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REPORT OF THE WORKING GROUP ON BEAM TRAWL SURVEYS (WGBEAM)

7 – 10 JUNE 2005

LOWESTOFT, ENGLAND

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Conseil International pour l'Exploration de la Mer

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Contents

Executive Summary

The Working Group on Beam Trawl Surveys (WGBEAM) is responsible for collating and summarising the results of beam trawl surveys carried out in the North Sea, English Channel, and Celtic Sea and in the Irish Sea. At its meeting in 2005, WGBEAM prepared and reported population abundance indices for all areas where surveys are undertaken covering both coastal and offshore regions.

As the combined dataset covers a wide geographical area and extensive time period, WGBEAM was able to analyse trends in population abundance and distribution. The results indicate that there have been distinct trends in abundance over time in some areas. In the south-eastern North Sea (roundfish area 6) there was a clear increase in species such as dragonet, solenette and long rough dab while other species including sole, dab, flounder, plaice and whiting had decreased. There appeared to be a particularly steep change in abundance in the Irish Sea which was attributed to increases in abundance of dab, plaice, gurnard, scaldfish, solenette and dogfish.

Changes in distribution of juvenile plaice from coastal to deeper water have been identified in the North Sea and the data set was used to investigate whether similar changes are apparent in other areas. Preliminary results for the Irish Sea and eastern English Channel did not show similar movements of juvenile plaice but WGBEAM concluded that further work is needed to confirm this.

The WG has continued investigations on relative efficiencies of beam trawls used in the different surveys. The results indicated that there were distinct differences in catch efficiency of some gears used in the Netherlands BTS, SNS and DFS surveys. The catch efficiencies differ for plaice and sole and for the size range caught. For the inshore surveys WGBEAM concluded that there is a need to review both catch efficiency of the different gears and the area-based weighting factors used to estimate combined indices of abundance.

1 Introduction

Fisheries independent beam trawl surveys using research vessels were established in the 1980s by countries bordering the North Sea to monitor stocks of plaice and sole. Collation and analysis of some of the data derived from these surveys was undertaken by the Beam Trawl Study Group, which in 1998 was re-established as the Working Group on Beam Trawl Surveys. Although the initial focus of its efforts was in the North Sea and Eastern Channel, the Working Group now evaluates all major surveys in Subarea IV and VII (ICES 1991).

The Working Group comprises regular participants from all countries involved in the surveys Belgium, Germany, Netherlands and the UK. An annual report describing the surveys and summarising the distribution and catch rate of fish species has been produced every year since 1990.

1.1 Terms of reference

The Working Group on Beam Trawl Surveys [WGBEAM] (Chair: R Millner, UK) will meet in Lowestoft, England from 7–10 June 2005 to:

a) Prepare a progress report summarising the results of the 2004 beam trawl surveys;

b) Calculate population abundance indices by age-group for sole and plaice in the North Sea, Division VIIa and Divisions VIId-g;

c) Further co-ordinate offshore and coastal beam trawl surveys in the North Sea and Divisions VIIa and VIId-g;

d) Describe and evaluate the current methods for calculating population abundance indices and consider possibilities of delivering improved indices;

e) Continue the work on developing relative catchabilities of the different gears used in the surveys;

f) Continue work of developing and standardising an international database of beam trawl survey data and co-ordinate such activities with those of the IBTSWG in particular on the compliance to DATRAS, the bottom trawl database at ICES;

g) Continue the work on collating information on the epibenthic invertebrate by-catch during beam trawl surveys into a common database and discuss which summary results should be reported;

h) Develop protocols and criteria to ensure standardisation of all sampling tools and surveys gears.

WGBEAM will report by 31 August 2005 for the attention of the Living Resources and the Resource Management Committees, and ACFM.

1.2 Participants

Bart Maertens	Belgium
Gerjan Piet	Netherlands
Ingeborg de Boois	Netherlands
John Dann	UK, England
Matt Parker Humphreys	UK, England
Richard Millner (Chair)	UK, England
Thomas Neudecker	Germany
Ulrich Damm	Germany

2 Results of offshore surveys 2004

2.1 Coverage of the area

The coverage of the area by each of the participating countries' surveys and the number of stations sampled in 2004 is shown in Annex 1, Figures 2.1.1–2.1.4. Belgian figures differ slightly from earlier maps due to corrections of location.

2.2 Population abundance indices

In 2003 a new database (FRISBE) was set up at the Netherlands Institute for Fisheries Research. As a consequence all survey files went through new and improved checking procedures and many newly discovered errors were corrected. Indices were recalculated using these new files. As a result the indices provided in 2004 and in this year's report may differ slightly from those in previous reports. The indices as provided in this report should be considered the correct ones. This applies for the catch rates of sole and plaice in the North Sea (Tables 2.2.1 and 2.2.2) as well as the indices of juvenile sole and plaice abundance for the Netherlands DFS in Tables 2.2.3 and 2.2.4.

Tables 2.2.1 and 2.2.2 give the catch rate by age for sole and plaice from each of the offshore survey areas separately. Tables 2.2.3 and 2.2.4 provide the results of the inshore surveys and Tables 2.2.5 and 2.2.6 give the mean length at age for sole and plaice from the Netherlands BTS.

Table 2.2.1: Catch rate of sole from Netherlands and UK surveys in the North Sea and VII d, a, e, f and g.

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

YEAR/AGE	0	1	2	3	4	5	6	7	8	9	10+
1985	0.0	2.7	7.9	3.5	1.7	0.6	0.3	0.0	0.0	0.0	0.0
1986	0.0	7.9	4.5	1.7	0.8	0.6	0.2	0.1	0.0	0.0	0.1
1987	0.0	7.0	12.5	1.8	0.6	0.6	0.2	0.2	0.1	0.0	0.0
1988	0.0	81.2	12.8	2.8	1.0	0.1	0.2	0.1	0.1	0.0	0.1
1989	0.0	9.4	68.1	4.2	4.1	0.7	0.1	0.2	0.0	0.1	0.0
1990	0.0	22.6	22.4	20.1	0.6	0.7	0.5	0.1	0.1	0.0	0.0
1991	1.1	3.3	23.2	5.8	6.0	0.1	0.1	0.1	0.0	0.0	0.0
1992	0.2	74.2	23.2	9.9	2.3	2.9	0.1	0.1	0.1	0.0	0.1
1993	0.0	5.0	27.4	1.0	4.4	2.4	4.3	0.0	0.1	0.1	0.1
1994	0.9	5.9	5.0	15.4	0.1	1.4	0.1	1.0	0.0	0.0	0.0
1995	0.7	27.6	8.5	7.0	6.7	0.5	0.9	0.3	1.0	0.0	0.0
1996	0.2	3.5	6.2	1.9	1.5	2.5	0.3	0.4	0.1	0.3	0.1
1997	1.3	173.2	5.4	3.2	0.8	0.8	0.4	0.1	0.0	0.0	0.1
1998	0.3	14.1	29.2	2.0	1.3	0.1	0.0	0.4	0.0	0.0	0.0
1999	6.6	11.4	19.3	16.6	0.6	2.1	0.3	0.2	0.7	0.0	0.3
2000	0.1	12.9	6.5	4.1	1.6	0.3	0.2	0.1	0.0	0.2	0.1
2001	10.0	8.0	10.8	2.4	1.7	0.7	0.1	0.0	0.0	0.0	0.2
2002	6.9	21.5	4.2	3.4	0.9	0.4	0.4	0.0	0.1	0.0	0.1
2003	0.4	10.8	10.6	2.5	1.8	0.4	0.2	0.3	0.0	0.0	0.0
2004*	0.6	3.7	4.4	3.6	0.6	0.7	0.1	0.1	0.1	0.0	0.0

***Preliminary figures.**

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
1995	0.0	5.2	16.9	2.1	3.8	2.2	2.4	0.2	0.3	0.2	0.2
1996	0.0	3.5	7.3	3.8	0.7	1.3	0.9	1.1	0.1	0.5	0.4
1997	0.0	19.0	7.3	3.2	1.3	0.2	0.5	0.4	0.9	0.0	0.7
1998	0.1	2.1	20.9	2.3	0.9	0.9	0.1	0.3	0.0	0.1	0.3
1999	1.2	25.5	9.0	12.4	2.6	1.5	0.7	0.2	0.9	0.8	0.5
2000	0.1	11.0	26.8	5.3	4.6	1.4	0.7	0.4	0.0	0.2	0.9
2001	1.2	8.5	25.1	11.2	1.9	2.4	0.8	0.6	0.3	0.1	0.9
2002	0.0	46.1	18.4	8.5	5.2	0.4	1.0	0.5	0.2	0.0	0.7
2003	0.0	8.5	33.8	6.4	3.7	1.7	0.4	0.5	0.2	0.0	0.8
2004	1.9	10.5	10.8	10.2	2.3	1.9	1.4	0.5	0.6	0.2	0.8

Table 2.2.1 (Cont'd)

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	0.2	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
1995	0.1	1.1	1.5	1.9	1.7	1.0	1.3	0.2	0.2	0.2	0.5
1996	0.0	1.9	4.7	2.4	1.0	1.3	0.7	0.6	0.1	0.0	0.4
1997	0.2	3.0	5.5	5.1	1.7	0.5	0.6	0.5	0.4	0.2	0.6
1998	0.0	0.9	6.0	4.4	2.6	0.9	0.3	0.4	0.2	0.3	0.4
1999	0.0	0.9	4.4	5.5	2.0	1.0	0.2	0.2	0.1	0.1	0.7
2000	0.0	0.9	5.3	2.9	2.0	1.1	0.6	0.2	0.1	0.2	0.3
2001	0.0	0.6	7.8	5.9	2.2	1.3	.4	0.5	0.2	0.0	0.3
2002	0.00	0.48	1.33	4.18	1.64	0.85	0.36	0.06	0.06	0.00	0.24
2003	0.00	2.49	6.70	3.78	3.84	2.16	0.54	0.22	0.16	0.22	0.22
2004	0.00	0.54	3.30	4.16	1.41	1.41	0.86	0.70	0.43	0.11	0.43

United Kingdom (N.hr^-1/8m trawl) Bristol Channel (VIIf)

Age	0	1	2	3	4	5	6	7	8	9	10+
1988	3.7	10.0	40.3	6.0	2.3	0.7	0.0	0.0	0.0	0.0	1.0
1989	22.0	34.0	50.7	27.0	3.0	2.3	1.0	0.7	0.3	0.3	0.7
1990	4.2	53.8	43.8	7.0	2.2	0.6	1.0	0.4	0.0	0.0	0.2
1991	4.8	36.0	77.3	10.1	2.5	2.2	0.6	0.0	0.4	0.2	0.1
1992	0.6	58.0	38.2	20.5	4.4	2.7	1.4	0.1	0.2	0.1	0.6
1993	0.7	24.2	51.2	6.1	3.3	0.4	0.2	0.2	0.1	0.1	0.2
1994	0.1	51.4	52.1	16.1	2.8	1.3	1.1	0.0	0.0	0.4	0.4
1995	4.3	16.3	29.4	6.6	1.6	0.9	1.6	0.4	0.3	0.3	0.5
1996	0.7	22.5	30.2	7.6	3.4	0.7	0.4	0.5	0.4	0.4	0.4
1997	4.8	64.9	27.8	2.9	1.7	2.1	0.7	0.5	0.8	0.0	0.7
1998	12.0	105.6	57.5	6.9	1.1	1.7	0.9	0.3	0.1	0.7	0.7
1999	3.5	358.2	35.2	4.7	2.0	0.8	0.5	0.8	0.3	0.0	1.1
2000	1.8	128.3	173.3	4.9	3.4	0.6	0.0	0.3	0.1	0.3	0.5
2001	2.6	42.8	72.3	31.7	2.7	0.8	0.3	0.3	0.1	0.0	1.2
2002	0.8	66.2	27.0	12.7	12.3	1.2	0.7	0.2	0.4	0.0	0.7
2003	1.2	38.7	53.4	6.7	4.6	6.7	1.0	0.4	0.3	0.0	0.1
2004	5.8	75.3	37.2	14.0	1.9	2.3	5.0	0.3	0.2	0.0	0.5

Table 2.2.1 (Cont'd)

Catch rate United Kingdom sole (N.hr^-1/8m trawl) in 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
1995	1.8	13.2	8.8	11.2	4.8	2.2	2.9	0.6	0.3	0.1	1.2
1996	0.2	46.2	8.3	2.5	5.8	3.3	1.7	2.1	0.6	0.2	0.7
1997	0.5	65.7	39.8	4.9	1.8	3.9	1.9	1.1	2.3	0.6	0.8
1998	0.5	35.9	44.2	21.9	2.5	0.6	2.2	1.8	0.3	1.5	0.9
1999	0.3	29.6	22.4	23.2	18.0	2.5	1.1	2.1	0.4	0.6	1.9
2000	0.0	15.8	41.2	10.3	12.0	6.3	1.1	0.1	0.8	0.4	1.6
2001	0.3	5.2	17.6	15.1	4.6	5.6	3.6	0.5	0.2	0.7	0.9
2002	0.1	15.1	7.6	7.8	9.2	3.0	4.7	2.8	0.1	0.1	1.1
2003	0.4	17.0	16.5	3.8	6.7	6.0	2.3	2.6	1.5	0.1	0.8
2004	0.0	22.1	17.9	9.5	2.0	4.5	3.4	3.0	1.2	1.4	0.9

Table 2.2.2: Catch rate of plaice from Netherlands and UK surveys in the North Sea and VII d, a, e, f and g.

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

Age	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10+**
1985	134.7	115.6	179.9	38.8	11.8	1.4	1.0	0.4	0.2	0.1	0.2
1986	16.5	660.2	131.8	51.0	8.9	3.3	0.4	0.3	0.1	0.0	0.2
1987	44.1	225.8	764.3	33.1	4.8	2.0	1.0	0.4	0.1	0.1	0.3
1988	79.1	577.3	140.1	173.7	9.2	2.6	0.8	0.4	0.0	0.1	0.2
1989	71.0	428.7	319.3	38.7	47.3	5.8	0.8	0.3	0.7	0.1	0.1
1990	14.7	112.1	102.6	55.7	22.8	5.6	0.8	0.2	0.4	0.3	0.2
1991	4.4	185.4	122.1	28.6	11.9	4.3	5.7	0.3	0.2	0.1	0.1
1992	13.2	171.5	125.9	27.3	5.6	3.2	2.7	1.1	0.3	0.1	0.1
1993	54.8	124.8	179.1	38.4	6.1	0.9	0.8	0.6	0.4	0.2	0.1
1994	145.6	145.2	64.2	35.2	10.9	2.9	0.6	0.9	1.0	0.4	0.0
1995	92.0	252.2	43.6	14.2	8.1	1.2	0.9	0.4	1.1	0.2	0.1
1996	209.8	218.3	212.1	22.9	4.8	3.7	0.9	0.0	0.2	0.1	0.1
1997	31.9	439.5	743.6	19.9	2.8	0.2	0.4	0.2	0.1	0.0	0.0
1998	243.0	338.2	436.2	47.4	8.9	1.4	0.8	0.1	0.1	0.1	0.1
1999	198.9	305.9	130.0	182.5	3.7	2.1	0.1	0.1	0.0	0.0	0.1
2000	175.6	278.8	75.2	31.6	24.2	0.6	0.2	0.5	0.0	0.0	0.1
2001	603.7	225.8	78.9	19.6	10.0	9.5	0.3	0.1	0.0	0.0	0.2
2002	241.4	568.7	45.5	15.4	5.5	2.7	1.4	0.1	0.1	0.0	0.1
2003	171.0	125.5	170.1	10.8	5.9	1.5	1.2	0.7	0.1	0.1	0.0
2004*	127.3	226.2	41.7	66.6	6.6	2.6	1.6	1.0	3.1	0.0	0.0

*** Preliminary figures**

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
1995	0.0	11.3	4.1	3.0	3.7	1.5	0.6	0.6	1.3	0.8	0.8
1996	13.6	13.2	11.9	1.3	0.7	1.3	0.9	0.4	0.3	0.4	2.8
1997	0.7	33.2	13.5	4.2	0.7	0.3	0.3	0.2	0.2	0.2	1.9
1998	0.3	11.4	27.3	7.0	3.1	0.3	0.2	0.2	0.1	0.0	1.0
1999	1.6	9.2	11.6	15.7	2.8	0.9	0.1	0.0	0.2	0.1	0.6
2000	1.2	17.9	24.9	14.6	19.1	4.5	1.7	0.5	0.3	0.4	2.2
2001	4.9	21.6	26.7	16.2	9.3	14.6	2.9	0.8	0.4	0.3	1.9
2002	2.0	34.0	22.1	12.2	5.7	2.5	5.4	1.3	0.1	0.2	1.0
2003	2.5	7.4	30.5	7.7	3.5	1.7	1.1	2.2	0.7	0.1	0.4
2004	12.2	45.3	18.3	17.6	4.5	1.0	0.6	0.6	1.5	0.1	0.1

Table 2.2.2 (Cont'd)

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
1995	0.3	2.1	1.7	1.9	2.1	0.5	0.2	0.3	0.2	0.1	0.2
1996	5.4	2.3	3.9	1.3	0.8	0.9	0.2	0.0	0.1	0.3	0.4
1997	10.4	8.1	4.8	8.1	0.9	0.3	0.6	0.3	0.1	0.0	0.4
1998	0.1	5.7	5.2	4.7	3.2	0.4	0.2	0.2	0.1	0.0	6.0
1999	5.1	2.0	2.1	8.2	2.1	1.3	0.1	0.1	0.3	0.1	0.1
2000	0.0	3.3	2.7	5.7	7.0	1.6	1.0	0.0	0.1	0.0	0.3
2001	4.1	1.4	2.8	1.9	3.9	3.7	0.8	0.6	0.0	0.1	0.2
2002	0.00	6.00	3.21	2.97	0.85	1.03	1.39	0.18	0.06	0.00	0.12
2003	0.76	1.19	4.54	3.08	1.78	0.38	0.70	1.14	0.38	0.16	0.16
2004	0.00	1.14	2.16	4.00	1.62	0.70	0.43	0.32	0.65	0.11	0.22

United Kingdom (N.hr^-1/8m trawl) Bristol Channel (VIIf)

Age	0	1	2	3	4	5	6	7	8	9	10+
1988	0.0	12.8	45.2	11.5	0.0	0.3	0.3	0.0	0.0	0.3	0.0
1989	0.3	34.3	52.2	12.0	2.5	0.8	0.0	0.3	0.0	0.0	0.0
1990	2.4	32.2	43.0	12.8	3.0	1.2	0.0	0.0	0.4	0.0	0.2
1991	0.2	101.9	4.0	7.9	2.5	1.5	0.4	0.0	0.1	0.0	0.0
1992	0.4	57.3	36.1	1.5	0.6	1.8	0.2	0.6	0.0	0.0	0.2
1993	0.5	14.1	12.6	5.2	0.2	0.6	0.1	0.1	0.0	0.0	0.0
1994	17.5	15.4	4.8	2.4	1.3	0.1	0.0	0.0	0.0	0.0	0.0
1995	0.1	31.4	11.0	2.1	0.5	1.0	0.1	0.0	0.0	0.3	0.0
1996	1.2	32.0	41.8	4.8	0.1	0.4	0.1	0.0	0.0	0.0	0.0
1997	1.1	34.3	15.2	5.2	0.7	0.3	0.1	0.1	0.0	0.0	0.0
1998	0.7	31.5	18.2	6.7	1.5	0.5	0.3	0.0	0.0	0.0	0.1
1999	24.9	22.1	11.7	4.3	2.9	1.4	0.0	0.0	0.1	0.0	0.0
2000	11.2	46.1	8.1	4.3	0.8	0.8	0.0	0.3	0.0	0.0	0.0
2001	3.8	26.6	18.5	2.3	1.2	0.4	0.5	0.2	0.0	0.0	0.0
2002	0.1	14.6	19.1	10.0	0.9	0.6	0.2	0.3	0.1	0.0	0.0
2003	5.6	9.7	10.2	6.2	2.5	0.3	0.2	0.1	0.1	0.3	0.0
2004	16.1	25.6	3.6	3.2	1.6	0.2	0.1	0.1	0.2	0.0	0.2

Table 2.2.2 (Cont'd)

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
1995	17.8	249.7	101.0	38.8	32.2	2.9	1.5	0.6	0.4	0.4	0.3
1996	6.3	144.0	69.3	20.4	9.1	7.1	2.3	1.0	0.1	0.4	0.5
1997	33.3	169.2	98.1	41.4	13.5	7.4	6.1	2.7	0.9	0.5	0.9
1998	23.8	124.4	112.1	41.9	1.6	10.4	4.9	4.3	1.1	0.5	1.2
1999	52.9	108.2	106.4	61.8	28.1	13.3	4.8	3.2	2.1	2.0	0.3
2000	61.3	200.4	81.7	44.0	34.6	16.3	3.6	3.0	1.6	1.5	0.9
2001	34.2	121.5	88.4	28.1	15.9	13.1	6.1	2.1	1.2	0.8	0.3
2002	8.1	155.6	147.0	83.5	31.9	16.2	17.4	7.1	2.1	2.4	1.7
2003	47.4	146.6	182.0	95.8	52.0	14.9	11.5	7.3	2.8	1.2	0.9
2004	58.8	194.6	110.6	103.3	52.7	37.3	10.5	8.5	6.4	2.1	2.9

Table 2.2.3: Indices of juvenile sole abundance from other coastal beam trawl surveys. Abundance indices are given as numbers per 1000 m2 sampled during the Netherlands DFS, as numbers per 100 fishing hours of the SNS, and as millions of fish sampled during the UKYFS (IVc and VIId) (see Section 3.2 for details).

Year/ Age	Netherlands DFS			Netherlands SNS				UKYFS (IVc)		UKYFS (VIId)	
	0	1	2	0	1	2	3	0	1	0	1
1980	20.9	1.0	0.0	5518	4483	80	99				
1981	16.8	0.4	0.1	3194	3739	1411	51	32.06	5.99	0.11	0.45
1982	17.0	0.6	0.1	2528	5098	1124	231	26.99	4.02	4.63	0.36
1983	4.1	0.7	0.0	769	2640	1137	107	70.66	5.64	25.45	1.52
1984	9.2	0.3	0.0	3473	2359	1081	307	59.84	11.3	4.33	4.04
1985	16.1	0.1	0.0	4268	2151	709	159	20.53	2.8	7.65	2.94
1986	3.4	0.3	0.0	901	3791	456	67	28.98	3.1	6.45	1.45
1987	30.8	0.3	0.0	13690	1890	955	59	20.87	1.89	16.85	1.38
1988	1.8	0.6	0.0	523	11227	594	284	35.55	9.7	2.59	1.87
1989	3.6	0.2	0.1	2171	3052	5369	248	47.2	3.78	6.67	0.62
1990	0.5	0.2	0.0	53	2900	1078	907	36.82	12.27	6.7	1.9
1991	22.9	0.0	0.1	3640	1265	2515	527	22.72	19.69	1.81	3.69
1992	0.9	0.5	0.0	303	11081	114	319	33.45	5.21	2.26	1.5
1993	0.8	0.0	0.0	231	1351	3489	46	36.42	24.46	14.19	1.33
1994	3.6	0.0	0.0	5114	559	475	943	27.32	9.14	13.07	2.68
1995	0.3	0.1	0.0	1365	1501	234	126	33.55	13.04	7.53	2.91
1996	1.8	0.0	0.0	2197	691	473	27	50.16	6.78	1.85	0.57
1997	2.2	0.3	0.0	972	10132	143	231	14.87	4.91	4.23	1.12
1998	2.1	0.1	0.0	235	2875	1993	131	37.99	2.12	7.97	1.12
1999	1.0	0.0	0.0	1867	1649	919	381	19.02	7.67	2.63	1.47
2000	0.6	0.0	0.0	71	1735	150	189	13.54	9.76	1.16	2.47
2001	2.8	0.0	0.0	8340	949	638	99	39.83	2.31	4.75	0.38
2002	1.4	0.0	0.0	1206	7542	379	185	32.48	7.76	4.45	4.15
2003	0.7	0.1	0.0	*	*	*	*	14.41	4.90	4.55	1.44
2004	0.2	0.0	0.0	142	1372	627	397	68.81	3.16	10.19	3.65

***: No survey by Netherlands SNS in 2003.**

Table 2.2.4: Indices of juvenile plaice abundance from other coastal beam trawl surveys. Abundance indices are given as numbers per 1000 m2 sampled during the Netherlands DFS, as millions of fish sampled during the UKYFS (IVc and VIId) (see Section 3.2 for details).

Year/ Age	Netherlands DFS			Netherlands SNS				UKYFS (IVc)		UKYFS (VIId)	
	0	1	2	0	1	2	3	0	1	0	1
1980	5.9	11.1	0.8	4039	58049	12084	456				
1981	29.9	8.6	2.4	31541	19611	16106	785	59.24	5.95	0.55	0.11
1982	25.0	15.9	0.7	23987	70108	8503	1146	11.65	13.15	0.58	0.06
1983	19.6	8.8	1.7	36722	34884	14708	308	74.11	6.86	10.71	0.77
1984	11.7	6.8	0.5	7958	44667	10413	2480	76.52	10.85	3.62	0.41
1985	40.3	5.1	0.6	47385	27832	13789	1584	48.33	13.74	5.18	1.16
1986	10.5	15.9	0.3	8658	93573	7558	1155	23.62	17.93	12.53	1.08
1987	28.5	11.2	3.6	21270	33426	33021	1232	20.38	5.41	13.95	1.07
1988	16.2	6.0	1.3	15598	36672	14430	13140	28.12	7.72	9.31	0.81
1989	22.4	6.3	1.4	24198	37238	14952	3709	27.8	12.9	2.26	0.7
1990	23.8	6.8	0.6	9559	24903	7287	3248	31.75	10.25	4.73	0.52
1991	27.0	7.7	0.7	17120	57349	11149	1507	14.89	9.06	1.34	0.43
1992	19.9	6.5	0.4	5398	48223	13742	2257	26.16	5.64	2.92	1.09
1993	13.1	4.2	0.1	9226	22184	9484	988	43.1	7.96	5.77	0.64
1994	24.2	1.9	0.0	27901	18225	4866	884	19.14	9.38	12.63	0.59
1995	7.0	1.2	0.0	13029	24900	2786	415	51.58	11.65	7.42	2.47
1996	20.3	12.1	0.1	91713	24663	10377	1189	60.16	4.07	1.22	0.72
1997	6.9	10.4	0.5	15363	64524	36374	1393	11.19	5.48	1.2	0.26
1998	9.8	3.8	0.8	22720	33391	29431	5739	40.26	0.92	5.23	0.29
1999	5.7	0.2	0.0	39201	35188	9235	14347	14.38	1.65	4.83	0.16
2000	10.6	0.2	0.0	18874	23027	2487	902	10.57	4.82	0.29	0.72
2001	23.4	0.2	0.0	50280	7983	1828	226	76.96	0.74	2.52	0.05
2002	10.4	0.1	0.0	31350	30813	1103	265	40.04	4.59	0.33	1.61
2003	19.1	0.3	0.0	*	*	*	*	30.24	3.15	8.20	0.16
2004	4.5	0.4	0.0	13545	18208	1354	1088	6.54	1.63	12.20	1.46

***: No survey by Netherlands SNS in 2003.**

Table 2.2.5: Mean length-at-age for sole in the North Sea based on BTS.

YEAR/AGE	0	1	2	3	4	5	6	7	8	9	10+
1985		17.2	23.6	27.6	31.8	31.0	31.6				
1986		17.3	23.3	27.3	30.0	32.9	36.1	36.5		40.0	40.2
1987		16.7	24.2	28.1	32.9	33.3	34.3	33.0	38.0	9.4	
1988		16.4	21.1	28.2	31.1	32.2	31.6	37.0	33.5	35.0	41.3
1989		17.5	23.0	26.0	27.8	30.1	35.0	35.9		21.3	37.0
1990		18.0	22.7	27.0	31.9	34.5	33.4	33.2	40.4	43.0	45.0
1991	9.6	20.0	24.0	26.8	30.4	33.4	34.9	35.4	39.0		45.0
1992		18.2	20.8	26.8	28.3	30.6	31.3	36.4	35.0	40.6	31.9
1993	8.7	19.5	22.9	24.0	26.3	26.1	26.2	38.0	31.3	35.4	38.2
1994	13.7	19.4	22.5	25.6	31.7	27.1	27.4	32.3	46.0		34.0
1995	11.5	18.5	22.8	24.3	26.9	30.8	30.9	28.3	27.8	42.3	
1996	8.9	19.1	23.2	25.5	26.6	28.2	26.5	27.0	30.7	32.3	35.1
1997	9.8	17.9	25.1	26.9	27.7	29.0	33.9	29.3	30.6	31.0	37.9
1998	11.1	19.1	23.7	24.0	28.4	27.1	30.0	31.2			
1999	9.1	19.4	23.1	26.1	26.4	26.1	33.3	28.5	27.9	32.0	28.4
2000	8.4	18.8	22.6	27.0	28.0	28.8	28.0	32.7	30.0	28.3	29.6
2001	7.3	18.9	23.1	25.4	27.3	29.2	26.2	28.0	26.3		25.3
2002	8.4	17.6	21.7	24.8	26.1	29.8	28.8	25.5	30.8		32.8
2003	12.6	19.0	22.9	25.8	27.1	26.3	27.8	26.1		25.0	27.3
2004	10.7	19.5	24.0	27.0	29.2	30.3	34.0	29.2	34.9		30.5

Table 2.2.6: Mean length-at-age for plaice in the North Sea based on BTS.

YEAR/AGE	0	1	2	3	4	5	6	7	8	9	10+
1985	8.1	16.4	24.2	28.9	32.9	37.8	41.0	43.1	41.4	44.1	49.1
1986	9.2	16.5	23.4	28.4	30.6	36.8	38.7	38.6	38.8	42.4	48.2
1987	9.7	15.4	21.8	26.9	33.9	35.9	37.3	40.2	44.5	42.7	44.3
1988	9.4	15.5	22.1	26.0	31.1	36.2	39.3	41.7	51.0	46.1	51.8
1989	10.4	16.0	22.1	28.5	29.2	28.5	41.1	42.0	43.2	41.9	50.4
1990	8.4	16.7	22.9	26.9	30.5	35.6	38.5	42.6	41.7	41.2	45.1
1991	11.9	16.9	23.6	26.8	31.1	33.0	36.2	36.9	34.3	46.8	46.9
1992	11.1	17.1	22.6	28.2	30.3	33.0	32.1	35.7	39.2	44.8	47.0
1993	10.9	16.9	21.3	25.5	31.1	35.3	36.9	37.3	40.2	45.8	45.5
1994	10.5	16.9	23.1	27.3	27.2	34.7	36.3	38.1	31.0	44.3	48.4
1995	10.6	17.4	24.1	29.5	33.6	36.2	36.5	34.2	37.2	37.8	46.2
1996	9.5	16.9	22.6	28.6	32.7	35.0	37.8	43.9	35.8	42.4	48.1
1997	8.8	14.6	16.7	28.3	32.5	35.5	37.8	42.5	44.2	0.0	47.7
1998	9.9	15.9	20.6	22.5	28.4	35.1	39.9	40.6	48.7	42.3	49.3
1999	10.2	16.4	20.2	24.8	32.2	34.7	41.0	42.7	43.0	47.4	44.4
2000	10.2	17.4	22.4	25.1	27.4	31.7	38.9	23.3	43.7	45.0	42.7
2001	11.0	18.0	22.6	27.2	28.6	31.6	38.1	42.6	38.1	51.0	47.5
2002	11.6	17.0	22.7	27.2	29.6	32.0	35.4	35.6	43.3	0.0	29.7
2003	11.4	18.0	22.1	28.5	29.6	32.8	34.4	36.3	28.7	30.0	20.0
2004	10.9	17.3	22.8	27.7	32.7	32.3	35.9	33.4	41.3		40.5

2.3 Trends in population abundance

2.3.1 Multivariate analysis of offshore and inshore data

Trends over time in the abundance of the species that make up the fish assemblage in several inshore and offshore surveys were explored using Principal Component Analysis (PCA). For the offshore surveys a number of subareas were differentiated. These were Round Fish (RF) areas 4, 5, 6 and 7 in the North Sea (see Annex 3 A) and Subareas a, d, e, f, and g of ICES area VII (see Annex 3 B). For the inshore surveys the Eastern Channel, Thames, Wash and Humber were analysed. The major trends occurring in these subareas were established by looking at the first two Principal Components (PCs) which for most of the offshore areas covered about 50% of the variation while for the inshore areas this was about 30% because more species or species-age groups (51 versus 26) were included in the analysis (Table 2.3.1).

Table 2.3.1: Variation (%) explained by the first two Principal Components.

