

Demersal Fish Committee

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REPORT OF THE STUDY GROUP ON BEAM TRAWL SURVEYS IN 1994

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1. Introduction

1.1. Terms of reference

At the 1994 Annual Science Conference of ICES it was resolved (C.Res. 1994/2:31) that the Study Group on Beam Trawl Surveys (Chairman: Dr. A.D. Rijnsdorp, Netherlands) will work by correspondence in 1995, and report to the 1995 ICES Annual Science Conference, to:

- a) carry out a detailed evaluation of the data series;
- b) analyse patterns in species richness and diversity;
- c) analyse population indices by age group and area for plaice and sole;
- d) evaluate survey designs and prepare modifications if necessary;
- e) prepare for the transfer of the Group's work to the International Bottom Trawl Survey Working Group.

1.2. Participants by correspondence

R. de Clerck	Belgium
U. Damm	Germany
B. Harley	United Kingdom
R.M. Millner	United Kingdom
S. Rogers	United Kingdom
A.D. Rijnsdorp (chairman)	Netherlands
M. Vince	United Kingdom

2. Survey details

The survey details and the number of hauls in each rectangle are shown in Figure 2.1. In total a number of 442 hauls were taken in 103 rectangles. Details of survey are given in the text table below.

Country:	Belgium	Netherlands	Germany	UK	UK	UK
Survey area:	IVbc west	IVbc east	IVb east	VIIId	VIIe	VIIa,f&g
Number of hauls	46	91	43	82	59	121
Dates:	20-25/8	15/8-22/9	4-17/9	4-16/8	26/9-3/10	4-16/8
Ship:	Belgica	ISIS	Solea	Corystes	Carhelmar	Corystes
Beam trawl length:	4-m	8-m	7-m	4-m	4-m	4-m
Number of beams fished:	1	2	2	1	2	1
Trawl duration (min):	30	30	30	30	30	30
Cod-end mesh (mm):	40	40	44	40	40	40
Number of ticklers	0	8	5	0	0	0
Attachment:	b	a	a	b	b	b
Year survey started:	1986	1985	1991	1988	1984	1988
Benthos sampling since:	1985	1985	1992	1991	-	1992

Attachment: a - none, b - chain mat & flip-up rope;

3. Sampling procedures

A detailed account on the sampling procedures used is given in Anon (1990, 1993). All surveys sample both fish and benthos. Fish species are sorted out and the number by size class (cm-below) is recorded. Large catches are subsampled. From the invertebrate benthic fauna, the main, generally larger species are sampled and their abundance is recorded. A list of species sampled is given in Anon (1994).

The catch rates are converted to the standard 8-m beam trawl by multiplying the observed catch rates with the ratio of the beam trawl widths (8/beam trawl width used). Catch rates were averaged by rectangle, and rectangle averages were averaged for the sub-areas distinguished (Fig.3.1).

4. Survey results in 1994

4.1 Distribution and trends in abundance

The mean abundance by rectangle for the standard species is shown in Figures 4.1.1. A glossary of the English and scientific names is given in Section 9. Catch rates by rectangle in 1994 can be compared with the mean catch rate in previous years given in the previous report (Anon, 1994).

Trends in abundance by sub-area can be examined in Table 4.1. Although the time series comprises only 4 years, the data indicate that the catch rates of some species has changed substantially in recent years. In the German Bight of the North Sea (area 1), the catch rates of dab and plaice (1- and 2-group) decreased. In the southern North Sea the catch rate increased of pogge (areas 3 and 4) and solenette and dragonet (area 3). In area 6, 7 and 8 (VIIe, VIIf&g, VIIa) the catch rate of thickback sole increased.

The species list presented in Table 4.1 is not complete. Some other species have been recorded in low numbers.

4.2 Year class strength of sole and plaice by management area

Year class strength indices for sole and plaice are given for the various management areas in Table 4.2 and 4.3. Each survey index is calculated as the arithmetic mean abundance over a standard number of rectangles.

North Sea (IVb,c)

Sole recruitment index was high in 1987 and 1991 and is reflected in the relatively high catch rate of these year classes in successive surveys. Recruitment of the 1992 and 1993 year class does not appear to be particularly strong.

Plaice recruitment index have decreased in recent years after the strong recruitment in the mid 1980s with a particularly strong 1985 year class. The high 0-group index in 1994 has to be interpreted with caution, because only the fringes of the 0-group distribution area is sampled.

Eastern Channel (VIIId)

Sole recruitment index in VIIId was high in 1989. The 1992 and 1993 year classes appear to be average or below average.

Like in the North Sea, plaice recruitment index in VIIId was high in 1985. Year classes 1992 and 1993 appear to be rather poor.

Western Channel (VIIe)

Catch rates of sole and plaice in this area peak at age 3. The catch rates of year classes 1991 and 1992 suggest an average or less than average year class strength in sole and plaice.

Bristol Channel (VIIf&g)

Sole recruitment index in VIIf&g appears to be above average in 1986 and 1989. The recent year classes of 1992 and 1993 do not appear to be particularly good. Plaice recruitment index in 1989 was low. Recruitment in 1985 to 1987 appeared to be relatively high, whereas the 1990 and 1991 year classes may also have been above average. The 1992 and 1993 year class, however, appear to be rather weak.

Irish Sea (VIIa)

Sole recruitment in VIIa appear to be high in 1984 and 1989. Year classes born after 1990 do not appear to be particularly good.

Plaice recruitment indices of 1- and 2- group appear to be relatively high for the 1991, 1992 and 1993 year classes.

5. Diversity

A preliminary analysis of the geographic trends in species richness and diversity has been conducted using survey data of the Netherlands. Species diversity was calculated according to the Shannon-Weaver index which takes account of the number of species as well as their numerical abundance:

$$H = \sum p_j \log p_j$$

where p_j is the proportion of species j in the total catch number.

Species diversity shows a decreasing trend from the southern North Sea towards the eastern part of the German Bight (Figure 5.1). In the early 1990s diversity has increased in all sub-areas. The increase in diversity may be partly related to the decrease in the abundance of plaice and dab which numerically dominate the catches. However, because the diversity index was also relatively low in 1985 and 1986, years in which the abundance of plaice and dab was not particularly high, also other factors must be involved. The increase in the number of stations in the coastal rectangles in the early 1990s will certainly have contributed to the increase in diversity and species richness. Further work is needed to analyse trends in greater detail.

6. Transfer of the Group's work to the International Bottom Trawl Survey Working Group

The transfer of the Group's work to the International Bottom Trawl Survey Working Group has not yet been discussed in the Beam Trawl Study Group. At present, the participating laboratories store the survey data in their national data base. Only the mean catch rates by rectangle of a selected group of fish species are being exchanged for analyses in the annual Report of the Study Group.

7. Recommendations

1. To improve the survey coverage by extended sampling along the English North Sea coast and into the central North Sea
2. Benthos samples should be collected on all surveys using a standardised methodology
3. Further work should be carried out to compare the efficiency of different beam trawls by use of overlapping stations and comparative fishing exercises. The data collected in previous years have to be made available and analysed prior to the next meeting
4. Detailed results comprising the catch rate of all fish species by individual hauls should be made available for the integrated analysis of trends in species richness and diversity.
5. Otoliths of all flatfish species should be collected where possible
6. The Study Group should meet in IJmuiden in the spring of 1996 to
 - a) carry out a detailed evaluation of the data series;
 - b) analyse patterns in species richness and diversity;
 - c) analyse population indices by age group and area for plaice and sole;
 - d) evaluate survey designs and prepare modifications if necessary;
 - e) prepare for the transfer of the Group's work to the International Bottom Trawl Survey Working Group.

8. References

- Anon, 1990. Report of the Study Group on beam trawl surveys in the North Sea and Eastern Channel. ICES C.M. 1990/G:59.
- Anon, 1994. Report of the Study Group on beam trawl surveys in 1993. ICES C.M. 1994/G:5.

9. Glossary of English and Scientific names of the selected group of main fish species analysed

Sole	<i>Solea solea</i>
Plaice	<i>Pleuronectes platessa</i>
Dab	<i>Limanda limanda</i>
Turbot	<i>Scophthalmus maximus</i>
Brill	<i>Scophthalmus rhombus</i>
Scaldfish	<i>Arnoglossus laterna</i>
Lemon Sole	<i>Microstomus kitt</i>
Long Rough Dab	<i>Hippoglossoides platessoides</i>
Flounder	<i>Platichthys flesus</i>
Solenette	<i>Buglossidium luteum</i>
Thickback Sole	<i>Microchirus variegatus</i>
Tub Gurnard	<i>Trigla lucerna</i>
Grey Gurnard	<i>Eutrigla gurnardus</i>
Red Gurnard	<i>Aspitrigla cuculus</i>
Pogge	<i>Agonus cataphractus</i>
Lesser weever	<i>Echiichthys vipera</i>
Dragonet	<i>Callionymus lyra</i>
Lesser Spotted Dogfish	<i>Scyliorhinus canicula</i>
Rays	<i>Rajidae</i>
Cod	<i>Gadus morhua</i>
Poor Cod	<i>Trisopterus minutus</i>
Bib	<i>Trisopterus luscus</i>
Whiting	<i>Merlangius merlangus</i>
Monkfish	<i>Lophius spp</i>
John Dory	<i>Zeus faber</i>
Red Mullet	<i>Mullus surmuletus</i>
Edible crab	<i>Cancer pagurus</i>

Table 4.1 Abundance of species by subarea (N.h⁻¹/1/8m trawl)

Sub-area 1 (German Bight, North Sea)

	1991	1992	1993	1994
Sole-1	2.4	56.8	3.9	2.8
Sole-2	26.3	5.0	18.6	3.4
Sole-3+	12.6	15.0	9.8	11.3
Pla-1	380.7	445.1	174.2	114.7
Pla-2	219.9	215.0	180.6	42.2
Pla-3+	56.2	49.4	51.1	54.5
Dab (all)	1366.9	1307.4	994.6	731.4
Dab-1	733.6	478.9	352.0	444.3
Dab-2	230.7	451.7	295.9	126.4
Dab-3+	377.9	340.3	332.4	151.4
Turbot	3.9	4.5	2.5	2.0
Brill	1.3	3.7	1.4	0.5
Scaldfish	62.4	72.9	111.4	48.3
Lemon Sole	2.7	0.6	1.2	8.8
Long Rough Dab	7.7	2.1	9.1	23.8
Flounder	23.0	7.0	11.9	3.7
Solenette	47.5	92.1	98.0	82.2
Tub Gumard	4.5	15.6	7.5	5.1
Grey Gumard	34.5	42.5	43.7	58.8
Red Gumard	0.0	0.0	0.0	0.0
Pogge	104.9	68.9	43.0	119.5
Lesser weever	1.2	3.0	3.1	3.8
Dragonet	47.3	151.5	65.7	85.4
Lesser Spotted Dogfish	0.0	0.0	0.0	0.0
Rays	0.7	0.4	0.5	4.7
Cod	12.9	3.4	3.9	14.3
Poor Cod	0.3	0.7	0.3	0.1
Bib	0.3	0.9	1.4	0.5
Whiting	93.3	40.8	85.7	109.8
Monkfish	0.0	0.0	0.2	0.5
John Dory	0.0	0.0	0.0	0.0
Red Mullet	0.0	0.0	0.0	1.5
Thickback Sole	0.0	0.0	0.0	0.0
Edible Crab	2.5	11.2	3.0	7.5

Sub-area 2 (Flamborough, North Sea)

	1991	1992	1993	1994
Sole-1	0.7	1.7	4.0	0.0
Sole-2	22.2	18.7	4.0	21.3
Sole-3+	20.8	70.9	45.0	34.7
Pla-1	0.0	3.2	12.0	13.0
Pla-2	34.0	34.6	12.0	19.7
Pla-3+	41.8	54.0	23.0	5.0
Dab (all)	78.7	223.1	14.0	230.0
Dab-1	165.6	291.5	124.0	34.3
Dab-2	96.6	79.8	96.0	120.3
Dab-3+	340.8	596.0	234.0	75.3
Turbot	0.0	1.4	0.0	0.0
Brill	1.0	0.8	5.0	4.0
Scaldfish	4.0	91.2	0.0	20.3
Lemon Sole	6.8	3.4	22.0	30.0
Long Rough Dab	0.0	0.0	0.0	0.0
Flounder	0.2	0.0	0.0	0.0
Solenette	42.6	66.6	1.0	33.7
Tub Gumard	7.0	0.2	7.0	0.0
Grey Gumard	7.6	94.8	0.0	30.7
Red Gumard	0.0	0.0	0.0	0.0
Pogge	4.8	31.4	82.0	20.0
Lesser weever	35.2	75.2	0.0	58.7
Dragonet	62.0	44.8	199.0	176.0
Lesser Spotted Dogfish	0.0	0.4	0.0	1.3
Rays	20.8	19.3	44.0	7.3
Cod	2.4	0.8	8.0	5.0
Poor Cod	0.0	0.0	0.0	0.0
Bib	11.4	1.2	11.0	71.7
Whiting	6.2	144.8	22.0	14.7
Monkfish	0.2	0.1	0.0	0.0
John Dory	0.0	0.0	0.0	0.0
Red Mullet	0.0	0.0	0.0	0.0
Thickback Sole	0.0	0.0	0.0	0.0
Edible Crab	19.1	32.8	52.0	64.3

Sub-area 3 (Transition area, North Sea)

	1991	1992	1993	1994
Sole-1	2.6	23.1	6.1	10.6
Sole-2	9.3	12.8	29.9	6.5
Sole-3+	8.7	9.2	10.0	13.1
Pla-1	23.8	52.0	135.9	102.3
Pla-2	37.9	35.2	62.9	52.1
Pla-3+	20.5	21.2	16.5	19.0
Dab (all)	663.4	971.6	688.2	847.0
Dab-1	365.1	384.5	177.2	561.9
Dab-2	199.1	362.4	315.4	214.9
Dab-3+	96.5	168.9	129.8	63.0
Turbot	1.5	0.9	1.9	2.8
Brill	0.7	1.1	2.6	3.3
Scaldfish	88.6	124.8	273.9	146.7
Lemon Sole	2.9	3.4	17.9	2.5
Long Rough Dab	0.9	0.0	0.0	0.0
Flounder	0.1	0.2	0.4	1.8
Solenette	47.0	242.6	253.4	316.4
Tub Gumard	3.0	2.1	9.0	8.8
Grey Gumard	32.2	26.5	16.8	54.4
Red Gumard	0.2	0.1	0.0	0.0
Pogge	14.1	13.5	32.1	42.7
Lesser weever	21.2	41.4	76.2	53.6
Dragonet	27.6	32.7	297.4	200.4
Lesser Spotted Dogfish	0.3	0.2	0.3	0.1
Rays	1.3	3.5	7.7	0.0
Cod	1.2	2.6	0.5	1.3
Poor Cod	1.7	0.4	0.3	1.2
Bib	17.4	1.4	2.9	6.1
Whiting	80.4	141.9	67.8	111.0
Monkfish	0.1	0.1	0.0	0.0
John Dory	0.1	0.0	0.0	0.0
Red Mullet	0.0	0.5	0.0	0.0
Thickback Sole	0.0	0.0	0.0	0.0
Edible Crab	4.1	8.2	42.9	1.1

Sub-area 4 (Southern Bight & Strait of Dover, North Sea)

	1991	1992	1993	1994
Sole-1	10.4	74.3	35.1	24.4
Sole-2	22.5	42.1	54.7	14.0
Sole-3+	8.8	21.4	13.6	18.2
Pla-1	14.4	50.5	17.4	24.6
Pla-2	15.8	13.7	21.3	10.1
Pla-3+	16.7	14.4	8.3	11.0
Dab (all)	133.6	203.5	129.6	158.3
Dab-1	68.0	83.8	34.8	83.3
Dab-2	36.8	45.1	55.2	16.8
Dab-3+	23.2	22.7	35.3	11.8
Turbot	0.9	1.0	0.9	2.8
Brill	0.7	1.0	0.9	1.3
Scaldfish	26.4	32.5	40.9	36.0
Lemon Sole	8.4	3.9	11.7	23.2
Long Rough Dab	0.5	0.0	0.0	0.0
Flounder	2.9	3.0	0.8	4.5
Solenette	50.4	58.8	60.1	73.0
Tub Gumard	5.1	4.2	5.5	5.1
Grey Gumard	9.4	16.8	15.0	9.7
Red Gumard	5.9	3.4	3.5	3.9
Pogge	37.0	35.2	34.0	104.7
Lesser weever	55.5	61.6	95.2	97.1
Dragonet	63.1	81.5	94.0	93.8
Lesser Spotted Dogfish	3.1	4.2	10.8	6.1
Rays	3.2	5.6	4.3	4.0
Cod	0.5	2.3	0.5	2.2
Poor Cod	34.4	12.5	14.5	16.8
Bib	36.2	24.3	16.8	42.6
Whiting	11.6	42.9	31.5	19.7
Monkfish	0.0	0.0	0.0	0.0
John Dory	0.1	0.0	0.1	0.1
Red Mullet	1.3	1.5	0.4	3.9
Thickback Sole	1.1	1.8	1.9	2.6
Edible Crab	1.5	11.6	7.5	5.4

Sub-area 5 (Eastern Channel north, VIId)

