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ACOUSTIC ESTIMATES OF ABUNDANCE OF O-GROUP GADOIDS IN THE
NORTHERN NORTH SEA IN JULY 1985

by

J. Lahn-Johannessen
Institute of Marine Research, Bergen, Norway

ABSTRACT

This paper presents the results from a joint survey with two research vessels in July 1985. Total estimates of abundance ($N \times 10^{-9}$), were: Norway pout 56, haddock 52, whiting 66 and cod 4. Comparisons are made with a similar survey in July 1984 and with some recruitment estimates from other surveys.

INTRODUCTION

During the period 15-28 July 1985 a joint acoustic survey covering most of the northern North Sea was carried out by R/V "Eldjarn" and R/V "G.O. Sars" (Fig.1). The main objectives were to chart the distribution and obtain abundance estimates of herring and O-group gadoids. Besides, efforts were made to collect data on saithe and other demersal species.

This paper deals with the results concerning O-group gadoids while those of herring and saithe are reported by Simmonds et al. (1986) and Smedstad (1986), respectively.

METHODS

The gears used and the methods applied were as described in Aglen et al 1985. Echo integration combined with trawling formed the basis of determining the distribution and abundance of fish. Technical data of acoustic instruments and trawls are presented in Table 1 and 2.

Calibration of the acoustic equipment with a standard sphere took place when the survey commenced. The echo integrator outputs were compensated for by the instrument constant (C_i) on each vessel. Integrator values were printed out as average figures over intervals of five nautical miles. Contributions of 0-group fish, identified by trawling and the pattern of echo traces, were separated from the recordings.

Within ICES statistical rectangles average integrator values (M) of 0-group fish were calculated. The average species composition by numbers, derived from relevant trawl catches, were used to calculate the average integrator value of each species. The average target strength (TS) by species was calculated by the equation:

$$TS = 21.8 \log L - 74.9 \quad (\text{where } L \text{ is the average length of the fish in cm})$$

RESULTS

The estimated number of 0-group gadoids within ICES statistical rectangles are shown in Figure 2 and 3. Total estimates for the area covered were as follows:

Norway pout	-	56 . 10 ⁹
Haddock	-	52 . 10 ⁹
Whiting	-	66 . 10 ⁹
Cod	-	4 . 10 ⁹

0-group Norway pout had a rather discontinuous distribution with a major concentration in the Shetland- Orkney area.

0-group haddock and whiting were widely distributed over the area surveyed. They were most densely concentrated in the Bressay-Fladen area.

0-group cod occurred in two separate sub-areas; one to the east of Shetland and another off the Danish coast.

The vertical distribution and diurnal behaviour of 0-group gadoids were similar to the observations made in 1984 (Aglen *et al.* 1985).

Total number caught, length ranges (cm) and mean lengths in pelagic trawl catches are given below:

Species	Number	Range	Mean length
Norway pout	8456	2.5 - 7.5	5.11
Haddock	5427	3.5 - 11.0	6.52
Whiting	7229	2.5 - 12.0	5.43
Cod (northern sub-area)	208	3.5 - 6.0	5.11
Cod (southern sub-area)	3907	5.0 - 8.0	6.94

DISCUSSION

The area covered in 1985 consisted of 68 statistical rectangles compared with 57 in 1984 (Aglen *et al.* 1985). In 1985 the survey area was extended to the south and southeast while some rectangles to the west of the Shetland-Orkney area were left out. Comparisons between abundance estimates are therefore separately calculated for the total area surveyed each year and for the area comprising the 48 rectangles covered in both years. The estimates (Number x 10⁻⁹) are as follows:

0-group species	Total area surveyed		Area covered both years	
	1984	1985	1984	1985
Norway pout	124.7	56.0	115.9	54.1
Haddock	42.2	52.1	41.5	49.2
Whiting	69.2	66.2	65.3	60.5
Cod	0.8	4.0	0.8	2.2

The acoustic estimates of Norway pout show a reduction in the range of 53-55 per cent from 1984 to 1985. The decline is to a lesser extent reflected in the English Groundfish Surveys (EGFS) 0-group indices and in the International Young Fish Surveys (IYFS) 1-group indices (Anon. 1986a). The estimates indicate a poor recruiting 1985 year class.

