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REPORT OF THE INTERNATIONAL BOTTOM TRAWL SURVEY WORKING GROUP

Copenhagen, 13-17 January 1992

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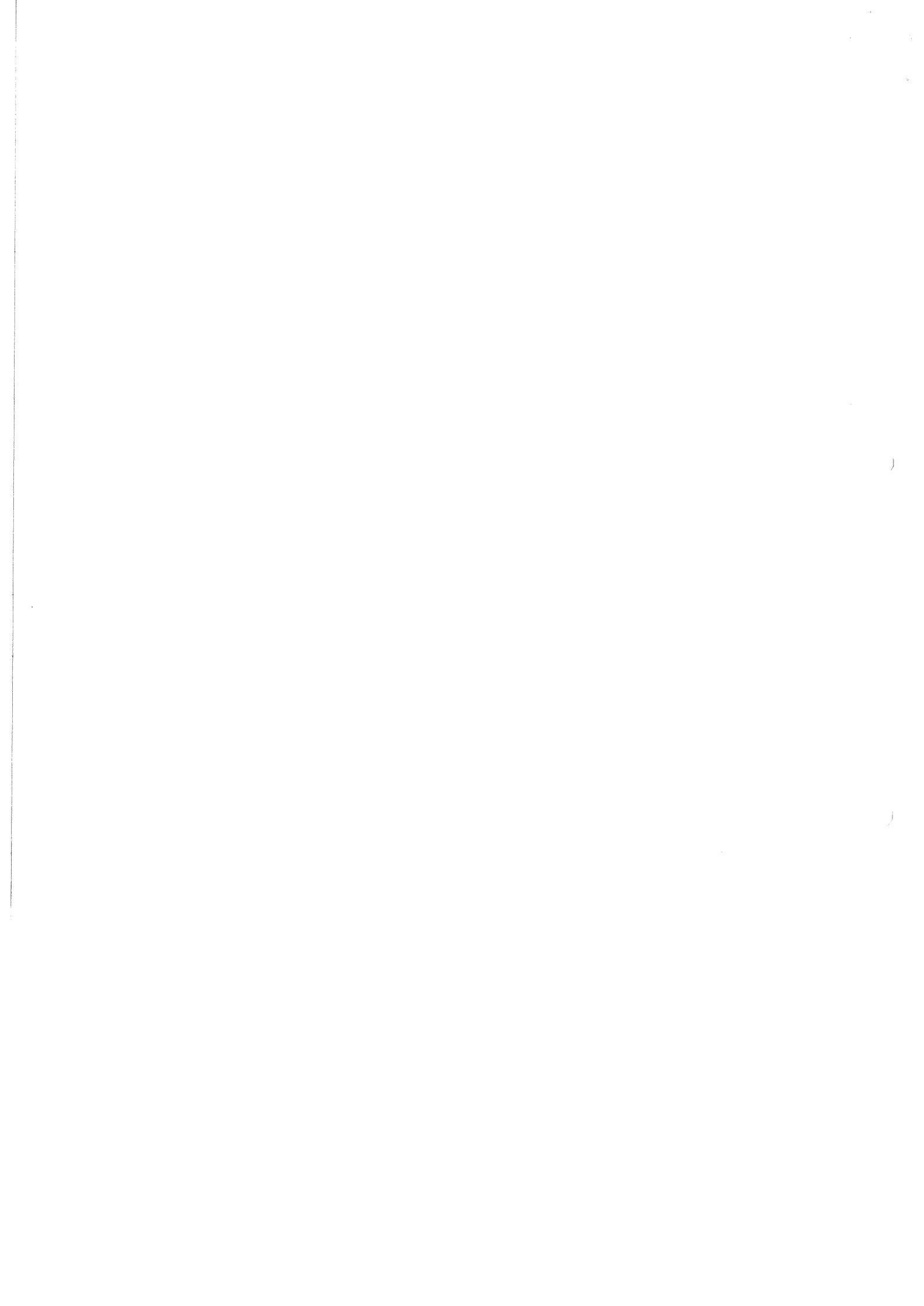
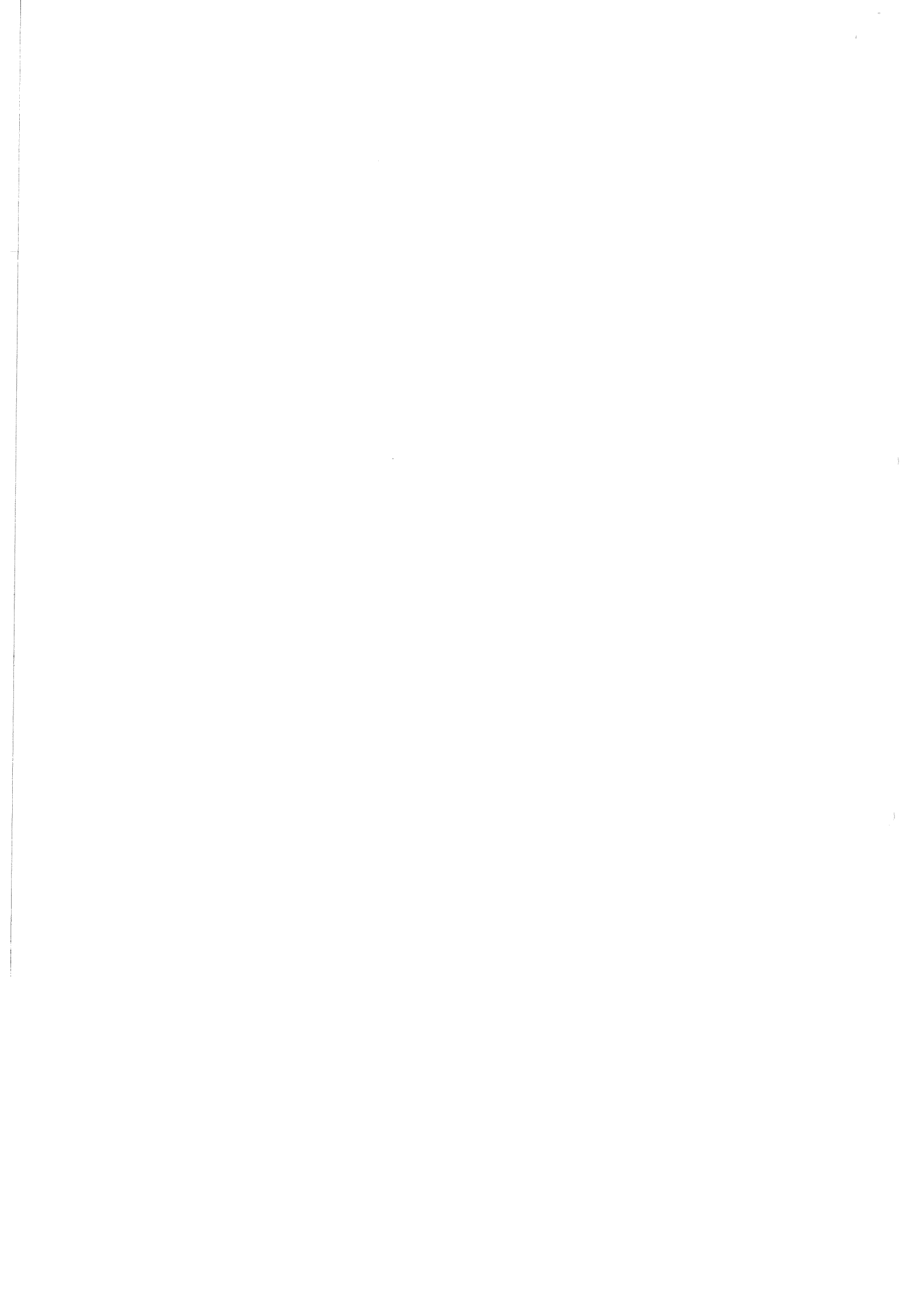


