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Incorporation of External Factors in Marine Resource Surveys

1999 ICES COORDINATED ACOUSTIC SURVEY OF ICES DIVISIONS IIIa, IVa, IVb and VIa (NORTH)

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ABSTRACT

Five surveys were carried out during late June and July covering most of the continental shelf north of 54°N in the North Sea and Ireland to the west of Scotland to a northern limit of 62°N. The eastern edge of the survey area is bounded by the Norwegian and Danish coasts, and to the west by the Shelf edge between 200 and 400 m depth. The surveys are reported individually, and a combined report has been prepared from the data from all surveys. The combined survey results provide spatial distributions of herring abundance by number and biomass at age by statistical rectangle.

METHODS

Five surveys (Fig. 1 .1) were carried out during late June and July covering most of the continental shelf north of 54° N in the North Sea and Ireland to the west of Scotland to a northern limit of 62°N. The eastern edge of the survey area is bounded by the Norwegian and Danish

coasts, and to the west by the Shelf edge between 200 and 400 m depth. The surveys are reported individually, and a combined report has been prepared from the data from all seven surveys.

1 SURVEY REPORT FOR FRV *SCOTIA* IN THE NORTHERN NORTH SEA 1-24 JULY 1999

Methods

The acoustic survey on FRV Scotia was carried out using a Simrad EK500 38 kHz sounder echo-integrator with transducer mounted on the drop keel. Further data analysis was carried out using Echoview software and Marine Laboratory analysis systems. The survey track (Fig. 1.2) was selected to cover the area in one levels of sampling intensity based on the limits of herring densities found in previous years, a transect spacing of 15 nautical miles was used in most parts of the area with the exception of a section over the 80 miles holes east of Orkney and areas both east and west of Shetland where short additional transects were carried out at 7.5 nm spacing. On the administrative boundaries of 1 °E and 4°W the ends of the tracks were positioned at ½ the actual track spacing from the area boundary, giving equal track length in any rectangle within the area. The between-track data could then be included in the data analysis. Additional work with Autosub 1 and autonomous submarine were carried out during the survey. The results are reported in Fernandes *et al.* (1999). Transects at the coast and shelf break were continued to the limits of the stock and the transect ends omitted from the analysis. The origin of the survey grid was selected randomly with a 15 nm interval the track was then laid out with systematic spacing from the random origin. Where 7.5 nm spacing was used the same random origin was used.

Trawl hauls (positions shown in Fig. 1.2) were carried out during the survey on the denser echo traces. Each haul was sampled for length, age, maturity and weight of individual herring. Between 250 and 700 fish were measured at 0.5 cm intervals from each haul. Otoliths were collected with five per 0.5 cm class below 27 cm, and 10 per 0.5 cm class for 27.5 cm and above. The same fish were sampled for weight including and excluding gonads, sex, maturity, stomach contents and macroscopic evidence of Ichthyophonus infection.

Data from the echo integrator were summed over quarter hour periods (2.5 nmi at 10 knots). Echo integrator data was collected from 11 m below the surface (transducer at 8 m depth) to 1 m above the seabed. The data were divided into four categories, by visual inspection of the echo-sounder paper record and the integrator cumulative output; 'herring traces', 'probably herring traces' and 'probably not herring traces' all below 50 m and shallow herring schools above 50 m. For the 1999 survey 77% of the stock by number was attributable to the 'herring traces' and 19% to the 'probably herring traces' and 4% to the shallow herring schools. The third category which gave 14% of total herring was attributable to particularly to Norway pout in the south and east of the area and some mixtures of haddock and whiting. In most cases the fish species in the area were either easily recognisable from the echo-sounder record or did not appear to occupy the same area as the herring. Some damage to fishing gear occurred in the second part of the cruise and trawling was reduced, giving some uncertainty in the area to the North of Orkney Herring were found almost exclusively in waters where the seabed was deeper than 100 m, except for the area east of Orkney.

One calibration was carried out the transducer and cable systems used during the survey. Agreement between calibration this year and last year on the same systems was better than 0.01 dB. The second calibration on the last day of the survey had to be abandoned due to bad

weather. To calculate integrator conversion factors the target strength of herring was estimated using the TS/length relationship recommended by the acoustic survey planning group (Anon, 1982):

$$TS = 20\log_{10}L - 71.2 \text{ dB per individual}$$

The weight of fish at length was determined by weighing fish from each trawl haul which contained more than 200 herring. Lengths were recorded by 0.5 cm intervals to the nearest 0.5 cm below. The resulting weight-length relationship for herring was:

$$W = 2.257\ 10^{-3}\ L^{3.400} \text{ g L measured in cm}$$

Herring Survey Results

A total of 38 trawl hauls were carried out (Fig. 1.2), the results of these are shown in Table 1.1. 27 hauls with significant numbers of herring were used to define four survey sub areas (Fig. 1.3). The mean length keys, mean lengths, weights and target strengths for each haul and for each sub area are shown in Table 1.2. A total of 2,694 otoliths were taken to establish four age length keys, one per area (Fig. 1.2). The numbers and biomass of fish by quarter ICES statistical rectangle are shown in Figure 1.2. A total estimate of 7,635 million herring or 1,379 thousand tonnes was calculated for the survey area. 1,263 thousand tonnes of these were mature. Herring were found mostly in water with the seabed deeper than 100 m, with traces being found in waters with depths of up to 200 m. The survey was continued to 250 m depth for most of the western and northern edge between 0" and 4°W. Herring were generally found in similar water depths and location to 1998 however, the distributions were more northerly with less herring found west of Shetland and Orkney. The fish traces were continuous in character similar to 1998 more mixed in size but in most case quite separate from other species. Table 1.3 shows the estimated herring numbers mean lengths weights and biomass and percentage mature by sub area and by age class.

In addition to the 1,379 thousand tonnes of herring, approximately 191 thousand tonnes of other fish species were observed in mid water in similar depths and conditions. Examination of the catch by species (Table 1 .1) shows the difficulty of allocating this between species so this has not been attempted. The dominant part must be considered to be Norway pout with some haddock, mackerel and whiting. The proportions of mature 2 ring and 3 ring herring were estimated at 71% and 91% respectively. This is a lower proportion for 2 ring mature than those found in 1998. Proportion of 3 ring mature was lower than the long term mean by about 4%. There is again evidence of icthyophonus in the population. The general lower than last to last year however, some 2 ring fish were found to be infected. Twenty-five out of 2,694 fish examined were found to be infected compared with 30 of the 3,600 herring examined in 1998. The age-structured infection rates are shown below.

Age/Matutity	1	2	3	4	5	6	7	8	9
% Infected	0.0%	1 1%	0 9%	0 7%	0 6%	1 .5%	1.8%	0 0%	0 0%

Sprat Results

Only one haul gave any sprats and effectively no sprat were found on the survey.

2. SURVEY REPORT RV GO SARS
29 JUNE - 18 JULY 1999

Objectives

Abundance estimation of herring and sprat in the area between latitudes, 57°00'N and 62°00'N and east of 02°00'E. Map the general hydrographical regime and monitor the standard profiles Utsira - Start Point and Feie - Shetland.

Participation

V Anthonypiliai, E Hermansen, R Johannesen, H Myran, B V Svendsen, R Toresen (crl), E Torstensen, J A Vågenes, Guest: Wang Yong, China

Narrative

In this report the results from the Norwegian coverage of the International Herring Acoustic Survey for 1999 is presented. The time series of this survey extends back to 1984. Five countries cooperate to survey the North Sea and the Skagerrak for an acoustic abundance estimation of herring and sprat. The surveys are planned in the Planning Group for Herring Surveys (ICES, 1999b) which is a sub group under the ICES Herring Assessment Working Group for the Area South of 62°N. In the recent years, the total survey area has been divided between the participating countries, represented by the vessels, as shown in Figure 1.1.

RV GO *Sars*, started in Bergen, 29 June 1999. A call was made in Arendal on 30 June, Egersund on 7 July, Haugesund on 10 July and in Lerwick, Shetland on 16 July. The survey was finished in Bergen on 18 July.

This year the Norwegian survey included Skagerrak. The survey started in the inner Skagerrak and was continued in the North Sea from south to north. Systematic parallel transects in the east-west direction were carried out and the distance between the transects was 15-20 NM.

Survey Effort

Figure 2.1 a-b shows the cruise track with fishing stations and the hydrographic profiles. Nearly 3,300 NM was surveyed and the total number of trawl hauls were 77, 68 pelagic and nine bottom trawls. The number of CTD stations for temperature, salinity and density measures were 125.

Methods

The catches were sampled for species composition, by weight and numbers. Biological samples, ie length and weight compositions were taken of the most important species. Otoliths were taken of herring, sprat and mackerel for age determination. Herring were also examined for fat content and maturity stage in the whole area. Vertebral counts for the separation of autumn spawning herring and Baltic spring spawners were taken of herring samples east of 2°00'E.

The acoustic instruments applied for abundance estimation were a SIMRAD EK500 echo sounder and the Bergen Echo Integrator system (BEI). The setting of the instruments were as follows:

Absorption coeff	10 dB/km
Pulse Length	Medium
Bandwidth	Wide
Max Power	2,000 w
Angle Sensitive	
2-Way Beam Angle	-21.0dB
Sv Transd Gain	26.86 dB
TS Transd Gain	27,07 dB
3 dB Beamwidth	7.0/6.8 deg
Alongship Offset	-0.07 deg
Athw ship Offset	0.04 deg

Sounder: ES 38 B

The weather conditions during the survey were excellent for acoustic registrations

The S_A-values were divided between the following categories on the basis of trawl catches and characteristics on the echo recording paper:

herring, sprat, other pelagic fish, demersal fish, plankton

The following target strength (TS) function was applied to convert S,-values of herring and sprat to number of fish:

$$20 \log L - 71{,}2 \text{ dB} \quad (1)$$

or on the form

$$C_F = 1.05 \cdot 10^6 \cdot L^{-2} \quad (2)$$

where L is total length

The acoustic method as used for the abundance estimation of small pelagic fish is described by Toresen et *al.* (1998).

In the Skagerrak and off the south west coast of Norway, North Sea autumn spawners and Western Baltic spring spawners mix during summer. No system for routine stock discrimination on individual herring during the'survey, is available. The proportion of Baltic spring spawners and North Sea autumn spawners by age were calculated by applying the formula, WBaltic = ((56,5-VS(sample))/(56.5-55.8)) (ICES, 1999a). To calculate the maturing part of the two stocks in each age group, the observed maturity stages were applied for both stocks.

Results

Hydrography

The horizontal distributions of temperature at 5 m, 50 m and at bottom in the surveyed area are shown in Figure 2.2a-c. The surface water had temperatures ranging from 13°C east of Shetland to 16-l 7°C off the west coast of Norway. In Skagerrak the surface temperature was about 14-15°C. The temperatures measured at 5 m were 2-3°C higher than last year, in which it was a rather cold summer. However, the temperatur regime in 50 m depth seems much the same as that of last year.

Distribution and abundance of herring

The horizontal distribution of herring is shown in Figure 2.3. In Skagerrak herring was found in the whole surveyed area with the highest densities along the Swedish west coast. Here immature autumn spawners (0- and l-ringers) dominated in a mixture with maturing and adult Western Baltic spring spawners. Herring in the North Sea was mostly found in the south eastern part and close to the east coast of Shetland.

The registrations were very scattered in the whole surveyed area and the recorded herring were mainly found close to the surface. No 'real' herring schools were detected and most of the trawling positions were regularly chosen, by trawling every 20-30 NM, and not based on echo registration. Due to this behaviour herring may have been underestimated during the survey. East of Shetland, herring were found in medium dense concentrations close to the bottom.

The abundance by ICES statistical squares, divided in Western Baltic spring spawners and North Sea autumn spawners, are given in Table 2.1 (Skagerrak) and Table 2.2 (North Sea). The numbers are given age desegregated. The numbers in age groups 2 and 3 are split in mature/immature parts. Surveyed squares with no herring recordings, are not presented in the tables. Table 2.3 and 2.4 present the mean weights at age applied for biomass estimations in Skagerrak and the North Sea, respectively. Total estimated number of herring by age and length are given for Skagerrak in Table 2.5 and for the North Sea in Table 2.6. The total estimated biomass per age group and stock is also shown in these tables.

The biomass estimates of North Sea herring and Baltic spring spawners, in Skagerrak and in the North Sea, are shown in the text table below. The total biomass estimate of herring in the area covered by the norwegian vessel is about 485,000 t. The estimated spawning stock biomass of North Sea herring was about 260,000 t which is significantly more than was estimated last year, 73,000 t. The estimated biomass of Baltic spring spawners in the North Sea this year of 75,000 tonnes is somewhat lower than last years estimate of 90,000 tonnes.

Area	Herring Biomass	(10^3 tonnes)
	North Sea herring	Baltic Spring
Skagerrak	3	115
North Sea	260	75
Total	263	190

Abundance of sprat

Few specimens of sprat were caught near the border between Skagerrak and Kattegat. From a low number in only one trawl haul, no Sa-values were allocated to sprat.

3. SURVEY REPORT *RV TRIDENS* 22 JUNE - 17 JULY 1999

Survey was carried out from 29 June to 17 July, the survey was preceded by calibration and intercalibration.

Calibration - 24 June

The calibration was conducted in a small Norwegian fjord near Kristiansand harbour on 24 June. Both the hull-mounted transducer and the towed body transducer were calibrated. The correction factors for the SV-gain were found without a problem. The calibration report is presented in Table 3.1 a and 3.1 b.

Intercalibration with Walter *Herwig III* - 25 June

Tridens and *WH* ///met during the calibration near Kristiansand. In the morning of the next day the intercalibration took place between 56°46'N-005°58'E and 55°44'N - 005°32'E, between 7.52 and 12.23 UTC. Although there was not much fish in the area, Tridens was due to arrive in IJmuiden the next morning, so there was no time to look for an area with more schools, Tridens took the speed information from the DGPS. During intercalibration the DGPS of Tridens fell away a few times. Once the DGPS failure was noticed, both vessels switched over to 'manual speed input' in the navigation menu of the EK500. Some of the recorded half mile intervals are therefore in reality much longer and the intervals during the whole first three hour session are slightly out of phase. This will cause problems for the analysis of the results. At first sight the sa-values of Tridens seemed to be higher than Walter *Herwigs*. One possible explanation that should be studied during analysis: the towed body of Tridens was at a rather deep level of 6.8 m, during the intercalibration. Integration started at 10 m below the water surface, which is 3.2 m from the the transducer.

Survey Methods

The methods used were similar to those in previous years. A SIMRAD EK-500 system was used. In contrast to previous years, the 38 kHz splitbeam transducer was mounted in a towed body. Infegration of echo recordings was done by the Bergen Integrator post processing system (BI500).

Ship's speed was 12.5 knots (weather allowing) and the survey was going on from 04.00 UTC to 21 .OO UTC. During the hours of darkness, the survey was interrupted because results from previous surveys had shown that herring at this time of the day may rise close to the surface and may not be seen by the transducer.

Due to lack of time, in low density areas the survey was continued during dark until some kind of traces showed up. However the fish was so dispersed over the area, even at day time, that the chance of missing fish during dark hours was considerable. Therefore, at darkness less survey hours than in previous years were conducted. There was also some delay caused by the bad weather. As a result the area covered was smaller than other years.

Trial fishing was done with a 2000 mesh pelagic trawl with a 20 mm cod end lining. Figure 3.1 shows the survey track and the trawl stations. In total 21 hauls were conducted from which 14 representative samples (n=50) of herring were taken,

Results

Herring

Table 3.2 shows the trawl stations and the catches. During the surface hauls 1 and 7, very small schools (red dots at 70dB threshold) were targeted in a very dense plankton layer, The number of herrings in these catches were to low too take a sample. Part of the herring may have escaped the trawl, scared away by the vessel. Despite the low numbers these hauls showed that there was at least some herring in the upper layers. Moreover there was no other species to which these red dots could have been assigned. These schools were therefore assigned to herring during scrutinising.

In the northern part of the area herring was found either in thin layers, very close or even at the bottom or in very small schools in the first 50 m in a very dense plankton layer. The herring in the southeastern part was found in a few typical herring pillars. Most hauls contained a mixture of immature and adult herring. Unlike previous years, herring was not found mixed with schools of Norway pout. The hauls have been grouped in 5 strata (A-E, Fig. 3.2). Results on herring are presented in Table 3.3 and 3.4 and Figure 3.3. Distribution by length and age is presented in Appendix 1.

Sprat

Sprat was found in the southwestern part of the area. Only one haul (18) consisted predominantly of sprat. In two other hauls, the catch consisted of only a few percent sprat. Of all three hauls representative samples were taken for the determination of sex, maturity and age. All hauls were grouped in one stratum. Results on sprat are presented in Table 3.5 and 3.6 and Figure 3.4. Distribution of length and age is presented in Appendix 2.

4. SURVEY REPORT FRV *SOLEA*, CRUISE 444 28 JUNE - 15 JULY 1999

Narrative

FRV *Solea* left the port of Büsum on 30 June 1999 with delay and the survey started in the southwest corner of the working area near Helgoland. Because of a serious damage in the ship's electric generator the survey had to be interrupted after only one day, and the ship returned for repair to the home port. The survey was continued on 9 July. To cope with the significantly reduced survey time, the remaining survey effort was concentrated on an area where the main part of herring was found during the last years. The limits of this area were 56" 30'N to 55°N, and 4°E to the 20 m depth line off the Danish coast as western boundary. During the last four years, a mean of more than 75% of the total estimated herring population numbers were found in this small part of the survey area originally planned to be covered.

The parallel transects were directed in west-east direction with a spacing of 15 nautical miles. The cruise track and the haul positions are shown in Figure 4.1.

The survey finished on 14 July and next morning FRV *Solea* arrived at Büsum

Method

The acoustic measurements were performed with the Simrad EK500 echosounder using a frequency of 38 kHz. The echosounder was connected to the Bergen-Integrator BI500. A single beam transducer 38-26 was installed in a towed body running 100 m behind the ship to reduce fish reactions to vessel's noise. The lateral distance of 30-40 m from the ship kept the transducer free from the bubbled keel water. The acoustic system was calibrated in Büsum harbour prior to the cruise. The difference of Sv gain to the last calibration was better than -0.1dB. This small deviation indicates a stable operation of the acoustic measuring system.

For the verification of echogram traces 10 trawl hauls were carried out to identify the targets. Trawling was conducted with the pelagic gear PSN388 in the midwater and the bottom trawl 'Aalhopser' near the bottom. The trawls were deployed to catch the'typical'shaped indications of clupeid shoals. Catch compositions are given in Table 4.1. From each haul samples were taken for the determination of length, weight, age and maturity.

The allocation of echo records was carried out by segmentation of 'typical' shoals using the BI500. The calibration of this allocation process was supported by the targeted fishery on these shoals. In the most cases a mixture of sprat and young herring was caught. It was not possible to discriminate shoals of the different species only by the inspection of the echogram. Therefore these 'shoals were classified as 'clupeoids' and the proportion of herring and sprat were estimated by means of the trawl results in this stratum. For each stratum the species composition and length distribution were determined as the weighted mean of all trawl results in the respective stratum. In the case of missing hauls in a stratum the results of the adjacent statistical rectangles were used. For these distributions the mean scattering cross section was calculated according to the following TS-length relation (Anon, 1982):

$$TS = 20 \log L - 71.2 \text{ dB}$$

The total number of fish was estimated as the product of the mean Sa values and the stratum area divided by the corresponding mean scattering cross section. The total number were splitted into herring and sprat age classes according to the catch compositions and age readings.

Results

The spatial distribution of the herring shoals was similar to the general patterns observed during the last years. It can therefore be assumed that the main part of the herring concentration in the planned observation area was covered. At least, the herring abundance estimates can be used as the lower limit of the true abundance. A total of 4,600 million herring was almost equally divided into age groups 1 and 2. Last year's results yielded only the half of the total number but with the same age proportions.

The general abundance of sprat was low, but the evaluation of the short track conducted south of Helgoland indicates high concentrations of sprat in the southern survey area. This is in accordance with the findings from previous years. The shape of the sprat dominated shoals was different from the typical herring indications in the northern part of the survey area. The spcial extension was small and the echo level of a single shoal was considerably lower than the typical level of the shoals known to be herring. A general estimation of the sprat abundance was not conducted because the coverage of the main distribution area of this species was too poor. Tables 2 and 3 shows herring and sprat abundance and biomass estimates separated by age class.

5. SURVEY REPORT FOR FRV *SCOT/A* IN ICES AREA VIA(N) 13-30 JULY 1999

Methods

The acoustic survey on the Marine Laboratory Aberdeen vessel FRV Scotia (13 July to 30 July 1999) was carried out using a Simrad EK500 38 kHz sounder echo-integrator. Further data analysis was carried out using Simrad BI500 and Marine Laboratory analysis systems. The survey track (Fig. 5.1) was selected to cover the area in three levels of sampling intensity based on herring densities found in 1991-99. Areas with highest intensity sampling had a transect spacing of 4.0 nautical miles, areas with medium intensity sampling had a transect spacing of 7.5 nautical miles and lower intensity areas a transect spacing of 15 nautical miles. The track layout was systematic, with a random start point. The ends of the tracks were positioned at two the actual track spacing from the area boundary, giving equal track length in any rectangle within each intensity area. Where appropriate the between-track data could then be included in the data analysis. Between track data were abandoned at the westward end of all transects, and on the eastward ends between 56°45' and 58°00'N, along the coast of the Outer Hebrides.

Thirty-eight trawl hauls (Fig. 5.2 and Table 5.1) were carried out during the survey on the denser echo traces. Each haul was sampled for length, age, maturity and weight of individual herring. Up to 350 fish were measured at 0.5 cm intervals from each haul. Otoliths were collected with two per 0.5 cm class below 22 cm, 5 per 0.5 cm class from 20 to 27 cm and 10 per 0.5 cm class for 27.5 cm and above. Fish weights were collected at sea from a random sample of 50 fish per haul.

Data from the echo integrator were summed over quarter hour periods (2.5 Nm at 10 knots). Echo integrator data was collected from 9 metres below the surface (transducer at 5 m depth) to 1 m above the seabed. The data were divided into five categories, by visual inspection of the echo-sounder paper record and the integrator cumulative output; 'herring traces', 'probably herring traces', 'sprat traces', 'gadoid traces' and a species mixture category. No 'probably not herring' category was included in this survey as all non herring traces were reliably identified as either gadoids, sprat or mackerel.

For the 1999 survey the total estimated stock was 524,000 tonnes. The spawning stock biomass (mature herring only) was estimated at 473,100 tonnes. The survey area extended into ICES Sub-area IVa, The observed tonnage in this area was approximately 58,000 tonnes giving a total of 466,000 tonnes in VIa(N). 75.7% of the stock by number was attributable to the 'herring traces' and 22.5% to the 'probably herring traces'.

As in previous years, in general, herring were generally found in waters where the seabed was deeper than 100 m, however, herring were also caught in reasonable quantities in shallower waters on three hauls (hauls 23, 28 and 29). Norway pout and blue whiting which were found commonly throughout the north of the survey area in some previous years were relatively uncommon in 1999. Blue whiting were caught in large quantities on only three hauls (13, 31 and 32), all these hauls were close to the shelf break. Isolated hauls showed good catches of pout, however these were usually isolated from herring schools. Mackerel was again relatively common across the area, but posed no identification problems. It is possible that a significant part of the fish scored in category 3 were in fact herring and this would indicate a small underestimate of the true stock. It was not usually possible to make a definite assignment of these marks to species, and where doubt existed it was assumed that they were NOT herring. Similar difficulties were encountered in 1994 and 95 but on a much larger scale.

