



*PART II*

*OF*

*REPORT OF THE HERRING ASSESSMENT WORKING GROUP  
FOR THE AREA SOUTH OF 62°N*

**Table 2.1.1** HERRING. Catch in tonnes 1974-85 North Sea, Sub-area IV and Division VIId by country. (National catches as officially reported, unless otherwise annotated.) Unallocated catches provided by Working Group members.

Country	1974	1975	1976	1977	1978	1979
Belgium	603	2,451	2,451	57	-	-
Denmark	61,728	115,616	34,841	12,769	4,359	10,546
Faroe Islands	26,161 <sup>1</sup>	25,854	14,378	8,078	40	10
Finland	-	-	1,034	-	-	-
France	12,548	20,391	14,468	1,613	2,119	2,560
German Dem.Rep.	3,268	2,689	2,624	2	-	-
Germany, Fed.Rep.	12,470	6,953	1,654	221	24	10
Iceland	29,017	16,286	9,412	-	-	-
Netherlands	35,106	38,416	20,146	4,134	18	-
Norway	40,975	34,183	27,386	4,065	1,189	3,617
Poland	9,850	7,069	7,072	2	-	-
Sweden	3,561	6,858	4,777	3,616	-	-
UK (England)	5,699	6,475	9,662	3,224	2,843	2,253
UK (Scotland) <sup>3</sup>	15,034	8,904	15,015	8,159	437	-
USSR	18,096	20,653	10,935	78	4	162
<b>Total North Sea</b>	<b>275,116</b>	<b>312,798</b>	<b>174,834</b>	<b>46,010</b>	<b>11,033</b>	<b>19,158</b>

Country	1980	1981	1982	1983	1984	1985 <sup>5</sup>
Belgium	-	-	9,700	5,969	5,080	3,482
Denmark	4,431	21,146	67,851	10,468	38,777	127,755 <sup>4</sup>
Faroe Islands	-	-	-	-	-	-
Finland	-	-	-	-	-	-
France	5,527	15,099	15,310	16,353	20,320	18,566 <sup>4</sup>
German Dem.Rep.	-	-	-	-	-	-
Germany, Fed.Rep.	147	2,300 <sup>2</sup>	349 <sup>2</sup>	1,837	11,609	9,724
Iceland	-	-	-	-	-	-
Netherlands	509	7,700	22,300	40,045	44,308	80,020 <sup>4</sup>
Norway	2,165	70	680	32,512	98,714	157,919 <sup>4</sup>
Poland	-	-	-	-	-	-
Sweden	-	-	-	284	886	2,442
UK (England)	77	303	3,730	111	1,689	4,791 <sup>4</sup>
UK (Scotland) <sup>3</sup>	610	45	1,780	17,260	31,393	55,795
USSR	-	-	-	-	-	-
<b>Total North Sea</b>	<b>13,466</b>	<b>46,663</b>	<b>122,056</b>	<b>133,794</b>	<b>252,776</b>	<b>460,494</b>
<b>Total including unallocated catches</b>	<b>60,994</b>	<b>140,972</b>	<b>235,925</b>	<b>317,124</b>	<b>317,263</b>	<b>529,969</b>

<sup>1</sup> Supplied by Fiskirannsóknarstofan.

<sup>2</sup> From Federal Republic of Germany national statistics compiled by Federal Research Board for Fisheries, Hamburg.

<sup>3</sup> Catches of juveniles from Moray Firth not included.

<sup>4</sup> Unofficial as reported by W G members.

<sup>5</sup> Preliminary.

Table 2.1.2 HERRING, catch in tonnes in Division IVa West.

Country	1980	1981	1982	1983	1984	1985
Denmark	687	11,357	3,155	4,282	26,786	76,856
France	651	1,851	1,970	680	1,408	989
Germany, Fed.Rep	-	-	-	1,542	12,092	5,585
Netherlands	-	-	-	15,745	19,143	47,370
Norway	-	-	-	16,971	21,305	10,383
UK (Scotland)	18	2	1,706	16,136	24,634	52,100
Sweden	-	-	-	213	- <sup>1</sup>	- <sup>1</sup>
Unallocated	1,762	6,492	300	3,955	24,030	4,930
Total	3,118	19,702	7,179	61,738	129,398	198,213

<sup>1</sup>Included in Division IVb.

Table 2.1.3 HERRING, catch in tonnes in Divisions IVa East.

Country	1980	1981	1982	1983	1984	1985
Denmark	-	-	491	-	126	-
Norway	21	70	680	-	49,125	109,993
UK (Scotland)	-	-	-	257	74	-
Unallocated	2,476	937	-	431	-	-
Total	2,497	1,007	1,171	688	49,325	109,993

Table 2.1.4 HERRING, catch in tonnes in Division IVb.

Country	1980	1981	1982	1983	1984	1985
Denmark	3,733	9,689	64,205	6,050	13,808	50,899
France	176	524	561	705	2,299	754
Germany, Fed.Rep	147	2,300	118	-	2	4,139
Netherlands	35	-	219	300	4,600	- <sup>3</sup>
Norway	1,607	-	-	14,156	25,820	37,543
UK (England)	76	13	3,128	40	1,956 <sup>1</sup>	4,441 <sup>1</sup>
UK (Scotland)	592	43	74	867	2,477	2,894 <sup>2</sup>
Sweden	-	-	-	71	884 <sup>2</sup>	2,442 <sup>2</sup>
Unallocated	9,258	65,811	90,262	159,124	41,294	48,765
Total	15,624	78,380	158,567	181,313	93,140	151,879

<sup>1</sup> Includes catches mis-reported from Division IVc.<sup>2</sup> Includes Division IVa catches.<sup>3</sup> Included in Division IVa.

Table 2.1.5 HERRING, catch in tonnes in Divisions IVc and VIId.

Country	1980	1981	1982	1983	1984	1985
Belgium	-	-	9,700	5,969	5,080	3,482
Denmark	11	100	-	135	53	-
France	4,700	12,724	12,799	14,968	16,613	16,823
Germany, Fed.Rep	-	-	183	295	-	-
Netherlands	474	7,700	22,081	24,000	21,922	32,650
Norway	482	-	-	1,385	-	-
UK (England)	1	290	602	71	571 <sup>1</sup>	350 <sup>2</sup>
UK (Scotland)	-	-	-	-	-	799
Unallocated	37,418	21,069	23,307	17,606	1,788	15,780
Total	43,086	41,883	68,652	64,430	46,027	69,884 <sup>3</sup>

<sup>1</sup> Includes 520 tonnes coastal spring-spawning herring.<sup>2</sup> Includes 269 tonnes coastal spring-spawning herring.<sup>3</sup> Includes 905 tonnes coastal spring-spawning herring.



Table 2.1.6 HERRING. North Sea catch in millions of fish by age.

Year/Area	Age in winter rings										Total
	0	1	2	3	4	5	6	7	8	>8	
<b>1982</b>											
IVaW of 2 <sup>0</sup> E	0.3	-	0.9	2.6	5.6	6.9	4.3	5.9	3.0	0.9	30.4
IVaE of 2 <sup>0</sup> E	-	4.3	7.0	-	-	-	-	-	-	-	11.3
IVb	9,552.5	815.2	59.3	6.1	1.6	0.7	0.3	0.4	0.1	0.1	10,436.3
IVc + VIId	3.9	20.9	201.2	221.4	26.5	6.8	2.2	1.5	0.5	0.1	485.0
Total NS	9,556.7	840.4	268.4	230.1	33.7	14.4	6.8	7.8	3.6	1.1	10,963.0
<b>1983</b>											
IVaW of 2 <sup>0</sup> E	-	51.9	126.8	74.9	27.5	13.5	18.4	12.3	10.9	12.1	348.3
IVaE of 2 <sup>0</sup> E	-	0.9	4.6	0.5	0.1	-	-	-	-	-	6.1
IVb	10,029.1	1,068.7	161.7	35.9	13.0	1.6	1.4	-	-	-	11,311.4
IVc + VIId	0.8	25.1	251.7	105.1	64.5	11.1	3.0	0.5	0.5	0.1	462.4
Total NS	10,029.9	1,146.6	544.8	216.4	105.1	26.2	22.8	12.8	11.4	12.2	12,128.2
<b>1984</b>											
IVaW of 2 <sup>0</sup> E	-	29.5	409.2	165.7	89.6	27.2	12.9	14.7	7.6	14.7	771.1
IVaE of 2 <sup>0</sup> E	-	60.5	138.6	71.3	37.5	18.6	2.5	6.3	0.6	1.0	336.9
IVb	2,187.3	457.4	266.1	63.5	29.8	9.4	4.3	2.7	2.4	1.7	3,024.6
IVc + VIId	2.1	13.7	172.6	116.6	33.0	22.6	2.0	0.5	-	0.4	363.5
Total NS	2,189.4	561.1	986.5	417.1	189.9	77.8	21.7	24.2	10.6	17.8	4,496.1
<b>1985</b>											
IVaW of 2 <sup>0</sup> E	-	37.7	509.1	468.4	161.5	57.8	15.0	11.1	8.4	10.2	1,279.2
IVaE of 2 <sup>0</sup> E	56.8	34.6	162.7	340.2	104.4	34.4	13.4	4.6	3.1	2.8	757.0
IVb	1,236.1	1,534.8	237.3	210.0	57.6	19.6	6.7	2.9	1.6	2.8	3,309.4
IVc + VIId	-	13.1	314.1	169.0	44.1	12.3	8.4	1.4	0.1	0.2	562.7
Total NS	1,292.9	1,620.2	1,223.2	1,187.6	367.6	124.1	43.5	20.0	13.2	15.9	5,908.3

Catches made in the South Buchan area of Division IVb (see Figure 1.3.1) included in Division IVa (W of 2<sup>0</sup>E) in 1984 and 1985.