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1 TERMS OF REFERENCE AND PARTICIPATION

At the 1991 ICES Statutory Meeting the Council decided (C. Res. 1991/2:23), that the International North Sea, Skagerrak and Kattegat Bottom Trawl Survey Working Group will be renamed the International Bottom Trawl Survey Working Group (Chairman: Dr H.J.L. Heessen, Netherlands) and will meet at ICES Headquarters from 13-17 January 1992 to:

- a) evaluate the 1991 quarterly bottom trawl surveys in Sub-area IV and Division IIIa;
- b) consider the implications of the 1991 report of the Working Group on Fishing Technology and Fish Behaviour on the surveys;
- c) propose any improvements in the collection of biological and environmental data;
- d) propose any improvements to data exchange and the data bases, and consider possible integration of biological and environmental data into a single data base;
- e) finalize the present draft survey manual;
- f) co-ordinate future surveys.

The meeting was attended by the following:

T. Boon	UK (England)
A. Corten	Netherlands
H. Degel	Denmark
S. Ehrich	Germany
O. Hagström	Sweden
H.J.L. Heessen (Chairman)	Netherlands
P. Munk	Denmark
A. Newton	UK (Scotland)
O.M. Smedstad	Norway
A. Souplet	France
H. Sparholt	Denmark

M. Zarecki, H. Dooley, R. Grainger and L. Pedersen from the ICES Secretariat also attended the meeting.

2 INTRODUCTION

The International Bottom Trawl Survey Working Group (IBTS) has succeeded the previous International North Sea, Skagerrak and Kattegat Bottom Trawl Survey Working Group. The Working Group is required to co-ordinate and evaluate all bottom trawl surveys in the North Sea, Skagerrak and Kattegat, to provide facilities for better serving the original customers (e.g. the Industrial Fisheries Working Group, Herring Assessment Working Group for the Area 62°N and the Roundfish Working Group) as well as the more recent ones (the Multispecies Assessment Working Group and the EC's Scientific and Technical Committee for Fisheries) and

future customers (e.g. the new area based Working Groups and the North Sea Task Force).

In 1990 it was decided to start, in 1991, a series of quarterly co-ordinated surveys, which would run for a period of 5 years. The expansion of the surveys into the second, third and fourth quarters of the year and the demands for additional sampling of biological and environmental data made it necessary to modify the survey manual and the data exchange format. Before 1991 this Working Group only coordinated the survey in the first quarter, known as the International Young Fish Survey (IYFS).

3 EVALUATION OF THE 1991 QUARTERLY IBTS: COVERAGE AND SAMPLING LEVELS

Coverage

Quarter 1: The survey in the first quarter of 1991 was the latest in the time series of surveys started in 1971 as the International Young Herring Survey of the North Sea, Skagerrak and Kattegat. This year seven nations took part. England withdrew its traditional participation in this survey so that the national effort could be re-distributed over the next three quarters. During the survey a total of 418 hauls were made. Figure 3.1 shows the distribution of effort by statistical rectangle. Nations participating in the first quarter were :

NATION	VESSEL	GEAR
Denmark	'Dana'	GOV
France	'Thalassa'	GOV
Germany	'Walther Herwig'	GOV
Netherlands	'Tridens'	GOV
Norway	'Johan Hjort'	GOV
Sweden	'Argos'	GOV
UK (Scotland)	'Scotia'	GOV

A full analysis of the survey in this quarter is available in ICES, Doc. C.M. 1991/H:5.

Quarter 2: During the second quarter the participating countries were :

NATION	VESSEL	GEAR
Germany	'Walther Herwig'	GOV
Netherlands	'Tridens'	GOV
	'Isis'	GOV
Norway	'Johan Hjort'	GOV
UK (England)	'Cirolana'	GOV
UK (Scotland)	'Scotia'	GOV

Figure 3.2 shows the number of valid hauls per rectangle. The number of rectangles covered in the North Sea was 144. This compares very favourably with the 155 rectangles sampled in the North Sea during the first quarter survey.

Quarter 3: Three nations took part in the surveys in this quarter.

NATION	VESSEL	GEAR
Netherlands	'Tridens'	GOV
	'Isis'	GOV
UK (England)	'Cirolana'	Granton
UK (Scotland)	'Scotia'	Aberdeen

Again there was a very comprehensive survey of Sub-area IV with a total of 149 rectangles covered (Figure 3.3).

Quarter 4: Five vessels from four nations co-operated during this quarter.

NATION	VESSEL	GEAR
Denmark	'Dana'	GOV
Netherlands	'Tridens'	GOV
	'Isis'	GOV
Norway	'G.O. Sars'	GOV
UK (England)	'Cirolana'	GOV

During this quarter several of the vessels experienced severe weather conditions and this limited the amount of time for survey work. Nevertheless Figure 3.4 shows a wide distribution of effort over the North Sea with 212 valid hauls in 136 rectangles.

In the original recommendation to set up quarterly surveys (ICES Doc. C.M. 1990/H:3) it was concluded that to obtain good spatial coverage each quarterly survey should contain about 240 hauls and cover 150 rectangles. The new surveys showed that these targets were obtainable and that in 1991 each quarter provided a very good coverage of Sub-area IV.

During 1991 Sweden conducted her own national surveys in each quarter in Skagerrak and Kattegat but did not take part in the co-ordinated surveys in the North Sea. However, during 1992 there is the possibility of Norwegian and Danish surveys in Division IIIa and Sweden has expressed a desire to participate in the exchange of future data.

Sampling levels

Tables 3.1 to 3.4 show the number of otoliths taken for each of the seven major species sampled in each quarter. The first quarter shows the highest level of sampling but this is to be expected given the number of nations participating in this time period. Some of the data sets are missing from the other three quarters and therefore it is difficult to make a rational judgement on how effective sampling was during these time periods. The underlying impression is that otolith sampling is of sufficiently high volume to give reliable information on the age structure of the major stocks. It was noted that during the first quarter the sampling of herring and sprat was at a much higher level than experienced during the rest of the year. This matter is to be investigated further. In addition to the seven major species otoliths were also taken from a number of other

species, e.g. plaice, saithe, but the level of sampling has not been reported.

