that Kriging would allow the analysis of data, regardless of whether it was collected according to a random-sampling design, it was felt that this method would be better suited for resources that are basically stationary during the course of the survey. It was also noted that the methodology is complex and requires considerable expertise to apply and interpret. Given the mobility of groundfish stocks and the relatively large distances between samples (sets) in most surveys, the use of this technique is not recommended for analysis of the USSR surveys. No other contouring methods were examined, as there are no such methods currently employed by STACFIS to provide estimates of abundance from surveys.

Fig 1. 3L A. plaice, Abundance $\times 10^{-6}$



335-5131

Metric

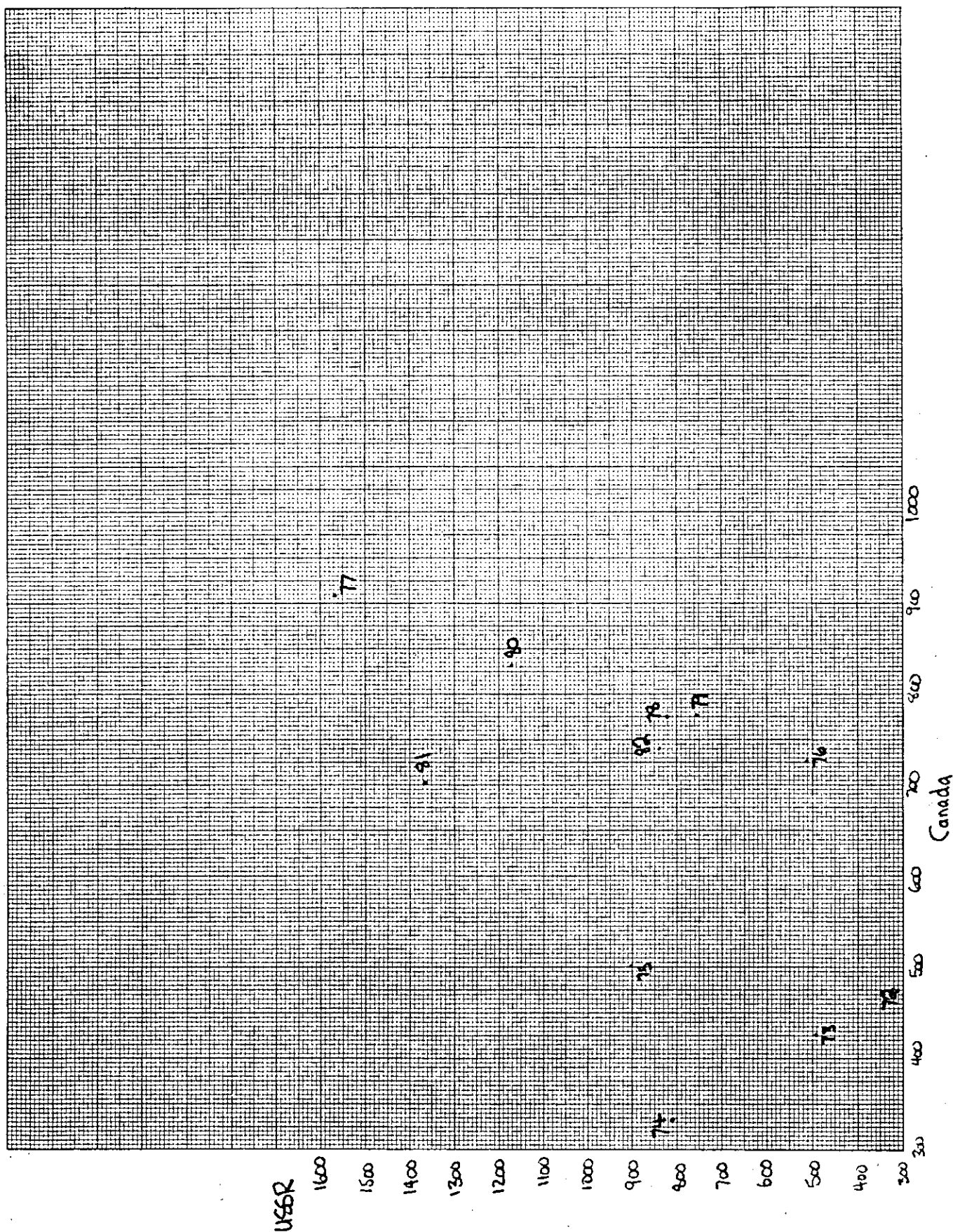


Fig 2. 3LNO Ytail, Abundance $\times 10^{-6}$



335-5131 Metric

