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INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA

C.M. 1975/H:9
Pelagic Fish (Northern) Committee.

REPORT OF THE WORKING GROUP ON NORTH SEA YOUNG HERRING SURVEYS

22 - 24 April 1975, Ymuiden, The Netherlands.

Contents

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1. Introduction and participation

At the meeting of the Working Group on North Sea Young Herring Surveys in Ymuiden, 29 April - 3 May 1974, it was decided to introduce a new sampling pattern during future surveys. In previous surveys, the sampling effort had been equally distributed over the whole survey area, but from now on most of the effort would be concentrated in strata with a high density of I-group herring. A proposal to have a further meeting in 1975 was endorsed by the 62nd ICES Statutory Meeting, which decided that: " the Working Group on North Sea Young Herring Surveys should meet in Ymuiden from 22 to 24 April 1975 to evaluate the survey results and the new sampling procedures which will be instituted in the 1975 survey " (C.Res. 1974/2:28).

Consequently, the meeting was held in Ymuiden on 22 - 24 April 1975, and it was attended by the following participants:

Dr. H. Ackefors.....Sweden

Mr. A. Corten (chairman).....The Netherlands

Dr. H. Dornheim.....Germany (F.R.)

Mr. O.J. Østvedt.....Norway

Mr. K. Popp Madsen.....Denmark

Mr. A. Saville.....Scotland

Mr. G. Wagner.....Germany (F.R.)

Mr. R.J. Wood.....England

2. Results of the stratified sampling scheme in 1975

The sampling pattern for the Young Herring Survey in 1975 was laid down in accordance with the stratified sampling procedure described in the report of the Working Group in 1974 (C.M. 1974 H/6). The number of hauls should ideally be equally divided between the three strata, with 72 hauls each. In some of the squares, however, fewer hauls were made than would have been demanded by this procedure, and one square in stratum 1 was not fished at all. A full report of the 1975 survey is given in Doc. C.M. 1975 H:10.

The estimated mean for each stratum together with its variance is given below:

	No. of squares	No. of hauls	Mean No./hour	S^2
stratum 1	35	77	1116	105452
stratum 2	12	69	2615	474097
stratum 3	6	59	2238	1318547
total	53	205	1582	100014

The results show no large difference between mean abundance indices for strata 2 and 3, whereas a clear difference exists between these two strata and stratum 1. This indicates that an improvement was achieved in the 1975 survey by introducing stratified sampling. It would appear that with the herring distribution in 1975 it would have been sufficient to cover the investigation area by only two strata. However, considering information from earlier surveys it seems that 1975 may have been a-typical in this respect.

The method used for estimating the mean and its confidence limits for the whole standard area is given in appendix I. The overall mean abundance of year-class 1973 was 1582/hour, and its 90% confidence limits ± 33%.

For calculating the variance within each stratum, it has been assumed that hauls are distributed randomly within a stratum. Actually, it is only within a square that sampling may be regarded as random, but in most squares too few hauls have been made to estimate the within-square variance. Therefore, meaningful estimates of the variance could only be made for larger subdivisions, e.g. the strata.

In order to evaluate the gain in precision caused by the stratified sampling method, the same calculations have been made for year-classes 1971 and 1972, sampled during the Young Herring Surveys in 1973 and 1974. The confidence limits of the overall mean in those years were 67% and 53% respectively. Obviously, there has been a considerable gain in precision over the most recent years. Already in 1974 the precision showed some improvement, due to a more intensive sampling of the southeastern North Sea.

It will be noted that the mean densities for year-classes 1971 and 1972 calculated in the appendix are different from the figures published in earlier reports. This difference is due to the calculation method used. Normally, the overall mean is calculated as the mean of all squares. This means in fact that each square is considered as a separate stratum. In the above example, the overall mean was calculated as the weighted mean of the three strata. This is a more crude method, but it gives an estimate of the confidence limits of the mean. Only for the 1975 survey do both methods give an identical overall mean, because squares within a stratum had equal numbers of hauls.

3. Relation between abundance estimates of I-group herring from Young Herring Surveys and from Virtual Population Analysis

The major objective of the Young Herring Surveys is to provide estimates of the strength of a year-class as I-group, comparable with those derived from VPA, which can be used in estimating the total allowable catch for the following year. In the previous report of the Working Group (CM 1974/H:6) it was shown that there was a significant regression between the estimates of year-class strength from the YHS and the VPA-estimates of the same year-class at the same age.

The regression equation was

$$y = 0.0013477x + 4.069$$

This equation has been recalculated inserting the additional values now available for the year-class 1971, and using the slightly amended values from VPA for some of the more recent year-classes, given in CM 1975/H:2. The recalculated equation is

$$y = 0.0013851x + 3.619$$

where y is the predicted value of year-class strength as 1-ringers from VPA, and x is the strength of the year-class measured from the YHS. It will be noted that in the new regression the constant is somewhat lower than the one given in the previous report; it is however still accounting for a major part of the predicted value, amounting to over 50% of an average year-class.

The reason for the large intercept of the regression line on the Y-axis is still not clear. It is possible that this could indicate an area, which is contributing recruits to the North Sea stock, and which is not included in the estimate of abundance derived from the YHS. The most likely area in this respect is the Skagerak, which is known to be a nursery area for herring of the North Sea stock. Accordingly, the data from this area for past Young Herring Surveys were examined to see if it would be possible to get an estimate for these years, for this area. The squares fished and the catches of I-group herring taken in them in each year are given in the table below.

The data given in this table indicate that the coverage of the Skagerak has not been consistent enough to calculate an abundance index for each year. However, the figures suggest that in none of these years, I-group herring in the Skagerak were sufficiently abundant to make an appreciable change in the abundance index for the North Sea. Although the Working Group felt that this area should be sampled more thoroughly in future, it thought that the omission of Skagerak catches from past surveys could not have caused the large constant in the regression equation.