The year 1991 had been designated as a year in which there was internationally co-ordinated effort to obtain stomach samples from a wide range of species. The quarterly surveys were seen as an ideal opportunity to implement an exhaustive collection system and all vessels participated in the stomach collection. It is likely that this aspect of the survey work depressed the normal level of otolith collection because of the high priority assigned to the stomach project.

4 IMPROVEMENTS IN DATA COLLECTION

4.1 Biological data

With the co-ordinated surveys in the second, third and fourth quarters of the year for a targetted period of five years it was felt that some additions/changes to the collection and reporting of biological data could usefully be made. Within the constraint of not causing too much change to the ICES IYFS exchange format and data handling system (see also section 8.2) the following was agreed:

- 1) To provide the possibility of reporting length distributions by separate sexes. This applies particularly to cartilagenous species and some flatfishes.
- 2) To reduce the herring maturity key to four stages and increase that for all other species to the same four stages: 1) immature, 2) maturing, 3) spawning and 4) spent. This will create a standard maturity key and allow the identification of spawning areas.
- 3) To allow the reporting of any species caught in the survey area instead of only those species that are mentioned on the present limited list. This will facilitate the identification of species infiltration.
- 4) To collect age, sex and maturity data for Saithe (*Pollachius virens*), Plaice (*Pleuronectes platessa*), and Division IIIa Sole (*Solea vulgaris*) if at all possible.
- 5) To report some biological data (e.g. sex, maturity and possibly age) for five different species each year, which have very little recent ecological information published about them. These species will be changed each year. It was decided to start collecting this additional information during the 1992 surveys on:
 - Grey gurnard (*Eutrigla gurnardus*)
 - Angler fish (*Lophius piscatorius*)
 - Pollack (*Pollachius pollachius*)
 - Tusk (*Brosme brosme*)
 - Four-bearded rockling (*Rhinonemus cimbrius*)

4.2 Environmental data

Nutrient data collected during the IYFS in recent years are being used by Working Groups of the North Sea Task Force. The IYFS is providing an extensive coverage of the North Sea at a time of the year which is most suitable for nutrient studies.

Now that internationally co-ordinated surveys are also conducted in other quarters of the year, the question arises whether nutrient sampling should be included in the standard programme for these other surveys. The IBTS Working Group is not qualified to evaluate the usefulness of nutrient sampling in other quarters of the year, and it refers this matter to the Working Group on Shelf Seas Oceanography. The ICES Hydrographer will draw the attention of that Working Group to the fact that ICES co-ordinated trawl surveys are now held in the North Sea in each quarter of the year, and that chemists could use this opportunity to expand their nutrient sampling schemes.

5 REPORT OF THE FTFB SUB-GROUP ON THE VARIABILITY IN FISHING POWER OF THE GOV TRAWL

A draft report was presented to the Group giving a comprehensive review of factors that could influence the catch efficiency of survey trawls. The final report is planned to be presented at the Working Group on Fishing Technology and Fish Behaviour (FTFB) meeting in June.

The results of a questionnaire circulated to the countries using the GOV trawl show that in many aspects a high degree of standardization has been achieved. Deviations from the recommendations were however reported. Some of these deviations could seriously change the fishing power of the gear. The preliminary conclusions of the FTFB Sub-group are that the manual needs improvements and clarification.

In the draft report of the FTFB Sub-group a list of recommendations is given. The aim is to improve the standardization and reduce the variability in fishing power. In summary these recommendations are:

1. It is recommended that a more detailed net drawing is made of the GOV.
2. It is recommended that in the drawing of the rigging the length of the wires be defined as given in the report of the FTFB Sub-group.
3. It is recommended that the connecting chains between the fishing line and the groundrope should be 30 cm long with a diameter of 14 mm and spaced 100 cm apart.
4. It is recommended that a protocol (check-list) be developed to be used in measuring the GOV trawl.
5. It is recommended that the accumulated large experience of using mounted sensors during the IYFS should be documented with detailed descriptions on riggings of different sensors.
6. Active control of the trawl performance is not recommended and the most promising method to reduce variability appears to be the constrain rope method. The Group therefore recommends that this method be subjected to field tests with the GOV and, if it proves useful and does not influence capture efficiency, that it be applied to the IBTS.

7. Regardless of recommendation no.6 it is recommended that only 60 m total sweep-backstrop length is used for all depths.
8. It is recommended that start time should be defined as the time when both door spread and vertical opening are stable, at a trawl speed (or ground speed) of 4 knots. Stop time should be defined as the time at start of pull back.
9. Standard towing speed should be 4 knots and defined as speed through water of the trawl or if not available ground speed measured with GPS.
10. It is recommended that the following gear parameters should be recorded at intervals of at least 30 seconds during trawling:
 - wing-end spread
 - door spread
 - vertical opening
 - speed through water
 - ground speed
 - depth of the constrain rope
11. To investigate the dependence of catch on environmental factors, the following parameters should be recorded:
 - bottom temperature
 - bottom light intensity
 - water transmissivity
 - bioluminescence
 - bottom type
12. The Group recommends that underwater observations of the GOV trawl in survey situation are carried out on all research vessels as an integrated part in the training programme. The costs involved in hiring equipment and personnel (if not available at the institute) and allocating ship time is well justified when compared to the total cost of the survey and the importance of the survey results.

The work on a new net drawing and a check-list is in progress and when available will be included in the new manual.

The constrain rope method will be tested further by Norway in a field experiment during spring 1992. The results of this test will be considered before the IBTS Working Group can take a decision on a change in fishing method. A change to the constrain rope method and/or a change to one standard sweep length (i.e. standard total length of sweep plus backstrop) will cause a major change in fishing power in the survey. The long time series of indices from the first quarter are likely to be affected by a change in fishing method. It was therefore decided to implement only recommendations that are not likely to change the time series at this stage. It is also important to consider how to secure the time series when a major change in fishing method is applied. This matter could be discussed at the meeting of the Workshop on the Analysis of Trawl Survey Data in Woods Hole in June 1992.

6 MIK SAMPLING

During the meeting the procedures for sampling larval fish during the first quarter (former IYFS) were discussed. Special attention was given to the following items:

The change of standard gear

At the IYFS (IBTS) meeting in 1990 it was decided to change the standard gear from an Isaacs Kidd Midwater Trawl (IKMT) to a Methot Isaacs Kidd net (MIK). The MIK (ring-version) was then standard gear from 1991 onwards. In 1991 Norway and Scotland still used the IKMT. In 1992 the IKMT will only be used by Scotland. From 1993 the transfer should be complete.