SURVEYS	AREA	PC 1	PC 2	TOTAL
Offshore	RFA 4	26	18	43
	RFA 5	21	20	41
	RFA 6	20	19	39
	RFA 7	28	19	47
	VIIA	32	16	48
	VIID	25	16	41
	VIIE	42	17	59
	VIIF	27	22	50
	VIIG	36	19	55
Inshore	Eastern Channel	19	11	31
	Humber	17	13	30
	Thames	18	10	28
	Wash	16	12	28

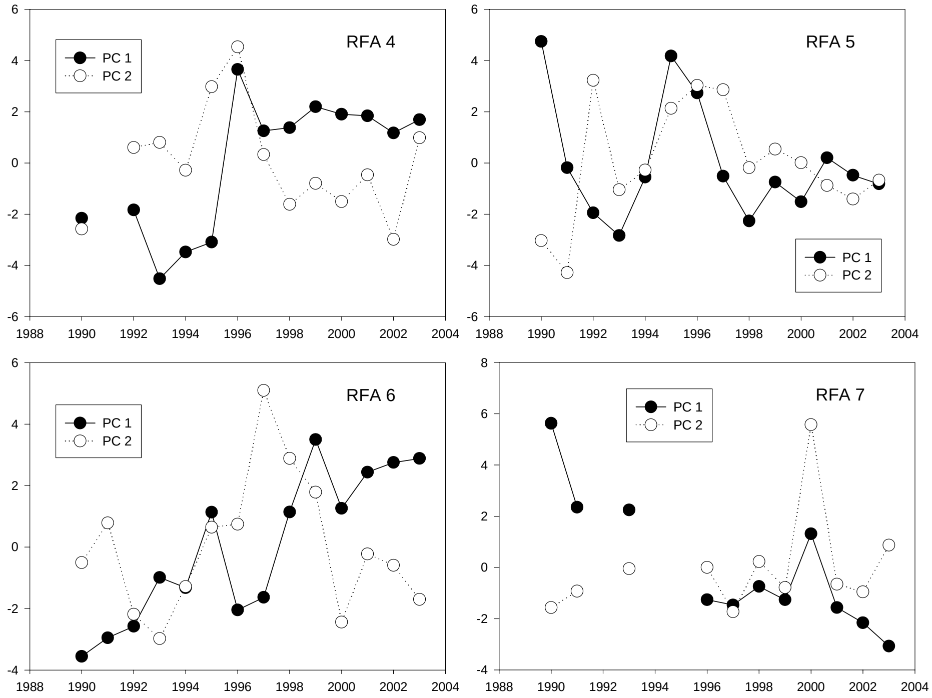
a) Results of offshore surveys

The trends in the first two Principal Components for each Roundfish Area (RF) are show in Figure 2.3.1a and for VIIa, d, f, g and e in Figure 2.3.2a. The scores of each species indicating their contribution to the trend observed in that Principal Component are summarised in Figures 2.3.1b and 2.3.2b. Abbreviations used for each species are given in Table 2 3.2.

The results show that in each area there has been considerable variation in the fish assemblage and in some areas there are distinct trends over time. In RF6 and VIIa, there appears to be a marked increase based on PC1. Whereas in RF7 and VIIf, there has been a decline. Other areas show a more or less gradual change over time. For most areas this is represented by PC1 but in the case of VIIe the PC1 describes a sudden increase of small non-target species like solenette, scaldfish, lesser weever, and common dragonet in 2002 and 2003. This was due to a change in sampling practice. Before 2002, only commercial species were sampled from the catches. Whereas, after 2002, all species caught were sampled and measured. The PC2 shows a gradual change over time except for the last two years where it compensates for the sudden increase in a subset of the species covered by PC1.

In the North Sea, RFA 6, the changes are mainly caused by a decrease of sole, dab, flounder, plaice and whiting and an increase of dragonet, solenette, anglerfish, long rough dab and red mullet. In VIIa, the increase is based on dab, plaice, gurnard, scaldfish, solenette and dogfish.

For the ICES Subareas VII d, e and f, the gradual change over time was mainly driven by a decrease in brill and bib and an increase in scaldfish, dab, plaice, solenette, thickback sole and dogfish.



Figures 2.3.1a: North Sea roundfish areas. Values of the first two Principal Components (PC 1, PC 2) per year.

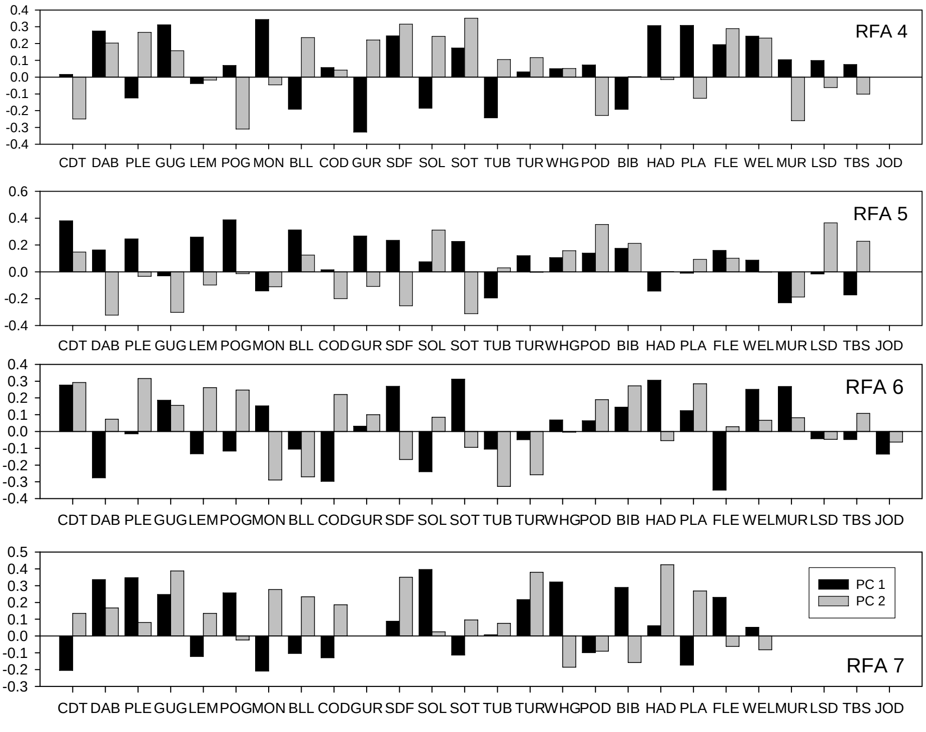


Figure 2.3.1 b: North Sea roundfish areas. The scores of each species indicating their contribution to the trend observed in each Principal Component.

2.3.2 Trends in species catch number

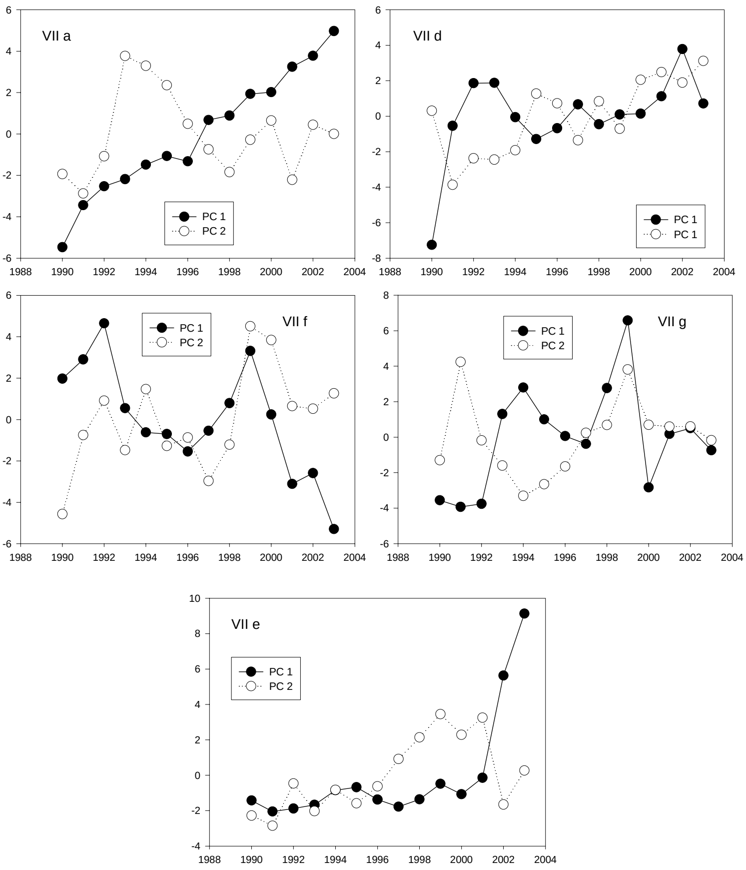
The multivariate analysis indicated that there had been significant trends in the abundance of a number of species. Data from Tables 2.3.1 to 2.3.9 and UK YFS were therefore standardised to the mean for the time period and plotted for a number of species showing marked changes over time. The results are shown in Figures 2.3.4.

The most obvious trends appear in ICES division VIIa where a number of species are shown to be increasing or decreasing in abundance.

The eastern English Channel (ICES Division VIId) does not show trends as distinct as VIIa, but does suggest a possible decrease in dab and solenette, with an increase in thickback sole. There were no other consistent patterns in abundance from other areas.

Table 2.3.2: Species abbreviations used in PCA.

Abbreviation	English name	Abbreviation	English name
BIB	WHITING POUT (BIB)	MUR	RED MULLET
BLL	BRILL	PLA	AMERICAN PLAICE (LR DAB)
CDT	COMMON DRAGONET	PLE	EUROPEAN PLAICE
COD	COD	POD	POOR COD
DAB	DAB	POG	POGGE (ARMED BULLHEAD)
FLE	FLOUNDER (EUROPEAN)	SDF	SCALD FISH
GUG	GREY GURNARD	SOL	SOLE (DOVER SOLE)
GUR	RED GURNARD	SOT	SOLENETTE
HAD	HADDOCK	TBS	THICKBACK SOLE
JOD	JOHN DORY	TUB	TUB GURNARD
LEM	LEMON SOLE	TUR	TURBOT
LSD	LESSER SPOTTED DOGFISH	WEL	LESSER WEEVER FISH
MON	ANGLERFISH (MONK)	WHG	WHITING



Figures 2.3.2a: VIIa, d, f, g, e. Values of the first two Principal Components (PC 1, PC 2) per year.

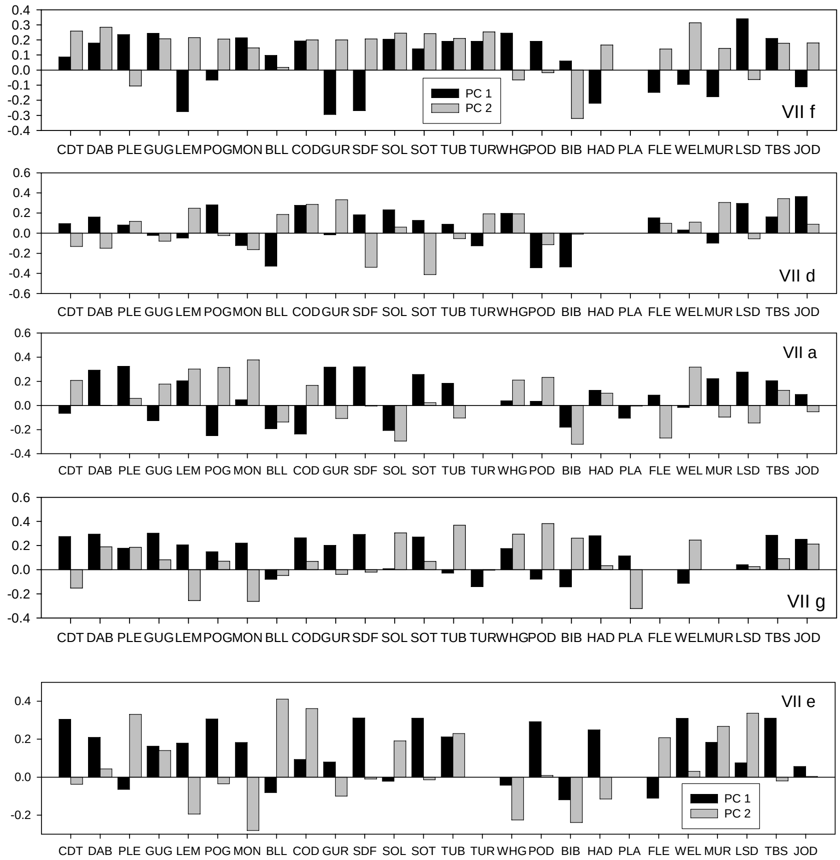


Figure 2.3.2 b: VIIa, d, f, g, e. The scores of each species indicating their contribution to the trend observed in each Principal Component.

b) Results inshore surveys

The PCA results (Figures 2.3.3a and b) show that in each area there has been considerable variation in the fish assemblage and in some areas there are distinct trends over time. For the period from about 1995 onwards all areas show a gradual change over time which appears to apply to practically all species except for example seasnail (SSL). This is the opposite of what is observed in the offshore surveys around UK (area VII) and suggests that there is a move towards deeper water by all major fish species. Although the analysis was performed on 51 species or species/age groups only the 23 most abundant are shown for the scores.

2.3.3 Changes in population distribution

2.3.3.1 Changes in juvenile plaice distribution in the eastern North Sea

Recent reports (Grift *et al.*, 2004) have shown a change in distribution of juvenile plaice in the Wadden Sea away from shallower inshore waters to deeper, further offshore waters. It is probable that the changes are linked with the increase in water temperature in the North Sea particularly since 2000 (van Keeken *et al*., 2004). Since the beam trawl database covers the whole survey area from the North Sea westwards to the Irish Sea, it offers the possibility to investigate whether similar changes have been observed in other sea areas or for species other than plaice.

2.3.3.2 Distribution of juvenile plaice in the Irish Sea and English Channel

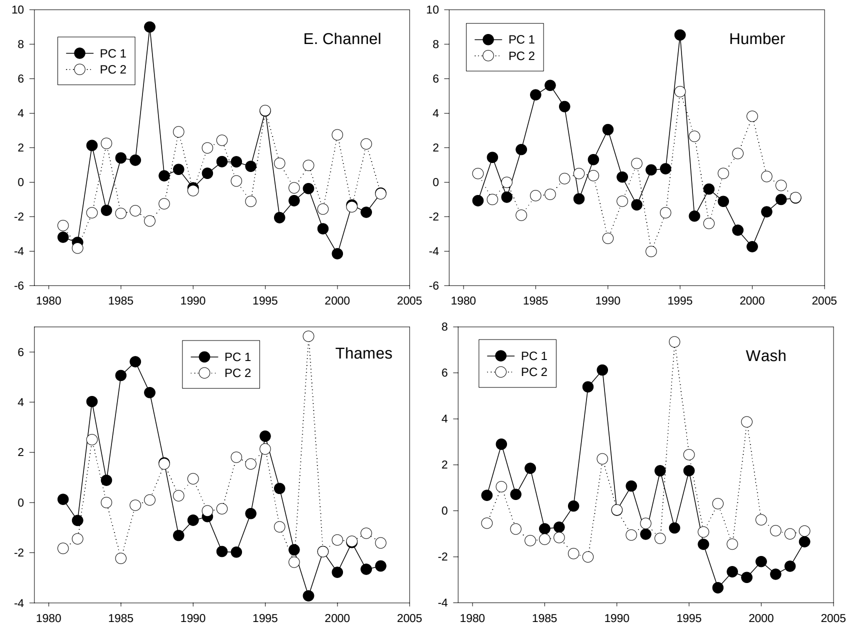
Data were analysed from the English offshore surveys in area VII for two length groups of plaice, 16–20 cm and 21–25 cm, in the eastern Irish Sea, and the eastern English Channel. The analysis looked at the percentage of juvenile plaice found in water depths of less than 20m in order to see whether there has been a shift over the time period from 1993–2003. The results did not show evidence of a change in movement of juvenile plaice into deeper water within the survey areas. However, the resolution of the analysis is regarded as relatively course because there are few stations in shallow water in the two areas investigated.

2.3.3.3 Temperature changes in the North Sea and area VII

The analysis on plaice distribution on the English coast (Section 2.3.3.2) suggests that there has not been a move into deeper water as noted in the Wadden Sea. One factor likely to be driving the offshore displacement is an increase in inshore temperature in the Wadden Sea and elsewhere in the North Sea. In order to see whether similar temperature changes have occurred in other sea areas sampled by the beam trawl surveys, temperature data recorded from around the coast of the UK, was analysed and compared to those results shown in Grift *et al*. (2004). The data shown are taken from an updated version of Norris (2001), which is in preparation, and are presented as the average temperature between July and September. The temperature of an area was calculated by averaging all of the ‘temperature recording stations’ within the vicinity. A table showing the ‘stations’ (described in Norris, 2001) allocated to each area is shown below:

AREA	STATIONS INCLUDED
Wash	5 – 7
Thames	11 – 17
Solent	21 – 23
Bristol Channel	27 – 31
Eastern Irish Sea	34 – 37

Figure 2.3.5 summarises the results. All areas show an increase in inshore surface temperature of between 1–2^{O}C over the time period, other than the Thames, which is already significantly higher in temperature than the other regions. It is worth noting that although no movement in plaice abundance was found in the eastern Irish Sea, this area shows the greatest gradient of temperature change, from around 13^{O}C–16^{O}C, although this area remains at a lower temperature than any of the other regions studied. If temperature is limiting the distribution of juvenile plaice, it is possible that the lower temperatures observed in the Irish Sea remain below the tolerance threshold.



Figures 2.3.3a: Inshore areas. Values of the first two Principal Components (PC 1, PC 2) per year.

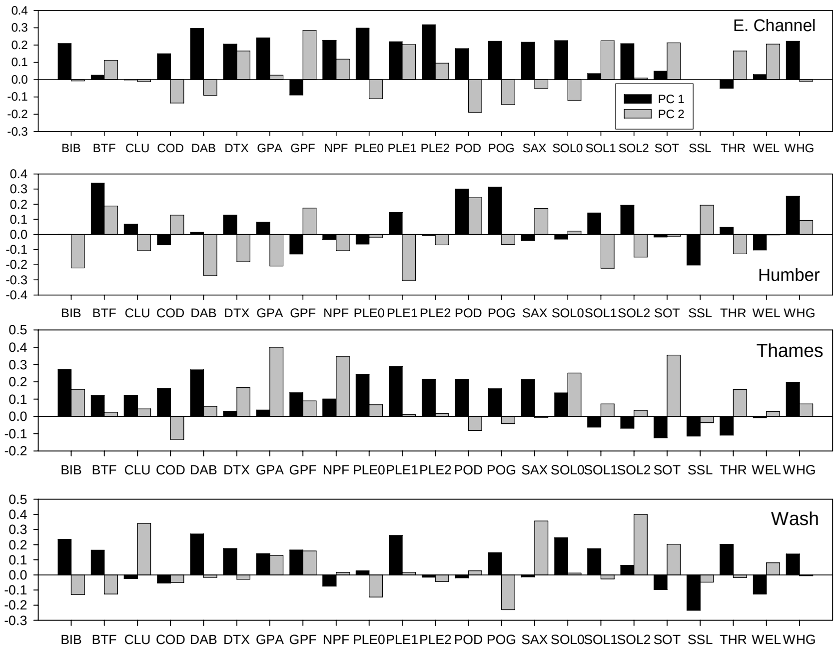


Figure 2.3.3 b: Inshore areas. The scores of each species indicating their contribution to the trend observed in each Principal Component.

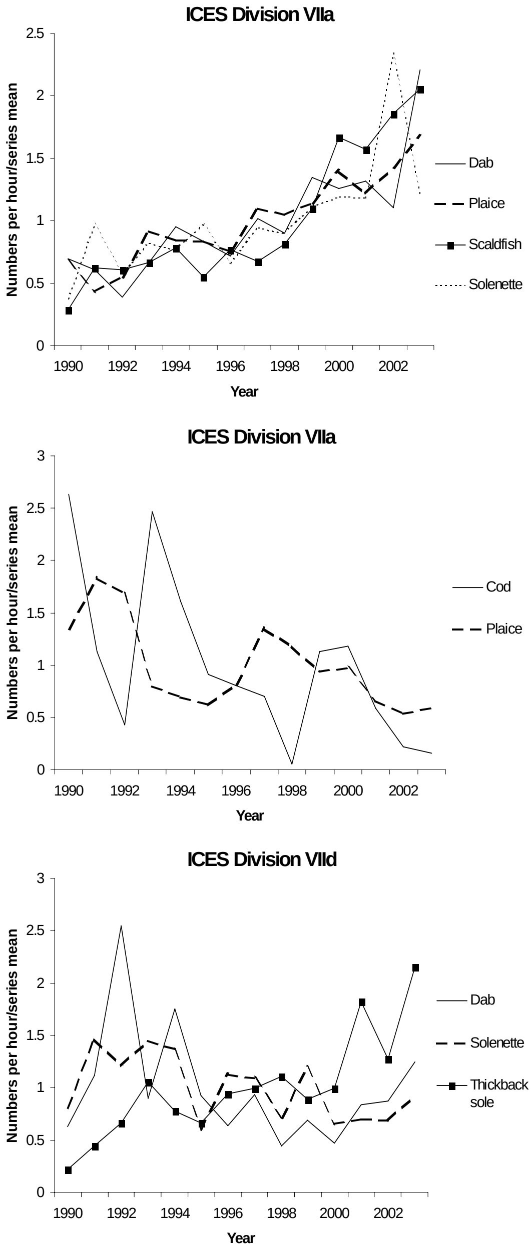


Figure 2.3.4: Trends in abundance of selected species from VIIa and VIId.

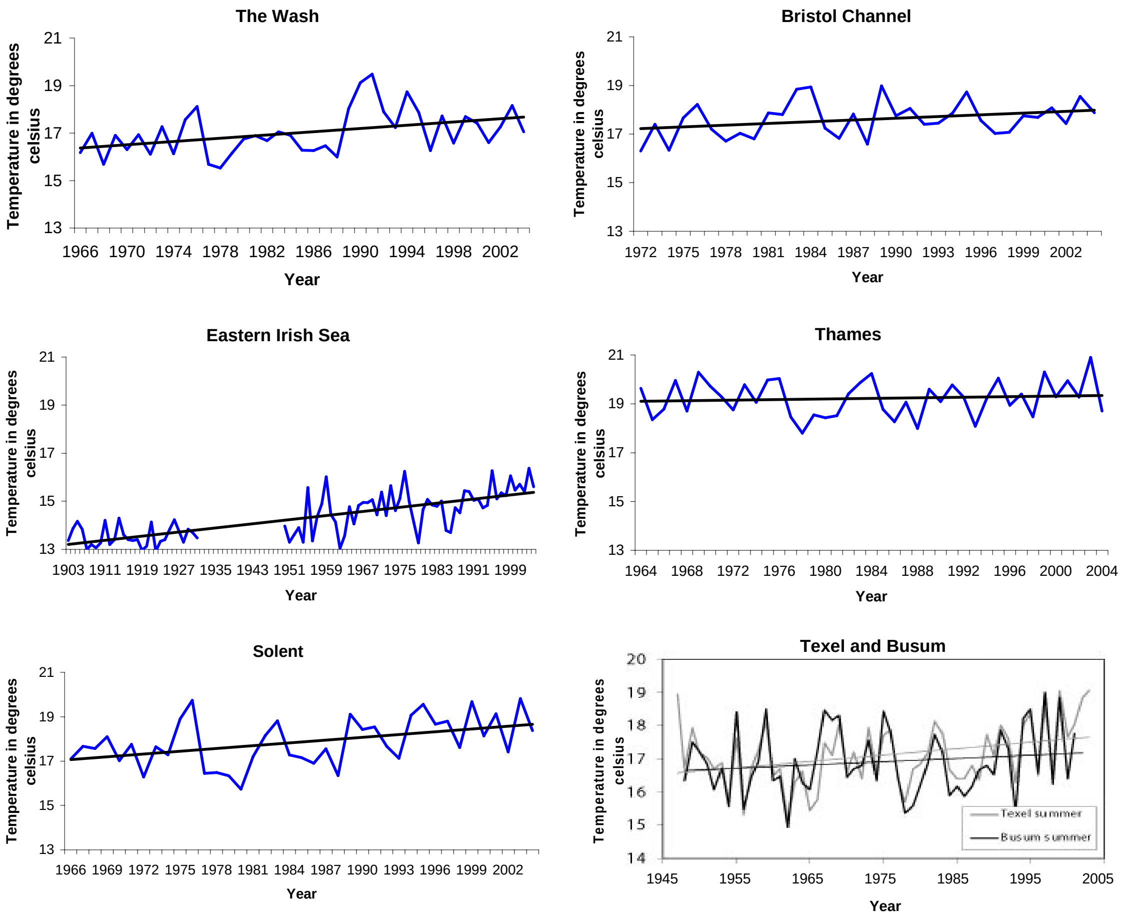


Figure 2.3.5: Trends in temperature for 5 areas in the western North Sea, Channel and Irish Sea from Norris 2001, compared with trends in the eastern North Sea (bottom right box from Grift *et al.*, 2004).

2.3.4 Reporting of data

The WG agreed that in order to ensure data is available for analysis in time for each meeting, all countries should provide their data to the coordinator at RIVO by the 1st March.

2.4 Abundance and distribution of fish and benthos species

2.4.1 Fish species

The yearly abundance per subarea of the main fish species in numbers per hour fished standardised to 8-meter beam trawl, are shown in Tables 2.4.1–2.4.12. The distribution is shown in maps per species in Annex 2. This year, roundfish areas 1, 2 and 3 have been added since the Dutch survey has been carried out in those areas for 9 years. The results for the other roundfish areas differ slightly from last year's report since the non-commercial fish of the Belgian sampling is taken into account. Additionally, the results of roundfish area 6 might have been changed due to re-allocation of a few Dutch hauls.

2.4.2 Benthos

Tables 2.4.13 to 2.4.19 show numbers sampled per hour per year for 13 frequently recorded epifauna species by roundfish area. Only Dutch (1990–2004) and Belgian data (2002–2004) have been used. UK data will be available from 2005. Since only few samples per year have been taken in roundfish areas 1, 2, 3 and 7, the numbers in the tables have not been used for detecting any possible trends since changes might be more due to extreme samples than something else. Roundfish areas 1, 2 and 3 have been sampled since 1996 by the Netherlands.

Liocarcinus depurator has been identified to species by the Netherlands since 1998 (Tridens surveys) and 2000 (ISIS surveys) and in roundfish areas 1, 2, 5 and 7, seems to be a substantial part of the *Liocarcinus* species found in the samples.

In roundfish area 6, *Astropecten irregularis* and *Liocarcinus holsatus* seem to increase in numbers. However, analyses have not yet been carried out to discover any trends in increasing or declining numbers.

Table 2.4.1: Abundance of fish species (per hour fishing) in Subarea VIIa per year.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
AMERICAN PLAICE (LR DAB)	20	1	2	3	8	17	8	29	9	6	4	2	2	2	23
ANGLERFISH (MONK)	1	4	4	9	6	5	5	4	4	4	3	4	7	4	3
BRILL	3	5	3	4	2	2	3	2	2	2	2	3	1	3	2
COD	49	21	8	46	30	17	15	13	1	21	22	11	4	3	16
COMMON DRAGONET	262	298	423	394	350	269	255	283	247	324	377	206	247	328	310
DAB	795	697	448	762	1097	960	823	1172	1032	1544	1447	1515	1269	2542	2337
EUROPEAN PLAICE	440	283	360	596	547	544	493	716	682	742	913	798	931	1091	1175
FLOUNDER (EUROPEAN)	5	2	4	2	2	1	1	4	4	3	3	9	1	5	2
GREY GURNARD	92	95	199	180	161	86	90	111	101	112	99	96	65	96	101
HADDOCK	3		1	1	23	3	15	9	7	22	7	12	2	14	34
JOHN DORY	1	1	1	1	1	1	1	2	1	2	1	1	1	1	2
LEMON SOLE	6	4	6	26	22	25	17	24	20	16	15	20	21	28	23
LESSER SPOTTED DOGFISH	29	39	55	46	39	37	40	80	67	58	55	77	71	64	124
LESSER WEEVER FISH	19	49	102	90	111	104	38	67	57	51	114	34	65	40	50
POGGE (ARMED BULLHEAD)	113	73	88	131	114	103	93	78	77	63	83	60	69	64	109
POOR COD	340	165	184	438	248	302	209	279	187	358	325	144	188	465	671
RED GURNARD	2	12	6	8	11	6	11	18	20	23	19	22	17	28	24
RED MULLET		1	1	1		1		1	1	1	1	1	1	1	1
SCALD FISH	34	75	73	80	94	66	92	81	98	132	201	189	224	247	194
SOLE (DOVER SOLE)	257	348	321	152	131	118	155	256	224	178	185	124	102	112	133
SOLENETTE	192	497	292	419	392	497	334	480	460	568	608	606	1192	608	833
THICKBACK SOLE	16	41	68	60	49	43	51	48	55	52	74	56	63	56	76
TUB GURNARD	10	13	29	16	14	15	18	19	27	21	22	20	19	24	19
TURBOT	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
WHITING	101	89	156	195	166	341	163	247	203	174	121	159	130	167	414
WHITING POUT (BIB)	55	54	55	15	3	22	7	33	58	23	13	11	14	12	8

Table 2.4.2: Abundance of fish species (per hour fishing) in Subarea VIId per year.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
ANGLERFISH (MONK)	1			1	1		1	1	1						1
BRILL	5	2	1	2	2	3	3	3	2	2	3	2	3	3	2
COD			1	1	1	1	1	1	1	1	1	1	2	1	1
COMMON DRAGONET	248	423	540	440	594	247	405	508	978	548	367	421	334	367	308
DAB	92	165	375	133	258	136	94	138	66	102	70	123	128	184	137
EUROPEAN PLAICE	101	117	133	116	70	62	127	133	221	107	140	153	142	131	196
FLOUNDER (EUROPEAN)	1	11	24	9	4	5	30	5	5	7	11	7	16	18	17
GREY GURNARD	2	2	1	1	1	1	1	1	1	4	1	1	2	2	3
JOHN DORY	0	1	1	1	1	1	1	1	1	1	1	1	2	1	1
LEMON SOLE	14	7	7	14	22	26	16	6	5	2	8	14	17	24	14
LESSER SPOTTED DOGFISH	6	10	14	21	13	13	11	20	11	12	10	11	18	11	16
LESSER WEEVER FISH	20	10	23	25	21	10	20	9	17	18	23	27	16	18	33
POGGE (ARMED BULLHEAD)	30	49	81	83	86	70	51	107	41	64	38	75	88	66	67
POOR COD	354	162	118	98	193	195	139	111	100	190	80	108	89	159	209
RED GURNARD	15	16	13	15	24	19	24	13	22	18	23	27	19	27	25
RED MULLET	1		1	1		1	1	1	1	1	1	1	1	1	1
SCALD FISH	13	36	27	30	20	12	16	19	15	29	16	13	18	24	44
SOLE (DOVER SOLE)	60	94	74	117	66	55	58	76	63	110	87	89	127	114	81
SOLENETTE	205	375	312	372	351	154	289	280	184	307	168	180	177	237	309
THICKBACK SOLE	4	8	12	19	14	12	17	18	20	16	18	33	23	39	28
TUB GURNARD	8	5	11	11	8	7	4	6	6	8	5	6	7	11	6
TURBOT	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1
WHITING	1	2	12	2	3	8	1	1	1	1	5	5	18	2	13
WHITING POUT (BIB)	540	77	99	67	122	92	127	183	273	182	41	133	30	278	120