	1991	1992	1993	1994
Sole-1	4.1	0.4	0.0	0.7
Sole-2	15.2	3.9	3.6	1.7
Sole-3+	5.8	8.4	12.9	11.4
Pla-1	4.4	3.6	1.0	1.9
Pla-2	4.7	2.4	4.3	1.4
Pla-3+	9.9	5.4	6.4	5.7
Dab (all)	2.6	4.9	1.2	8.6
Dab-1	1.4	1.3	0.5	2.8
Dab-2	1.6	0.7	0.4	1.1
Dab-3+	7.6	7.1	2.0	0.2
Turbot	0.1	0.1	0.0	0.5
Brill	1.0	0.7	0.8	0.6
Scaldfish	4.7	3.9	6.3	4.3
Lemon Sole	1.0	2.4	2.6	5.8
Long Rough Dab	0.0	0.0	0.0	0.0
Flounder	0.0	0.0	0.0	0.0
Solenette	155.3	141.5	143.3	206.9
Tub Gumard	1.3	3.5	6.9	2.2
Grey Gumard	0.2	0.3	0.3	0.2
Red Gumard	9.5	9.7	9.9	23.9
Pogge	4.0	9.6	4.3	18.7
Lesser weever	0.1	0.3	0.4	0.1
Dragonet	39.2	45.1	61.6	77.7
Lesser Spotted Dogfish	1.7	11.0	22.0	18.1
Rays	6.1	8.2	9.6	6.1
Cod	0.0	0.0	0.0	0.0
Poor Cod	170.2	134.1	156.1	179.0
Bib	30.7	27.0	11.1	27.4
Whiting	0.1	0.0	0.7	0.0
Monkfish	0.0	0.0	0.1	0.5
John Dory	0.9	0.5	0.4	0.1
Red Mullet	0.0	0.4	0.1	0.0
Thickback Sole	0.7	0.8	0.3	0.5
Edible Crab	4.3	4.8	2.9	4.7

Sub-area 7 (Western Channel, VIle)

	1991	1992	1993	1994
Sole-1	0.6	0.1	0.3	0.1
Sole-2	8.6	4.0	2.7	1.7
Sole-3+	5.5	11.6	13.6	8.0
Pla-1	0.3	2.9	0.7	0.8
Pla-2	0.5	0.6	2.4	0.8
Pla-3+	4.2	5.5	7.6	6.9
Dab (all)	7.5	14.3	21.6	23.5
Dab-1	0.0	0.2	-	-
Dab-2	0.3	0.2	-	-
Dab-3+	1.7	0.3	-	-
Turbot	0.0	0.0	0.1	0.0
Brill	0.5	0.5	0.3	0.4
Scaldfish	1.5	14.8	55.9	79.3
Lemon Sole	0.9	0.3	0.4	0.7
Long Rough Dab	0.0	0.0	0.0	0.0
Flounder	0.0	0.0	0.0	0.0
Solenette	0.0	126.2	354.3	95.7
Tub Gumard	0.6	1.8	0.7	0.2
Grey Gumard	3.5	2.8	3.8	7.0
Red Gumard	10.4	28.9	25.8	42.5
Pogge	0.2	2.7	10.9	10.7
Lesser weever	0.0	2.7	0.5	3.9
Dragonet	224.8	84.7	157.1	161.4
Lesser Spotted Dogfish	6.4	13.4	20.8	11.0
Rays	3.4	2.3	2.3	1.5
Cod	0.0	0.0	0.0	0.1
Poor Cod	156.0	123.1	150.3	104.4
Bib	34.3	8.3	6.6	4.6
Whiting	6.7	4.4	27.2	2.3
Monkfish	0.0	0.4	0.8	1.5
John Dory	1.0	1.5	2.2	0.8
Red Mullet	0.4	0.6	2.2	0.7
Thickback Sole	2.8	55.1	98.6	98.4
Edible Crab	1.0	2.1	1.1	0.8

Sub-area 6 (Eastern Channel south, VIId)

	1991	1992	1993	1994
Sole-1	7.7	2.4	0.7	1.3
Sole-2	26.2	12.0	25.4	3.1
Sole-3+	6.2	14.8	18.4	14.8
Pla-1	6.7	7.1	1.9	4.0
Pla-2	3.4	6.3	2.5	2.9
Pla-3+	19.5	35.2	13.2	12.1
Dab (all)	2.2	70.9	11.3	76.7
Dab-1	2.4	10.1	4.1	18.5
Dab-2	2.3	9.2	3.3	11.7
Dab-3+	24.5	98.9	23.1	7.2
Turbot	0.0	0.6	0.5	0.4
Brill	1.0	1.5	1.7	0.7
Scaldfish	1.6	2.7	8.3	4.3
Lemon Sole	1.8	0.8	0.0	0.6
Long Rough Dab	0.0	0.0	0.0	0.0
Flounder	2.8	2.7	0.7	2.2
Solenette	87.9	88.2	157.8	85.1
Tub Gumard	1.2	7.4	8.5	3.4
Grey Gumard	1.0	0.1	0.0	0.0
Red Gumard	11.2	7.1	9.9	16.6
Pogge	49.8	34.6	59.9	81.2
Lesser weever	4.4	5.6	11.1	7.2
Dragonet	401.4	660.1	498.9	593.3
Lesser Spotted Dogfish	8.7	11.6	4.5	3.9
Rays	3.4	5.1	4.0	2.1
Cod	0.0	0.5	0.5	0.3
Poor Cod	235.3	82.0	44.2	65.7
Bib	106.5	146.4	117.3	102.3
Whiting	0.7	2.3	0.2	0.4
Monkfish	0.0	0.0	0.0	0.0
John Dory	0.2	0.7	0.5	1.4
Red Mullet	0.0	0.2	0.7	0.0
Thickback Sole	1.3	4.3	7.2	9.0
Edible Crab	1.2	3.1	2.0	1.6

Sub-area 8 (Bristol Channel, VIIf&g)

	1991	1992	1993	1994
Sole-1	33.6	30.7	7.4	9.7
Sole-2	81.3	18.9	13.0	4.7
Sole-3+	33.9	20.5	14.9	14.4
Pla-1	92.7	28.4	3.9	5.1
Pla-2	4.1	18.5	13.1	4.3
Pla-3+	16.8	3.3	5.0	5.1
Dab (all)	35.6	72.0	179.7	149.8
Dab-1	-	-	-	-
Dab-2	-	-	-	-
Dab-3+	-	-	-	-
Turbot	2.6	1.8	0.6	0.6
Brill	1.1	1.5	1.3	0.6
Scaldfish	0.8	0.6	70.4	34.3
Lemon Sole	0.8	1.5	9.4	10.6
Long Rough Dab	0.0	0.0	13.6	47.1
Flounder	0.9	0.5	0.4	0.3
Solenette	120.8	73.3	96.7	78.7
Tub Gumard	4.2	5.9	1.3	1.9
Grey Gumard	30.3	45.4	69.8	72.4
Red Gumard	2.4	0.5	7.5	5.1
Pogge	0.8	1.5	13.5	4.9
Lesser weever	2.1	0.5	2.1	1.2
Dragonet	19.4	36.6	64.5	76.5
Lesser Spotted Dogfish	47.7	68.1	22.7	18.8
Rays	15.0	19.8	5.3	5.8
Cod	0.5	1.1	0.6	0.6
Poor Cod	243.0	225.2	214.1	93.5
Bib	75.5	47.1	11.6	3.2
Whiting	61.5	71.2	76.3	23.5
Monkfish	1.3	6.2	12.0	14.7
John Dory	0.8	0.2	1.3	0.2
Red Mullet	0.0	0.0	0.0	0.0
Thickback Sole	11.6	15.6	39.8	34.6
Edible Crab	3.7	4.5	3.0	1.2

Sub-area 9 (Irish Sea, Vlla)

	1991	1992	1993	1994
Sole-1	13.2	14.9	3.6	1.7
Sole-2	104.5	26.2	13.3	17.9
Sole-3+	33.8	86.6	25.9	26.2
Pla-1	64.4	50.7	168.5	207.0
Pla-2	67.3	96.2	155.4	124.6
Pla-3+	18.2	47.3	57.9	108.6
Dab (all)	369.8	226.7	398.2	638.5
Dab-1	-	-	-	-
Dab-2	-	-	-	-
Dab-3+	-	-	-	-
Turbot	0.4	0.2	0.1	0.2
Brill	2.0	1.5	1.7	0.8
Scaldfish	24.6	25.1	18.8	26.1
Lemon Sole	1.3	3.0	15.1	12.3
Long Rough Dab	0.2	0.1	1.9	4.5
Flounder	1.2	0.9	0.6	0.7
Solenette	146.0	103.0	134.4	165.9
Tub Gumard	5.3	13.2	4.7	4.4
Grey Gumard	46.0	69.3	80.9	88.7
Red Gumard	5.2	2.2	4.6	5.1
Pogge	36.6	37.1	88.7	47.3
Lesser weever	15.8	31.3	24.0	53.4
Dragonet	135.2	272.4	187.7	184.0
Lesser Spotted Dogfish	20.1	34.6	34.7	24.9
Rays	16.5	17.5	16.7	15.6
Cod	10.9	9.6	35.8	16.2
Poor Cod	37.2	69.2	331.5	130.6
Bib	30.5	33.2	6.0	1.1
Whitng	49.1	74.8	129.5	156.4
Monkfish	1.9	1.1	5.5	4.4
John Dory	0.3	0.4	0.4	0.1
Red Mullet	0.0	0.0	0.1	0.0
Thickback Sole	2.9	10.0	42.3	31.2
Edible Crab	9.9	10.9	8.5	9.7

Table 4.2 Catch rate of sole from Netherlands and UK surveys
in the North Sea and VII d,a,e,f&g

Netherlands (N.hr⁻¹/8m trawl) North Sea

Age	0	1	2	3	4	5	6	7	8	9	10+
1985	0.00	2.37	6.02	3.96	1.61	0.59	0.22	0.02	0.02	0.00	0.01
1986	0.00	5.93	4.88	1.55	1.04	0.46	0.23	0.11	0.00	0.00	0.13
1987	0.09	6.10	9.84	2.50	0.77	0.55	0.19	0.15	0.06	0.01	0.03
1988	0.00	70.61	11.14	3.06	0.80	0.16	0.16	0.09	0.06	0.02	0.05
1989	0.91	8.02	60.49	3.20	4.09	0.53	0.19	0.14	0.03	0.02	0.04
1990	0.09	18.99	19.40	19.49	0.95	0.69	0.23	0.08	0.07	0.01	0.02
1991	0.95	3.33	17.37	4.60	9.12	0.26	0.48	0.13	0.04	0.01	0.04
1992	0.21	67.82	24.40	9.13	2.48	3.44	0.11	0.17	0.04	0.03	0.06
1993	0.03	4.95	24.50	2.65	3.93	1.67	3.27	0.03	0.09	0.04	0.04
1994	0.82	6.54	5.65	15.26	0.11	1.49	0.01	0.88	0.01	0.00	0.02

United Kingdom (N.hr⁻¹/8m trawl) Eastern Channel (VIId)

Age	0	1	2	3	4	5	6	7	8	9	10+
1988	0.0	8.2	14.2	9.9	0.8	1.3	0.6	0.1	0.1	0.2	0.2
1989	0.0	2.6	15.4	3.4	1.7	0.6	0.2	0.2	0.0	0.0	0.7
1990	0.0	12.1	3.7	3.7	0.7	0.8	0.2	0.1	0.2	0.0	0.1
1991	0.0	8.9	22.8	2.2	2.3	0.3	0.5	0.1	0.2	0.1	0.1
1992	0.0	1.4	12.0	10.0	0.7	1.1	0.3	0.5	0.1	0.2	0.6
1993	0.0	0.5	17.5	8.4	7.0	0.8	1.0	0.3	0.2	0.0	0.4
1994	0.0	4.8	3.2	8.3	3.3	3.3	0.2	0.6	0.1	0.3	0.3

United Kingdom (N.hr⁻¹/8m trawl) Western Channel (VIle)

Age	0	1	2	3	4	5	6	7	8	9	10+
1989	0.0	0.2	2.5	4.9	4.3	1.5	1.6	0.7	0.3	0.3	0.4
1990	0.0	0.6	1.7	3.1	1.3	1.0	0.3	0.6	0.1	0.2	0.5
1991	0.0	0.3	7.9	2.9	2.1	1.0	0.8	0.3	0.7	0.2	0.7
1992	0.0	0.2	5.8	11.6	1.5	1.3	0.5	0.3	0.2	0.4	0.5
1993	0.0	0.3	2.7	5.4	5.4	1.0	0.5	0.3	0.2	0.1	0.7
1994	0.0	0.1	1.7	3.3	2.4	1.4	0.2	0.3	0.0	0.1	0.3

United Kingdom (N.hr⁻¹/8m trawl) Bristol Channel (VIIf&g)

Age	0	1	2	3	4	5	6	7	8	9	10+
1988	2.2	6.7	26.6	3.7	1.8	0.9	0.0	0.0	0.0	0.0	0.4
1989	18.6	19.7	27.0	18.7	2.2	2.4	1.2	0.4	0.1	0.1	0.0
1990	6.9	30.8	18.2	6.2	1.9	1.0	3.4	0.5	0.0	0.0	0.5
1991	4.0	16.9	40.6	8.8	2.9	4.3	0.4	0.0	0.1	0.3	0.3
1992	0.3	30.7	18.9	12.1	3.0	2.1	1.5	0.1	0.5	0.2	1.0
1993	0.0	7.4	13.0	4.5	6.4	2.6	0.7	0.1	0.1	0.2	0.2
1994	0.1	9.7	4.7	5.9	3.8	2.5	1.0	0.1	0.1	0.7	0.1

United Kingdom (N.hr⁻¹/8m trawl) Irish Sea (VIIa)

Age	0	1	2	3	4	5	6	7	8	9	10+
1988	0.2	8.8	24.3	23.3	43.8	8.6	4.6	0.1	0.0	0.0	0.0
1989	2.0	15.8	25.9	22.1	9.9	25.0	4.9	1.8	0.0	0.0	0.2
1990	0.9	122.7	53.8	12.1	4.0	9.5	15.2	2.6	1.4	0.6	0.1
1991	0.3	13.2	105.2	17.0	2.8	1.1	2.1	8.4	2.3	0.2	0.3
1992	0.1	14.9	26.2	53.9	14.3	6.2	1.2	0.5	7.9	1.7	0.8
1993	0.0	3.6	13.3	7.0	11.3	2.7	1.0	0.4	0.7	1.9	0.9
1994	0.0	1.7	17.9	10.0	4.3	6.5	2.4	0.7	0.5	0.2	1.6

Table 4.3 Catch rate of plaice from Netherlands and UK surveys
in the North Sea and VII d,a,e,f&g

Netherlands (N.hr⁻¹/8m trawl) North Sea

Age	0	1	2	3	4	5	6	7	8	9	10+
1985	44.76	105.67	185.89	39.49	13.33	1.50	1.02	0.52	0.16	0.19	0.45
1986	14.56	634.26	125.85	50.38	10.18	4.69	0.91	0.48	0.25	0.07	0.24
1987	39.04	207.67	707.45	32.12	9.46	2.67	1.54	0.33	0.18	0.10	0.25
1988	86.69	541.24	151.10	207.99	6.78	3.05	0.74	0.57	0.13	0.14	0.26
1989	73.25	397.99	337.87	56.08	51.10	7.89	1.13	0.42	0.25	0.07	0.32
1990	15.36	123.15	122.13	67.36	22.32	10.20	1.13	0.28	0.23	0.07	0.12
1991	6.12	187.16	125.54	30.11	21.64	5.36	4.58	0.59	0.17	0.08	0.21
1992	15.34	179.56	117.20	20.62	6.10	4.97	2.88	1.41	0.39	0.04	0.09
1993	49.66	124.92	164.11	36.89	7.26	1.77	1.54	0.51	0.47	0.15	0.13
1994	154.82	153.12	62.38	33.76	10.62	2.76	0.55	0.77	1.33	0.38	0.04

United Kingdom (N.hr⁻¹/8m trawl) Eastern Channel (VIId)

Age	0	1	2	3	4	5	6	7	8	9	10+
1988	0.0	26.5	31.3	43.8	7.0	4.6	1.5	0.8	0.7	0.6	1.2
1989	0.0	2.3	12.1	16.6	19.9	3.3	1.5	1.3	0.5	0.3	1.7
1990	0.6	5.2	4.9	5.8	6.7	7.5	1.8	0.7	1.0	0.8	0.4
1991	0.0	11.7	9.1	7.0	5.3	5.4	3.2	1.2	1.0	0.1	1.2
1992	0.0	16.5	12.5	4.2	4.2	5.6	4.9	3.4	0.7	0.5	0.7
1993	0.1	3.2	13.4	5.0	1.7	1.9	1.6	2.0	2.8	0.4	0.6
1994	1.2	8.3	7.5	9.2	5.6	2.0	0.8	0.9	1.8	1.2	0.8

United Kingdom (N.hr⁻¹/8m trawl) Western Channel (VIIe)

Age	0	1	2	3	4	5	6	7	8	9	10+
1989	0.0	0.8	2.2	10.6	7.5	1.4	0.2	0.3	0.2	0.1	0.3
1990	0.0	0.8	1.1	7.0	3.4	2.4	0.0	0.2	0.1	0.1	0.3
1991	0.0	0.6	0.8	1.4	2.7	2.1	1.6	0.7	0.1	0.0	0.3
1992	0.0	4.3	1.0	1.4	0.5	1.3	0.7	0.5	0.1	0.2	0.2
1993	0.0	0.7	2.4	3.3	1.1	0.5	1.2	0.7	0.6	0.0	0.1
1994	0.0	0.8	0.8	3.6	1.2	0.4	0.2	0.5	0.6	0.3	0.0

United Kingdom (N.hr⁻¹/8m trawl) Bristol Channel (VII f&g)