The change of standard gear makes it necessary to convert the earlier IKMT samples to MIK-comparable values. Therefore, in 1992 (or 1993), each participant should make a series of comparable hauls (at the same position) for estimation of a conversion factor.

In order to make the sampling as standardized as possible, only the ring-version of the MIK, as described in the manual, should be used during the IBTS.

The procedures when using the MIK

The procedures described in the preliminary manual were discussed. There was general agreement on the proposed procedures. The speed to be used when paying out wire was set to 25 m/min and not the proposed slower speed (12 m/min).

It is important that the participants adhere strictly to the agreed procedures as they are described in the new version of the manual. The use of calibrated flowmeters, which were not used routinely in the earlier IKMT sampling, is now of great importance for the calculation of abundance indices.

Data exchange

It was decided to continue the procedure whereby standard sheets are mailed to DIFMAR (Denmark) where data are transferred to a common data base. A revised version of the database will be sent each year to the ICES Secretariat.

Since the information on herring abundance from the first quarter sampling is used shortly after the end of the survey, the participants are asked to mail their results as early as possible to Peter Munk (DIFMAR).

The possibility of introducing MIK-sampling in other quarters

An introduction of MIK-sampling for gadoid larvae/juveniles in the second quarter was discussed. Preliminary results from sampling of gadoids in May 1991 were described. According to the results from this investigation the MIK could be appropriate for the size range of gadoids in the northern part of the North Sea. The Working Group members, however, were reluctant to increase the workload in the second quarter, and expressed scepticism about the benefits from a sampling programme for gadoid larvae. The Working Group members leave it to national authorities to

investigate further the possibilities of estimating larval/juvenile abundance of gadoids.

7 UPDATE OF THE SURVEY MANUAL

A new version of the survey manual was prepared to replace the existing version (ICES Doc.1986/H:2). The present manual applies to all surveys that are conducted within the framework of the IBTS. The standard fishing gear and sampling procedures are uniform for all quarterly surveys.

The recommended fishing method differs slightly between the first quarter survey and the other surveys. In the first quarter, hauls in the herring standard area should be conducted during daylight only. Furthermore, the length of the sweeps depends on the bottom depth. In the other quarters the total length of sweeps and backstrops should be 60 m throughout the survey area. The 60 m was chosen because most vessels have been using 50 m sweeps and about 10 m backstrops during earlier surveys.

During the meeting it was noted that the specification given for the cod-end lining had been interpreted in different ways by various countries. The results of a review of the cod-end lining in use are shown below:

Country	Length(m)	Full mesh	No.mesh around
Denmark	26,5	20	240
England	7	20	600
France	8	20	600
Germany	4	20	600
Netherlands	8	20	600
Norway	4	20	N/A
Scotland	7	20	600
Sweden	20	20	N/A

Two countries, Norway and Sweden, do not use an inner lining as recommended. The dimensions in this case refer to the cod-end or extension part.

Because of the existing confusion with regard to the definition of the cod-end lining, it was decided that the length of the lining should be 8 m or 400 stretched meshes. The circumference of the cod-end lining should be 600 meshes.

The present manual contains a number of additional amendments concerning fishing gear, fishing method, and biological sampling. Most of these changes are not related to the extension of the survey to other quarters of the year, but to new insights into the performance of the gear, and to revised demands for biological data. The main points of difference with the former manual are:

- new description of cod-end lining,
- new specification of sweep length,
- no allowance for roller gear or rockhopper gear,
- uniform sampling areas for age/sex/maturity for all species,
- minimum requirements concerning sampling for length and age,
- a new standard gear for sampling herring larvae during the first quarter survey,
- use of standard length instead of total length for herring larvae.

The present specifications for the GOV construction and fishing method are being critically reviewed by the FTFB Working Group. It is expected that this study will result in further amendments to the present manual in the near future.

8 DATA EXCHANGE AND STORAGE

8.1 Inclusion of other quarters in the IYFS data base

With the expansion and co-ordination of surveys into the second, third and fourth quarter of the year, a considerable quantity of data will be collected. It is desirable to have these data in a central location and as they are generally similar to those from the first quarter, the IYFS data base at ICES would provide for this need. However, as it is not anticipated that there will be a need to aggregate data across quarters, initially, at least, a data base will be established at ICES Headquarters for each quarter separately.

8.2 Changes in the exchange tape specification

The requirement to collect additional environmental data and gear parameters, together with the changes in biological data collection, are accompanied by the need to change the exchange tape specifications.

Hauling position, towing direction, tide direction, tide speed, wind direction, wind speed, sea height, swell height, swell direction, wing end spread, ground speed of the trawl, and speed of the trawl through the water may all be reported in one record and these records will be reported in a separate file. Initially, these data will not be entered into the data base, but will be retained separately by ICES.

Thus far a closed species list has been used when exchange tapes were checked before the data were stored in the ICES IYFS data base. There will no longer be any restriction on fish species reported on exchange tapes.

The four stage maturity key (see also section 4.1) will be reported for quarters two, three and four after 1 January 1991 but for quarter 1 from January 1993. However, the old maturity keys will be adjusted to the new one for quarter 1 for 1991 and 1992 at a later date (these data will have to be resubmitted). The same time scale will also apply to the other changes in exchange format. No data in the new format should be submitted before 1 June 1992.

It will be possible to exchange length data separated by sex, the sex identifier appearing in the HL record at position 69.

However, initially these sex-disaggregated length compositions will be combined at ICES prior to transfer to the database. The reason for this is that the introduction of sex-disaggregated length data would require a major re-structuring of the database and a revision of the retrieval procedures.

The implementation of such substantial changes must await a decision about which database management system the IYFS dataset will be stored in in the long term. There is some uncertainty about the future viability of the SIR database currently used. The Working Group recommends that this question be decided soon so that sex-disaggregated length data can be accommodated in the not too distant future.

During quarter 3 England and Scotland use trawls other than the recommended GOV. As these surveys form a part of the area coverage it is desirable to include these data in the data base. They will be reported and stored in the data base in an unaltered form, but facility will be made to adjust these data to GOV standard for the most important species by applying correction factors by species and length in the aggregation procedure.

8.3 Integration of biological and environmental data into a single data base

The Working Group requested that bottom temperature and salinity data are made available for cross-comparisons with fish data presently held in the ICES IYFS data base. At present hydrographic station data which are collected during the IBTS are submitted to ICES separately, and no merger of these data with the data base contents is attempted. In principle however, merging of the data is easy to achieve as the hydrographic station number is an existing field in the data base. Unfortunately this field is currently not completed by all participants in the survey. Rather than transfer the temperature and salinity data to the IYFS data base, which will require a re-configuration, the hydrographic data will be prepared in such a form that will allow for easy merging (probably via SAS) with any other parameters with which a cross-analysis is required. Thus the hydrographic data will not be entered to the SIR data base, but will be made available in requested extraction products. Any analysis must be done outside the data base.