Table 2.4.3: Abundance of fish species (per hour fishing) in Subarea VIIe per year.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
ANGLERFISH (MONK)	2	1	1	5	2	4	3	1	1	1	1	1	5	4	3
BRILL	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
COD			1		1			1	1	1	1	1	1	1	
COMMON DRAGONET	25	84	3	1	1	1	1	1	1	3	4	31	268	412	378
DAB	34	25	17	20	64	43	40	39	32	40	20	85	111	69	30
EUROPEAN PLAICE	37	21	29	19	19	18	30	68	39	43	44	54	29	26	23
FLOUNDER (EUROPEAN)				1		1	1		1	1	1	1			
GREY GURNARD	11	7	5	8	20	6	13	5	13	25	17	2	15	25	12
HADDOCK						1							1	1	1
JOHN DORY	1	2	2	4	2	1	1	1	1	2	1	4	3	2	2
LEMON SOLE	4	3	1	1	2	3	2	2	2	1	1	3	3	4	6
LESSER SPOTTED DOGFISH	19	3	1	29	22	30	26	56	41	54	25	51	31	45	45
LESSER WEEVER FISH	1	1	1	1	1	1	1	1	1	1	1	1	10	17	9
POGGE (ARMED BULLHEAD)	1	1	1	1	1	1	1	1	1	1	1	1	29	31	30
POOR COD	19	61	11	1	1	1	1	1	1	16	10	13	132	405	224
RED GURNARD	68	17	47	66	101	63	51	43	42	62	55	20	61	68	89
RED MULLET	2	2	2	3	2	3	4	3	2	8	4	8	1	14	6
SCALD FISH	4	1	1	1	1	1	1	1	1	1	1	12	136	189	170
SOLE (DOVER SOLE)	20	41	44	26	21	18	26	36	33	30	28	38	17	38	30
SOLENETTE	1	1	1	1	1	1	1	1	1	1	2	41	678	889	737
THICKBACK SOLE	9	3	1	1	1	1	1	1	1	1	6	8	201	266	225
TUB GURNARD	1	1	3	1	1	1	2	1	3	2	2	2	2	5	2
TURBOT	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
WHITING	2	24	10	22	4	7	9	13	7	3	3	10	9	8	3
WHITING POUT (BIB)	25	34	22	15	9	2	11	28	15	4	2	1	9	3	3

Table 2.4.4: Abundance of fish species (per hour fishing) in Subarea VIIf per year.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
ANGLERFISH (MONK)	1	6	22	10	10	6	5	2	1	18	3	3	12	5	6
BRILL	4	5	3	3	4	5	3	4	2	3	7	1	2	3	1
COD	1	2	3	1	2	2	1	1	1	3	7	2	1		1
COMMON DRAGONET	38	81	152	88	238	99	173	93	81	148	174	87	73	89	130
DAB	127	156	306	198	335	165	210	162	246	359	250	236	188	197	213
EUROPEAN PLAICE	190	244	203	57	73	83	144	96	119	139	138	117	97	75	115
FLOUNDER (EUROPEAN)	2	2	2	1	3	3	2	1	3	1	5	11	6	3	1
GREY GURNARD	29	104	170	106	90	50	46	49	66	111	124	85	86	63	42
HADDOCK					1		1	1			1		1	1	2
JOHN DORY	2	4	1	5	2	1	1	3	2	6	5	12	6	6	6
LEMON SOLE	3	4	7	8	18	12	24	11	8	11	13	18	33	41	38
LESSER SPOTTED DOGFISH	138	173	201	82	80	64	68	93	103	168	93	75	93	49	196
LESSER WEEVER FISH	1	6	2	5	6	7	7	3	4	5	15	8	7	8	12
POGGE (ARMED BULLHEAD)	1	4	6	13	7	8	9	5	31	22	18	14	17	29	39
POOR COD	611	587	670	502	226	227	243	334	763	646	593	159	311	698	550
RED GURNARD	3	10	2	12	21	13	19	12	1	8	11	21	22	24	38
RED MULLET	4	1		1	1	1	2	3		6	3	5	1	19	3
SCALD FISH	1	4	3	2	6	7	8	7	1	4	6	8	8	19	21
SOLE (DOVER SOLE)	225	274	260	136	220	107	118	178	378	834	625	330	257	240	312
SOLENETTE	215	561	306	232	494	233	222	137	282	492	368	306	249	393	919
THICKBACK SOLE	14	54	62	46	47	45	45	31	20	46	56	30	33	23	28
TUB GURNARD	18	15	25	5	17	13	12	11	21	42	21	17	22	21	26
TURBOT	2	5	2	2	4	5	3	1	3	9	6	3	4	3	2
WHITING	162	175	246	275	106	109	183	283	146	355	135	40	126	84	213
WHITING POUT (BIB)	485	201	58	23	11	15	31	316	229	109	23	35	85	44	56

Table 2.4.5: Abundance of fish species (per hour fishing) in Subarea VIIg per year.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
AMERICAN PLAICE (LR DAB)				45	174	112	85	43					23	31	43
ANGLERFISH (MONK)				26	52	38	19	9	13	19		5	13	17	12
BRILL	8		8	1	1				8						
COD				2	2	2	1	1		5				1	
COMMON DRAGONET		8	8	101	194	121	83	80	67	133	8	131	64	53	390
DAB		8		150	131	101	87	197	365	681	8	184	80	77	31
EUROPEAN PLAICE		24	8	14	15	17	23	35	104	56	24	8	11	13	5
GREY GURNARD		64	8	124	198	97	77	50	256	267	16	173	91	123	45
HADDOCK				36	88	31	41	33	3	133		43	58	7	16
JOHN DORY				1	1		1		5	11			6	1	7
LEMON SOLE				26	38	31	25	13	32	8		8	2	7	5
LESSER SPOTTED DOGFISH			16	21	27	35	29	91	8	72	16	277	414	40	95
LESSER WEEVER FISH		8			1		2								
POGGE (ARMED BULLHEAD)				39	19	23	10	32	59	83		32	194	29	44
POOR COD	12	936	360	252	136	103	105	325	277	429	464	115	216	153	545
RED GURNARD				5	3	1	1	3	5	3		5			4
SCALD FISH				106	88	82	88	42	173	141		3	24	23	35
SOLE (DOVER SOLE)	12	120	32	27	25	22	16	46	21	107	56	163	32	67	75
SOLENETTE			8	98	89	77	18	41	251	189					
THICKBACK SOLE		16		105	137	129	95	72	123	352		160	266	113	305
TUB GURNARD		8					1	1	3	3				1	
TURBOT	4		8	1		1			5		8	8	5	3	1
WHITING	20	216	80	86	38	67	57	248	189	1586	616	333	95	107	289
WHITING POUT (BIB)		24	8		2			15	3				2	1	

Table 2.4.6: Abundance of fish species (per hour fishing) in roundfish area 1 per year.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
AMERICAN PLAICE (LR DAB)									17	177	150	101	116	142	218
ANGLERFISH (MONK)									3	9	4	1	7	12	4
COD									31	7	5	5	8	2	9
COMMON DRAGONET										1		1	1	1	
DAB									5	109	73	68	54	98	111
EUROPEAN PLAICE									12	10	8	7	5	11	4
GREY GURNARD									4	25	7	3	16	19	15
HADDOCK									45	102	132	56	58	24	48
LEMON SOLE									15	20	9	10	20	8	13
LESSER SPOTTED DOGFISH														1	
POGGE (ARMED BULLHEAD)											1	1		1	4
POOR COD													1	20	1
TURBOT									1						
WHITING									11	27	66	11	34	11	35

Table 2.4.7: Abundance of fish species (per hour fishing) in roundfish area 2 per year.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
AMERICAN PLAICE (LR DAB)							182	189	564	153	265	182	271	265	128
ANGLERFISH (MONK)							1	2	2	2	3	2	1	1	1
COD							49	10	13	9	7	4	5	6	1
COMMON DRAGONET							1		1	1	2	1	1	2	2
DAB							179	268	648	112	270	336	471	463	210
EUROPEAN PLAICE							7	29	39	10	19	14	28	27	15
GREY GURNARD							33	40	44	10	31	32	24	28	30
HADDOCK							32	20	23	30	113	55	22	20	11
JOHN DORY								1							1
LEMON SOLE							10	10	26	8	16	18	18	22	21
LESSER WEEVER FISH										1	1	1	1		
POGGE (ARMED BULLHEAD)							3	1	2	2	4	3	4	4	2
POOR COD											1		1	1	
SCALD FISH									1	1	1	1	3	2	2
SOLE (DOVER SOLE)									1						1
SOLENETTE									1			1		1	
THICKBACK SOLE										1	1				
TURBOT									1		1	1			1
WHITING							19	11	30	10	16	16	13	14	7
WHITING POUT (BIB)													1		

Table 2.4.8: Abundance of fish species (per hour fishing) in roundfish area 3 per year.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
AMERICAN PLAICE (LR DAB)							91	66	75	121	101	142	91	117	116
ANGLERFISH (MONK)							5	5	3	5	5	3	4	12	7
COD							9	13	4	2	5	4	9	24	23
COMMON DRAGONET							5	3	2	9	27	15	20	29	25
DAB							98	119	143	427	297	192	199	262	306
EUROPEAN PLAICE							28	37	65	101	58	57	101	114	125
FLOUNDER (EUROPEAN)										1				1	
GREY GURNARD							42	48	48	92	64	58	68	113	70
HADDOCK							110	167	68	143	166	187	86	75	49
JOHN DORY														1	
LEMON SOLE							22	23	34	33	42	31	50	119	54
LESSER SPOTTED DOGFISH									1	1	2	5	1	3	1
POGGE (ARMED BULLHEAD)							9	9	21	19	46	13	22	17	18
POOR COD							1	1	6	1	8	1	5	45	4
RED GURNARD												1		1	1
SCALD FISH										1	1	1	1	1	1
SOLE (DOVER SOLE)										1			1		1
THICKBACK SOLE							1		1	4	5	2	1	5	2
TURBOT									1	1	1				1
WHITING							45	107	117	90	146	55	112	146	57
WHITING POUT (BIB)												1			

Table 2.4.9: Abundance of fish species (per hour fishing) in roundfish area 4 per year.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
AMERICAN PLAICE (LR DAB)							43	66	73	103	56	60	68	85	54
ANGLERFISH (MONK)							2	1	2	2	1	1	1	1	1
BRILL				8	1	2	2	1	1	1	1	1	1	1	1
COD				16	5	10	9	100	9	5	5	2	10	4	6
COMMON DRAGONET	128			2		4	54	14	25	46	78	80	77	107	122
DAB	136			462	101	291	546	398	217	548	504	423	281	550	320
EUROPEAN PLAICE	8			116	19	259	49	54	35	89	81	64	54	186	102
GREY GURNARD	8				5	24	157	37	40	130	44	75	27	32	45
HADDOCK						6	29	34	29	12	32	22	16	11	6
LEMON SOLE	120			34	48	87	58	87	32	34	48	45	60	58	38
LESSER SPOTTED DOGFISH										1					1
LESSER WEEVER FISH						10	85	4	6	39	47	29	16	85	65
POGGE (ARMED BULLHEAD)	32			136	16	33	59	9	2	38	51	18	85	105	49
POOR COD								2	1	1	1	1	2		5
RED GURNARD						17									
RED MULLET									1		1		1		1
SCALD FISH						15	76	7	2	14	15	17	9	31	20
SOLE (DOVER SOLE)				48	69	130	12	29	30	35	56	30	30	22	5
SOLENETTE						39	67	52	9	5	14	10	3	31	4
THICKBACK SOLE											1				
TUB GURNARD				10		3					1		1		1
TURBOT						1		1			1	1		1	
WHITING				30	18	126	36	64	165	17	73	36	49	63	15
WHITING POUT (BIB)				22	32	8	4	18	2	5	19	6	25	4	

Table 2.4.10: Abundance of fish species (per hour fishing) in roundfish area 5 per year.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
AMERICAN PLAICE (LR DAB)													1		
ANGLERFISH (MONK)			1							1	1			1	
BRILL	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1
COD	2	1	3	1	4	2	3	20	4	3	2	1	2	1	1
COMMON DRAGONET	93	24	1	81	71	122	55	8	54	118	90	73	44	97	40
DAB	141	49	316	51	90	187	211	260	111	309	286	300	144	244	88
EUROPEAN PLAICE	50	51	36	21	38	58	35	53	51	68	58	91	73	81	27
FLOUNDER (EUROPEAN)	19	9	5	1	2	16	9	12	2	13	14	12	49	10	2
GREY GURNARD	11	12	27	8	19	12	18	26	15	32	10	10	10	5	7
HADDOCK									1		1				
LEMON SOLE	22	27	6	27	30	45	56	29	24	28	28	40	20	23	16
LESSER SPOTTED DOGFISH	8	20	5	10	1	2	5	3	8	4	19	6	18	5	3
LESSER WEEVER FISH	44	42	69	70	51	113	145	46	50	118	79	58	60	76	111
POGGE (ARMED BULLHEAD)	70	54	12	47	163	138	96	37	26	44	77	76	46	79	32
POOR COD	169	143	22	26	48	28	11	7	17	30	19	44	20	8	49
RED GURNARD	1	2	1	1	1	8	2	1	1	1	1	1	1	1	1
RED MULLET		1	1	1	1	1	1	1	1	1	1	1	1	1	1
SCALD FISH	35	7	78	28	17	67	36	25	17	45	46	27	23	41	22
SOLE (DOVER SOLE)	227	176	45	139	154	103	74	138	109	164	197	182	94	228	64
SOLENETTE	59	5	125	19	9	75	97	72	45	60	99	52	39	59	16
THICKBACK SOLE		1		1				1	1			1	1	1	1
TUB GURNARD	2	1	2	5	1	1	1	1	1	1	2	1	2	2	1
TURBOT	1	1	1	1	1	1	1	1		1	1	1	1	1	1
WHITING	149	20	29	69	44	57	47	46	119	98	122	105	119	65	50
WHITING POUT (BIB)	129	120	19	22	105	110	31	40	125	304	87	219	72	204	154

Table 2.4.11: Abundance of fish species (per hour fishing) in roundfish area 6 per year.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
AMERICAN PLAICE (LR DAB)	3	2	1	1	2	2	3	8	33	11	6	4	9	5	6
ANGLERFISH (MONK)			1	1	1	1	1				1	1	1	1	
BRILL	2	1	3	3	2	1	1	1	2	1	2	1	1	1	1
COD	4	10	3	1	10	9	9	24	3	1	2	2	1	1	1
COMMON DRAGONET		1	1	6	10	144	21	110	117	122	68	79	126	98	57
DAB	1906	1125	1219	1119	1055	755	1461	1368	1363	1203	997	990	799	843	490
EUROPEAN PLAICE	509	645	603	620	573	502	763	1174	1045	752	571	1183	739	497	401
FLOUNDER (EUROPEAN)	10	16	5	9	4	7	9	11	5	1	3	4	4	5	4
GREY GURNARD	24	25	35	34	59	35	36	36	60	84	44	24	36	35	32
HADDOCK				1		1			1		1	1	1	1	1
JOHN DORY					1		1								1
LEMON SOLE	2	2	1	3	13	8	9	83	6	6	5	8	10	17	9
LESSER SPOTTED DOGFISH	1	1	1		1			1		1	1		1	1	1
LESSER WEEVER FISH	29	27	36	64	65	77	61	62	124	82	66	102	53	73	60
POGGE (ARMED BULLHEAD)	44	62	63	41	152	120	59	184	163	37	49	63	90	59	51
POOR COD	3	1	1	1	1	5	2	1	6	3	1	1	2	2	5
RED GURNARD		2	1	1	1	1	1	1	1	1	1	1	1	1	1
RED MULLET	1	1	1	1	4	2	1	1	1	13	1	2	4	10	2
SCALD FISH	93	71	77	184	90	80	18	40	88	88	79	138	166	223	212
SOLE (DOVER SOLE)	86	50	136	72	47	57	23	150	69	50	34	42	52	34	12
SOLENETTE	81	78	150	182	169	139	33	90	68	322	404	219	269	147	188
THICKBACK SOLE	1	1				1			1			1			1
TUB GURNARD	8	6	13	12	10	6	5	4	7	4	6	5	5	7	6
TURBOT	5	3	3	3	4	3	2	2	3	2	5	3	3	4	2
WHITING	358	70	85	78	123	106	41	50	197	185	174	267	103	79	48
WHITING POUT (BIB)	26	1	7	3	6	27	2	29	34	100	16	16	8	13	5

Table 2.4.12: Abundance of fish species (per hour fishing) in roundfish area 7 per year.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
AMERICAN PLAICE (LR DAB)	27	28		73			184	75	200	105	116	88	135	70	26
ANGLERFISH (MONK)		1					3	1	2	1	2	1	1	1	1
BRILL				1			1	1	1	1	1			1	
COD	1	3		2			101	15	18	4	26	7	7	17	2
COMMON DRAGONET							6	1	11	18	7	3	5	33	4
DAB	2799	1532		3382			1646	467	1622	842	3092	649	508	742	182
EUROPEAN PLAICE	871	692		286			200	291	644	323	703	89	99	155	11
FLOUNDER (EUROPEAN)	7	3		1			6	2	1	1	1			1	
GREY GURNARD	110	86		92			84	34	111	89	269	51	38	27	5
HADDOCK							3	5	2	7	46	13	2	4	1
LEMON SOLE	8	3		1			10	9	8	5	9	8	10	10	1
LESSER WEEVER FISH				5						1			1	1	
POGGE (ARMED BULLHEAD)	35	52		84			27	9	25	16	31	5	3	13	1
POOR COD								1							
SCALD FISH	5	18		21					4	9	61	15	11	38	6
SOLE (DOVER SOLE)	16	12		9			4	1	7	4	12	2	1	1	1
SOLENETTE	5	3		24			2	1	1	3	29	13	15	168	1
TUB GURNARD	3			2			5	6	3	1	2	1	1	1	1
TURBOT	2	1		1			1	1	1	1	4	1	1	1	1
WHITING	659	152		89			11	2	9	15	52	153	26	12	7
WHITING POUT (BIB)	1														

Table 2.4.13: Average of 13 epifauna species (numbers per hour) per year in roundfish area 1 (NL).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Aphrodita aculeata									120		483	104	79	154	82
Asterias rubens									618	770	166	254	213	1080	16
Astropecten irregularis									270	368	5607	2035	2853	9776	160
Buccinum undatum									8		36	20	50	220	26
Cancer pagurus														16	
Corystes cassivelaunus															
Echinocardium sp.									1920	4	176	40	46	63	10
Liocarcinus depurator									96		214	52	113	109	88
Liocarcinus sp.									138		112	22	67	42	20
Nephrops norvegicus									12		204	43	69	571	16
Ophiothrix fragilis													422	94	
Ophiura sp.									30	1888	285	114	98	154	14
Pagurus sp.									36		104	126	327	732	62

Table 2.4.14: Average of 13 epifauna species (numbers per hour) per year in roundfish area 2 (NL).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Aphrodita aculeata							341	358	101		148	223	244	121	126
Asterias rubens							16677	73481	106	769	1514	967	769	820	950
Astropecten irregularis							13163	6900	823	4101	5968	5091	2389	2465	3935
Buccinum undatum							1322	111	150		203	337	208	184	288
Cancer pagurus							20	20			4	4	6	12	12
Corystes cassivelaunus							1008	1461	8	43	57	37	36	62	291
Echinocardium sp.							1156	380	74	321	227	420	226	156	579
Liocarcinus depurator									194	460	22	443	493	103	268
Liocarcinus sp.							967	6405	210		306	142	246	103	210
Nephrops norvegicus								48				117	50	12	19
Ophiothrix fragilis									251		875	207	1523	703	12
Ophiura sp.							17114	4199	87	446	190	85	121	49	60
Pagurus sp.							491	174	100		219	252	186	245	314

Table 2.4.15: Average of 13 epifauna species (numbers per hour) per year in roundfish area 3(NL).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Aphrodita aculeata							280	1104	120		195	120	84	68	128
Asterias rubens							9082	51659	790	1896	1214	1807	4998	2692	189
Astropecten irregularis							9568		66	490	648	768	460	720	191
Buccinum undatum							432	6400	64		41	29	54	63	70
Cancer pagurus							14	628	7	6	27	12	48	52	13
Corystes cassivelaunus										8					
Echinocardium sp.							7968		81	67	63	104	368	16	10
Liocarcinus depurator									36	64	219	151	115	656	661
Liocarcinus sp.							965	19479	121	0	124	70	235	273	606
Nephrops norvegicus									76	385	264	637	39	1170	131
Ophiothrix fragilis									84		120	22	1808	2837	20
Ophiura sp.							992	52245	118	713	124	401	846	120	207
Pagurus sp.							144	1536	173		279	142	195	580	436

Table 2.4.16: Average of 13 epifauna species (numbers per hour) per year in roundfish area 4 (NL and BEL).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Aphrodita aculeata							1848		40		229	120	183	124	71
Asterias rubens							21296	24910	226	822	1054	332	1185	615	188
Astropecten irregularis							1456	80	178	2026	1800	484	2297	2232	2875
Buccinum undatum							192		48		1526	41	146	54	22
Cancer pagurus							6	10	29	17	37	60	22	14	17
Corystes cassivelaunus									22	51	81	45	26	65	90
Echinocardium sp.							2560		9	200	24	16	16		39
Liocarcinus depurator													320	68	181
Liocarcinus sp.							5133	4274	175		912	186	374	193	828
Nephrops norvegicus							32				66	92	16	32	4
Ophiothrix fragilis									53		77013	23	213	23	149
Ophiura sp.							528	1488	43	184	204	69	286	91	177
Pagurus sp.							160	272	55		439	150	262	244	333

Table 2.4.17: Average of 13 epifauna species (numbers per hour) per year in roundfish area 5 (NL and BEL).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Aphrodita aculeata	48		16	24			152	157			176	4	576	43	361
Asterias rubens	32	10295	1049	97	872	24	1512	7221	1107	4818	7950	9771	1050	1373	636
Astropecten irregularis		43	2488					128	112	368	195		242	581	80
Buccinum undatum	16	245	629	142	32		48	144		1059	72	12	61	122	116
Cancer pagurus	9	21	5	6	1	2	17	7	286	113	532	2434	132	18	69
Corystes cassivelaunus			505	51					12	64	49	28	25	28	40
Echinocardium sp.	72	2609	6300	53	392		133	262	4		64	356	416		707
Liocarcinus depurator									553	42	5264	9020	150	492	169
Liocarcinus sp.	208	1746	775	3268	784	256	7419	5260	1950	4149	3435	4469	1666	3007	2506
Nephrops norvegicus			5				16	1		18					
Ophiothrix fragilis									64		331	16	418	454466	2
Ophiura sp.	160	536	915	121	416	112	341	124	31	893	691	105	13741	163	282
Pagurus sp.	648	2244	769	791	472	360	536	1096	57	2643	349	85	262	237	138

Table 2.4.18: Average of 13 epifauna species (numbers per hour) per year in roundfish area 6 (NL and BEL).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Aphrodita aculeata	212	241	541	273	404	184	723	899	213	386	368	580	318	453	309
Asterias rubens	3899	7160	7289	4808	2765	3790	5051	6855	15564	23496	9849	674	10895	7527	8572
Astropecten irregularis	3796	3266	2523	2156	2036	1927	3171	1526	3918	7672	4895	3452	14578	12222	12001
Buccinum undatum	77	113	68	67	248	60	212	44	943	265	243	24	36	119	136
Cancer pagurus	2	2	1	6	2	4	116	7	24	13	15	12	73	26	18
Corystes cassivelaunus	134	200	275	128	410	190	686	519	201	449	282	222	239	577	597
Echinocardium sp.	2517	2453	1263	2171	1345	1069	1528	12483	224	15669	664	470	1611	3113	1309
Liocarcinus depurator											171	146	175	681	430
Liocarcinus sp.	1734	2330	3806	3111	4196	4883	2112	4057	4850	9565	3242	3606	9055	14226	15342
Nephrops norvegicus	20	132	214	69	34	2	45	277	62	53	2637	15	175	114	171
Ophiothrix fragilis	96	99	36	16	16	40	112		50	656	97	174	93	52	198
Ophiura sp.	576	9001	6268	4171	14101	681	44197	16744	4745	12369	5656	436	1833	1266	1228
Pagurus sp.	315	286	281	275	493	162	457	292	682	519	439	114	307	411	221

Table 2.4.19: Average of 13 epifauna species (numbers per hour) per year in roundfish area 7 (NL).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Aphrodita aculeata	320	371		304			638	32	258		348	1544	566	499	1015
Asterias rubens	3404	1948		1549			1318	51328	387	2258	849	1171	760	7040	1395
Astropecten irregularis	2265	4679		1934			3934	1920	7924	5975	5311	7940	3838	5747	7164
Buccinum undatum	48			6			21	1690	237		417	560	478	650	399
Cancer pagurus	1	129		4			8	13	4	14	20	60	12	4	4
Corystes cassivelaunus	64	443		81			7080	512	32	172	446	611	215	89	128
Echinocardium sp.	41593	44889		7294			2221	160	104	2240	1848	1228	1046	1205	5322
Liocarcinus depurator											212	138	207	300	509
Liocarcinus sp.	484	255		797			1056	4148	596		523	609	336	526	1045
Nephrops norvegicus		1		5			30			252	28	414	55	227	664
Ophiothrix fragilis	192			16					188		21	112	4	21	16
Ophiura sp.	1333	2571		48			1744	4480	299	417	365	224	238	274	278
Pagurus sp.	201	238		203			349	373	151		163	498	400	745	469

3 Coordination and standardisation of beam trawl surveys

The WG reviewed the protocols carried out by each country to ensure standardization of the surveys. The main areas considered to be important for survey consistency were vessel and gear (including gear deployment), sampling period and area coverage.

3.1 Offshore beam trawl surveys

The WG reviewed the available beam trawl surveys, which are used to derive indices of year class strength for plaice and sole. Table 3.1.1 lists the existing surveys, which include all the surveys using heavy beam trawls and covering mostly offshore but also some inshore stations in the North Sea and ICES area VII. Although the surveys are intended to sample the youngest age groups of plaice and sole they also catch the older ages and can provide indices for those. The main surveys are listed below:

Gear and vessel: In general, there is lack of standardization between countries for gear size and for attachments such as tickler chains. This is because fishing is carried out on a range of seabed types, which require different gear specifications for effective fishing. The Netherlands surveys are mainly on sandy grounds where tickler chains are most effective for flatfish. In the southwestern North Sea and in area VII, grounds tend to be much harder and it is necessary to use beam trawls with chain mats rather than tickler chains. This approach follows common commercial fishing practice in the areas surveyed. There is much greater standardization between countries in gear deployment. All countries tow for 30 minutes and use a towing speed of 4 knots. In all countries except Germany, cod end mesh is fixed at 40mm.

Vessel size varies between countries but no analysis has been done on potential vessel effects and these differences have not been taken into account when combining data across surveys. It is expected that vessel differences would be small, in view of the standardization on towing speed and duration and the fixed length of beam trawl which determines the swept area.

Most countries have written protocols for setting up and rigging gear in a standard way but there was a lack of a clear audit trail for ensuring gear had been checked prior to a survey. The **WG recommended** that each country set up a clearly defined audit system, which should include a checklist of repairs carried out and changes made to the gear since the previous survey. This list should be signed off when completed by a senior scientist in the institute. The **WG also suggested** that a standard replacement schedule should be developed by all countries to indicate when such items as tickler chains, chain mats and rubbing strips on the underneath of the beam trawl shoes should be replaced.

In order to assist with standardisation of procedures, the WG suggested that scientific personnel should go on surveys of other countries from time to time.

Period of survey: The survey period has been relatively stable since the start of the survey but some changes have taken place in the Dutch offshore surveys as seen from Figure 3.1.

Table 3.1.1: Details of the beam trawl surveys currently undertaken by each country.

	BELGIUM	GERMANY	NETHERLANDS	NETHERLANDS	UK	UK	UK
Survey area:	IVb and c west	IVb east	Ivb and c east	Central N Sea	VIId	VIIe	VIIa, f and g
Year survey started:	1992	1991	1985	1996	1988	1988	1988
Dates:	August	mid August	end August	end August	late July	late Sep/early Oct	Sept
Usual start date	week 33	week 32	week 32/33	week 35	week 30	week 39/40	week 36/37
Number of survey days	10	11	20	16–20	15	8	21–24
Ship:	RV Belgica	RV Solea	RV Isis	RV Tridens	RV Corystes	MFV Carhelmar	RV Corystes
Ship length:	50 m	42 m#	28 m	73.5	53 m	22 m	53 m
Beam trawl length:	4 m	7 m	8 m	8 m	4 m	4 m	4 m
Number of beams fished:	1	2	2	2	1	2	1
Trawl duration (min):	30	30	30	30	30	30	30
Tow speed (knots):	4	4	4	4	4	4	4
Cod end liner stretched mesh (mm):	40	44	40	40	40	40	40
Number of ticklers:	0	5	8	8	0	0	0
Gear code:	BT4M	BT7	BT8	BT8S	BT4FM	BT4FM	BT4FM
Attachment:	*	(none)	(none)	**	*	*	*
Station positions:	fixed	pseudo-random	pseudo-random	pseudo-random	fixed	fixed	fixed
Av No stns/yr	53	63	88	63	100	57	94
Benthos sampling since:	1992	1992	1985	1996	1991	1992	1992

 # new vessel since 2004; previously 35m

*** chain mat and flip-up rope**

**** flip-up rope only**

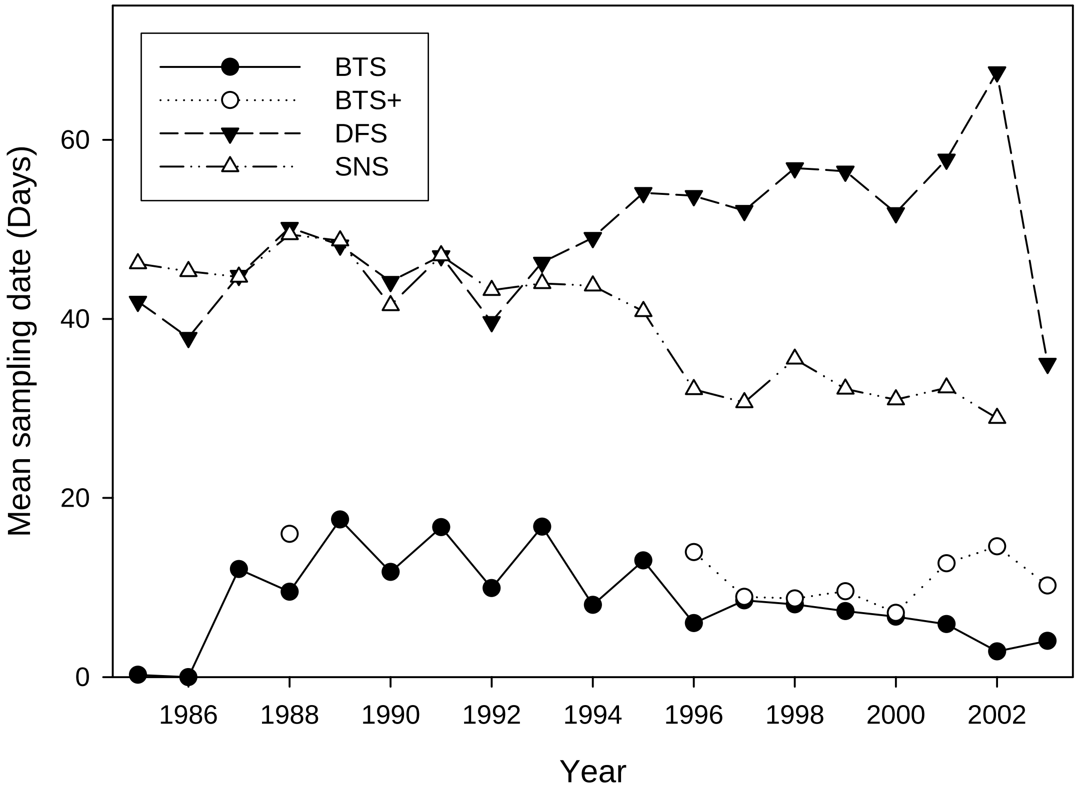


Figure 3.1: Timing of the surveys. Indicated is the mean sampling date per year. Earliest date (0) is the 20th of August.

Area of survey grid: The survey area from which abundance indices have been calculated has been unchanged over the time period of the surveys. However some changes to the extent of the survey have occurred as noted below:

Belgium: Fixed grid, no change since start of survey

Germany: Westerly stations in deeper water were discontinued in 2004 and some more southerly stations included.

Netherlands: i) Isis – no changes; ii) Tridens– some rectangles where gear damage has occurred regularly have been omitted and alternative rectangles included. This has not affected the stations used to calculate abundance indices for assessments.

UK: i) VIId – Some deep water stations have been excluded where flatfish rarely caught. ii) IVc – additional stations in deeper water included from 2004 onwards. No impact on abundance indices as not yet utilized for assessments; iii) VIIe – some additional stations added and impact on abundance indices is being evaluated; iv) VIIf,g – stations off SE Ireland have been excluded in recent years as not part of prime stations used for calculating abundance indices; v) VIIa – standard grid has been maintained.

3.2 Inshore surveys

Table 3.2.1 lists the inshore surveys together with the geographic area covered, the gear used and the date started. More details on the surveys are given in ICES 2002.

Four of the inshore surveys (Belgian DYFS; Germany – Schlesweig Holstein survey; Netherlands all DFS; UK North Sea only) are combined to derive an international index of abundance, which is used in estimating recruitment for plaice and sole in the ICES North Sea and Skagerrak Demersal WG. The level of standardisation for these surveys has not been reviewed since the surveys were combined in the 1980s and the WG therefore felt that it would be useful to look at the current position on standardisation.