Three sets of calibrations were carried out during the survey, at the beginning, middle and end of the survey. One tow cable was found to be faulty on the second calibration and was replaced. Examination of the echograms showed that the fault had developed approximately four days prior to the calibration. The fault resulted in the loss of function on two quadrants of the transducer. The faulty system was calibrated and a theoretical calculation of beam pattern calculated for the system, this was used to correct the scrutinised echo-integrals prior to analysis. A new cable was installed and the system re-calibrated. Two days after calibration this cable also developed a fault, which was detected immediately, and was replaced. The final calibration was carried out on this cable/transducer configuration. The integrator data were corrected for the deviations between the calibrations of the three cable/transducer configuration.

To calculate integrator conversion factors the target strength of herring was estimated using the TS/length relationship recommended by the acoustic survey planning group (Anon, 1982) for clupeoids:

$$TS = 20\log_{10}L - 71.2 \text{ dB per individual}$$

The weight of herring at length was determined by weighing fish from each trawl haul which contained more than 50 fish. Lengths were recorded by 0.5 cm intervals to the nearest 0.5 cm below. The resulting weight-length relationship for herring was:

$$W = 0.004833\ L^{3.172} \text{ g L measured in cm}$$

Survey Results

A total of 38 trawl hauls were carried out, the results of these are shown in Table 5.1. Twenty-two hauls contained more than 50 herring and these hauls were used to define nine survey sub areas (Fig. 5.3). The sub-areas were defined as:

1. North Minch
2. South Minch
3. Barra Head
4. Barra Head South
5. South West Hebrides
6. Lewis
7. Shelf Break
8. North VIa(N)
9. Orkney

The stock estimate for VIa(N) is very similar to 1998 (458.200 to 466,000 tonnes). There was little evidence of change in distribution. The main concentrations were again at Barra Head, off the coast of Lewis and along the shelf edge North and west of Lewis (Figs 5.4 and 5.5). No herring were seen south of 56°30'N in contrast to 1998 and the abundances between 4 and 5°W were lower in 1999.

There are also some indications of changes in the age and maturity structure of the stock (see Table 5.3). In 1998 87% of the two ringers were mature, in 1999 64% were mature. The proportion of older fish (4+) in the stock increase from 34% in 1998 to 41% in 1999. This can be compared with 55% in 1995, 43% in 1996 and 16.6% in 1997 - it should be noted that the 1997 survey was carried out one month earlier than the other years surveys. The stock estimates in the last two years are consistent with the pattern up to 1996. This suggests that

the stock situation is relatively stable, and that the 1997 survey can be considered as an underestimate.

6. COMBINED SURVEY REPORT FOR ALL AREAS

The survey areas for each vessel are given in Figure 6.1. The results for the six surveys have been combined. Procedures and TS values are the same as for the 1998 surveys (Simmonds et *al.*, 1999). Stock estimates have been calculated by age and maturity stage by ICES statistical rectangle for the whole survey area where survey areas overlap the estimated abundance at age is obtained by a weighted mean dependant on the length of cruise track in each survey. The combined data gives estimates of immature and mature (spawning) herring for ICES areas VIa_{north}, Iva, IVb and parts of IIIa. The numbers biomass and mean weights at age estimated from the survey are given in Tables 6.1 to 6.6 inclusive for Autumn and Spring spawning herring. The data from all areas have been split between autumn spawners, in the North Sea and West of Scotland, and spring spawning Baltic stocks. The total SSB of autumn spawning herring from the North Sea was 1,500,000 tonnes for IVa_{north} 419,000 tonnes. The SSB for Baltic spring spawners was 115,000 tonnes. Where the survey areas for individual vessels overlap, the effort weighted mean estimates by age and maturity stage for each overlapping rectangle have been used. Stock estimates by number and biomass are shown in Tables 6.1 and 6.2 respectively for areas VIa_{north}, IVa, IVa and IVb separately; mean weights at age are shown in Table 6.3. Stock estimates for Baltic herring by number and biomass are shown in Tables 6.4 and 6.5 respectively for ICES areas IIIa, IVa and IVb; mean weights at age for Baltic herring are shown in Table 6.6. The results of the surveys, (numbers, biomass, mean weight and maturity at age) are summarised by stock in Table 6.7. Figure 6.2 shows the distribution of abundance (numbers and biomass) of mature autumn spawning herring for all areas surveyed. Figure 6.3 shows the distribution of autumn spawning herring split by age; 1 ring, 2 ring and 3 ring and older herring. Figure 6.4 shows the distribution of abundance (numbers and biomass) of maturewestern Balticspring spawning herring for all areas surveyed. Figure 6.5 shows the distribution of western Baltic spawning herring split by age; 1 ring, 2 ring and 3 ring and older herring. Estimates of '0' group have been omitted in all plots. Figure 6.6 shows the density distribution of numbers of adult autumn spawning herring as a contour plot and Figure 6.7 shows the distribution for all juvenile autumn spawning herring.

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TABLE

pe positio by ha FRV *Sco* 999

Trawl shooting position						Estimated raised numbers caught by species													
No	Date	Time	Latitude	Longitude	depth	Herring	Mackerel	Sprat	NPout	Bl whiting	Haddock	Whiting	Argentine	L sole	G gurnard	C Dab	T minutus	Sample (kg)	
275	2/7/99	21:20	58°04.20'N	001 29.20W	50														O grp Pout meshed
276	3/7/99	06:00	58°04.03'N	000°42.36'W	104	14,160	30												
277	3/7/99	17:55	58°11.00'N	361°29.84'E	105	460			12		42	1							
278	4/7/99	09:55	58°19.70'N	001°39.90'W	114	1800			25		20	35							0 mm 5
279	5/7/99	04:29	58°33.86'N	000°43.52'W	131	2,190	180		415		10								
280	5/7/99	08:05	58°33.80'N	000°02.90'W	100														O grp Pout meshed
281	6/7/99	06:05	58°49.00'N	360°01.08'E	130	2,030	5		245			5							
282	6/7/99	12:28	58°49.13'N	001°18.83'W	112	3,698	8		1,238			15							
283	7/7/99	05:07	59°03.93'N	000°54.53'W	133	12,175			4,900		275	75	25					70	
284	7/7/99	21:20	59°19.00'N	360°26.03'E	132	4,392	17		125		8	8							
285	8/7/99	05:55	59°11.85'N	000°31.52'W	140	27,540			1,620			180							
286	8/7/99	14:20	59°25.53'N	360°00.13'E	136	13,354			1,716			22						106	
287	8/7/99	21:10	59°19.00'N	001°15.60'W	111	1,725	21		141		156	117	27	12	9	3		98	
288	9/7/99	04:12	59°19.01'N	001°53.21'W	104														O grp Pout meshed
289	9/7/99	11:21	59°34.46'N	001°34.20'W	80														O grp Pout meshed
290	9/7/99	13:30	59°39.94'N	001°11.13'W	113	1440	69		307		75	83	5	3	3	3	3		
291	10/7/99	09:35	59°48.80'N	360°17.00'E	124	15,880			1,400										
292	11/7/99	04:10	59°58.31'N	001°08.24'W	94														O grp Pout meshed

	Trawl shooting position				Estimated raised numbers caught by species												
No	Date	Time	Latitude	Longitude	Depth	Herring	Mackerel	Sprat	Sandeel	Blue Whiting	Haddock	Whiting	Argentine	Lemon sole	Gurnard	Cod	Trisopterus minutus		
293	1/7/99	07:00	50°03.96'N	000°53.42'W	105	85	8		93		42	13	1					32	Sebastes.
294	3/7/99	13:08	50 11.97N	000°21.78'W	127	21			250		4		1						Hake
295	3/7/99	15:44	50 11.77N	000°12.48'W	137	5	15		262	1	8	1							Cod!
296	3/7/99	21:00	30 26.90N	000°37.30'W	130	1,647			213		10								
297	4/7/99	04:00	30 34.11N	000°30.76'W	144	1,587			200				7						
298	14/7/99	08:55	50 33.90N	360°09.60'E	135				3,450		5		15						
299	14/7/99	11:53	50 33.93N	360°34.15'E	143	23,500	50		#####		50							96	
300	15/7/99	04:06	50 49.01N	360°01.33'E	155	12,525	75												
301	15/7/99	09:10	50 41.90N	000°31.70'W	128	701	2		174		15	2	6						
302	16/7/99	08:49	61 03.19N	361°15.15'E	148	285	4		1,691	787								200	
303	17/7/99	06:03	61 19.04N	000°00.34'W	170	1,005	2		492		1	16							
304	17/7/99	21:00	60 56.32N	001°00.19'W	104	332	26												'Cod
305	18/7/99	15:46	60 39.96N	001°35.68'W	106	5													
306	18/7/99	20:45	60 40.06N	002°14.02'W	137	555	76											102	
307	19/7/99	08:26	60 31.94N	002°08.43'W	140	2,905	5												
308	19/7/99	14:00	60 18.98N	002°18.91'W	122	767	42												
309	20/7/99	07:49	60 04.16N	002°10.36'W	95		4					2							'out neshed
310	21/7/99	15:21	59 26.55N	003°37.45'W	165	890													
311	22/7/99	05:10	59 18.95N	003°25.39'W	115	591	1				1								
312	22/7/99	13:55	59 07.00N	003°53.34'W	107	3,393	53	7											
313	23/7/99	06:46	58 59.39N	003°59.34'W	60														'out neshed

TAB

ength req cy istributio gth ht nd ta ength y trawl and (l ig V *cot* luly

ength/trawl	27	mean	281	285	mean	276	277	279	282	283	287	290	mean	284	286	291	296	297	299	300	301	302	303	304	306	307	308	310	311	312	mean
17.5							0.2						0																		
18							0.2						0																		
18.5																															
19	0.3	0.3					0.2						0																		
19.5	0.3	0.3					0.4						0																		
20	1.1	1.1																											0.2		0
20.5	1.9	1.9					0.4		0.2				0																		
21	10.8	10.8					0.2		0.2				0																		
21.5	15.6	15.6				0.2	0.9		0.6	0.2	1.2	0.7	0.6																		
22	24.4	24.4	0.7		0	3.6	2.2	2.7	4.1		4.7	1.7	2.7				0.2												0.2		0
22.5	15.0	15.0				5.1	4.8	5.9	6.1	1.0	5.4	2.4	4.4								0.2										0
23	14.7	14.7	0.2	0.4	0.3	10.2	7.0	6.6	10.8	4.9	7.7	4.4	7.4				0.4				0.4						0.2		0.2	0.2	0.1
23.5	7.8	7.8	0.5	0.7	0.6	10.8	8.3	10.7	11.2	8.4	11.1	6.3	9.5				1.6				1.3			0.6				0.2	0.9		0.3
24	3.3	3.3	3.0	4.6	3.8	19.1	10.9	17.6	17.6	15.2	13.9	13.0	15.3	0.2	0.8	1.0	2.2	0.2		0.2	2.8			0.6				0.4	1.8	0.2	0.6
24.5	1.7	1.7	8.1	10.9	9.5	16.9	11.7	16.9	16.6	18.5	17.4	14.4	16.1	2.8	5.3	3.3	3.0	0.8		0.2	4.5			3.3		0.3	2.6	0.9	1.1	0.6	1.7
25	1.9	1.9	14.0	22.2	18.1	13.8	13.5	16.4	16.4	23.4	15.0	22.0	17.2	8.2	9.2	6.8	5.3	2.5	0.4	0.8	5.6			4.5	0.2	0.2	5.0	0.9	2.5	3.1	3.3
25.5	0.3	0.3	15.5	16.8	16.1	8.5	8.5	10.7	6.9	12.3	10.1	11.7	9.8	11.8	11.9	13.4	5.7	3.6	1.7	6.0	6.9			5.1	0.2	0.7	8.9	3.7	6.5	8.8	5.6
26	0.3	0.3	20.7	18.3	19.5	5.7	10.7	7.8	5.1	10.5	8.7	12.4	8.7	15.7	19.4	17.6	9.7	7.8	9.8	9.6	9.6	4.9		6.3	3.6	3.4	15.2	6.4	11.1	14.9	9.7
26.5	0.6	0.6	13.1	10.9	12.0	3.0	6.5	2.5	3.4	3.9	2.3	5.9	3.9	14.4	14.7	17.4	10.7	9.5	13.6	12.2	12.4	9.5	1.9	6.9	7.0	8.3	16.3	7.7	13.5	11.8	11
27			9.9	9.2	9.5	2.1	4.8	0.5	0.4	1.0	0.7	2.6	1.7	14.0	12.4	17.6	12.3	16.6	21.9	20.6	14.1	11.6	7.2	9.6	13.5	12.7	18.5	11.6	15.3	16.7	14.5
27.5			3.7	2.6	3.2	0.6	3.7	1.1	0.2	0.6	1.0	1.5	1.3	8.9	9.1	10.1	10.3	11.6	14.5	15.8	11.6	8.8	10.9	8.4	14.7	12.2	10.7	12.0	12.6	11.0	11.4
28			4.4	2.0	3.2		2.2	0.2	0.2		0.5		0	6.3	7.4	6.8	8.3	13.4	14.5	12.8	10.7	12.6	16.4	9.6	13.5	13.8	7.4	12.2	10.8	11.8	11.1
28.5			1.2	0.4	0.8	0.2	1.1	0.2			0.3	0.4	0.3	5.1	1.5	2.3	6.9	10.7	8.3	7.2	4.9	8.1	14.1	8.1	10.8	8.8	2.2	8.4	6.1	7.7	7.1
29			2	0.2	1.1	0.2	0.4					0.2	0.1	1.5	2.0	0.8	5.1	3.2	4.7	1.6	1.9	10.2	11.7	6.6	9.6	8.1	1.7	9.7	4.5	4.9	5.2
29.5			1	0.2	0.6		0.4						0	1.7	1.8	2.0	2.4	4.2	2.6	2.6	2.1	7.7	10.1	6.0	6.0	6.4	1.5	6.7	3.4	2.9	4.1
30			0.5	0.2	0.4		0.4					0.2	0.1	2.3	1.3	0.3	3.0	4.0	1.5	3.2	2.1	5.6	8.2	5.1	3.8	6.9	2.2	5.8	2.9	1.4	3.5
30.5			0.5	0.2	0.4		0.2						0	2.3	0.8	0.5	2.6	2.1	1.1	2.0	2.1	3.2	4.2	5.4	3.8	4.8	2.4	4.7	2.0	1.8	2.7
31			0.5		0		0.2					0.2	0.1	1.7	1		3.6	2.9	1.3	2.4	1.7	3.9	3.4	3.9	4.3	4.5	1.1	3.2	2.0	1.0	2.5
31.5														1.3	0.3		2.4	2.9	1.9	1.0	1.5	3.5	4.5	2.7	1.9	3.6	1.3	2.6	0.9	0.6	1.9
32			0.2		0									0.9	1.0	0.3	1.2	1.9	1.5	0.4	1.3	3.2	4.0	1.8	2.9	3.1	1.3	0.9	0.7	0.2	1.6
32.5				0.2	0.1									0.2	0.2		1.4	1.3	0.2	0.8	1.1	1.8	1.3	2.7	1.9	1.5	0.7	0.6	0.2	0.2	0.9
33			0.2		0									0.4			0.6	0.2	0.2	0.4	0.6	1.8		0.9	1.7	0.2	0.7	0.9		0.2	0.5

Length/trawl	27	mean	281	285	mean	276	277	279	282	283	287	290	mean	284	286	291	296	297	299	300	301	302	303	304	306	307	308	310	311	312	mean
33.5																	0.2	0.4	0.2			1.1	0.8	0.9	0.5	0.3	0.2	0.2	0.2		0.3
34																	0.6	0.2	0.2	0.2	0.4	0.7	0.5	0.3				0.2			0.2
34.5														0.2						0.2		1.4	0.3	0.3							0.1
35																						0.7	0.5								0.1
35.5																															
36																															
36.5																										0.2					0
Number	36		406	459		472	460	438	493	487	575	540		527	607	397	494	476	470	501	467	285	377	332	416	581	460	534	443	509	
mean	22	22.8	26.6	26.2	26.4	24.8	25.4	24.9	24.7	25.3	24.9	25.4	25.1	27.5	27.1	27.0	28.0	28.4	28.1	28.1	27.7	29.3	29.6	28.7	29.0	29.1	27.6	28.7	27.8	27.7	28.2
mean	94	94	159	151	155	126	137	128	124	133	127	136	130	179	171	168	192	201	193	192	184	224	229	209	215	216	182	207	186	184	196
TS/ individual	-44.0	-44.0	-42.7	-42.8	-42.8	-43.3	-43.1	-43.3	-43.3	-43.1	-43.3	-43.1	-43.2	-42.4	-42.5	-42.6	-42.2	-42.1	-42.2	-42.2	-42.3	-41.8	-41.8	-42.0	-41.9	-41.9	-42.4	-42.0	-42.3	-42.3	-42.2
TS/	-33.8	-33.8	-34.7	-34.6	-34.7	-34.3	-34.5	-34.3	-34.3	-34.4	-34.3	-34.4	-34.4	-34.9	-34.8	-34.8	-35.1	-35.1	-35.1	-35.1	-35.0	-35.3	-35.4	-35.2	-35.3	-35.3	-35.0	-35.2	-35.0	-35.0	-35.1

TABLE 1.3

Numbers, mean length, mean weight, biomass and percentage mature by area (Fig. 2). FRV Scotia 1-24 July 1999.

	Number (millions)	Mean length (cm)	Mean weight (g)	Biomass tonnes*103	Maturity (%)
Area I					
0.04167	15.76	21.87	88.08	1.39	0
2I	33.35	22.14	91.71	3.06	
2M	8.49	23.32	109.13	0.93	20.3
3I	2.41	22.2	93.54	0.23	
3M	1.86	24.37	125.89	0.23	43.5
0.166667	0			0	100
0.208333	0			0	100
0.25	0			0	100
0.291667	0			0	100
0.333333	0			0	100
9+	0			0	100
Total	61.86	22.3	94.27	5.83	
Area II					
0.04167	0.49	22	89.32	0.04	0
2I	12.65	24.6	129.94	1.64	
2M	50.58	25.47	145.88	7.38	80
3I	28.32	25.27	142.02	4.02	
3M	79.52	25.98	156.17	12.42	73.7
0.166667	19.05	26.91	175.77	3.35	100
0.208333	5	28.45	211.01	1.05	100
0.25	2.54	29.82	247.59	0.63	100
0.291667	0.48	29.77	246.62	0.12	100
0.333333	0.24	30.5	265.56	0.06	100
9+	0.73	31.69	303.61	0.22	100
Total	199.6	25.89	155.02	30.94	
Area III					
0.04167	75.32	22.75	100.91	7.6	0
2I	331.14	23.46	111.21	36.82	
2M	644.36	24.61	130.59	84.15	66.1
3I	186.38	24.61	130.14	24.26	
3M	284.01	25.64	149.58	42.48	60.4
0.166667	40.72	26.34	163.17	6.64	100

	Number (millions)	Mean length (cm)	Mean weight (g)	Biomass tonnes *103	Maturity (%)
Cl.208333	17.47	27.42	137.37	3.27	100
0.25	0.95	30.22	258.15	0.24	100
0.291667	1.42	30.16	256.65	0.36	100
0.333333	0			0	100
9+	0			0	100
Total	1581.76	24.55	130.13	205.83	
Area IV					
0.04167	2.93	22.09	91.65	0.27	0
2I	69.11	24.88	135.19	9.34	
2M	569.31	25.75	151.84	86.45	89.2
3I	161.86	25.71	150.92	24.43	
3M	3339.07	27.2	182.17	R03.26	95.4
0.166667	534.09	28.63	216.72	180.76	100
0.208333	571.22	30.02	253.69	94.17	100
0.25	261.17	31.12	285.71	74.62	100
0.291667	103.94	31.75	305.01	31.7	100
0.333333	29.52	31.65	302.74	8.94	100
9+	49.46	32.62	335.25	16.58	100
Total	5791.68	27.7	196.06	1135.53	
Total Area					
0.04167	94.5	26.11	112.65	9.3	0
2I	446.25	24.57	117.17	50.87	
2M	1272.74	24.29	135.49	578.9	74
3I	378.96	23.37	129.65	52.93	
3M	3704.46	26.51	175.79	663.4	90.7
0.166667	393.85	27.92	209.66	190.76	100
0.208333	393.68	29.52	247.53	98.5	100
0.25	264.66	30.82	282.87	75.49	100
0.291667	105.84	31.58	302.97	32.18	100
0.333333	29.76	31.4	302.44	9	100
9+	50.18	32.14	334.79	16.8	100
Total	7634.9	26.46	180.5	1378.13	

TABLE 2.1

HERRING-SKAGERRAK. Estimated number of herring in ICES stat squares in Skagerrak by stocks and age-groups. R/V GO *Sars*, 29 June - 18 July 1999.

46F9					North Sea Autumn Spawners							
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0	1.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	1.13
					Baltic Spring Spawners							
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0	0.22	1.86	0.56	4.41	0.00	2.64	0.00	0.00	0.00	0.00	0.00	9.69
46G0					North Sea Autumn Spawners							
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
466.2	357.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	823.2
					Baltic Spring Spawners							
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0	165.7	96.81	2.57	24.18	10.07	10.07	1.28	1.28	0.00	0.00	0	311.94
45F8					North Sea Autumn Spawners							
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0	6.04	1.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.25
					Baltic Spring Spawners							
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0	1.24	2.97	0.00	1.82	0.73	1.27	0.55	0.91	0.36	0.00	0.36	10.21
45F9					North Sea Autumn Spawners							
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0	3.08	3.23	0.79	0	0	0	4.66	0.72	2.15	0.36	0	14.99
					Baltic Spring Spawners							
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0	0.5	15.77	3.87	21.86	6.09	7.17	0	0	0	0	0	55.26
45G0					North Sea Autumn Spawners							
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
577.3	440.1	0	0	0.64	0	0	0	0	0	0	0	1018.05
					Baltic Spring Spawners							
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0	159.49	88.08	0.00	9.27	7.70	7.70	0.00	0.00	0.00	0.00	0.00	272.23
45G1					North Sea Autumn Spawners							
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
339	244.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.001	583.09

					Baltic Spring Spawners							
0	1	2I	2M	31	3M	4	5	8	7	8	9+	Total
0	90.3	40.67	4.52	6.33	2.71	4.52	0	0	0	0	0	149.c
44F8					North Sea Autumn Spawners							
0	1	2I	2M	3I	3M	4	5	8	7	8	9+	Total
0	23.18	0	0	0	0	0	0	0.00	0	0	0	23.1
					Baltic Spring Spawners							
0	1	2I	2M	3I	3M	4	5	8	7	8	9+	Total
0	7.32	71.16	20.33	40.67	10.17	50.83	0	0	0.00	0.00	0	200.4
44F9					North Sea Autumn Spawners							
0	1	2I	2M	3I	3M	4	5	8	7	8	9+	Total
0	281.6	18.85	5.28	0	0	1.82	0	0	0	0	0	307.5
					Baltic Spring Spawners							
0	1	2I	2M	3I	3M	4	5	8	7	8	9+	Total
0	70.39	59.71	16.72	9.43	0.00	4.46	3.14	0.00	0.00	0.00	0.00	163.8
44G0					North Sea Autumn Spawners							
0	1	2I	2M	3I	3M	4	5	8	7	8	9+	Total
389	315.09	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0	704.2
					Baltic Spring Spawners							
0	1	2I	2M	3I	3M	4	5	8	7	8	9+	Total
0	113.95	57.34	0.00	4.95	5.46	4.95	0.00	0.00	0.00	0.00	0	186.6
44GI					North Sea Autumn Spawners							
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
474.1	341.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	815.6
					Baltic Spring Spawners							
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0	126.31	63.22	0	6.32	6.32	6.32	0.00	0.00	0.00	0.00	0	208.
43F8					North Sea Autumn Spawners							
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0	103.2	0	0	0	0	0	0	0	0	0	0	103.2
					Baltic Spring Spawners							
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0	12.76	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	12.7
43F9					North Sea Autumn Spawners							
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0	235.15	15.75	4.41	0.00	0.00	1.52	0.00	0.00	0.00	0.00	0.00	256.8
					Baltic Spring Spawners							
0	1	"I	2M	3I	3M	4	5	6	7	8	9+	Total
0	58.79	49.86	13.96	7.87	0.00	3.73	2.62	0.00	0	0	0	136.8

Table 2.2

HERRING-NORTH SEA. Estimated number by ICES stat squares divided in stocks and agegroups. R/V GO *Sars*, 29 June - 18 July 1999.