Catches of I-group herring in each year in the Skagerak area

Square	43F9	43G0	43G1	43G2	44F9	44G0	44G1	45F9	45G0	45G1	45G0	46G1
1960	-	-	-	-	835	490	-	-	-	-	-	-
1961	2680	-	-	-	31	25	320	-	-	-	-	-
1965	-	-	-	-	-	-	-	-	-	-	-	-
1966	-	-	-	-	-	-	-	-	-	-	-	-
1967	-	-	-	-	191	-	-	38	11	-	-	-
1968	-	-	-	-	193	-	-	-	-	-	-	-
1969	-	-	-	-	18315	269	2577	-	26	-	-	-
1970	-	-	-	-	24	43	56	-	81	-	-	-
1971	-	-	-	-	21	-	-	-	-	-	-	-
1972	-	-	158	383	194	1291	323	-	-	845	1	0
1973	-	-	208	238	173	163	33	-	-	16	-	-
1974	-	-	666	585	38	630	539	-	-	180	-	-
1975	-	-	1471	-	780	73		0	-	-	13	-

In figure 1a the abundance indices from the YHS are plotted against the values for these year-classes obtained from VPA. It is seen that the large intercept of the regression line is caused mainly by the year-classes 1964 - 67. For these year-classes, and also for year-class 1963, the YHS-indices may not be very reliable estimates because little sampling was done in the eastern coastal area where the highest concentrations of I-group herring are normally found.

In estimating the strength of these year-classes an attempt has been made to correct for these deficiencies in sampling (CM 1974/H:6), but the validity of these values is still suspect.

During the meeting of the Herring Assessment WG in February 1975, a new regression equation was calculated using only the 5 most recent year-classes, i.e. 1968 - 72. (CM 1975/H:2). The regression equation obtained was

$$y = 0.00278x + 0.68$$

Using the preliminary YHS-estimate for year-class 1973 of 1383 (the definite figure was not yet available at that time), the stock size of 1-ringers was estimated at 4.52×10^9.

During the present meeting it was considered that the estimate for year-class 1972 was not yet reliable enough to be used for the regression analysis. On the other hand, the WG thought that the estimates for year-classes 1958 and 1959 should be included, because the coverage for these year-classes was comparable to that for recent year-classes. Using this slightly different set of year-classes, the regression formula obtained is

$$y = 0.002286x + 1.555$$ (table 1, figure 1b)

It will be noted that the constant in this equation is quite low, accounting for only about 20% of an average year-class. Using this regression equation, the strengths of the 1972 and 1973 year-classes are estimated at 4.17 and 5.17×10^9 respectively.

The Working Group's attention was drawn to a draft paper on the relation between VPA-estimates and YHS-values by BURD and BOON (CM 1975/H), in which by statistical transformation of the data a regression was obtained with a somewhat lower value of the intercept than given above. The WG felt that in the absence of both authors, it had not sufficient information to assess the appropriateness of the statistical techniques used, and that this should be discussed at the forthcoming Statutory Meeting.

4. Sampling of 0-group herring during the YHS

Ackefors (CM 1974/H:34) using an Isaacs-Kidd midwater trawl showed that post-larvae of herring could be caught in considerable numbers in the Skagerak area. In order to extend these observations to the North Sea, participating countries were asked to include pelagic hauls with some suitable gear as part of the Young Herring Surveys.

For those nations which complied with the request, the gear used and the number of hauls are given below:

England	Booth-Bay net	12 stepwise hauls
Germany	Gulf III (unencased)	44 oblique hauls
Netherlands	Isaacs-Kidd midwater trawl	6 oblique hauls
Norway	Isaacs-Kidd midwater trawl	12 oblique hauls
Sweden	Isaacs-Kidd midwater trawl	34 oblique and
	"	31 horizontal hauls

Figure 2 shows the distribution of sampling by the various countries. The catches of the Gulf III sampler and those of the larger gears have been represented separately in figures 3 and 4.

It is indicated that at this time of the year larvae are mainly found in the eastern North Sea and Skagerak, obviously a result of an easterly larval drift from the spawning area along the Britisch coasts.

The largest patch extends from the Jutland Bank and into the easternmost part of the Skagerak. A smaller patch found west of Texel probably derives from the recent Channel spawning, judged by the relatively smaller size of the larvae.

Out of the large number of hauls made by Gulf III sampler, only six hauls contained any larvae, and the maximum number caught in one haul was three. For the purpose in question the Gulf III sampler can not be considered an effective gear and the Working Group felt that the Isaacs-Kidd net should be recommended as a standard gear.

It is not possible from these preliminary results to ascertain the true value of this type of survey. However, the Group felt that it is of the utmost importance to obtain a year-class estimate at the earliest possible stage. In future a complete coverage of at least the area sampled for I-group herring should be made, using an Isaacs-Kidd net during the night, until a proper evaluation of this technique for estimating year-class strength is possible.

The results of the Swedish sampling, using both oblique and horizontal hauls are given in tables 2 and 3, and also in figure 5 It appears from this comparison that in terms of average numbers caught, oblique hauls are more effective in the North Sea and western Skagerak. The opposite is apparently the case in the innermost Skagerak, a feature already found in earlier investigations by Ackefors (loc.cit.). That the larvae in the inner Skagerak tend to concentrate closer to the surface may be ascribed to the special hydrographic regime of that area.

The Group concluded that in order to standardise the sampling, oblique hauls should be made as a routine, but that additional horizontal hauls shoud be made east of 8° E., in order to continue the series of data already available for that area.

5. Standardisation of fishing gear

During the meeting, specifications of the fishing gear currently in use were available only for the Netherlands, England, Germany and Norway. Details of the rigging were available for the Netherlands, England and Norway. Even from this limited material it was evident that considerable differences exist between the gears used by various participants. For example, some countries used 1 or 2 kites, while others employed only floats on the headline. There are also considerable differences in length of the headline and mesh size of the nets. Basic specifications of some trawls used are listed in table 4. As part of this information was compiled after the meeting of the WG, there was no opportunity to discuss the differences in detail during the meeting.