The estimates of haddock give an increase in the range of 19-23 per cent in 1985 and those of whiting a decrease of 4-7 per cent. The corresponding EGFS and IYFS indices, however, indicate a considerable decrease and increase respectively (Anon. 1986b).

The cod estimates partly reflect the substantial increase in recruitment from 1984 to 1985 derived from various trawl surveys (Anon. 1986b).

0-group gadoids were on an average smaller sized in 1985 than in 1984 (Aglen et al. 1985). The length reduction ranged from 0.22 cm (cod) to 0.57 cm (Norway pout and haddock). It may have reduced the relative catch rates of the smallest 0-group fish in the sea compared with the previous year. This leads to the assumption of a possible acoustic underestimation of abundance and most likely a delayed availability to demersal trawling as the occurrence of 0-group gadoids at the bottom tends to increase with increasing length. To some extent the assumption may serve as an explanation for the different trends in abundance estimates from 1984 to 1985.

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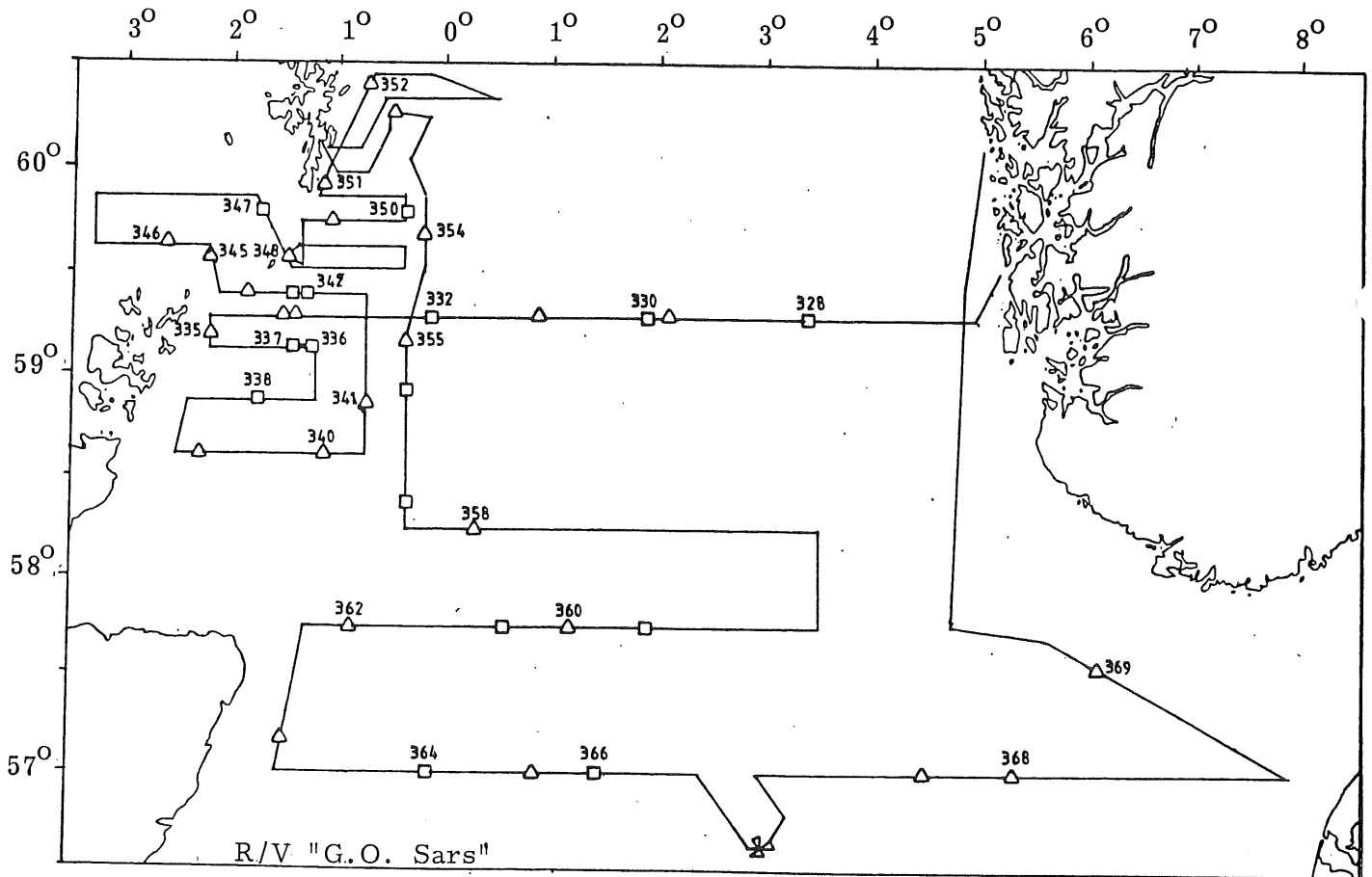
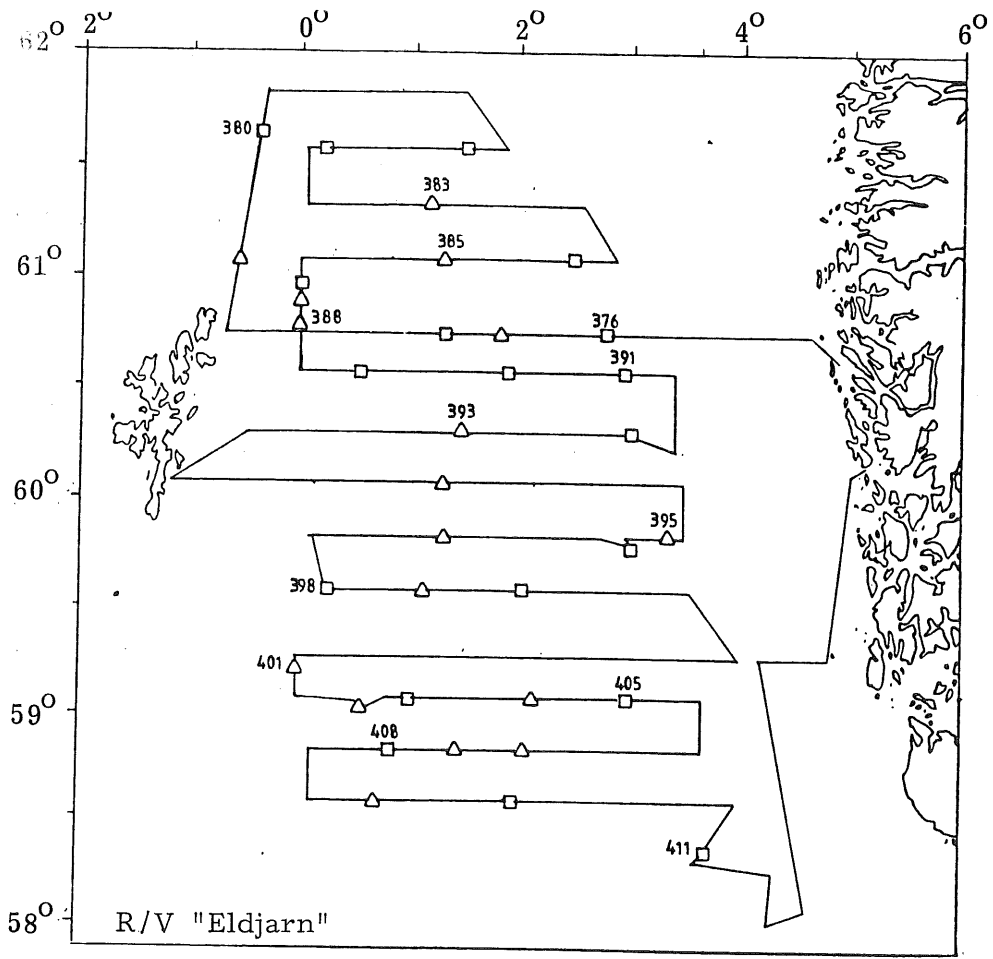


Fig.1. Survey grid and stations. Pelagic (Δ) and bottom trawl (□).