Since station number is the only means by which temperature and salinity data can be identified with trawl stations, participants must ensure that hydrographic station numbers are included in their submissions to the SIR data base.

9 CO-ORDINATION OF FUTURE SURVEYS

9.1 Surveys planned for 1992

During the 1990 meeting of this Working Group it was estimated that 12 weeks of ship time for each quarterly survey were required. This time is needed not only to obtain a good spatial coverage of the North Sea, but also to have substantially

overlapping areas for intership calibration. The experience in 1991 has shown that at least 15 weeks are needed for each quarter, to compensate for time lost due to rough weather conditions, especially in the fourth quarter. In 1992 this requirement is fulfilled for each of the quarters. The text table below gives the amount of ships time (in weeks) available for the 1992 IBTS.

Country	I	II	III	IV
Netherlands	3	5 coarse *)	3 complem.*)	6 southern
UK (England)	-	-	4 coarse	5 coarse
UK (Scotland)	3	3 complem.	3 northern	-
France	3	-	3 southern	-
Germany	6	3 central	2 central (complem.)	-
Norway	4	4 northern (incl.IIIa)	-	4 northern
Denmark	3	-	-	3 central (incl.IIIa)
Sweden	3 IIIa	-	3 IIIa	-
TOTAL	25	15	18	18

*) the coarse and complementary coarse grids are shown in Figures 9.1 and 9.2.

In comparison to the other three quarters, the effort in the first quarter is much higher, due to the special tasks of the International Young Fish Survey. The allocation of the sampling areas to the participating nations is nearly the same as in 1991. The only difference is that Germany will cover the stations in the former herring sampling area 71, instead of Sweden.

For the three other quarters the continuity with existing surveys will be maintained, in particular with the German survey in the second quarter, the English and Scottish surveys in the third quarter, and the Dutch survey in the fourth quarter.

As in 1991 the quarterly surveys in 1992 will be co-ordinated by different national laboratories: quarter 1 Netherlands, quarter 2 Scotland, quarter 3 France and quarter 4 England. The programmes for the quarterly survey will be worked out in detail by the co-ordinators in correspondence with the participating countries and the Chairman of this Working Group.

9.2 Clear tow data

A pilot scheme to exchange national clear tow data for the GOV trawl provided useful information when working in an area new to a country or when there has been a need to move a fishing station. It has been agreed to exchange clear tow data on an annual basis and instructions have been included in the survey manual.

9.3 Data exchange during the surveys and preliminary reports

Each year, in the course of the first quarter survey, information on the number of 1 group fish, based on pre-defined delimiters of length, are exchanged between participating nations. This allows an almost immediate construction of preliminary indices for a number of important species. The table below gives the comparison between the North Sea preliminary indices and the final indices constructed after the otoliths have been read. The two sets of indices show very close agreement. Therefore the Working Group decided to exchange similar preliminary data during the surveys in the other three quarters.

Comparison of North Sea Preliminary and Final Indices for 1991

	Preliminary	Final
Cod	4.3	2.4
Haddock	628	679
Whiting	948	1014
N Pout	2770	2497
Herring	2358	2433
Sprat	940	1121
Mackerel	6.8	6.9

It was also decided to extend the preliminary data for the last three quarters to also cover 0-groups (where applicable) and fish older than 1 year. Such indices would give an early indication of the distribution of fish in the area surveyed. The quarterly co-ordinators will advise the participants of the data required and the format in which the data will be exchanged. If not already exchanged at sea, preliminary data should be sent to the quarterly co-ordinators not later than four weeks after the end of the survey. The co-ordinators will produce the preliminary report for the quarter for which they are responsible and subsequently send the analysis to the Chairman of the IBTS Working Group.

All vessels participating in a co-ordinated survey should maintain frequent contact by either telex or radio. At the very minimum, the identity of the statistical rectangles fished should be communicated to the quarterly co-ordinator on a regular basis. The co-ordinator should confirm communicating schedules and frequencies prior to the survey.

The length distributions of the target species should be reported in three groups. Namely 0-group if available, 1-group fish and older fish. The split between 1-group and older fish is described in the Manual.

9.4 Annual reports

The results should be finalised and summarised in an annual report presented to the Statutory Meeting. The final report from the first quarter should be kept as it is. The text for this report on the pelagic species will be prepared by A. Corten, and T. Boon will be responsible for the text on the gadoid species. The results from the other quarters should be summarised in one report containing the same types of maps and indices as the report from the first quarter. The ICES Secretariat is responsible for preparing the annual final reports.

10 RECOMMENDATIONS

The Workshop on the Analysis of Trawl Survey Data in Woods Hole is asked:

- 1) to advise on the introduction of measures to reduce the variability in fishing power of the GOV trawl, such as a change from the use of 110 m sweeps at water depths greater than 70 m to the use of 60 m sweeps throughout the survey area and the use of a constrain rope;
- 2) to advise on the design of a comparative fishing experiment.

All participants in the IBTS quarterly surveys should report:

- 1) the hydrographical station numbers on the exchange tapes to enable the combination of temperature and salinity data with the fish data for further studies;
- 2) gear parameters for each haul, to enable the statistical analysis of the influence these parameters have on catch rates.

The ICES Secretariat should soon decide which database management system the IYFS dataset will be stored in in the long term, so that sex-disaggregated length data can be accommodated in the not too distant future.

Table 3.1 Otolith Sampling in Quarter 1 1991

species/area	1	2	3	4	5	6	7	8	9	total
cod	814	421	168	121	44	538	261	0	0	2367
haddock	1222	1210	704	386	0	0	276	0	0	3798
whiting	833	927	686	662	421	1345	640	0	0	5514
N pout	332	167	108	62	0	0	76	0	0	745
herring	1895	610	460	1149	382	2929	2118	412	719	10674
sprat	14	5	190	379	200	1912	650	39	245	3634
mackerel	73	1	2	0	0	0	0	0	0	76

Table 3.2 Otolith Sampling in Quarter 2 1991

species/area	1	2	3	4	5	6	7	8	9	total
cod	656	683	194	109	55	754	282	278	256	3267
haddock	1173	909	558	387	3	15	322	111	23	3501
whiting	710	753	464	454	368	966	433	197	156	4501
N pout	347	196	122	126	0	13	39	0	0	843
herring *	606	505	594	636	263	344	147	240	346	3681
sprat	0	43	91	166	215	177	31	33	155	911
mackerel *	23	91	38	18	28	392	0	0	0	590

* data missing from Norway

Table 3.3 Otolith Sampling in Quarter 3 1991

species/area	1	2	3	4	5	6	7	8	9	total
cod	503	419	272	106	14	86	146	0	0	1546
haddock	645	1266	823	538	102	2	178	0	0	3554
whiting	1133	636	724	321	210	435	262	0	0	3721
N pout	229	96	96	39	0	0	25	0	0	485
herring *	23	85	36	66	41	144	54	0	0	449
sprat *	0	0	0	0	0	66	0	0	0	66
mackerel *	24	26	29	22	25	109	0	0	0	235

* data still to be provided by Scotland

Table 3.4 Otolith Sampling in Quarter 4 1991

species/area	1	2	3	4	5	6	7	8	9	total
cod	374	150	31	27	30	354	112	97	325	1500
haddock	2362	569	395	49	0	23	168	162	76	3804
whiting	469	532	372	184	157	890	337	209	333	3483
N pout	218	186	135	50	0	16	3	106	18	732
herring *	103	455	0	103	18	463	50	0	352	1544
sprat	100	313	100	117	180	513	100	0	28	1451
mackerel *	125	3	88	0	0	93	0	0	0	309

* data missing for Norway

Figure 3.1 First Quarter 1991. Number of valid hauls by rectangle.