43F4					North Sea Autumn Spawners							
0	1	2I	2 M	31	3 M	4	5	6	7	6	9+	Total
161.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	161.54
					Baltic Spring Spawners							
0	1	2I	2M	31	3M	4	5	6	7	8	9+	Total
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
43F5					North Sea Autumn Spawners							
0	1	2I	2M	31	3 M	4	5	6	7	8	9+	Total
8.48	20.67	2.42	1.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	33.46
					Baltic Spring Spawners							
0	1	2I	2M	3I	3 M	4	5	8	7	8	9+	Total
0	3.09	2.33	1.83	0.00	1.02	0.00	0.00	0.00	0.00	0.00	0.00	8.26
43F6					North Sea Autumn spawners							
0	1	2I	2M	3I	3 M	4	5	6	7	8	9+	Total
0	262.17	8.82	6.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	277.46
					Baltic Spring Spawners							
0	1	2I	2 M	3I	3 M	4	5	6	7	8	9+	Total
0	0.00	6.93	5.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.01
43F7					North Sea Autumn Spawners							
1	1	2I	2M	3I	3 M	4	5	6	7	8	9+	Total
0	378.98	12.74	9.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	401.07
					Baltic Spring Spawners							
1	1	2I	2 M	3I	3 M	4	5	6	7	8	9+	Total
0	0	10.01	7.34	0.00	4.23	0.00	0.00	0.00	0.00	0.00	0.00	21.58
44F3					North Sea Autumn Spawners							
0	1	2I	2 M	3I	3 M	4	5	6	7	8	9+	Total
0	13.29	1.78	8.92	0.36	1.86	0.81	0.19	0.00	0.00	0.00	0.00	27.21
					Baltic Spring Spawners							
0	1	2I	2 M	3I	3 M	4	5	6	7	8	9+	Total
0	1.00	0.92	4.60	0.61	3.16	0.35	0.00	0.00	0.00	0.00	0.00	10.63
44F4					North Sea Autumn Spawners							
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0	6.33	0.85	4.25	0.17	0.88	0.39	0.09	0.00	0.00	0.00	0.00	12.96
					Baltic Spring Spawners							
0	1	2I	2 M	3I	3 M	4	5	6	7	8	9+	Total
0	0.48	0.44	2.19	0.29	1.51	0.17	0.00	0.00	0.00	0.00	0.00	5.06
44F5					North Sea Autumn Spawners							
0	1	2I	2 M	3I	3M	4	5	6	7	8	9+	Total
0	157.57	21.16	10578	4.24	22.03	9.62	2.29	0.00	0.00	0.00	0.00	322.67

Baltic Spring Spawners												
0	1	2I	2 M	3I	3M	4	5	6	7	8	9+	Total
0	11.86	10.90	54.49	7.21	37.50	4.12	0.00	0.00	0.00	0.00	0.00	126.09
44F6	North Sea Autumn Sawners											
0	1	21	2M	31	3M	4	5	6	7	8	9+	Total
0	7.08	20.11	9.31	5.03	9.68	0.00	0.00	0.00	0.00	0.00	0.00	51.21
Baltic Spring Spawners												
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0	0.54	9.31	4.31	9.68	18.65	8.17	4.90	0.00	1.09	0.00	0.00	56.65
44F7	North Sea Autumn Spawners											
0	1	2I	2 M	3I	3 M	4	6	6	7	8	9+	Total
0	2.97	6.43	3.90	2.11	4.06	0.00	2.06	0.00	0.46	0.00	0.00	23.99
Baltic Spring Spawners												
	0.23 1	3.90 2I	2M	4.06 3I	7.52 3M	3.43 4	0.00 5	0.00 6	7	8	9+	Total
									0.00	0.00	0.00	21.24
45F3	North Sea Autumn Spawners											
0	1	2I	2 M	3I	3M	4	5	6	7	8	9+	Total
0	25.57	3.43	17.16	0.69	3.57	1.56	0.37	0.00	0.00	0.00	0.00	52.36
Baltic Spring Spawners												
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0	1.92	1.77	8.84	1.17	6.09	0.67	0.00	0.00	0.00	0.00	0.00	20.46
45F4	North Sea Autumn Spawners											
0	261 1.90	352 1.16	172 5 M 82	5 3I 0	30 3.M 1	15 4 9 8	3.81	0.60 0	0.70 0	0.80 0	0 9+ 0	5 Total 0
Baltic Spring Spawners												
0	19.71	162 1	92 M 7	103 5	52 3.M 6	6.485	0.30 0	0.60 0	0.70 0	0.80 0	0 9+ 0	1 Total 0
45F5	North Sea Autumn spawners											
0	1	2I	2 M	3I	3 M	4	5	6	7	8	9+	Total
0	17.12	13.52	2.43	0.00	0.00	0.00	1.35	0.45	0.00	0.00	0.00	34.67
Baltic Spring Spawners												
0	1	2I	2 M	3I	3M	4	5	6	7	8	9+	Total
0	0.00	9.01	1.62	13.72	17.37	8.11	0.00	0.00	0.00	0.00	0.00	49.63
45F6	North Sea Autumn Spawners											
0	1	2I	2 M	3I	3M	4	5	6	7	8	9+	Total
0	1.53	1.66	0.36	0.93	1.77	0.00	0.00	0.00	0.00	0.00	0.00	6.26
Baltic Spring Spawners												
0	1	2I	2M	3I	3 M	4	6	6	7	8	9+	Total
0	0.00	4.05	0.89	0.46	0.67	0.70	0.00	0.00	0.00	0.00	0.00	6.97
46F2	North Sea Autumn Spawners											
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0	1.65	1.57	1.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	4.37
Baltic Spring Spawners												
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0	0.25	0.58	0 39	0.43	1 64	0.69	0.17	0.00	0.00	0.00	0.00	4.15

46F3					North Sea Autumn Spawners							
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0	16.80	16.02	10.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.88	44.59
					Baltic Spring Spawners							
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0	2.51	5.92	4.03	4.39	16.68	7.02	1.76	0.00	0.00	0.00	0.00	42.31
46F4					North Sea Autumn Spawners							
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0	43.77	26.36	0.23	0.22	1.12	0.00	0.00	0.00	0.00	0.00	0.00	71.7
					Baltic Spring Spawners							
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0	0.00	6.18	0.05	3.43	17.49	6.20	2.55	0.00	0.00	0.00	0.36	36.27
46F5					North Sea Autumn Spawners							
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0	4.12	2.63	0.47	0.00	0.00	0.00	0.26	0.09	0.00	0.00	0.00	7.57
					Baltic Spring Spawners							
0	1	2I	2M	3I	3M	4	5	8	7	8	9+	Total
0	0.00	1.75	0.32	2.67	3.38	1.58	0.00	0.00	0.00	0.00	0.00	9.69
47F3					North Sea Autumn Spawners							
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0	34.00	13.76	10.52	3.24	11.33	3.64	3.24	0.40	0.00	0.00	0.00	80.14
					Baltic Spring Spawners							
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
47F4					North Sea Autumn Spawners							
0	40.95	1 16.58	2I 12.62	2M 3.90	3I 13.65	3M 4.39	4 3.90	5 0.49	6 7	0.00	8 0.00	9+ 0.00	Total 96.54
					Baltic Spring Spawners							
0	1	2I	2M	3I	3M	4	5	8	7	8	9+	Total
0	0	0	0	0	0	0	0	0	0	0	0	0
48F3					North Sea Autumn spawners							
0	34.77	1 8.02	2I 26.21	2M 7.49	3I 18.72	3M 6.42	4 3.21	5 0.53	6 1.07	7 0.53	8 0.00	9+ 106	Total
					Baltic Spring Spawners							
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
48F4					North Sea Autumn Spawners							
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0	1.05	0.24	0.79	0.23	0.57	0 19	0.10	0.02	0.03	0.02	0.00	3.24
					Baltic Spring Spawners							
0	0.00	1 0.00	2I 0.00	2M 0.00	3I 0.00	3M 0.00	4 0.00	5 0.00	6 0.00	7 0.00	8 0.00	9+	Total 0
49F2					North Sea Autumn Spawners							
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0	0.15	0.35	027	1.31	196	0.81	0.50	0.42	0.12	0.00	0.12	6

Baltic Spring Spawners												
0	1	2I	2M	31	3 M	4	5	6	7	6	9+	Total
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
49F3	North Sea Autumn Spawners											
0	1	2I	2 M	3I	3M	4	5	6	7	6	9+	Total
0	0.55	1.25	0.97	4.71	7.06	2.91	1.80	1.52	0.42	0.00	0.42	21.6
Baltic Spring Spawners												
									7	8	9+	Total
	0.00 1	0.002I	0.00 2M	0.003I	0.00 3M	0.00 4	0.00 6	0.00 6	0.00	0.00	0.00	0
49F4	North Sea Autumn Spawners											
0	1	2I	2 M	3I	3M	4	5	6	7	8	9+	Total
0	1.37	1.42	0.74	0.19	4.65	1.42	0.68	0.40	0.17	0.00	0.06	11.11
Baltic Spring Spawners												
0	1	2I	2 M	3I	3M	4	5	6	7	8	9+	Total
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
II 5e+10	North Sea Autumn Spawners											
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0	7.15	7.15	171.50	7.15	450.18	221.52	78.60	0.00	0.00	0.00	0.00	943.24
50F1	North Sea Autumn Spawners											
	1.091	2.462I	12M	9.283I	13.92 3M	5.73 4	3.55 5	3.00 6	0.82 7	0.00 8	0.829+	42.57 Total
50F2	North Sea Autumn Spawners											
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0	0.27	0.61	0.48	2.32	3.48	1.43	0.89	0.75	0.20	0.00	0.20	10.64
50F3	North Sea Autumn Spawners											
0	1	2I	2 M	3I	3M	4	5	6	7	8	9+	Total
0	0.49	1.09	0.85	4.12	6.19	2.55	1.58	1.33	0.36	0.00	0.36	18.92
50F4	North Sea Autumn Spawners											
0	1	2I	2 M	3I	3M	4	5	6	7	8	9+	Total
0	0.64	1.43	1.11	5.41	8.12	3.34	2.07	1.75	0.48	0.00	0.48	24.83
5e+10	North Sea Autumn Spawners											
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0	0.53	0.53	0.53	0.53	33.66	16.56	5.88	0.00	0.00	0.00	0.00	58.24
51 F4	North Sea Autumn Spawners											
0	1	2I	2 M	3I	3M	4	5	6	7	8	9+	Total
0	0.61	1.36	1.06	5.15	7.73	3.18	1.97	1.67	0.45	0.00	0.45	23.65

TABLE 2.3

HERRING-SKAGERRAK. Weight at age (g) for age groups and mature/immature fish in sub areas. R/V GO *Sars,* 29 June - 18 July 1999.

46F9												
0	1	21	2M	31	3M	4	5	6	7	8	9+	Total
0	69.03	77.70	86.50	94.30	117.00	98.30	135.20	137.00			116.00	83.8
46G0-W												
0	1	21	2M	3I	3M	4	5	6	7	8	9+	Total
	57.00	80.20	84.00	97.80	113.70	102.70	138.00	167.00				74.5
46G0-E												
0	1	21	2M	3I	3M	4	5	6	7	8	9+	Total
4.4	46.20	62.20		111.00	98.00	68.00						28.67
45F8												
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	59.10	78.10		96.00	126.80	118.10	170.30	198.00	223.00	120.00	190.50	93.7
45F9												
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0	66.10	88.40	112.80	112.40	123.50	142.60	158.50	218.00	180.50	142.00		113.18
45G0-W												
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	62.2	64.60		60.00								62.7
45G0-E												
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
4.4	46.2	62.20		111.00	98.00	68.00						28.67
45G1												
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
4.4	46.20	62.20		111.00	98.00	68.00						28.67
44F8												
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	74.00	80.00	128.50	108.50	124.00	119.20						99.7
44F9												
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	62.40	62.10	94.60	91.70		101.00	95					69.63
44G0-W												
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
5.4	51.60	64.10			98.00							43.88
44G0-E												
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
4.4	46.20	62.20		111.00	98.00	68.00						28.67
44G1												
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
4.4	46.20	62.20		111.00	98.00	68.00						28.67
43F8												
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	37.60											37.8
43F9												
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	62.40	82.10	94.60	91.70		101.00	95.00					69.63

TABLE 2.4

HERRING-NORTH SEA. Weight at age (g) for age groups and mature/immature fish in sub areas. R/V GO *Sars*, 29 June - 18 July 1999.

51F4												
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	99.50	130.80	179.70	146.20	211.50	209.60	218.20	248.30	245.70		247.70	192.2
50F4												
0	1	2I	2M	31	3M	4	5	6	7	8	9+	Total
	99.50	130.80	179.70	146.20	211.50	209.60	218.20	248.30	245.70		247.70	192.5
50F3												
0	1	21	2M	3I	3M	4	5	6	7	8	9+	Total
	99.50	130.80	179.70	146.20	211.50	209.60	218.20	248.30	245.70		247.70	192.5
50F2												
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	99.50	130.80	179.70	146.20	211.50	209.60	218.20	248.30	245.70		247.70	192.5
50F1												
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	99.50	130.80	179.70	146.20	211.50	209.60	218.20	248.30	245.70		247.70	192.5
49F4												
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	93.90	115.50	133.70	139.40	158.10	169.90	188.10	227.30	245.70		193.00	146.7
49F3												
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	99.50	130.80	179.70	146.20	211.50	209.60	218.20	248.30	245.70		247.70	192.5
49F2												
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	99.50	130.80	179.70	146.20	211.50	209.60	218.20	248.30	245.70		247.70	192.5
49000000000												
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	81.00	110.00		89.00	181.10	248.80	235.30	261.00	230.00	0.00	0.00	109.3
48F4												
0	. 1	2I	2M	3I	3M	4	5	8	7	8	9+	Total
	77.70	97.50	128.30	112.90	153.70	161.30	173.80	142.00	264.50	199.00		118
48F3												
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	77.70	97.50	128.30	112.90	153.7	161.3	173.8	142	264.5	199		118
47F4												
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	73.9	88.6	111.6	103.4	120.8	119.4	145.4	142				94.5

						47F3						
0	1	2I	2M	3I	3M	4	5	6	7	6	9+	Total
	73.90	88.60	111.60	103 40	120.80	119.40	145.40	142 00				34.5
						46F5						
0	1	2I	2M	3I	3M	4	5	6	7	6	9+	Total
	65.40	88.90	116.90	96.30	114 50	116 90	112.30	105.00				93.8
						46F4						
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	70.30	90.2	112.60	107.40	123.50	130.29	145.10				173.00	94.9
						46F3						
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	76.50	92.80	119.10	109.40	120.70	136.00	160.00				173.00	105.5
						46F2						
0	1	2I	2M	3I	3M	4	5	6	7	a	9+	Total
	76.50	92.80	119.10	109.40	120.70	136.00	160.30				173.00	105.5
						45F6						
0	1	2I	2M	3I	3M	4	5	6	7	a	9+	Total
	69.90	84.30	105.20	90.30	109.30	109.20	143.50		131.00			93
						45F5						
0	1	2I	2M	3I	3M	4	5	6	7	a	9+	Total
	65.40	88.90	116.90	96.30	114.50	116.90	112.30	105.00				33.3
						45F4						
0	1	2I	2M	3I	3M	4	5	6	7	a	9+	Total
	69.00	97.30	133.80	105.40	138.20	126.50	163.00					106.5
						45F3						
0	1	2I	2M	3I	3M	4	5	6	7	a	9+	Total
	69.00	97 30	133.80	105.40	138.20	126.50	163.00					106.5
						44F7						
0	1	2I	2M	3I	3M	4	5	6	7	a	9+	Total
	70.90	34.40	114.80	104.10	112.30	119 10	140.80		165.50			103.3
						44F6						
0	1	2I	2M	3I	3M	4	5	6	7	6	9+	Total
	70.90	84.40	114.80	104.10	112.30	119.10	140.80		165.50			103.3
						44F5						
0	1	2I	2M	3I	3M	4	5	6	7	a	9+	Total
	69.00	97.30	133.80	105.40	138.20	126.59	163.00					106.5
						44F4						
0	1	2I	2M	3I	3M	4	5	6	7	a	9+	Total
	69	97.3	133.8	105.4	138.2	126.5	163					106.5

						44F3						
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	89.00	97.30	133.80	105.40	138.20	126.50	163.00					106.5
						43F7						
0	1	2I	2M	31	3M	4	6	6	7	8	9+	Total
	49.60	81.20	119 50		95.70							56.7
						43F6						
0	1	21	2M	3I	3M	4	5	8	7	8	9+	Total
	49.60	81.20	119.50		95.70							56.7
						43F5						
0	1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
1.7	61.70	81.50	119 50		95.70							S-7.8
						43F4						
0	1	2I	2M	3I	3M	4	6	6	7 .	8	9+	Total
1 7												1.7

Table 2.5

HERRING-SKAGERRAK. Estimated number and biomass of herring by age and length groups.
Totals also divided in stocks. RV GO *Sars*, 29 June-18 July 1999.

Length (cm)	Age groups 0	1	2	3	4	5	6	7	8	9+	N (mill)	Ton (10^3)
7.0-7.9	119	0	0	0	0	0	0	0	0	--ii---	119	0
8.0-8.9	477	0	0	0	0	0	0	0	0	0	477	2
9.0-9.9	1197	0	0	0	0	0	0	0	0	0	1197	5
10.0-I 0.9	423	0	0	0	0	0	0	0	0	0	423	3
11.0-11.9	30	0	0	0	0	0	0	0	.0	0	30	0
12.0-12.9	0	0	0	0	0	0	0	0	0	0	0	0
13.0-13.9	0	0	0	0	0	0	0	0	0	0	0	0
14.0-14.9	0	0	0	0	0	0	0	0	0	0	0	0
15.0-I 5.9	0	78	0	0	0	0	0	0	0	0	78	2
16.0-16.9	0	233	0	0	0	0	0	0	0	0	233	8
17.0-17.9	0	727	0	0	0	0	0	0	0	0	727	29
18.0-18.9	0	890	0	1	0	0	0	0	0	0	891	42
19.0-I 9.9	0	532	41	0	0	0	0	0	0	0	572	31
20.0-20.9	0	352	81	1	10	0	0	0	0	0	544	33
21.0-21.9	0	236	57	1	30	0	0	0	0	0	424	30
22.0-22.9	0	99	42	11	1	0	0	0	0	0	253	21
23.0-23.9	0	11	01	59	19	6	0	0	0	0	196	18
24.0-24.9	0	1	18	65	19	1	0	0	0	0	104	11
25.0-25.9	0	0	8	31	12	1	0	0	0	0	51	6
26.0-26.9	0	0	11	17	4	2	0	0	1	0	36	5
27.0-27.9	0	0	0	1	1	2	1	0	0	0	5	1
28.0-28.9	0	0	0	0	11	1	0	0	0	0	13	2
29.0-29.9	0	0	0	0	0	0	1	1	0	0	2	0
30.0-30.9	0	0	0	0	0	0	0	1	0	0	2	0
31.0-31.9	0	0	0	0	0	0	0	0	0	0	0	0
32.0-32.9	0	0	0	0	0	0	0	0	0	0	1	0
N (mill)	2246	3158	360	187	107	13	3	3	1	0	6377	250
NS herring	2246	2351	50	1	3	5	1	2	0	0		
Baltic spr	0	807	310	186	104	8	2	0	0	0		

NS herring (millions)	4658.5
SSB, NS herring (ton 10^3)	2.7
Baltic spr (ton 10^3)	115.09

Table 2.6

HERRING-NORTH SEA. Estimated number and biomass by age and length groups.

Totals also divided in stocks. RV GO *Sars*, 29 June-18 July 1999,

	Age groups											
Length (cm)	0	1	2	3	4	5	6	7	8	9+	N mill)	Ton (10^3)
6.0-6.9	33.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	3 3	0.03
7.0-7.9	107.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	107	0.19
8.0-8.9	22.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23	0.06
9.0-9.9	5.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5	0.02
10.0-10.9	1.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2	0.01
11.0-11.9	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
12.0-12.9	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
13.0-13.9	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
14.0-14.9	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
15.0-I 5.9	0	30.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	31	0.92
16.0-16.9	0	126.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	127	4.38
17.0-17.9	0	222.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	222	9.01
18.0-18.9	0	193.92	7.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	202	9.74
19.0-19.9	0	198.08	0.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	199	11.27
20.0-20.9	0	218.73	3.83	0.00	0.00	0.00	0.00	0.00	0.00	0	223	15.06
21.0-21.9	0	184.99	39.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	224	16.9
22.0-22.9	0	139.81	140.48	15.72	3.34	1.45	0.00	0.00	0.00	0.00	301	25.9
23.0-23.9	0	71.30	259.33	54.62	6.07	0.00	0.00	0.00	0.00	0.00	391	38.89
24.0-24.9	0	0.00	244.03	132.25	14.50	1.26	0.00	0.00	0.00	0	392	49.4
25.0-25.9	0	0.00	249.83	163.89	35.93	4.79	0.54	0.00	0.00	0.00	455	61.38
26.0-26.9	0	0.00	121.11	183.41	39.32	7.57	0.00	0.91	0.00	0.00	382	57.26
27.0-27.9	0	0.00	46.26	179.71	20.88	5.69	0.00	0.00	0.00	0.00	253	42.33
28.0-28.9	0	0.00	0.00	190.39	75.98	21.67	1.44	1.01	0.55	0.00	291	58.79
29.0-29.9	0	0.00	1.01	59.50	55.85	11.83	10.70	0.77	0.00	0.00	149	32.81
30.0-30.9	0	0.00	0.00	1.90	58.62	25.00	24.05	0.00	7.68	2.34	120	28.21
31.0-31.9	0	0.00	0.00	0.95	0.00	41.31	27.96	2.11	0.00	0.00	72	17.81
32.0-32.9	0	0.00	0.00	0.00	0.00	7.88	0.95	8.69	0.00	0	17	4.97
N (mill)	170	1387	1114	982	351	128	66	13	8	2	1221	485
NS herring	170	1345	831	719	299	116	65	12	8	3		
Balticspr	0	42	280	251	48	10	0	1	0	0		
										NS herring (millions)		3568.11
										SSB,NS herring(ton 10^3)		259.3
										Baltic spr (ton 10^3)		73.9

TABLE 3.1A

Calibration report EK-500, 38 kHz transducer - **Hull** mounted. *Tridens* 29 June - 15 July 1999.

