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PRELIMINARY RESULTS OF THE NORWEGIAN ACOUSTIC SURVEY OF BLUE

WHITING (March-April 1974)

by

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INTRODUCTION

In order to compare methods and techniques of acoustic abundance estimation of fish, it was agreed by the institutes of Aberdeen, Lowestoft and Bergen to undertake a joint survey of the blue whiting stock at their spawning grounds west of the British Isles. The survey was carried out in March-April 1974 by "Cirolana" of Lowestoft, "Scotia" of Aberdeen and "G.O. Sars" of Bergen. This paper is a preliminary report presenting the results from "G.O. Sars"'s survey. Only the acoustic observations are dealt with here, but a more comprehensive report is in preparation to Fiskets Gang where the biology of the blue whiting is also discussed.

METHOD

The recordings onboard "G.O. Sars" were made with a SIMRAD EK sounder working on 38 kHz with a 45 cm x 48 cm stabilized transducer. In conjunction worked 6 integrator channels in different layers between surface and 600 metres depth. A time varied gain function compensated for one way spreading loss and two way attenuation down to 500 metres. Integrator deflection in mm will then be proportional to fish density expressed as number per unit surface (square nautical miles).

$$f = CM$$

f is fish density, M is integrator deflection in mm per mile and C is a constant dependent on fish species and size.

During the blue whiting survey the recordings of this fish was easily identified on the recording paper and there was no difficulties in separating the blue whiting recordings from traces caused by other species. Integrator values from blue whiting were then entered in a map along the cruise track.

RESULTS

The area covered by the survey and the integrated echointensities are shown in Figures 1 and 2. The cruise track is indicated. The areas where parallel runs were made together with R/V "Cirolana" and R/V "Scotia" for calibration purpose are inserted in Fig. 2.

Due to lack of time, only a part of the area surveyed on the first crossing was covered on the northward (2nd) crossing (only 34 900 sq.n.m. of a total of 65 500 sq.n.m.).

During the first part of the cruise (15-29 March) the fish was found scattered throughout the area but beginning to concentrate south of Rose Mary Bank and on Porcupine Bank. On the second part (31 March - 8 April) heavy concentrations were found on the Porcupine Bank area.

In order to obtain absolute values of abundance, the constant C must be found. This is possible in areas of low concentration where single fish traces can be distinguished and counted on the recording paper (Midttun and Nakken, 1971, Forbes and Nakken, 1972). The value found was 438 fishes per sq.n.m. This value is based on rather few observations and seem to be somewhat lower than expected (Fig. 3, Table 1.). Using the calculated value of C and the echo intensity values recorded throughout the area an estimation of the absolute abundance was obtained. The method is the same as described by Midttun and Nakken 1973.

In the first crossing the total abundance was found to be 1.8 million tons, with a mean density of 27 T/sq.n.m.

In the second crossing the total abundance was again estimated to be 1.8 million tons (Table 2) but the mean density was much higher (52.8 Ton/sq.n.m.).

The fish was still coming into the spawning area by the time of the second crossing. This is also supported by biological evidences (sexual ratio, maturing), an analysis of which will be made on a separate paper. It is assumed thus, that the density calculated on the second part is more representative of the spawning concentration. Using this value, a rough figure of 3.5 million tons is obtained for the whole area surveyed on the first crossing. This figure is rather low compared with previous years. An apparent delay on the spawning season may have caused the cruise to miss the peak of the spawning concentration, and further adjustments based on biological considerations are likely to increase this first estimation.

SUMMARY

A short report is given on the results of an acoustic survey made on Blue Whiting with the R/V "G.O. Sars" from 15 March to 8 July 1974.

The acoustic technique for absolute abundance estimations was applied using echo integrators and sounders for direct fish counting.

A rough figure of 3.5 million tons was calculated for the spawning stock.

The value of constant C calculated was found lower than expected. An apparent delay in the spawning season may be the cause of the low figure estimated for the stock this year. A further report considering biological parameters is likely to increase this first estimation. Calibration runs were conducted together with R/V "Cirolana" from Lowestoft and R/V "Scotia" from Aberdeen for future comparison of echo survey results.