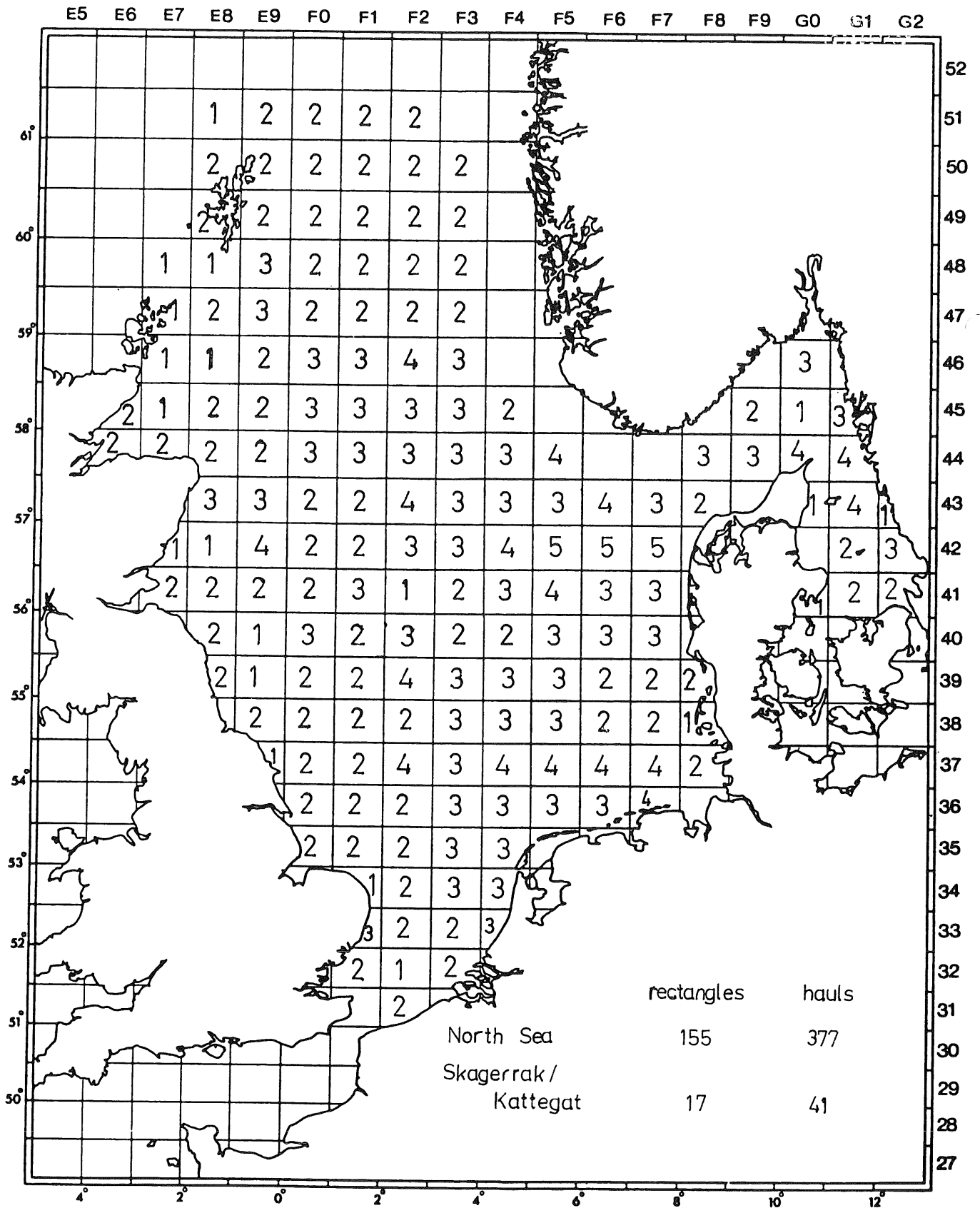


Figure 3.2 Second Quarter 1991. Number of valid hauls by rectangle.