Obviously, the differences in fishing gear mentioned above will correspond to differences in fishing power between the ships. Because of practical problems, it has not been possible yet to quantify these differences in fishing power, and it seems unlikely that this can be achieved in the near future. Therefore, the best solution would be for every ship to use a standard fishing gear, which would eliminate at least part of the differences in fishing power between the ships. Although the change to a new gear will not be without problems for some countries, the WG felt that every effort should be made to increase the reliability of the YHS-estimates in view of the considerable economic consequences.

Ways were considered in which standardisation could be achieved:

1) A standard gear should preferably be supplied by the same manufacturer or made according to very strict and detailed specifications, which should also include the rigging.

2) The standard gear should be easy to handle by even the smallest or least efficient vessel likely to participate in the YHS.

3) Standard trawl doors should be used.

4) The speed of tow and the warp/depth ratio should be standardised.

5) It was recommended to choose from the nets that are currently used the one which comes nearest to the specifications set out above.

The Working Group felt that it did not possess enough specialised knowledge to attempt any detailed recommendation for the construction of a standard trawl. However, as a first guiding line it could recommend a trawl with a headline of 63 feet, using floats instead of kites. Such a gear would comply with paragraphs 2 and 5 set out above; it would insure a reasonable degree of comparability between past and future surveys, and it would be somewhat less costly in purchase than a large trawl with more elaborate rigging.

The Working Group decided that technical advice should be sought for drawing up a detailed recommendation. A proposal for a standard gear will be circulated among the participating countries, and the final decision should be taken at the ICES Statutory Meeting in 1975.

If countries are not yet able to comply with this recommendation during the 1976 YHS, they should provide specifications on the gear they have used as listed in Appendix II.

6. Planning of future surveys

Coding of statistical rectangles

The coding system for statistical rectangles, given in the programme for the 1975 survey, is different from the one now officially adopted by ICES (Council Resolution 1974/4:8). The Working Group decided that for future surveys only the official ICES coding system should be used.

Radio contact at sea

During the survey, a uniform system should be used to communicate catch data between the ships. The system used during the 1975 survey has proved to be quite satisfactorily. For each haul the following data were transmitted to the coordinating vessel:

- square number
- number of herring < 20 cm
- number of cod < 25 cm
- number of haddock < 20 cm
- number of whiting < 20 cm

Using this system, results can also be exchanged in Morse code.

Exchange of suitable trawling positions

During previous surveys, some countries lost a great deal of vessel time and fishing gear in finding suitable trawling positions. It was agreed that a list will be compiled in which for each square at least 5 clear trawling tracks will be given in Decca positions, together with the direction of tow.

7. Conclusions

a) The use of a stratified sampling scheme in 1975 has resulted in a higher sampling intensity in areas where most of the herring was concentrated. The distiction between strata II and III, however, had little meaning in the 1975 survey since fish abundance in these two strata was approximately the same. A proper evaluation of the gain in precision, achieved by the stratification procedure, will only be possible after the new scheme has been used for several years.

b) The large intercept of the regression line of VPA estimates on abundance indices from the YHS is largely caused by year-classes sampled in the period 1965 - 1969. The coverage, particularly of the easternmost parts of the North Sea, was poor in this period and the Working Group considered this may have caused an underestimate of the herring abundance. A new regression line was calculated by leaving out the year-classess 1963 - 1967, and this regression line has a much lower intercept.

c) The Working Group recommends the adoption of a standard trawl gear with a 63 ft headline. A detailed specification will be circulated to participating countries.

d) From the limited sampling of 0-group herring in 1975, it is not possible to evaluate this type of survey. The Working Group recommends that the sampling by Isaacs-Kidd nets, started during the 1975 survey, should be intensified in future years.

TABLE 1 - Data used in calculating different regression formules for VPA values on YHS estimates.
VPA values of yearclass strength in numbers x 10^{-9}
YHS estimates in mean number of 1-group herring per hour for standard area.

yearclass	YHS-estimate	VPA values used to calculate the regression formula			
		CM 1974/H:6	CM 1975/H:2	this report	this report
1958	2413	7.07		7.07	7.07
1959	37	1.63		1.63	1.63
1963	4064	9.44		9.40	
1964	815	5.07		5.02	
1965	429	4.44		4.43	
1966	419	6.30		6.24	
1967	320	6.29		6.10	
1968	1042	4.93	3.38	3.35	3.35
1969	2570	7.75	7.63	7.31	7.31
1970	1632	6.29	6.29	5.69	5.69
1971	837		4.13	3.78	3.78
1972	1144		2.23		
1973	1582				
regression formula		y= 0.00135 x + 4.07	y = 0.00278 x + 0.68	y = 0.00139 x + 3.62	y = 0.00229 x + 1.56

TABLE 2 - Swedish sampling of O-group herring during the IYHS 1975. Oblique hauls with Isaacs-Kidd net.

Square	Number of hauls	Mean number per hour	Range in numbers per hour	Size range mm
1133	4	27.8	21 - 42	27 - 39
1134	2	34.5	18 - 51	26 - 38
1136	1	12	24 - 33	24 - 33
1141	1	0		
1235	3	35.8	11.4-69	26 - 39
1236	4	23.5	3 -42.8	22 - 42
1240	1	0		
1241	2	0		
1337	2	78	33 - 123	21 - 44
1340	1	0		
1341	2	2.7	0 - 5.4	35
1438	2	7.5	3 - 12	24 - 35
1439	3	1.9	0 - 3	32 - 35
1539	4	3.8	0 - 9	26 - 41
1540	2	16.5	3 - 30	21 - 39
	34	18.8	0 - 123	21 - 44

TABLE 3 - Swedish sampling of O-group herring during the IYHS 1975. Horizontal hauls with Isaacs-Kidd net.