Swedish catches included in Division IVa (E of 2<sup>0</sup>E).

Table 2.1.7 North Sea HERRING 1985  
Millions caught by age groups (winter rings), Sub-divisions and quarters.

Division	Quarter	0 (1984)	1 (1983)	2 (1982)	3 (1981)	4 (1980)	5 (1979)	6 (1978)	7 (1977)	8 (1976)	>8	Total	O+1 Rings
IVa(W of 2 <sup>0</sup> E)	I	-	0.3	21.8	98.2	49.7	19.5	3.6	5.1	3.5	2.6	204.4	0.3
	II	-	2.9	58.4	64.7	28.2	12.7	3.9	1.1	1.7	4.4	178.0	2.9
	III	-	10.4	276.5	214.9	56.0	19.1	5.7	3.6	2.3	2.1	590.6	10.4
	IV	-	24.1	152.4	90.6	27.6	6.5	1.8	1.3	0.9	1.1	306.3	24.1
	Total	-	37.7	509.1	468.4	161.5	57.8	15.0	11.1	8.4	10.2	1,279.2	37.7
IVa(E of 2 <sup>0</sup> E)	I	-	-	10.1	47.6	18.7	8.8	2.0	1.4	0.9	0.7	90.2	-
	II	-	3.1	132.0	283.5	82.5	24.3	10.8	3.0	1.9	1.7	542.8	3.1
	III	34.0	18.5	17.8	5.6	0.7	0.1	0.1	-	-	-	76.8	52.5
	IV	22.8	13.0	2.8	3.5	2.5	1.2	0.5	0.2	0.3	0.4	47.2	35.8
	Total	56.8	34.6	162.7	340.2	104.4	34.4	13.4	4.6	3.1	2.8	757.0	91.4
IVb	I	-	888.4	41.2	28.0	5.8	1.7	0.4	0.2	0.1	+	965.8	888.4
	II	122.4	20.8	12.0	19.3	5.7	1.8	0.9	0.3	0.2	0.1	183.5	143.2
	III	1,113.5	529.3	171.0	153.0	39.7	13.9	4.6	2.1	1.0	2.5	2,030.6	1,471.8
	IV	0.2	96.2	13.0	9.7	6.4	2.2	0.8	0.3	0.3	0.1	129.2	96.4
	Total	1,236.1	1,534.7	237.2	210.0	57.6	19.6	6.7	2.9	1.6	2.7	3,309.1	2,770.8
IVc + VIId	I	-	0.4	10.2	69.8	19.8	4.9	3.0	0.3	+	0.2	108.6	0.4
	II	-	-	+	1.0	0.8	0.3	0.1	-	-	-	2.2	-
	III	-	-	+	0.3	0.4	0.3	0.1	-	0.1	-	1.2	-
	IV	-	12.7	303.9	97.9	23.1	6.7	5.2	1.1	-	-	450.6	12.7
	Total	-	13.1	314.1	169.0	44.1	12.3	8.4	1.4	0.1	0.2	562.6	13.1

+ = <0.1

**Table 2.1.8** Millions of HERRING caught annually per age group (winter rings) in the North Sea 1970-85.

Year	Winter Rings										Total
	0	1	2	3	4	5	6	7	8	>8	
1970	898.1	1,196.2	2,002.8	883.6	125.2	50.3	61.0	7.9	12.0	12.2	5,294.3
1971	684.0	4,378.5	1,146.8	662.5	208.3	26.9	30.5	26.8	-	12.4	7,176.7
1972	750.4	3,340.6	1,440.5	343.8	130.6	32.9	5.0	0.2	1.1	0.4	6,045.5
1973	289.4	2,368.0	1,344.2	659.2	150.2	59.3	30.6	3.7	1.4	0.6	4,906.6
1974	996.1	846.1	772.6	362.0	126.0	56.1	22.3	5.0	2.0	1.1	3,189.3
1975	263.8	2,460.5	541.7	259.6	140.5	57.2	16.1	9.1	3.4	1.4	3,753.3
1976	238.2	126.6	901.5	117.3	52.0	34.5	6.1	4.4	1.0	0.4	1,482.0
1977	256.8	144.3	44.7	186.4	10.8	7.0	4.1	1.5	0.7	+	656.3
1978	130.0	168.6	4.9	5.7	5.0	0.3	0.2	0.2	0.2	0.3	315.4
1979	542.0	159.2	34.1	10.0	10.1	2.1	0.2	0.8	0.6	0.1	759.2
1980	791.7	161.2	108.1	91.8	32.1	21.8	2.3	1.4	0.4	0.2	1,211.0
1981	7,888.7	447.0	264.3	56.9	39.5	28.5	22.7	18.7	5.5	1.1	8,772.9
1982	9,556.7	840.4	268.4	230.1	33.7	14.4	6.8	7.8	3.6	1.1	10,963.0
1983	10,029.9	1,146.6	544.8	216.4	105.1	26.2	22.8	12.8	11.4	12.2	12,128.2
1984	2,189.4	561.1	986.5	417.1	189.9	77.8	21.7	24.2	10.6	17.8	4,496.1
1985	1,292.9	1,620.2	1,223.2	1,187.6	367.6	124.1	43.5	20.0	13.2	15.9	5,908.3

**Table 2.1.9** Percentage age compositions of NORTH SEA HERRING  
(2-rings and older), 1985.

Division	Quarter	2	3	Older	Total No. caught (millions)
		(1982)	(1981)		
IVa(W of 2 <sup>0</sup> E)	I	10.7	48.1	41.2	204.1
	II	33.4	37.0	29.6	175.1
	III	46.8	37.0	16.2	580.2
	IV	54.0	32.1	13.9	282.2
Total		41.0	37.7	21.3	1,241.6
IVa(E of 2 <sup>0</sup> E)	I	11.2	52.8	36.0	90.2
	II	24.5	52.5	23.0	539.7
	III	73.3	23.1	3.6	24.3
	IV	24.6	30.7	44.7	11.4
Total		24.4	51.1	24.5	665.6
IVb	I	53.2	36.2	10.6	77.4
	II	29.8	47.9	22.3	40.3
	III	44.1	39.5	16.4	387.8
	IV	39.6	29.6	30.8	32.8
Total		44.1	39.0	16.9	538.3
IVc + VIId	I	9.4	64.5	26.1	108.2
	II	0.1	45.5	54.4	2.2
	III	0.1	25.0	74.9	1.2
	IV	69.4	22.4	8.2	437.9
Total		57.2	30.8	12.0	549.5
IVa + IVb	I	19.7	46.8	33.5	371.7
	II	26.8	48.7	24.5	755.1
	III	46.9	37.6	15.5	992.3
	IV	51.5	31.8	16.7	326.4
Total		37.2	41.7	21.1	2,445.5
Total North Sea	I	17.4	50.8	31.8	479.9
	II	26.7	48.7	24.6	757.3
	III	46.8	37.6	15.6	993.5
	IV	61.8	26.4	11.8	764.3
Total		40.8	39.7	19.5	2,995.0

Table 2.2.1 Predation Mortality on HERRING 1981  
MSVPA, Key-Run 1985.

Age (winter rings)	Quarter				Total
	1	2	3	4	
0	-	0.11	0.37	0.36	0.84
1	0.95	0.15	0.02	0.02	1.14
2	0.04	0.02	0.02	+	0.08
3	0.07	0.01	0.18	0.01	0.27
4	+	+	0.01	0.01	0.02
5	+	0.01	0.01	0.02	0.04
6	+	+	+	0.02	0.03
7	-	-	-	-	-
8	-	-	-	-	-

+ = < than 0.005.



Table 2.3.1 1-group HERRING abundance in International Young Fish Survey.