Date and time: 1 July 1999	Positron. off Kristiaansand harbour 58°56.71'N-003°00 57'W
Bottom depth. 30 m	Wind: 6 BF (but in the shelter)
Salinity: 34.7‰	Wave height. 0.5 m
Water temperature: 12 1 °C (surface), 10.2 (20 m)	Transducer. 38 kHz

Transceiver Menu Before Calibration

Pulse length: medium	Bandwidth: wide
Max power: 2,000 W	Angle sensitivity: 21.9
2-way beam angle: -20.6	Sv transducer gain: 26.5
TS transducer gain: -26.5	3 **dB** beam width: 7.1
Alongship offset: ?	athw ship offset: ?
Ping interval: 1 .O	Transmitter power: normal

Standard target:		copper sphere, -33.6 dB
Distance transducer - target:		
TS values measured:		-33.8
New transducer gain:		26.4
New TS values measured:		
SA values measured:		5,320
SA value calculated:		5,347
Default transducer gain:	26.5	
Correction factor:	1.01	

TABLE 3.1 B

Calibration Report EK-500, 38 kHz transducer - Towed body. *Tridens* 29 June - 15 July 1999.

Date and time: 1 July 1999	Position: off Kristiaansand harbour 58°56.71'N-003°00.57'W
Bottom depth: 30 m	Wind: 6 BF (but in the shelter)
Salinity: 34.7‰	Wave height: 0.5 m
Water temperature: 12.1 °C (surface)	Transducer: 38 kHz

Transceiver Menu Before Calibration

Pulse length: medium	Bandwidth: wide
Max power: 2.000 W	Angle sensitivitv: 21.9
2-way beam angle: -20.6	Sv transducer gain: 26.5
TS transducer gain: -26.5	3 dB beam width: 7.1
Alongship offset: ?	athw. ship offset: ?
Ping'interval: 1 .O	Transmitter power: normal

Standard target:		copper sphere, -33.6 dB
Distance transducer - target:	9.6	
TS values measured:		-32.5
New transducer gain:		27.05
New TS values measured:	-33.6	
SA values measured:		
SA value calculated:		24,976
Default transducer gain:	26.5	
Correction factor:	0.79	

ABI

Trawl ta List *Tride* ily.

Haul No	Date	Time UTC	Latitude (N)	Longitude	E/W	Depth meters	Duration min	Herring	N pout	Other gadoids	Mackerel	Sprat	Others	Comments
1	36705	0.4	58.1	1.3	E	100	70	210	450		2.5			
2	36706	0.2	58.1	1.2	W	105	21	4800	1	7.0		0.1	0.2	
3	36706	0.03	57.6	1.6	W	74	22.0	90.0				7.5		
4	36708	0.45	58.0	2.2	W	51	15.0							Sandeel in the meshes
5	36711	0.45	57.6	1.2	E	90	20.0	18.1	3.3	0.3	17.4			Jellyfish
6	36711	0.15	57.4	1.4	E	85	28.0	15.3	105.0	0.6	5.1		1	
7	36712	0.3	57.3	1.1	W	63	15.0		80.0	0.5		0.2	1.5	
8	36712	0.55	57.1	1.5	E	92	65.0	220.0	136.0	3.0	35.0			
9	36713	0.1	56.6	1.4	E	70	15.0	15.0	26.4	3.0		4.5		Jellyfish
10	36713	0	56.6	0.1	W	80	104.0	19.0	16.0	9.6	19.5		0.7	Jellyfish
11	36715	0.29	56.1	0.3	W	78	23.0	1.4	7.0	41.0	1.0	0.3	1.2	Sandeel in the meshes/ jellyfish
12	36718	0.3	55.6	1.2	W	70	24.0	8.0			7.8	22.0		Jellyfish (herring = 0 group!)
13	36719	0.35	55.3	0.6	W	92	54.0	93.0	0.1	3.4		2.9		Jellyfish
14	36719	0.5	55.1	1.2	E	53	50.0	0.1		4.8			16.6	
15	36720	0.33	55.1	0.4	E	70	47.0	0.1		320.0	5.7		16.2	
16	36720	0.5	55.1	1.1	W	86	30	66	2.5	39.0		11.4	1	Jellyfish
17	36721	0.1	54.4	0.2	W	62	65	0.2		403			5.4	

TABLE 3.3

Length distribution herring by haul *Tridens* 29 June - 17 July 1999.

length/ Haul	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
13.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15.5	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.5	0.0	0.0	0.0	0.0	0.0	0.0
16.5	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	6.5	0.0	0.0	0.0	0.0	0.0	0.0
17.0	0.0	0.0	4.5	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17.5	0.0	0.0	4.5	0.0	0.0	0.6	0.0	0.8	0.0	3.6	3.2	0.0	0.0	33.3	0.0	1.4	0.0
18.0	0.0	0.0	2.0	0.0	0.0	2.3	0.0	0.0	0.0	6.6	19.4	0.0	0.6	0.0	0.0	5.6	0.0
18.5	0.9	0.0	2.0	0.0	0.0	7.8	0.0	0.0	0.0	10.2	9.7	0.0	0.6	33.3	0.0	3.5	0.0
19.0	0.0	0.0	1.5	0.0	0.0	6.5	0.0	0.0	0.0	6.6	19.4	0.0	3.2	0.0	0.0	5.6	0.0
19.5	0.0	0.0	2.0	0.0	0.8	1.6	0.0	0.8	0.0	15.3	9.7	0.0	4.5	0.0	0.0	12.6	0.0
20.0	1.8	0.0	1.5	0.0	0.8	3.1	0.0	0.0	0.0	15.3	9.7	0.0	3.9	33.3	0.0	6.4	0 0
20.5	0.0	0.6	4.5	0.0	0.0	6.2	0.0	0.8	0.0	7.3	3.2	0.0	12.3	0.0	0.0	9.1	0.0
21.0	0.0	0.6	10.1	0.0	3.1	11.6	0.0	5.3	0.0	7.3	3.2	0.0	5.2	0.0	0.0	3.5	0.0
21.5	1.8	12.8	13.1	0.0	10.0	5.4	0.0	4.8	0.0	3.6	0.0	0.0	7.1	0.0	0.0	4.2	0.0
22.0	4.5	10.5	12.6	0.0	9.2	7.0	0.0	7.6	0.0	7.3	6.5	0.0	4.5	0.0	0.0	0.0	0.0
22.5	4.5	20.3	12.6	0.0	5.4	7.6	0.0	7.6	0.0	5.1	0.0	0.0	4.5	0.0	0.0	4.2	0.0
23.0	9.9	12.8	7.5	0.0	3.8	5.4	0.0	4.6	0.0	2.2	0.0	50.0	0.6	0.0	0.0	2.8	0.0
23.5	0.0	8.1	7.0	0.0	10.0	7.8	0.0	14.5	0.0	2.9	0.0	0.0	3.2	0.0	0.0	1.4	0.0
24.0	15.3	16.3	3.0	0.0	13.1	16.3	0.0	13.7	0.0	0.7	0.0	0.0	2.6	0.0	0.0	3.5	0.0
24.5	9.9	3.5	1.5	0.0	8.5	8.5	0.0	13.7	0.0	2.9	3.2	0.0	0.6	0.0	0.0	3.5	50.0
25.0	17.1	8.1	0.5	0.0	10.0	0.0	0.0	13.7	0.0	0.0	0.0	0.0	7.1	0.0	33.3	1.4	50.0
25.5	13.5	3.5	1.0	0.0	8.5	0.0	0.0	5.3	0.0	0.0	0.0	0.0	7.7	0.0	66.7	4 9	0.0
26.0	5.4	2.3	0.0	0.0	10.0	0.0	0.0	3.8	0.0	0.0	0.0	0.0	7.1	0.0	0.0	4.2	0 0
26.5	5.4	0.6	1.0	0.0	2.3	0.0	0.0	3.1	0.0	0.0	0.0	0.0	9.7	0.0	0.0	7.7	0 0
27.0	2.7	0.0	0.0	0.0	3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	0.0	0.0	6.3	0.0
27.5	0.0	0.0	0.5	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.1	0.0	0.0	2.1	0.0
28.0	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0	3.5	0.0
28.5	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.7	0.0
29.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29.5	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0	0.0	0.0	0.0	0.0
30.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31.5	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mean length	24.7	23.2	21 1		23.9	21.8		23.7		20.2	19.0	26.5	23.6	18.7	25.3	22.4	24.6
TS mean length	-43.3	-43.8	-45		-43.5	-44 3		-43.6		-45	-45.5	-42.7	-43.7	-45.7	-43 0	-44.1	-43
Mean weight	128 2	994	781		112.2	90		1156		63.6	51 4		105			90.7	

TABLE 3.4

Summarised results all sampling areas Herring - best estimate. *Tridens* 29 June-17 July.

	Autumn Spawners												
	97im	96im	96ad	95im	95ad	94	93	92	91	90	89	88	<88	Totals
A	297.3	157.8	324.6	0.0	124.3	7.8	0.7	2.9	0.0	0.0	0.3	0.0	0.0	915.7
B	81.0	65.6	163.5	0.0	124.6	38.8	6.7	0.0	1.8	0.0	0.7	0.7	0.0	483.5
C	104.3	7.6	9.2	0.0	0.9	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	126.0
D	92.6	30.8	15.9	0.0	14.1	13.4	12.1	34.0	11.6	14.3	12.4	6.8	0.0	258.1
Totals	575.3	262.8	513.2	0.0	263.9	63.9	19.5	36.9	13.4	14.3	13.5	7.5	0.0	1783.2

Summary All Sampling Areas
weight in '000 tons

	Autumn Spawners												
	97im	96im	96ad	95im	95ad	94	93	92	91	90	89	88	<88	totals
A	17.2	13.3	34.5	0.0	15.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	81.4
B	5.5	5.3	18.6	0.0	16.3	5.7	1.3	0.0	0.5	0.0	0.0	0.0	0.0	53.3
C	5.5	0.5	0.8	0.0	0.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.3
D	5.5	2.1	1.4	0.0	1.5	1.6	1.7	4.7	1.7	2.0	1.9	1.0	0.0	25.0
Totals	33.7	21.2	55.4	0.0	33.3	8.7	3.0	4.7	2.2	2.0	1.9	1.0	0.0	167.0

TABLE 3.5

Length distribution sprat. *Tridens 29* June - 15 July 1999

Length	Haul 1	Haul 2	Haul 3	Haul 4	Haul 5	Haul 6	Haul 7	Haul 8	Haul 9	Haul 10	Haul 11	Haul 12	Haul 13	Haul 14	Haul 15	Haul 16	Haul 17
5.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8.0	0.00	0.00	0.00	0.00	0.00	0.00	8.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.23	0.00
8.5	0.00	0.00	0.00	0.00	0.00	0.00	20.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.61	0.00
9.0	0.00	0.00	9.39	0.00	0.00	0.00	12.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.29	0.00
9.5	0.00	0.00	28.18	0.00	0.00	0.00	12.00	0.00	0.00	0.00	0.00	0.00	6.90	0.00	0.00	8.06	0.00
10.0	0.00	0.00	39.23	0.00	0.00	0.00	28.00	0.00	0.00	0.00	0.00	0.00	16.09	0.00	0.00	16.13	0.00
10.5	0.00	0.00	17.13	0.00	0.00	0.00	8.00	0.00	0.00	0.00	0.00	0.00	21.84	0.00	0.00	11.29	0.00
11.0	0.00	0.00	2.76	0.00	0.00	0.00	8.00	0.00	0.00	0.00	0.00	0.00	14.94	0.00	0.00	17.74	0.00
11.5	0.00	0.00	0.55	0.00	0.00	0.00	4.00	0.00	0.00	0.00	0.00	0.00	17.24	0.00	0.00	6.45	0.00
12.0	0.00	0.00	1.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.05	0.00	0.00	9.68	0.00
12.5	0.00	0.00	0.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.05	0.00	0.00	6.45	0.00
13.0	0.00	0.00	0.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.30	0.00	0.00	8.06	0.00
13.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.45	0.00	0.00	0.00	0.00
14.0	0.00	0.00	0.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.15	0.00	0.00	0.00	0.00
14.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Length	Haul 1	Haul 2	Haul 3	Haul 4	Haul 5	Haul 6	Haul 7	Haul 8	Haul 9	Haul 10	Haul 11	Haul 12	Haul 13	Haul 14	Haul 15	Haul 16	Haul 17
17.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean length			9.96				9.54						11.08			10.69	
TS mean length			-51.02				-51.38						-50.12			-50.42	
Mean weight			7.80				5.76						9.12			9.60	

TABLE 3.6

Summarised results all sampling areas. Sprat best estimate, *Tridens* 29 June - 15 July 1999.

Summary All Sampling Areas
numbers in millions

	98im	98ad	97im	97ad	96	95	94	93	Totals
A	83.7	224.7	0.0	29.7	0.9	0.0	0.0	0.0	339.1
B	55.4	294.6	0.0	321.2	15.8	0.0	0.0	0.0	687.0
Totals	139.1	519.3	0.0	350.9	16.7	0.0	0.0	0.0	1,026.0

Summary All Sampling Areas
weight in '000 tons

	98im	98ad	97im	97ad	96	95	94	93	Totals
A	0.4	1.5	0.0	0.3	0.0	0.0	0.0	0.0	2.1
B	0.0	2.0	0.0	3.3	0.2	0.0	0.0	0.0	5.5
Totals	0.4	3.5	0.0	3.6	0.2	0.0	0.0	0.0	7.6

TABLE 4.1

Catch composition of hauls (in kg per 30 min hauling time) conducted during cruise 444 of FRV *Solea* in 1999. Net type (benthic or pelagic) is indicated.

Station	1	2	3	4	5	6	7	8	9	10	Sum
Net type	pel	benth	pel	pel	pel	benth	benth	pel	benth	pel	
Sum	**238.01**	**132.97**	**90.25**	**4.41**	**466.55**	**130.26**	**32.54**	**37.66**	**207.49**	**247.34**	**1,587.48**
Sum clupeids	**233.09**	**132.90**	**88.73**	**0.00**	**465.71**	**120.93**	**31.76**	**37.18**	**154.17**	**247.34**	**1,511.81**
Clupea harengus	*4.68*	123.34	*88.06*		**465.71**	**115.26**	**3.00**	**36.19**	**154.17**	**181.27**	**1,171.68**
Sprattus sprattus	**228.41**	**9.56**	**0.67**			**5.67**	**28.76**	**0.99**		**66.07**	**340.13**
Eutrigla gurnardus		0.04	1.36	2.22	0.84	1.81	0.04	0.48	22.10		**28.89**
Gadus **morhua**									3.42		**3.42**
Hippoglossoides platessoides									8.31		**9.62**
Hyperoplus lancoela **tus**							*0.03*				**0.03**
Limanda **limanda**						*2.71*			16.10		**18.81**
Merlangius *merlangus*	*1.28*	*0.03*	*0.16*	*0.02*		*2.75*	*0.71*		1.02		**5.97**
Microstomus kitt						*0.14*			0.62		**0.76**
Nephrops ***norvegicus***						*0.17*					**0.17**
Pleuronectes platessa						*0.44*			1.07		**1.51**
Scomber scombrus	*1.87*			*0.40*							**2.27**
Trachurus trachurus	1.77			1.78					0.68		**4.23**

TABLE 4.2

Total estimates of herring abundance (numbers at age in millions) as obtained during the hydroacoustic survey of FRV *Solea* in summer 1999. Values for rectangle 37F7 are not shown as only one hydroacustic cruise track was completed and the abundance is very likely to be overestimated. Numbers in italics: from interpolated species- and length relations.

CES Rect	Age	F4 %	F5 n	F5 %	F6 n	F6 %	F? n	F? %	n
41	numbers per rct		32.8		256.9		112.1		11.9
	1	41%	*13.6*	32%	*82.7*	*61%*	*68.4*	*67%*	*8.0*
	2i	0%	*0.1*	0%	*0.0*	*0%*	*0.1*	*0%*	*0.0*
	2m	58%	*19.1*	68%	*174.2*	*39%*	*43.6*	*33%*	*3.9*
	3m	*0%*	*0.0*	0%	*0.0*	*0%*	*0.0*	*0%*	*0.0*
	4	0%	*0.0*	0%	*0.0*	*0%*	*0.0*	*0%*	*0.0*
40	numbers per rct		43.7		623.2		1596		59.5
	1	*45%*	*19.7*	49%	*303.1*	68%	*1,086.1*	*65%*	*38.9*
	2i	0%	*0.2*	1%	*4.2*	0%	*0.0*	*0%*	*0.0*
	2t-n	54%	*23.5*	51%	*315.8*	32%	*509.5*	*35%*	*20.6*
	3m	*1%*	*0.3*	0%	*0.0*	0%	*0.0*	*0%*	*0.0*
	4	*0%*	*0.0*	0%	*0.0*	0%	*0.0*	*0%*	*0.0*
39	numbers per rct		149.5		1,037.1		636.9		
	1	9%	*14.1*	*54.2%*	*561.9*	53%	*335.8*		
	2i	0%	*0.0*	*0%*	*2.0*	0%	*0.0*		
	2m	85%	*127.3*	*45.3%*	*469.3*	47%	*301.1*		
	3m	5%	*8.1*	*0.4%*	*3.8*	0%	*0.0*		
	4	0%	*0.0*	*0%*	*0.0*	0%	*0.0*		

age 1	2,532.3
age 2 i	6.6
age 2 m	2,007.9
age 3 m	122
age 4	0.0
total	4,559.0

TABLE 4.3

Total estimates of herring biomass (weight at age in kg) as obtained during the hydroacoustic survey of FRV *Solea* in summer 1999. Values for rectangle **37F7** are not shown as onlybne hydroacustic cruise track was completed and the abundance is very likely to be overestimated. Numbers in italics: from interpolated species- and length relations.

ICES Rect	Age	F4 w/age	n...	F5 w/age	n.l	F6 w/age	n...	F 7 w/age	n
41	total	826	32.8	7,276	256.9	2,092	112.1	198	11.9
	1	77	13.6	465	82.7	385	68.4	45	8.0
	2i	3	0.1	0	0.0	3	0.1	0	0.0
	2m	745	19.1	6811	174.2	1,704	43.6	153	3.9
	3m	1	0.0	0	0.0	0	0.0	0	0.0
	4	0	0.0	0	0.0	0	0.0	0	0.0
40	total	1,061	43.7	14,150	623.2	26,030	1,596	1,024	59.5
	1	111	19.7	1,706	303.1	6,115	1,086.1	219	38.9
	2i	4	0.2	98	4.2	0	0.0	0	0.0
	2m	920	23.5	12,346	315.8	19,915	509.5	805	20.6
	3m	26	0.3	0	0.0	0	0.0	0	0.0
	4	0	0.0	0	0.0	0	0.0	0	0.0
39	total	5,729	149.5	21,872	1,037.1	13,659	636.9		
	1	80	14.1	3,164	561.9	1,890	335.8		
	2i	0	0.0	46	2.0	0	0.0		
	2m	4976	127.3	18,346	469.3	11,769	301.1		
	3 m	674	8.1	317	3.8	0	0.0		
	4	0	0.0	0	0.0	0	0.0		

age 1	14,256.7
age 2 i	153.3
age 2 m	78,489 4
age 3 m	1,017 8
age 4	0.0
total	93,917.2

TABLE 5.1

Catch composition by trawl haul. *Scotia* (13 July - 30 July 1999).

Haul umber	Position		Depth (m)	Numbers caught								
	Latitude (°N)	ongitude (°W)		Herring	Whiting	Haddock	Pout	Mackerel	Horse mackerel	Blue whiting	Sprat	Others
1	58 32.41	5 34.91	140	91	126	50	5			3		10 dogfish
2	58 18.95	6 56.70	115		249	669	507			69	183	
3	58 62.72	5 45.30	110	2	62	15	257			5	48	
4	57 39.25	6 36.80	85	2	197	17	73				316	1
5	56 42.30	6 31.07	100	49	36			676			10,290	
6	56 23.04	6 45.26	80	12	28			7			15,960	
7	56 05.47	9 03.31	170	1		10	4					poor cod
8	56 32.24	7 48.34	150	1,860	15	10	10					5 hake, 35
9	56 40.00	8 43.97	125	420				4	5			
10	56 38.94	7 36.66	100	21,550								
11	56 46.54	7 37.91	100	33,465	460			805				
12	56 47.46	8 29.30	125	44	10	92	4			1		8 Argentine, 1 cod, 1 saithe
13	57 02.53	9 02.90	140	233		48	108		20	348		56 argentine, 16 poor cod
14	57 10.10	8 18.82	125	16,695				410				
15	57 32.48	8 25.66	150	4,685				60				
16	57 46.71	8 46.72	140	98	2	8	77			20		1 poor cod
17	57 45.00	7 46.10	100				3,140					
18	57 54.97	7 40.56	100	5,313								
19	58 10.38	7 18.80	100	37,151								

Haul Number	Position		Depth (m)	Numbers caught								
	Latitude (°N)	Longitude (°W)		Herring	Whiting	Haddock	Pout	Mackerel	Horse mackerel	Blue whiting	Sprat	Others
20	58 16.02	5 53.78	100	14	322	322	21					
21	58 20.13	5 57.94	125		96	312	12					
22	58 16.70	7 05.46	100	1,830				260				
23	58 23.05	5 29.32	90	30,856								
24	58 40.07	6 02.84	120	5	2	18					360	
25	58 36.86	6 28.44	100	73				645				
26	58 48.81	7 34.27	160	38,214			515		103			
27	58 47.93	4 53.75	85	2	7	24	108	25	15			
28	58 48.18	3 53.64	90	7,832				59			14	
29	58 55.25	5 34.10	90	1,652								
30	58 55.12	6 23.43	125	1,955				10				
31	58 55.19	6 57.38	175	9,482						341		
32	59 02.88	6 56.29	195	7	1			36		1,080		1 hake, 1 argentine
33	59 02.86	4 59.09	60				620	42				
34	59 10.47	5 14.40	115	706	16			6				
35	59 10.21	6 20.30	115	340		7		3				
36	59 19.92	6 30.10	200		36	1						
37	59 35.22	5 44.68	125	760								
38	59 48.53	3 13.31	80	609			62	4				

TABLE

Herring length frequency by trawl haul by sub *Scotia* (13 July July 1999) mean length cm, mean weight g, target strength dB)

Haul No	Area I				Area II	Area III	Area IV			Area V							Area VI			
	1	23	25	Mean	5	11	8	10	Mean	9	12	13	14	15	16	Mean	18	19	22	Mean
13.0																				
13.5																				
14.0																				
14.5					2.0															
15.0																				
15.5					6.1															
16.0					10.2															
16.5					8.2															
17.0					14.3															
17.5					14.3															
18.0					8.2															
18.5	3.3			1.1	18.4															
19.0	1.1		15.1	5.4	8.2															
19.5			21.9	7.3		0.3		0.2	0.1									0.4		0.1
20.0	1.1		19.2	6.8		3.4												0.4		0.1
20.5	1.1		12.3	4.5		4.1														
21.0			8.2	2.7		8.9		0.2	0.1											
21.5			5.5	1.8		8.2														
22.0		0.4		0.1		4.5												0.4	0.3	0.2
22.5	1.1			0.4		1.7														
23.0	9.9		2.7	4.2		1.7													0.5	0.2
23.5	6.6	1.5	1.4	3.2		1.7		0.2	0.1										0.3	0.1
24.0	20.9	2.2	4.1	9.1		4.5		0.9	0.5				0.4			0.1	0.4	1.4	1.1	1.0
24.5	16.5	3.7		6.7		5.2	0.3	3.5	1.9					1.1		0.2	0.4	4.6	3.0	2.7
25.0	12.1	13.5		8.5		13.4	4.0	6.0	5.0	2.1			7.3	4.0		2.2	12.1	16.3	13.9	14.1
25.5	13.2	20.2		11.1	2.0	13.4	5.9	7.9	6.9	4.3	9.1		10.7	8.4		5.4	18.6	17.4	16.4	17.5