Square	Number of hauls	Mean number per hour	Range in numbers per hour	Size range mm
1133	4	25.5	0 - 72	26 - 37
1134	2	4.5	0 - 9	31 - 34
1135	1	0		
1136	2	1.5	0 - 3	22
1235	3	5.0	0 - 9	31 - 39
1236	3	12.5	0 - 28.6	29 - 41
1240	1	0		
1241	2	0		
1337	2	1.5	0 - 3	31
1340	1	0		
1341	1	0		
1438	1	0		
1439	3	12.0	0 - 36	27 - 46
1539	4	41.3	9 - 66	22 - 44
1540	2	16.5	9 - 24	30 - 47
	32	13.6	0 - 72	22 - 47

TABLE 4 - Basic specifications of trawls used during 1975 YHS.

country	headline length (m)	groundrope length (m)	bridle length (m)	number of kites	number of floats	weight on groundrope (kg)	number of legs
Denmark							
England	19	39	29	2	0	57	3
Germany	22	41	10-15	1	?	?	2
Netherlands	22	45	55	2	0	100	3
Norway	29	32	37	0	?	?	3
Scotland	21	36	50	0	40	?	3
Sweden	43	58	108	0	21	88	3
USSR							

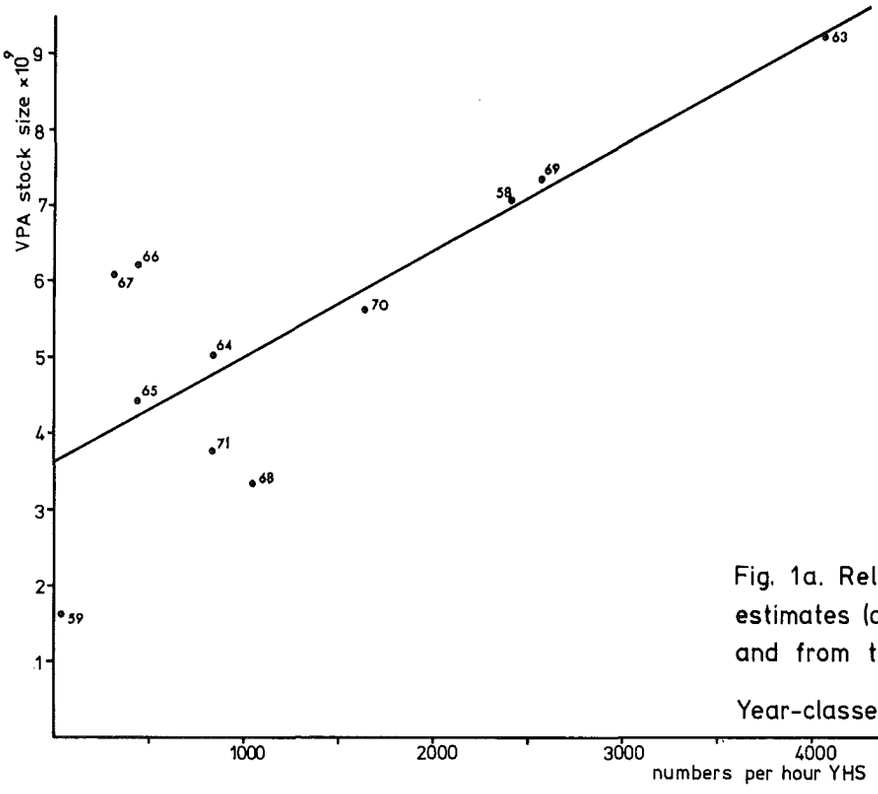


Fig. 1a. Relation between year-class estimates (as 1-group) from VPA and from the Young Herring Surveys.

Year-classes 1958-59 and 1963-71.