Survey Year	Year class	Abundance 1-group in no./hour/ rectangle in standard area	VPA estimate, 1-group $\times 10^9$
1970	1968	822	5.92
1971	1969	2,647	11.67
1972	1970	1,629	9.23
1973	1971	827	5.90
1974	1972	1,195	2.87
1975	1973	1,592	6.11
1976	1974	452	0.69
1977	1975	342	0.66
1978	1976	575	1.05
1979	1977	139	1.11
1980	1978	535	2.43
1981	1979	551	3.53
1982	1980	1,293	6.68
1983	1981	1,797	13.02
1984	1982	2,714	-
1985	1983	3,227	-
1986	1984	3,613 <sup>1</sup>	-

<sup>1</sup>Preliminary.

Table 2.3.2 English coastal 0-group indices as mean no/ hour and North Sea recruitment as 1-ringers.

Year class	0-group (no/hr)		1-group
	Total	Downs	VPA (total North Sea) x 10 <sup>9</sup>
1967	1,806	698	10.55
1968	1,165	1,917	5.92
1969	2,506	1,168	11.67
1970	1,061	2,316	9.23
1971	821	784	5.90
1972	578	53	2.87
1973	448	47	6.11
1974	158	42	0.69
1975	194	26	0.66
1976	96	36	1.05
1977	4,911	65	1.11
1978	1,506	1,650	2.43
1979	608	157	3.53
1980	516	521	6.68
1981	2,548	1,596	13.02
1982	633	863	11.51
1983	2,536	193	14.89
1984	5,149	2,152	17.07



Table 2.3.3 Abundance indices of first length component of 1-group in the IYFS and numbers of 2-ringed DOWNS HERRING from VPA.

Year class	IVc, VIId VPA 2-ringers (millions)	First component IYFS 1-group no/hr/rectangle (thousands)
1970	76	4.70
1971	75	5.80
1972	182	9.58
1973	108	4.31
1974	53	5.07
1975	66	3.39
1976	159	4.11
1977	206	1.95
1978	624	13.11
1979	409	8.83
1980	519	35.12
1981	670	46.55
1982	959	38.27
1983	-	(1.00)
1984	-	2.17

**Table 2.3.4** Results of IKMT sampling compared with VPA estimates of 0-group stock size.

Year	Mean number of larvae per rectangle					IKMT index weighted by area <sup>1</sup>	VPA estimates of 0-group stock size x 10 <sup>9</sup>
	North Sea NW	North Sea NE	North Sea SE	North Sea SW	Skagerrak/Kattegat		
1976	19.82	1.50	1.14	11.00	0.17	1,237	3.27
1977	4.19	6.07	1.82	6.75	0.94	632	3.22
1978	42.67	5.35	0.81	15.60	8.64	2,460	7.47
1979	12.03	25.89	38.08	34.52	18.47	4,768	10.85
1980	12.43	0.33	28.69	17.78	33.67	3,423	30.12
1981	23.25	7.27	49.62	26.67	12.83	5,193	50.10
1982	2.63	9.79	37.96	14.23	47.92	3,904	46.66
1983	3.27	12.17	51.60	23.23	33.86	4,880	43.91
1984	19.18	5.83	52.24	40.85	22.31	5,829	-
1985	24.88	17.89	54.45	49.12	6.69	6,421	-

<sup>1</sup>Number of rectangles per area in NW North Sea 38, NE North Sea 18, SE North Sea 61, SW North Sea 35, Skagerrak/Kattegat 17. The areas are those given in Figure 2.2 of the 1985 Report (Anon., 1985).

**Table 2.4.1** Numbers of herring at age (million) and biomass ('000 tonnes) on acoustic surveys in the second half of July and early August.

Age (rings)	Orkney-Shetland area	Moray Firth	Buchan area	Fladen area	Eastern area	Egersund Bank area	Total
0	-	-	48.8	-	-	-	49
1	642.5	-	17.6	66.0	0.2	0.3	727
2	1,247.9	-	68.3	382.1	93.6	87.9	1,907
3	539.4	-	31.0	174.6	90.6	58.1	894
4	169.5	-	3.5	21.3	33.3	9.1	237
5	61.8	-	0.9	5.0	13.3	2.4	83
6	21.8	-	0.3	1.6	4.8	1.8	30
7	11.7	-	0.02	0.09	1.5	-	13
8	21.2	-	0.06	0.4	1.6	0.5	24
>9	17.0	-	-	0.05	2.4	0.2	20
Total	2,760.1	-	170.6	651.0	241.5	160.3	3,984
Total biomass	375.7	-	16.0	87.4	47.7	20.5	547.3
Spawner <sup>1</sup> biomass	285.0	-	13.0	73.4	43.2	20.5	435.1

<sup>1</sup>Fish at stage 3 and over.

Table 2.4.2 Numbers of herring-at-age estimated by acoustic survey of Division IVa in 1984 and 1985 and estimates of Z.

Year class	July 1984	July 1985	Z <sub>84-85</sub>
1983	-	726.3	-
1982	550.7	1,818.9	-
1981	1,717.6	835.6	0.72
1980	609.6	227.6	0.98
1979	264.1	81.0	1.18
1978	81.5	28.5	1.05
1977	36.0	13.3	1.00
1976	45.9	23.3	0.68
1975	38.1	19.4	1.35
pre-1975	36.9		
pre-1982	2,829.7	1,228.7	0.83

Covers Orkney-Shetland, Moray Firth, Buchan, Fladen and eastern area in Figure 2.4.1.

July 1984 estimates taken from Table 2.10 in Anon. (1985).

Table 2.4.3 Numbers of HERRING at age (millions) and s biomass ('000 tonnes) during the November survey.

Age (rings)	Fladen area	Egersund Bank area	Sum Div.IVa E of 1 <sup>0</sup> W
0	-	-	-
1	128	2	130
2	562	4	566
3	389	18	407
4	358	16	374
5	102	13	115
6	19	10	29
7	-	7	7
8	-	7	7
>9	6	3	9
Total	1,564	81	1,645
Total biomass	219	15	234

**Table 2.4.4** Age composition (year class) of HERRING samples<sup>1</sup> during the northeast coast acoustic survey, August 1985 (Division IVb).

Parameter	Age (rings)						Overall
	2 (1982)	3 (1981)	4 (1980)	5 (1979)	6 (1978)	7 (1977)	
% number	47.9	43.0	5.6	2.3	0.9	0.3	
% weight	40.8	46.9	7.2	3.3	1.2	0.6	
Mean length (cm)	25.95	27.99	29.41	30.51	30.48	32.92	27.19
(S.D.)	(1.01)	(0.95)	(1.03)	(0.65)	(0.66)	(0.71)	(1.64)
Mean weight (g)	142.2	182.1	214.7	242.2	241.2	310.8	167.1

<sup>1</sup> Mainly stage 5 maturity fish, excluding a small proportion of 1-group fish.

**Table 2.4.5** Percentage age compositions from Acoustic Survey samples compared with commercial catch age composition Southern Bight and Eastern Channel.

Category	2 (1982)	3 (1981)	4 (1980)	5 (1979)	6 (1978)	7 (1977)
<u>French Surveys (VIId)</u>						
11-14 Nov.	68.5	24.8	5.5	1.2	-	-
16-20 Nov.	61.0	29.7	8.1	0.8	0.4	-
<u>English Survey</u>						
(VIId) 7-15 Dec.	70.2	26.1	2.4	0.4	0.6	0.3
(IVc) 15-19 Dec.	62.0	18.4	9.9	4.1	5.1	0.5
<u>IV Quarter (Commercial catches) [Mainly Nov.-Dec.]</u>						
Netherlands	70.0	17.9	4.7	1.5	1.5	0.4
France	61.1	31.0	6.1	1.4	0.4	-

**Table 2.4.6** Acoustic estimates of HERRING biomass ('000 tonnes) in Divisions IVc and VIId.

Year	Survey dates	Country	IVc	VIId	Biomass at end of year <sup>1</sup>
1981	2-15 Dec	England	73.0	23.0	96.0
1982	1-9 Feb	England	143.0	-	146.0
1983	17-28 Nov	England	178.0 <sup>2</sup>	104.0	260.0 <sup>2</sup>
			70.0 <sup>3</sup>		150.0 <sup>3</sup>
1984	11-23 Nov	France	35.6	110.5	133.0
1985	11-23 Nov	France	-	85.0	124.0 <sup>4</sup>
	7-19 Dec	England	69.0	53.0	

<sup>1</sup> Biomass at end of year represents the acoustic estimates adjusted by mean weights and catches in the last quarter.

<sup>2</sup> This estimate assumed 75% of the biomass in IVc was herring (1984 Working Group Report).

<sup>3</sup> This estimate assumes 30% of the biomass in IVc was herring using the same proportion determined on the French survey in 1984.

<sup>4</sup> The combined estimate from the French and English surveys in the Channel only.

**Table 2.5.1** Larvae production estimates (LPE x 10<sup>11</sup> larvae) calculated using area-specific natural mortality rates (z/k) compared to larvae abundance indices (LAI) from Saville and Rankine (1985).