Haul No	Area I				Area II	Area III	Area IV			Area V							Area VI			
	1	23	25	Mean	5	11	8	10	Mean	9	12	13	14	15	16	Mean	18	19	22	Mean
26.0	4.4	29.2	2.7	12.1	6.1	11.3	8.3	13.9	11.1	11.4	15.9	6.0	26.1	18.3	6.1	14.0	29.0	32.2	28.7	30.0
26.5	3.3	15.0	2.7	7.0		7.9	7.8	15.3	11.6	15.2	15.9	9.9	19.5	19.4	6.1	14.3	17.7	15.2	15.8	16.3
27.0	3.3	9.4	1.4	4.7	2.0	7.2	10.8	16.0	13.4	18.6	15.9	16.3	18.4	21.6	19.4	18.4	12.6	7.1	10.9	10.2
27.5	1.1	2.8	2.7	2.2		1.4	10.8	12.1	11.4	16.2	15.9	17.2	9.2	11.3	24.5	15.7	6.5	3.5	4.1	4.7
28.0	1.1	1.5		0.9		1.0	13.7	7.7	10.7	11.9	13.6	23.6	5.0	7.3	22.4	14.0	2.6	1.0	4.4	2.7
28.5		0.2		0.1			12.4	4.9	8.6	8.6	6.8	13.3	1.5	5.1	9.2	7.4		0.2		0.1
29.0		0.2		0.1			12.6	5.8	9.2	9.0	4.5	7.3	1.9	2.0	9.2	5.7			0.3	0.1
29.5		0.2		0.1	0.1		8.3	2.1	5.2	1.9	2.3	4.3		0.5	3.1	2.0			0.3	0.1
30.0							2.7	2.1	2.4			1.3		1.0		0.4				
30.5							2.2	0.7	1.4	0.7		0.4				0.2				
31.0							0.3	0.2	0.3			0.4				0.1				
31.5								0.2	0.1											
32.0																				
32.5																				
33.0																				
33.5																				
34.0																				
34.5																				
Number	91	30,586	73		49	33,465	1,860	21,550		420	44	233	16,695	4,685	98		5,313	7,151	1,830	
mean lgt	24.8	26.4	21.4	24.2	18.7	24.7	28.2	27.4	27.8	27.8	27.6	28.2	27.0	27.3	28.2	27.7	26.6	26.3	26.5	26.5
mean wt	130	156	84	123	57	130	194	177	186	185	180	194	168	174	192	182	161	155	159	159
TS/ind	-43.3	-42.8	-44.5	-43.5	-45.6	-43.3	-42.2	-42.4	-42.3	-42.3	-42.4	-42.2	-42.6	-42.5	-42.2	-42.4	-42.7	-42.8	-42.7	-42.7
TS/kg	-34.4	-34.7	-33.8	-34.4	-33.2	-34.4	-35.1	-34.9	-35.0	-35.0	-34.9	-35.1	-34.8	-34.9	-35.0	-35.0	-34.8	-34.7	-34.7	-34.7

TAB (Co I)

He ıth fr· uency awl haul by b *coti* (· to 30 ı) le gth ight ta gth

Haul No	Area VII					Area VIII					Area IX
	26	31	37	38	Mean	29	30	34	35	Mean	28
15.5											
16.0											
16.5											
17.0											
17.5											
18.0											
18.5											
19.0											1.1
19.5											0.5
20.0											0.8
20.5											0.8
21.0											0.8
21.5											0.3
22.0				0.3	0.1						2.2
22.5											3.6
23.0				0.3	0.1						6.3
23.5				0.3	0.1						6.3
24.0				0.3	0.1						11.6
24.5		0.6		0.3	0.2	0.3		0.3		0.1	9.7
25.0		0.3		6.2	1.6	4.2	4.2	2.0		2.6	10.5
25.5		0.3		6.2	1.9	9.5	5.4	4.0	0.3	4.8	9.9
26.0	1.1	1.2	0.3	14.4	5.5	21.4	27.0	17.8	5.3	17.9	16.0
26.5	6.2	2.7	1.3	14.4	6.7	20.3	21.6	17.8	10.6	17.6	7.2
27.0	8.4	8.7	6.8	12.5	11.1	17.9	20.5	15.9	16.8	17.7	6.1
27.5	16.4	9.6	8.9	8.5	11.2	9.3	8.1	12.2	15.0	11.1	3.6
28.0	17.8	10.8	15.1	7.6	12.8	6.5	6.2	11.3	17.6	10.4	1.9
28.5	17.8	12.6	16.1	6.2	11.4	5.9	3.1	4.2	12.4	6.4	

Haul No	Area VII					Area VIII					Area IX
	26	31	37	38	Mean	29	30	34	35	Mean	28
29.0	10.5	15.6	16.8	5.6	11.9	2.3	2.8	3.4	8.5	4.3	0.9
29.5	9.7	9.6	12.9	3.3	8.0	0.7	0.5	2.8	3.8	2.0	
30.0	6.2	7.2	6.8	3.6	5.1	0.5	0.3	1.8	2.4	1.2	
30.5	2.7	6.9	5.9	4.6	4.6	0.5		1.4	2.4	1.1	0.2
31.0	0.9	5.7	4.2	1.8	3.2	0.2	0.3	1.6	3.2	1.3	
31.5	1.2	3.3	1.8	1.8	1.9	0.1		1.4	0.9	0.6	
32.0	0.5	1.9	1.1	1.5	1.2	0.2		1.1	0.9	0.6	
32.5	0.3	1.1	0.7		0.5			0.4		0.1	
33.0	0.1	0.8	0.5		0.3			0.3		0.1	
33.5		0.4	0.3		0.2						
34.0	0.1		0.4		0.1	0.1				0.1	
34.5		0.1			0.1			0.1		0.1	
35.0											
35.5		0.2			0.1						
36.0		0.1			0.1						
36.5											
37.0		0.1			0.1						
Number	38,214	9,482	760	609		1,652	1,955	706	340		7,832
mean lgt	28.4	29.5	29.4	27.9	28.8	27.3	27.2	27.8	28.5	27.7	25.4
mean wt	197	223	222	189	208	174	172	187	200	183	140
TS/ind	-42.1	-41.8	-41.8	-42.3	-42.0	-42.5	-42.5	-42.3	-42.1	-42.3	-43.1
TS/kg	-35.1	-35.3	-35.3	-35.0	-35.2	-34.9	-34.9	-35.0	-35.1	-35.0	-34.5

TABLE 5.3

Herring numbers and biomass by age, maturity and area. Scotia (13 July to 30 July 1999).

Category	Number x 10^{-6}	Mean Length (cm)	Mean weight (g)	Biomass (tonnes x10^{-3})
Area I (North Minch)				
1 ring	143.11	19.87	68.97	9.87
2 ring immature	67.46	23.98	123.38	8.32
2 ring mature	72.82	24.28	128.46	9.35
3 ring immature	5.75	24.76	135.79	0.78
3 ring mature	190.55	25.96	157.76	30.06
4	6.96	27.46	188.02	1.31
5	3.66	27.26	183.21	0.67
6	0.00			0.00
7	0.83	27.50	188.19	0.16
8	0.00			0.00
9+	0.00			0.00
Total	491.15	23.69	123.24	60.53
Area II (South Minch)				
1 ring	328.76	17.34	45.67	15.01
2 ring immature	0.00			0.00
2 ring mature	0.00			0.00
3 ring immature	0.00			0.00
3 ring mature	29.89	25.88	155.72	4.65
4	7.47	27.00	177.74	1.33
5	0.00			0.00
6	0.00			0.00
7	0.00			0.00
8	0.00			0.00
9+	0.00			0.00
Total	366.12	18.23	57.34	20.99
Area III (Barra Head)				
1 ring	13.29	21.22	84.48	1.12
2 ring immature	10.68	25.00	140.34	1.50
2 ring mature	5.76	25.34	146.37	0.84
3 ring immature	0.00			0.00
3 ring mature	8.30	25.91	156.62	1.30
4	2.26	27.13	180.35	0.41

Category	Number x 10^{-6}	Mean Length (cm)	Mean weight (g)	Biomass (tonnes x10^{-3})
5	0.71	27.40	186.27	0.13
6	0.14	28.00	199.06	0.03
7	0.00			0.00
8	0.00			0.00
9+	0.00			0.00
Total	41.14	24.1	129.61	5.33
Area IV (Barra Head South)				
1 ring	0.33	20.25	73.07	0.02
2 ring immature	10.80	25.23	144.16	1.56
2 ring mature	14.84	25.62	151.20	2.24
3 ring immature	3.20	26.75	172.62	0.55
3 ring mature	32.59	26.52	168.47	5.49
4	23.43	27.37	185.56	4.35
5	23.46	28.12	202.38	4.75
6	11.74	28.50	210.60	2.47
7	6.91	29.18	227.21	1.57
8	3.93	29.64	238.01	0.94
9+	9.53	29.25	228.31	2.18
Total	140.75	27.29	185.54	26.12
Area V (South West Hebrides)				
1 ring	0.00			0.00
2 ring immature	11.83	25.43	147.63	1.75
2 ring mature	24.82	25.77	153.83	3.82
3 ring immature	8.38	26.60	169.89	1.42
3 ring mature	360.19	26.50	168.18	60.58
4	186.87	27.27	183.70	34.33
5	143.22	27.76	194.29	27.83
6	67.59	28.22	204.32	13.81
7	52.02	28.64	213.92	11.13
8	14.62	28.86	219.41	3.21
9+	13.83	28.98	221.77	3.07
Total	883.39	27.17	182.18	160.93
Area VI (Lewis)				
1 ring	1.42	20.44	75.55	0.11
2 ring immature	20.17	24.76	135.84	2.74
2 ring mature	21.91	25.29	145.72	3.19

Category	Number x 10^{-6}	Mean Length (cm)	Mean weight (g)	Biomass (tonnes xl 0^{-3})
3 ring immature	5.89	25.77	153.80	0.91
3 ring mature	303.31	25.97	157.76	47.85
4	41.94	26.74	173.03	7.26
5	19.39	27.13	180.90	3.51
6	1.32	27.80	194.85	0.26
7	0.53	28.00	199.06	0.10
8	0.00			0.00
9+	0.00			0.00
Total	415.87	25.97	158.87	65.86
Area VII (Shelf Break)				
1 ring	0.00			0.00
2 ring immature	3.18	24.13	126.32	0.40
2 ring mature	20.31	25.85	155.84	3.17
3 ring immature	6.78	28.12	202.56	1.37
3 ring mature	199.18	27.32	185.24	36.90
4	110.64	28.23	205.15	22.70
5	103.31	29.04	224.24	23.17
6	52.36	29.80	242.62	12.70
7	20.83	30.44	259.62	5.41
8	8.12	30.61	263.58	2.14
9+	12.09	31.79	298.28	3.61
Total	536.80	28.29	207.82	111.56
Area VIII (North VIIa)				
1 ring	0.00			0.00
2 ring immature	1.99	25.16	142.72	0.28
2 ring mature	13.55	25.87	155.92	2.11
3 ring immature	2.23	26.52	168.47	0.38
3 ring mature	171.96	26.74	173.04	29.76
4	49.86	27.73	193.93	9.67
5	20.82	28.48	211.28	4.40
6	10.18	29.84	244.00	2.48
7	4.48	30.06	249.96	1.12
8	1.14	31.12	278.30	0.32
9+	0.71	32.23	309.95	0.22
Total	276.91	27.19	183.23	50.74

Category	Number x 10^{-6}	Mean Length (cm)	Mean weight(g)	Biomass (tonnes xl 0^{-3})
Area IX (Orkney)				
1 ring	5.63	19.89	69.10	0.39
2 ring immature	20.38	23.18	111.34	2.27
2 ring mature	62.00	24.49	132.08	8.19
3 ring immature	1.99	23.00	107.96	0.22
3 ring mature	60.27	26.09	160.34	9.66
4	6.24	26.75	173.87	1.09
5	0.29	28.00	199.06	0.06
6	0.30	30.50	259.91	0.08
7	0.00			0.00
8	0.00			0.00
9+	0.00			0.00
Total	157.11	24.86	139.70	21.95
Total Area				
1 ring	492.54	18.22	53.86	26.53
2 ring immature	146.49	24.28	128.48	18.82
2 ring mature	236.01	24.92	139.48	32.92
3 ring immature	34.23	26.25	164.42	5.63
3 ring mature	1,356.24	26.42	166.82	226.25
4	435.67	27.51	189.20	82.43
5	314.86	28.21	204.88	64.51
6	143.62	28.93	221.63	31.83
7	85.59	29.18	227.66	19.49
8	27.81	29.58	237.35	6.60
9+	36.16	30.05	250.80	9.07
Total	3,309.23	25.55	158.35	524.01

TABLE 6.1

Numbers (millions) of autumn spawning herring by ICES Area by age class and maturity for 2 and 3 ring herring.

ICES A	IIIa	IVa	IVb	Vlan
0	1,856.57	0.00	170.02	0.00
1	2,562.92	1,047.25	3,449.66	487.00
2i	124.81	703.62	89.05	125.24
2m	43.67	1,889.76	2,096.85	168.66
3i	13.18	394.19	0.00	30.42
3m	24.14	3,893.96	50.95	1,235.36
4	6.79	1,009.27	19.58	393.79
5	16.88	439.49	13.77	280.75
6	0.72	259.96	28.80	126.41
7	4.87	104.61	19.44	78.85
a	0.36	28.84	22.40	25.17
9+	0.00	50.67	32.00	32.28
immature	4,557.47	2,145.06	3,708.73	642.66
Mature	97.41	7,676.55	2,283.79	2341.26
Total	4,654.88	9,821.61	5,992.53	2,983.92

TABLE 6.2

Biomass (thousands of tonnes) of autumn spawning herring by ICES Area by age class and maturity for 2 and 3 ring herring.

ICES A	IIIa	IVa	IVb	VIan
0	8.17	**0.00**	**0.29**	**0.00**
1	140.58	72.63	61.67	26.14
2i	10.38	72.35	6.22	16.44
2m	4.61	244.20	87.54	23.89
3i	1.36	54.29	0.00	5.02
3m	2.71	685.52	5.45	205.38
4	0.69	211.64	2.40	74.08
5	2.46	106.34	1.98	56.91
6	0.16	73.04	3.98	27.69
3	0.84	31.39	2.82	17.75
8	0.05	8.61	3.20	5.91
9+	**0.00**	16.51	4.94	7.92
Immature	152.32	199.26	67.88	47.61
Mature	11.51	1,377.23	112.32	419.52
Total	172.00	1,576.50	180.49	467.12

TABLE 6.3

Mean weight of autumn spawning herring by ICES Area by age class and maturity for 2 and 3 ring herring.

ICES A	IIIa	IVa	IVb	VIan
0	4.40		1.70	
1	54.85	69.35	17.88	53.68
2I	83.15	102.82	69.82	131.29
2m	105.67	129.22	41.75	141.64
3I	103.19	137.73		165.06
3m	112.30	176.05	106.94	166.25
4	101.00	209.69	122.40	188.12
5	145.69	241.97	143.61	202.70
6	218.00	280.95	138.33	219.01
7	172.13	300.03	145.30	225.13
8	142.00	298.51	142.86	234.72
9+		325.86	154.50	245.25
Immature	80.40	103.30	43.85	116.68
Mature	142.40	245.29	124.46	202.85
Total	112.94	206.56	98.64	179.35

TABLE 6.4

Numbers (millions) of Western Baltic spring spawning herring by ICES Area by age class and maturity for 2 and 3 ring herring.

ICES A	IIIa	IVa	Ivb
0	0.00	0.00	0.00
1	820.08	38.28	3.09
2i	555.01	68.95	19.27
2m	84.53	172.31	14.25
3i	133.46	54.11	0.00
3m	80.10	176.61	5.24
4	76.68	44.62	0.00
5	13.54	9.38	0.00
6	2.19	0.00	0.00
7	0.36	1.09	0.00
8	0.00	0.00	0.00
9+	0.36	0.36	0.00
Immature	1,508.55	161.34	22.36
Mature	257.77	404.37	19.50
Total	1,766.32	565.71	41.85

TABLE 6.5

Biomass (thousands of tonnes) of autumn spawning herring by ICES Area by age class and maturity for 2 and 3 ring herring.

ICES A	IIIa	IVa	Ivb
0	0.00	0.00	0.00
1	44.26	2.66	0.19
2I	40.93	6.37	1.57
2m	7.82	22.85	1.70
3I	13.50	5.56	0.00
3m	8.77	22.83	0.50
4	7.66	5.58	0.00
5	1.38	1.37	0.00
6	0.39	0.00	0.00
7	0.08	0.18	0.00
8	0.00	0.00	0.00
9+	0.07	0.06	0.00
Immature	98.70	14.60	1.76
Mature	26.18	52.87	2.21
Total	124.87	67.46	3.96

TABLE 6.6

Mean weight of autumn spawning herring by ICES Area by age class and maturity for 2 and 3 ring herring.

ICES A	IIIa	IVa	IVb
0			
1	53.97	69.57	61.70
2i	73.75	92.42	81.24
2m	92.57	132.60	119.50
3i	101.18	102.77	
3m	109.49	129.27	95.70
4	99.86	124.95	
5	102.11	145.91	
6	179.86		
7	223.00	165.50	
8			
9+	190.50	173.00	
Immature	76.30	88.25	71.47
Mature	142.48	145.21	107.60
Total	122.63	126.22	89.53

Table 6.7

Combined output from all surveys by population for North Sea autumn spawners, Baltic Spring spawners and West of Scotland herring July 1999. Numbers (millions), Biomass, (Thousands of tonnes) Fraction mature, mean weight at age. Total numbers and biomass mature and immature herring.

North Sea	Numbers	Biomass	Maturity	Weight (g)	Baltic	Numbers	Biomass	Maturity	Weight (g)	West Scot	Numbers	Biomass	Maturity	Weight
0	2,026.6	8.5	0.00	4	0	0.0	0.0	0.00		0	0.0	0.0	0.00	
1	7,059.8	-274.9	0.00	39	1	861.4	47.1	0.00	54.7	1	487	26.1	0.00	54
2	4,947.8	425.3	0.81	86	2	914.3	81.2	0.30	88.9	2	293.9	40.3	0.57	137
3	4,376.4	749.3	0.91	171	3	449.5	51.2	0.58	113.8	3	1,265.8	210.4	0.98	166
4	1,035.6	214.7	1 .00	207	4	121.3	13.2	1 .00	109.1	4	393.8	74.1	1 .00	188
5	470.1	110.8	1 .00	236	5	22.9	2.8	1.00	120.0	5	280.7	56.9	1.00	203
6	289.5	77.2	1 .00	267	6	2.2	0.4	1 .00	179.9	6	126.4	27.7	1.00	219
7	128.9	35.0	1.00	272	7	1.5	0.3	1.00	179.9	7	78.9	17.8	1.00	225
8	51.6	11.9	1.00	230	8	0.0	0.0	1.00	#DIV/0!	8	25.2	5.9	1 .00	235
9+	82.7	21.5	1.00	260	9+	0.7	0.1	1.00	181.7	9+	32.3	7.9	1 .00	245
Immature	10,411 3	419.5			Immature	1,692.2	115.0			Immature	642.7	47.6		
Mature	10,057.8	1,501.1			Mature	681.6	81.2			Mature	2,341.3	419.5		
Total	20,469.0	1,929.0			Total	2,373.9	196.3			Total	2,983.9	467.1		