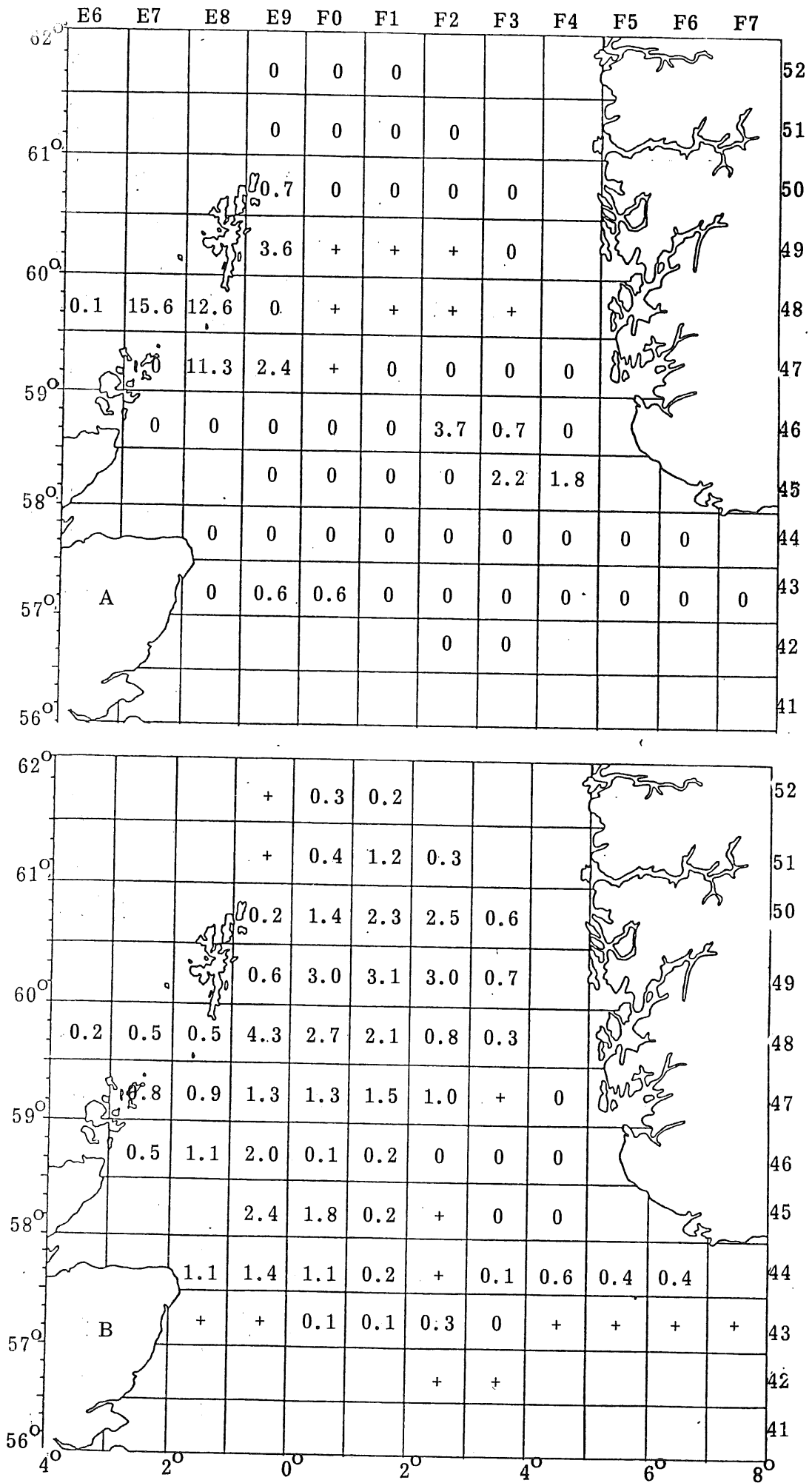


Fig.2. Estimated number in millions of Norway pout (A) and haddock (B) by statistical rectangles.