Year	Orkney-Shetland		Buchan		IVa (incl. Buchan)		Central N. Sea		IVc + VIId	
	LPE	LAI	LPE	LAI	LPE	LAI	LPE	LAI	LPE	LAI
1972	150	578	5	1	155	579	20	11	51	2
1973	76	239	7	1	83	240	90	73	54	1
1974	56	128	28	38	84	166	(53)	(63)	1	-
1975	40	44	9	44	49	88	39	6	-	-
1976	16	66	4	-	20	66	12	8	1	-
1977	(<133)	132	29	23	-	155	70	17	1	-
1978	90	371	21	36	111	407	86	46	3	1
1979	231	565	(<565)	20	231	585	53	19	2	4
1980	247	398	(<127)	2	247	400	121	21	47	12
1981	171	394	(<151)	2	171	396	233	36	119	49
1982	257	380	132	100	389	480	78	34	113	37
1983	207	335	365	448	572	783	87	66	(>74)	24
1984	161	354	590	430	751	783	653	105	114	23
1985	295	1,049	666	435	961	1,484	724	380	141	41
z/k	0.25	-	0.42	-	-	-	0.40	-	0.55	-

**Table 2.5.2** SSB ('000 tonnes) estimated from larvae production estimates (LPE x 10<sup>11</sup> larvae), and number of eggs (x 10<sup>7</sup>) per kg SSB compared to SSB from VPA.

year	IVa (incl.Buchan				IVb				IVa + IVb			IVc + VIId				North Sea	
	Eggs/		LPE	VPA	Eggs/		LPE	VPA	LPE	VPA		Eggs/	LPE	VPA	LPE	VPA	
	LPE	kg	SSB	SSB	LPE	kg	SSB	SSB	SSB	SSB	LPE	kg	SSB	SSB	SSB	SSB	
1972	155	(1.56)	99	207	20	1.50	13	43	112	256	51	0.94	54	30	166	274	
1973	83	(1.56)	53	147	90	1.51	60	80	113	240	54	0.93	58	8	171	225	
1974	84	(1.56)	54	88	(53)	1.54	(34)	78	88	179	1	0.87	1	7	89	159	
1975	49	1.59	31	65	39	1.63	24	30	55	104	-	1.01	-	6	55	85	
1976	20	1.52	13	106	12	1.53	8	13	21	121	1	0.74	1	2	22	80	
1977	-	1.57	-	88	70	(1.54)	45	8	-	96	1	1.02	1	6	-	54	
1978	111	1.57	71	108	86	(1.54)	56	13	127	117	3	1.18	3	14	130	75	
1979	231	1.64	141	112	53	(1.54)	34	19	175	133	2	1.07	2	28	177	120	
1980	247	1.69	146	131	121	(1.54)	79	30	225	150	47	1.14	41	21	266	146	
1981	171	1.51	113	138	233	(1.54)	151	51	264	175	119	1.06	112	55	376	214	
1982	389	1.60	243	192	78	(1.54)	51	101	294	272	113	1.11	102	45	396	308	
1983	572	1.53	373	307	87	(1.54)	56	202	429	476	(>74)	1.10	(>67)	49	>496	521	
1984	751	1.67	450	532	653	(1.54)	424	437	874	907	114	1.04	110	81	984	968	
1985	961	(1.60)	601	546	724	(1.54)	470	534	1,071	1,085	141	(1.08)	131	124	1,202	1,196	

Table 2.7.1 VIRTUAL POPULATION ANALYSIS

HERRING IN THE NORTHERN NORTH SEA (FISHING AREA IVA)

CATCH IN NUMBERS

UNIT: millions

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
2	921	758	123	128	584	9	0	3	2	1	18	131
3	195	476	124	76	57	177	0	1	7	8	3	75
4	74	64	98	51	18	10	3	2	1	19	6	28
5	20	47	36	41	14	5	0	1	3	22	7	14
6	4	21	19	10	4	3	0	0	1	19	4	18
7	0	3	5	6	3	2	0	0	1	18	6	12
8	1	1	2	3	1	1	0	0	0	5	3	11
9+	0	1	1	1	0	0	0	0	0	1	1	12
TOTAL	1255	1371	406	317	680	206	4	6	15	93	47	302
	1984	1985										
2	548	672										
3	257	809										
4	127	266										
5	46	92										
6	15	28										
7	21	16										
8	8	12										
9+	16	13										
TOTAL	1018	1907										



HERRING IN THE NORTHERN NORTH SEA (FISHING AREA IVA)

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Table 2.7.3 VIRTUAL POPULATION ANALYSIS

FISHING IN THE NORTHERN NORTH SEA (FISHING AREA IVA)

STOCK SIZE IN NUMBERS UNIT: millions

BIOMASS TOTALS UNIT: tonnes

ALL VALUES, EXCEPT THOSE REFERRING TO THE SPAWNING STOCK ARE GIVEN FOR 1 JANUARY; THE SPAWNING STOCK DATA REFLECT THE STOCK SITUATION AT SPAWNING TIME, WHEREBY THE FOLLOWING VALUES ARE USED: PROPORTION OF ANNUAL F BEFORE SPAWNING: .670  
PROPORTION OF ANNUAL M BEFORE SPAWNING: .670

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
2	1738	1055	275	277	966	172	114	158	111	184	505	1086
3	343	703	242	133	130	324	147	103	140	98	166	440
4	187	127	188	102	49	63	126	132	93	121	81	148
5	57	80	54	77	44	27	48	112	118	83	91	68
6	11	33	28	15	32	27	19	43	101	104	54	76
7	2	6	10	8	4	25	21	17	39	90	76	45
8	1	2	3	5	1	1	21	0	16	34	65	63
9+	1	1	2	2	1	0	32	0	4	7	19	70
TOTAL NO	2341	2007	802	619	1226	638	528	566	621	722	1057	1996
SPS NO	1110	744	422	317	555	419	472	499	552	581	875	1496
TOT.BIOM	431422	386075	108692	127229	226120	132361	119678	125321	146237	171080	228050	405521
SPS BIOM	207435	147189	87537	63244	106149	87974	107960	111860	131395	137872	191755	307070
	1984	1985	1986									
2	2645	2134	0									
3	858	1874	1294									
4	326	552	931									
5	107	175	248									
6	49	54	71									
7	31	30	22									
8	29	27	12									
9+	55	30	28									
TOTAL NO	4122	4875										
SPS NO	2773	2741										
TOT.BIOM	739010	963253										
SPS BIOM	532813	546128										

# VIRTUAL POPULATION ANALYSIS

HERKING IN THE CENTRAL NORTH SEA (FISHING AREA IVB)

CATCH IN NUMBERS

UNIT: millions

98

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
2	518.7	443.3	427.7	218.2	176.2	22.5	1.8	9.2	6.6	40.9	58.3	161.7
3	108.0	47.0	152.2	127.6	14.1	5.1	1.0	.3	1.3	8.5	6.1	35.9
4	24.4	15.5	13.5	74.1	23.6	.2	.8	1.7	.7	1.4	1.6	13.0
5	7.2	2.7	13.0	13.0	15.6	1.4	.1	.8	.4	.2	.7	1.6
6	.7	3.5	2.8	4.5	1.4	.7	.1	.1	.0	.4	.3	1.4
7	.2	.3	.2	1.9	1.5	.0	.0	.7	.1	.0	.4	.0
8	.5	.0	.3	.4	.4	.0	.0	.5	.0	.1	.1	.0
9+	.0	.0	.1	.3	.1	.0	.0	.0	.0	.0	.1	.0
TOTAL	519.7	512.1	609.8	440.0	232.9	29.9	3.8	13.3	9.1	51.5	67.6	213.6

	1984	1985
2	240.7	174.3
3	55.8	195.8
4	28.0	55.7
5	8.8	19.1
6	4.3	6.5
7	2.6	2.9
8	2.4	1.4
9+	1.7	2.8
TOTAL	344.3	458.5

Table 2.7.5 VIRTUAL POPULATION ANALYSIS

## HERRING IN THE CENTRAL NORTH SEA (FISHING AREA IVB)

FISHING MORTALITY COEFFICIENT		UNIT: Year <sup>-1</sup>												NATURAL MORTALITY COEFFICIENT = .10																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
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	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										

Table 2.7.6 VIRTUAL POPULATION ANALYSIS

## HERRING IN THE CENTRAL NORTH SEA (FISHING AREA IVB)

STOCK SIZE IN NUMBERS UNIT: millions

BIOMASS TOTALS UNIT: tonnes

ALL VALUES, EXCEPT THOSE REFERRING TO THE SPAWNING STOCK ARE GIVEN FOR 1 JANUARY; THE SPAWNING STOCK DATA REFLECT THE STOCK SITUATION AT SPAWNING TIME, WHEREBY THE FOLLOWING VALUES ARE USED: PROPORTION OF ANNUAL F BEFORE SPAWNING: .667  
PROPORTION OF ANNUAL M BEFORE SPAWNING: .667

