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**ACOUSTIC ESTIMATES OF SAITHE IN THE NORTH SEA
IN 1984 AND 1985.**

by

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ABSTRACT

This paper describes the results from a joint cruise in July 1984 with two vessels, and the results from two cruises in February - March 1985.

In July the saithe were standing well above the bottom, but the saithe were often mixed with high densities of plankton which might result in too high integrator values for saithe. It is also a problem that big specimens are more difficult to catch than small ones. This may result in an overestimation of small fish. The estimate for July were 645 000 tonnes compared with a VPA estimate of 637 000 tonnes.

In February - March the saithe were standing very close to the bottom, especially at the spawning grounds. The acoustic estimates therefore give only about 35% of the VPA estimate. The relative abundance of the year-classes are in good agreement in all estimates. The 1981 and 1982 year-classes seem to be good ones.

INTRODUCTION

The only method used for assessing the saithe stock in the North Sea are the VPA. However, the data for tuning the VPA are not satisfactory. It is therefore a need for improved data for tuning the VPA and also it is a need for other methods of assessing the stock.

On the background of the good experiences with the acoustic method on demersal fish in the Barents Sea (Dalen et al., 1983), we decided to do an attempt to assess the saithe stock by means of acoustics.

This paper describes the results from a joint cruise in July 1984 which main purpose was to estimate 0-group gadoids, and the results from two cruises in February - March 1985. One on saithe and one on herring.

METHODS

During the period 10-31 July 1984 R/V "G.O.Sars" covered the Orkney-Shetland area while R/V "Eldjarn" and R/V "G.O.Sars" covered most of the northern North Sea during July. The survey tracks and the positions of the trawl hauls are shown for each vessel in Figures 1-3. The main purpose of the surveys were to collect data on abundance and distribution of herring and 0-group gadoid fish (Aglen et al., 1985).

However, data were also collected for other species as saithe.

During the period 7-28 February 1985 R/V "Håkon Mosby" covered the the spawning grounds of saithe in the northern North Sea while R/V "Michael Sars" carried out an investigation mainly on herring in the North Sea in the period 4-21 March. Survey tracks and positions of trawl hauls are shown for each vessel in Figures 4-5.

Observations on distribution and abundance of saithe were made by echo integration and trawling. Technical data and setting of acoustic equipment are given in Table 1.

The integrator outputs were compensated for the instrument constant (Table 1) and scaled by a factor of 10. Average integrator values were obtained every five nautical miles sailed. Contributions from traces considered to be saithe were separated. This separation was based on the experience from the trawl catches together with the pattern of the traces on the echogrammes. An average value (M) was calculated for each rectangle.

The number of saithe in each rectangle were calculated in the same way as in the Barents Sea (Dalen et al., 1979 and 1983) using the same integration conversion factor for saithe as for cod:

$$C = 3.13 \cdot 10^6 \cdot L^{-2.18}$$

where L is the length of the fish in cm (Dalen et al., 1984). The VPA data are taken from the 1985 report of the saithe Working Group (Anon 1985).

RESULTS

In July 1984 the highest abundance of saithe were found at West-Tampen and around the northern part of Shetland (Fig. 7). The youngest fish were most abundant at the western slope of the Norwegian Trench, while the mature fish were most abundant in the Tampen area. Compared with the VPA estimates from the saithe Working Group in 1985 the acoustic estimates give higher numbers for the three and five years old fish, while the numbers of two years old fish are too low. However, the low number of two years old fish are easily explained by the fact that a great part of the young saithe are living close to the Norwegian coast. This part of the stock migrate into the North Sea when they are about three and a half years old. The year-class 1982 is reported to be numerous along the coast.

The higher number of the 1981 year-class may indicate that this year-class is stronger than estimated by the Working Group. The same can be said about the five years old fish (1979 year-class). However, during July, the saithe were often mixed with high densities of plancton, which might result in too high integrator values for saithe.