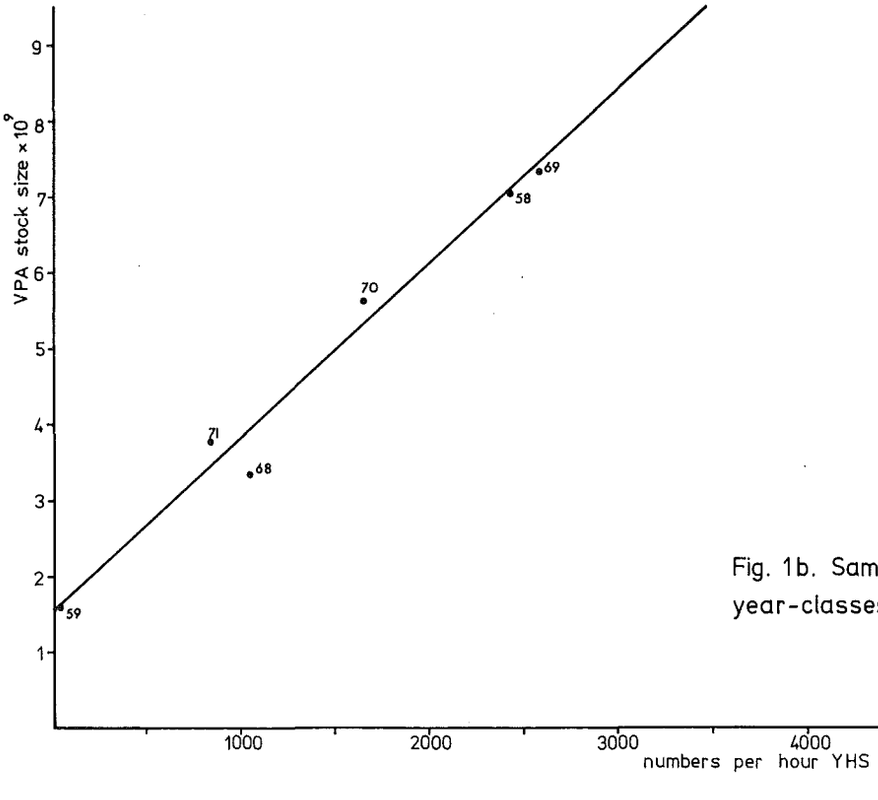
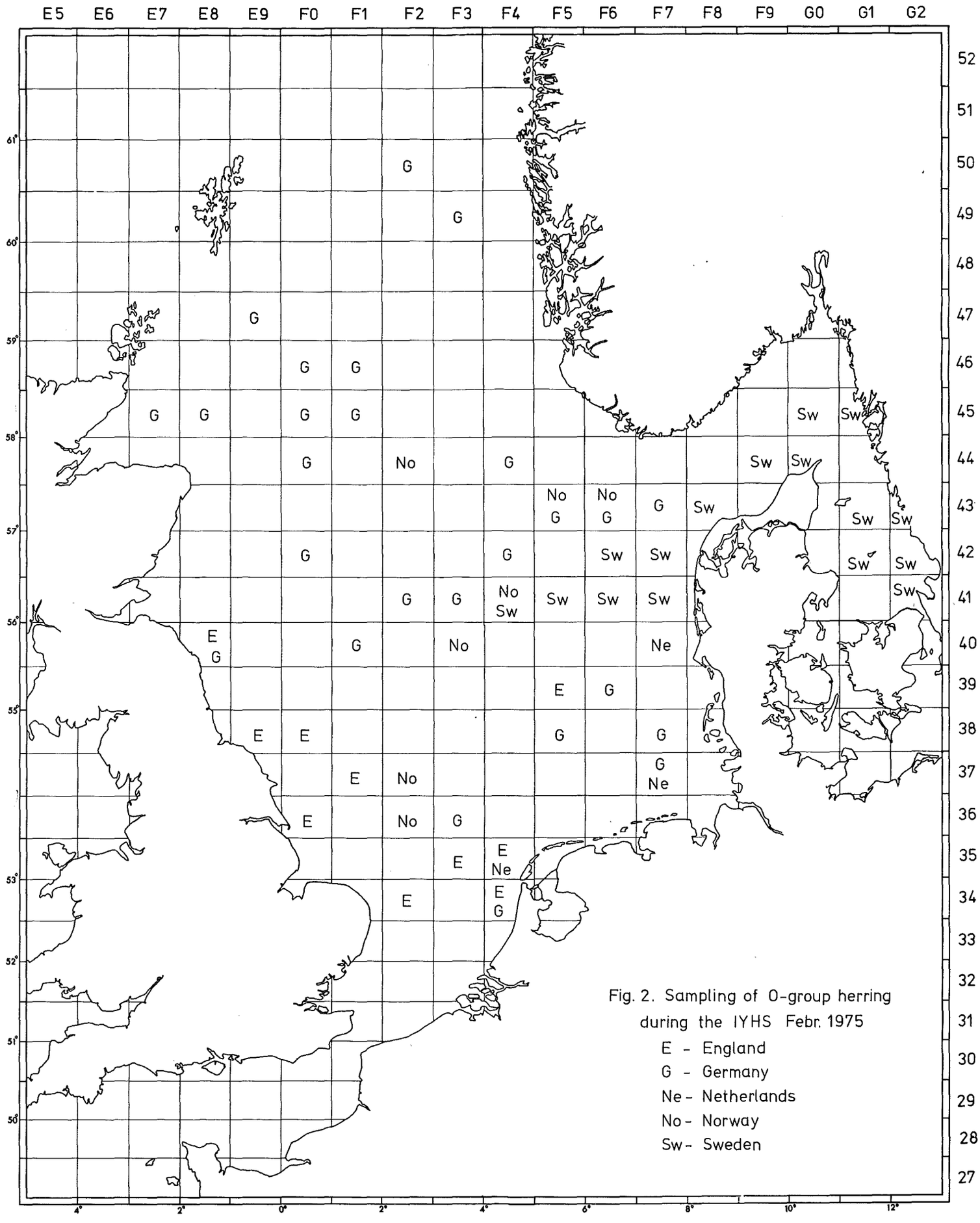


Fig. 1b. Same relation, but only for year-classes 1958-59 and 1968-71.


E5 E6 E7 E8 E9 F0 F1 F2 F3 F4 F5 F6 F7 F8 F9 G0 G1 G2
52 51 50 49 48 47 46 45 44 43 42 41 40 39 38 37 36 35 34 33 32 31 30 29 28 27
61° 60° 59° 58° 57° 56° 55° 53° 52° 51° 50°
4° 2° 0° 2° 4° 6° 8° 10° 12°
G
G
G
G G G G
G G G G
G No G
No G No G G Sw
G G Sw Sw Sw Sw
G G No Sw Sw Sw Sw Sw Sw
E G G No Ne
E G
E E G G
E No G Ne
E No G
E Ne
E G
Sw Sw
Sw Sw
Sw Sw
Sw Sw
Sw
Fig. 2. Sampling of 0-group herring during the IYHS Febr. 1975
E - England
G - Germany
Ne - Netherlands
No - Norway
Sw - Sweden