Age	0	1	2	3	4	5	6	7	8	9	10+
1988	0.4	10.9	26.2	7.5	0.0	0.7	0.7	0.0	0.0	0.2	0.0
1989	0.5	15.1	26.5	7.4	2.1	0.8	0.0	0.1	0.0	0.0	0.0
1990	0.9	11.4	15.8	6.4	2.5	0.4	0.0	0.0	0.3	0.0	0.3
1991	0.1	43.2	1.8	3.6	1.4	0.5	0.3	0.0	0.3	0.0	0.0
1992	0.2	28.4	18.5	0.8	0.4	1.2	0.3	0.3	0.0	0.0	0.1
1993	0.1	3.9	13.1	2.9	0.7	0.3	0.8	0.2	0.0	0.0	0.0
1994	3.3	5.1	4.3	3.4	1.0	0.0	0.0	0.2	0.1	0.0	0.4

United Kingdom (N.hr⁻¹/8m trawl) Irish Sea (VIIa)

Age	0	1	2	3	4	5	6	7	8	9	10+
1988	2.9	72.6	145.3	30.8	1.2	6.8	1.2	0.5	0.0	0.1	0.8
1989	5.9	41.3	67.6	64.8	11.3	1.4	3.4	0.3	0.0	0.0	0.1
1990	63.4	146.9	36.7	19.9	9.1	4.8	4.1	0.2	0.1	0.9	0.3
1991	6.7	60.4	59.8	8.1	4.4	0.1	0.9	1.8	0.1	0.0	0.4
1992	4.8	50.7	96.1	38.0	2.0	2.1	1.5	1.6	0.1	0.0	2.0
1993	9.3	168.5	155.4	38.7	13.0	2.0	1.9	1.0	0.4	0.4	0.6
1994	14.6	207.0	124.6	81.4	17.5	5.6	1.4	1.4	0.6	0.2	0.6

Figure 2.1 Number of hauls

Beam trawl survey: August-October 1994 (N/h in 8-m beam trawl)

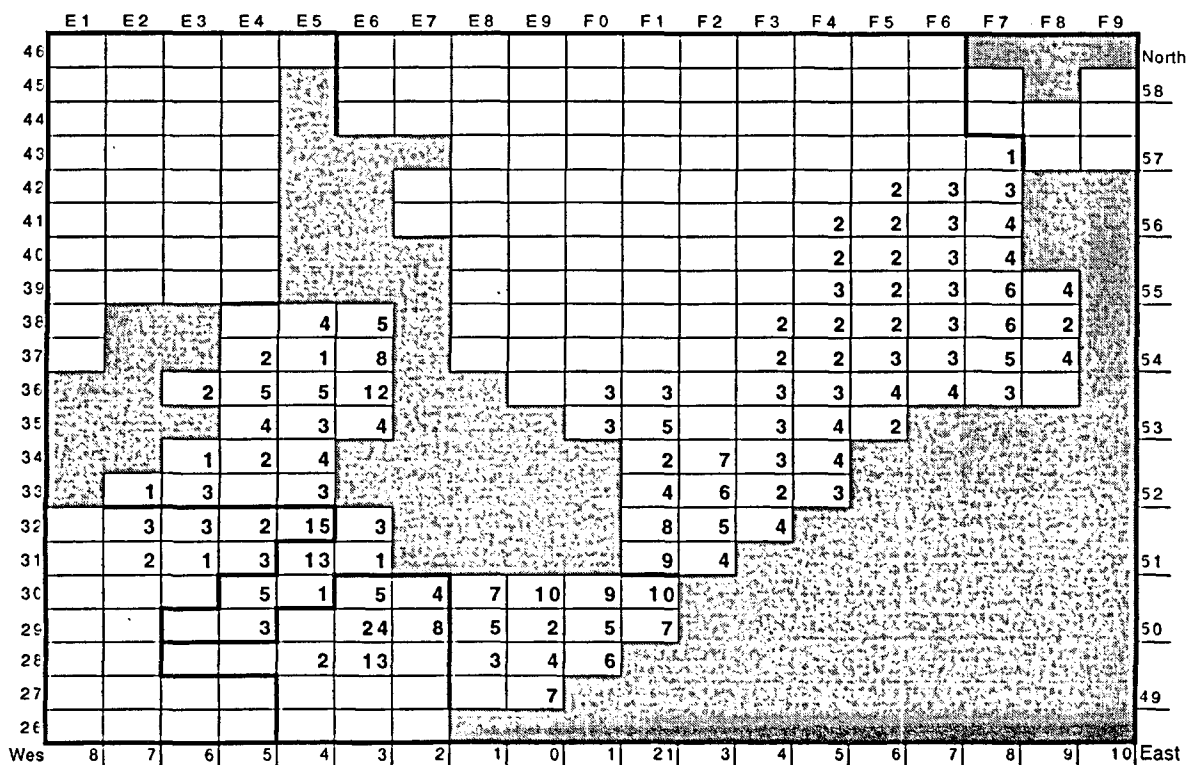
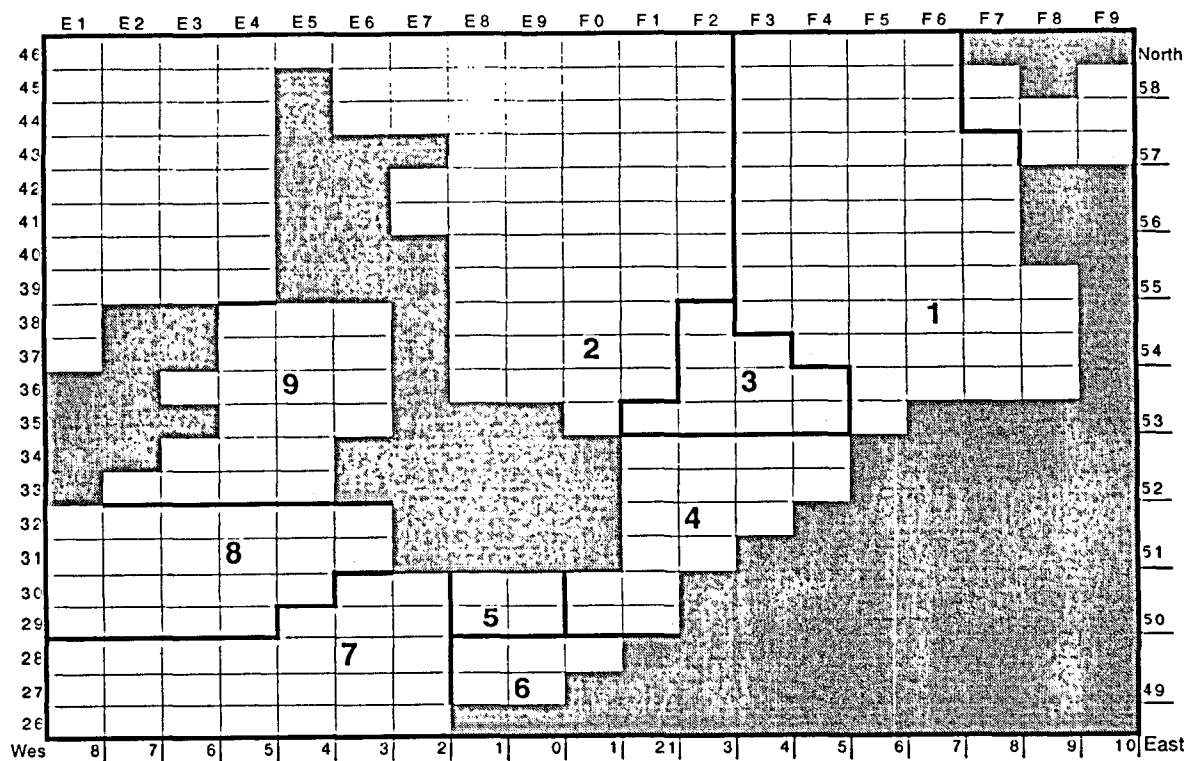


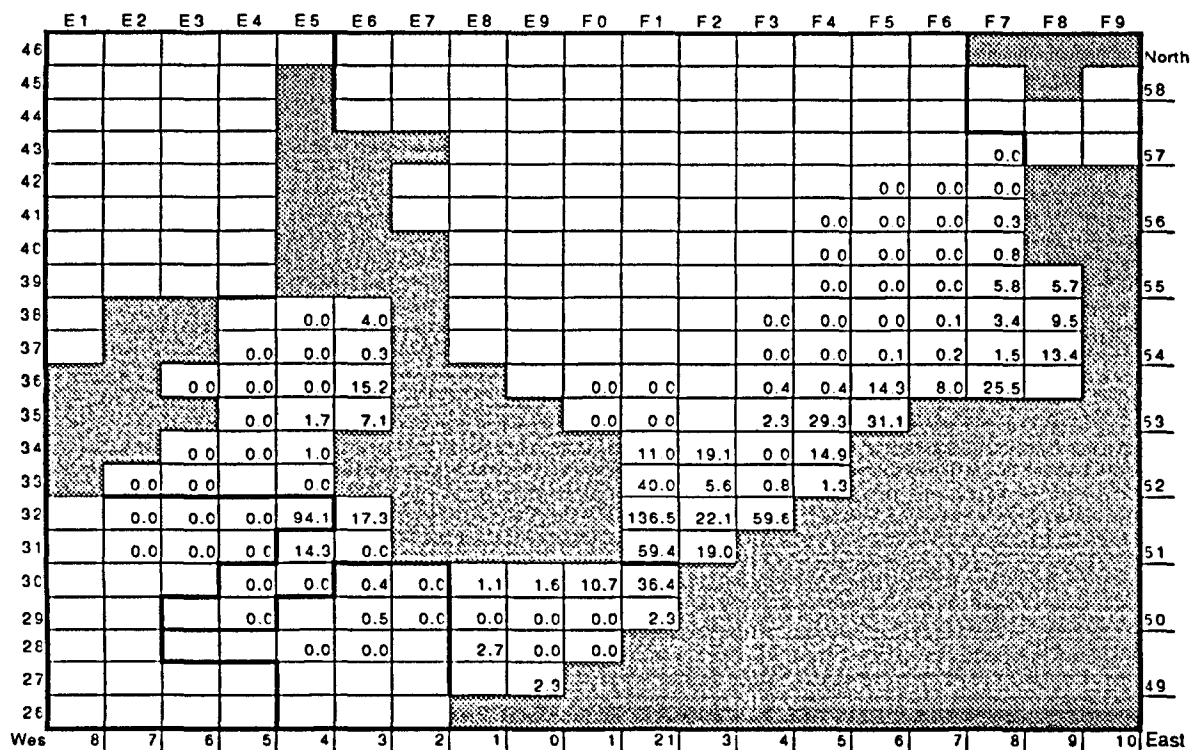
Figure 3.1 Sub-area codes

Beam trawl survey: August-October 1994



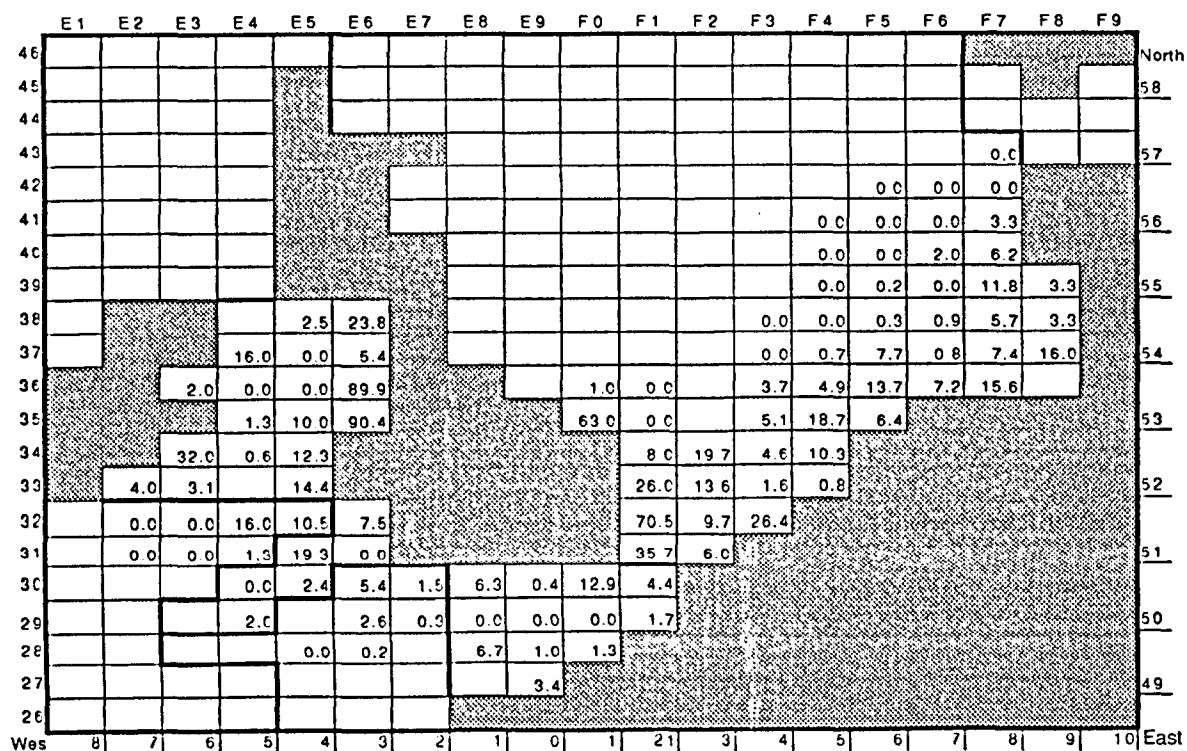
Sole-1

Beam trawl survey: August-October 1994 (N/h In 8-m beam trawl)



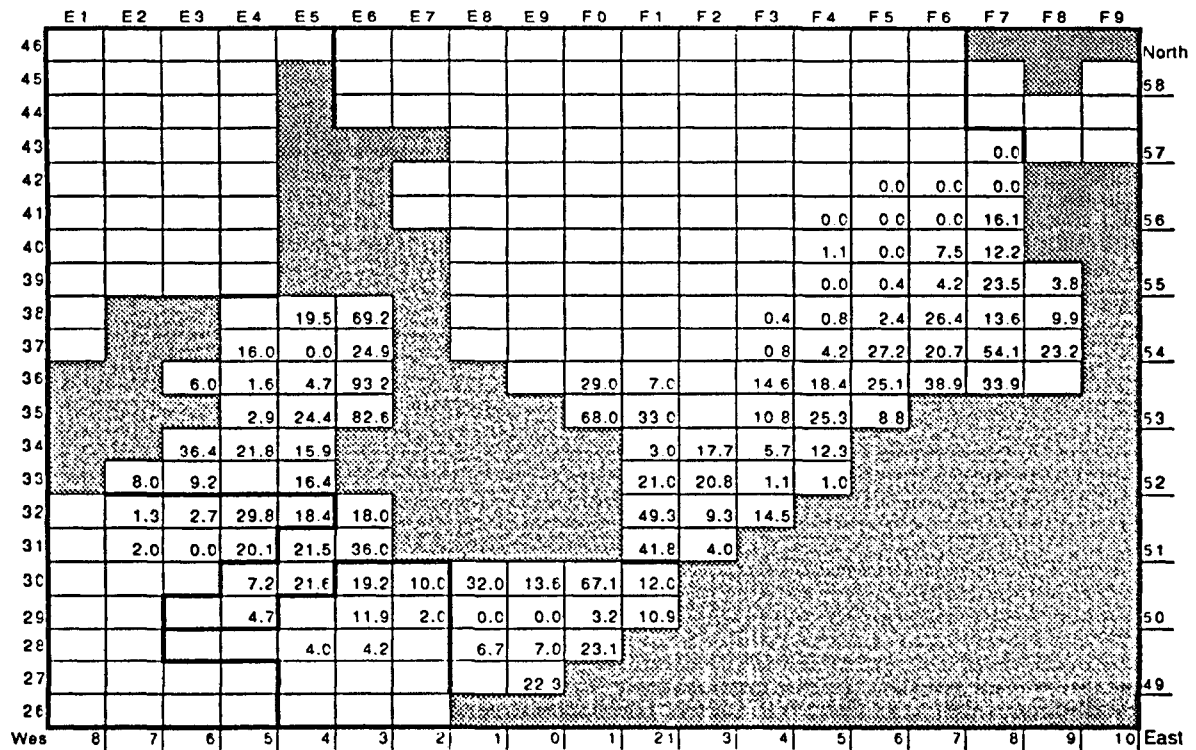
Sole-2

Beam trawl survey: August-October 1994 (N/h In 8-m beam trawl)