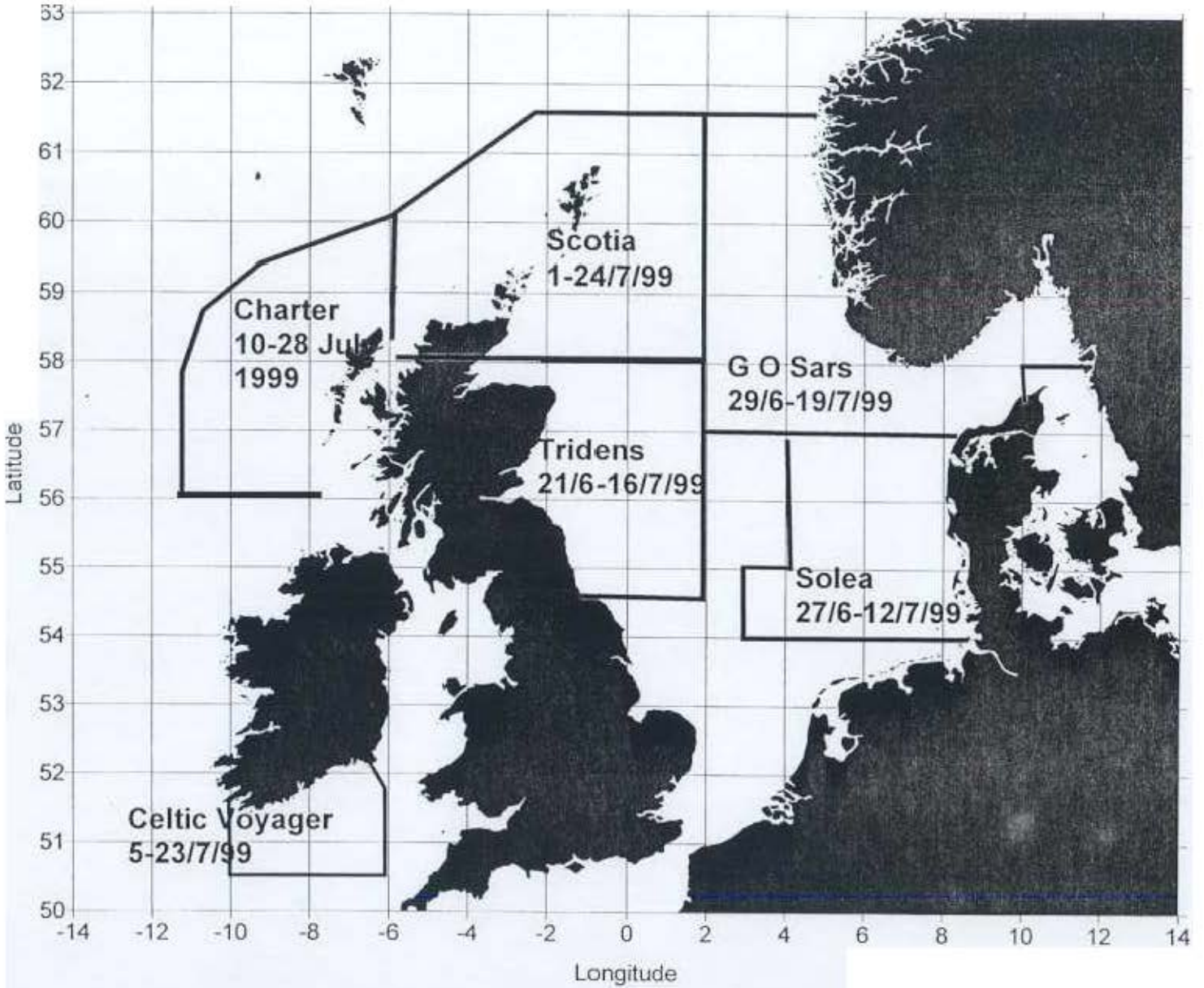


Figure 1.1 layout and dates of survey areas for all participating vessels 1999

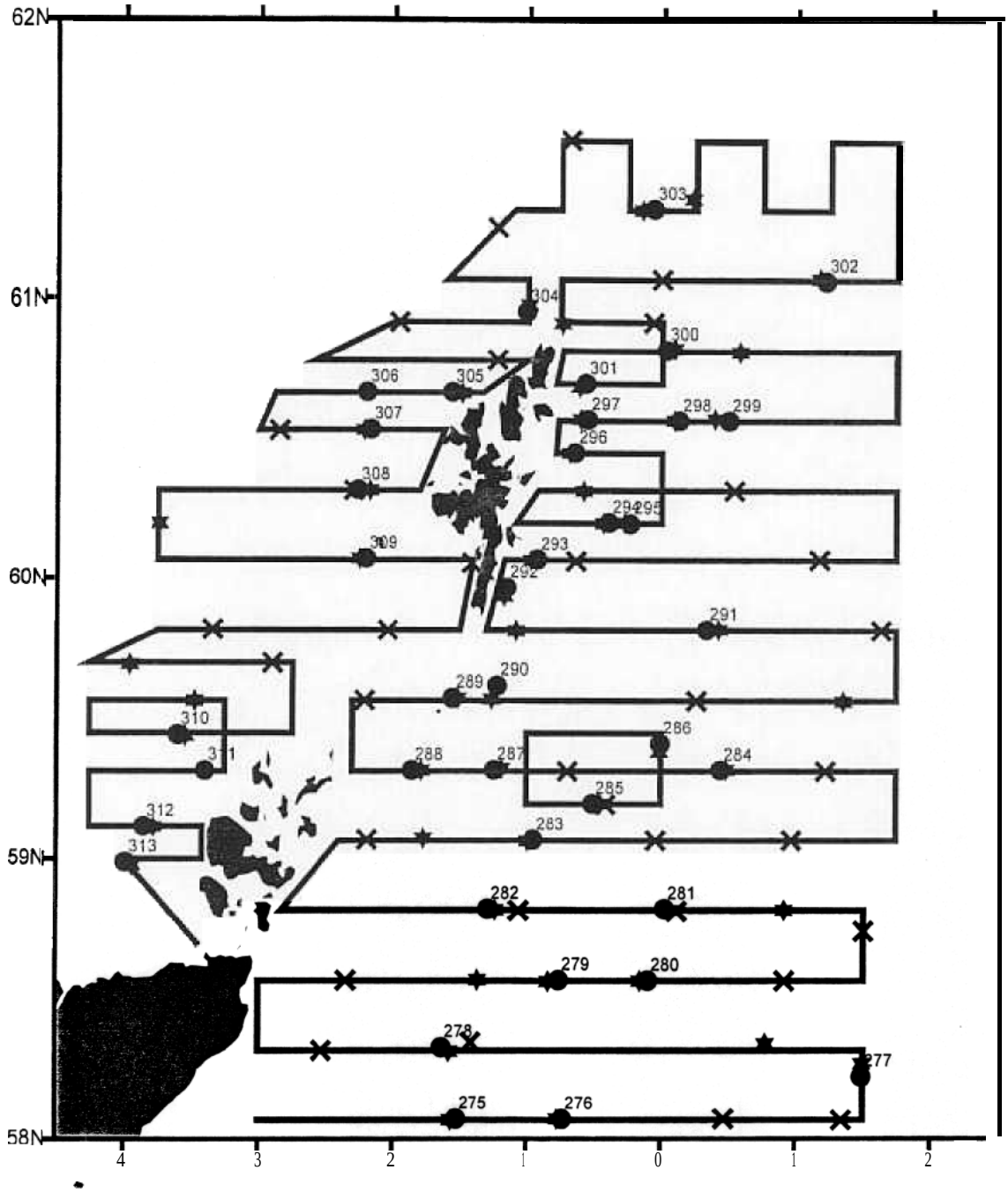


Figure 1.2 Cruise track, trawl stations ( ), CTD stations ( ), XBT Stations ( )
FRV Scotia 1-24 July 1999

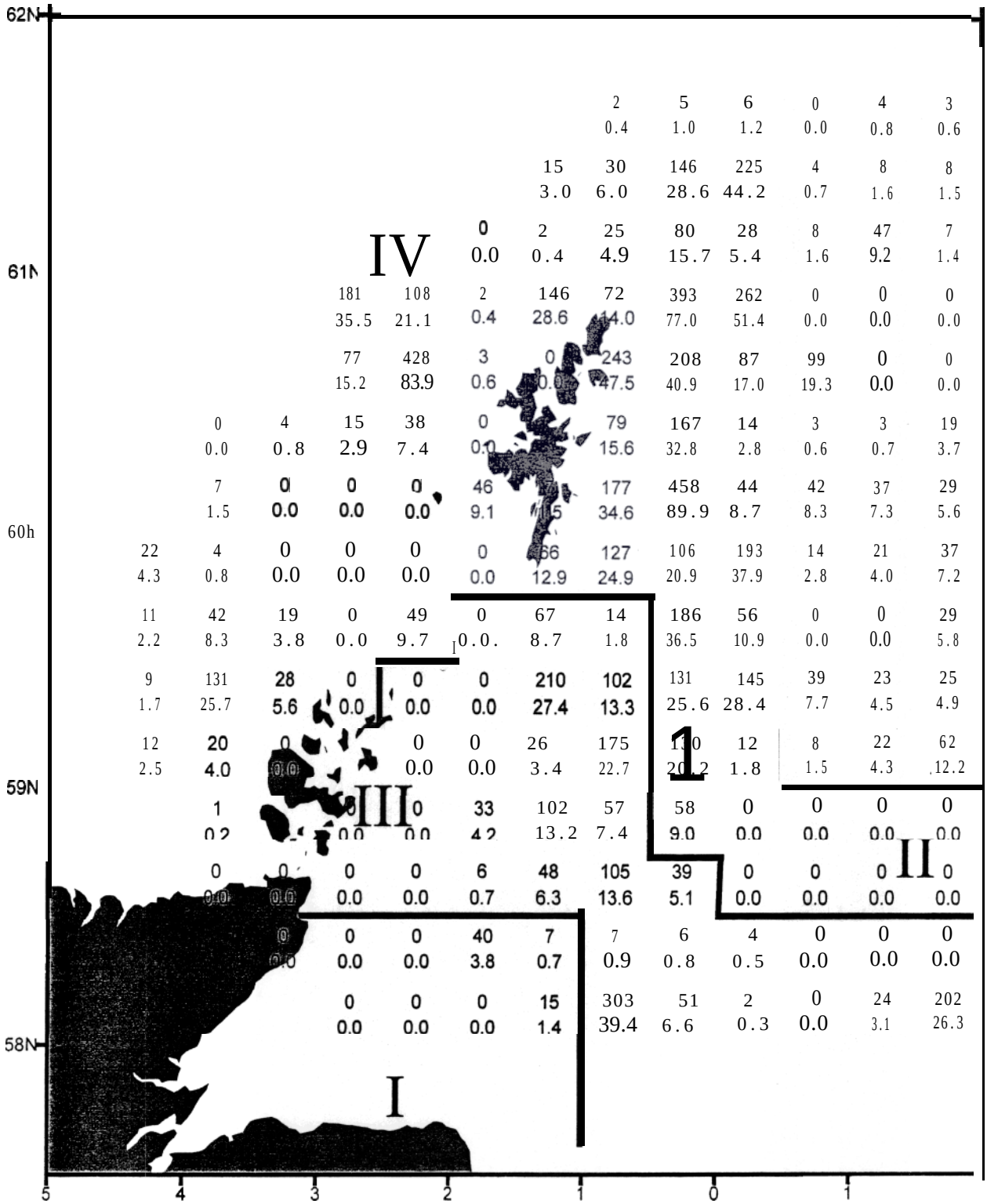


Figure 1.3 Numbers (millions and Biomass (thousands of tonnes and analysis area FRV Scotia l-24 July 1999

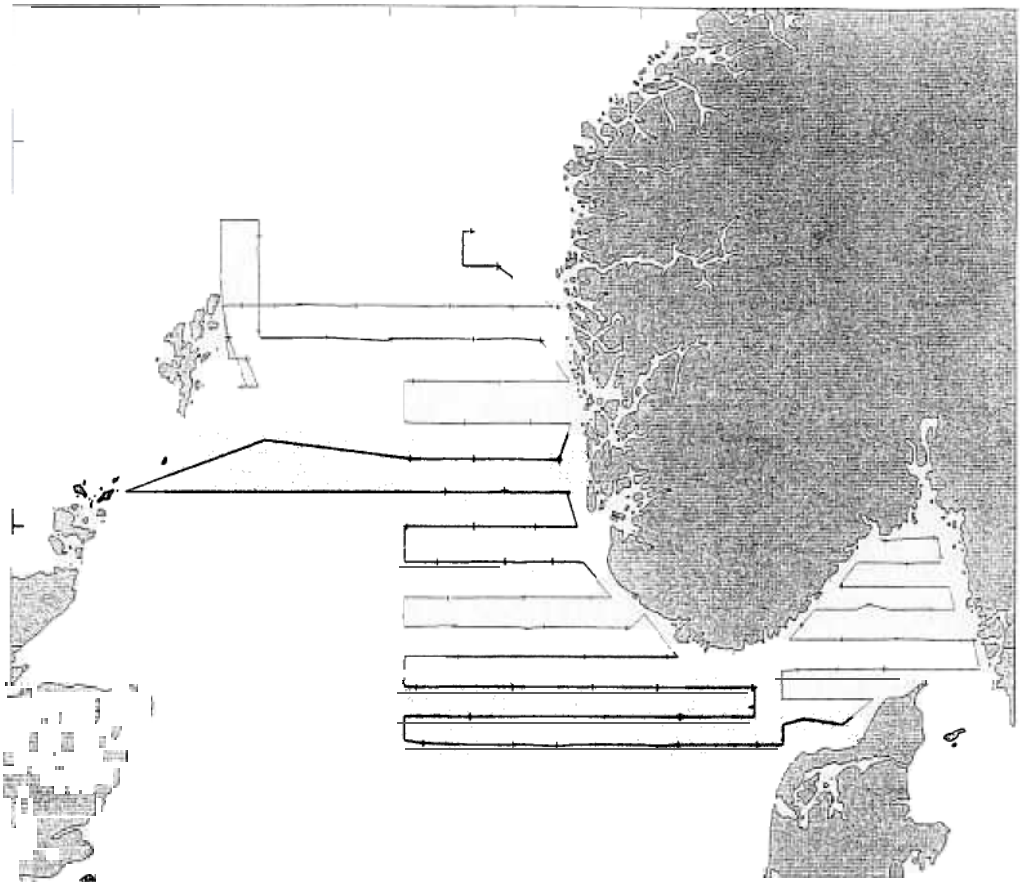


Figure **2.1a .Course** lines with trawl stations, RN G. 0. Sars, 29 June - 18 July 1999

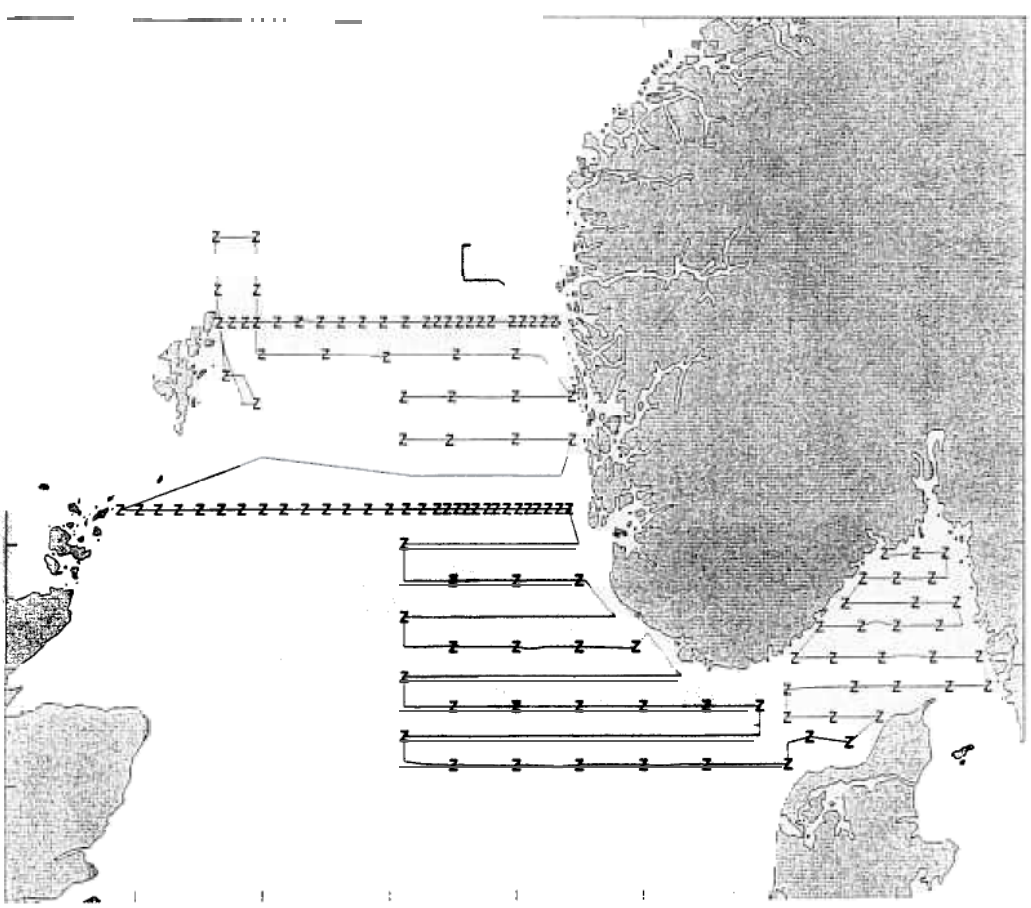


Figure **2.1b .Course lines** with CTD (Z) stations, R/V G. 0. Sars, 29 June - 18 July 1999

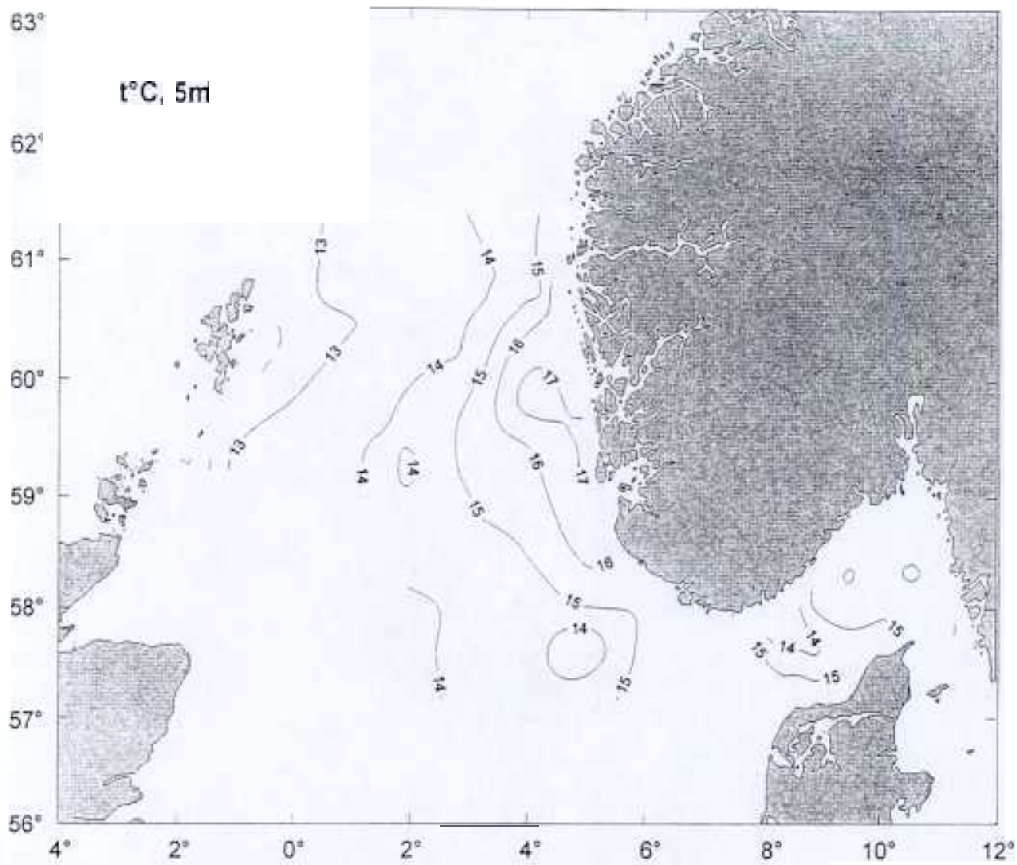


Figure 2.2a .Distribution of temperature in 5m, R/V G. O. Sars, 29 June - 18 July 1999

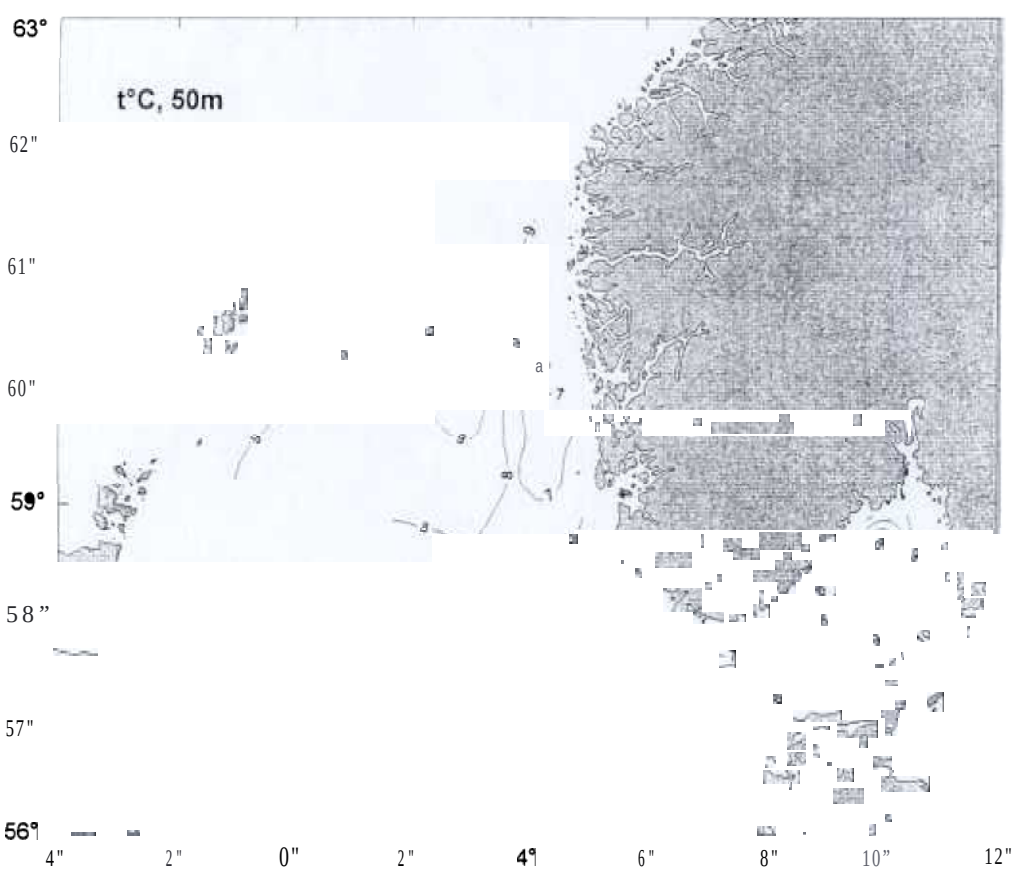


Figure 2.2b .Distribution of temperature in 50m, R/V G. 0. Sars, 29 June - 18 July 1999

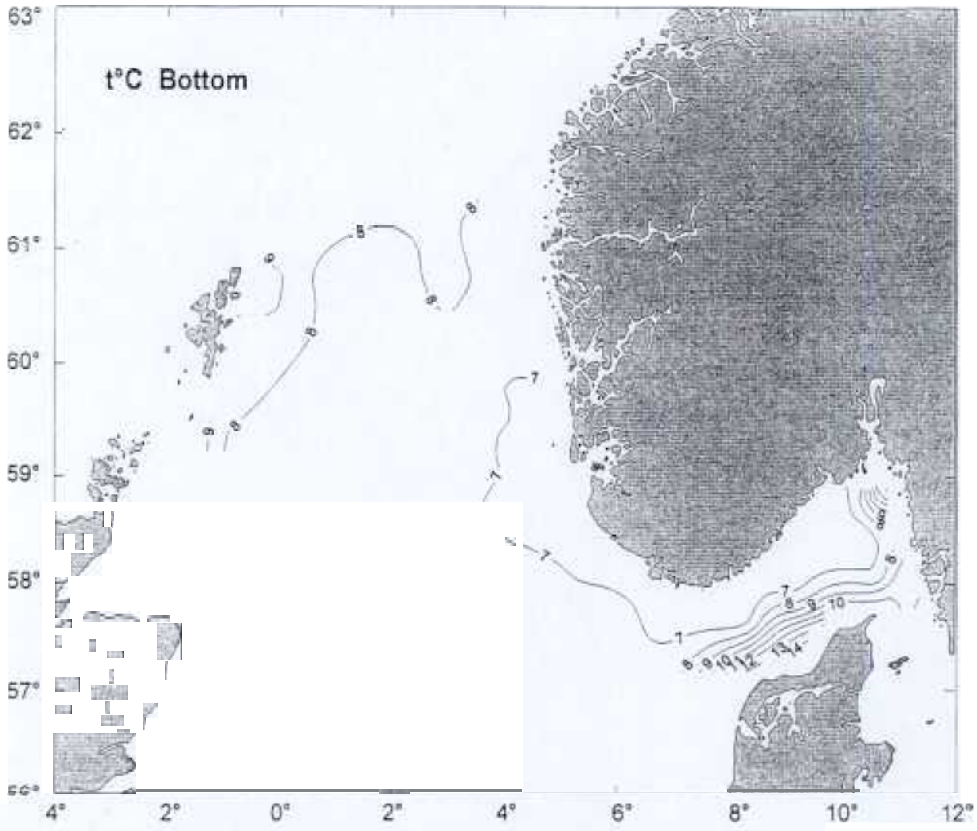


Figure 2.2c .Distribution of temperature at bottom, R/V G. O. Sars, 29 June - 18 July 1999