The cruise in February were aimed at the spawning stock of saithe and covered only the northern part of the North Sea (Fig. 4). At this time the saithe were standing very close to the bottom. And as seen from Table 2 the acoustic estimate of the spawning stock in 1985 were only 43% by numbers of the VPA estimate.

In the southern area, which were covered by R/V "Michael Sars" in March (Fig. 5), mainly young saithe were found. The acoustic estimate of the young fish are very low. However, in February-March only part of the distribution area were covered. In addition a great part of the three years old fish were still situated along the Norwegian coast.

The results from the acoustic surveys are encouraging, especially those from summer 1984. However, for evaluation of the method, a time series is needed. The greatest problems by using the acoustic method on saithe in the North Sea are the high densities of plancton which may occur during summertime and the tendency of the saithe to stand close to the bottom during wintertime. In addition it may also be a problem that it is more difficult to catch big specimens than small ones. This may result in an overestimation of small fish.

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Table 1. Technical data and settings of acoustic equipment

	R/V "G.O.Sars"	R/V "Eldjarn"	R/V "Håkon Mosby"	R/V "Michael Sars"
Echo sounder	Simrad EK 400	Simrad EK 400	Simrad EK 400	Simrad EKS 38
Frequency	38 kHz	38kHz	38kHz	38kHz
Receiver gain	-10 dB	-20 dB	-20 dB	-20 dB
Pulse length	1.0 ms	1.0 ms	1.0 ms	0.6 ms
Bandwith	3.3 kHz	3.3 kHz	3.3 kHz	3.0 kHz
Transducer	45 x 48 cm	30 x 30 cm	30 x 30 cm	30 x 30 cm
Basic range	150 m	150/250 m	250 m	125/250 m
Source level + voltage response	134.4 dB	141.3 dB	139.5 dB	141.6 dB
Integrator	Nord 10 computer	Nord 10	Simrad QD	Nord 10
Instrument const.	0.087	0.104	0.106	0.108

Table 2. Stock size of saithe estimated by VPA and the acoustic method. Numbers in millions and weight in 1000 tonnes.

Age	VPA July 1984 (Anon 1985)	Acoustic July 1984	VPA 1. January 1985	Acoustic Feb/March 1985
2	402	167		
3	189	268	346	58
4	108	107	155	62
5	32	62	83	23
6	28	22	22	20
7	3	3	19	10
8	2	1	2	2
N	764	630	628	175
W	636.6	644.7	831.5	295.1
N 5+	65	88	127	55
W 5+	171.5	217.6	340.3	157.3

Table 3. Abundance of different age groups of saithe in different areas in July 1984 estimated by acoustic method. Numbers in millions.

Age	2	3	4	5	6	7	8	9	Sum
Tampen	37	101	54	44	15	1	+	+	252
Norw. trench	86	51	11	3	1	+	+	-	152
N.S. Plateau	22	70	30	12	5	1	+	-	140
W.of Shetland	22	46	12	4	2	+	+	+	86
TOTAL	167	268	107	62	22	3	1	+	630