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
2	487	761	626	252	200	31	44	50	80	178	382	829
3	157	85	270	164	24	16	6	39	36	66	122	290
4	36	40	32	101	29	9	10	5	35	32	51	105
5	13	9	22	17	22	4	8	8	3	31	27	45
6	2	5	6	8	3	5	2	7	6	2	28	24
7	1	1	1	3	3	1	4	2	6	6	2	25
8	1	1	1	1	1	1	1	3	1	5	5	1
9+	0	1	0	0	0	1	1	0	1	0	5	1
TOTAL NO	696	903	958	545	280	67	76	113	168	319	622	1319
SPS NO	239	464	433	150	68	40	69	97	151	263	537	1090
TOT. BIOM	123068	155186	170803	103947	51326	13397	15015	22327	32976	60976	116520	242652
SPS BIOM	43094	80410	78272	29713	13200	8521	13563	19154	29767	50998	101239	201760
	1984	1985	1986									
2	1788	995	0									
3	596	1390	735									
4	228	487	1072									
5	82	180	387									
6	39	66	145									
7	21	31	54									
8	22	16	26									
9+	16	32	40									
TOTAL NO	2793	3197										
SPS NO	2332	2683										
TOT. BIOM	511471	634430										
SPS BIOM	436786	534014										

Table 2.7.7 Estimation of F in 1985 Division IVc + VIId HERRING (No in millions).

Category	Age (winter ring)						Total
	2	3	4	5	6	7	
French Acoustic Estimate <sup>1</sup> (November)	415.8	211.0	41.5	9.5	2.7	-	680.5
English Acoustic Estimate <sup>2</sup> (December)	310.4	80.1	18.6	6.3	5.1	1.3	421.8
Total	726.2	291.1	60.1	15.8	7.8	1.3	1,102.3
Total at year end (Adjusted by subtracting half Q4 catches)	574.2	242.1	48.5	12.5	5.2	0.8	888.3
Catch in 1985	314.1	169.0	44.1	12.3	8.4	1.4	549.3
F	0.42	0.51	0.62	0.66	0.93	0.97	

<sup>1</sup>Raised by age distribution from French catches in November.

<sup>2</sup>Raised by age distribution from Dutch catches in December.

Table 2.7.8 VIRTUAL POPULATION ANALYSIS

## HERRING IN THE SOUTHERN NORTH SEA (FISHING AREAS IVC AND VIID)

CATCH IN NUMBERS

UNIT: millions

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	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
2	22.57	25.50	54.80	42.40	22.90	161.80	81.60	130.80	135.10	43.30	24.10	127.20
3	73.50	60.50	9.90	15.40	19.90	8.80	85.80	41.70	29.30	115.10	20.30	39.60
4	.70	32.60	1.20	4.90	9.70	5.30	5.40	31.10	9.30	55.00	8.40	5.30
5	5.97	2.10	3.10	2.20	1.50	1.90	1.60	.70	5.07	7.40	1.20	1.80
6	.00	2.40	.00	.10	3.00	.40	1.00	.30	.00	1.90	.10	.00
7	.00	.50	.00	.00	.60	.40	.10	.60	.00	.50	.20	.00
8	.00	.00	.00	.00	.00	.01	.40	.00	.00	.10	.00	.00
9+	.07	.03	.00	.00	.07	.02	.10	.30	.07	.00	.00	.00
TOTAL	107.40	123.63	69.00	65.00	57.60	178.63	174.00	205.50	178.70	223.30	54.30	173.90

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
2	94.40	6.40	2.80	21.60	99.10	222.60	201.20	251.70	172.60	514.10
3	41.30	3.00	4.00	9.00	85.30	40.40	221.40	105.10	116.60	169.00
4	3.50	.70	1.20	5.60	50.20	19.30	26.50	64.50	33.00	44.10
5	.50	.20	.00	.60	18.40	6.70	0.80	11.10	22.60	12.30
6	.30	.00	.00	.10	1.70	3.30	2.20	3.00	2.07	8.40
7	.00	.00	.00	.00	.50	.60	1.50	.50	.50	1.40
8	.00	.00	.00	.00	.00	.00	.50	.50	.03	.10
9+	.00	.00	.00	.00	.00	.00	.10	.10	.40	.20
TOTAL	140.50	17.30	8.00	36.90	233.70	292.90	460.20	436.50	347.73	549.60

Table 2.7.9 VIRTUAL POPULATION ANALYSIS

HERRING IN THE SOUTHERN NORTH SEA (FISHING AREAS IVC AND VIID)

FISHING MORTALITY COEFFICIENT	UNIT: Year <sup>-1</sup>											
	NATURAL MORTALITY COEFFICIENT = .10											
	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
2	.14	.83	.96	.62	.82	.77	.79	.84	.68	.91	.41	1.30
3	1.05	.59	.81	.70	.59	.78	1.08	1.15	.39	2.36	1.43	2.37
4	.27	1.87	.02	1.15	1.21	.27	1.56	1.57	.76	3.76	1.52	2.37
5	1.19	7.29	.88	.04	1.30	.72	.11	.78	1.15	4.21	6.73	1.87
6	.00	7.55	.01	.05	.06	1.53	.95	.02	.00	2.27	4.38	.01
7	.01	6.08	.01	.01	.43	.01	4.48	6.26	.00	6.08	5.17	.01
8	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
9+	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
( 2- 6)U	.53	3.62	.55	.51	.79	.81	.89	.87	.60	2.70	2.89	1.58
( 6- 7)U	.00	3.81	.01	.05	.24	.77	2.71	3.14	.00	4.17	4.77	.01
	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1980-83	
2	2.30	.14	.05	.15	.70	.47	.72	.71	.31	.42	.65	
3	3.26	.39	.11	.18	1.23	.60	1.06	.94	.74	.51	.96	
4	2.83	.64	.24	.19	1.33	.95	.91	.93	.78	.62	1.03	
5	3.86	4.95	.00	.16	1.37	1.15	.97	1.17	.91	.66	1.17	
6	3.46	.01	.01	.17	.77	.88	1.53	1.61	.59	.93	1.19	
7	.01	.01	.01	.01	6.03	.60	1.21	2.32	1.34	.97	2.55	
8	.01	.01	.01	.01	.01	.01	1.37	1.97	.96	.97	.84	
9+	.01	.01	.01	.01	.01	.01	1.37	1.97	.96	.97	.84	
( 2- 6)U	3.94	1.22	.08	.17	1.08	.81	1.04	1.07	.67	.63		
( 6- 7)U	2.74	.01	.01	.09	3.42	.74	1.37	1.97	.96	.95		



Table 2.7.10 VIRTUAL POPULATION ANALYSIS

HERRING IN THE SOUTHERN NORTH SEA (FISHING AREAS IVC AND VIID)

STOCK SIZE IN NUMBERS UNIT: millions

BIOMASS TOTALS UNIT: thousand tonnes

ALL VALUES, EXCEPT THOSE REFERRING TO THE SPAWNING STOCK ARE GIVEN FOR 1 JANUARY; THE SPAWNING STOCK DATA REFLECT THE STOCK SITUATION AT SPAWNING TIME, WHEREBY THE FOLLOWING VALUES ARE USED: PROPORTION OF ANNUAL F BEFORE SPAWNING: 1.000  
PROPORTION OF ANNUAL M BEFORE SPAWNING: 1.000

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
2	180.3	47.2	92.5	96.1	42.7	315.1	155.4	240.9	286.1	75.8	75.1	181.6
3	125.9	142.0	18.6	32.0	46.8	17.0	132.3	63.5	94.5	131.1	27.8	45.1
4	3.1	39.9	71.2	7.5	14.4	23.6	7.1	40.7	16.2	57.7	11.2	6.0
5	8.8	2.1	5.5	65.5	2.1	3.9	16.3	1.4	7.6	7.7	1.2	2.2
6	.6	2.4	.0	2.1	55.2	.5	1.7	13.2	.6	2.2	.1	.0
7	.0	.5	.0	.0	1.8	47.1	.1	.6	11.7	.5	.2	.0
8	.0	.0	.0	.0	.0	1.1	42.2	.0	.0	10.6	.0	.0
9+	.0	3.2	.0	.0	.0	2.1	10.6	31.7	.0	.0	.0	.0
TOTAL NO	318.7	237.3	187.9	201.0	163.1	410.4	365.7	392.0	418.6	285.6	115.5	234.9
SPS NO	187.0	98.2	104.9	120.4	93.2	202.5	166.7	160.9	209.7	49.9	53.3	49.3
TOT.BIOM	45.6	38.3	29.4	32.8	29.3	59.6	58.4	59.2	59.2	46.4	16.4	31.8
SPS BIOM	25.4	15.5	17.8	20.9	17.9	31.8	28.8	25.7	30.3	7.8	7.1	6.4
	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	
2	108.3	53.2	65.5	159.0	206.6	623.5	409.3	519.4	670.1	959.1*****		
3	44.6	9.8	42.0	50.6	123.3	93.2	353.3	180.2	232.1	442.7	570.2	
4	3.8	1.5	6.0	34.2	42.7	32.7	46.1	111.0	63.9	99.8	240.5	
5	.5	.2	.7	4.3	25.6	10.2	11.4	16.7	39.6	26.6	48.6	
6	.3	.0	.0	.7	3.3	5.9	2.9	3.9	4.7	14.5	12.4	
7	.0	.0	.0	.0	.5	1.4	2.2	.6	.7	2.4	5.2	
8	.0	.0	.0	.0	.0	.0	.7	.6	.1	.2	.8	
9+	.0	.0	.0	.0	.0	.0	.1	.1	.7	.3	.2	
TOTAL NO	157.6	64.7	114.3	254.8	402.1	766.9	826.1	832.5	1011.7	1545.4		
SPS NO	11.5	48.8	95.3	195.5	143.4	416.7	313.2	341.0	586.3	877.9		
TOT.BIOM	21.7	8.6	16.3	36.8	60.4	103.7	121.1	120.5	143.9	220.9		
SPS BIOM	1.5	6.4	13.0	28.1	20.6	55.4	44.9	48.3	80.7	123.9		