REFERENCES

- 1) Midttun, L. and O. Nakken 1971. On acoustic identification sizing and abundance estimation of fish. Fisk.Dir. Skr. Ser. HavUnders., 16:36-48.
- 2) Forbes and Nakken (ed.) 1972. Manual of methods for fisheries resource survey and appraisal. Part 2. FAO Manual in Fisheries Science No. 5. 1972.
- 3) Midttun, L. and O. Nakken 1973. Some results of abundance estimation studies with echo integrators. Symposium on Acoustic Method in Fisheries Research No. 38.

Table 1. Echo integrator deflection M (m.m. per nautical mile) and corresponding densities of fish ρ_A (number of fish per square mile) obtained by counting of fish traces, N, on the recording paper. N_1 to N_4 are obtained by four different persons counting the same fish traces. The results of a least mean square regression, $\rho = mM+b$, are shown at the bottom of the table.

M	N_1	ρ_{A_1}	N_2	ρ_{A_2}	N_3	ρ_{A_3}	N_4	ρ_{A_4}
14	73	5 733	67	5 262	70	5 498	77	6 047
15	89	6 990	75	5 890	80	6 283	82	6 440
13	85	6 675	65	5 105	69	5 419	63	4 948
10	54	4 241	47	3 691	56	4 398	52	4 084

$r = 0.87$

$m = 438$

$b = -269$

Table 2. (Blue whiting cruise 1974)
Echo abundance estimations

Latitude	I Part		II Part	
	Area (nm ²)	$\bar{M} \times A$ ($\times 10^3$)	Area (nm ²)	$\bar{M} \times A$ ($\times 10^3$)
52°-53°	6 894.0	4 798.3	6 875.1	5 070.0
53°-54°	5 096.8	2 823.5	5 557.9	3 927.3
54°-55°	6 778.4	4 054.0	7 189.2	10 026.2
55°-56°	3 367.2	806.4	4 548.0	4 348.3
56°-57°	5 022.8	1 308.3	3 261.2	1 303.2
57°-58°	8 314.2	3 600.0	3 414.6	2 319.2
58°-59°	8 352.7	3 332.7	4 101.0	3 509.0
59°-60°	7 204.4	3 798.8		
60°-61°	7 370.2	3 661.7		
61°-62.5°	9 103.2	2 560.3		
	67 503.9	30 744.0	34 947.0	30 503.2

= 1.8 mill. tons

= 1.8 mill. tons

C = 438 fish/nm/nm²

\bar{W} = 138 grs.

Table 3. (Blue whiting cruise, 1974). Echointegrator deflexion M and abundance estimation on the calibration areas.

a) Calibration with R/V "CIROLANA".

Lat 57°-58°N (scale: 1 mm² = 0.01 nm²)

M	mm ²	=	nm ²	\bar{M}	M x nm ²
0-100	866		8,7	50	435
100-200	2 772		27.7	150	4 155
200-500	22 980		229.8	350	80 430
500-1000	39 418		394.2	750	295 650
1000-2000	12 492		124.9	1 500	187 350
> 2000	5 472		54.7	2 440	133 468
			840.0		701 488

Total abundance = 41.172 tons

b) Calibration with R/V "SCOTIA".

Lat 58°40'-58°50' (scale = 1 mm² = 0.01 nm²)

M	mm ²	=	nm ²	\bar{M}	M x nm ²
0-100	-				
100-200	3 701		37	150	5 550
200 -500	5 396		54	350	18 900
500-1000	6 296		63	750	47 250
1000-2000	4 207		42	1 500	63 000
			196		134 700