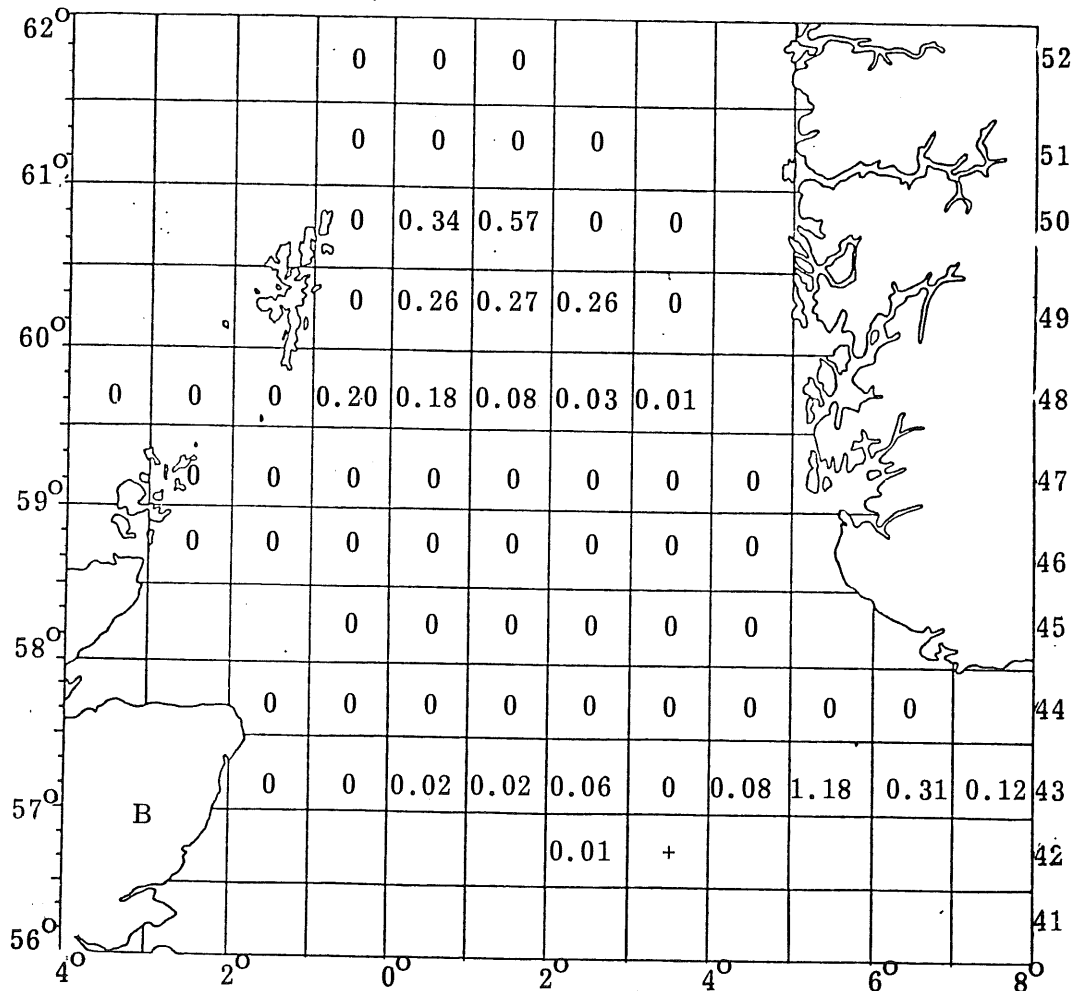
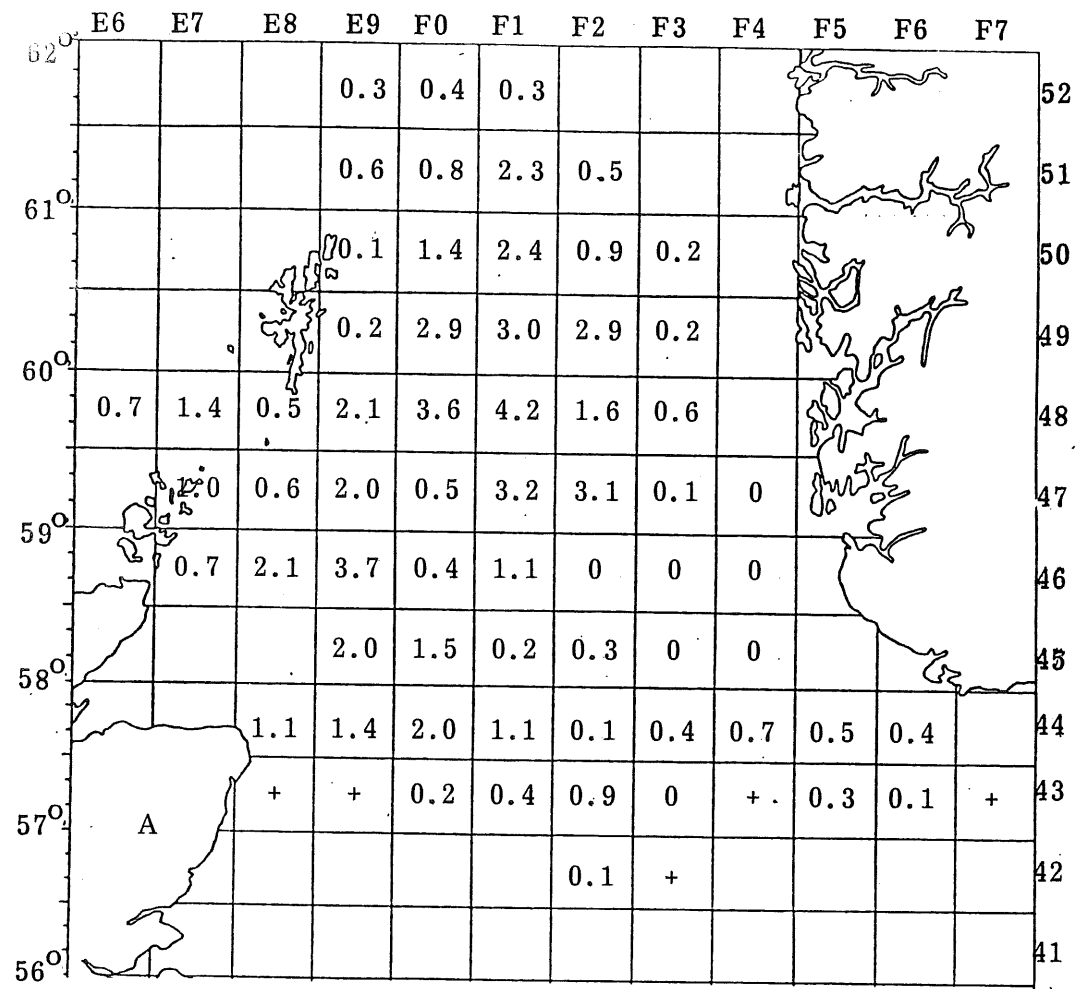