Table 2.7.11 VIRTUAL POPULATION ANALYSIS

HERRING IN THE NORTHERN NORTH SEA (FISHING AREAS IVA + IVB)

CATCH IN NUMBERS

UNIT: millions

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
2	1305	1301	749	415	807	38	2	13	9	42	67	293
3	315	544	342	220	76	183	2	1	8	16	9	111
4	121	95	118	135	49	10	4	5	2	20	7	41
5	23	52	55	55	54	7	0	2	3	22	8	15
6	5	29	22	16	6	4	0	0	1	19	5	20
7	0	5	5	9	4	2	0	1	1	18	6	12
8	1	1	2	3	1	1	0	1	0	5	3	11
9+	0	1	1	1	0	0	0	0	0	1	1	12
TOTAL	1776	2026	1293	855	977	245	9	21	24	144	106	515

	1964	1985
2	776	909
3	291	1019
4	152	324
5	54	112
6	19	35
7	23	19
8	10	13
9+	17	16
TOTAL	1342	2446

Table 2.17.12 VIRTUAL POPULATION ANALYSIS

HERRING IN THE NORTHERN NORTH SEA (FISHING AREAS IVA + IVB)

FISHING MORTALITY COEFFICIENT		UNIT: Year <sup>-1</sup>		NATURAL MORTALITY COEFFICIENT = .10								
-----												
	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
2	.919	1.091	1.162	1.285	1.180	.214	.016	.066	.052	.134	.084	.177
3	.936	1.179	.855	1.248	.752	.839	.012	.009	.049	.114	.034	.175
4	.792	.733	.775	.894	.933	.182	.031	.035	.019	.152	.060	.194
5	.488	.846	1.159	.938	.516	.275	.007	.014	.030	.265	.071	.156
6	.492	1.244	.989	1.233	.200	.095	.010	.002	.006	.216	.073	.237
7	.090	.596	.613	1.439	1.325	.065	.005	.047	.025	.229	.091	.254
8	.791	1.123	.825	1.080	.500	.670	.010	.018	.027	.130	.050	.200
9+	.791	1.123	.825	1.080	.500	.670	.010	.018	.027	.130	.050	.200
( 2- 6)U	.725	1.018	.988	1.120	.716	.321	.015	.025	.031	.176	.064	.188
( 2- 6)W	.900	1.087	1.026	1.176	1.068	.512	.017	.034	.035	.158	.071	.179
	1984	1985										
2	.205	.300										
3	.238	.400										
4	.341	.400										
5	.377	.400										
6	.266	.400										
7	.423	.400										
8	.304	.400										
9+	.304	.400										
( 2- 6)U	.235	.380										
( 2- 6)W	.229	.356										

Table 2.7.13 VIRTUAL POPULATION ANALYSIS

HERMIES IN THE NORTHERN NORTH SEA (FISHING AREAS IVA + IVB)

STOCK SIZE IN NUMBERS UNIT: millions

BIOMASS TOTALS UNIT: tonnes

ALL VALUES, EXCEPT THOSE REFERRING TO THE SPAWNING STOCK ARE GIVEN FOR 1 JANUARY; THE SPAWNING STOCK DATA REFLECT THE STOCK SITUATION AT SPAWNING TIME, WHEREBY THE FOLLOWING VALUES ARE

USED: PROPORTION OF ANNUAL F BEFORE SPAWNING: .670

PROPORTION OF ANNUAL M BEFORE SPAWNING: .670

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
2	2265	2040	1134	596	1212	209	139	206	186	348	674	1900
3	540	818	620	321	149	337	133	124	174	160	276	727
4	231	191	228	239	33	64	132	136	111	150	129	241
5	76	95	35	95	38	30	48	116	119	99	117	110
6	13	42	37	24	34	46	20	43	103	105	68	98
7	2	7	11	12	6	25	39	18	39	93	76	58
8	2	2	4	5	3	1	21	35	16	34	67	63
9+	1	1	2	2	1	0	32	6	4	7	22	70
TOTAL NO	5131	5197	2119	1294	1577	713	584	684	752	996	1328	3267
SPS NO	1599	1234	916	511	639	459	317	595	657	780	1313	2423
TCT.BIOM	563366	587150	402943	256279	285836	146350	130951	150927	169567	220707	330257	632798
SPS BIOM	256489	239989	178622	104124	120891	95217	117348	132863	150358	174833	271788	476291
	1984	1985	1986									
2	4590	3677	0									
3	1441	5236	2465									
4	552	1028	1965									
5	160	555	623									
6	35	112	215									
7	70	59	66									
8	40	42	36									
9+	68	50	56									
TOTAL NO	8527	3558										
SPS NO	4823	5460										
TCT.BIOM	1272598	1669823										
SPS BIOM	977114	1084688										

Table 2.7.14 VIRTUAL POPULATION ANALYSIS

## NORTH SEA HERRING (FISHING AREA IV)

CATCH IN NUMBERS

UNIT: millions

108

	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958
0	0	0	0	0	0	0	150	219	164	96	279	97
1	0	3	0	0	462	722	1023	1451	2072	1697	1483	4279
2	494	247	478	535	660	1346	1322	1493	1931	1860	1644	1029
3	416	672	644	1039	959	576	1003	1111	1032	1221	736	999
4	638	323	396	617	1255	610	474	591	479	516	644	322
5	526	601	287	290	630	652	386	361	337	249	344	461
6	736	487	652	254	262	464	473	330	232	194	207	147
7	431	400	462	331	142	236	278	379	120	104	147	73
8	627	252	414	195	206	166	118	194	109	134	100	46
9+	684	665	623	402	239	388	275	317	106	138	153	72
TOTAL	4571	3655	3956	3661	4815	5160	5502	6445	6581	6228	5737	7526

	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
0	0	195	1269	142	443	497	157	375	645	839	112	898
1	1609	2393	336	2147	1262	2972	3209	1383	1674	2425	2503	1196
2	4934	1142	1889	270	2961	1548	2218	2570	1172	1795	1883	2003
3	488	1967	480	797	177	2243	1325	741	1365	1494	296	884
4	477	166	1456	335	158	148	2039	450	372	621	133	125
5	233	168	124	1082	31	149	145	890	298	157	191	50
6	249	113	153	127	230	95	132	45	393	145	50	61
7	120	126	61	145	22	256	118	65	68	163	43	8
8	32	129	56	86	42	26	413	96	82	14	27	12
9+	219	142	88	87	51	58	78	236	173	92	25	12
TOTAL	3431	6539	5917	5218	5427	7992	9854	6850	6241	7746	5264	5249

etc.

ctd. Table 2.7.14 VIRTUAL POPULATION ANALYSIS

NORTH SEA HERRING (FISHING AREA IV)

CATCH IN NUMBERS

UNIT: millions

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
0	684	750	289	996	264	238	257	130	542	792	7889	9557
1	4379	3341	2368	846	2401	127	144	169	159	161	447	340
2	1147	1441	1344	773	542	902	45	5	34	108	264	268
3	663	344	659	562	260	117	136	6	10	92	57	230
4	208	131	150	126	141	52	11	5	10	32	40	34
5	27	33	59	56	57	35	7	0	2	22	29	14
6	31	5	31	22	15	6	4	0	0	2	23	7
7	27	0	4	5	9	4	2	0	1	1	19	8
8	0	1	1	2	3	1	1	0	1	0	6	4
9+	12	0	1	1	1	0	0	0	0	0	1	1
TOTAL	7177	6046	4907	3189	3753	1412	656	315	759	1211	8773	10965