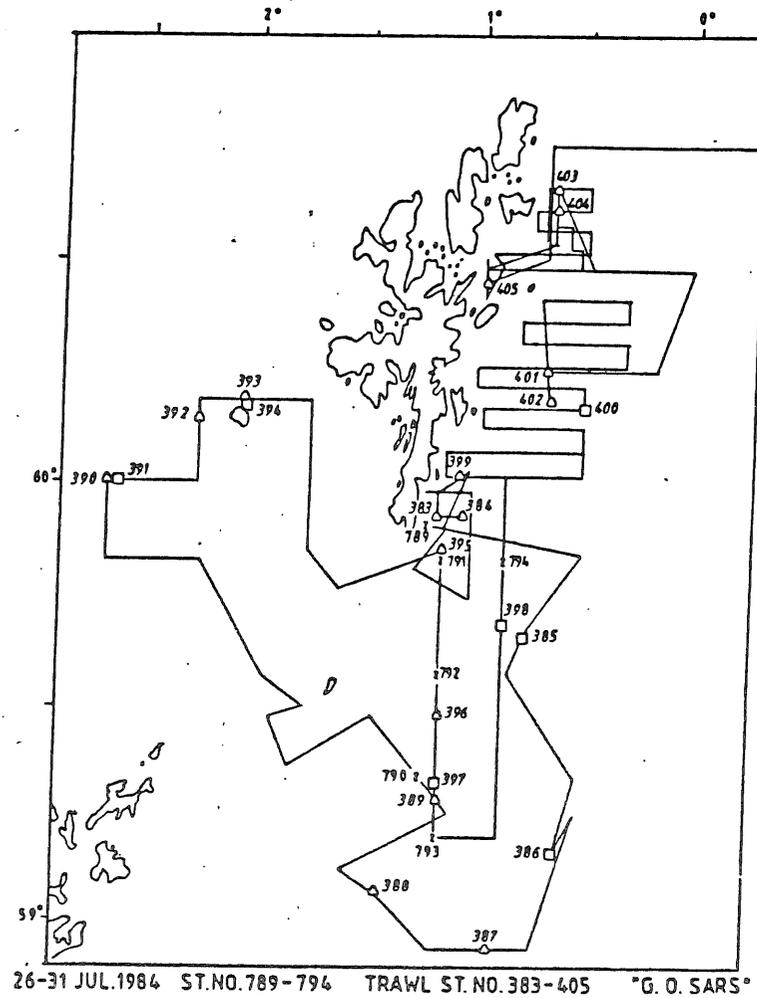
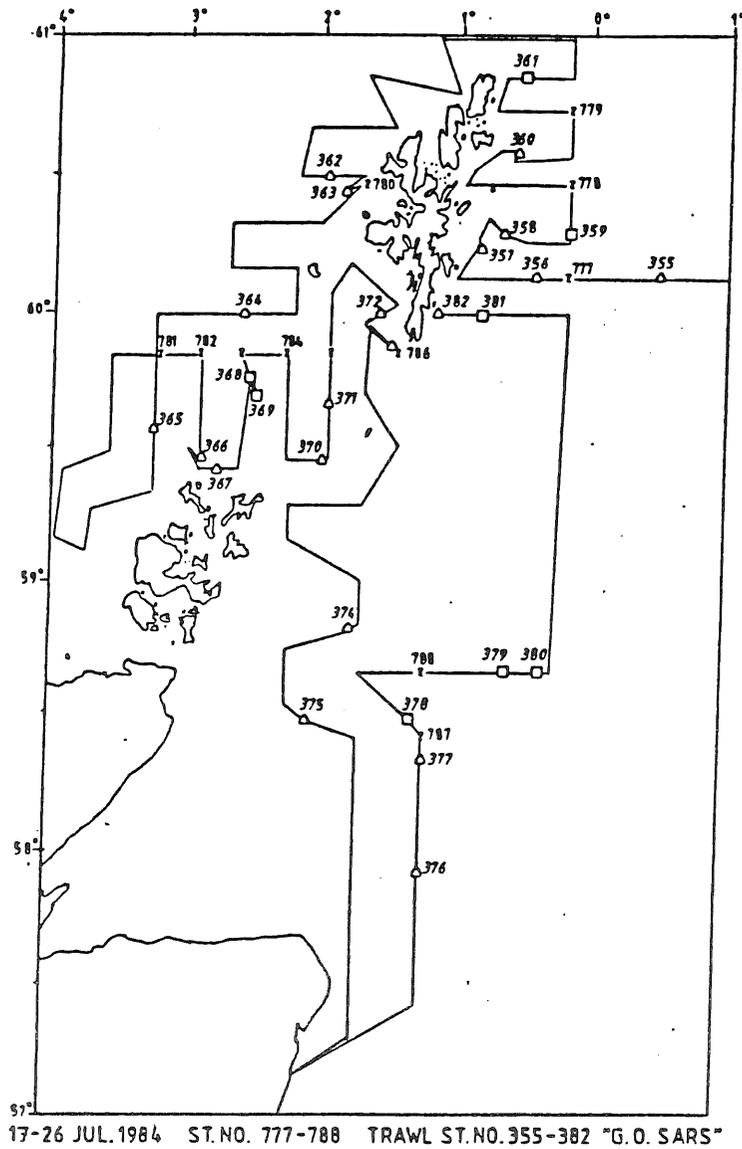