Fig. 3 Estimated number in millions of whiting (A) and cod (B) by statistical rectangles.

Table 1 Technical data and settings of acoustic equipment

	R/V "GO Sars"	R/V "Eldjarn"
Echo sounder	Simrad ES 400	Simrad ES 400
Frequency	38 kHz	38 kHz
Receiver gain	- 10 dB	- 10 dB
Time varied gain	$20 \log R + 2.0.008 \cdot R$	$20 \log R + 2.0.008 \cdot R$
Pulse length	1.0 ms	1.0 ms
Bandwidth	3.3 kHz	3.3 kHz
Transducer	30 x 30 cm	30 x 30 cm
Effective beam angle ($10 \log \psi$)	-19.6 dB	- 19.6 dB
Basic range	150 m	150 m
Source level +	135.9 dB	136.7 dB
Voltage response		
Integrator	NORD-10 computer	NORD-10 computer
Integrator gain	40 dB	40 dB
Integrator threshold	17 millivolts	17 millivolts
Instrument constant (C_1) for survey settings	0.33	0.29
Date of calibration	16 July 1985	16 July 1985

Table 2 Technical data of trawl equipment

	R/V "GO Sars"	Bottom		R/V "Eldjarn"
	Pelagic			Pelagic Bottom
Trawl type	Fotø (Mod 84) herring trawl	Campelen shrimp trawl	Capelin trawl	Campelen shrimp trawl
Vertical opening (typical)	15 m	5 m	15 m	5 m
Mesh size front (stretched)	6400 mm	80 mm	200 mm	80 mm
Mesh size cod end (stretched)	11 mm	6 mm	10 mm	6 mm
Bridle length	100 m	40 m	80 m	40 m
Door shape	Circular			Rectangular
Door weight	500 kg			1700 kg
Door area	4.6 m ²			8 m ²