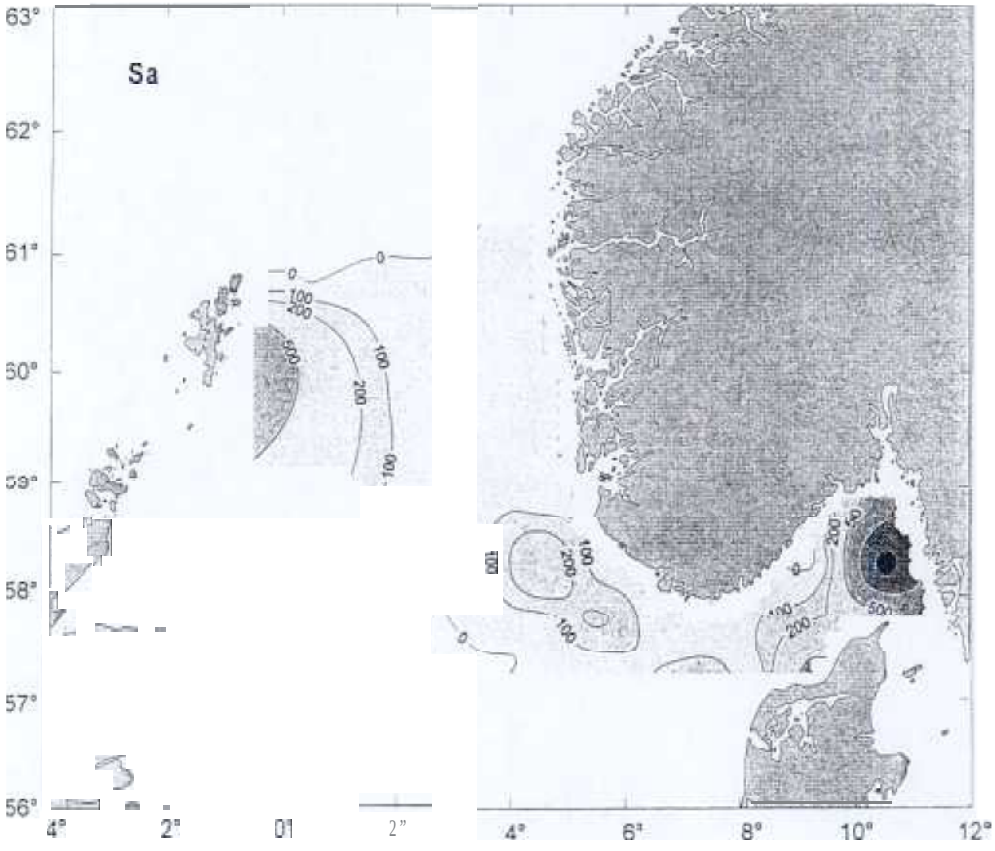
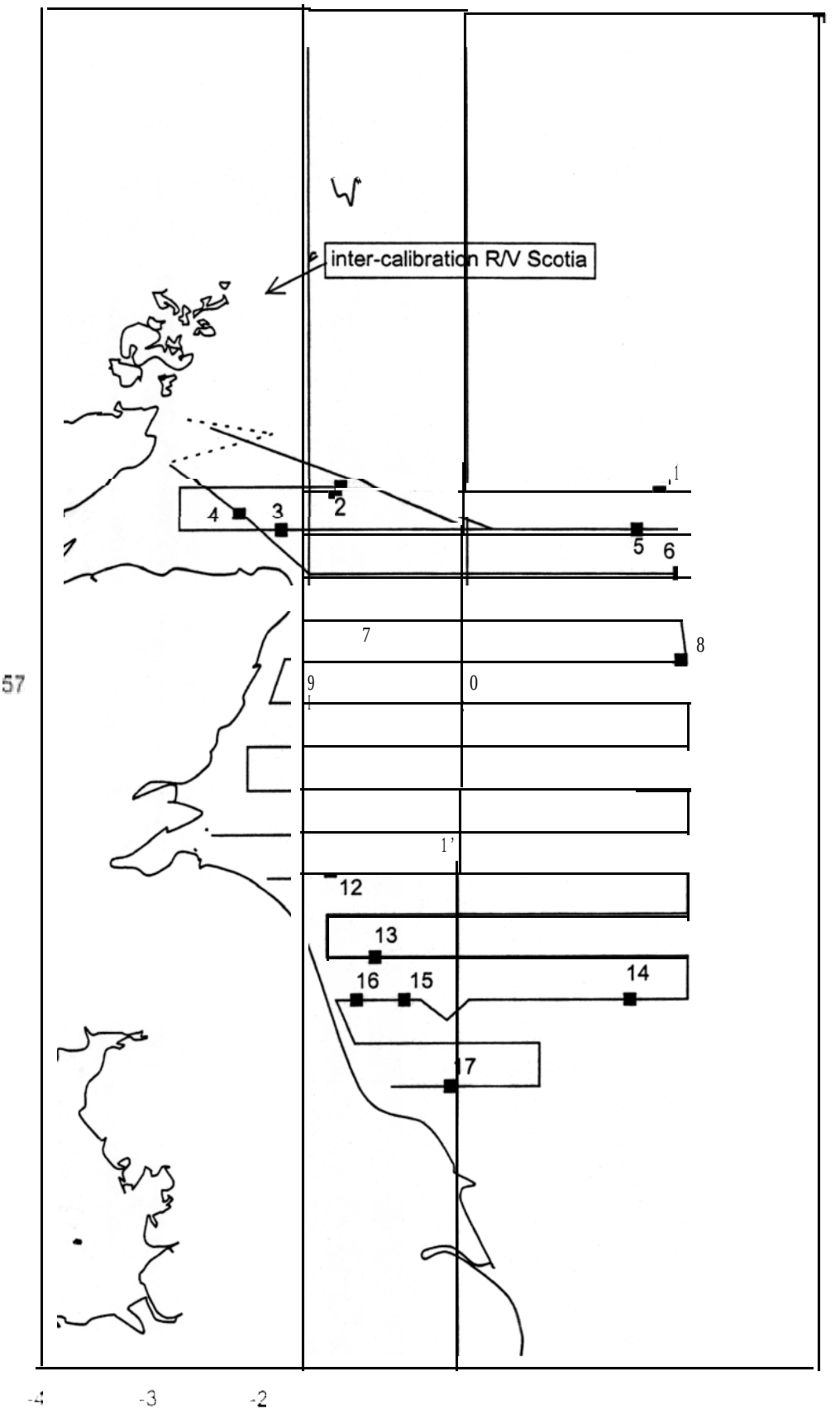


Figure 2.3 .The horizontal distribution of herring, R/V G. 0. **Sars,** 29 June • 18 July 1999



Cruise track and trawl stations. Tridens June July 1999

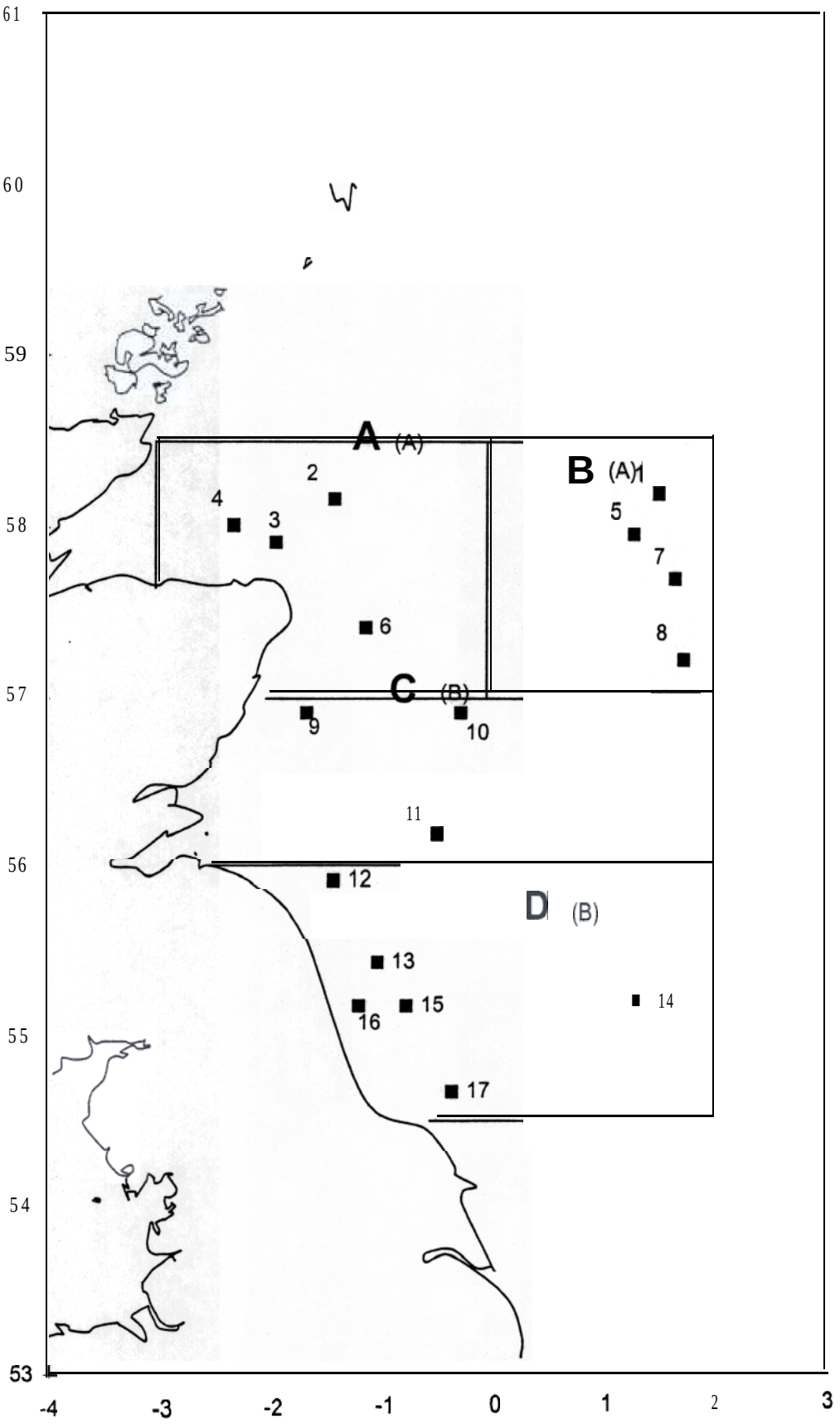


Figure 3.2. Sampling areas for the combination of length and age maturity samples of herring (sprat). Tridens: 29 June - 15 July 1999.

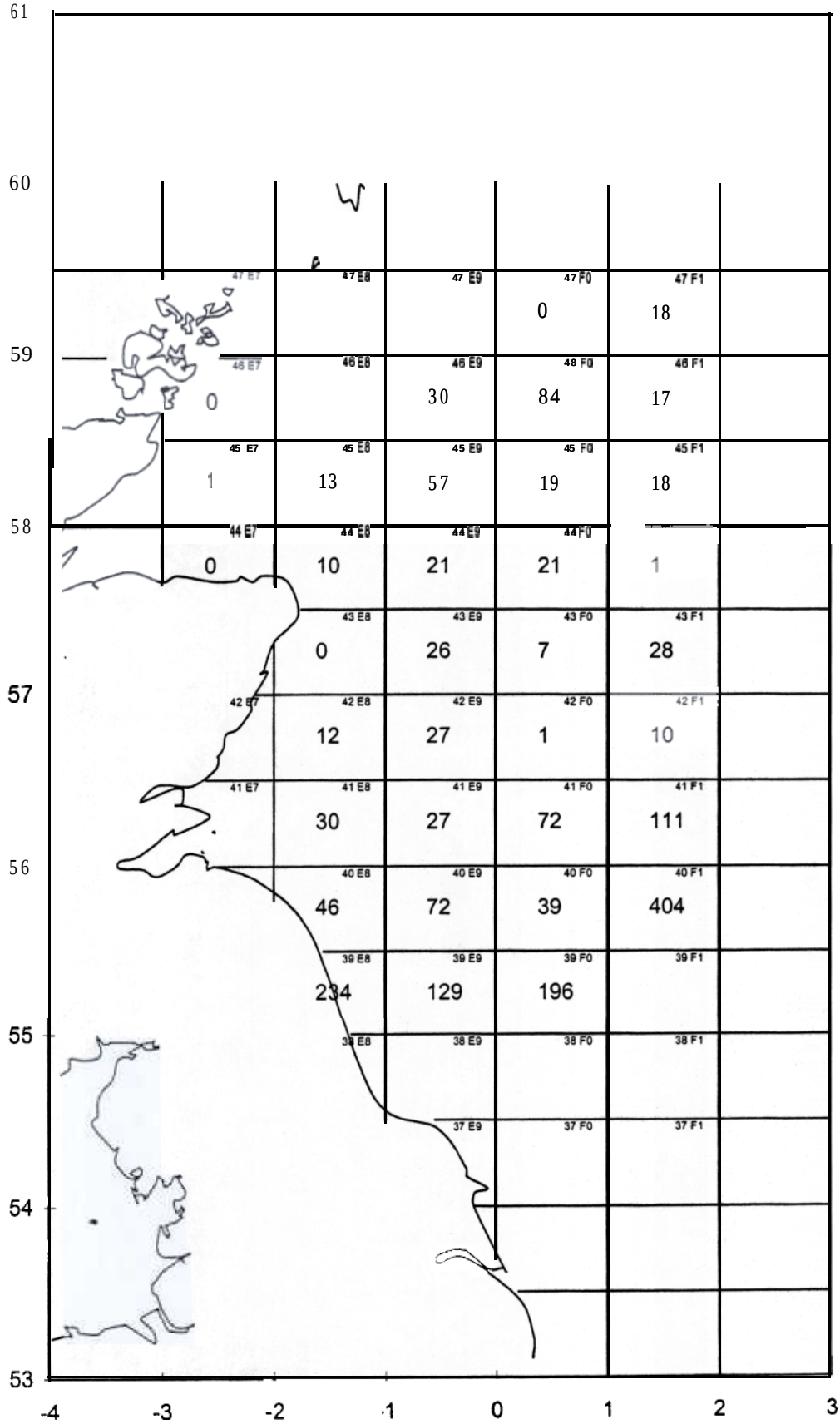
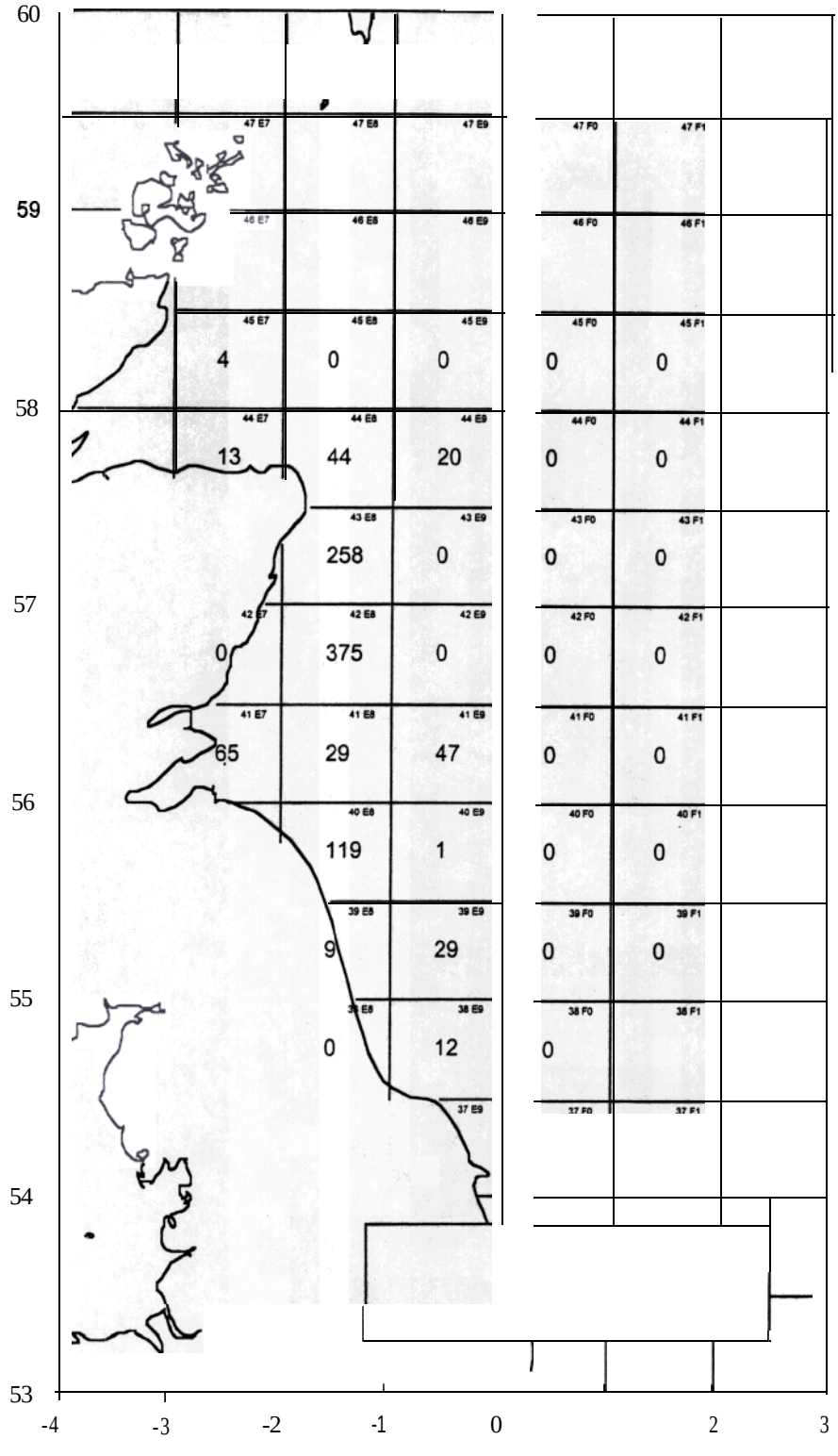


Figure 3.3. Numbers of herring (millions) per square ▪ all ages. Tridens:
29 June ▪ 15 Julv 1999.

Figure 3.4. Numbers of **sprat(millions)** per square - all ages Tridens: 29 June - 15 July 1999.



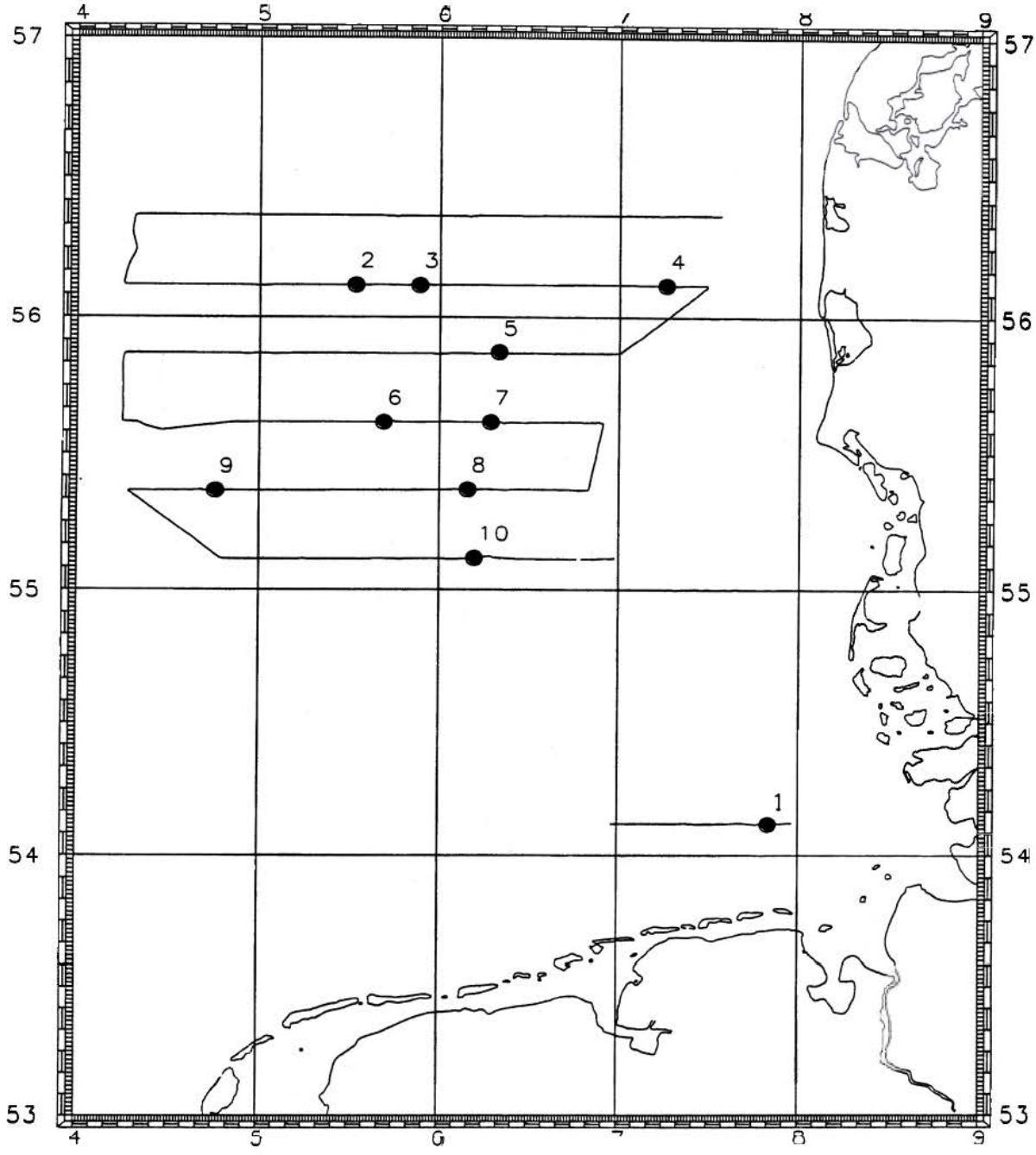


Figure 4.1 Cruise Track and Trawl positions FRV **Solea 28/6-15/7** 1999

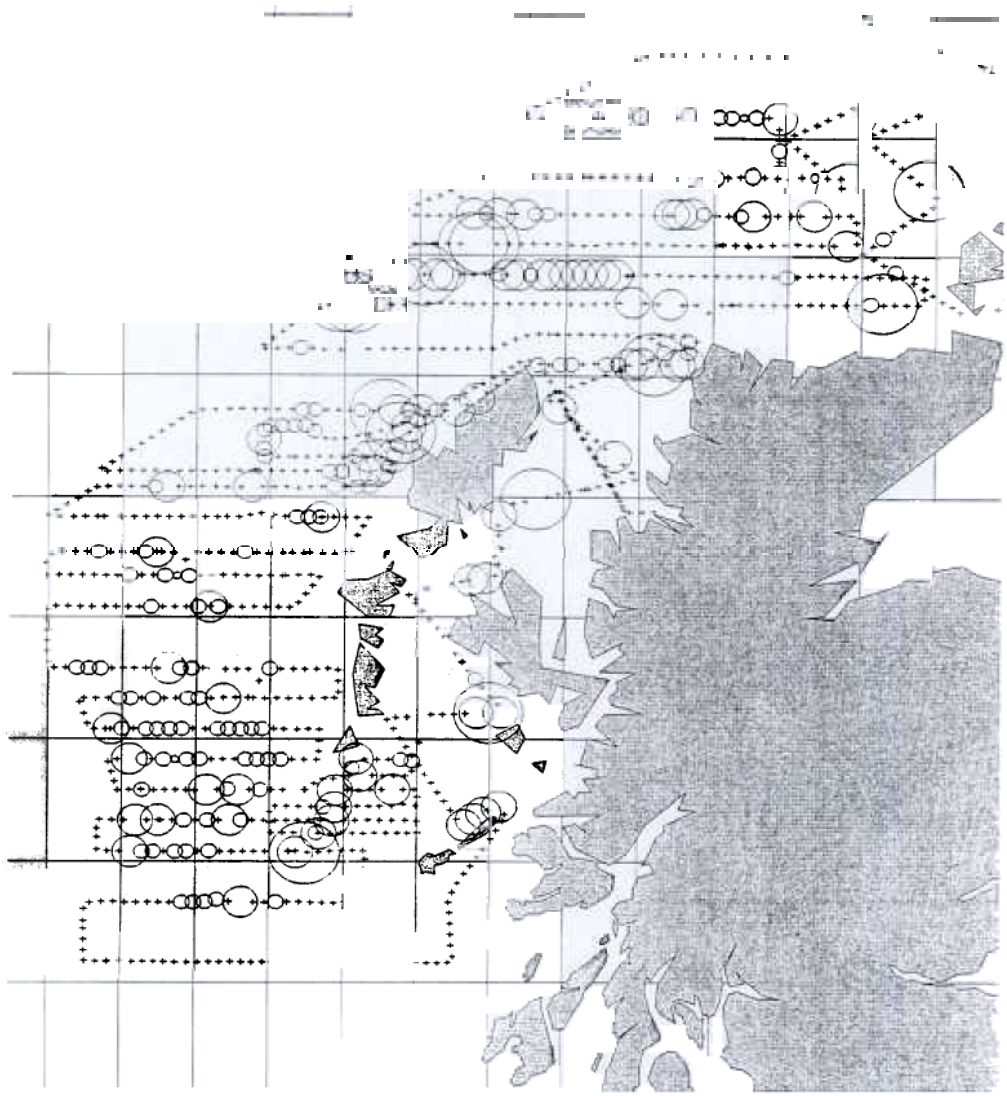


Figure 5.1. Map of the survey area showing the cruise track for Christina S (13 July to 30 July 1999). Circles are proportional to herring integral on a log scale. Crosses represent EDSU where no herring were observed.