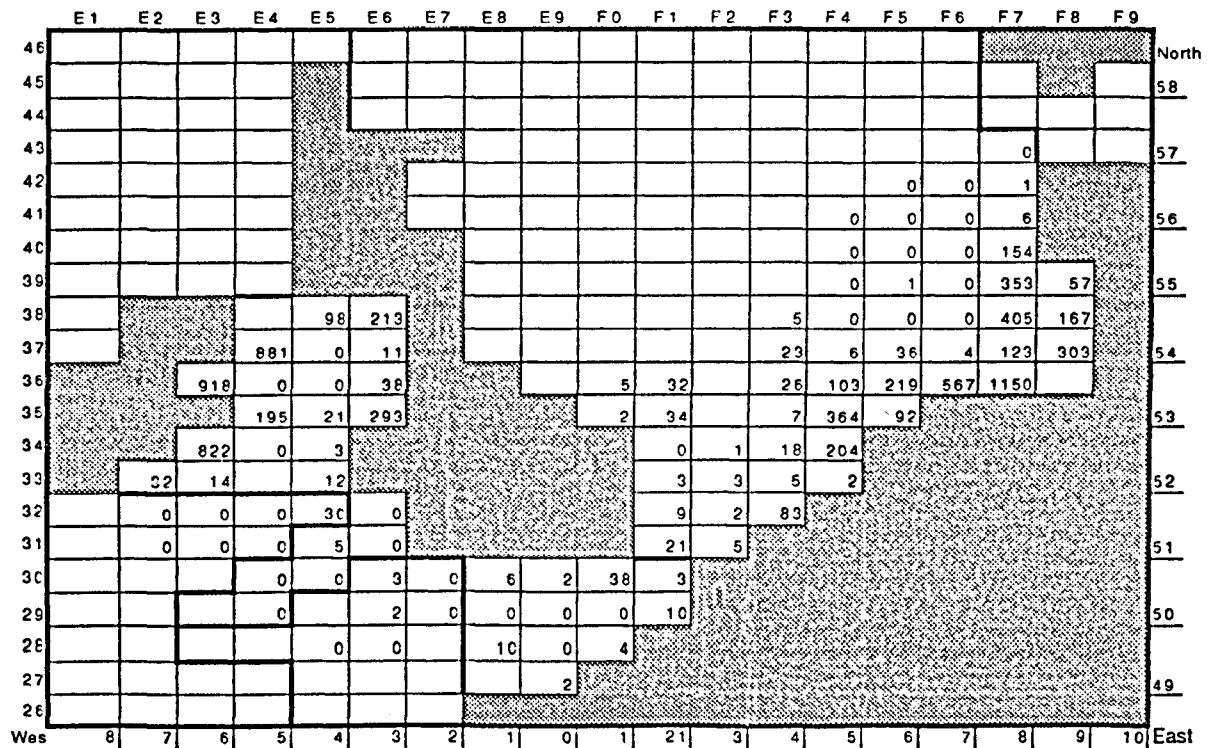
Sole-3+

Beam trawl survey: August-October 1994 (N/h in 8-m beam trawl)



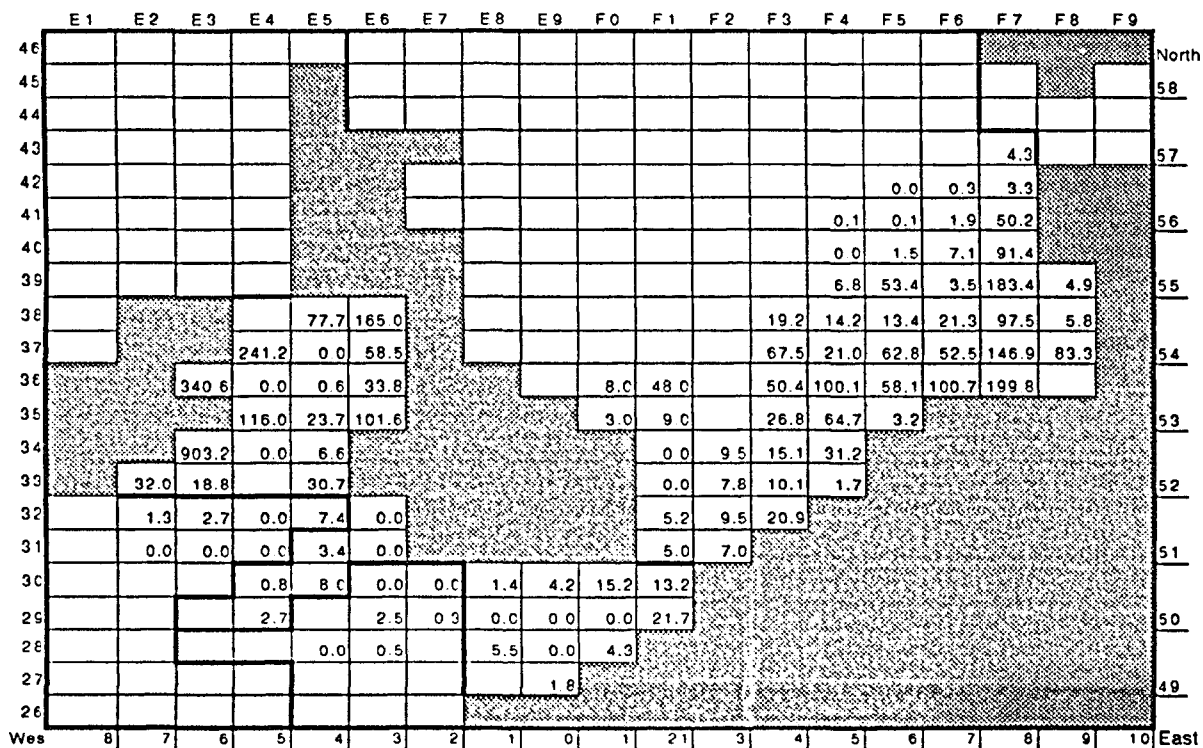
Pla-1

Beam trawl survey: August-October 1994 (N/h in 8-m beam trawl)



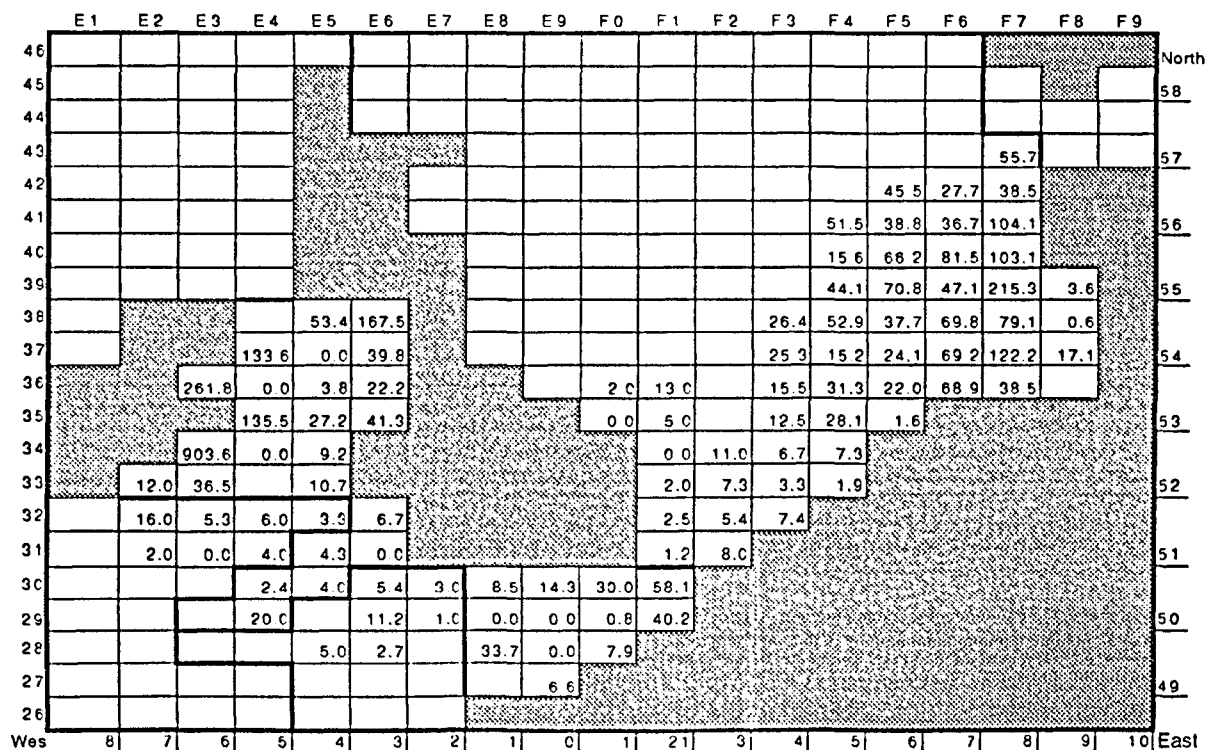
Pla-2

Beam trawl survey: August-October 1994 (N/h in 8-m beam trawl)



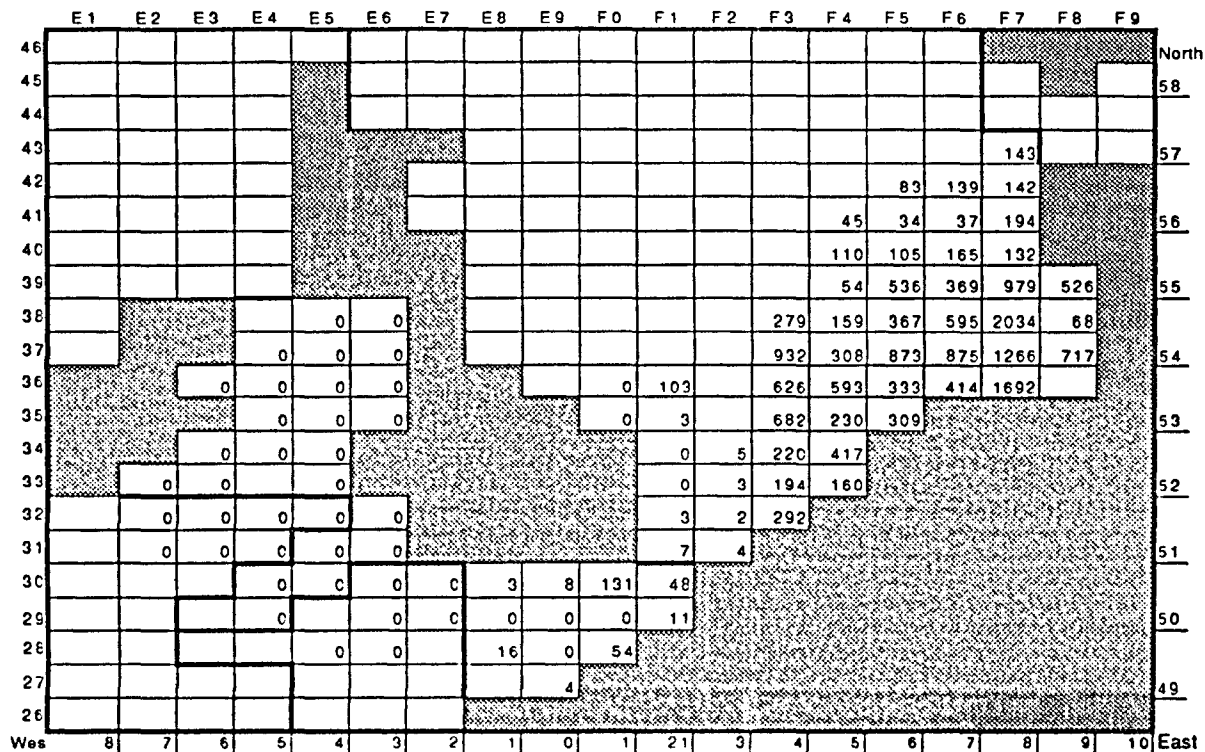
Pla-3+

Beam trawl survey: August-October 1994 (N/h in 8-m beam trawl)



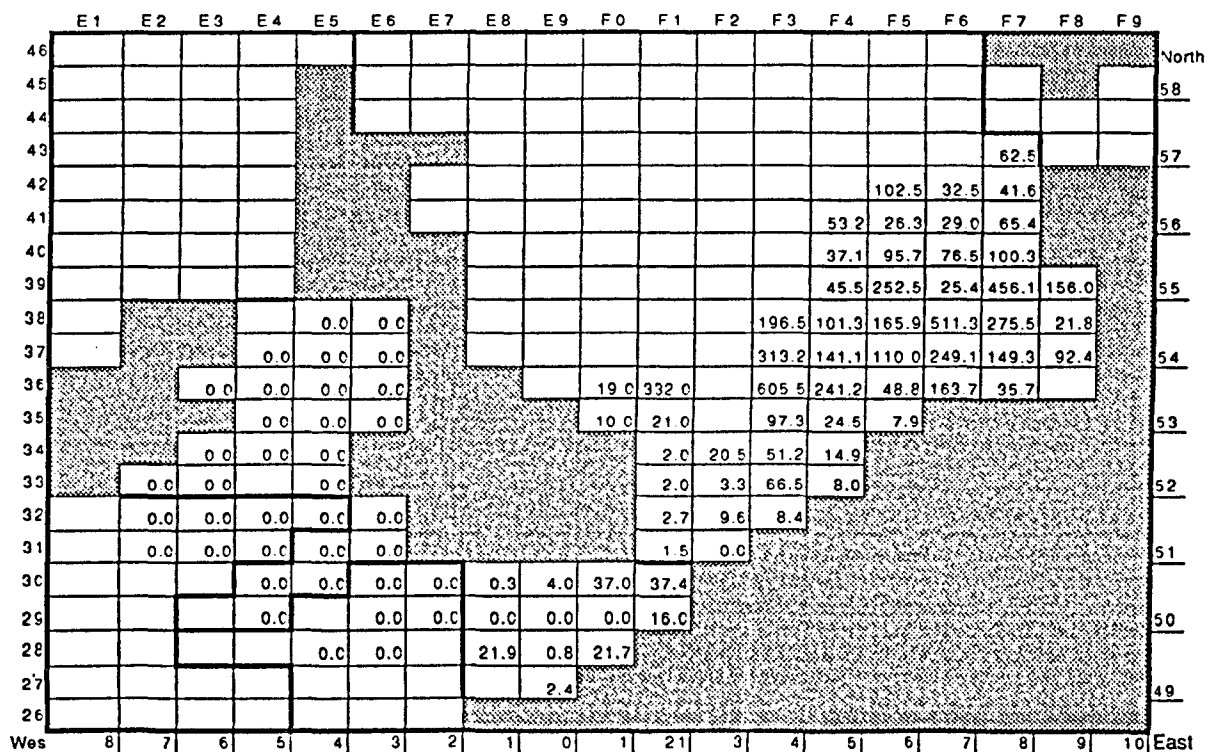
Dab-1

Beam trawl survey: August-October 1994 (N/h in 8-m beam trawl)



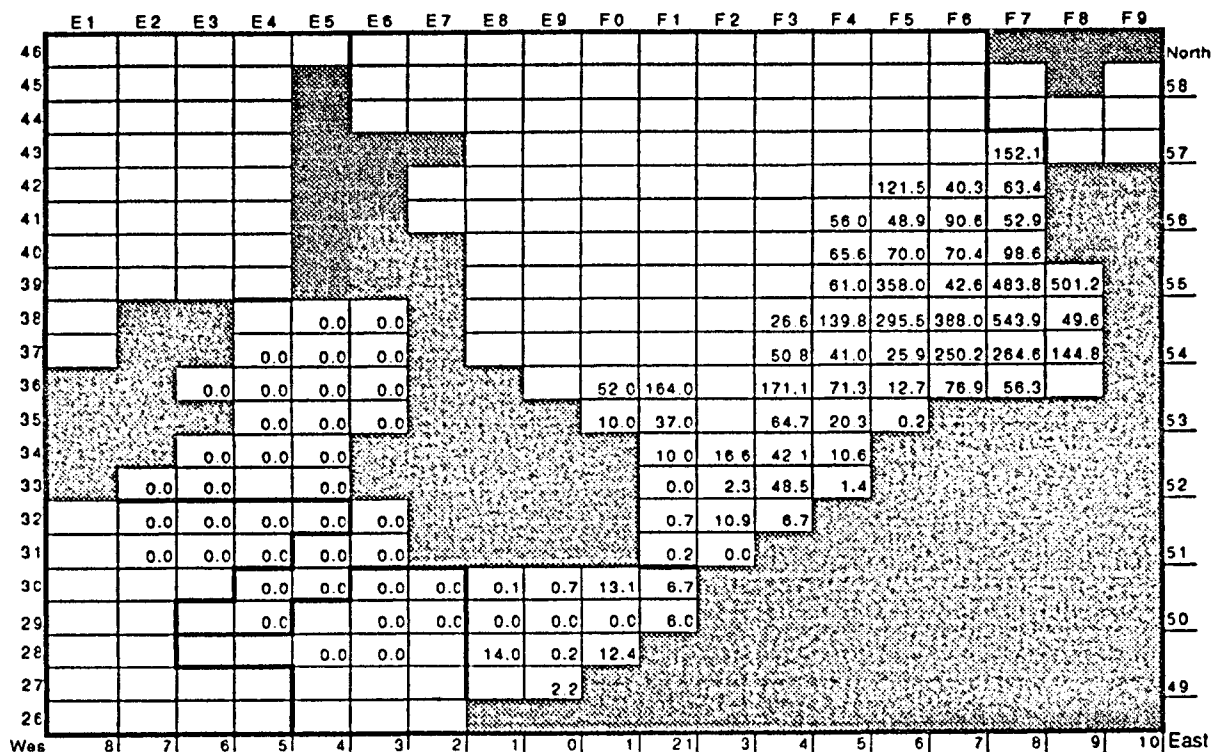
Dab-2

Beam trawl survey: August-October 1994 (N/h in 8-m beam trawl)