Total abundance = 8.142 tons

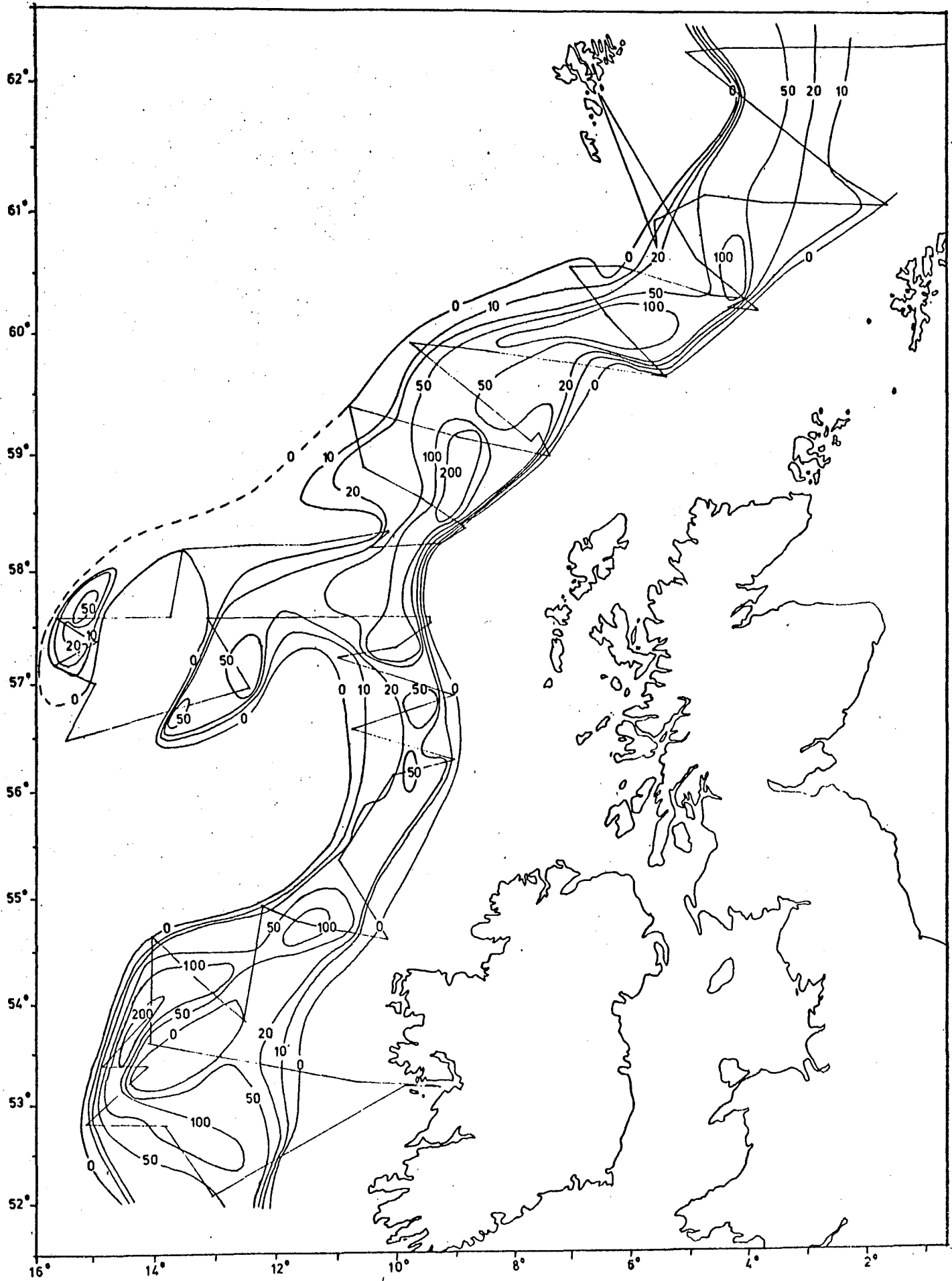


Fig. 1. Cruise track and Blue whiting distribution on the period 15.-29. March. Isolines of echo intensity in cm of integrator deflexion.