Gear and vessel: A direct comparison of the surveys is difficult due to the wide range of gears used by different countries and the different catch efficiencies. There are also wide variations in the attachments used. Most countries use one or more tickler chain but in the Belgian and German inshore surveys, no tickler chains are used. Apart from England, all countries use a codend mesh of 18–20mm. In England, the mesh size in use is 4mm. The combination of samples from these surveys involves the use of relative gear efficiencies determined from comparative hauls undertaken during the 1980s (ICES CM 1985/G:2).

Period of survey: Details of the survey period for each country are shown in Table 3.2.1. The survey dates have remained relatively stable since they started. Details for individual countries are shown below:

Belgium: No changes in survey time period

Germany: The survey has been carried out in the spring and autumn until 2004. Only the autumn survey will be continued from 2005 and an extended area will be surveyed.

Netherlands: The surveys begin in week 35 (beginning of September) in the Waddensea and extend over 2–5 weeks depending on area and weather.

England: Usually the first neap tide period in September. Recently it has been necessary to start the survey at the end of August in order to complete indices in time for the ICES NSSK WG.

Area of survey grid: The aim of the inshore surveys is to cover the most important nursery areas for plaice and sole in the North Sea and eastern English Channel. The existing inshore survey extends in the north as far as approximately 55^0N on the southern coast of Denmark. However, some important nursery areas have been omitted such as the northernmost part along the Danish coast and the Weser estuary. The Weser will be included in the survey by Germany from 2005 onwards but the gap along the northern Danish coast remains a problem. The WG considered that the inclusion of the remaining Danish Waddensea area into the survey would be highly beneficial and felt that it would be helpful if Denmark were able to participate.

The WG recognised that the inter-calibration of gears which are currently used to combine surveys may no longer be valid in view of possible changes in net design used in the survey. As a result, it **recommended** that the issue of gear efficiencies for the inshore surveys should be included in the Terms of Reference for consideration at the next meeting of WG Beam.

Table 3.2.1: Inventory of International Inshore Young fish Surveys.

COUNTRY	NETHERLANDS (SNS)	NETHERLANDS (DFS)	NETHERLANDS (DFS)	NETHERLANDS (DFS)	ENGLAND (YFS)	BELGIUM (DYFS)	GERMANY (DYFS)	GERMANY (DYFS)
Geographical Area of Survey	Dutch coastal to Danish coastal, Scheveningen to Esbjerg	Waddensea	Scheldt Estuary	Dutch coastal to Danish coastal areas 1– 4 inner stations	Eastern/South-Eastern English Coast	Belgian Coast	Niedersachsen Waddensea + Elbe Estuary	Schlesweig-Holstein Waddensea
Ship	Tridens/ISIS	Stern/Waddenzee Navicula (from 2006)	Schollevaar	ISIS/ Breukels/G)28	Chartered vessels	Hinders/Brood winner	Chartered vessels	Chartered vessels
ship size (m)	Trid 73m; Isis 28m	Stern/Wadd 21m; Navic 24m	21m	28m	8–10m	27m	12–16m	12–18m
Date started	1969–1984 Tridens 1984 – ISIS	1970	1970	1970	1973	1970	1972	1974
Sampling Period	Sept/Oct	Sept/Oct	Sept/Oct	Sept/Oct	Sept/Oct	Sept/Oct	Apr/May* Sept/Oct	Apr/May* Sept/Oct
Usual Start date	12 Sept	29 Aug	5 Sept	26 Sept	1 Sept	1–14 Sept	15 Sept	5 Sept
Number of days	8–9 within 2 weeks	20 within 5 weeks	12 within 3 weeks	16 within 5 weeks	3 surveys x 8 days	7 within 2 weeks	5 Apr/May 5 Sept/Oct	5 Apr/May 7 Sept/Oct
Beam trawl type	6m BT	3m shrimp trawl	3m shrimp trawl	6m shrimp trawl	light 2m Beam Trawl	6m shrimp trawl	3m shrimp trawl	3m shrimp trawl
Tickler Chains	4	1	1	1	3	0	0	0
Mesh size net	80	35	35	35	10	40	32	32
in cm. Cod-end	40	20	20	20	4	22	18	18
Speed fished	3.5 knots / 4 knots	3 knots	3 knots	3 knots	1 knot	3 knots	3 knots	3 knots
Time Fished	15 min	15 min	15 min	15 min	10 min	15 min	15 min	15 min
Species Target	1– 2-group sole/plaice	0–1-group sole/plaice	0–1-group sole/plaice	0–1-group sole/plaice	0–1 - 2+ sole/plaice	0-1 - 2 sole/plaice	0–1-group sole/plaice	0–1-group sole/plaice
other	All	crangon/All	crangon/All	crangon/All	Turbot Brill crangon/All	All (no crangon since 1992)	crangon/All	crangon/All
Av No stns/yr		148	88	102				
Age information	All years	All years	All years	All years	None	None	None	None

*** 1974–2004 Apr/May; from 2005 only Sept/Oct**

3.3 Development of inshore surveys database

In the absence of a coordinated database covering all inshore surveys, the WG was not able to assess issues such as possible changes to the survey area with time or extent of overlap by different countries. The **WG agreed** that the available time series of inshore survey data should be provided to the Netherlands in a common exchange format similar to data provided for offshore surveys. Data up to and including 2004 should be provided by 1 Feb 2006. Data of 2005 by 1 March. Once data was available for all countries, it would enable a comprehensive analysis of the surveys to be undertaken in time for the next WG Beam meeting.

4 Evaluation of population abundance indices

4.1 Calculation of existing Indices

Tuning fleets and estimates of recruitment from beam trawl surveys are provided for plaice and sole to the Northern Shelf WG (VIIa); Southern Shelf WG (VIIe, VIIfg) and the WG on the Assessment of Demersal Stocks in North Sea and Skagerrak. The calculation of the indices for the various stocks is described below:

4.1.1 Offshore survey indices

The beam trawl surveys are developed to deliver indices for sole and plaice. The Netherlands Institute for Fisheries Research (RIVO) runs a beam trawl survey (BTS) in the North Sea conducted by two vessels RV “Isis” and RV “Tridens” (Figure 4.1.1). CEFAS runs three beam trawl surveys: in the Irish Sea and Bristol Channel (ISBTS), in the western Channel (WCBTS), and in the eastern Channel and southwestern North Sea (ECBTS). The principles underlying estimation of abundance indices for each species are the same in each case.

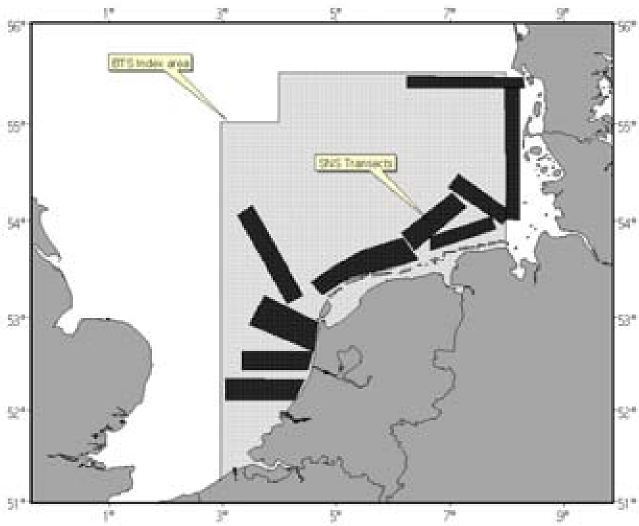


Figure 4.1.1: Locations of the BTS Index area and SNS transects in the North Sea.

North Sea

1) The total survey area is divided into strata (ICES rectangles) and otolith areas, the latter primarily to localise age-length keys (ALK).

2) Numbers-at-length caught standardised to a half-hour tow are averaged across all hauls within a stratum to estimate a length frequency distribution (LFD) for each rectangle.

3) Otoliths are collected from most plaice and sole caught on these surveys. ALK's are assembled for each rectangle or otolith area.

4) ALK's are applied to LFD's to estimate age-length distributions (ALD) in each rectangle.

5) Numbers-at-age-given-length are summed across all lengths to estimate numbers-at-age by rectangle.

6) Mean catch in numbers-at-age for half an hour trawling are determined for the index area (see figure)

Irish Sea and Western Channel surveys (VIIa, f, g and VIIe).

1) The total survey area is divided into strata, primarily to localise age-length keys (ALK).

2) Numbers-at-length caught standardised to a half-hour tow are added across all prime stations within a stratum to estimate a length frequency distribution (LFD) for each stratum.

3) Otoliths are collected from most plaice and sole caught on these surveys. ALK's are assembled for each stratum.

4) ALK's are applied to LFD's to estimate age-length distributions (ALD) in each stratum.

5) Numbers-at-age-given-length are summed across all lengths to estimate numbers-at-age by stratum. These are divided by total fishing effort in the stratum (hours or kilometres towed) to give stratum catch per unit effort (CPUE)-at-age.

6) A weighted average of estimated CPUE-at-age by stratum is formed using stratum areas as weights. This gives the estimated abundance index for the survey.

Eastern Channel survey VIId

1) For the purpose of assembling ALK's the survey area comprises of 2 strata these being the English and French sectors of the eastern Channel.

2) ALK's are constructed for each sector by sex.

3) Station Length frequency distributions are proportioned using these ALK's to give the numbers at age per hours fishing by sex for each trawl position.

4) The numbers at age by sex are then combined to give an overall number of fish per hour.

5) The average numbers per hour by rectangle are then calculated by dividing the summed numbers per hour for all stations worked within a rectangle by the number of stations worked within the rectangle that year.

6) The numbers per hour are then summed for all rectangles and divided by the total number of rectangles worked to give a cruise average number per hour.

4.1.2 Inshore survey indices

Two inshore surveys exist that deliver indices for North Sea plaice and sole to ICES assessment WGs: the Netherlands SNS and the international DFS.

The Netherlands SNS: The catches are summed for each transect and multiplied so as to arrive at a catch/100 hours trawling. The index of abundance is derived from the unweighted arithmetic mean across all transects.

The International DFS: The method used to calculate a combined international index using Belgian, English, German and Netherlands DFS surveys has been described in detail (ICES 1985). Numbers per $1000m^2$ are calculated by station within depth strata. The mean abundance by strata is calculated and standardised for gear efficiency. A population estimate is then derived by raising the mean number per $1000m^2$ to the area of the depth strata. The combined North Sea index is the sum of the area totals.

4.2 Estimation of the survey indices

4.2.1 Offshore surveys

4.2.1.1 Sampling and calculation of indices from stratified surveys

Beam trawl surveys are the major provider of information on pre-recruit year class abundance to be used as tuning indices in flatfish stock assessments throughout ICES areas IV and VII. The indices stabilize catch-at-age models for pre-recruit ages, where fisheries information is highly variable and inconsistent. In addition they play a major role in determining the model predictions of future recruitment to the fishery and are thus essential tools in forecasting and management of flatfish fisheries. A reliable index, one that accurately tracks year-class strength prior to recruitment into the fishery, can greatly improve model performance and enhance management effort to conserve important stocks.

WGBEAM has provided indices of relative abundance for plaice and sole for the survey series, supplied by the respective institutes. Some of the work done by this group has concentrated on combining the information from several surveys and investigating possible ways to intercalibrate different vessels. Although this is necessary and important in order to examine spatial and temporal shifts in the distribution / growth or other biological parameters of the species, it does not necessarily allow us to make predictions about future recruitment or current stock abundance. The problem is that irrespective of whether we are looking at one or several surveys, it is currently not clear how best to combine the information from the fixed station designs into an index representative of the stock dynamics (outside of the stations / samples). One widely used method is to use a stratification scheme, where the observed mean abundance is weighted by the size of the area of that stratum and summed over all strata. However, it is frequently difficult to identify an effective stratification and where this is based on seabed or potential habitat type; it is usually difficult or impossible to examine the total area for particular habitat types (potential strata)

In the current absence of such information, one possible approach is to investigate trends observed over time at individual stations and the effect of individual station on the index as a whole. Results of such analysis would provide information on suitable stratification schemes, even if it is currently not possible to find appropriate weightings to use to combine these into representative indices of relative abundance

A programme developed at CEFAS, Lowestoft was used to investigate the effect of different strata on survey indices and the possible impact these changes have on deriving stock estimates from XSA. The method uses catch at age data from each station over the survey time period and outputs plots and correlation matrices to show which stations indicate similar trends in abundance-at-age over time and which stations show divergent or uncorrelated signals. Finally a colour plot indicating the level of correlation, initially at random and then ordered by stratum will indicate by the level of pattern ordering as to whether the stratification scheme in use is useful for the index in question.

The resulting numbers-at-age by station information can also be bootstrapped over the prime station-stratum matrix within the specified strata and a new index calculated for each permutation given a protocol appropriate for the stock / survey combination in question. This gives some estimation of the variability of the index, given that it may not be possible to sample all stations in a particular year. The plots of a jack-knife analysis of the bootstrap results indicate which station drive the index, and the consequence of removing the stations from the index. This may aid in identifying a priority order for stations within the survey design.

Finally the package also uses the results of the bootstrap analysis from the index to perform an XSA analysis according to the currently set procedures by the relevant working group. This will indicate the effects of individual station within the survey index on the estimates of SSB and F in the recent time period. Because the results are also bootstrapped it can also be used to empirically determine the component of variability due to the survey in the analysis (the internal se of the tuning fleet).

Initial results carried out on two stocks (Plaice VIIa, and Sole VIIe) using two different surveys (the Irish Sea Beam Trawl Survey, and the Western Channel Beam Trawl Survey (also known as the Carhelmar Survey) respectively) indicate that the current stratification scheme is quite poorly organised in the sense that there is only marginally more correlation between stations within strata than between stations across strata, for most of the ages. Examination of the trends over time indicates, that there may be some better stratification schemes possible, however it is not entirely clear what is driving these differences.

Bootstrapping of the results by prime stations suggests that for the youngest and the oldest ages the index is driven by a small number of stations, so that the results for these ages are highly dependent on the stations sampled, the weight given to a particular station and potentially the environmental conditions at the station when it is sampled.

Bootstrapping the assessments derived from XSA indicates that there is only minimal effect of some quite large changes to the index on the estimates of F and SSB in the assessment. This is at least partly due to the fact that young fish do not contribute much to either F or SSB and these are typically the most variable indices. But even recruitment estimates, which should largely be driven by the survey, show relatively little fluctuations except for those ages, which have not recruited to the fishery at all. This indicates that the assessment process using XSA, places the majority of the weight on the catch numbers matrix. Changes to the indices can have much larger effects on stock estimates using other methods which rely on survey indices such as SURBA.

The results of this analysis has provided some tools to examine the reliability and reproducibility of the surveys and some insight as to how one might improve surveys, although further work is needed on how to weight the information from different strata in combining to a single survey.

4.2.1.2 Relative Gear Efficiency

For four Dutch national beam trawl surveys that overlap to some extent in space and time but differ in the size or the rigging of the gear (see Table 3.1.1 and 3.2.1) the relative catch efficiency was determined and an exploratory analysis carried out on the effects of temporal differences and spatial scale. For these analyses one survey was considered to be the standard and the catchabilites of the other surveys was determined relative to this standard.

In this study four surveys were distinguished: two offshore surveys, the “standard” beam trawl survey (BTS), the BTS+ which uses the same gear as the standard beam trawl survey but with flip-up ropes, and two inshore surveys, the Sole Net Survey (SNS) and Demersal Fish Survey (DFS).

The difference between surveys in the age-classes targeted and the area covered is reflected in the size-composition of their catches of plaice and sole where BTS Tridens catches the largest fish followed by BTS Isis, SNS and DFS (Figure 4.2.1). In order to be able to take size into account we distinguished between small (≤15 cm) and large (>15 cm) fish.

For each combination of surveys pairs of hauls were created, one form each survey depending on the distance. The number of pairs per depth interval varies depending on the depth interval and the combination of surveys (Figure 4.2.2).

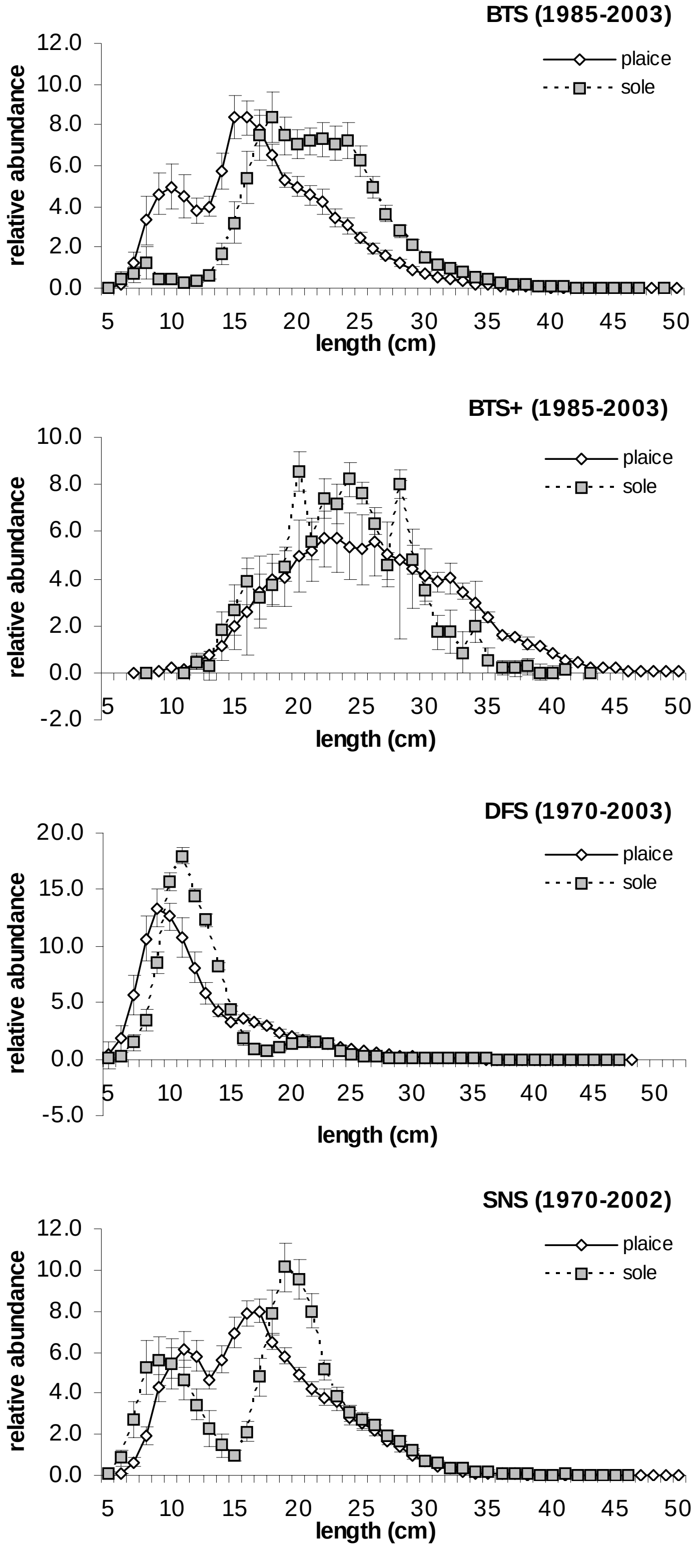


Figure 4.2.1: Length-frequency distributions of plaice and sole for each of the surveys given as the mean annual relative abundance (+ s.e.), based on numbers per hour.

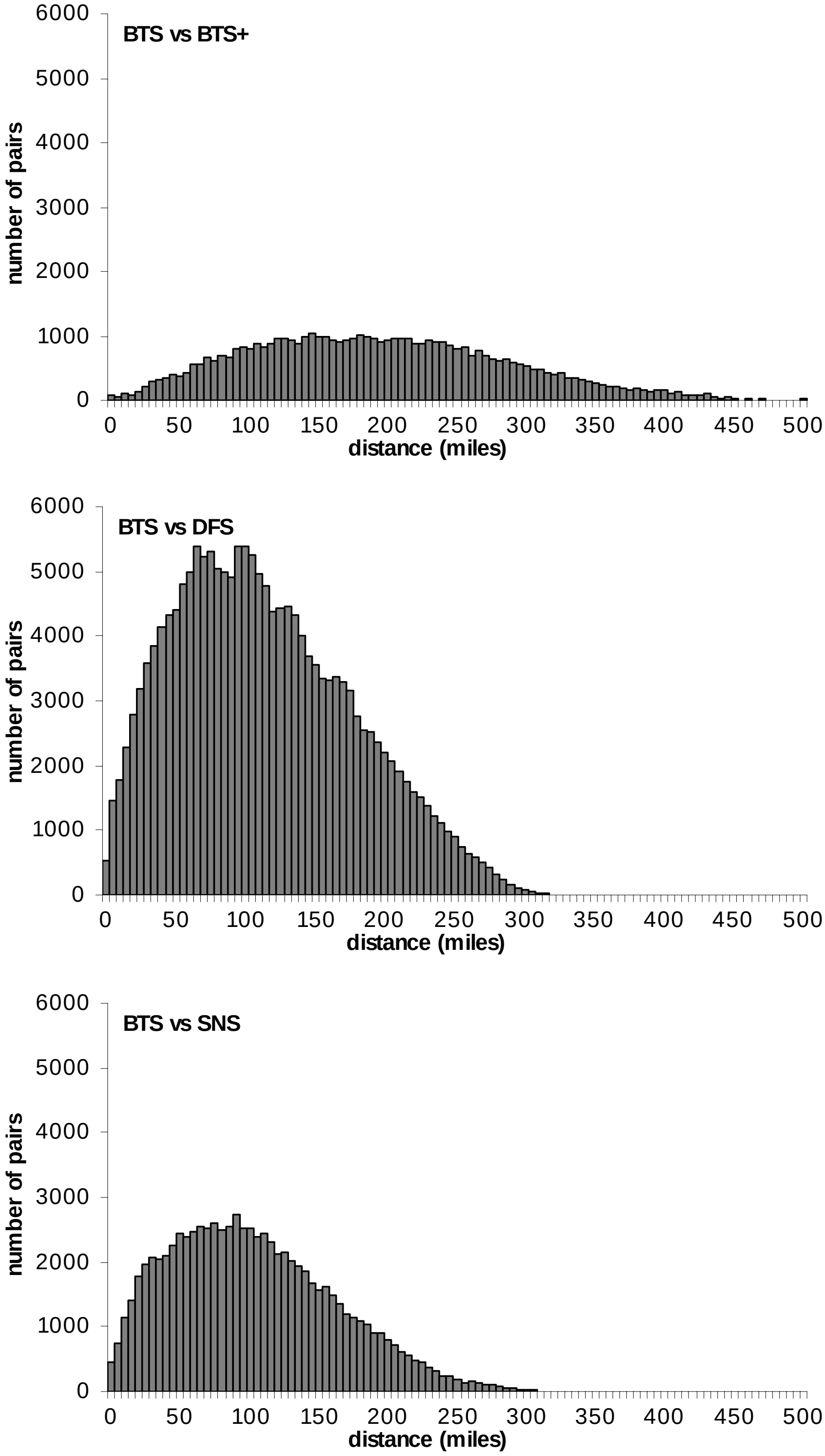


Figure 4.2.2: Number of pairs per distance interval for combinations of three surveys with the standard BTS.

The relative catch efficiency of each combination of gears was determined based on all pairs in a specific distance interval using functional regression.

Relative catch efficiency also varied considerably with distance from the coast (Figure 4.2.3). Catch efficiency of DFS and SNS relative to the BTS standard always increases with increasing distance. This applies for both large and small, plaice and sole. BTS+ (standard BTS with flip-up rope) shows a different pattern where relative catch efficiency of small plaice and sole initially increases up to 20 (plaice) or 25 (sole) miles after which it decreases. Relative catch efficiency of larger plaice and sole shows a more or less continuous decrease with increasing distance.

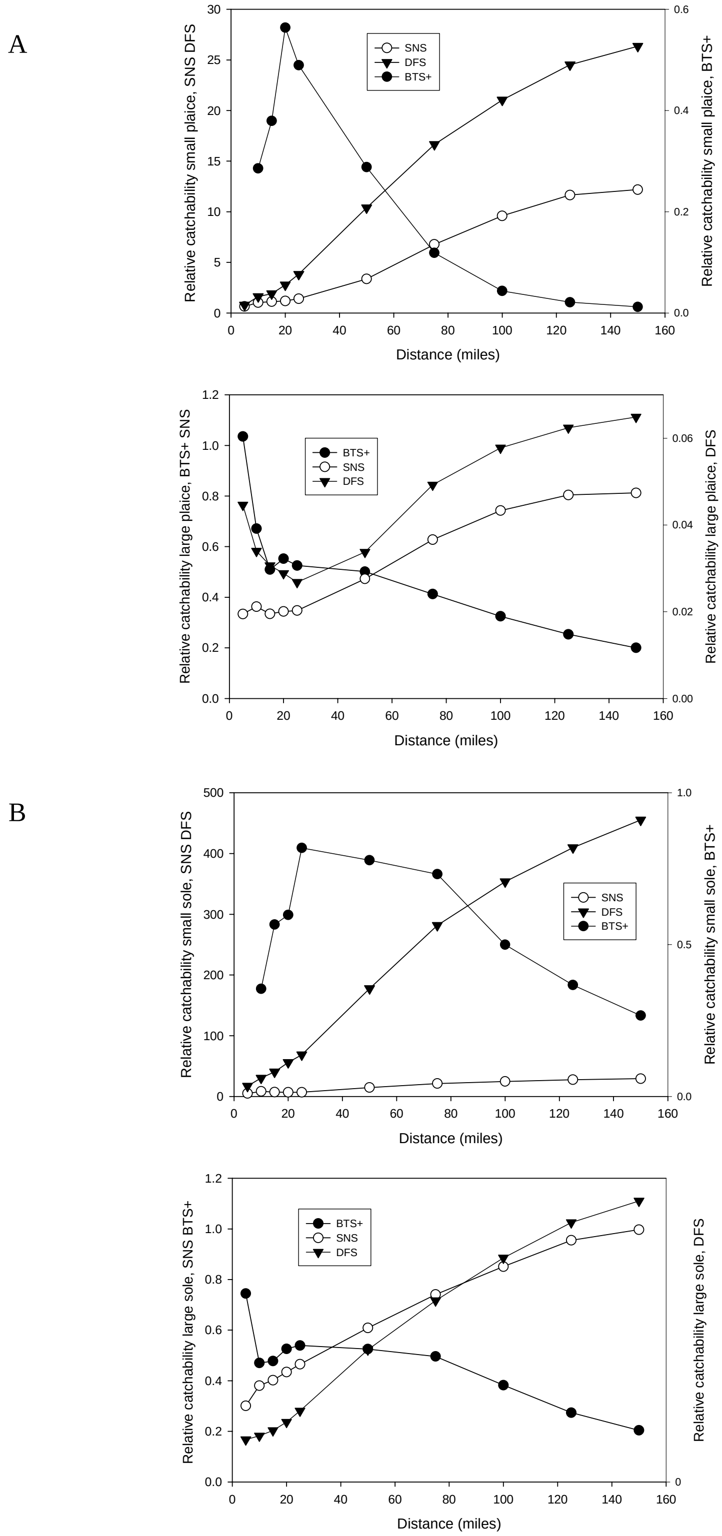


Figure 4.2.3: Change in predicted relative catch efficiency between paired hauls depending on the distance from the coast. (A) sole and (B) plaice. Relative catch efficiency was calculated as the ratio of the predicted catch of a specific gear type/ BTS standard at a value representative of the catches of that species/size group (e.g. 50 small plaice, 250 large plaice, 5 small sole, 50 large sole). Note the different scaling of the y-axis.

The fit of the regression and hence the uncertainty around the catch efficiency estimates varies markedly with distance and appears to be best at the highest distance intervals where there are the most pairs for the regression and R^2 is maximal while p is lowest. However, with increasing distance the catch efficiency estimates are increasingly biased due to changes in population density between the areas covered by the respective surveys. As there appears to be a trade-off between increasing precision by reducing variability or increasing accuracy by reducing bias (e.g. a biased estimate with low uncertainty at high distances and an accurate estimate with high uncertainty at low distances) we chose the lowest distance at which we were able to obtain catch efficiency estimates for all cases (e.g. small plaice, small sole, large plaice, large sole): 10 miles.

The following relationship describes the catch efficiencies of three different beam trawls relative to one standard (e.g. BTS standard):

Catch BTS standard = $\exp^{\text{Intercept}} * (\text{Catch Gear-type})^{\text{slope}}$

Where gear-type may be BTS+ (flip-up rope), SNS or DFS type of gear. The values for each type of gear are indicated in Table 4.2.1.

Table 4.2.1: Values for intercept and slope that describe the relationship between the catches of three types of gear relative to a standard (BTS). Catch efficiency is the ratio of the catch of each gear-type and the catch of the standard BTS. The ratio is determined for the mean catch of each specific species/size group in the standard gear.

PARAMETER	GEAR	PLAICE		SOLE	
		Small	Large	Small	Large
Intercept	BTS+	-0.42	-0.55	-0.98	-1.24
	SNS	0.36	-2.98	1.93	-3.23
	DFS	1.58	-7.14	3.22	-7.39
Slope	BTS+	0.79	1.03	0.97	1.12
	SNS	0.91	1.36	1.11	1.58
	DFS	0.72	1.68	1.12	1.58
Catch efficiency at mean	BTS+	0.34	0.66	0.36	0.39
	SNS	0.99	0.40	6.69	0.31
	DFS	1.54	0.04	23.61	0.01

Figure 4.2.4 shows how the catches of each of the three beam trawls compare to those of the standard BTS. For small plaice and sole the catch efficiency of DFS is higher than that of SNS which in turn is higher than that of BTS+ while for large plaice and sole the opposite applies. Catch efficiency of SNS compares best to that of the standard BTS for small plaice but for large plaice and all sole BTS+ compares best to the standard BTS.

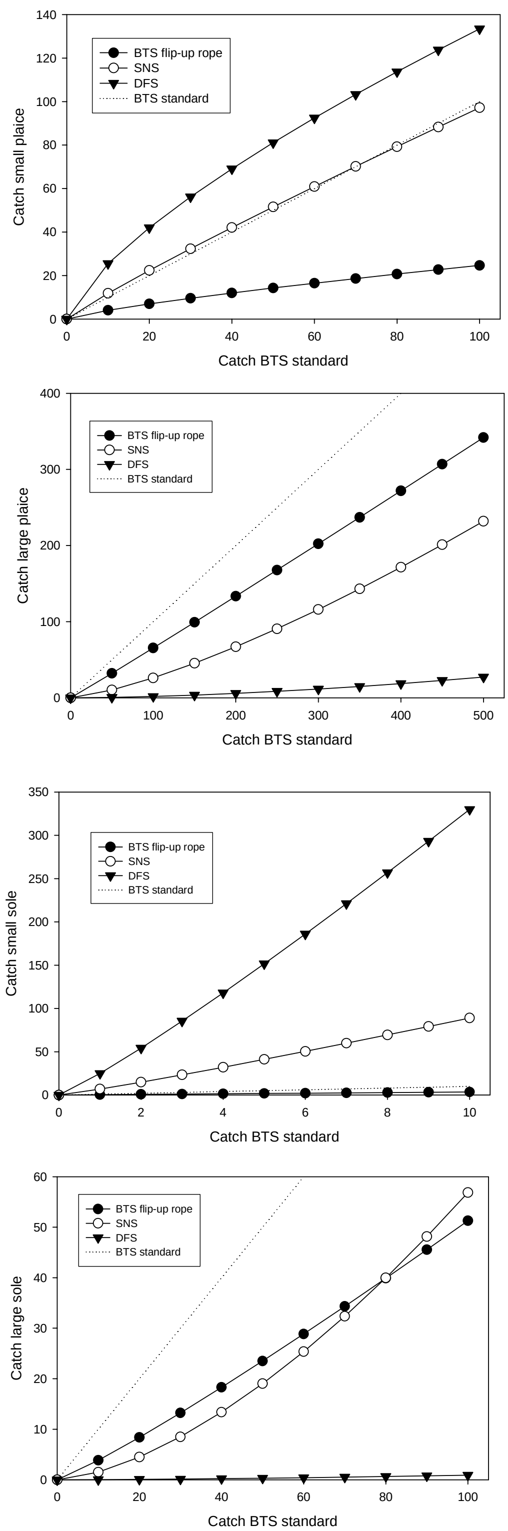


Figure 4.2.4: Predicted catches of different gear types relative to the catch of the standard BTS. The parameter values were based on a distance of 10 Nm.

These analyses show that there are distinct differences in catch efficiency between the different types of gear applied in the Dutch beam trawl surveys and that these differ depending on the species (plaice versus sole) and size (small≤15 cm versus large>15 cm).