Figure 1. Survey track and stations R/V "G.O.Sars" 17-26 and 26-31 July 1984.
 Triangle = pelagic trawl, square = bottom trawl, Z or \bar{x} = hydrographic station.

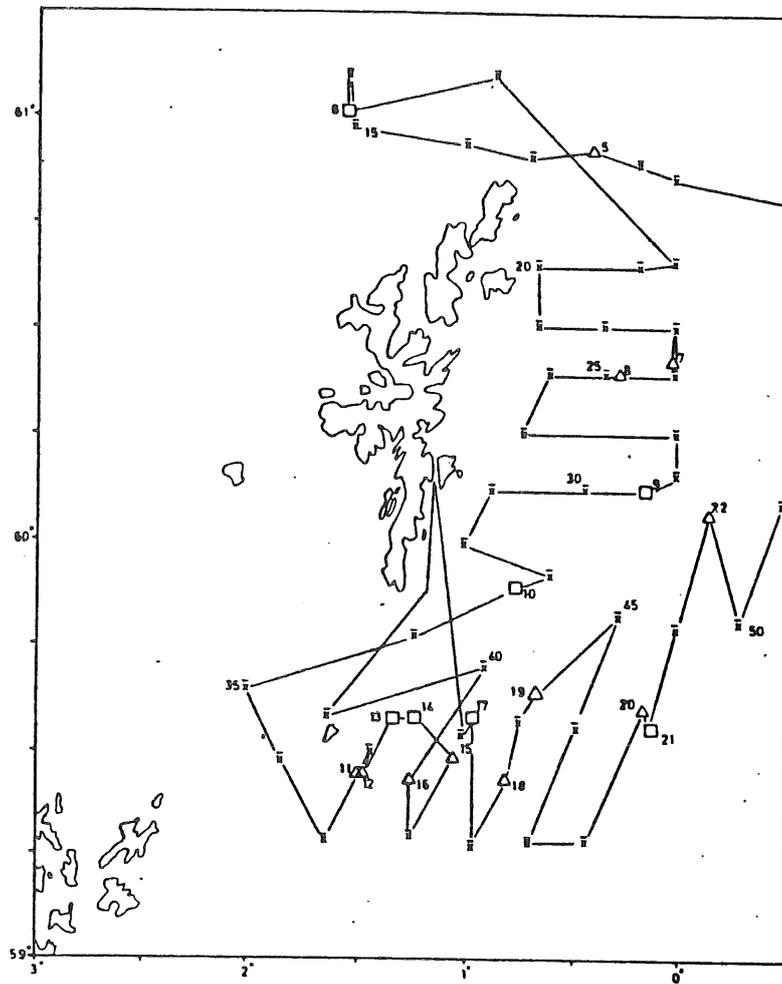


Figure 2. Survey track and stations R/V "Bei Dou" 19-25 July 1984.