MEAN WEIGHT AT AGE OF THE STOCK

	1983	1984	1985	
0	10050	2190	1293	1947-85
1	1147	560	1620	0 15.000
2	545	970	1225	1 50.000
3	216	422	1188	2 155.000
4	105	193	568	3 187.000
5	26	78	124	4 223.000
6	23	22	44	5 239.000
7	13	24	20	6 276.000
8	11	11	15	7 290.000
9+	12	18	16	8 305.000
TOTAL	12128	4492	5908	9+ 312.000

Table 2.7.15 VERJUAL POPULATION ANALYSIS

## NORTH SEA HERDING (FISHING AREA IV)

	FISHING MORTALITY COEFFICIENT				UNIT: Year-1		VARIABLE NATURAL MORTALITY COEFFICIENT						110
	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	
0	.000	.000	.000	.000	.000	.000	.000	.010	.008	.007	.005	.006	
1	.000	.000	.000	.000	.063	.095	.118	.147	.268	.215	.331	.189	
2	.143	.250	.081	.134	.204	.364	.350	.351	.417	.598	.474	.590	
3	.165	.262	.159	.227	.332	.246	.448	.492	.387	.449	.444	.524	
4	.188	.170	.217	.202	.415	.325	.292	.459	.361	.302	.401	.315	
5	.222	.242	.197	.218	.291	.351	.312	.337	.457	.237	.301	.494	
6	.274	.293	.398	.240	.279	.322	.410	.424	.334	.461	.366	.181	
7	.338	.205	.441	.320	.134	.385	.289	.595	.239	.220	.672	.190	
8	.300	.300	.300	.300	.300	.300	.300	.300	.300	.300	.300	.400	
9+	.300	.300	.300	.300	.300	.300	.300	.300	.300	.300	.300	.400	
( 2- 6)U	.198	.203	.210	.204	.304	.321	.363	.413	.391	.419	.397	.421	
( 2- 9)U	.241	.223	.262	.243	.283	.324	.333	.407	.349	.365	.407	.387	
	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	
0	.000	.037	.027	.007	.020	.017	.010	.028	.034	.045	.011	.044	
1	.294	.329	.178	.124	.167	.390	.319	.243	.365	.378	.409	.338	
2	.494	.506	.701	.293	.347	.449	.877	.677	.478	1.467	.880	1.035	
3	.546	.331	.366	.642	.234	.430	.765	.732	.837	1.925	.945	1.306	
4	.476	.320	.387	.416	.221	.362	.772	.567	.909	1.071	.870	1.319	
5	.352	.258	.372	.491	.148	.297	.634	.824	.813	1.174	1.054	.865	
6	.481	.256	.365	.711	.161	.233	.492	.366	.979	1.118	1.526	1.079	
7	.197	.423	.193	.592	.227	.243	.442	.356	1.295	1.432	1.110	1.000	
8	.300	.300	.300	.400	.300	.400	.670	.690	.900	.900	.900	1.000	
9+	.300	.300	.300	.400	.300	.400	.670	.690	.900	.900	.900	1.000	
( 2- 6)U	.470	.334	.438	.510	.233	.334	.708	.633	.803	1.351	1.055	1.131	
( 2- 9)U	.393	.337	.373	.493	.249	.352	.665	.613	.889	1.249	1.023	1.082	

ctd.

otd. Table 2.7.15 VERTICAL POPULATION ANALYSIS

NORTH SEA HERRING (FISHING AREA 19)

	FISHING MORTALITY COEFFICIENT					VARIABLE NATURAL MORTALITY COEFFICIENT						
	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
0	.042	.071	.057	.070	.122	.128	.131	.060	.121	.121	.507	.547
1	.754	.699	.807	.554	.310	.305	.371	.259	.250	.100	.200	.199
2	.995	.909	1.155	1.140	1.302	1.455	.251	.025	.105	.337	.328	.244
3	1.256	.835	1.574	.992	1.549	1.217	1.385	.057	.050	.339	.266	.468
4	1.202	.797	.780	.952	1.295	1.715	.275	.094	.077	.247	.257	.222
5	1.056	.551	.745	1.120	1.787	1.274	1.158	.010	.047	.212	.321	.126
6	2.426	.489	1.259	1.054	1.256	.891	.416	.070	.007	.060	.319	.105
7	2.695	.079	.725	.612	1.820	1.415	.497	.028	.564	.058	.794	.154
8	.000	1.000	1.000	1.000	1.000	1.000	.800	.100	.100	.500	.500	.500
9+	.000	1.000	1.000	1.000	1.000	1.000	.800	.100	.100	.500	.500	.500
( 2- 6)J	1.533	.712	1.140	1.070	1.451	1.308	.688	.047	.059	.249	.298	.233
( 2- 9)J	1.204	.705	1.055	.995	1.584	1.244	.692	.058	.110	.258	.361	.240
	1983	1984	1985									
0	.599	.082	.145									
1	.156	.075	.170									
2	.265	.224	.310									
3	.283	.300	.410									
4	.359	.387	.410									
5	.240	.455	.410									
6	.267	.284	.410									
7	.262	.442	.410									
8	.500	.520	.410									
9+	.507	.320	.410									
( 2- 6)J	.235	.326	.390									
( 2- 9)J	.284	.339	.397									



Table 2.7.16 VIRTUAL POPULATION ANALYSIS

## NORTH SEA HERRING (FISHING AREA IV)

STOCK SIZE IN NUMBERS UNIT: millions

BIOMASS TOTALS UNIT: tonnes

ALL VALUES, EXCEPT THOSE REFERRING TO THE SPAWNING STOCK ARE GIVEN FOR 1 JANUARY; THE SPAWNING STOCK DATA REFLECT THE STOCK SITUATION AT SPAWNING TIME, WHEREBY THE FOLLOWING VALUES ARE USED: PROPORTION OF ANNUAL F BEFORE SPAWNING: .667  
PROPORTION OF ANNUAL H BEFORE SPAWNING: .667

	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958
J	33879	27148	22706	29786	31222	36013	41730	34528	34428	20500	97261	24599
1	11853	14310	9987	8553	10952	11486	13243	15283	12575	12570	7486	35618
2	3901	5326	6428	4488	3753	4624	4693	5290	5929	4321	4556	2417
3	2869	3061	4585	5361	3552	2769	2908	2992	3371	3535	2150	2565
4	3908	2201	2132	3537	3866	2305	1959	1681	1655	2072	2042	1248
5	2771	2950	1680	1553	2615	2309	1508	1323	961	1044	1386	1237
6	3302	2008	2081	1248	1130	1769	1471	998	855	551	709	928
7	1576	2270	1355	1265	839	774	1160	883	591	554	314	445
8	2534	1018	1674	789	852	669	476	736	441	421	402	145
9+	2767	2689	2521	1625	968	1570	1111	1282	427	758	620	230
TOTAL NO	74379	62262	55149	58605	59785	64288	70314	65046	61232	46326	116926	69431
SPS NO	17998	16187	16600	14948	12557	11632	10262	9749	9033	9286	8616	6402
TOT. BIOM	6872120	6095228	5648968	5193658	4883516	4829220	4602562	4532572	3973971	3661400	4334222	4083526
SPS BIOM	4380390	3801903	3743060	3301276	2912020	2643462	2298153	2147613	1864262	1945506	1782986	1368181

	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
0	32958	2556	74122	32245	36108	46240	25150	21705	30671	30009	16287	32887
1	3993	12124	2961	26533	11780	13026	16722	9161	7767	10938	10553	5927
2	15246	3010	3919	1114	10532	4478	3962	5462	3228	2423	5357	3151
3	1213	7313	1642	1760	752	6722	2586	1492	2512	1811	505	1260
4	1375	636	4752	1031	852	512	3957	1088	649	985	239	178
5	824	775	418	2920	615	608	323	1654	559	237	305	91
6	683	524	541	261	1618	480	409	155	656	224	66	96
7	700	332	367	339	116	1246	344	226	97	223	66	13
8	533	520	226	274	170	84	884	200	143	24	48	20
9+	884	574	354	276	206	183	168	495	304	161	44	20
TOTAL NO	61208	34213	89308	66752	62735	73580	54505	41638	46566	47095	31472	43642
SPS NO	13220	10108	1386	5591	11529	10238	7073	6394	4764	2149	2365	2110
TOT. BIOM	4502950	3439541	3772907	3583223	3355170	4143469	3809402	2873557	2445651	2172170	1579671	1617733
SPS BIOM	2472822	2044210	1757742	1195014	2086796	2021763	1473471	1242469	909367	425777	409271	360637

ctd.

ctd. Table 2.7.16 VIRTUAL POPULATION ANALYSIS

NORTH SEA HERRING (FISHING AREA IV)