Overall the standard BTS has the highest catch efficiency for large fish followed by BTS+, SNS and DFS while for small fish DFS has the highest catch efficiency followed by SNS, the standard BTS and finally BTS+.

In a previous study the catch efficiency of the standard 8m beam trawl (BTS) was compared to that of a similar trawl equipped with a flip-up rope (BTS+) by contrasting 81 parallel hauls of both trawls (Groeneveld and Rijnsdorp, 1990). For small plaice and sole (ages 0–2) our results agreed with what was observed in this study where the standard beam trawl caught markedly more fish than the beam trawl + flip-up rope (factor 0.25). For larger plaice and sole (> age 3) the results differed in that Groeneveld and Rijnsdorp (1990) did not observe any difference for plaice (factor 1.00) and caught slightly more sole with the beam trawl equipped with flip-up rope (factor 1.12) while in this study the factors were respectively 0.66 and 0.39.

To some extent, however, relative catch efficiencies may be affected by factors that were not explicitly incorporated in the analyses such as depth/distance from shore or time of year. For both plaice and sole the abundance of small fish decreases with increasing depth (or distance from shore) while the abundance of large fish shows the opposite. When comparing a typical offshore survey such as BTS or BTS+ with a typical inshore survey such as DFS, or less so SNS, the positions of the offshore survey will usually be in deeper water and hence the catches of small fish in that survey lower and of large fish higher than those of the inshore survey. To some extent this may confound the observed differences between gear types.

Another factor that affects the catch is the time of year. It is known from commercial catches of plaice and sole that Catch per Unit of Effort varies over time and this is confirmed by an analysis on the survey catches where catch of both large and small, plaice and sole decreases as the haul is conducted later in the year. Considering that BTS and BTS+ are always conducted first followed by SNS and DFS the catch efficiency of these latter two surveys is probably underestimated, DFS more so than SNS.

4.2.2 Inshore surveys

For the DFS the main potential sources of bias were identified as:

- factors used for correction of gear efficiency
- the sampling and area-based raising of strata
- derivation of age length keys

4.2.2.1 Factors used for correction of gear efficiency

In deriving the international combined index, factors were used to account for variation in gear efficiency and for estimating area-based population abundance. Both these factors may lead to biases in the combined index. Although some information was available from comparative tows, gear efficiency figures were based on a limited number of cross comparisons. The raising figures used are shown in Table 4.2.2.1. It has not been possible to review these estimates, as no further work on the comparative efficiency of the gears has been carried out. The WG agreed that gear efficiency should be considered further at the next meeting of WG Beam.

Table 4.2.2.1: Raising factors used since 1983 to standardise gear efficiencies in international Demersal Fish Surveys (ICES 1985).

AREA	GEAR	PLAICE		SOLE	
		0-gp	1-gp	0-gp	1-gp
Belgian coast	6m no tickler[1]	1.22	1.00	1.59	1.88
Coastal areas	6m + tickler	1.00	1.00	1.00	1.00
Scheldt Estuary/Dutch Waddensea	3m + tickler	1.00	1.00	1.00	1.00
German Waddensea	3m no tickler	1.22	1.00	1.59	1.88
English coast	2m + 3 ticklers	0.75	1.00	0.30	0.35

Note 1: Since the comparison, the Belgian gear has changed and now carries 8–10 tickler chains.

4.2.2.2 The sampling and area-based raising of strata

The combined index is obtained by calculating individual strata indices for each region weighted by the area of each depth band. The weighting factors used are shown in Table 4.2.2.2

Table 4.2.2.2: Area-based weighting factors.

COUNTRY	REGION	DEPTH CLASS	WEIGHT	KM2
NL + Bel	Wadden Sea	0–6	0.048	866
		6–12	0.014	250
		12–20	0.007	123
		>20	0	
	Scheldt estuary	0–5	0	
		5–10	0.009	154
		10–20	0.009	167
		>20	0	
	Dutch Coast	0–5	0	
		5–10	0.052	934
		10–20	0.269	4881
		>20	0	
	German Bight	0–5	0	
		5–10	0.103	1876
		10–20	0.399	7233
		>20	0	
	Belgian Coast	0–5	0	
		5–10	0.045	817
		10–20	0.047	844
		>20	0	
NL + Bel	Total		18.14	18145
UK	Total		1*	6695
Ger	Total		1.56	1559
* already raised to total area				

Strata were originally defined on the basis of depth from 0–20m. However, the 0–5m and >20m zones were not included along the continental coast because these area were not thought to be effectively sampled. However, improved sampling in this depth band since then suggests that they should be considered for inclusion, in future. Another possible anomaly is the area allocated in the German Waddensea. In the calculations, a figure of 1559 km^2 was used. Germany has since carried out a detailed review of the area surveyed using ArcView software. The results were presented in a working document to the meeting (WD-4). The results of the area analysis suggest that the actual area surveyed is in excess of 5,000km^2 but a proportion of this could be areas within the 0–5m depth zone. The WG **recommended** that the issue of strata used in raising the population estimates for the inshore surveys should be included in the Terms of Reference for consideration at the next meeting of WG Beam.

4.2.2.3 Estimation of age length keys

Different approaches have been used in estimating age at length across different surveys. The Netherlands have consistently used otoliths samples taken on a regional basis and Belgium has made use of the Dutch ALKs. The UK has taken otoliths by region since 2002 only and previously relied on length frequency. Germany separates age groups on the basis of length frequencies. No analysis of the sensitivity of the indices to errors in age estimation has been made and this should be investigated in future.

5 Compliance to DATRAS

At its last meeting in 2003, the WG agreed that data from the offshore surveys should be provided directly to ICES for inclusion in the DATRAS database. For data from the inshore surveys it was decided that these should first be collated in the WGBEAM database and scrutinized by the group before they can be added to the DATRAS database.

In 2004, the Dutch offshore beam trawl data (haul and length information, 1985–2004) have been delivered to DATRAS (ICES database). The historic age data will follow by the end of 2005 or beginning of 2006, depending on the progress made in the Dutch database. At the moment, there is a routine to deliver haul and length data to DATRAS shortly after finishing the survey. Age data will follow when all otolith reading has been carried out.

The procedure of delivering data to DATRAS for Dutch offshore survey data is noted below.

After checking the survey data, they are added to the Dutch database. From there, an extraction is made by using a SAS program. This program reads the database information and puts the data into the DATRAS format. The DATRAS files are checked via an internet application (see www.ices.dk – DATRAS – checking program). When the files have been checked by the DATRAS checking program, they are sent to the ICES data coordinator who adds the data to DATRAS.

No beam trawl data from other countries has yet been sent to ICES and the WG hoped that this would be given greater priority in future. The WG noted that an alternative approach was for RIVO to provide the DATRAS format to each country to enable them to generate data in the correct format.

6 Recommendation: Protocols and criteria for standardisation

Survey manuals are available for all countries either nearly or fully completed. A general format does not exist and all manuals use the standard formats at the different institutes with regionally adapted protocols. At the last years meeting, there was a request to exchange manuals but this has been delayed because, apart from the UK, no other nation had an English version. WGBEAM understands that a common format is not crucial but would like to see essential parts like the gear used, deployment, rigging etc. documented in a common way for easy access and use. The following topics are regarded as essential:

- detailed gear description and fishing protocols
- pre cruise gear preparation
- audit trail for gear standardisation and gear preparation
- history of survey (timing, duration, changes to survey grid etc)

7 References

Grift, RE., Tulp, I., Clarke, L., Damm, U., McLay, A., Reeves, S., Vigneau, J., Weber, W. 2004 Assessment of the ecological effects of the Plaice Box. Report of the European Commission Expert Working Group to evaluate the Shetland and Plaice boxes. Brussels. 121 pp.

ICES 1985. Report of the 0-Group North Sea Flatfish Working Group. ICES CM 1985/G:2

ICES 2001. Report of the Working Group on Beam Trawl Surveys. ICES CM 2001/G:06

Norris, S.W. 2001. Near-surface sea temperatures in coastal waters of the North Sea, English Channel and Irish Sea – Volume II. Science Series Data Reports No 40, CEFAS, Lowestoft, England, 31pp.

Van Keeken, O.A., Van Hoppe, M., Grift, R.E., and Rijnsdorp, A.D. 2004. The effect of changes in the spatial distribution of juvenile plaice (*Pleuronectes platessa*) on the management of its stocks. ICES CM 2004/K:24.

Annex 1: Sampling coverage of the area

Figure 2.1.1 Total number of beam trawl hauls per rectangle.
Total hauls in 2004 (above) and total for 1990 – 2004 (below) for BEL .

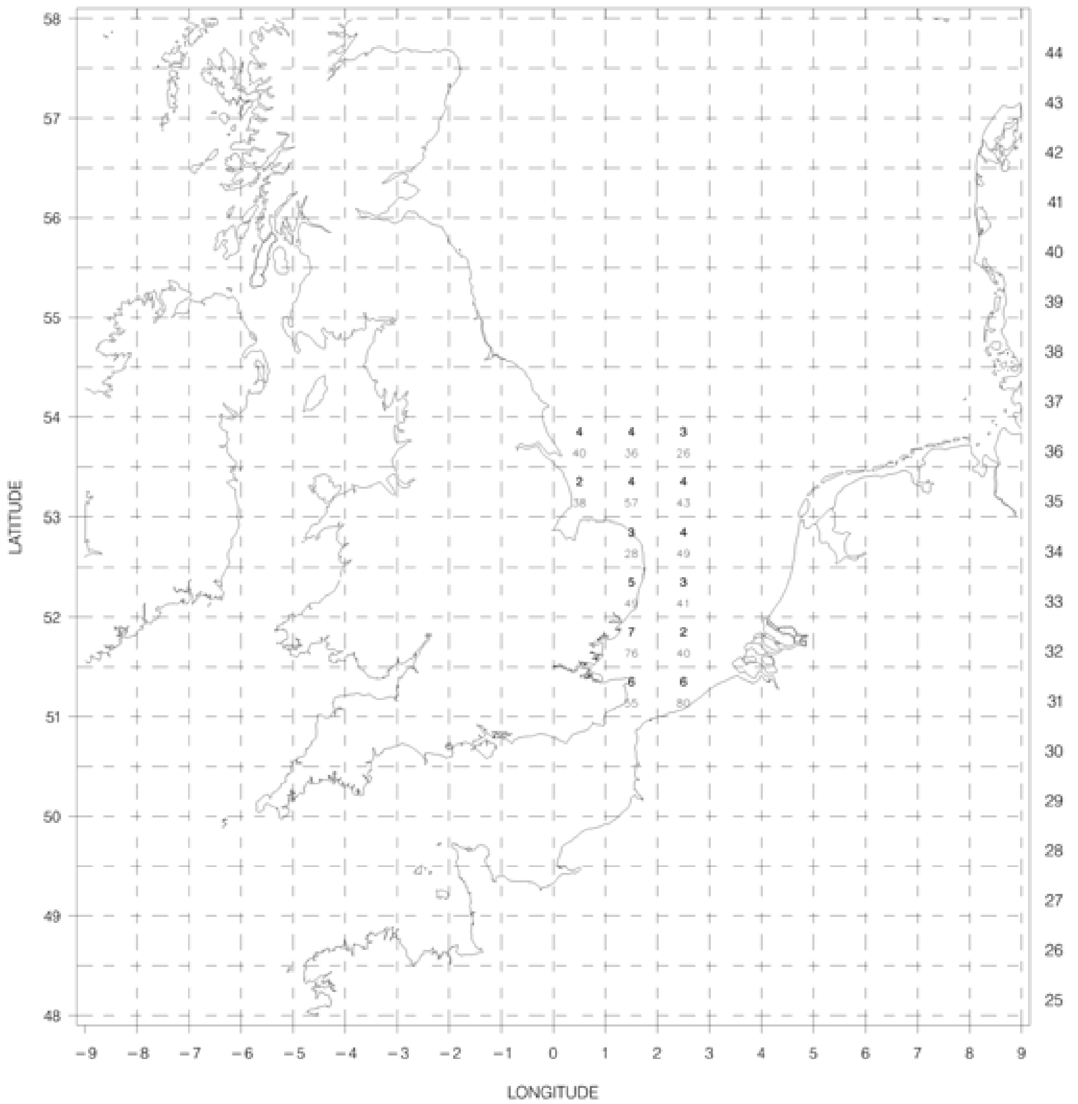


Figure 2.1.2 Total number of beam trawl hauls per rectangle.
Total hauls in 2004 (above) and total for 1990 – 2004 (below) for ENG .

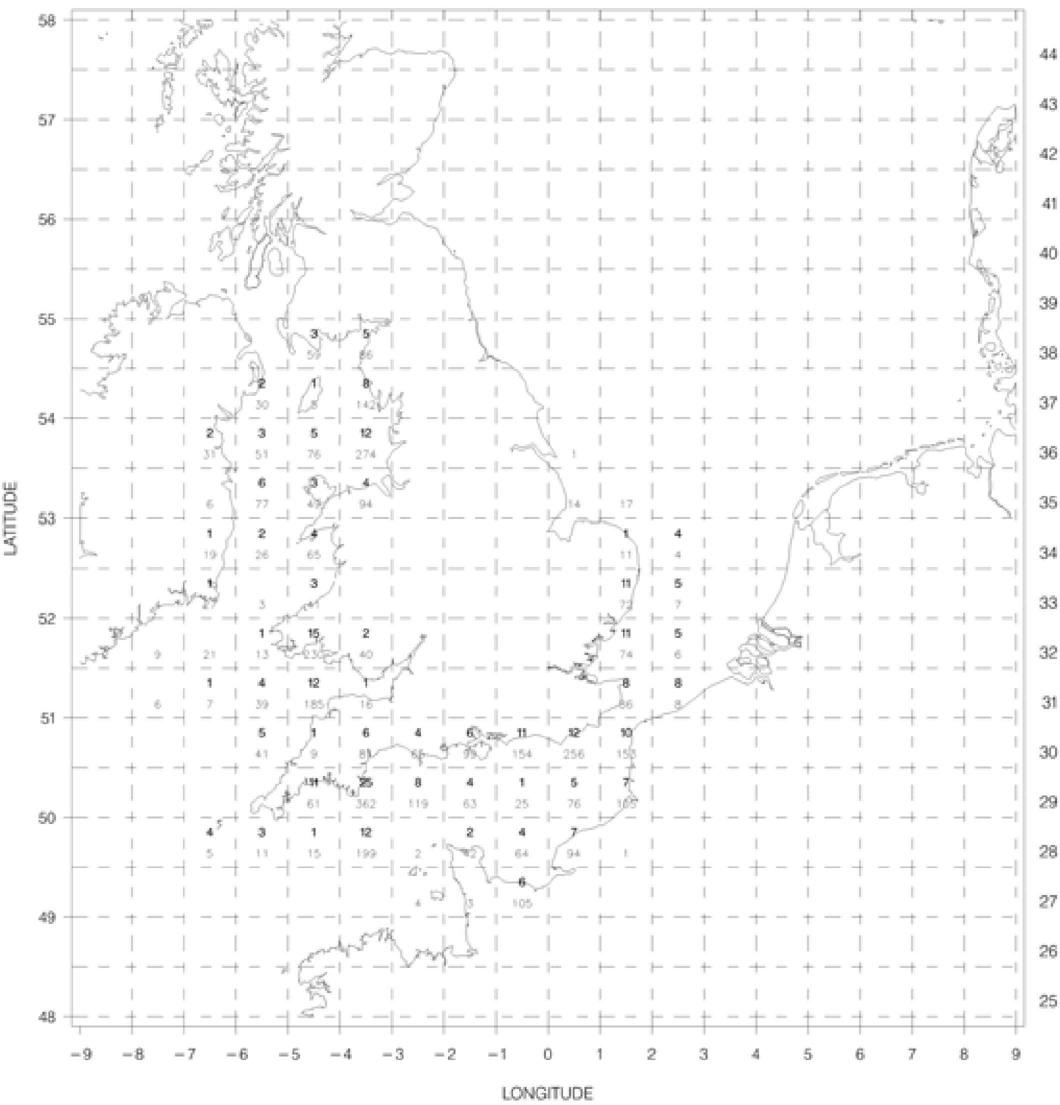


Figure 2.1.3 Total number of beam trawl hauls per rectangle.
Total hauls in 2004 (above) and total for 1990 – 2004 (below) for GFR .

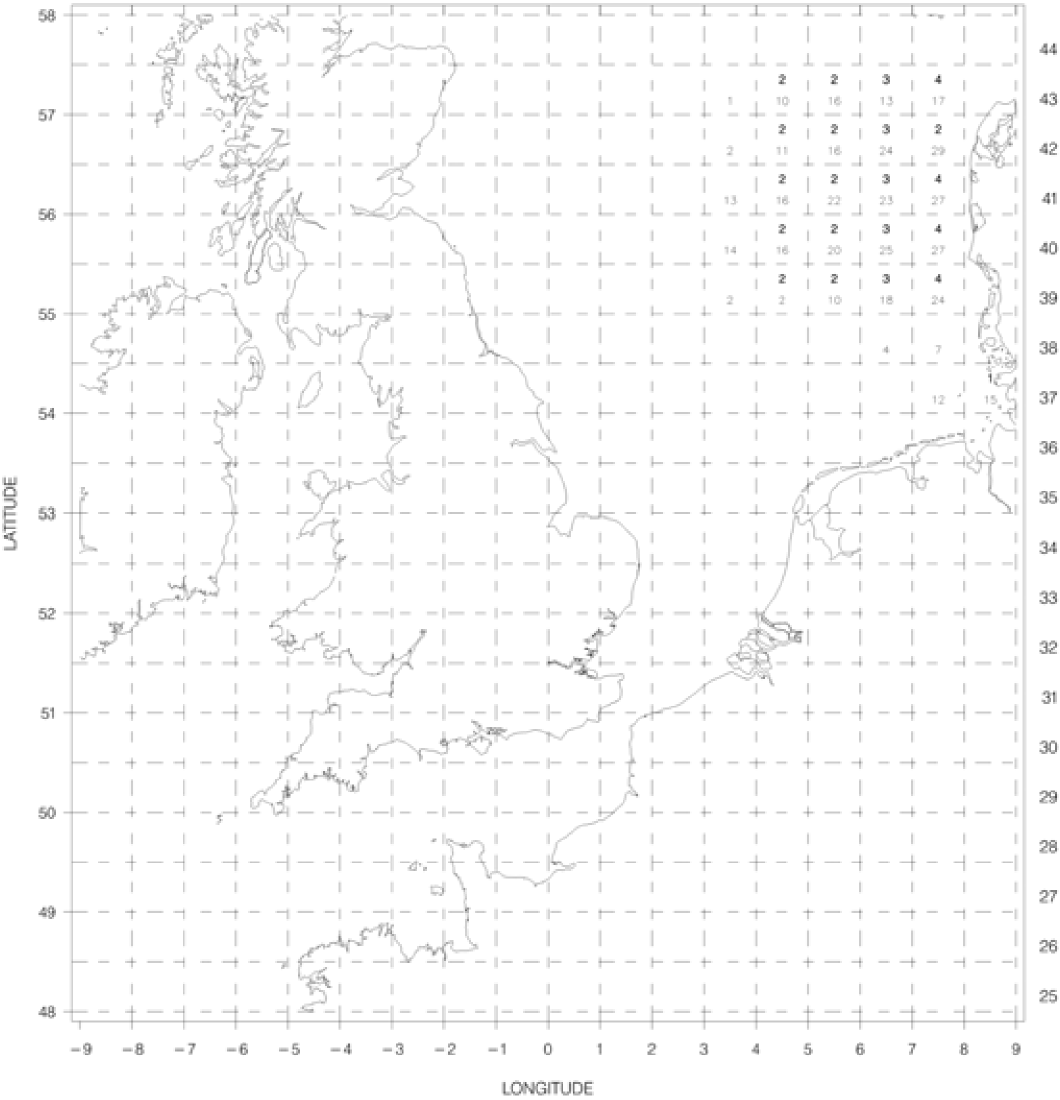
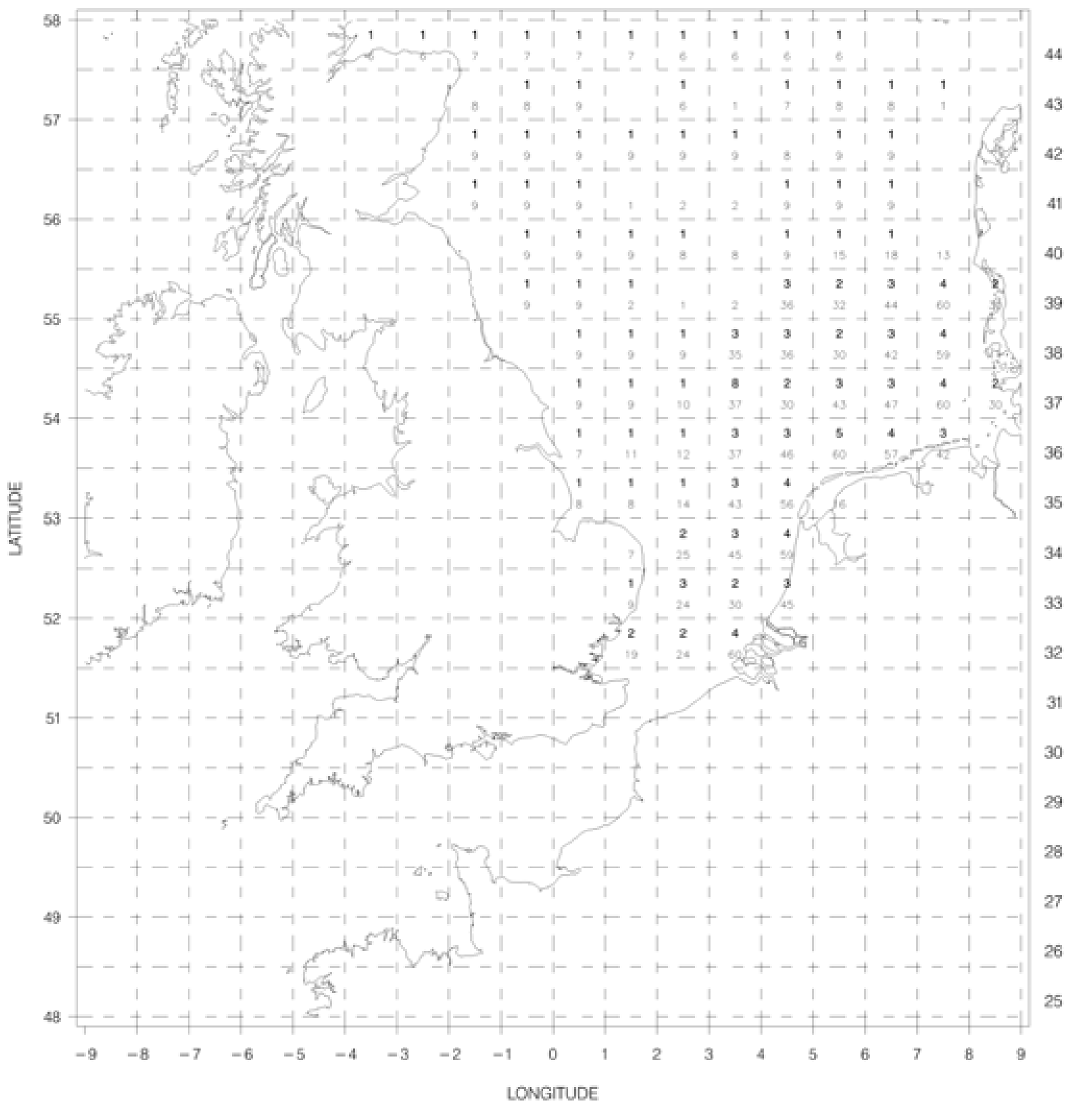


Figure 2.1.4 Total number of beam trawl hauls per rectangle.
Total hauls in 2004 (above) and total for 1990 – 2004 (below) for NED .



Annex 2: Spatial distribution of fish species

Figure 2.3.1 International Beam Trawl Surveys 1990 – 2004
Catches in number / 8m beam / hour / rectangle
2004 data in bold, above the survey mean ('+' = < 0.5)
Dab

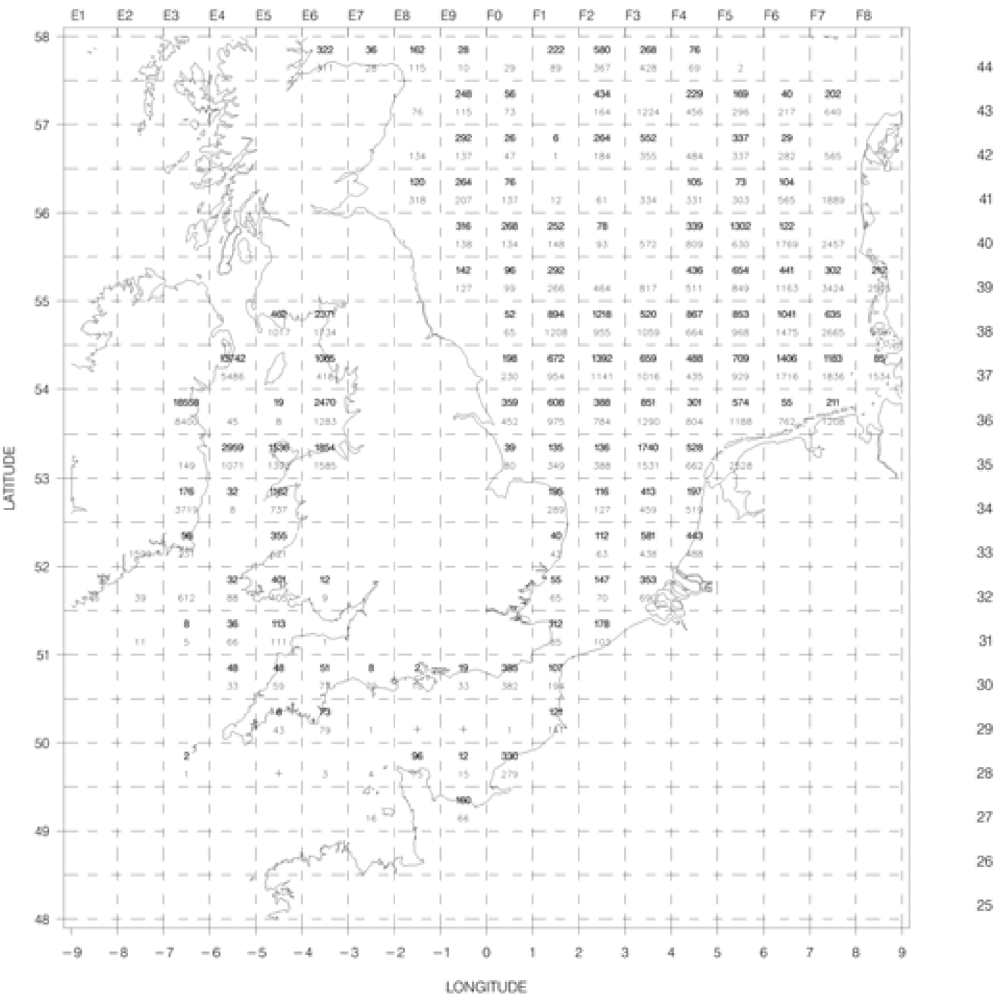


Figure 2.3.2 International Beam Trawl Surveys 1990 – 2004
Catches in number / 8m beam / hour / rectangle
2004 data in bold, above the survey mean ('+' = < 0.5)
Sole

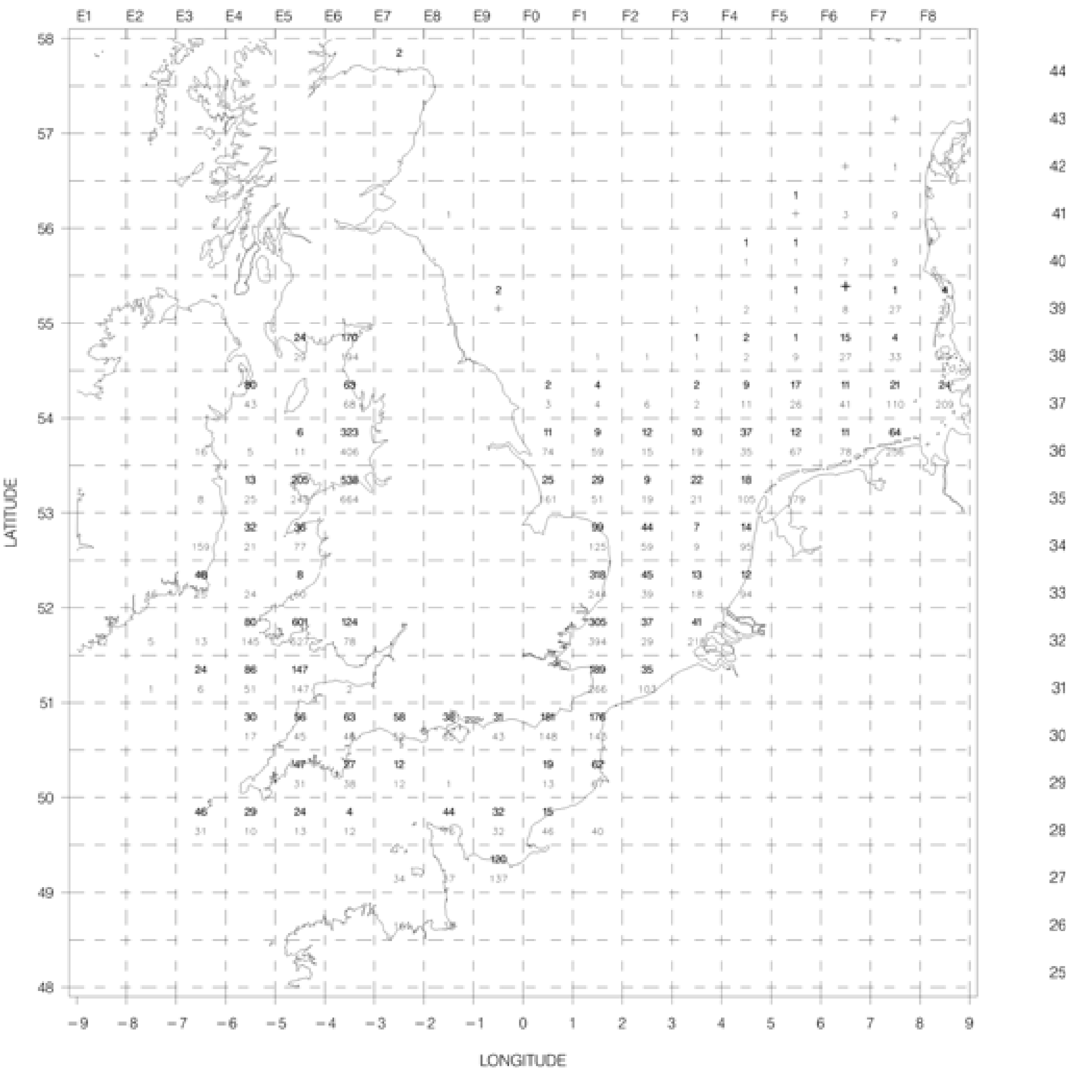


Figure 2.3.3 International Beam Trawl Surveys 1990 – 2004
Catches in number / 8m beam / hour / rectangle
2004 data in bold, above the survey mean ('+'= < 0.5)
Plaice