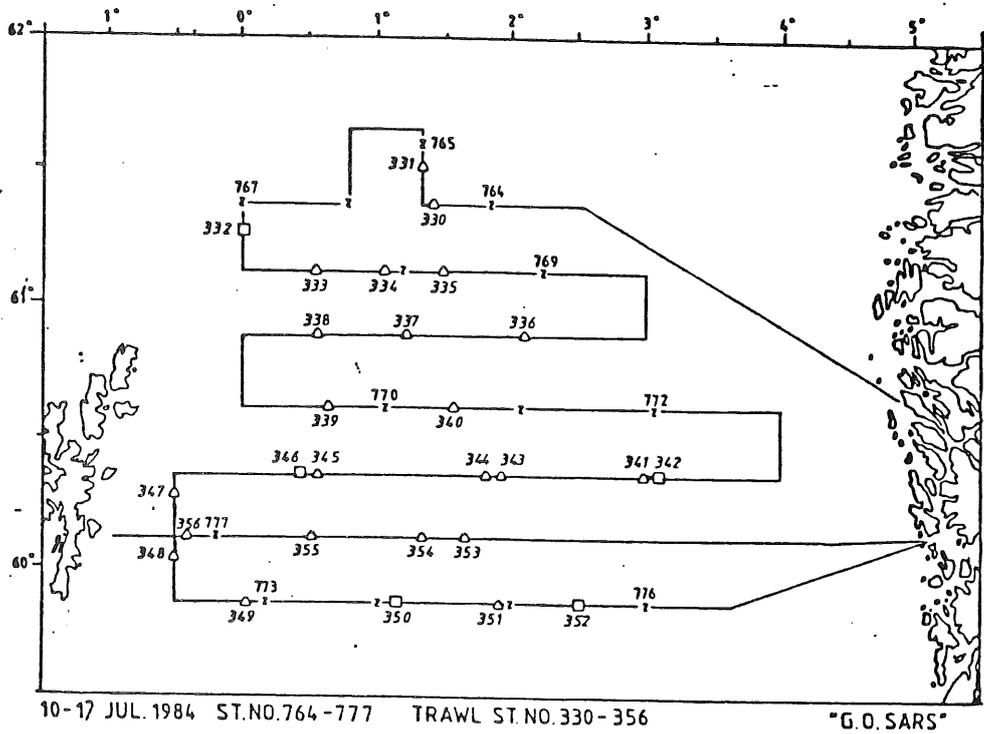


Figure 3. Survey track and stations R/V "G.O.Sars" 10-17 July 1984.