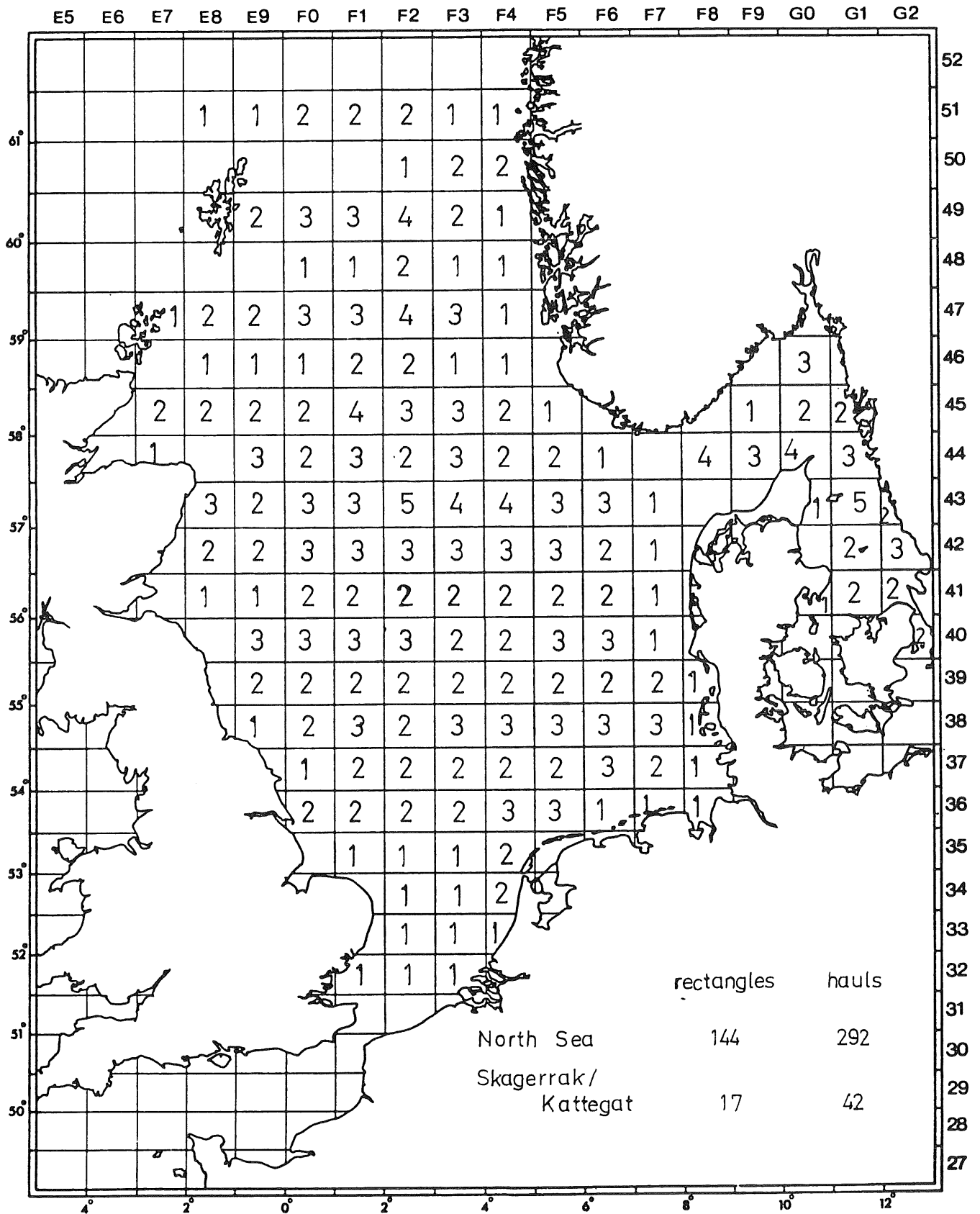


Figure 3.3 Third Quarter 1991. Number of valid hauls by rectangle.

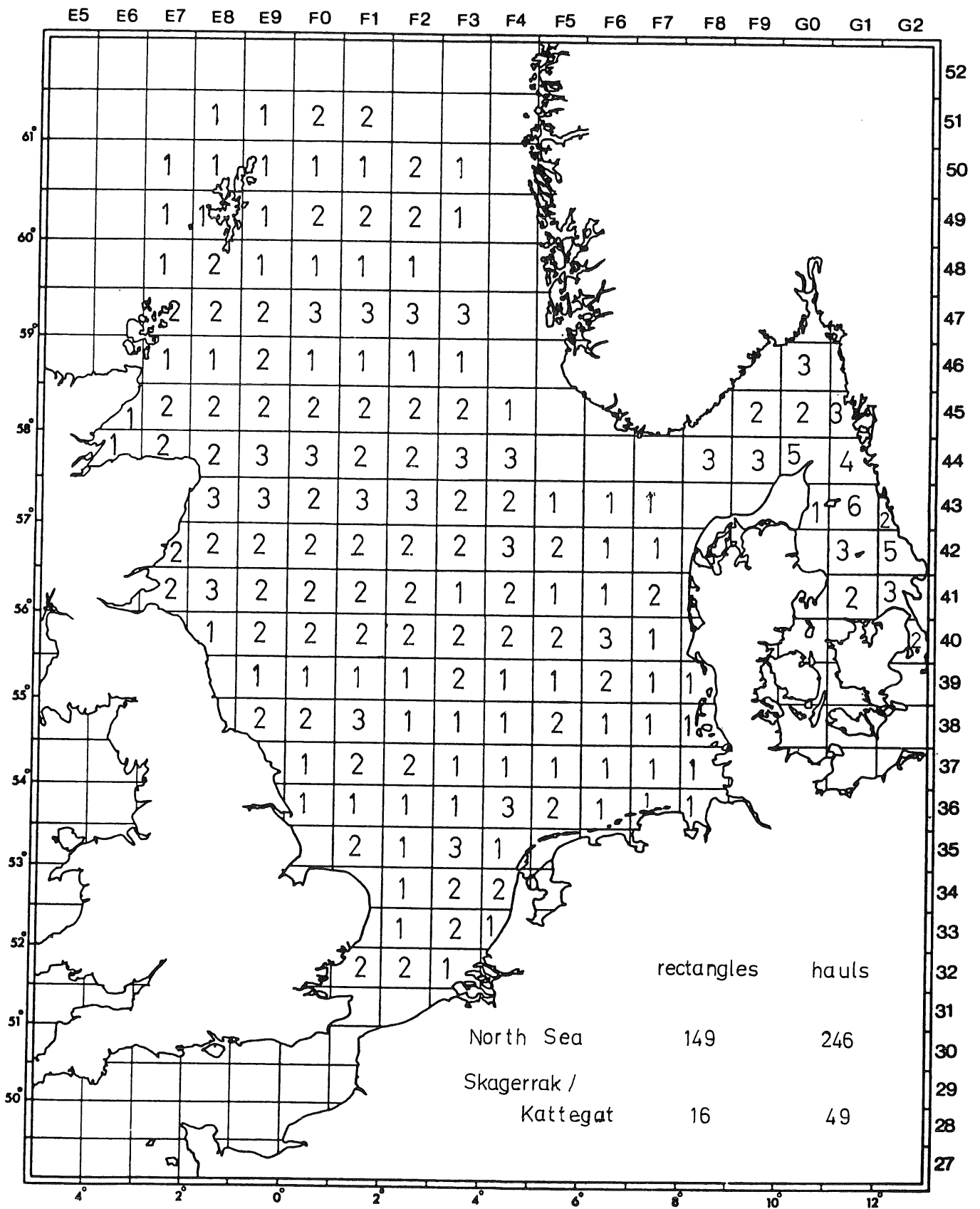


Figure 3.4 Fourth Quarter 1991. Number of valid hauls by rectangle.