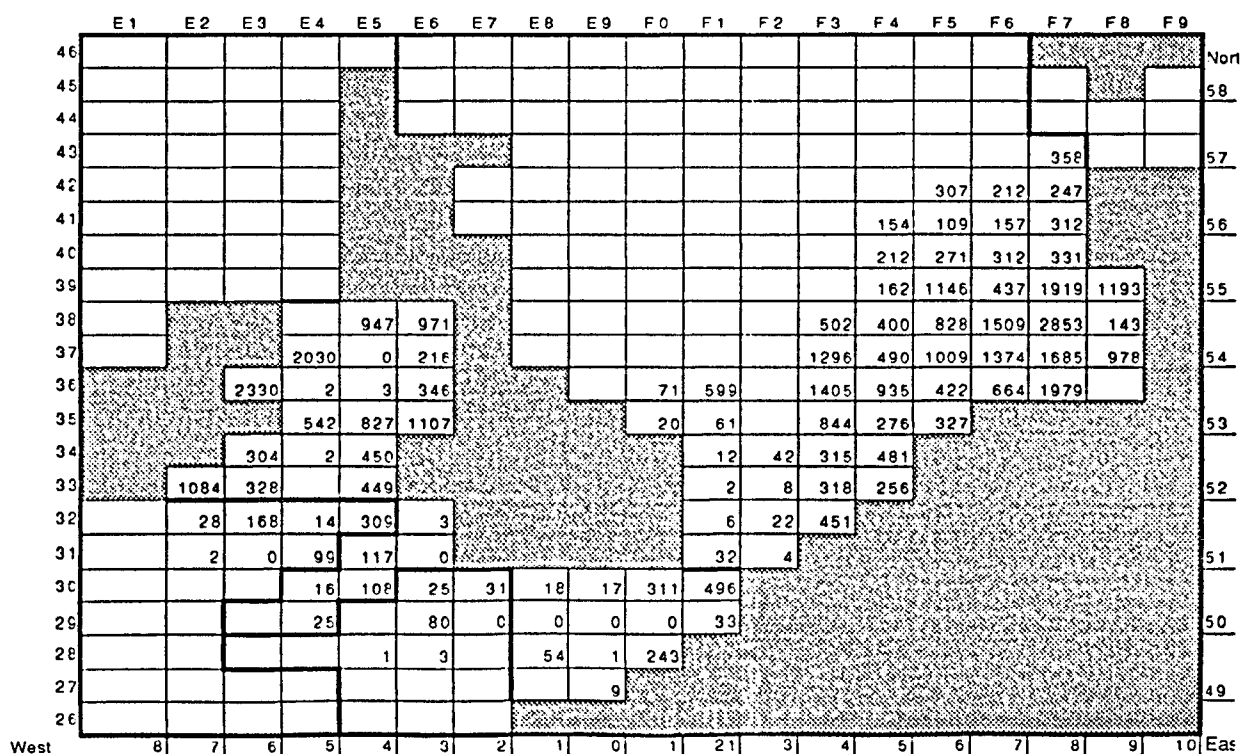
Dab-3+

Beam trawl survey: August-October 1994 (N/h in 8-m beam trawl)



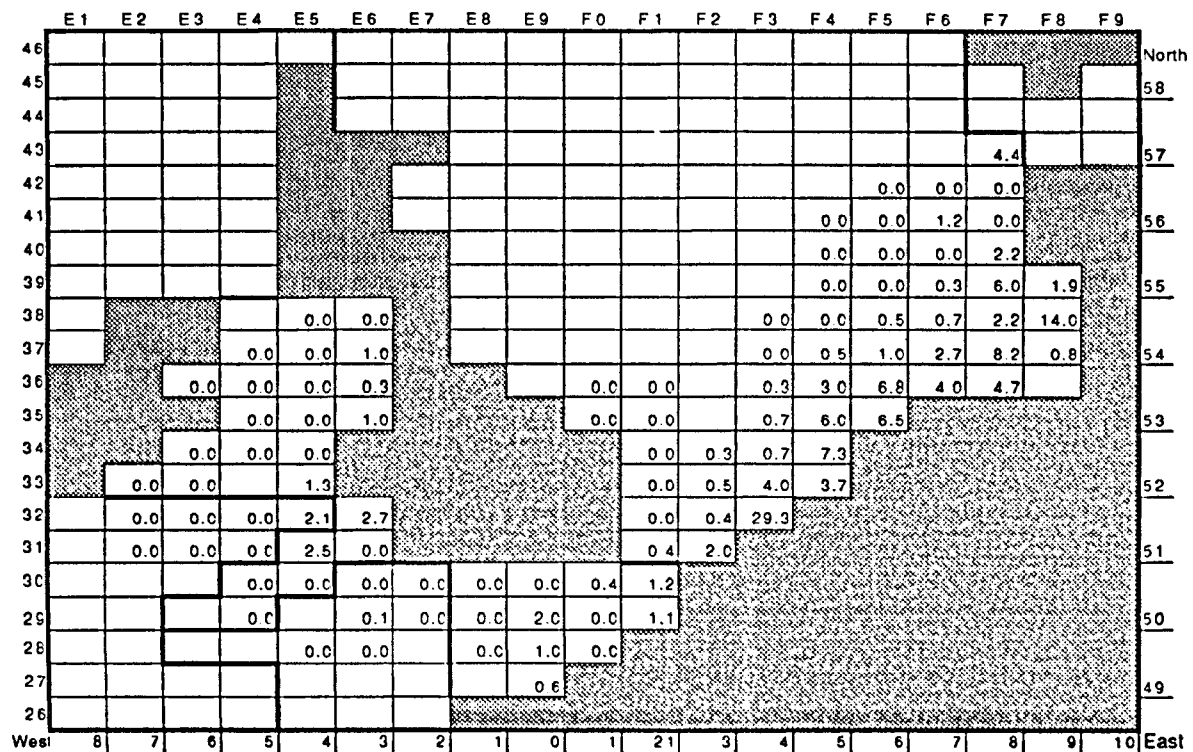
Dab (all)

Beam trawl survey: August-October 1994 (N/h in 8-m beam trawl)



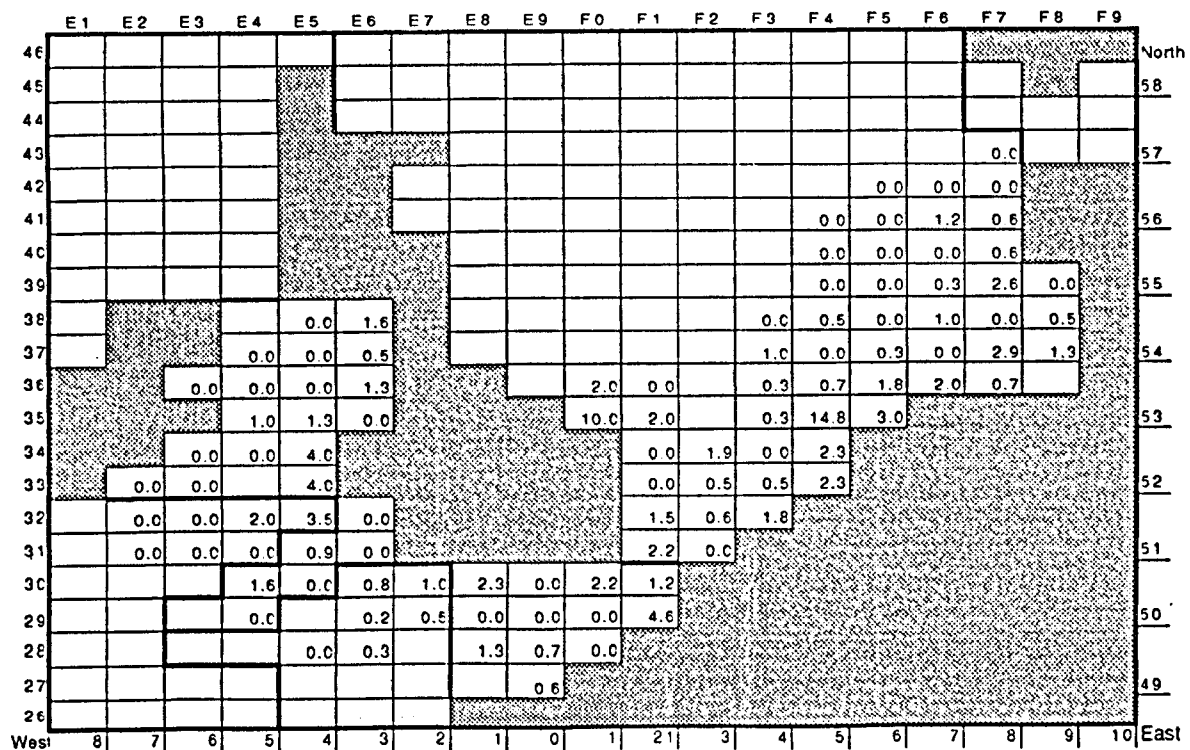
Turbot

Beam trawl survey: August-October 1994 (N/h in 8-m beam trawl)



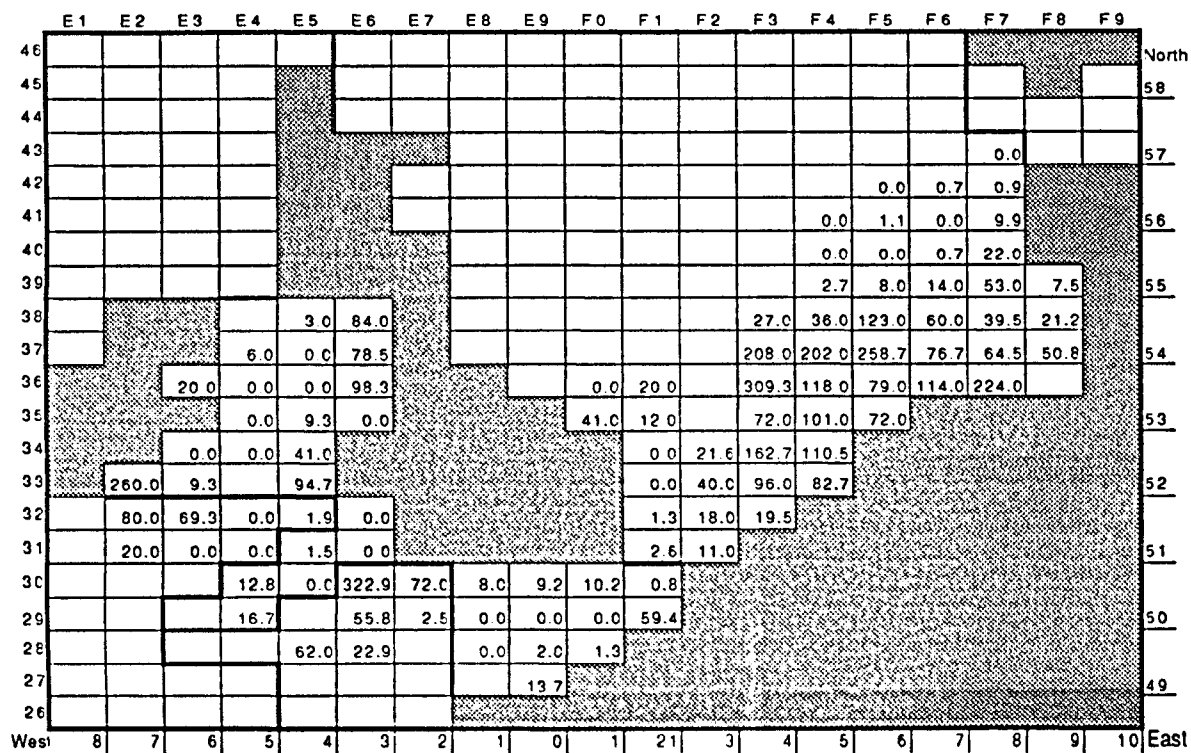
Brill

Beam trawl survey: August-October 1994 (N/h in 8-m beam trawl)



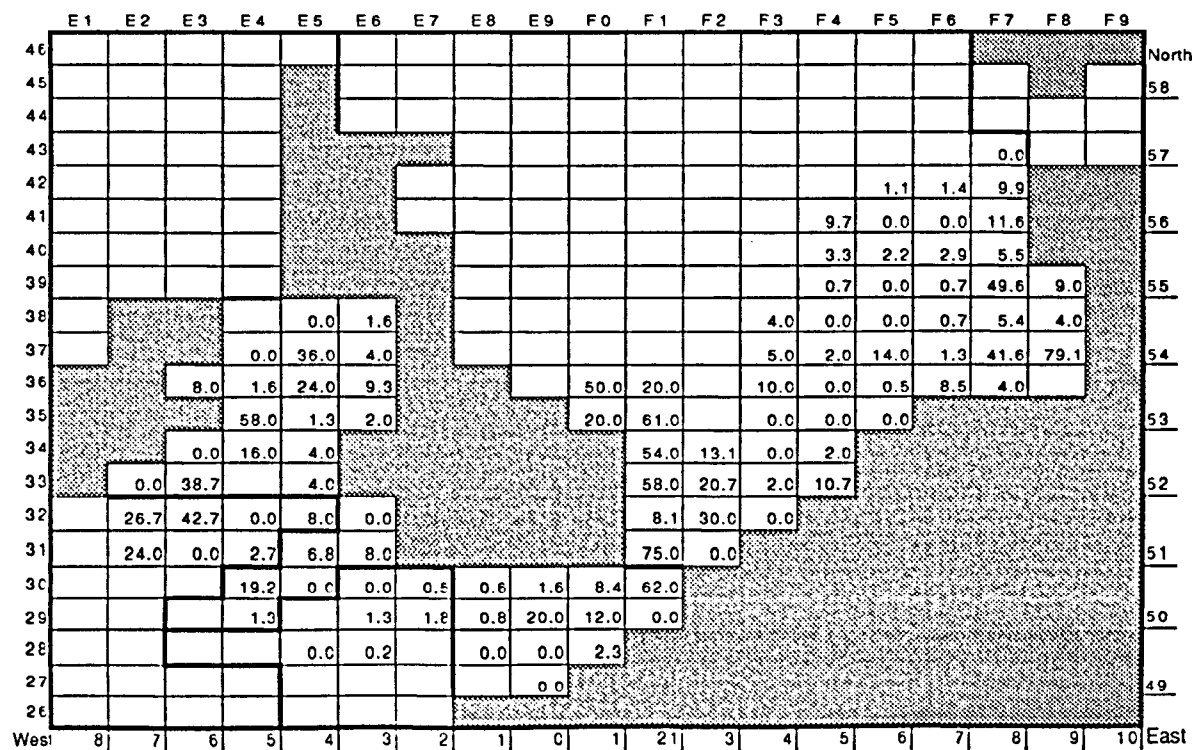
Scaldfish

Beam trawl survey: August-October 1994 (N/h in 8-m beam trawl)



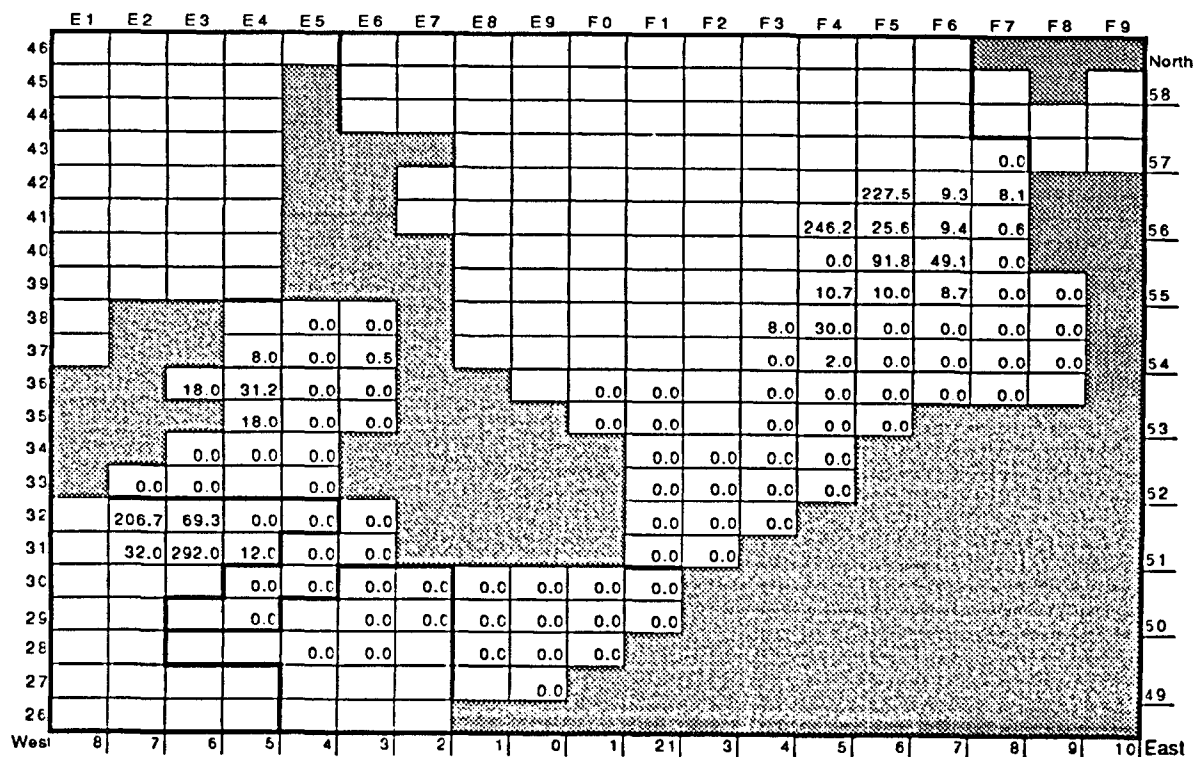
Lemon Sole

Beam trawl survey: August-October 1994 (N/h in 8-m beam trawl)