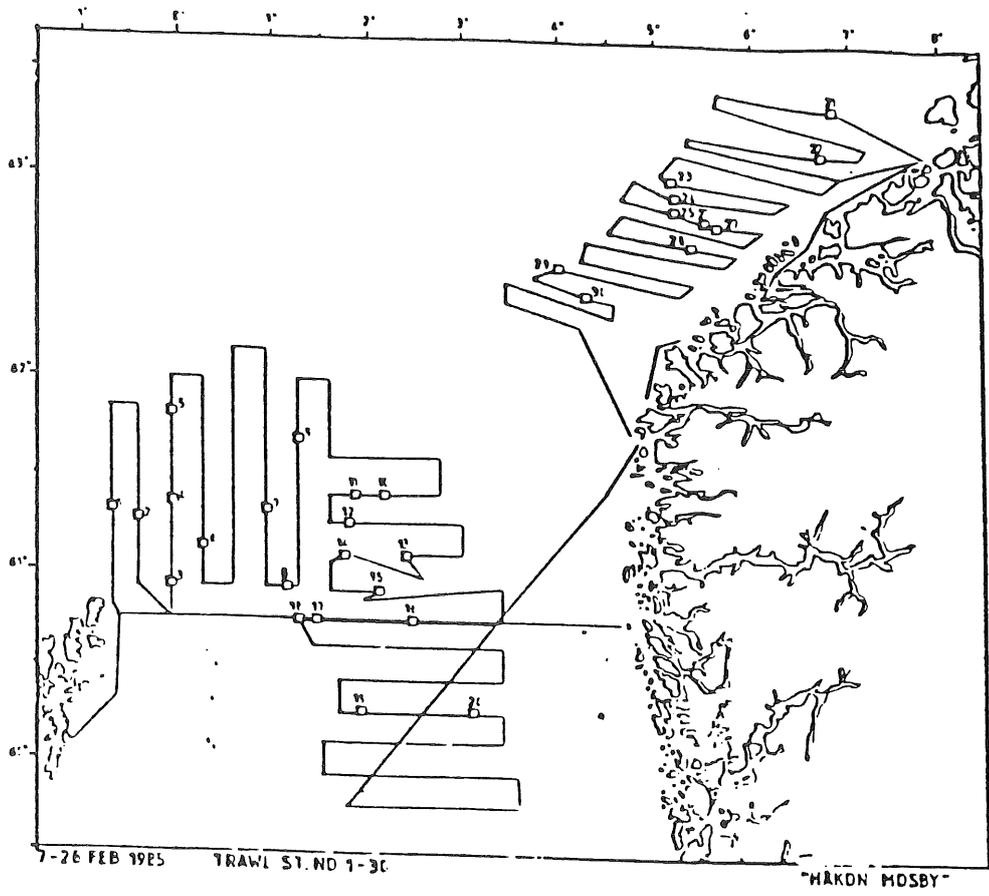


Figure 4. Survey Track and stations R/V "Håkon Mosby", 2-28 February 1985

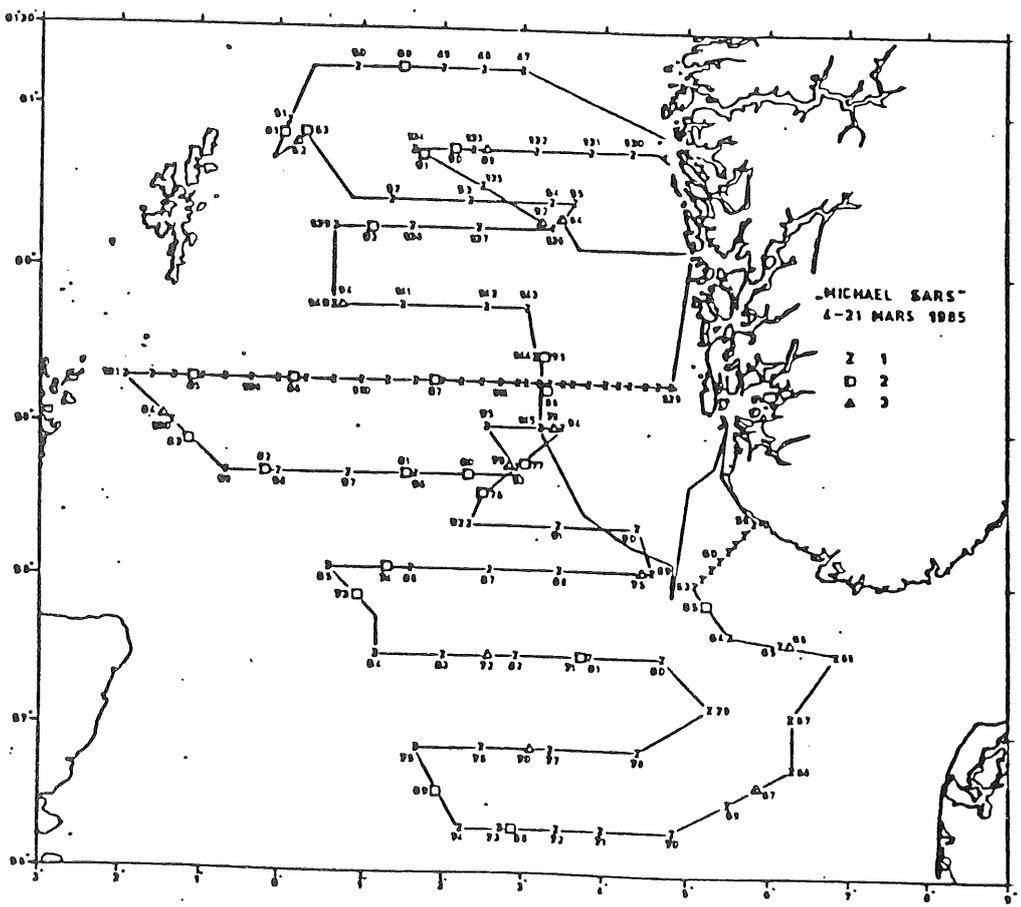