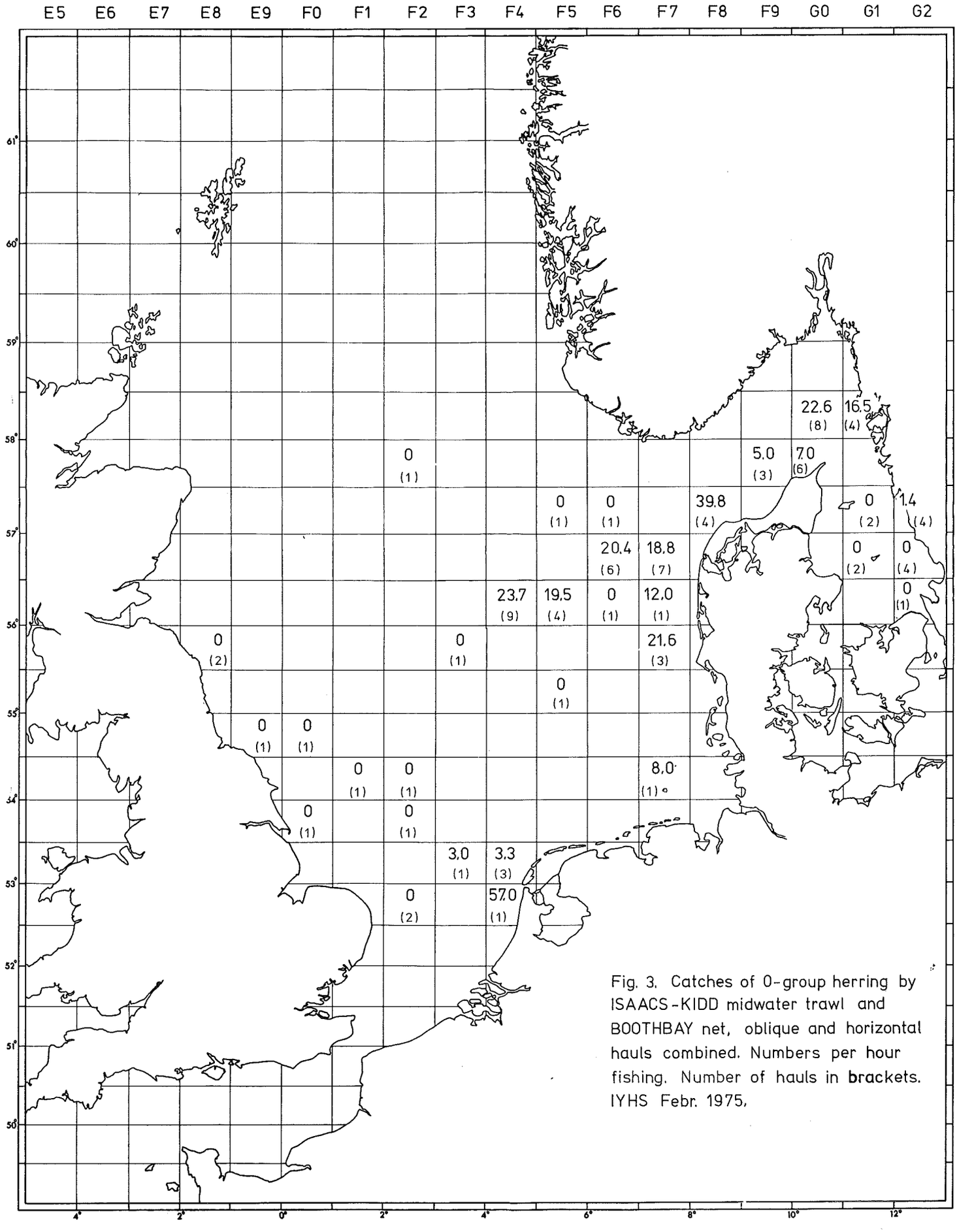


Fig. 3. Catches of 0-group herring by ISAACS-KIDD midwater trawl and BOOTHBAY net, oblique and horizontal hauls combined. Numbers per hour fishing. Number of hauls in brackets. IYHS Febr. 1975.