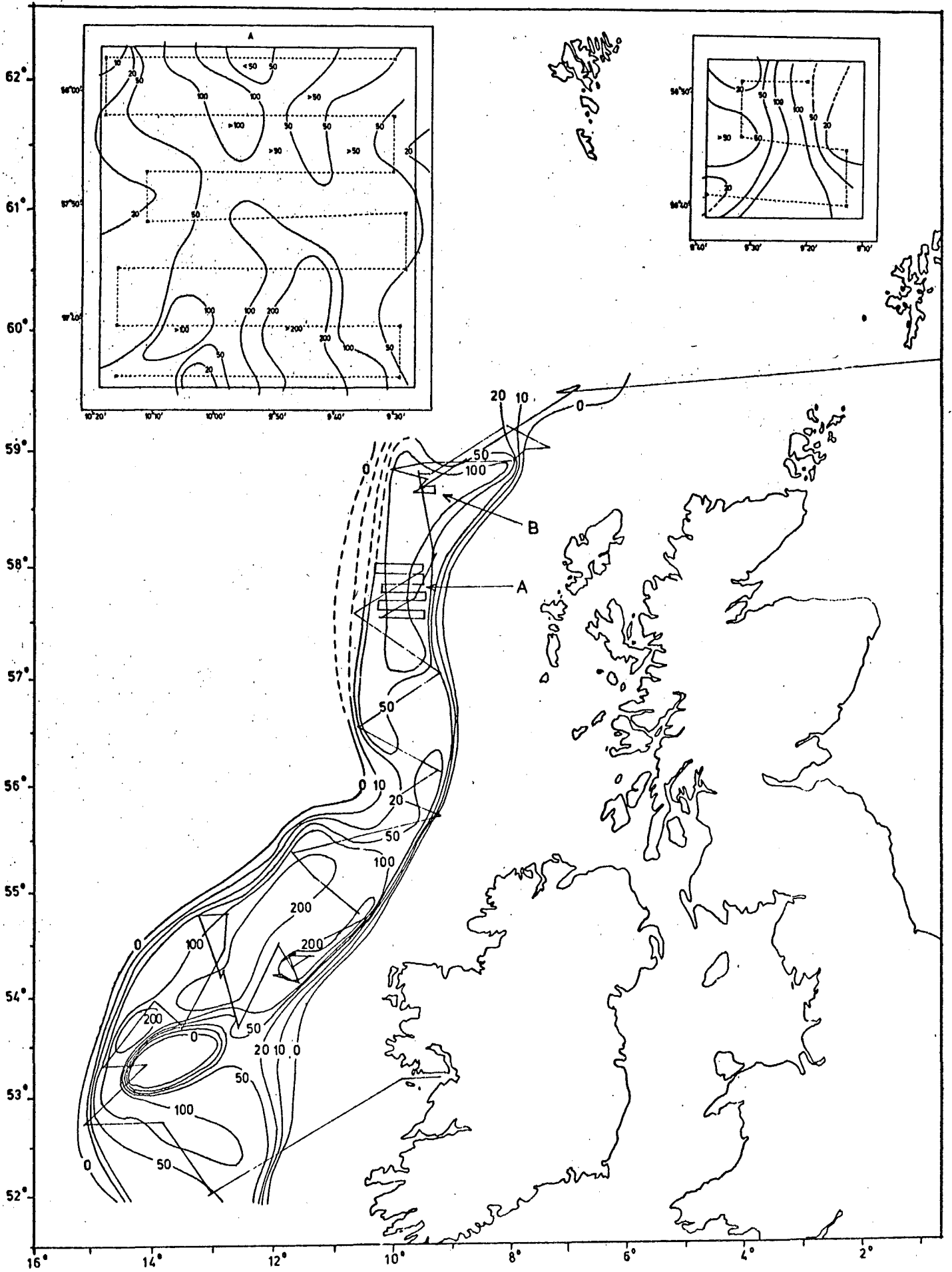


Fig 2. Cruisetrack and Blue whiting distribution during the period 31. March - 8. April. Isolines of echo intensity in cm of integrator deflexion. Inserted, calibration runs with R/V "CIROLANA", A, and R/V "Scotia", B.