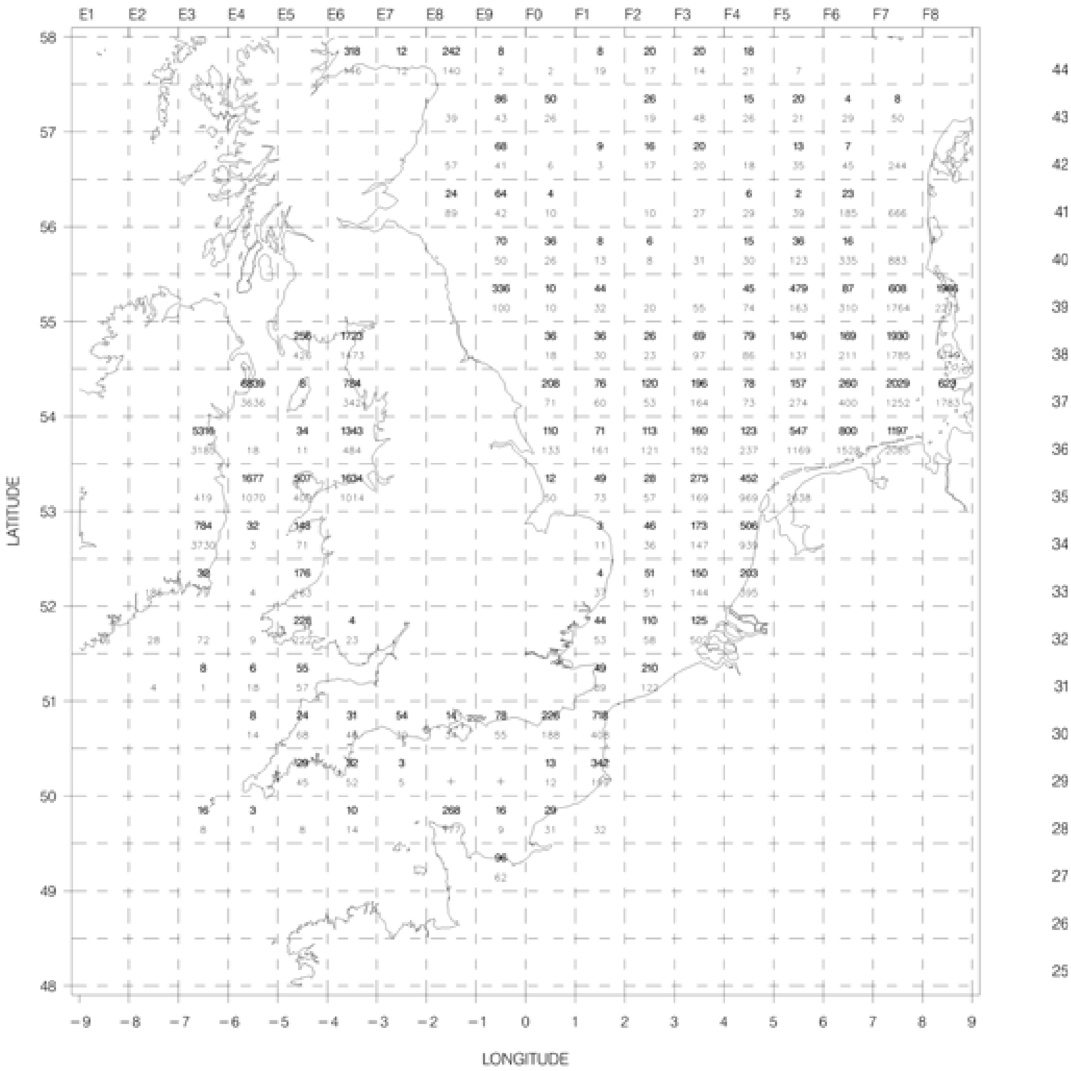


Figure 2.3.4 International Beam Trawl Surveys 1990 – 2004
Catches in number / 8m beam / hour / rectangle
2004 data in bold, above the survey mean ('+' = < 0.5)
Turbot

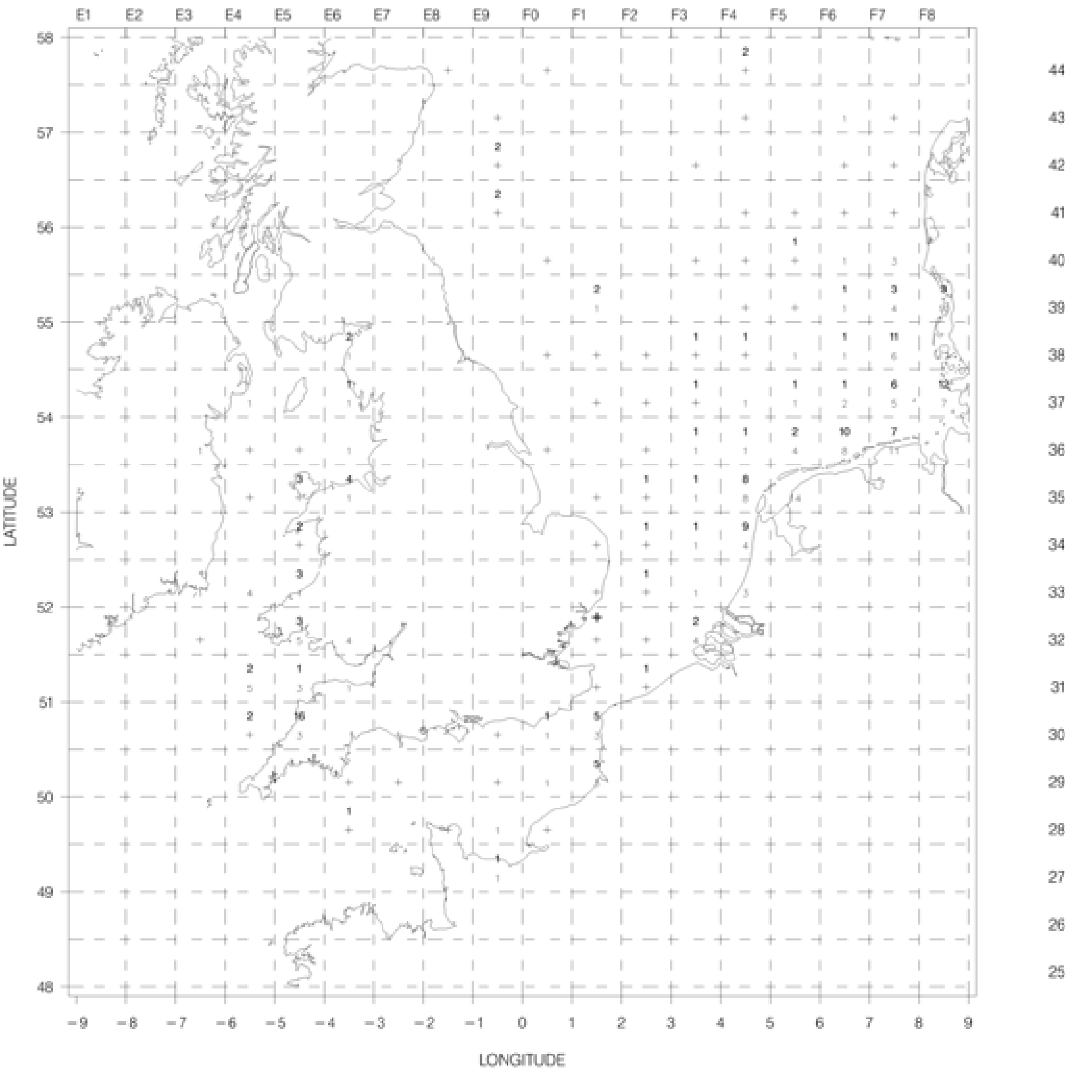


Figure 2.3.5 International Beam Trawl Surveys 1990 – 2004
Catches in number / 8m beam / hour / rectangle
2004 data in bold, above the survey mean ('+' = < 0.5)
Brill

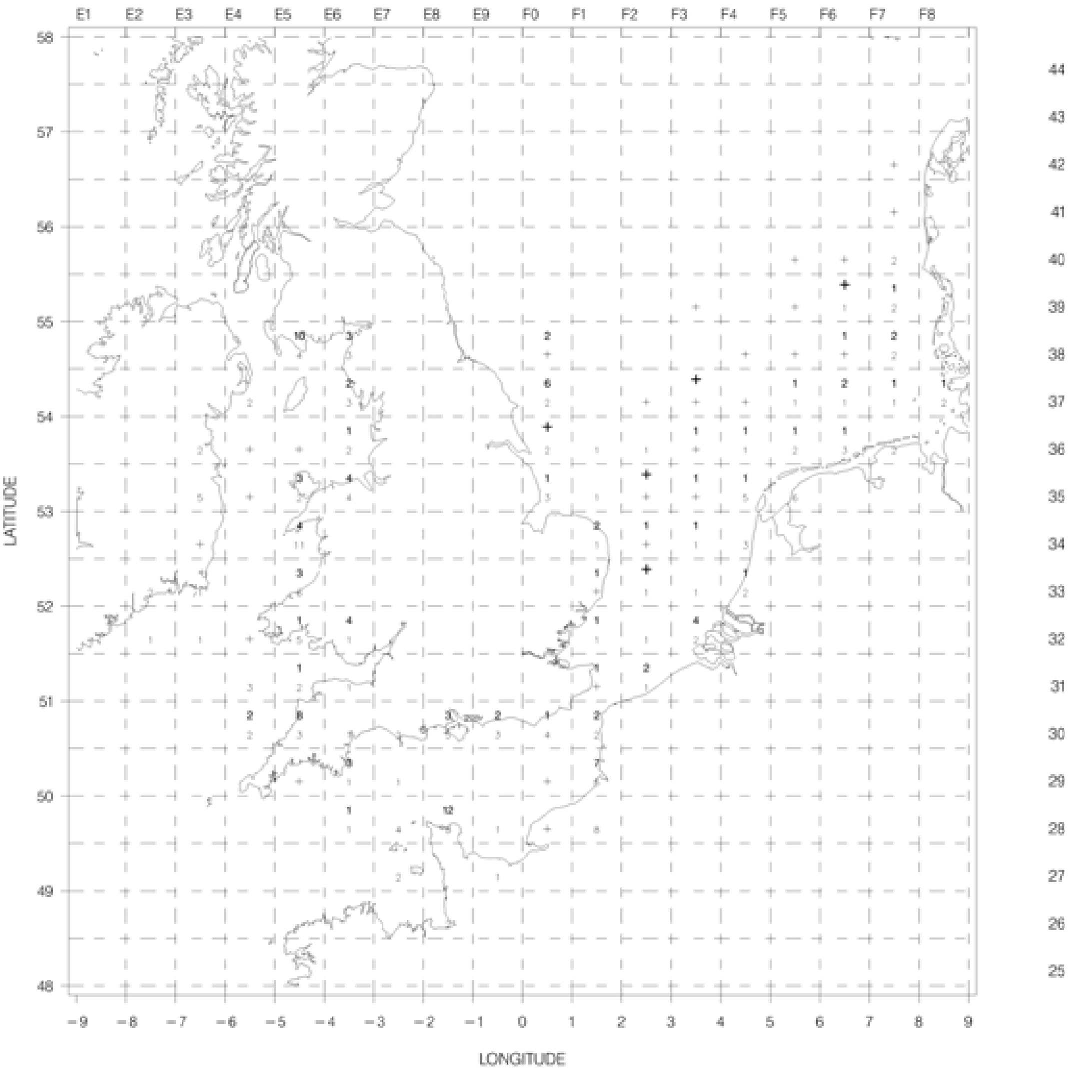


Figure 2.3.6 International Beam Trawl Surveys 1990 – 2004
Catches in number / 8m beam / hour / rectangle
2004 data in bold, above the survey mean ('+' = < 0.5)
Scaldfish

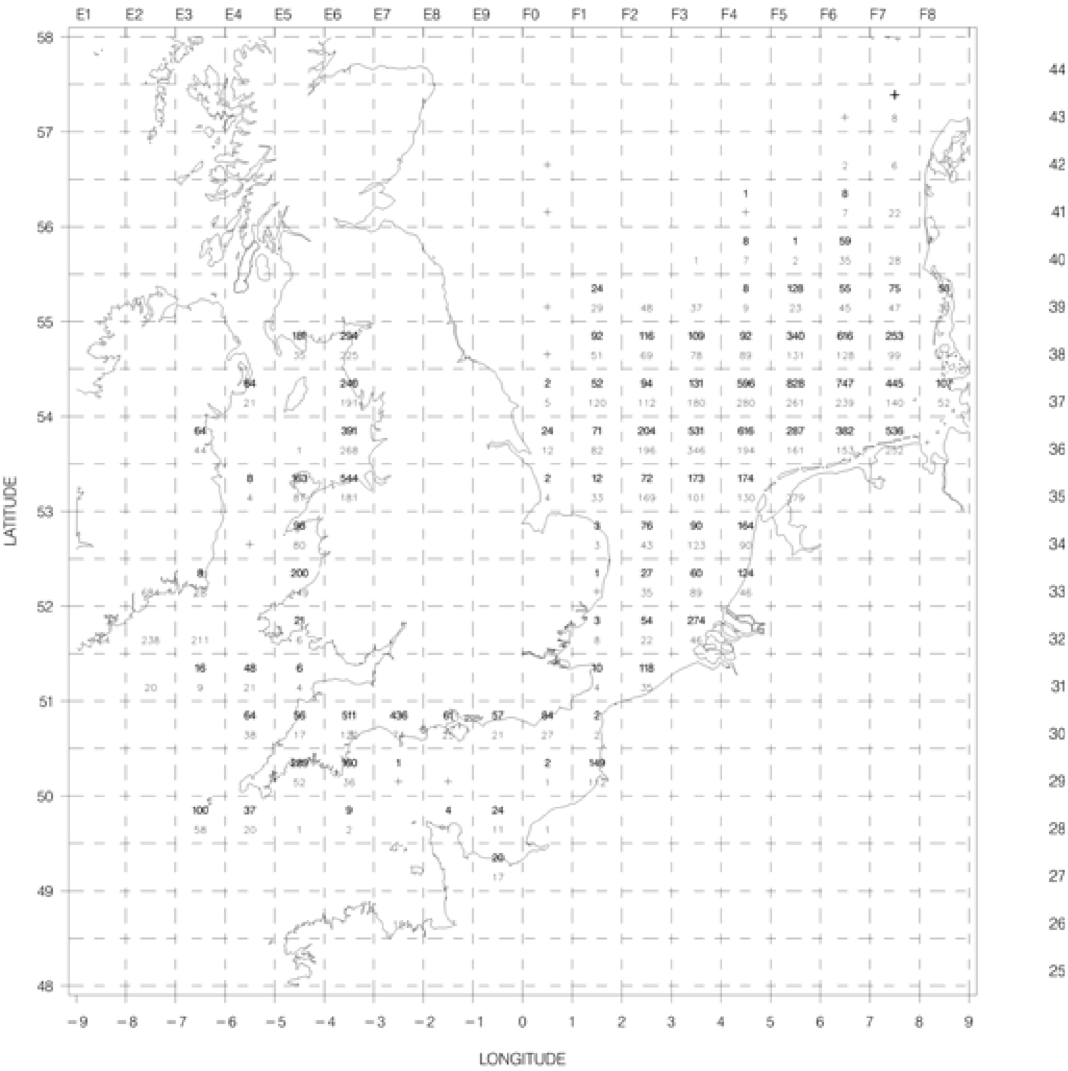


Figure 2.3.7 International Beam Trawl Surveys 1990 – 2004
Catches in number / 8m beam / hour / rectangle
2004 data in bold, above the survey mean ('+' = < 0.5)
Lemon sole

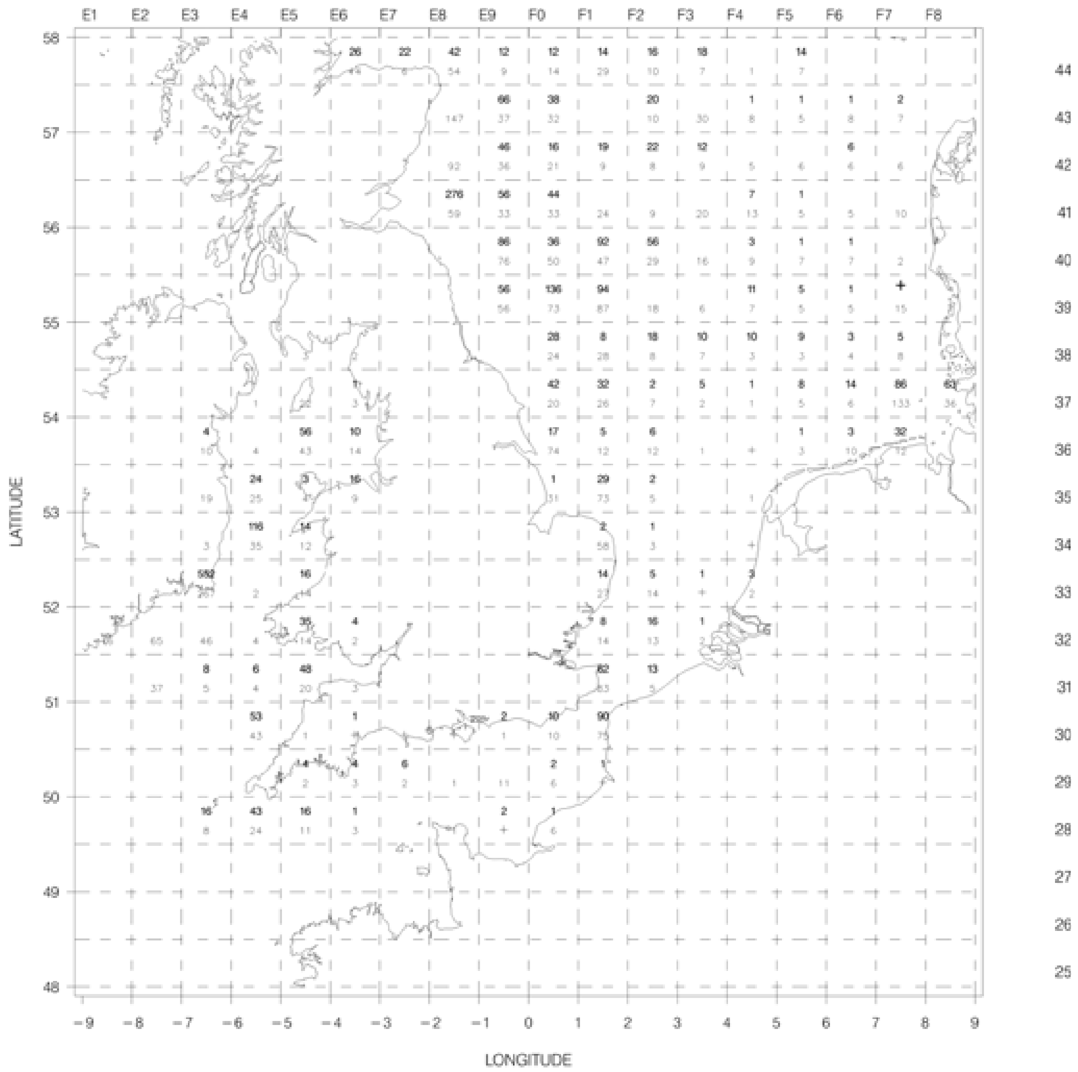


Figure 2.3.8 International Beam Trawl Surveys 1990 – 2004
Catches in number / 8m beam / hour / rectangle
2004 data in bold, above the survey mean ('+' = < 0.5)
American plaice (Long rough dab)

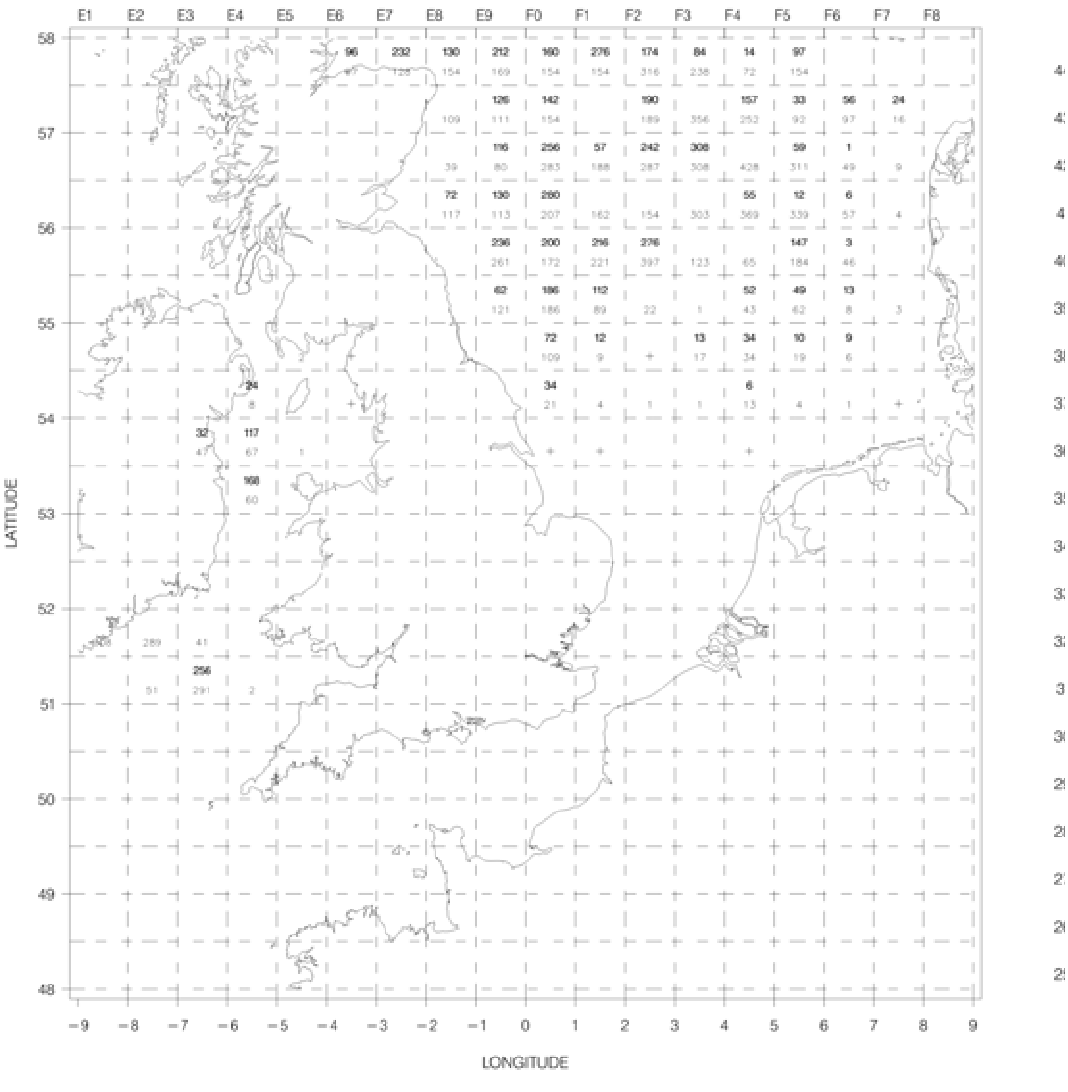


Figure 2.3.9 International Beam Trawl Surveys 1990 – 2004
Catches in number / 8m beam / hour / rectangle
2004 data in bold, above the survey mean ('+' = < 0.5)
Flounder

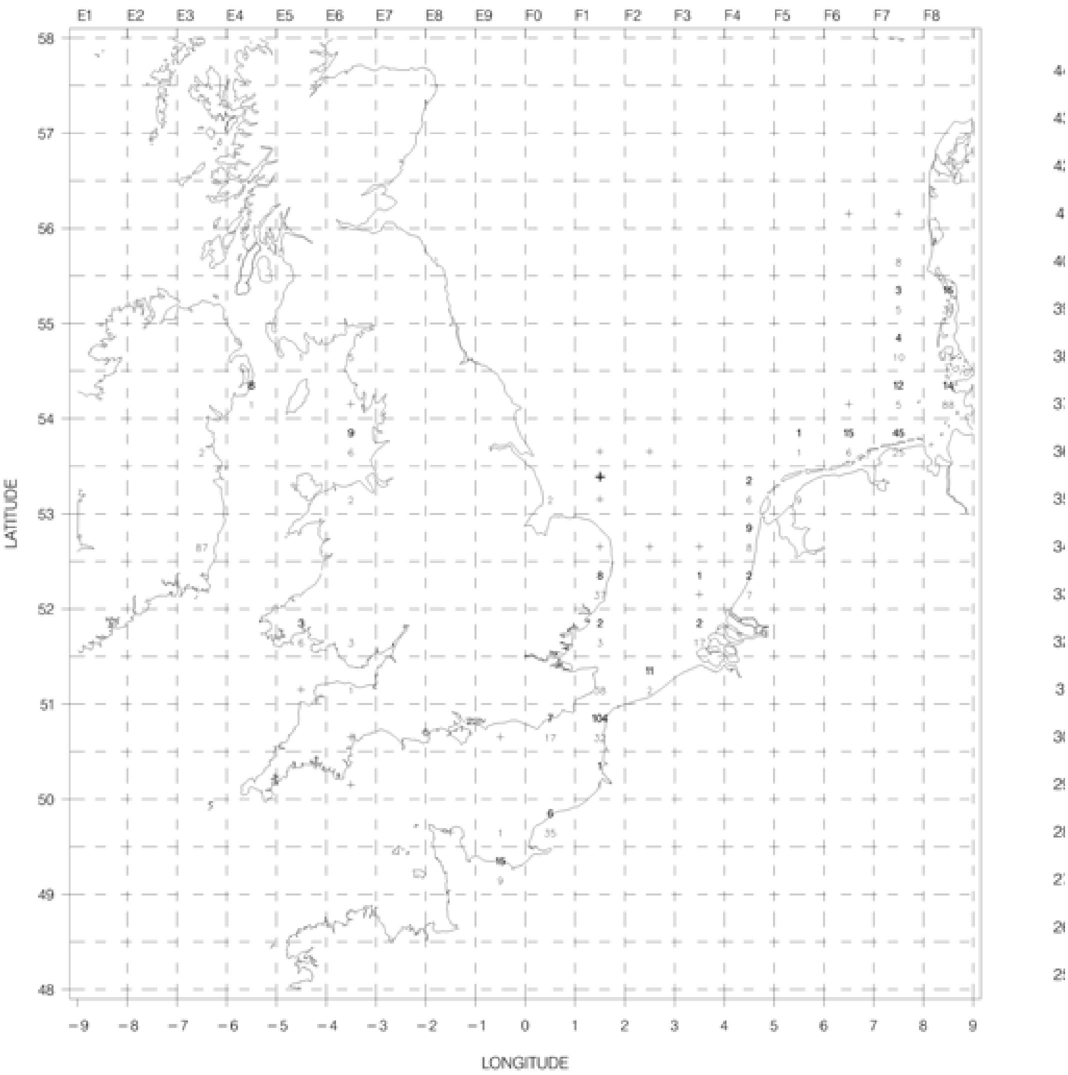


Figure 2.3.10 International Beam Trawl Surveys 1990−2004
Catches in number / 8m beam / hour / rectangle
2004 data in bold, above the survey mean ('+'= < 0.5)
Solenette

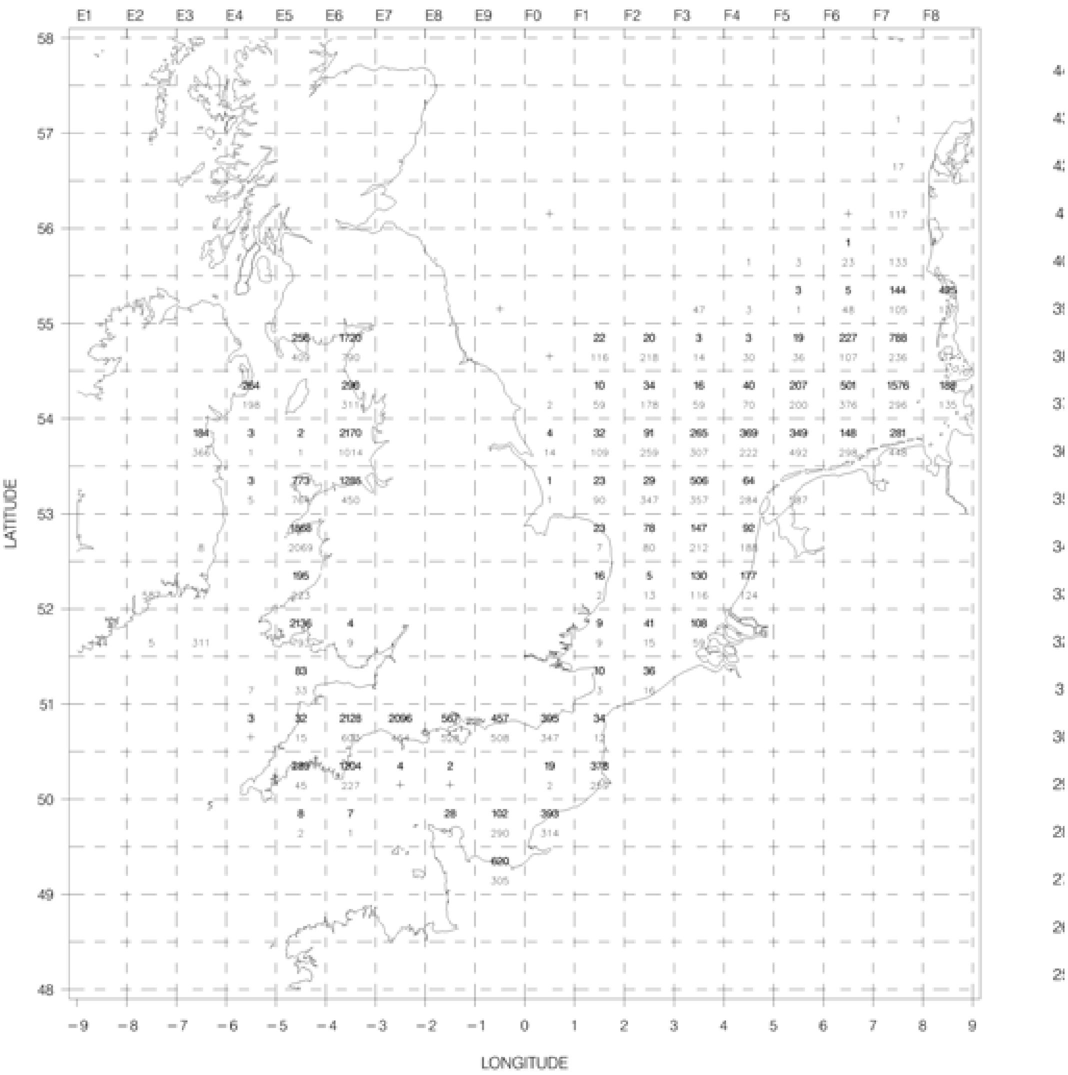


Figure 2.3.11 International Beam Trawl Surveys 1990–2004
Catches in number / 8m beam / hour / rectangle
2004 data in bold, above the survey mean ('+'= < 0.5)
Thickback sole

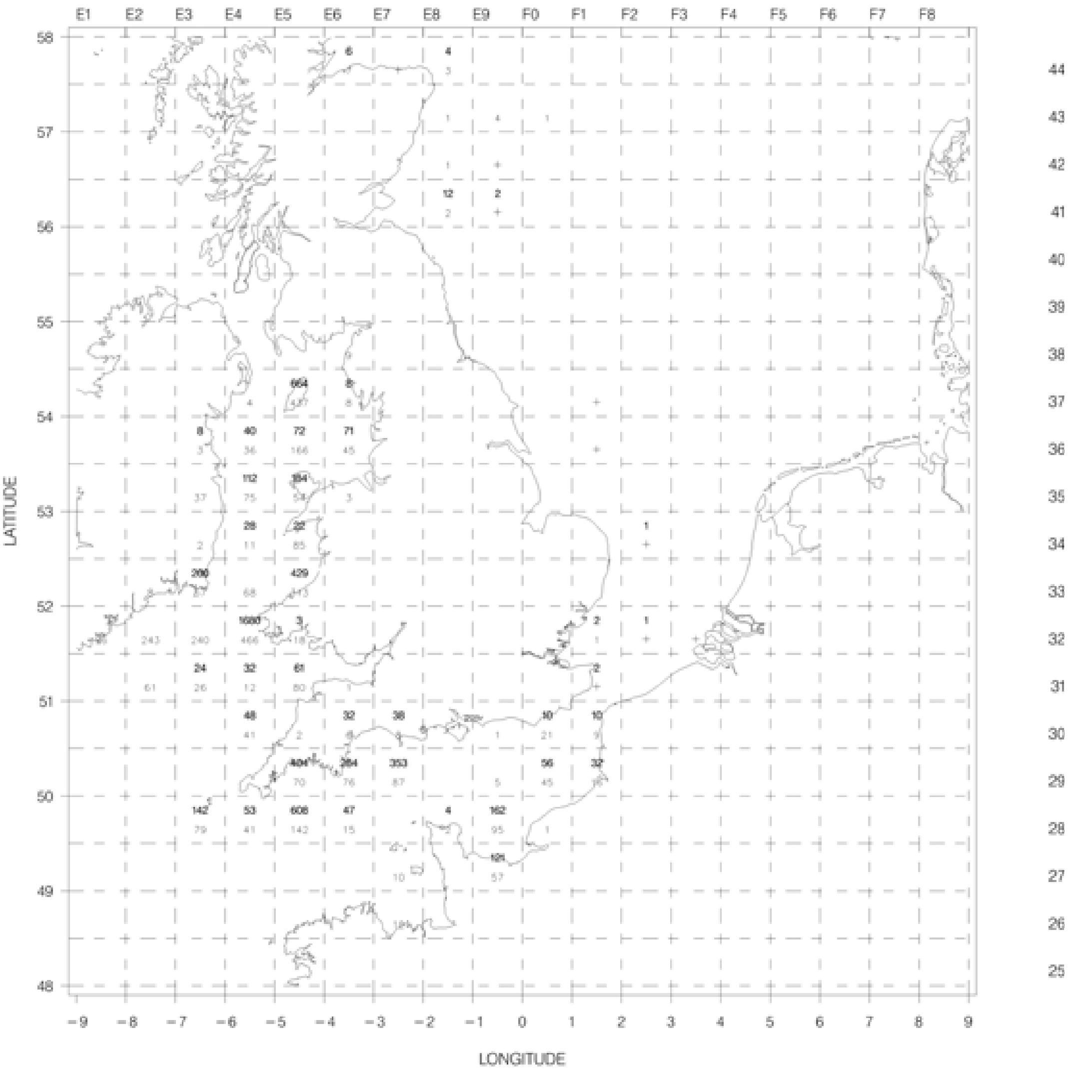


Figure 2.3.12 International Beam Trawl Surveys 1990 – 2004
Catches in number / 8m beam / hour / rectangle
2004 data in bold, above the survey mean ('+'= < 0.5)
Pogge (Armoured bullhead)