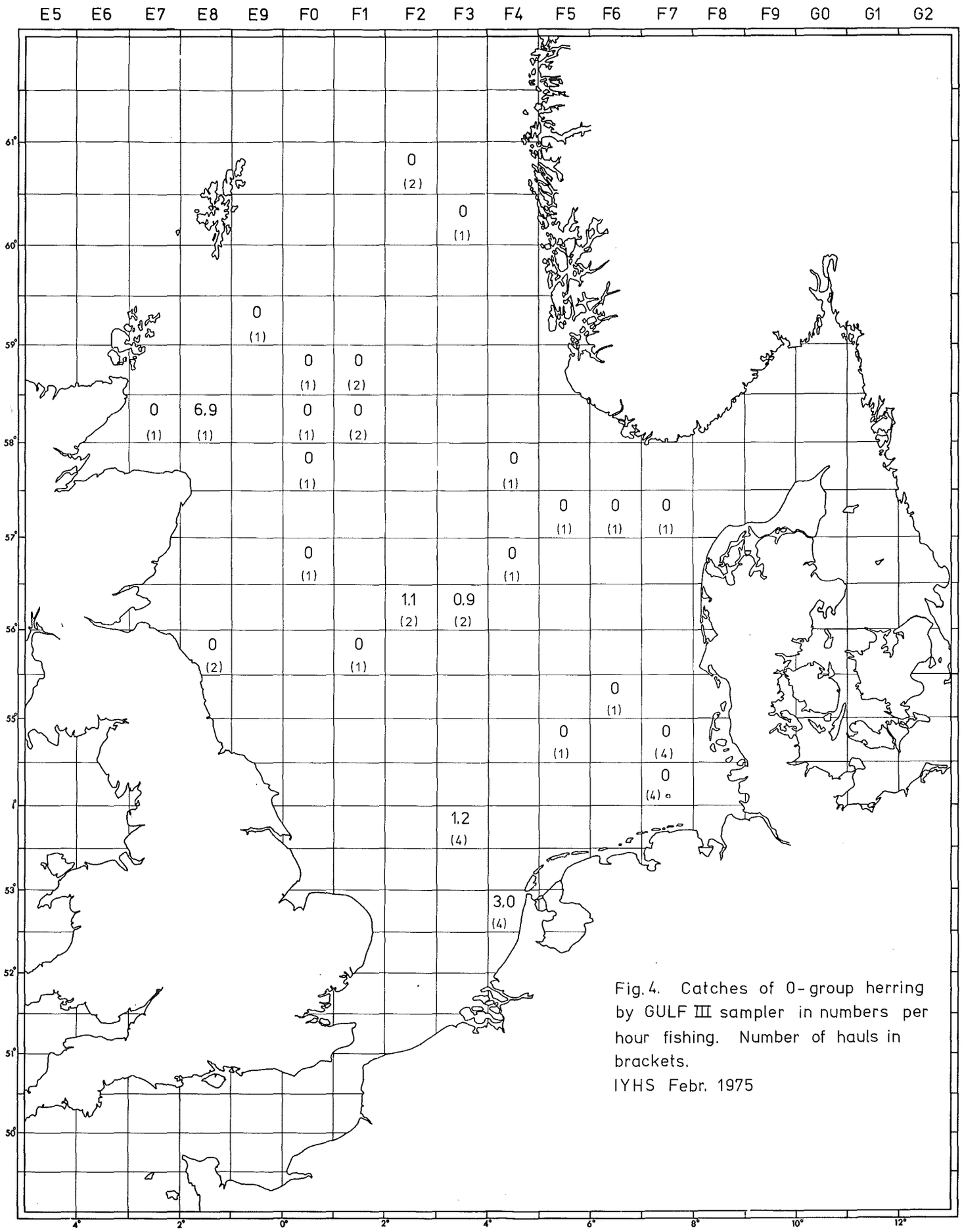


Fig. 4. Catches of 0-group herring by GULF III sampler in numbers per hour fishing. Number of hauls in brackets.
IYHS Febr. 1975

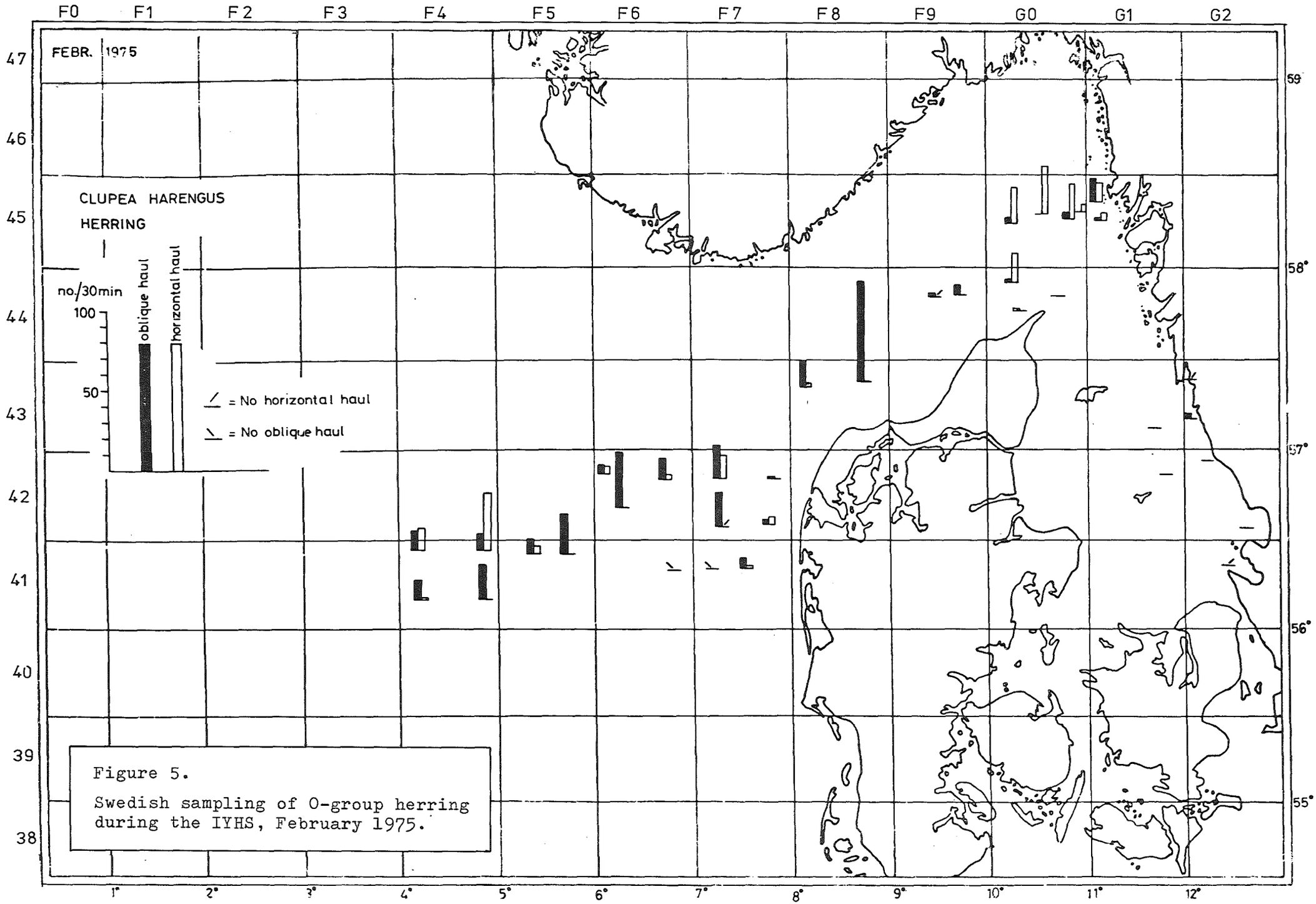


Figure 5.

Swedish sampling of 0-group herring during the IYHS, February 1975.

APPENDIX 1.

The calculation of the mean abundance index and its confidence limits, applied to the young herring surveys in 1973, 1974 and 1975.

For the 1975 survey, the standard area of 53 squares was divided into three different strata. The stratified mean for the whole standard area is given by:

$$\bar{y}_{st} = \sum_{h=1}^{3} \frac{N_h \cdot \bar{y}_h}{N}$$

in which N_h = area of stratum h

N = total standard area

$\bar{y}_h$ = sample mean in stratum h

The stratified mean $\bar{y}_{st}$ has a variance of:

$$S^2(\bar{y}_{st}) = \sum_{h=1}^{3} \frac{N_h^2}{N^2} \cdot \frac{S_h^2}{n_h}$$

S_h^2 = sample variance in stratum h

N_h = number of samples in stratum h.