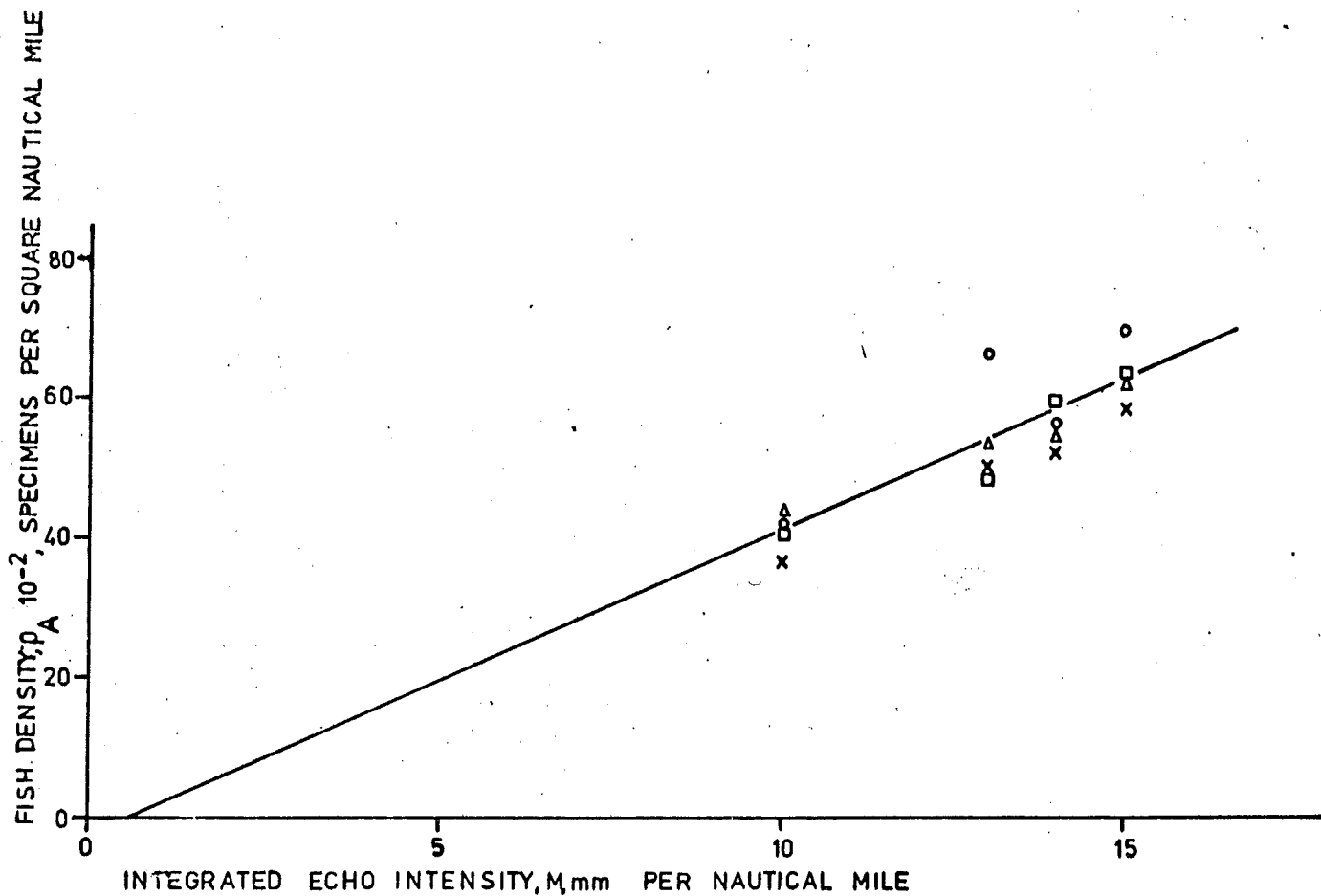


Fig 3. Corresponding values of integrated echo intensity M_1 and fish density, p_A , (Calculated from counts on the recording paper) for blue whiting. (1 - 4) estimates from four different people counting the same recordings.