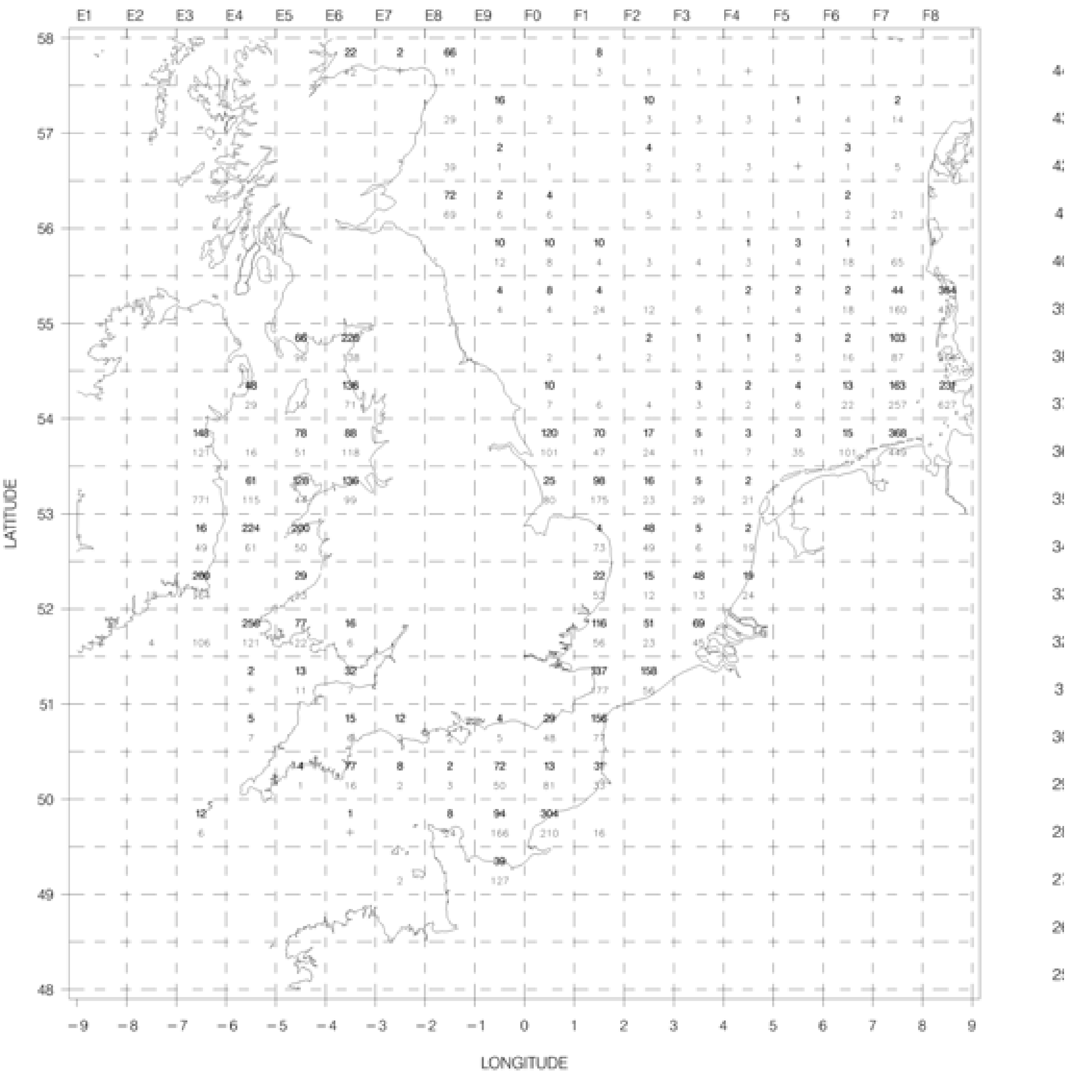


Figure 2.3.13 International Beam Trawl Surveys 1990 – 2004
Catches in number / 8m beam / hour / rectangle
2004 data in bold, above the survey mean ('+'= < 0.5)
Tub gurnard

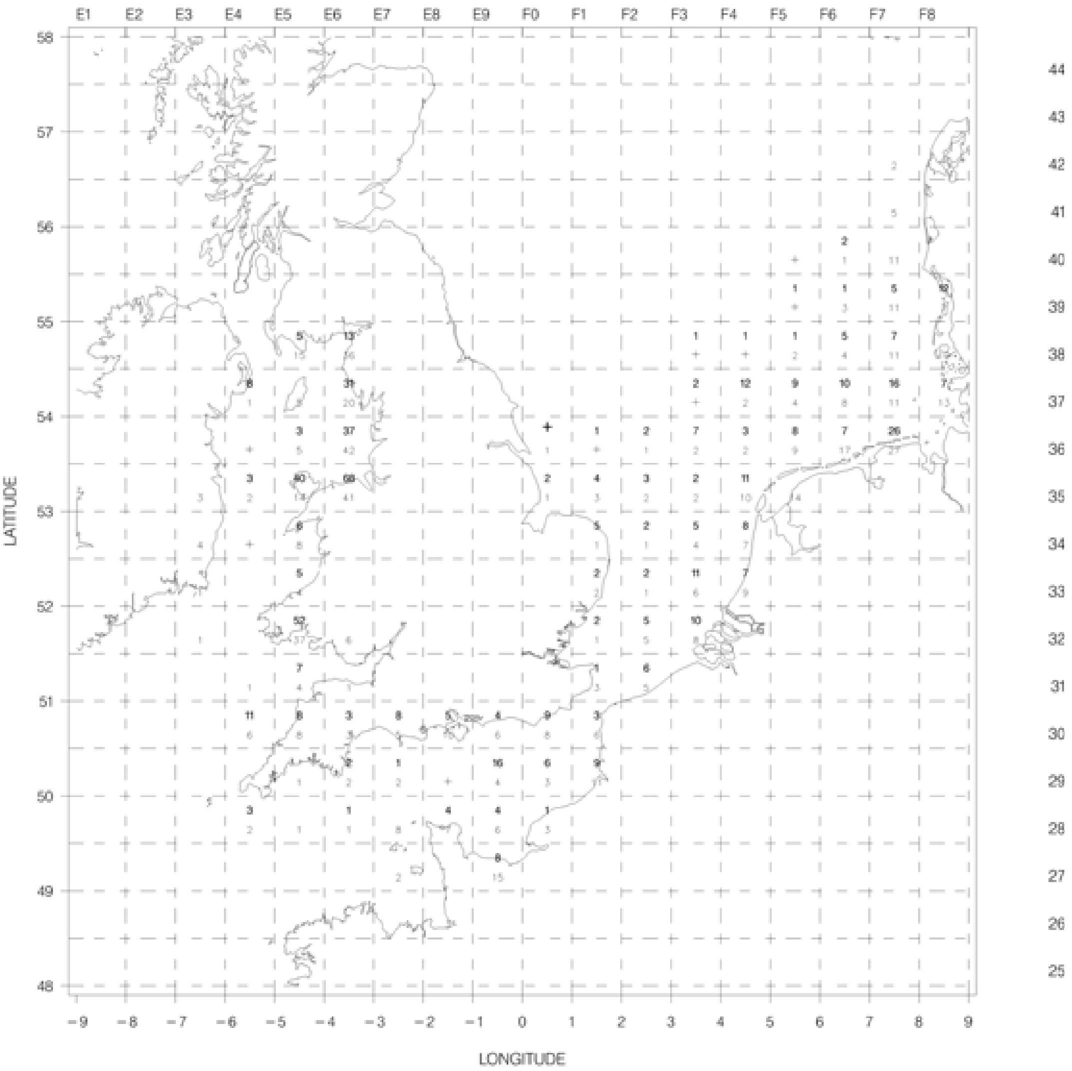


Figure 2.3.14 International Beam Trawl Surveys 1990–2004
Catches in number / 8m beam / hour / rectangle
2004 data in bold, above the survey mean ('+'= < 0.5)
Grey gurnard

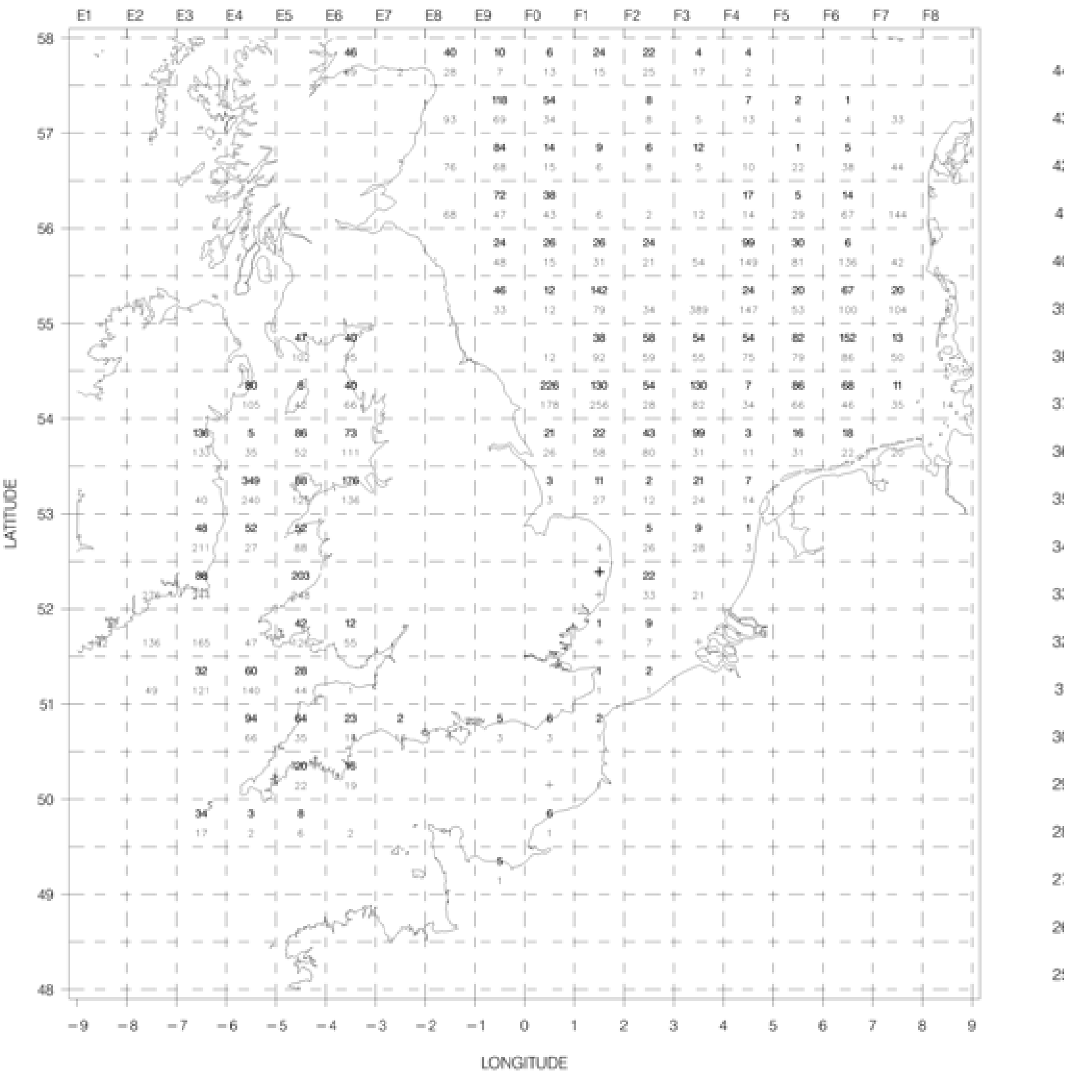


Figure 2.3.15 International Beam Trawl Surveys 1990 – 2004
Catches in number / 8m beam / hour / rectangle
2004 data in bold, above the survey mean ('+' = < 0.5)
Lesser weever

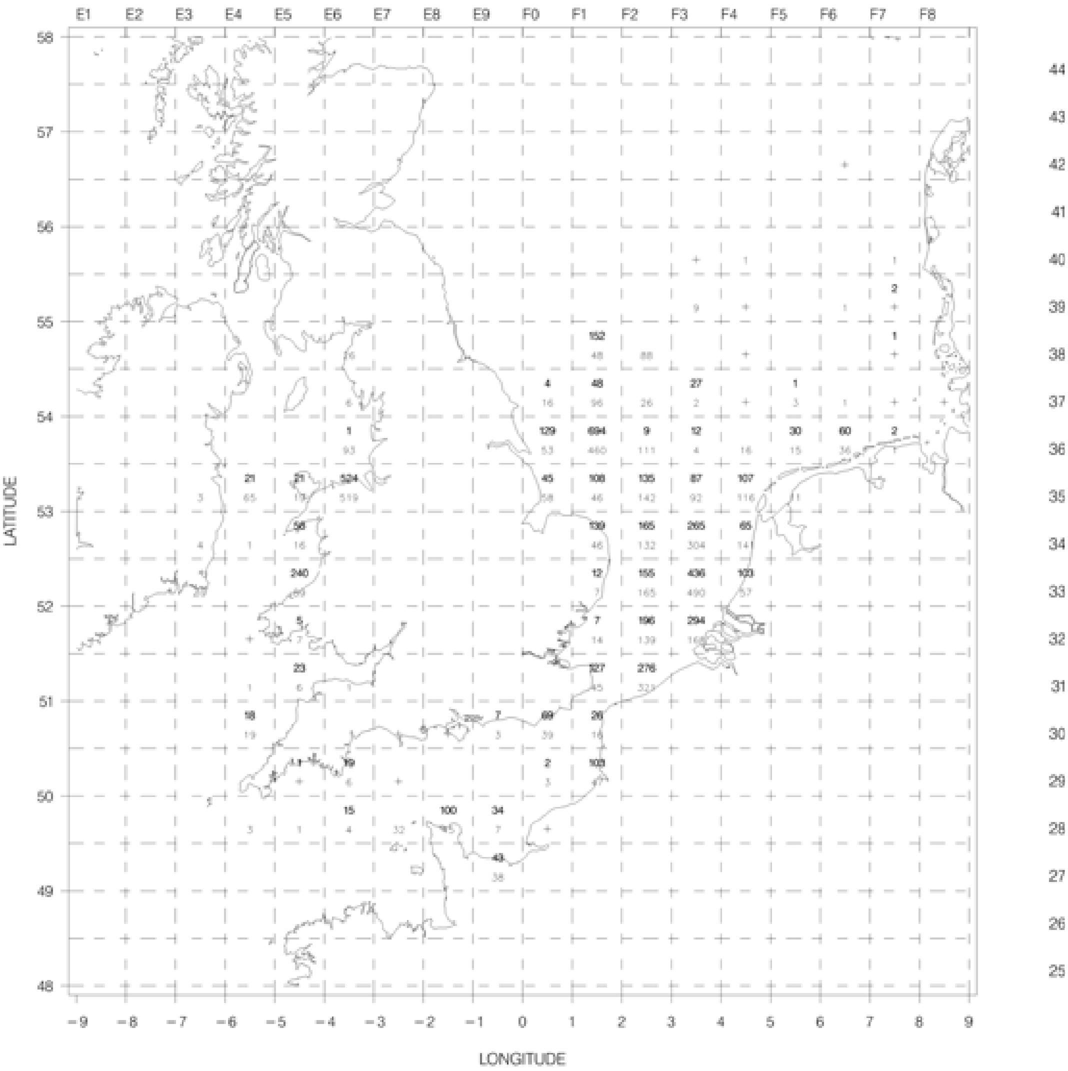


Figure 2.3.16 International Beam Trawl Surveys 1990–2004
Catches in number / 8m beam / hour / rectangle
2004 data in bold, above the survey mean ('+'= < 0.5)
Common dragonet

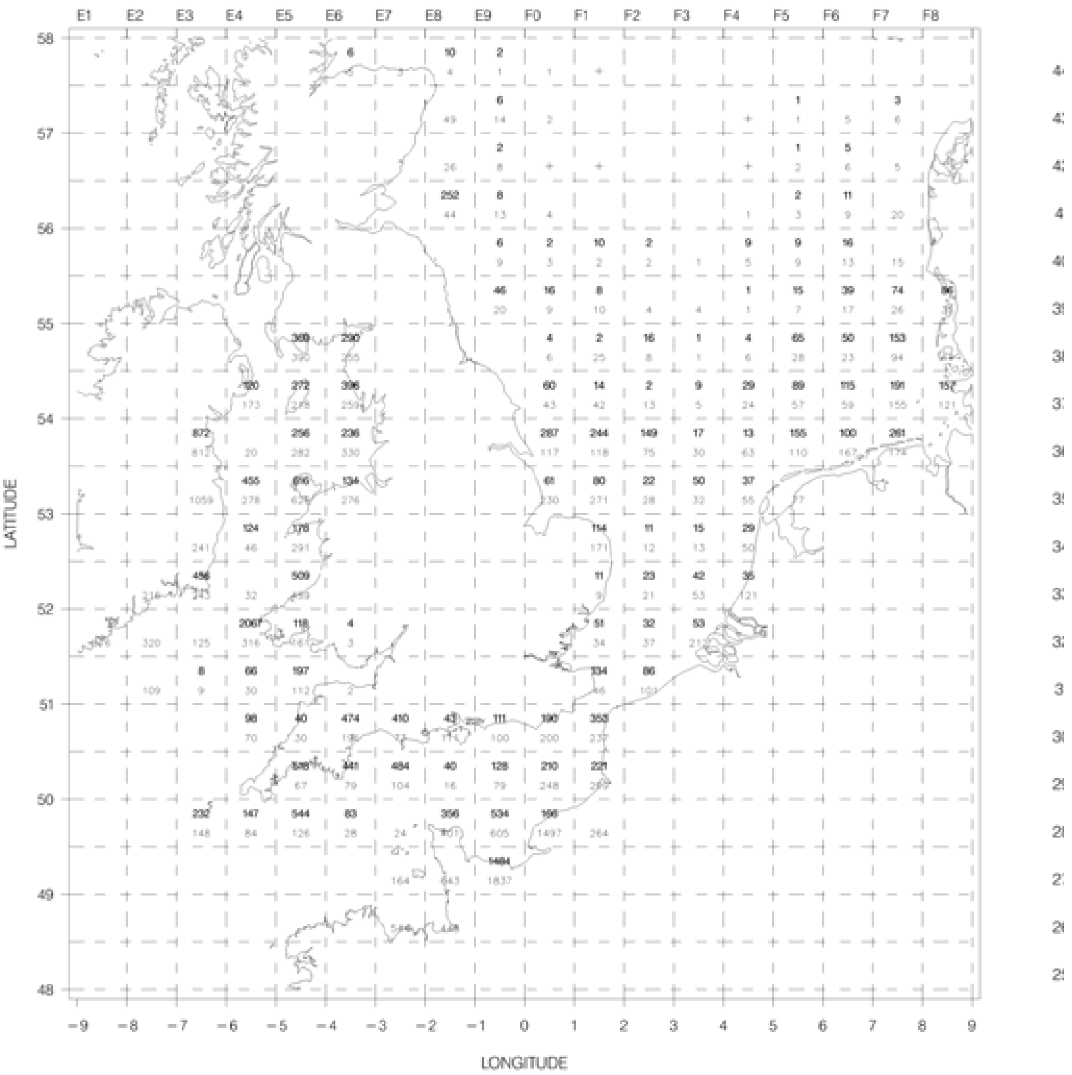


Figure 2.3.17 International Beam Trawl Surveys 1990–2004
Catches in number / 8m beam / hour / rectangle
2004 data in bold, above the survey mean ('+'= < 0.5)
Lesser spotted dogfish

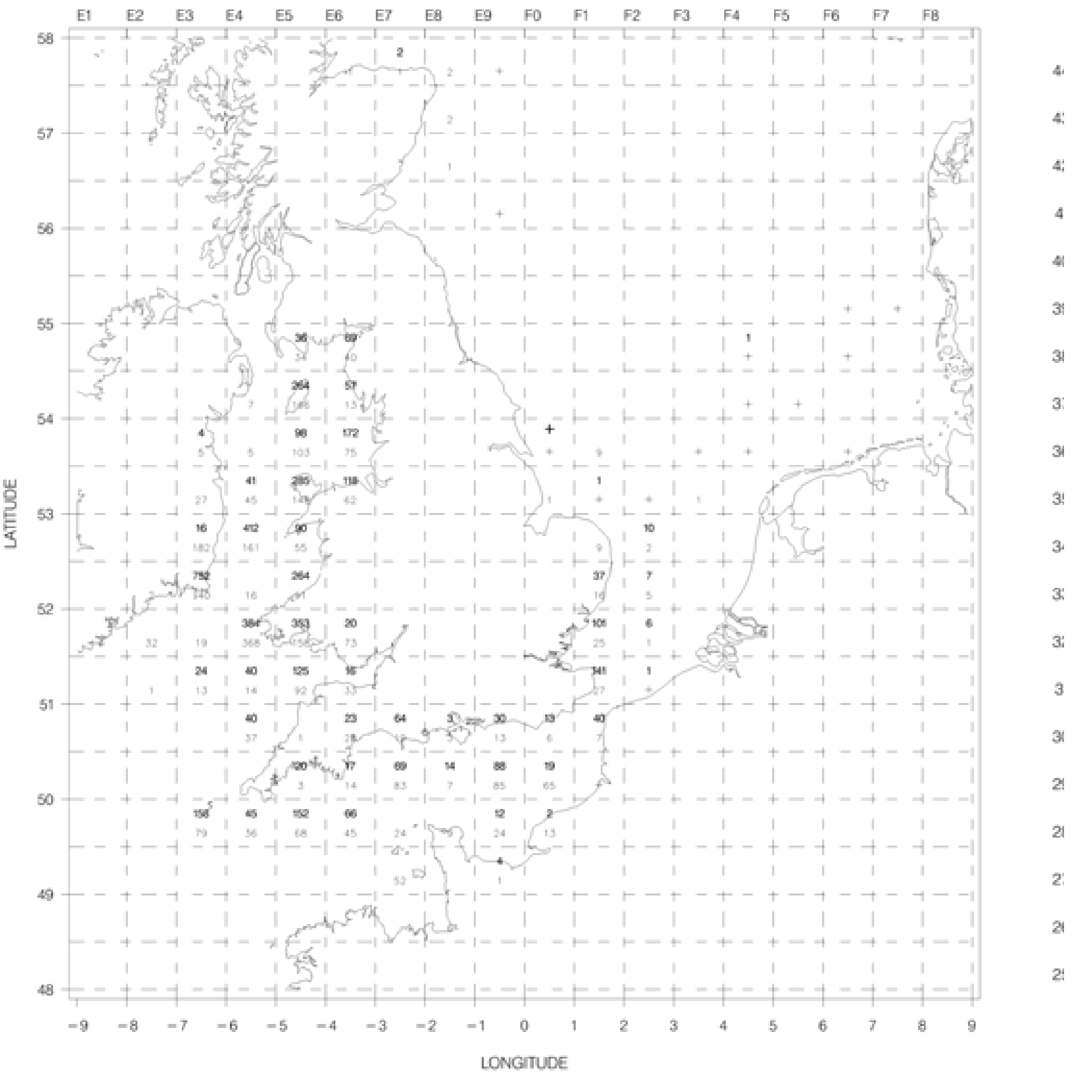


Figure 2.3.18 International Beam Trawl Surveys 1990 – 2004
Catches in number / 8m beam / hour / rectangle
2004 data in bold, above the survey mean ('+'= < 0.5)
Rays

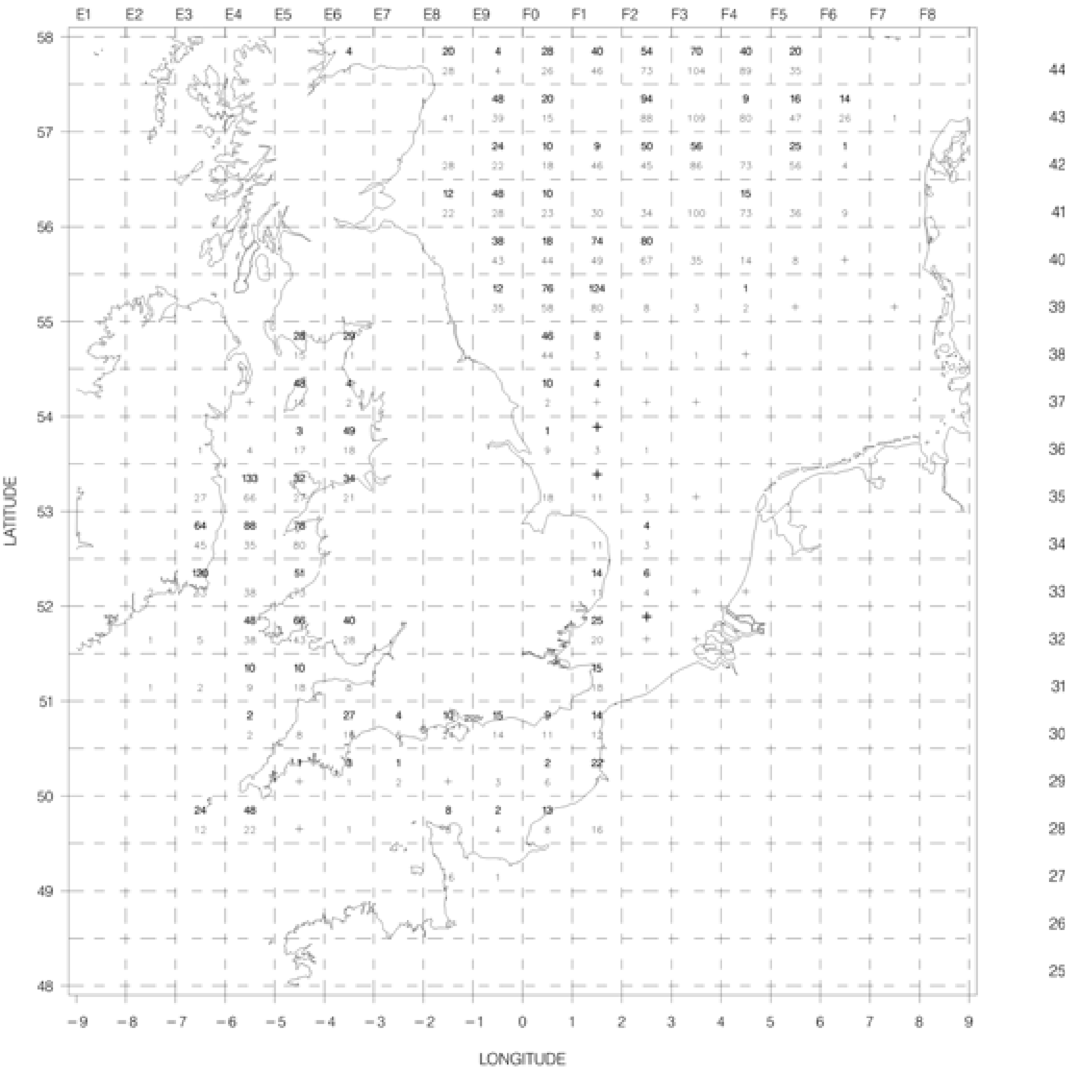


Figure 2.3.19 International Beam Trawl Surveys 1990–2004
Catches in number / 8m beam / hour / rectangle
2004 data in bold, above the survey mean ('+'= < 0.5)
Cod

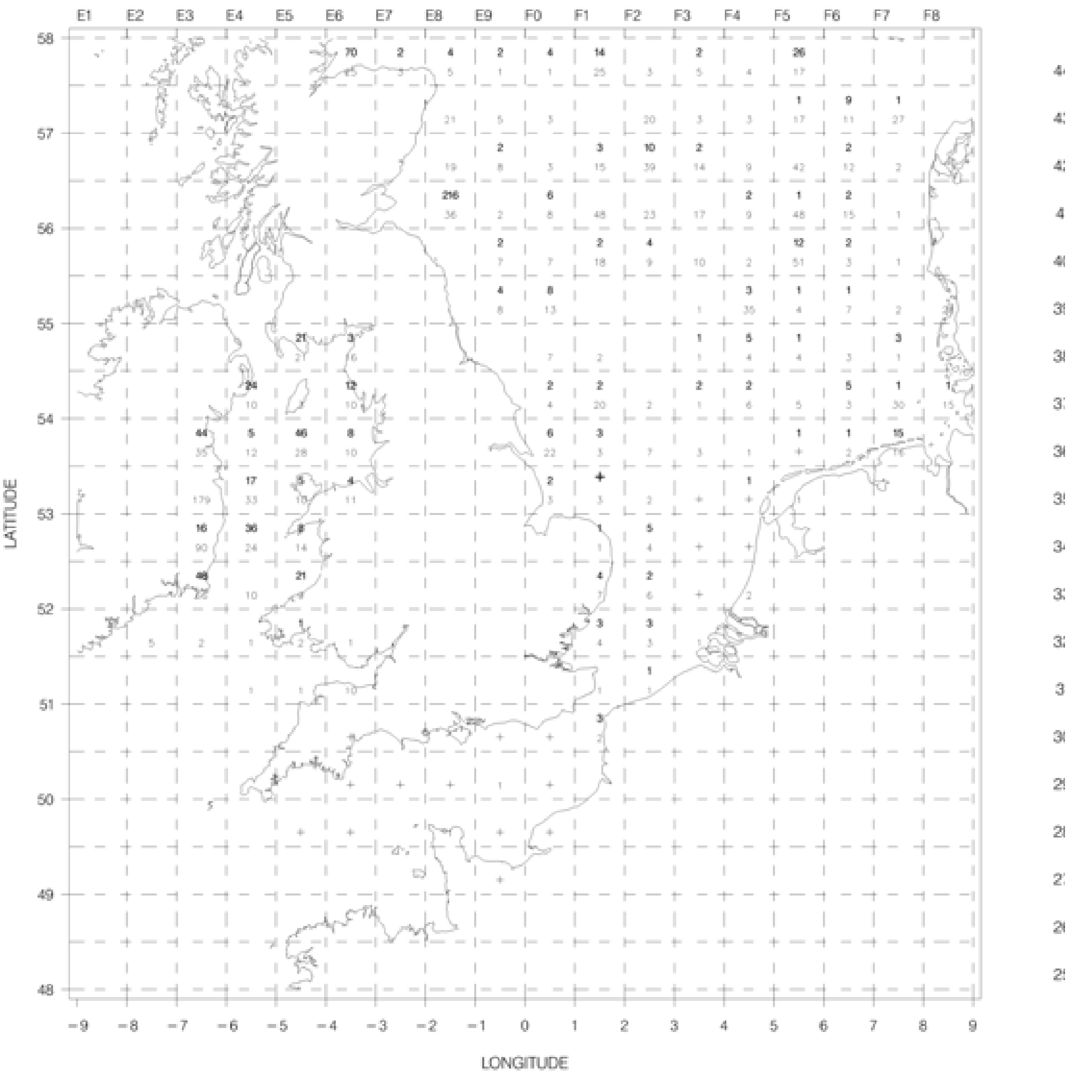


Figure 2.3.20 International Beam Trawl Surveys 1990 – 2004
Catches in number / 8m beam / hour / rectangle
2004 data in bold, above the survey mean ('+'= < 0.5)
Poor cod