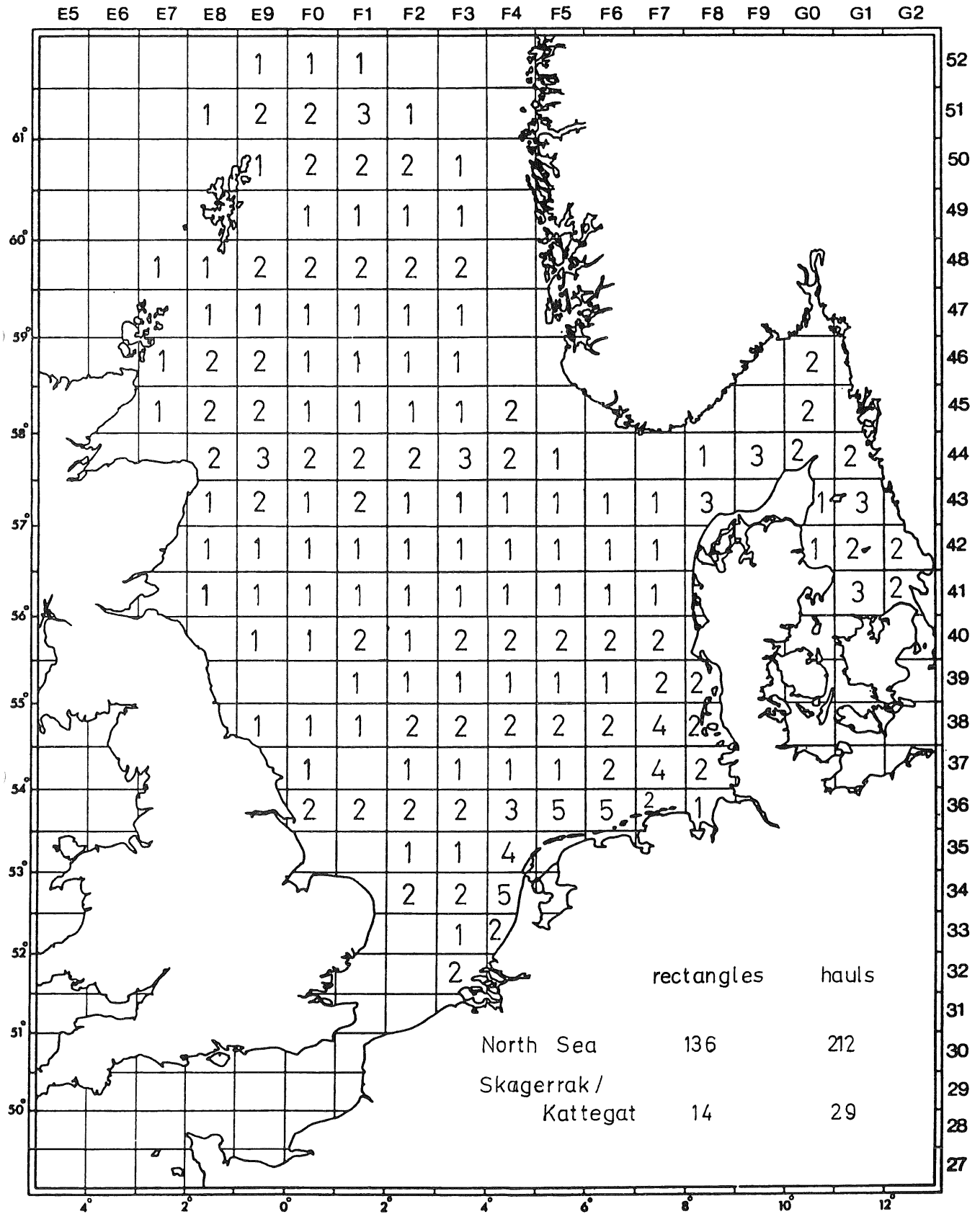


Figure 9.1 "Coarse" survey grid (76 stations).

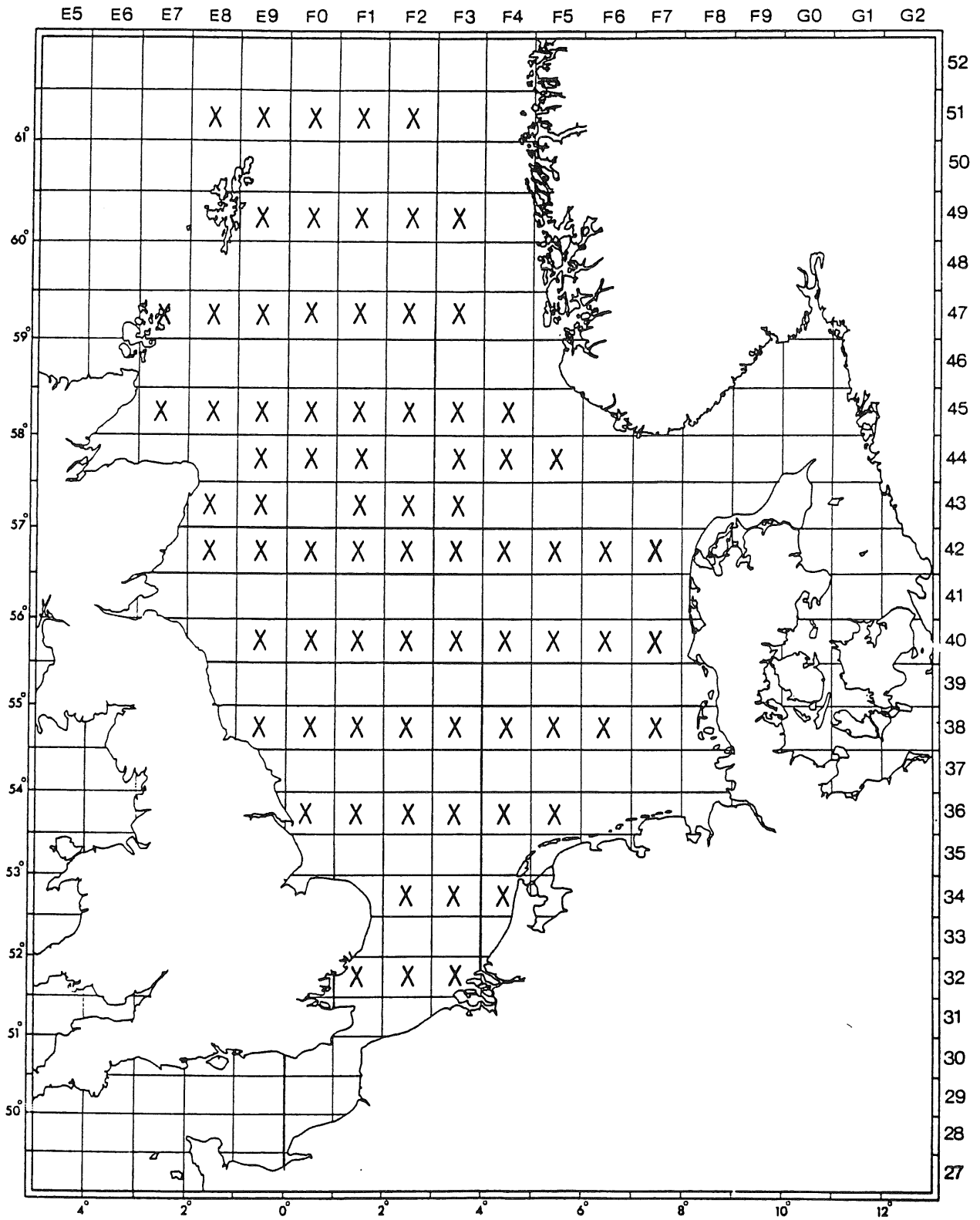


Figure 9.2 Complementary "coarse" grid (71 stations).