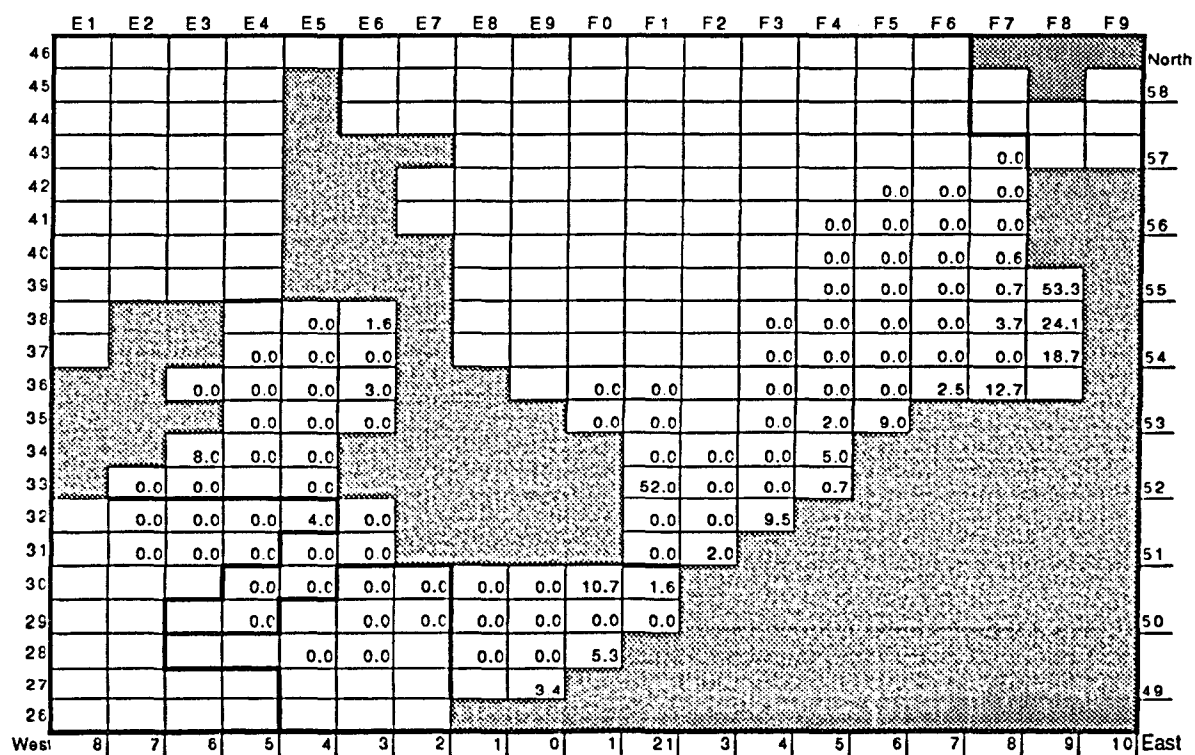
Long Rough Dab

Beam trawl survey: August-October 1994 (N/h in 8-m beam trawl)



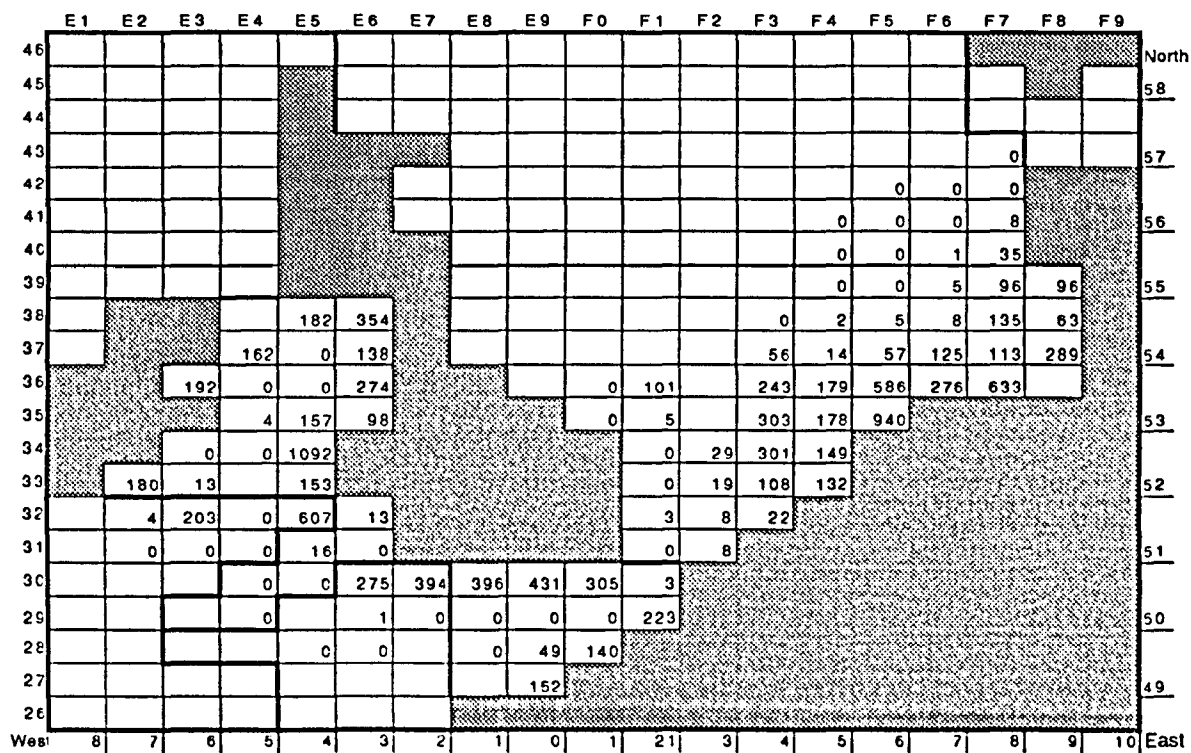
Flounder

Beam trawl survey: August-October 1994 (N/h in 8-m beam trawl)



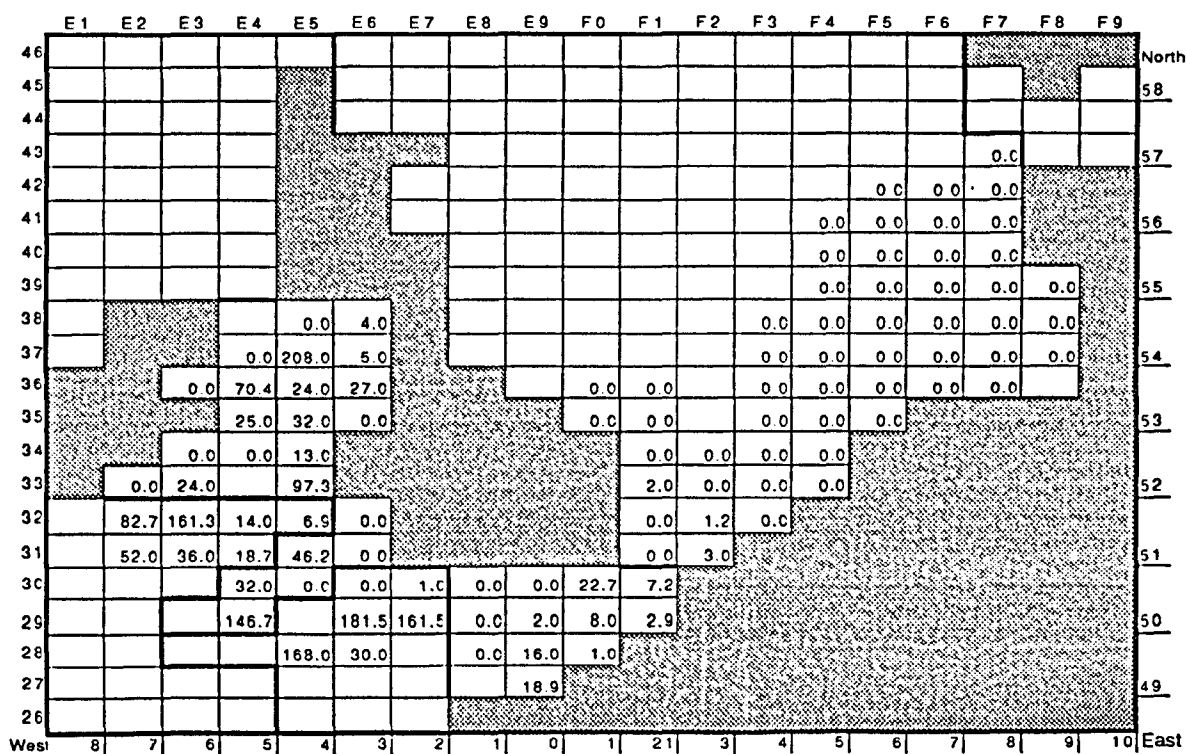
Solenette

Beam trawl survey: August-October 1994 (N/h in 8-m beam trawl)



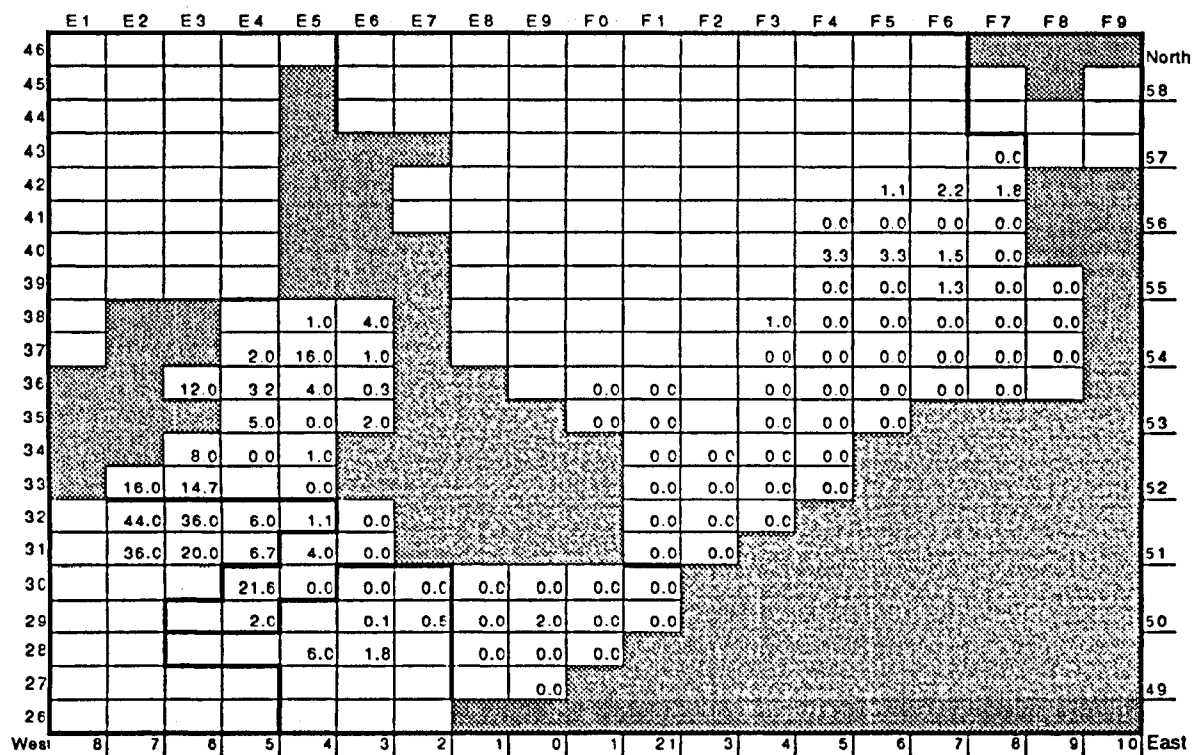
Thickback Sole

Beam trawl survey: August-October 1994 (N/h in 8-m beam trawl)



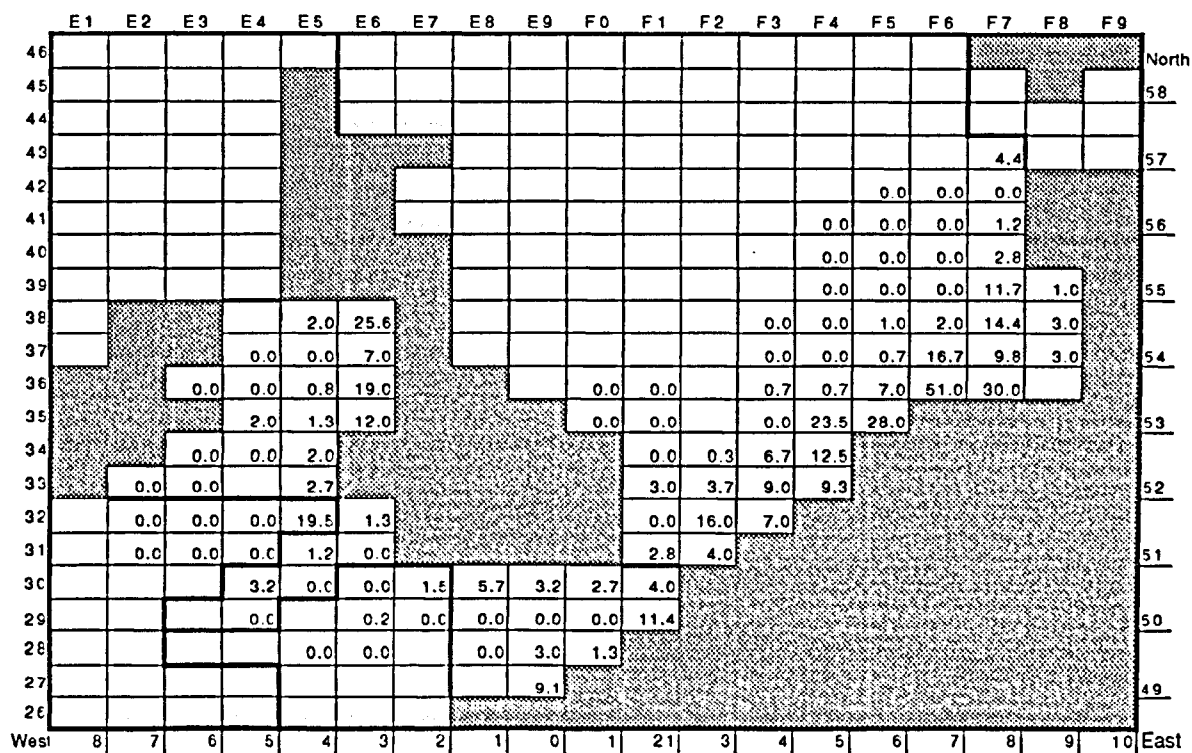
Monkfish

Beam trawl survey: August-October 1994 (N/h in 8-m beam trawl)



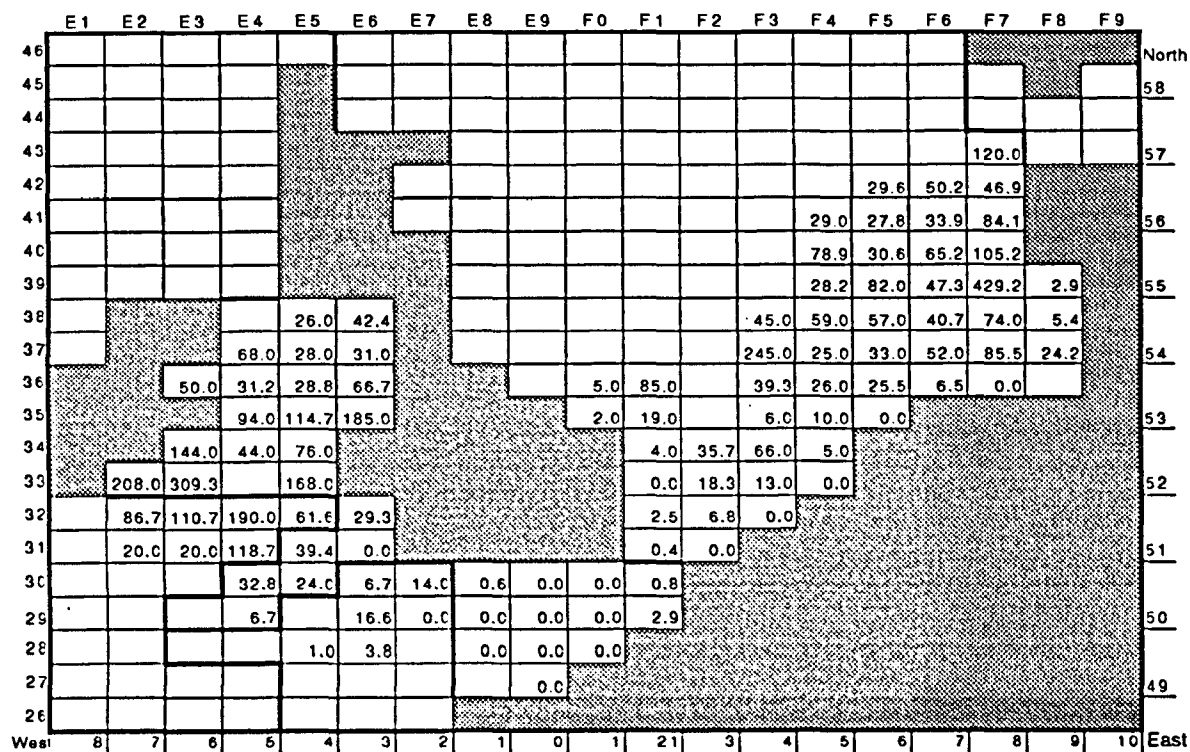
Tub Gurnard

Beam trawl survey: August-October 1994 (N/h in 8-m beam trawl)