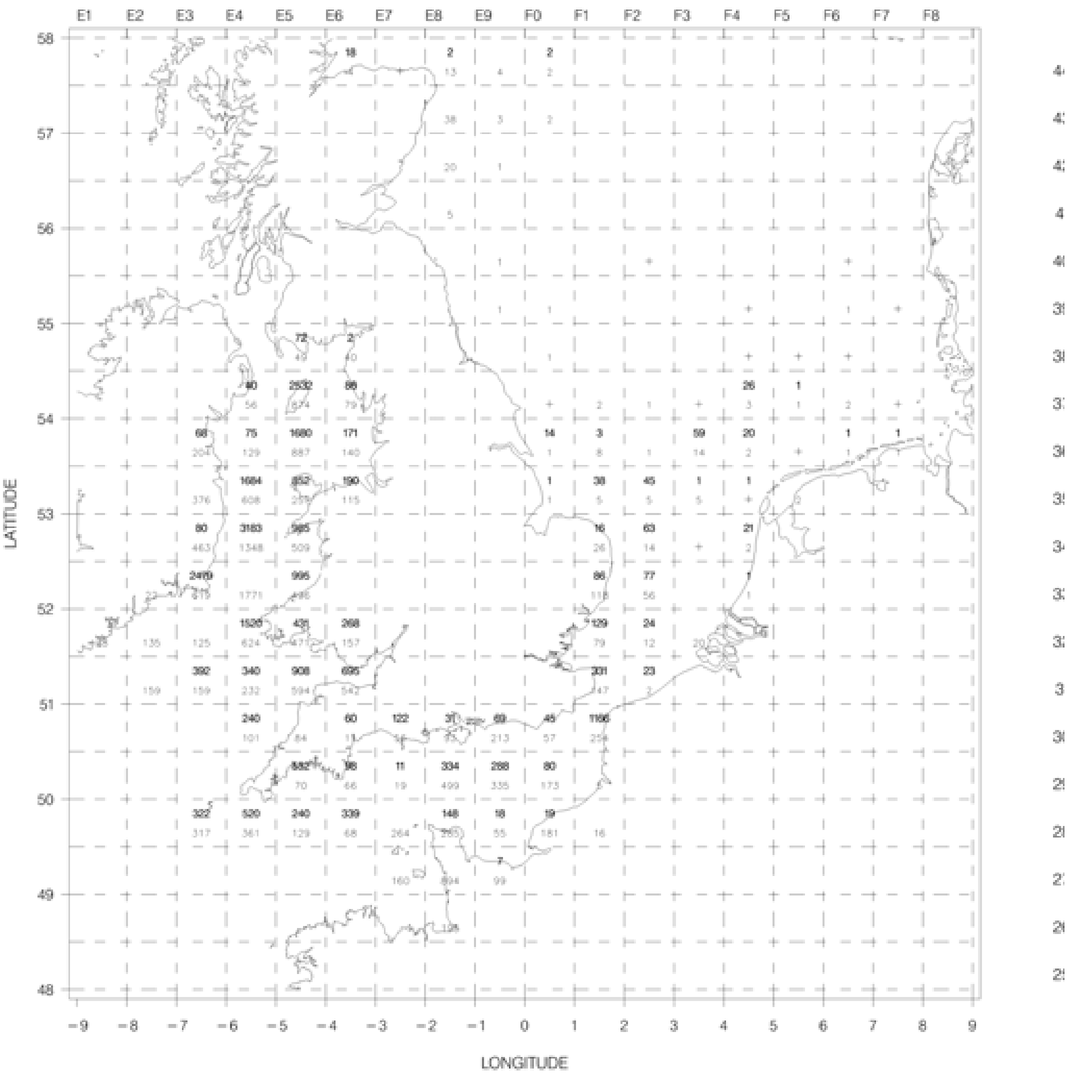


Figure 2.3.21 International Beam Trawl Surveys 1990 – 2004
Catches in number / 8m beam / hour / rectangle
2004 data in bold, above the survey mean ('+' = < 0.5)
Haddock

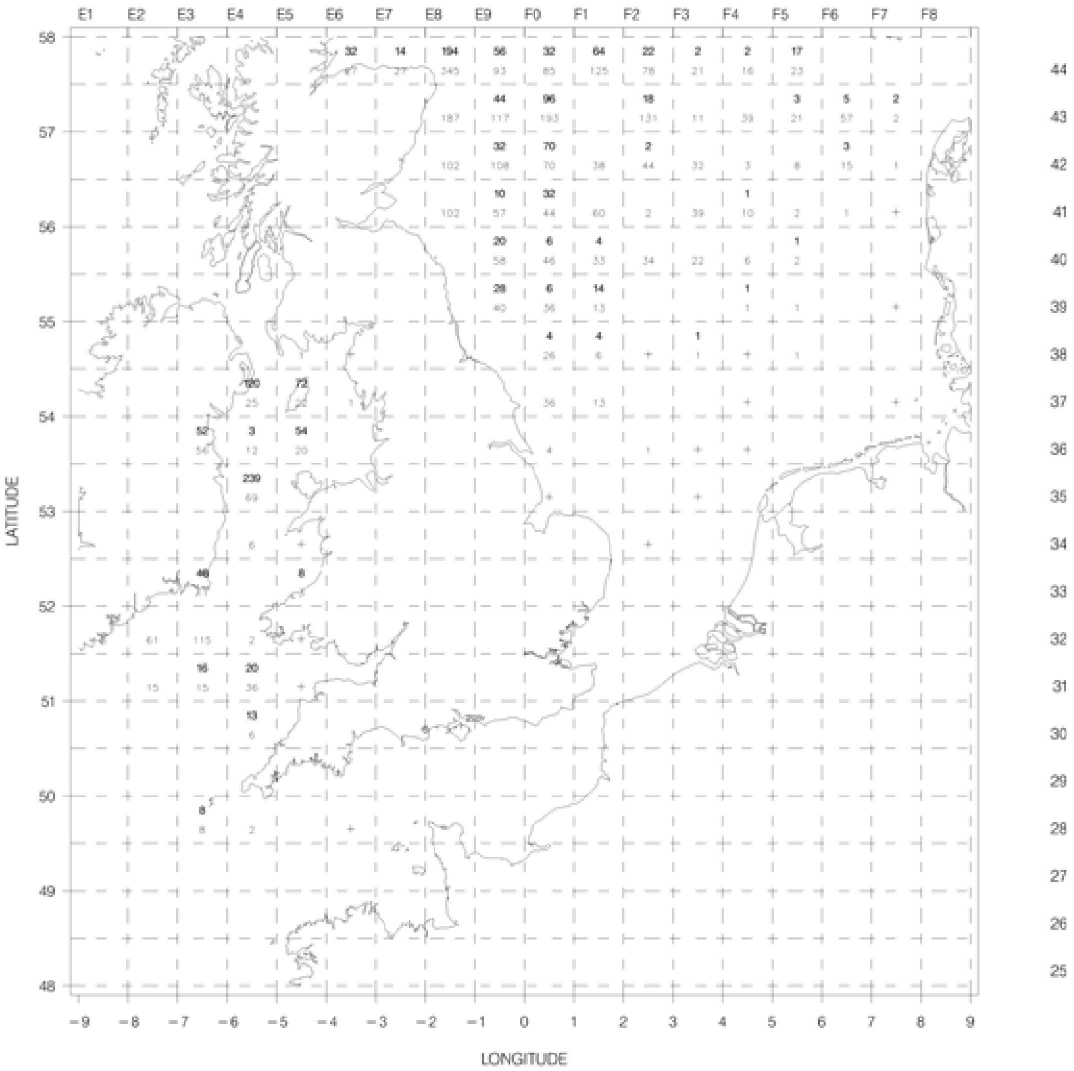


Figure 2.3.22 International Beam Trawl Surveys 1990 – 2004
Catches in number / 8m beam / hour / rectangle
2004 data in bold, above the survey mean ('+'= < 0.5)
Pout whiting (Bib)

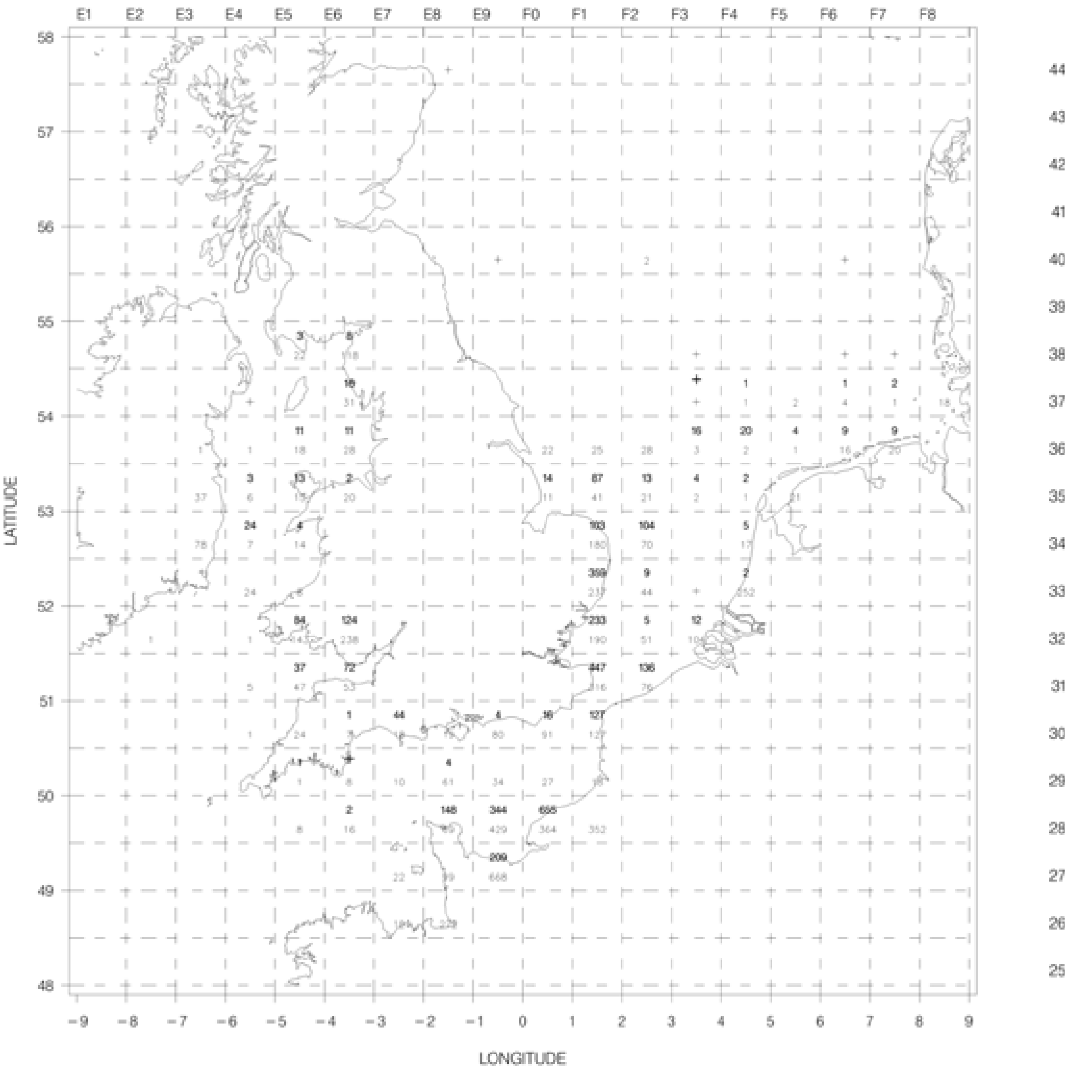


Figure 2.3.23 International Beam Trawl Surveys 1990 – 2004
Catches in number / 8m beam / hour / rectangle
2004 data in bold, above the survey mean ('+'= < 0.5)
Whiting

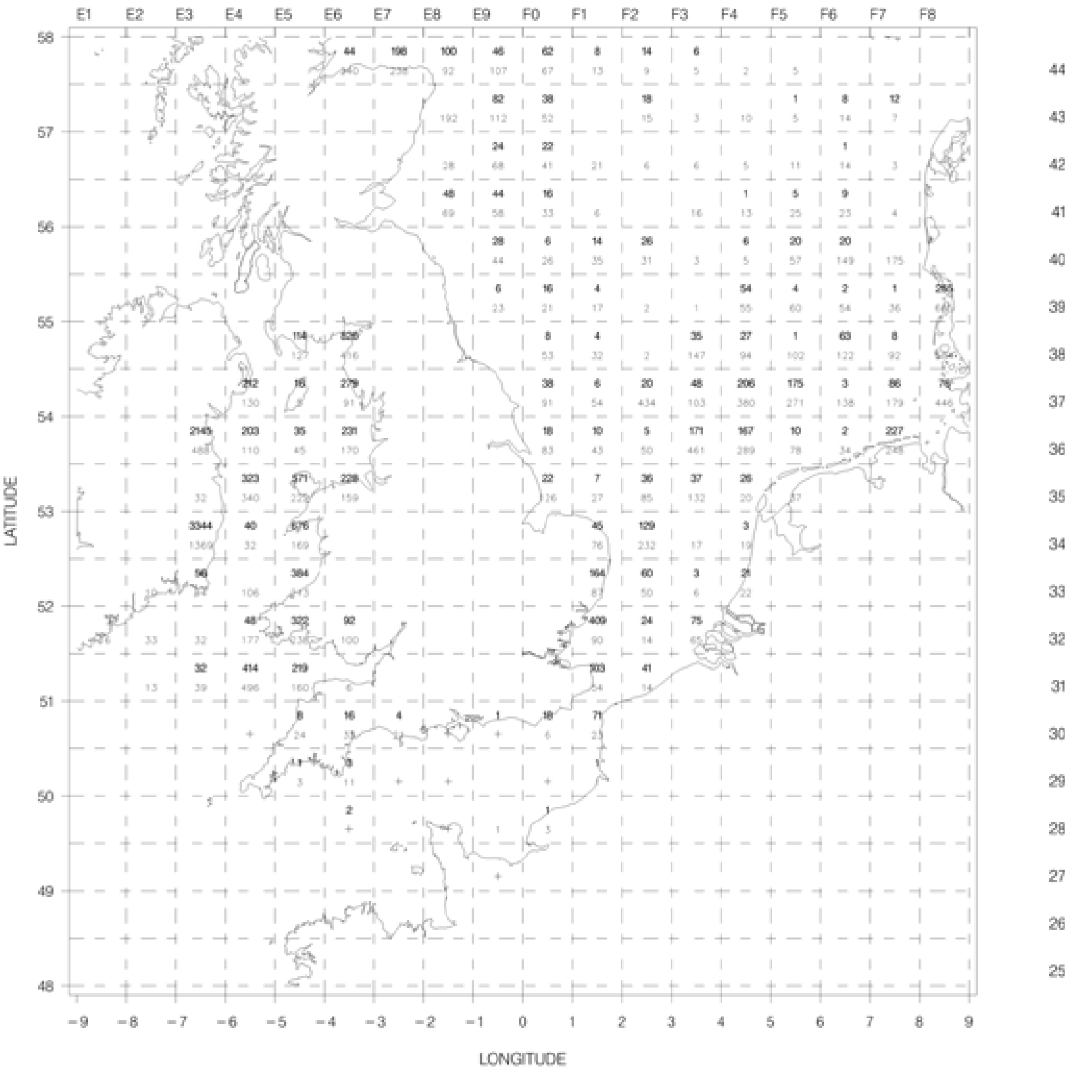


Figure 2.3.24 International Beam Trawl Surveys 1990 – 2004
Catches in number / 8m beam / hour / rectangle
2004 data in bold, above the survey mean ('+' = < 0.5)
Angler fish (Monk fish)

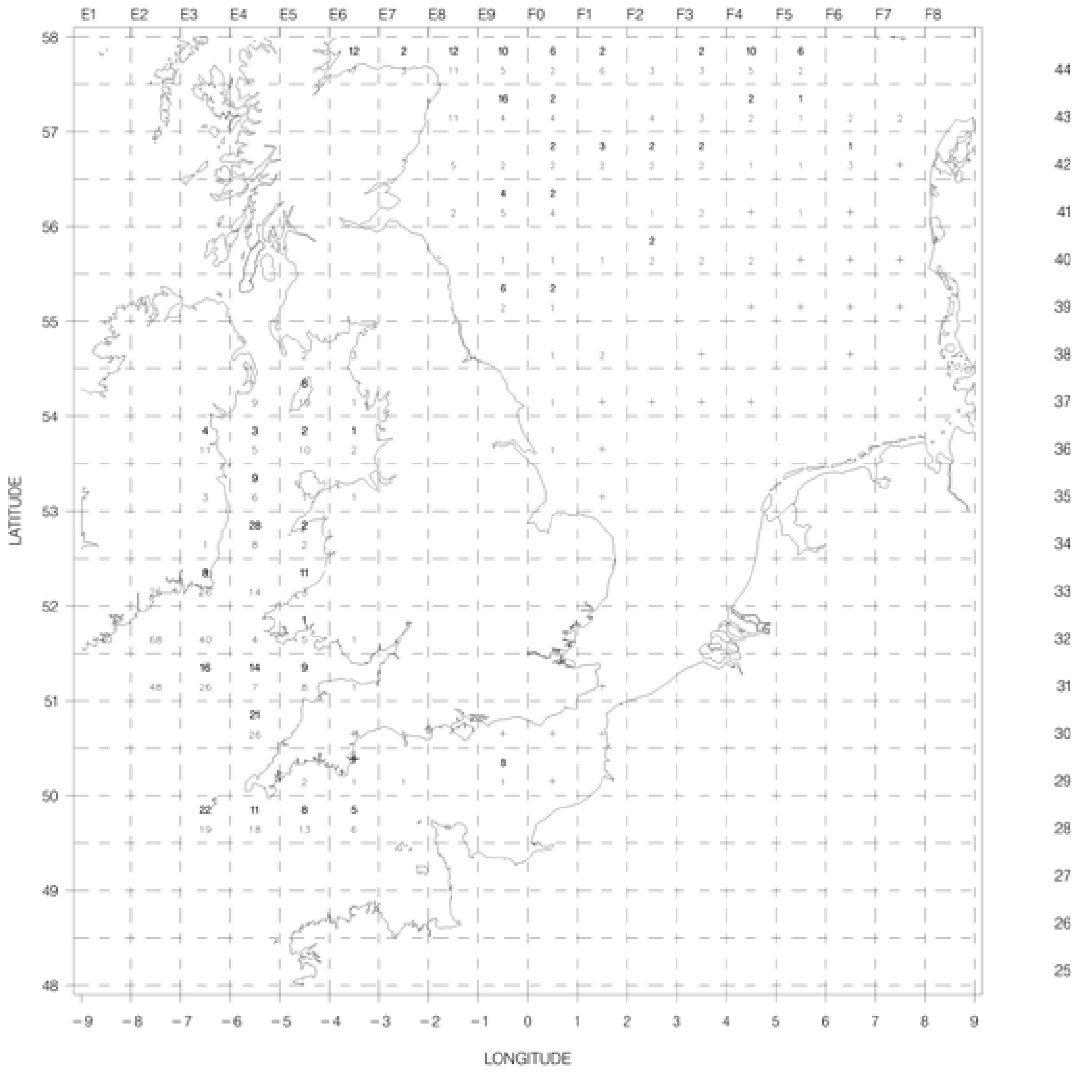


Figure 2.3.25 International Beam Trawl Surveys 1990–2004
Catches in number / 8m beam / hour / rectangle
2004 data in bold, above the survey mean ('+'= < 0.5)
John dory

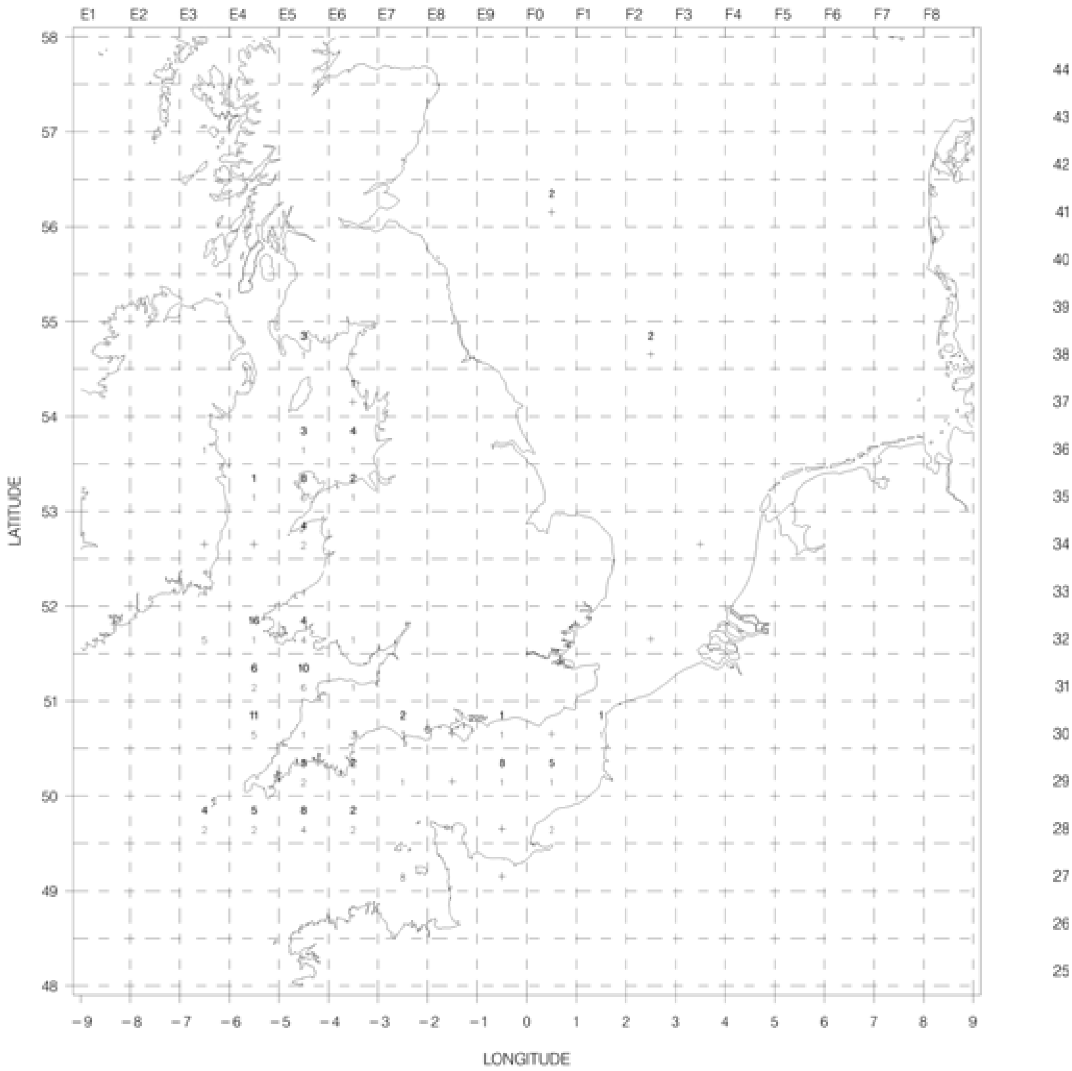
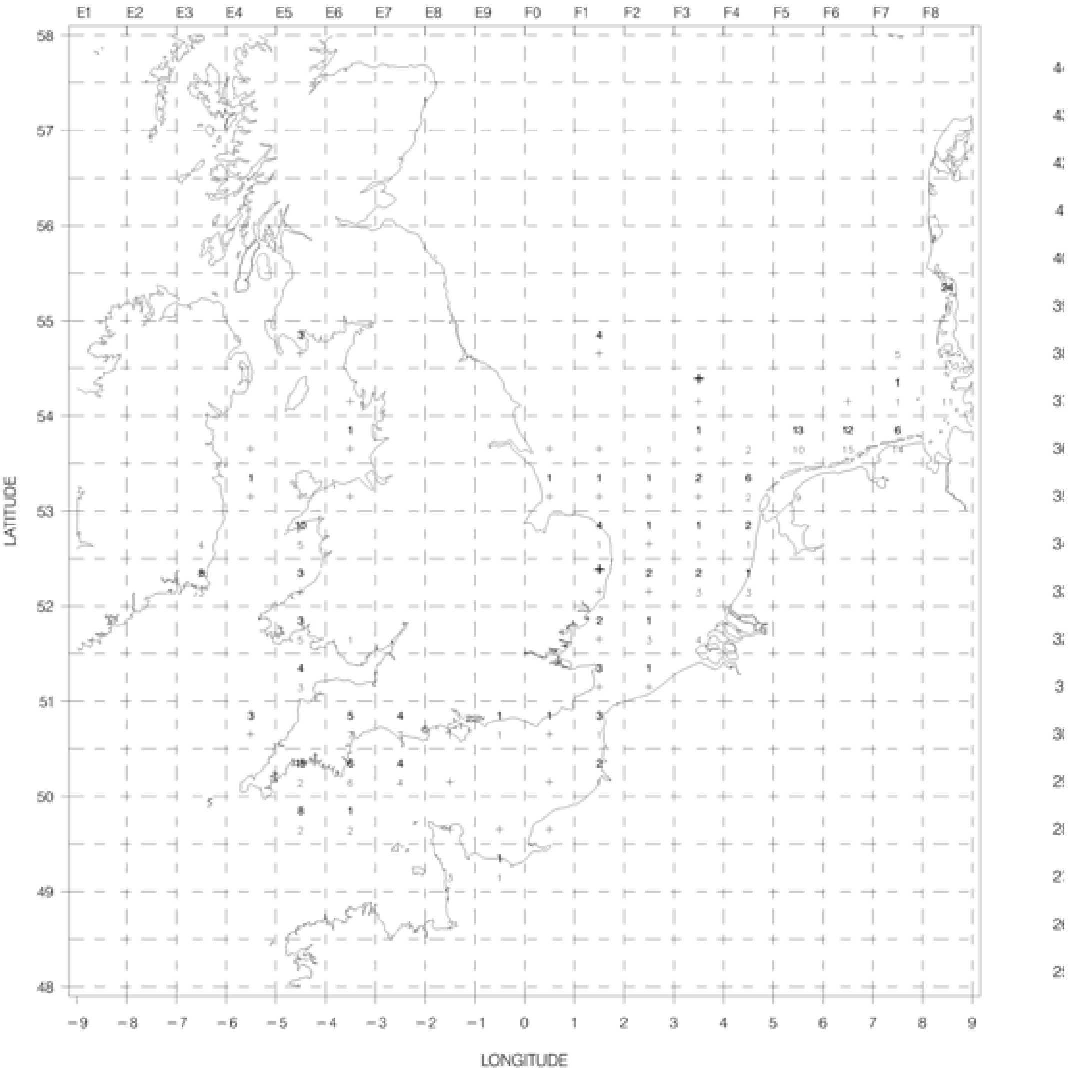
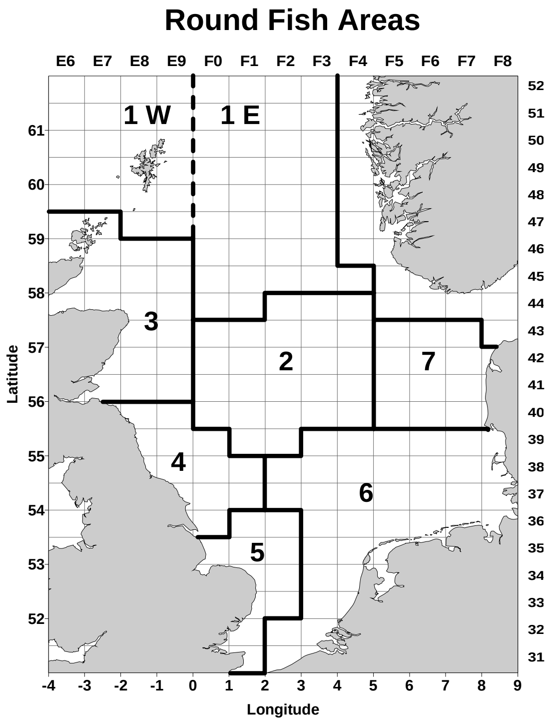


Figure 2.3.26 International Beam Trawl Surveys 1990–2004
Catches in number / 8m beam / hour / rectangle
2004 data in bold, above the survey mean ('+' = < 0.5)
Red mullet

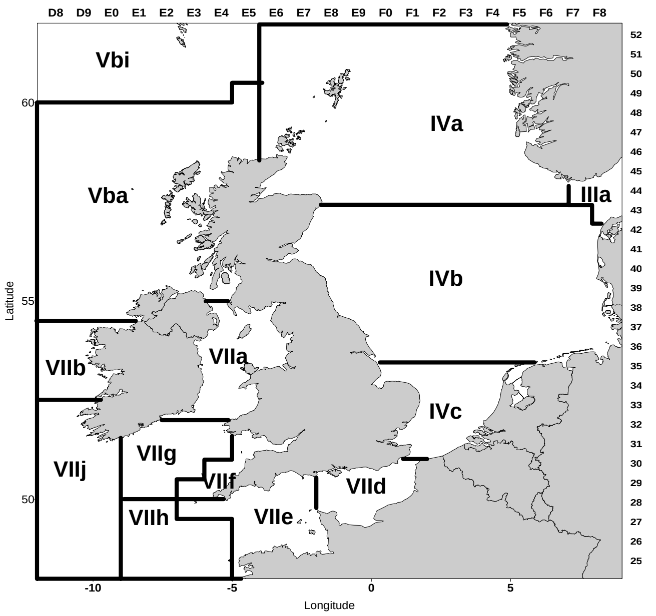


Annex 3: Charts of areas covered by Principal component analysis

A. North Sea Roundfish areas



B. ICES Divisions in Subarea VII. Only VIIa, d, e, f, and g were used in the analysis



Annex 4: Action Plan Audit

Year	Committee Acronym	Committee name	Expert Group	Reference to other committees	Expert Group report (ICES Code)	Resolution No.		
2004/2005	LRC	Living Resources Committee	WGBEAM	D, ACFM	2005/G:12	2G10		
Action Plan	Action Required	ToR's	ToR	Satisfactory Progress	No Progress	Unsatisfactory Progress	Output (link to relevant report)	Comments (e.g., delays, problems, other types of progress, needs, etc.
No.	Text	Text	Ref. (a, b, c)	S	0	U	Report code and section	Text
1.2.2	Quantify the changes in spatio-temporal distribution of the stocks of important species in relation to environmental change, using survey and commercial data.	prepare a progress report summarising the results of the 2004 beam trawl surveys;	a)	S			2005/G:12, section 2	
1.2.2	Quantify the changes in spatio-temporal distribution of the stocks of important species in relation to environmental change, using survey and commercial data. [OCC/LRC/RMC/BCC/DFC]*	calculate population abundance indices by age-group for sole and plaice in the North Sea, Division VIIa and Divisions VIId–g;	b)	S			2005/G:12, section 2	
1.11	Continue to improve the coordination, conduct, and analysis of oceanographic and biological surveys to assure their accuracy and precision. [LRC/RMC/OCC/MHC/DFC]	further coordinate offshore and coastal beam trawl surveys in the North Sea and Divisions VIIa and VIId–g;	c)	S			2005/G:12, section 3	need to work on the inshore surveys at next meeting
1.11	Continue to improve the coordination, conduct, and analysis of oceanographic and biological surveys to assure their accuracy and precision. [LRC/RMC/OCC/MHC/DFC]	describe and evaluate the current methods for calculating population abundance indices and consider possibilities of delivering improved indices;	d)	S			2005/G:12, section 4	review strata raising of inshore surveys at next WG
1.11	Continue to improve the coordination, conduct, and analysis of oceanographic and biological surveys to assure their accuracy and precision. [LRC/RMC/OCC/MHC/DFC]	continue the work on developing relative catchabilities of the different gears used in the surveys;	e)	S			2005/G:12, section 4	review gear effeciencies of inshore surveys at next WG
1.13.4	Promote the development and use of new survey designs, data analysis methods, acoustic instrumentation and survey gears.	continue the work on developing relative catchabilities of the different gears used in the surveys;	e)	S			2005/G:12, section 4	
6.1	Integrate and expand databases to support ICES programmes within a well-defined data management policy. [CONC/MCAP/all Science Committees]*	continue work of developing and standardising an international database of beam trawl survey data and coordinate such activities with those of the IBTSWG in particular on the compliance to DATRAS, the bottom trawl database at ICES;	f)	S			2005/G:12, section 5	
1.2.2	Quantify the changes in spatio-temporal distribution of the stocks of important species in relation to environmental change, using survey and commercial data. [OCC/LRC/RMC/BCC/DFC]*	continue the work on collating information on the epibenthic invertebrate by-catch during beam trawl surveys into a common database and discuss which summary results should be reported;	g)	S			2005/G:12, section 2	
6.1	Integrate and expand databases to support ICES programmes within a well-defined data management policy. [CONC/MCAP/all Science Committees]*	continue the work on collating information on the epibenthic invertebrate by-catch during beam trawl surveys into a common database and discuss which summary results should be reported;	g)	S			2005/G:12, section 2	
1.11	Continue to improve the coordination, conduct, and analysis of oceanographic and biological surveys to assure their accuracy and precision. [LRC/RMC/OCC/MHC/DFC]	develop protocols and criteria to ensure standardisation of all sampling tools and surveys gears.	h)		O		2005/G:12, section 6	
1.13.1	Improve the standardisation and performance of survey gears.	develop protocols and criteria to ensure standardisation of all sampling tools and surveys gears.	h)		O		2005/G:12, section 6	