Figure 5. Survey track and stations R/V "Michael Sars" 4-21 March 1985

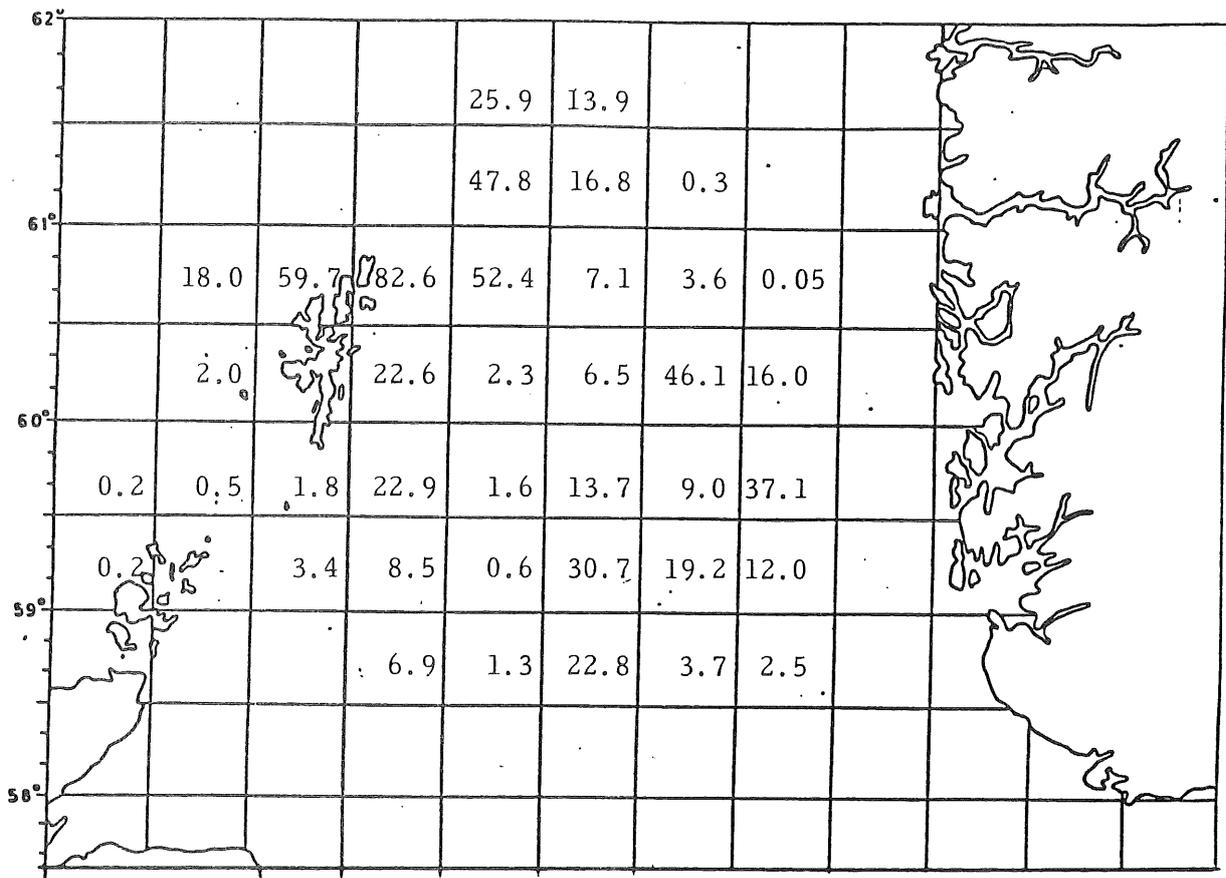


Figure 6. Distribution and abundance of Saithe in July 1984. Numbers in millions.