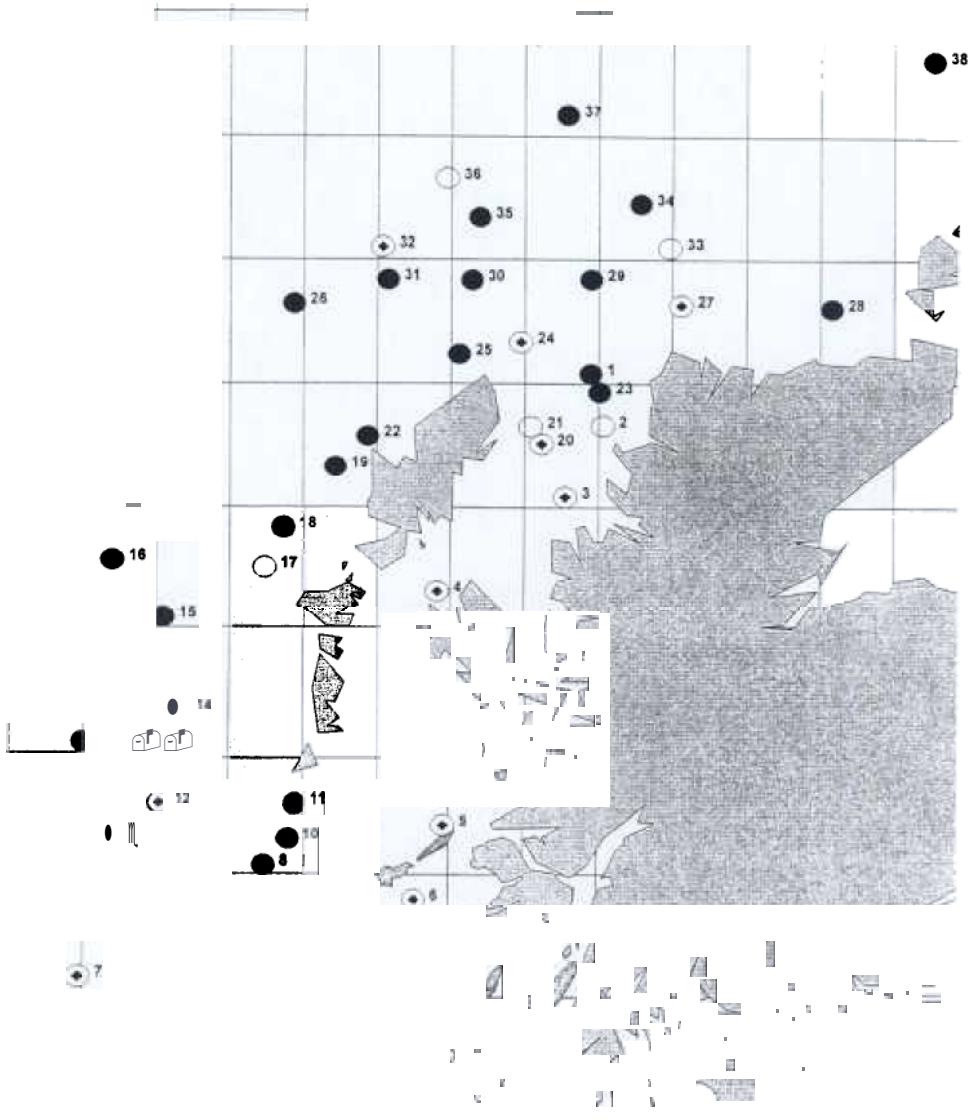


Figure 5.2. Map of the survey area showing the haul locations for Christina S (13 July to 30 July 1999). Closed circles represent hauls with more than 50 herring, marked open circles represent hauls with less than 50 herring, and plain open circles represent hauls with no herring.

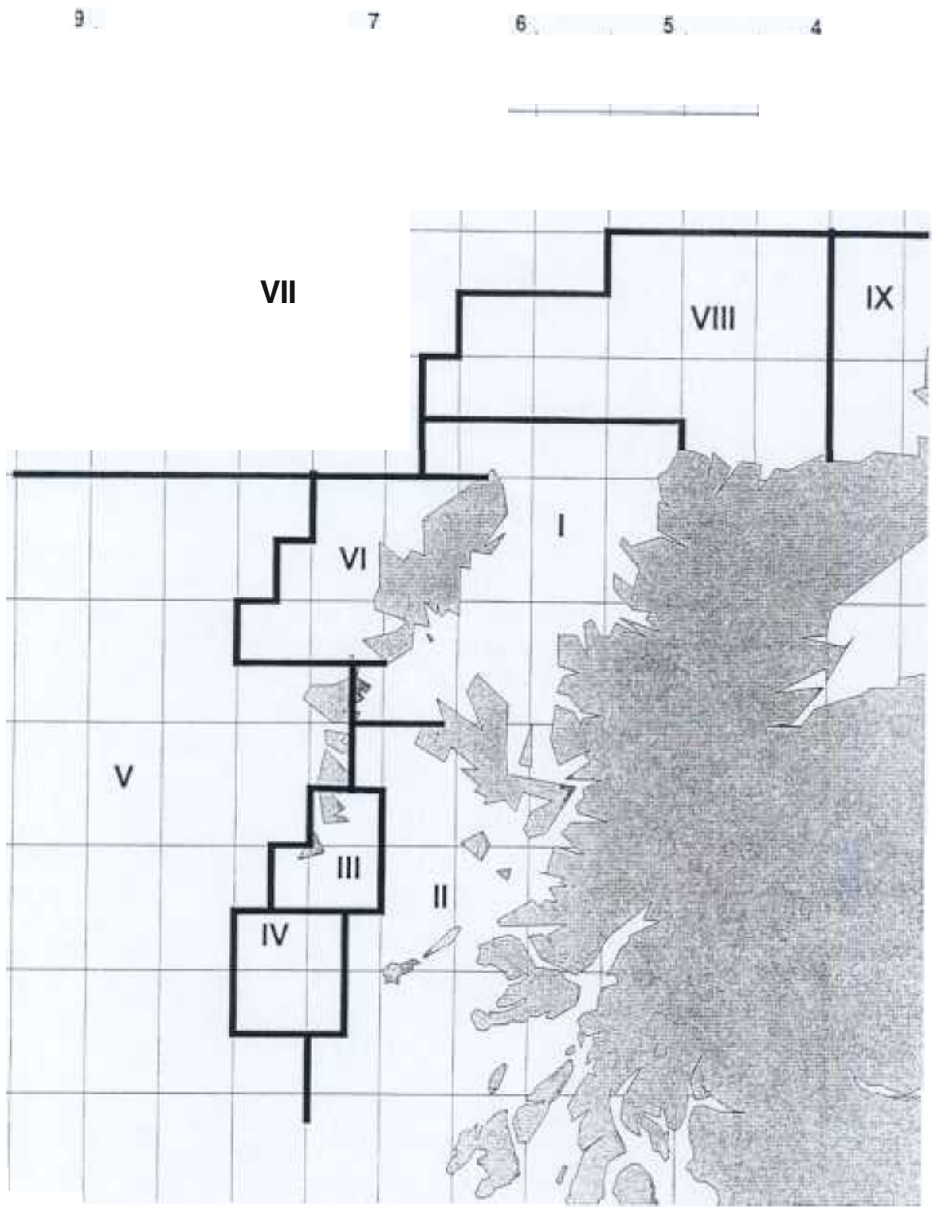


Figure 5..3. Map of the survey area showing herring strata subdivisions based on analysis of length frequency patterns from trawl hauls.

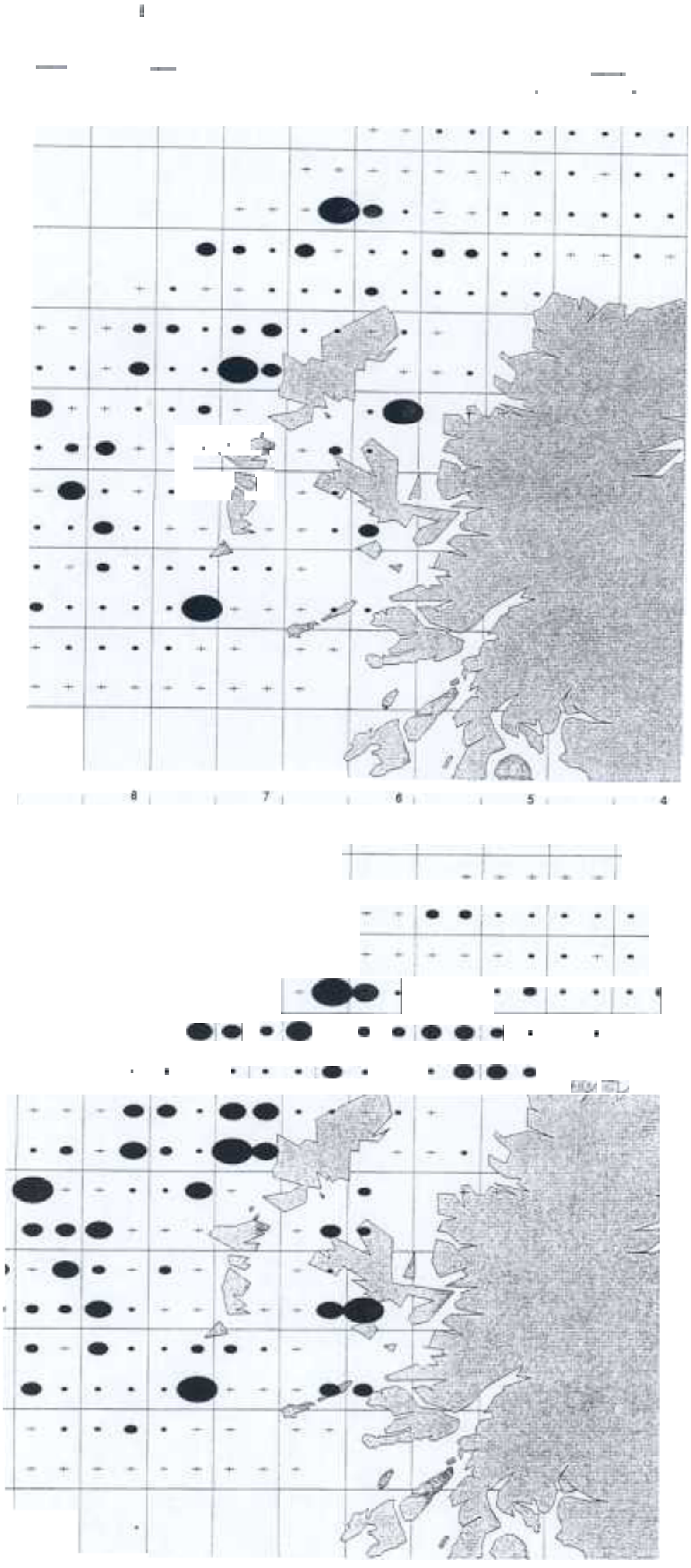


Figure 5.4. Distribution of herring by biomass (left) and numbers (right) from Christina S survey (13 July to 30 July 1999). Circles are proportional to abundance.

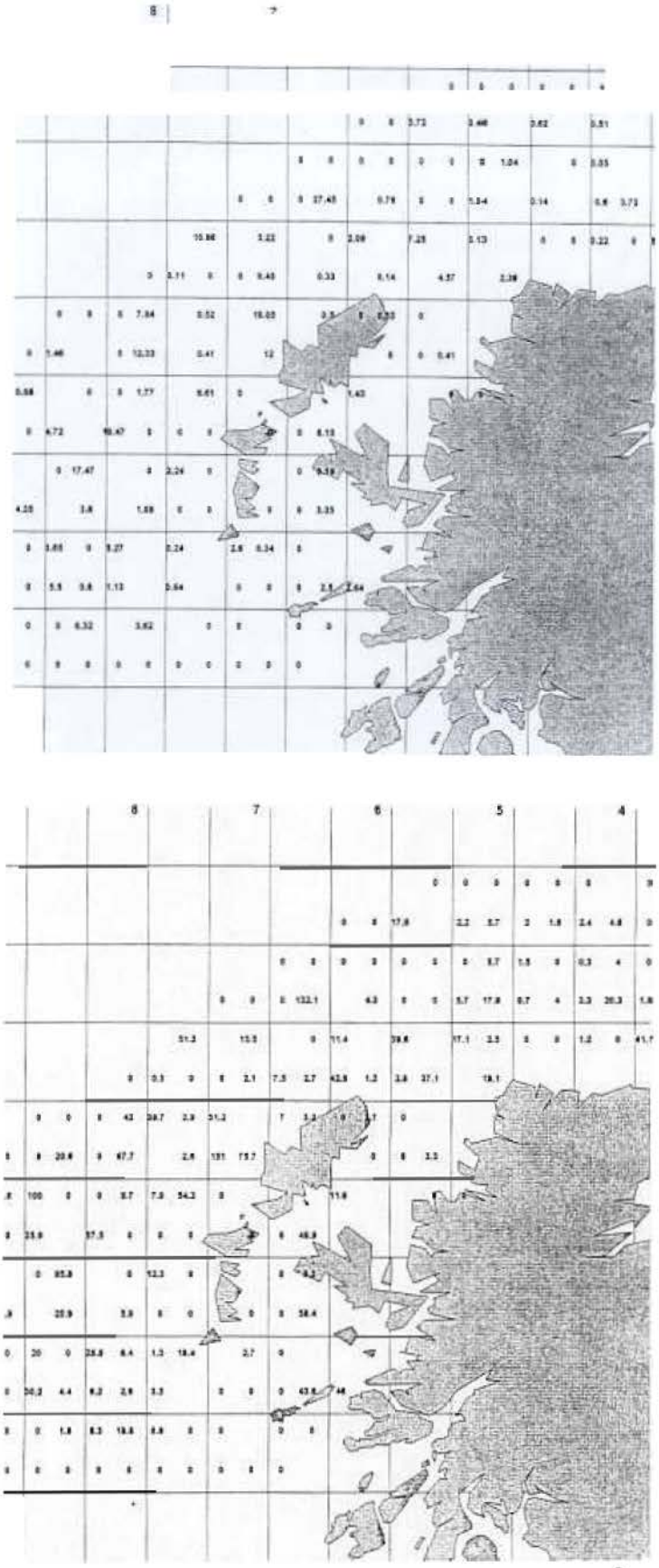


Figure 5.5. Distribution of herring by biomass (left) and numbers (right) from Christina S survey (13 July to 30 July 1999). Biomass is in thousands of tonnes and numbers in millions of herring.

Figure 12 Numbers (millions) and biomass (thousands of tonnes) Autumn spawning herring combined survey July 1999

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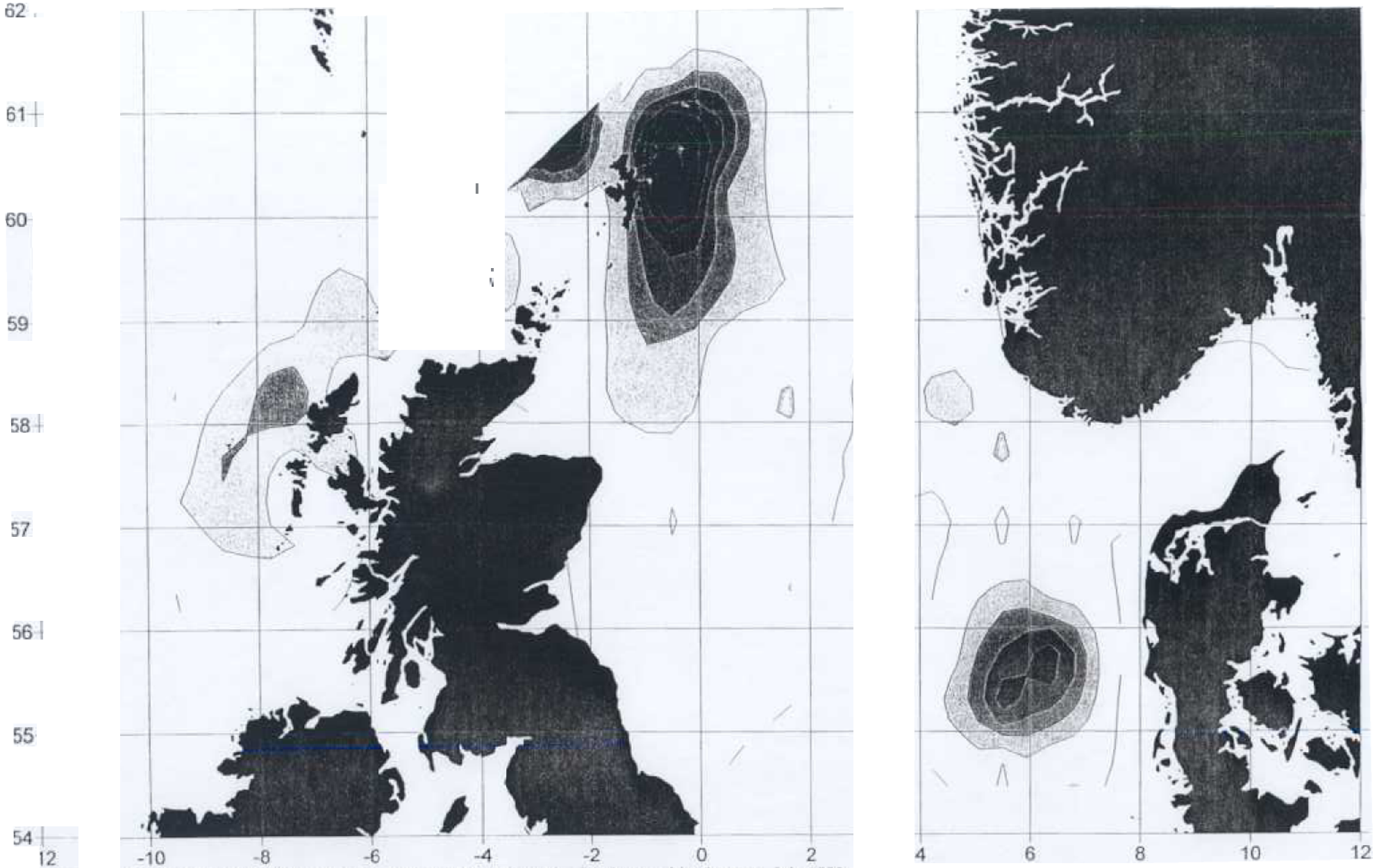
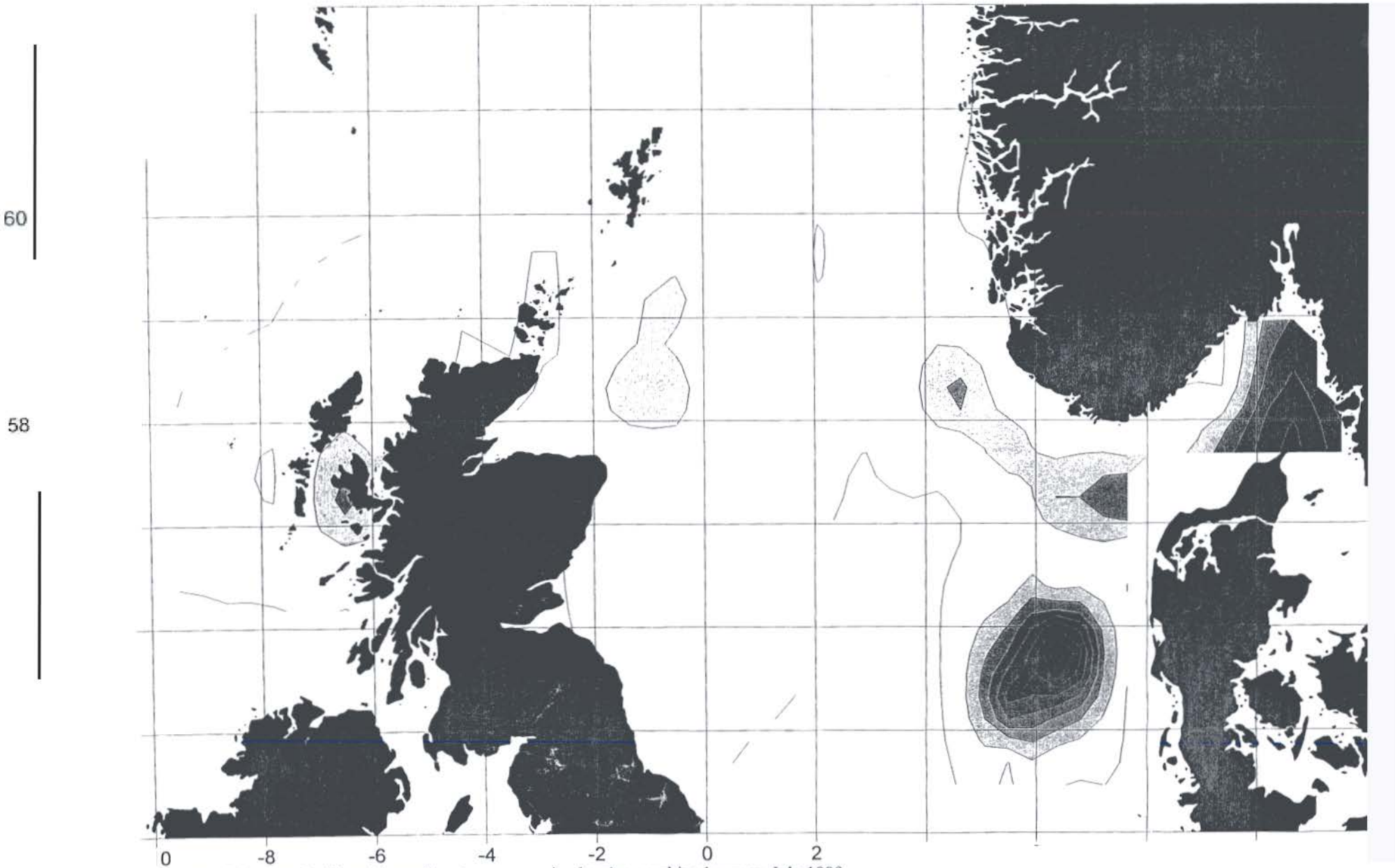
bu ion bers lions and Biomass W Ba spa ombinec July


60
59
58
56
54
-6
-4
umbers millions
Western Bal
spring spawning herring combined
Jul



Figur Distribution of Numbers (millions) Mature autumn spawning herring combined survey July 1999



ibution of Numbers (millions) juvenile autumn spawning herring combined survey July 1999