Assuming a normal distribution of $\bar{Y}_{st}$, the 90% confidence limits are then given by:

$$\bar{Y}_{st} \pm 1.65 \cdot S_{(\bar{y}_{st})}$$

In the calculations for the surveys in 1973 and 1974, the same stratification was used as for 1975.

YHS 1973, year-class 1971

individual hauls per stratum				
stratum 1			stratum 2	stratum 3
0	0	1382	0	26166
0	0	1710	35	1834
0	0	110	1068	2
4	0	31	0	0
34	0	234	0	8318
1550	0	32	682	2220
2241	0	94	996	102
13	286	9	159	119
1189	8	173	16166	320
99	143	82	1090	200
8	792	1345	244	134
0	0	86	210	
0	0	852	286	
0	0	1022	92	
0	30	1	68	
0	42	1	262	
0	17	5	230	
0	16	0	0	
0	370		0	
0	1			
n= 58 m= 242 S^2=. 260866			n= 19 m= 1136 S^2= 13385749	n= 11 m= 3583 S^2 = 62109445

$$\bar{y}_{st} = \left(\frac{35}{53} \times 242\right) + \left(\frac{12}{53} \times 1136\right) + \left(\frac{6}{53} \times 3583\right) = 823$$

$$S^2(\bar{y}_{st}) = \left(\frac{35}{53}\right)^2 \times \frac{260866}{58} + \left(\frac{12}{53}\right)^2 \times \frac{13385749}{19} + \left(\frac{6}{53}\right)^2 \times \frac{62109445}{11} =$$

$$= 1961 + 36141 + 72273 = 110\,376$$

$$S(\bar{y}_{st}) = 332$$

The 90% confidence limits of $\bar{y}_{st}$ are

$823 \pm 1.65 \times 332 = 823 \pm 548 = 823 \pm 67\%$

YHS 1974, year-class 1972

individual hauls per stratum						
stratum 1				stratum 2		stratum 3
0	0	202	808	19658	41	44
6	0	2692	154	21	160	4
2	242	1735	16	138	96	0
0	2	176	2	18	20	16196
0	0	12	11	10	82	160
213	0	0	195	312	10664	70
0	4	0	1562	577	960	9
348	0	161	50	7390		30
592	1077	2370	11	20		100
4	814	542	1160	0		60
114	188	4000	0	6		
9	1108	612	0	2500		
12	890	2072	0	0		
6	67	432		69		
0	488	500		160		
0	580	636		0		
3	270	580		491		
0	1	326		314		
0	0	658		1926		
0	8	1052		232		
n = 72				n = 27		n = 10
m = 408				m = 1699		m = 1667
s^2 = 517136				s^2 = 18794542		s^2 = 26062062

$$\bar{y}_{st} = \left(\frac{35}{53} \times 408\right) + \left(\frac{12}{53} \times 1699\right) + \left(\frac{6}{53} \times 1667\right) = 843$$

$$s^2_{(\bar{y}_{st})} = \left(\frac{35}{53}\right)^2 \times \frac{517136}{72} + \left(\frac{12}{53}\right)^2 \times \frac{18794542}{27} + \left(\frac{6}{53}\right)^2 \times \frac{26062062}{10} =$$

$$= 3132 + 35710 + 33359 = 72201$$

$$s_{(\bar{y}_{st})} = 260$$

The 90% confidence limits of $\bar{y}_{st}$ are

$$843 \pm 1.65 \times 269 = 843 \pm 443 = 843 \pm 53\%$$

YHS 1975 , year-class 1973

individual hauls per stratum							
stratum 1			stratum 2			stratum 3	
0	6	7654	520	0	326	0	1258
0	29	136	3	0	2911	3	1294
1	0	7	41705	2	1186	10	2254
0	3	0	14858	0	1152	225	312
328	470	234	11613	0	1647	209	178
85	486	116	1020	0	783	206	192
429	122	0	325	374	100	673	143
149	0	840	4056	194	852	130	499
6	0	2031	1799	126	1621	190	583
5	0	1483	306	4075		2624	406
4	0	9353	153	18		224	0
3	2	133	1078	3		526	377
12	6	15540	450	4796		836	0
3	12	1083	352	269		677	0
948	22	0	4968	0		106	1
3680	75	570	14168	1		2174	394
86	14	10	750	879		1332	0
2690	13735		136	15		3509	5
50	0		3872	162		1962	0
3	0		2004	0		938	0
0	0		432	2199		400	12194
0	0		1847	3337		67156	4176
70	1018		1405	3520		1928	1890
8	34		3725	7618		0	4494
267	88		3483	31		0	900
3620	0		7392	4743		15	619
1181	0		7920	556		60	1266
62	7		302	2		20	6458
3969	3252		3501	327		168	2651
1952	7739		2021	424		3170	
n = 77 m = 1116 s^2 = 8119789			n = 69 m = 2615 s^2 = 32712680			n = 59 m = 2238 s^2 = 77794297	

$$\bar{y}_{st} = \left(\frac{35}{53} \times 1116\right) + \left(\frac{12}{53} \times 2615\right) + \left(\frac{6}{53} \times 2238\right) = 1582$$

$$s^2_{(\bar{y}_{st})} = \left(\frac{35^2}{53}\right) \times \frac{8119789}{77} + \left(\frac{12^2}{53}\right) \times \frac{32712680}{69} + \left(\frac{6^2}{53}\right) \times \frac{77794297}{59} =$$

$$= 45988 + 29731 + 24296 = 100014$$

$$s_{(\bar{y}_{st})} = 316$$

The 90% confidence limits of $\bar{y}_{st}$ are $1582 \pm 1.65 \times 316 =$

$$= 1582 \pm 521 = 1582 \pm 33\%$$

APPENDIX 2

List of gear specifications (to be supplied together with the results from the IYHS)

1. Length of headline
2. Length of groundrope
3. Length of bridles
4. Number and length of legs
5. Number and volume of floats
6. Number of kites
7. Total weight on groundrope
8. Weight and area of otter boards
9. Vertical net opening

All dimensions should preferably be given in metric units.