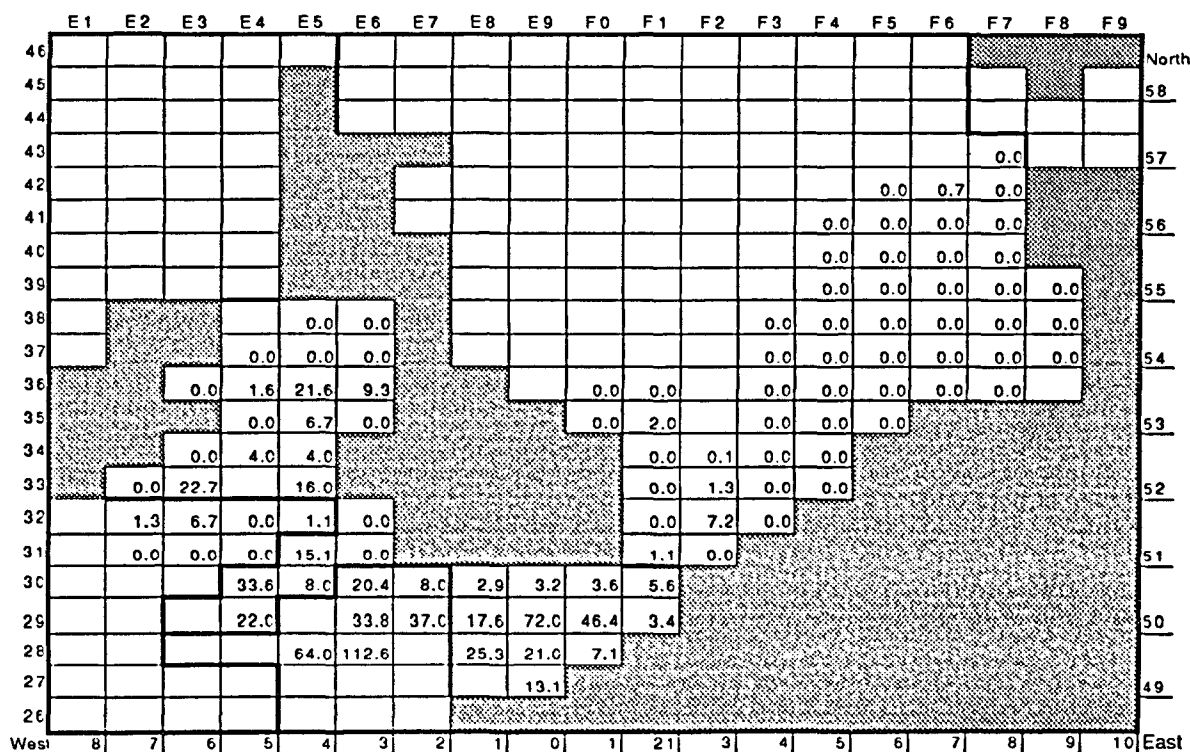
Grey Gurnard

Beam trawl survey: August-October 1994 (N/h in 8-m beam trawl)



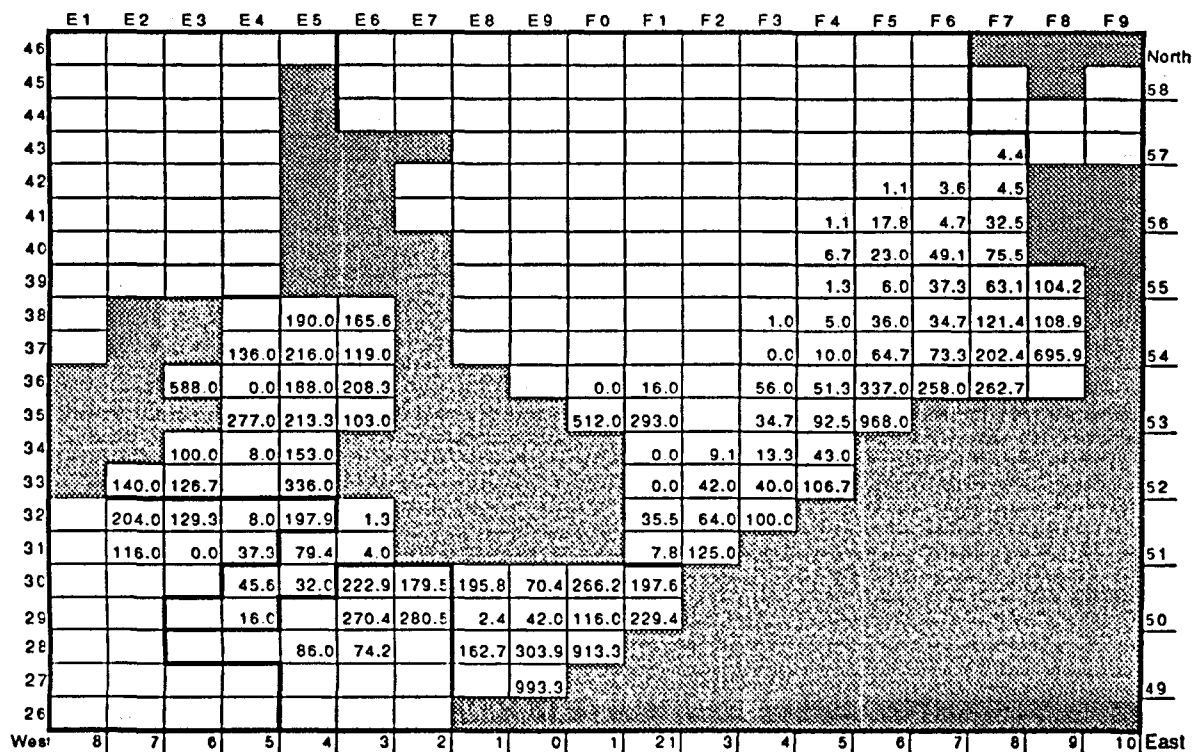
Red Gurnard

Beam trawl survey: August-October 1994 (N/h in 8-m beam trawl)



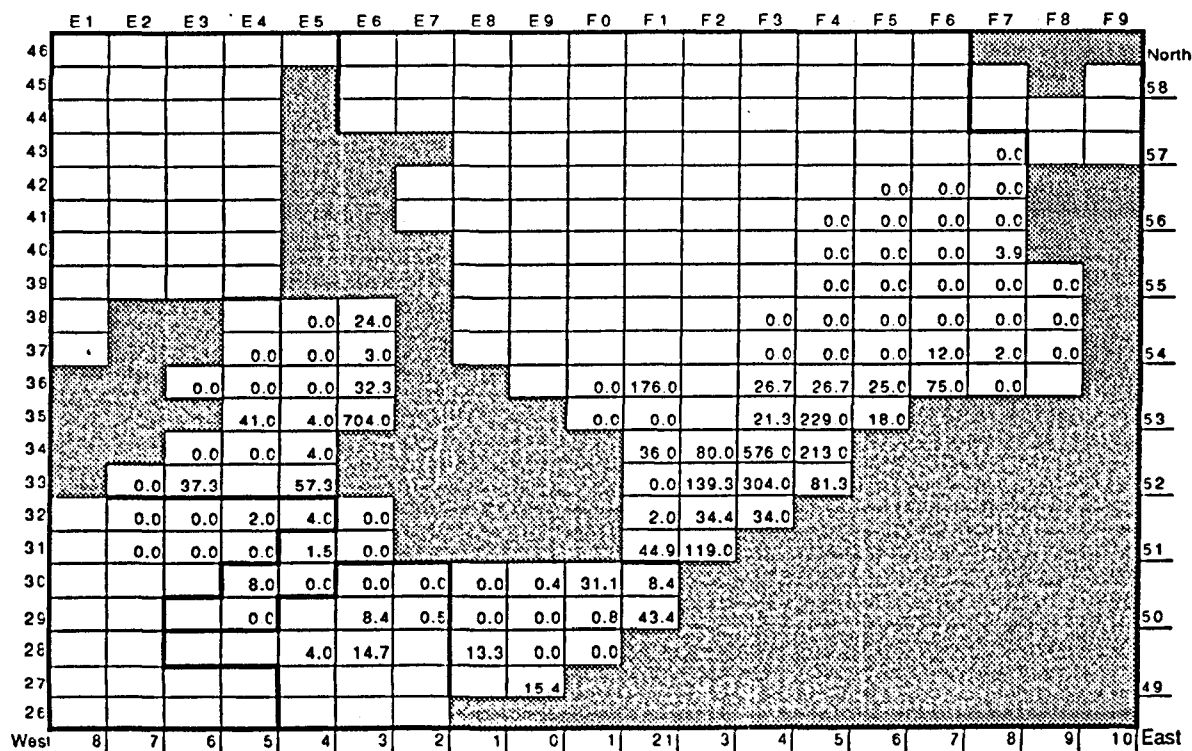
Dragonet

Beam trawl survey: August-October 1994 (N/h In 8-m beam trawl)



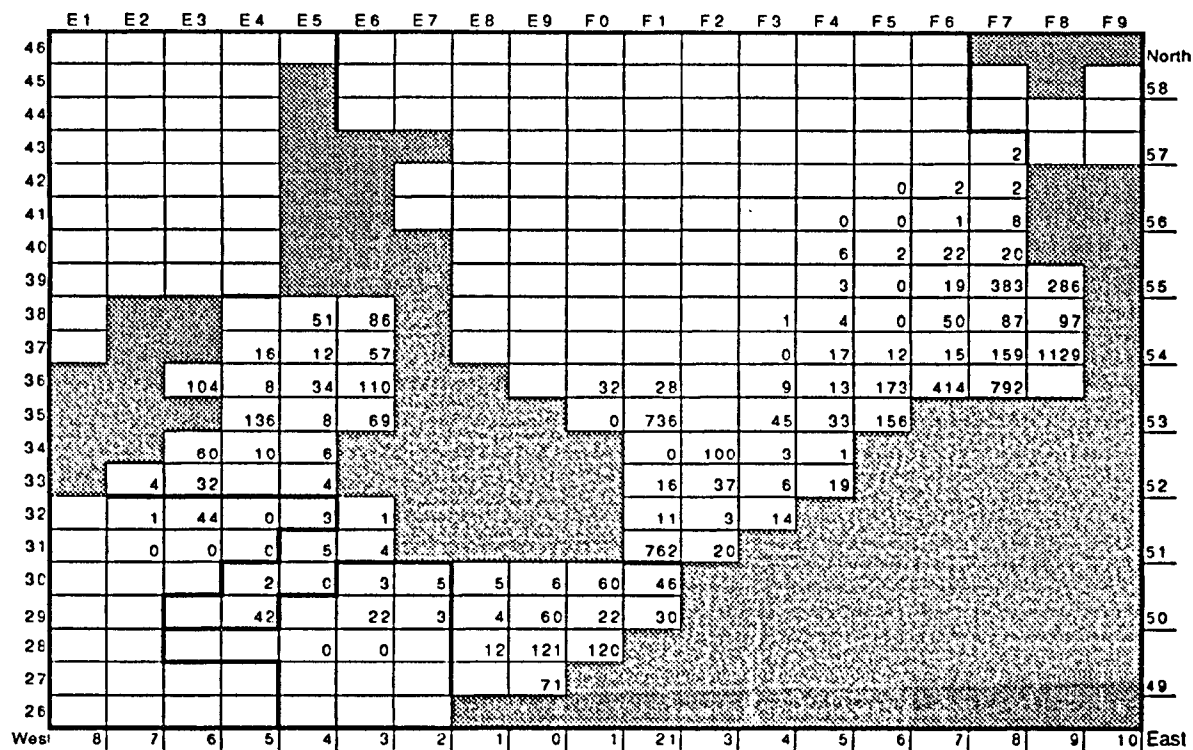
Lesser weever

Beam trawl survey: August-October 1994 (N/h In 8-m beam trawl)



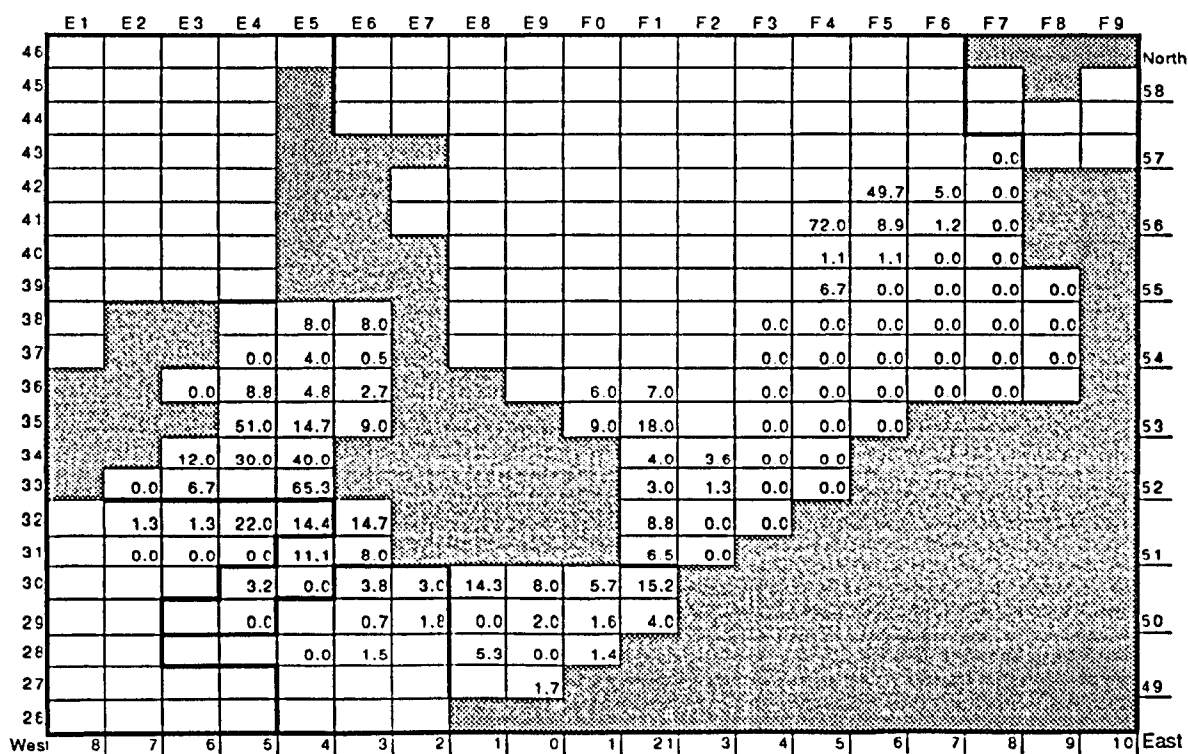
Pogge

Beam trawl survey: August-October 1994 (N/h in 8-m beam trawl)



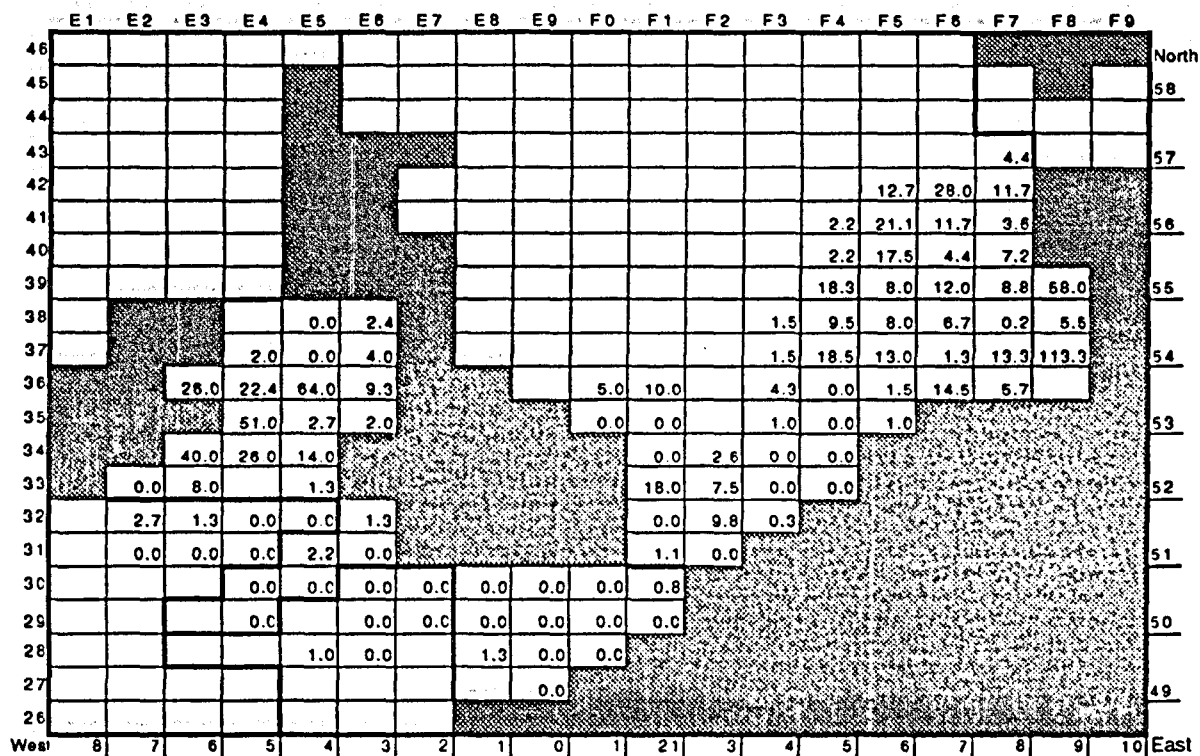
Rays

Beam trawl survey: August-October 1994 (N/h in 8-m beam trawl)