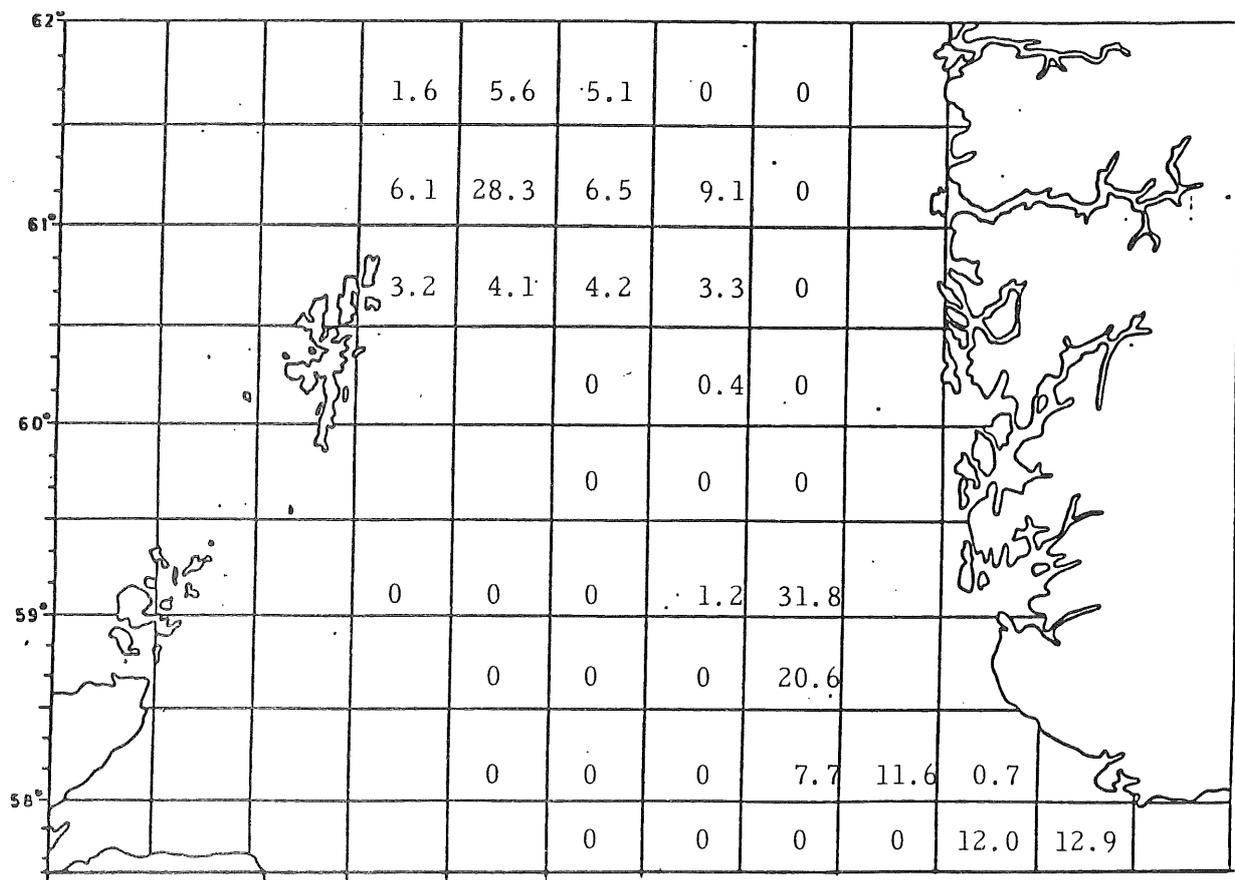


Figure 7. Distribution and abundance of Saithe in February-March 1985. Numbers in millions.