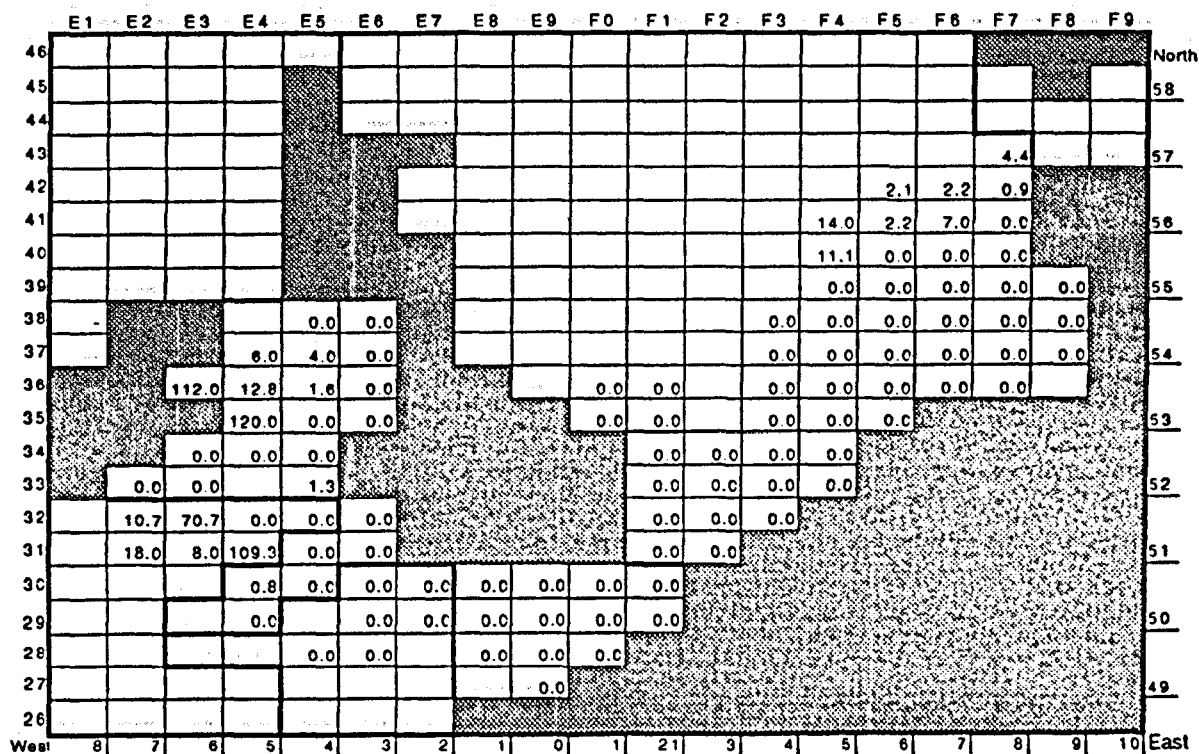
Cod

Beam trawl survey: August-October 1994 (N/h in 8-m beam trawl)



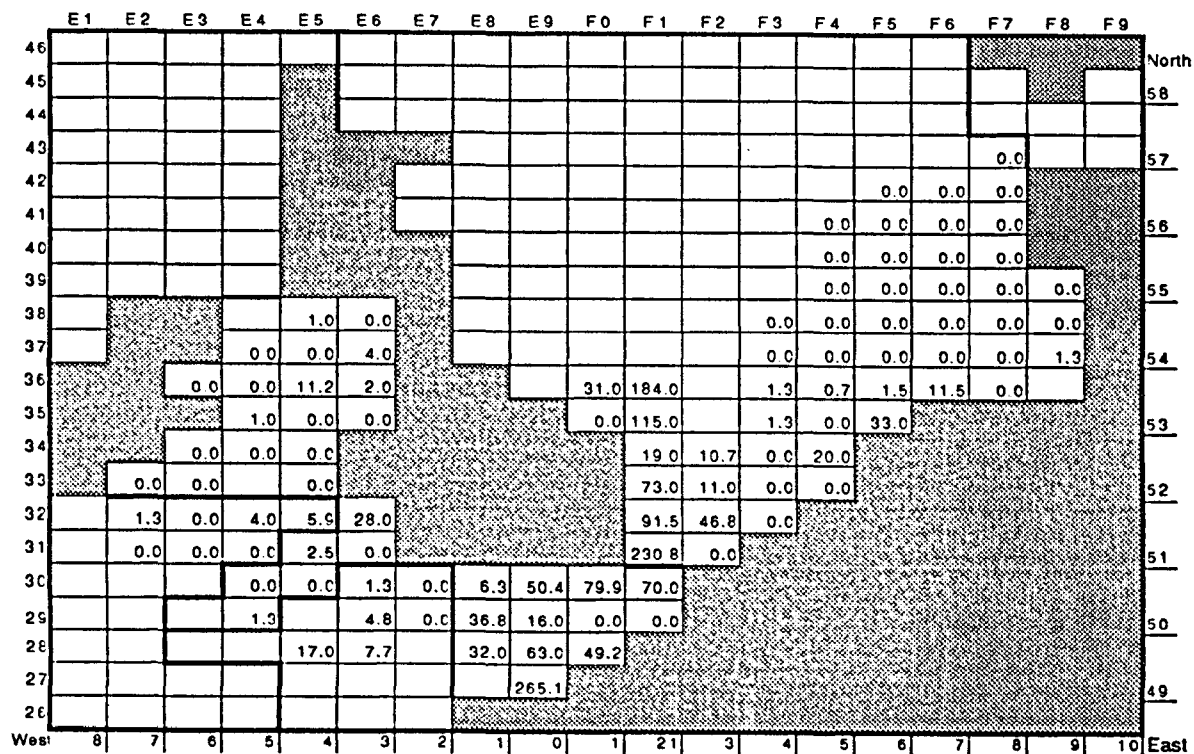
Haddock

Beam trawl survey: August-October 1994 (N/h in 8-m beam trawl)



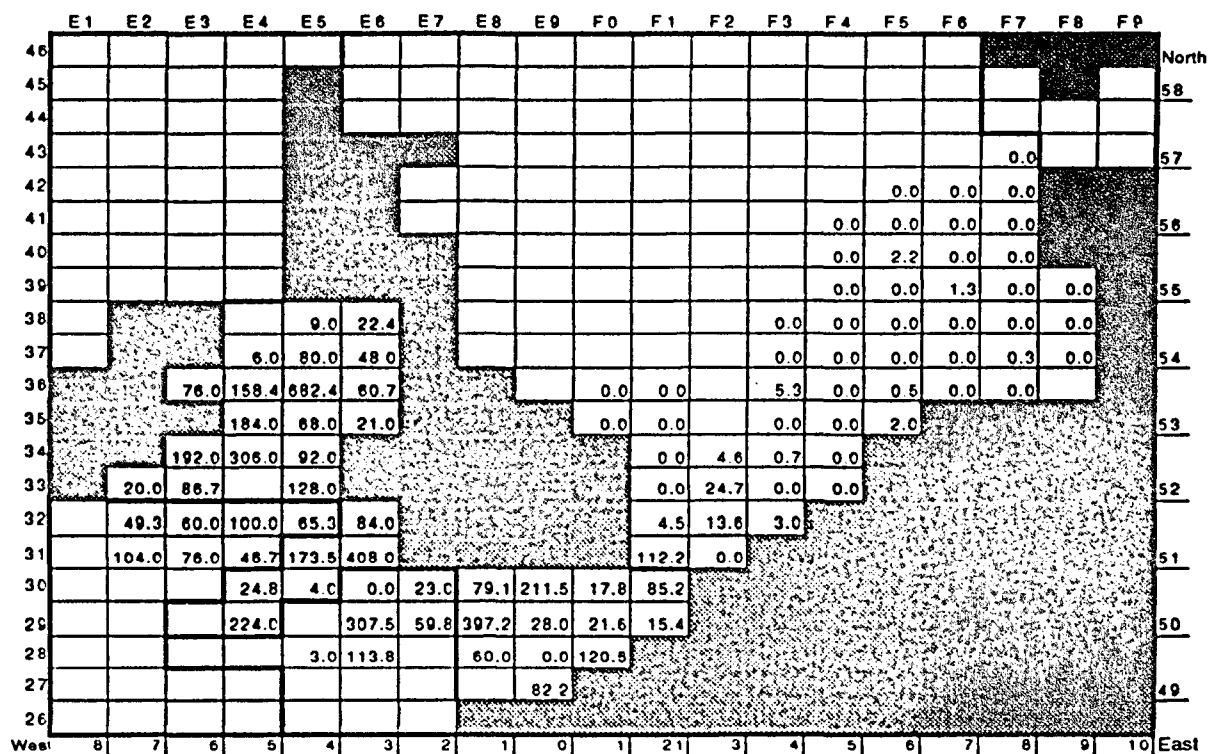
Bib

Beam trawl survey: August-October 1994 (N/h in 8-m beam trawl)



Poor Cod

Beam trawl survey: August-October 1994 (N/h in 8-m beam trawl)



Beam trawl survey: August-October 1994 (N/h in 8-m beam trawl)

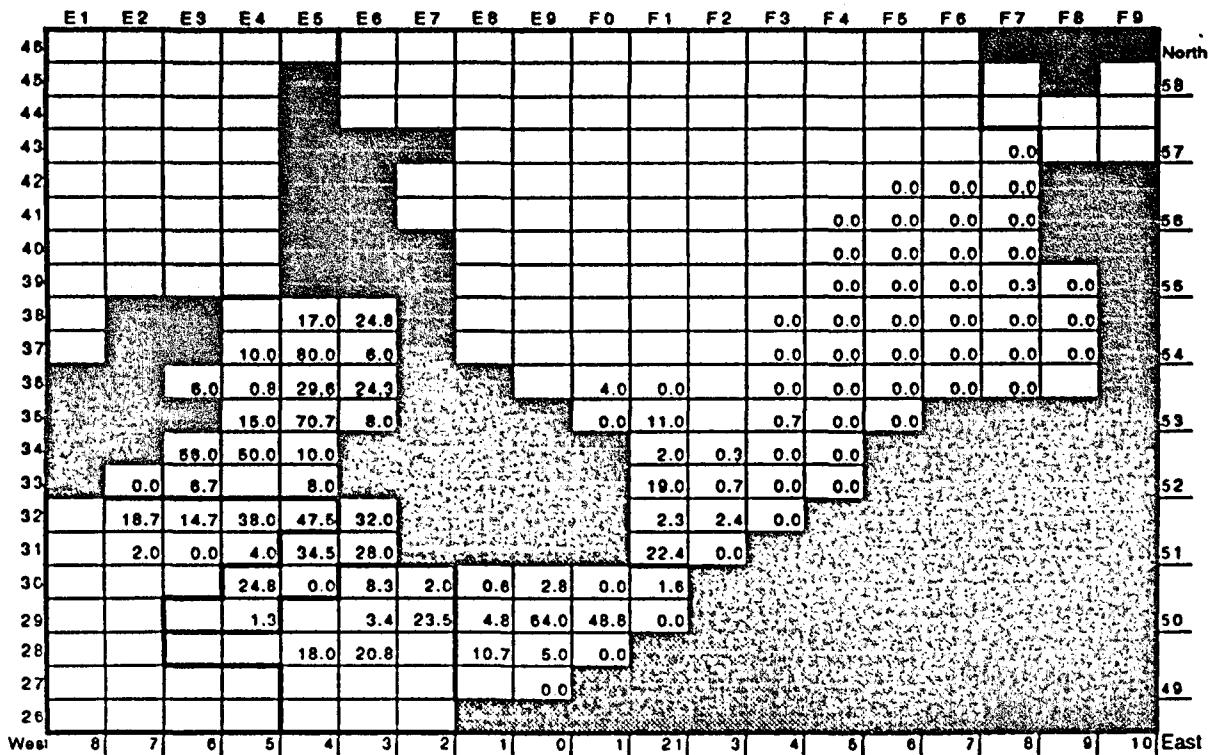


Beam trawl survey: August-October 1994 (N/h in 8-m beam trawl)



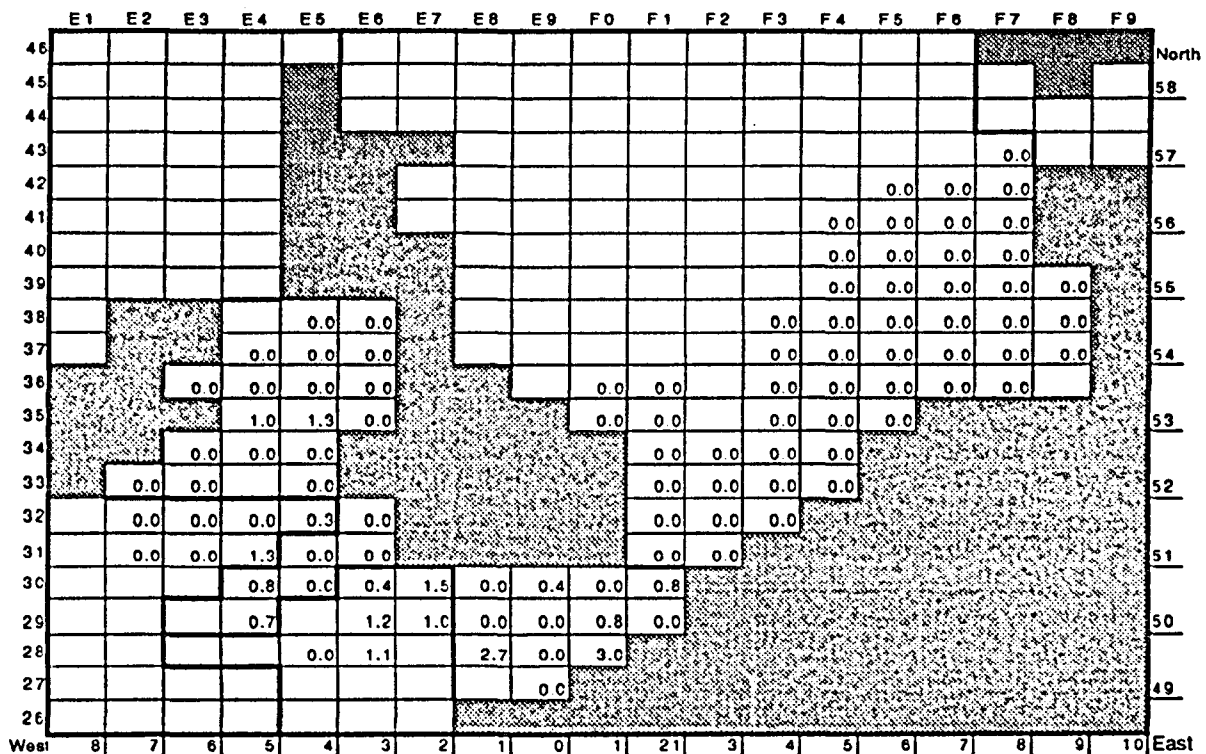
Lesser Spotted Dogfish

Beam trawl survey: August-October 1994 (N/h in 8-m beam trawl)



John Dory

Beam trawl survey: August-October 1994 (N/h in 8-m beam trawl)



Edible Crab

Beam trawl survey: August-October 1994 (N/h in 8-m beam trawl)

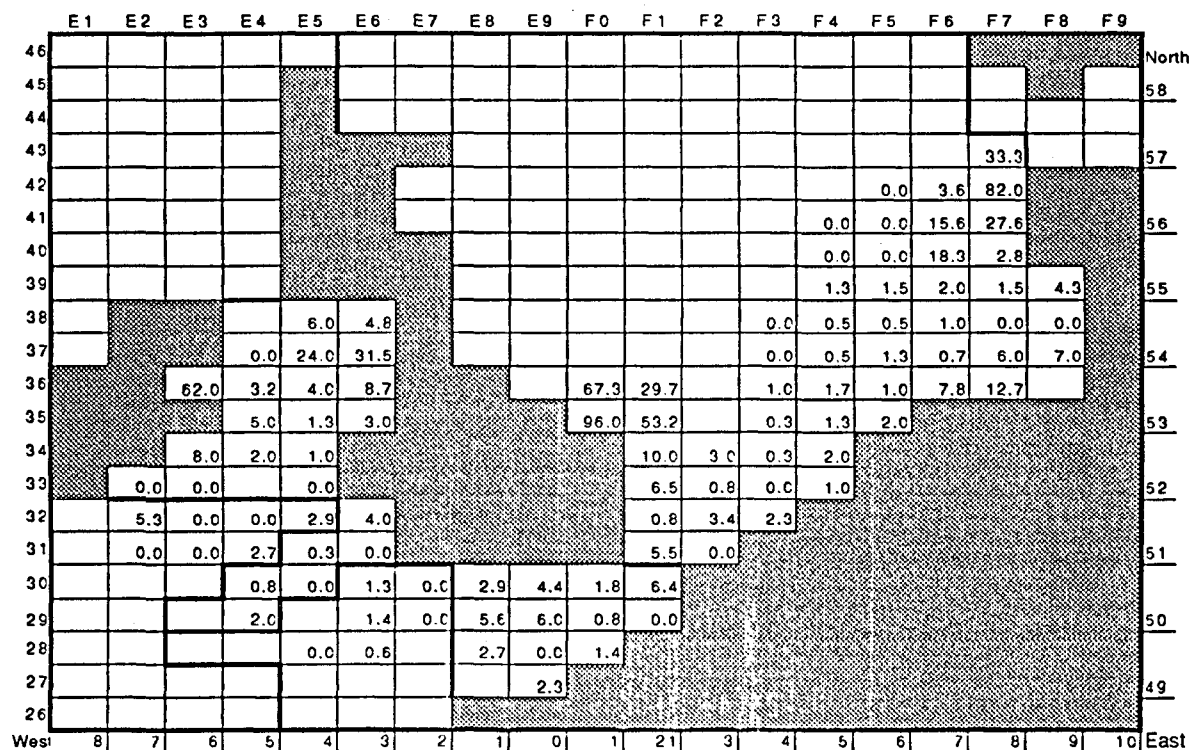


Figure 5.1 Time trends in the Shannon-Weaver diversity index, number of species and catch rate of all fish species between 1985 and 1994 in the BTS of The Netherlands (RV ISIS).