STOCK SIZE IN NUMBERS UNIT: millions

BIO MASS TOTALS UNIT: tonnes

ALL VALUES, EXCEPT THOSE REFERRING TO THE SPAWNING STOCK ARE GIVEN FOR 1 JANUARY; THE SPAWNING STOCK DATA REFLECT THE STOCK SITUATION AT SPAWNING TIME, WHEREBY THE FOLLOWING VALUES ARE USED: PROPORTION OF ANNUAL F BEFORE SPAWNING: .667  
PROPORTION OF ANNUAL B BEFORE SPAWNING: .667

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
J	26164	17212	3255	18181	2275	2168	3266	3213	7466	10347	30124	50102
1	11667	9227	5398	2868	6113	486	661	1054	1109	2434	3534	6675
2	1897	2516	2062	1182	755	1222	227	205	365	396	939	1500
3	963	635	917	600	342	174	259	163	181	298	256	644
4	509	248	250	210	201	66	47	59	142	154	183	177
5	43	64	101	84	71	50	11	32	48	119	109	128
6	35	14	44	36	25	11	15	3	29	42	97	72
7	30	3	8	11	11	6	4	8	3	26	36	57
8	0	2	2	3	6	2	1	2	7	2	22	15
9+	0	1	1	2	2	1	0	3	1	0	4	4

TOTAL NO	41108	29942	17536	23173	9301	4385	4483	4747	9350	14318	35344	59175
SFS NO	1465	1598	1261	878	463	477	299	400	630	739	1142	1667
TOT. BIO	1547373	130475	1035265	793568	594936	329867	163763	188897	512291	484286	939409	1520154
SFS BIO	251631	274117	225064	133685	36662	30463	35959	74838	119700	146064	214097	308286

	1983	1984	1985	1986
J	43662	45913	48425	0
1	13024	11514	14889	17065
2	2458	5110	4210	5644
3	922	1707	3698	3192
4	365	629	1145	2220
5	129	231	586	687
6	102	91	135	232
7	58	71	62	81
8	44	41	41	37
9+	49	68	50	54

TOTAL NO	65213	55375	73641	
SFS NO	2363	5504	6439	
TOT. BIO	2271055	2621123	3339423	
SFS BIO	529866	967776	1196473	

**Table 2.8.1** 1985 North Sea HERRING - mean weight at age (year class) weighted by numbers caught.

Division	Quarter	0	1	2	3	4	5	6	7	8	9+
		(1984)	(1983)	(1982)	(1981)	(1980)	(1979)	(1978)	(1977)	(1976)	
IVa W	I	-	70	103	132	165	191	214	247	248	263
	II	-	75	125	168	207	228	224	273	274	322
	III	-	83	146	196	238	264	283	323	338	339
	IV	-	75	138	179	206	215	243	263	257	276
	Total	-	77	139	175	205	226	246	276	279	305
IVa E	I	-	-	87	124	148	163	169	185	221	216
	II	-	70	135	170	199	213	234	254	261	257
	III	11	87	117	163	191	222	233	284	290	-
	IV	17	82	128	156	175	196	199	224	235	261
	Total	14	84	130	163	189	199	223	232	247	248
IVb	I	-	12	75	117	141	159	165	184	198	238
	II	5	31	135	169	201	215	241	259	260	259
	III	9	63	134	190	215	227	228	260	285	297
	IV	14	80	124	155	174	191	201	222	236	242
	Total	9	34	123	177	202	216	223	250	267	291
IVc + VIId	I	-	32	78	103	120	145	147	159	270	193
	II	-	-	69	118	148	177	188	-	-	-
	III	-	-	85	154	177	187	196	-	191	-
	IV	-	84	114	139	171	188	179	223	198	-
	Total	-	82	113	124	148	170	168	212	207	193
IVa	Total	14	80	137	170	199	216	235	263	270	293
IVa + IVb	Total	9	36	133	171	200	216	233	261	270	293
North Sea	Total	9	36	128	164	194	211	220	252	270	292

**Table 2.8.2** Comparison between mean weights at age in catch of North Sea HERRING from earlier years<sup>1</sup> and 1985.

Age	IVa/IVb	IVa	IVb	IVa/IVb	Differences (g)		
	Pre-1985	1985	1985	1985	IVa	IVb	IVa/IVb
2	126	137	123	133	+11	- 3	+ 7
3	176	170	177	171	- 6	+ 1	- 5
4	211	199	202	200	-12	- 9	-11
5	243	216	216	216	-27	-27	-27
6	256	235	223	233	-21	-33	-23
7	267	263	250	261	- 4	-17	- 6
8	271	270	267	270	- 1	- 4	- 1
9+	271	293	291	293	+22	+20	+22

Age	IVc + VIId			Total North Sea		
	Pre-1985	1985	Difference (g)	Pre-1985	1985	Difference (g)
2	117	113	- 4	125	128	+ 3
3	141	124	-17	166	164	- 2
4	170	148	-22	204	194	-10
5	192	170	-22	228	211	-17
6	221	168	-53	253	220	-33
7	224	212	-12	266	258	- 8
8	216	207	- 9	271	270	- 1
9+	208	193	-15	270	292	+22

<sup>1</sup>Pre-1985 values taken from Table 2.16, Anon., (1985).

Table 2.9.1

List of input variables for the ICES prediction program.

## HERRING - DIVISIONS IVA AND IVB

The reference F is the mean F for the age group range from 2 to 5

The number of recruits per year is as follows:

Year	Recruitment
1986	5430.0
1987	5700.0
1988	2700.0

proportion of F (fishing mortality) effective before spawning: .6700  
 proportion of M (natural mortality) effective before spawning: .5700

Data are printed in the following units:

Number of fish: millions  
 Weight by age group in the catch: kilogram  
 Weight by age group in the stock: kilogram  
 Stock biomass: thousand tonnes  
 Catch weight: thousand tonnes

age	stock size	fishing pattern	natural mortality	maturity ogive	weight in the catch	weight in the stock
2	5430.0	.30	.10	.70	.133	.133
3	2465.0	.40	.10	1.00	.171	.171
4	1965.0	.40	.10	1.00	.200	.200
5	625.0	.40	.10	1.00	.216	.216
6	215.0	.40	.10	1.00	.233	.233
7	68.0	.40	.10	1.00	.261	.261
8	36.0	.40	.10	1.00	.270	.270
9+	56.0	.40	.10	1.00	.293	.293

Table 2.9.2

List of input variables for the ICES prediction program.

## HERRING IN DIVISIONS IVC AND VIIID

The reference F is the mean F for the age group range from 2 to 6

The number of recruits per year is as follows:

Year	Recruitment
----	-----
1986	600.0
1987	800.0
1988	700.0

Proportion of F (fishing mortality) effective before spawning: 1.0000

Proportion of M (natural mortality) effective before spawning: 1.0000

Data are printed in the following units:

Number of fish: millions  
 Weight by age group in the catch: kilogram  
 Weight by age group in the stock: kilogram  
 Stock biomass: thousand tonnes  
 Catch weight: thousand tonnes

age	stock size	fishing pattern	natural mortality	maturity ogive	weight in the catch	weight in the stock
2	600.0	.65	.10	1.00	.113	.126
3	570.2	1.00	.10	1.00	.124	.161
4	240.5	1.00	.10	1.00	.148	.171
5	48.6	1.20	.10	1.00	.170	.215
6	12.4	1.20	.10	1.00	.168	.231
7	5.2	1.20	.10	1.00	.212	.232
8	.8	1.20	.10	1.00	.207	.232
9+	.2	1.20	.10	1.00	.193	.232

Table 2.9.3 Effects of different levels of fishing mortality on catch, stock biomass and spawning stock biomass. HERRING in Divisions IVc and VIId.

Management option	Year 1986				Management option	Year 1987					Year 1988	
	$F_{(2-6)}$	SB 1 Jan	SSB 31 Dec	Catch		$F_{(2-6)}$	SB 1 Jan	SSB 31 Dec	Catch		SB 1 Jan	SSB 31 Dec
No further catch in 1986 after 1 Apr 1986	0.04	228	199	6	$F_{0.1}$	0.14	339	270	31		406	321
					$0.5F_{86}$	0.29		235	61		365	249
					$F_{86}$	0.58		182	106		303	160
					$F_{85}$	0.63		174	113		294	149
Catch in 1986 = TAC	0.58	228	124	70	$F_{0.1}$	0.14	250	201	22		328	261
					$0.5F_{86}$	0.29		176	44		298	206
					$F_{86}$	0.58		138	76		254	137
					$F_{85}$	0.63		132	82		247	128

The data unit of the biomass and the catch is 1,000 tonnes.

The spawning stock biomass (SSB) is given for the time of spawning (31 December).

The spawning stock biomass (SSB) for 1988 has been calculated with the same fishing mortality as for 1987.

The reference  $F$  is the mean  $F$  for the age group range from 2 to 6.

Both sets of  $0.5F_{86}$  and  $F_{86}$  options in 1987 assume the TAC option in 1986.

**Table 2.9.4** Input variables for catch prediction for the total North Sea.

Year	Recruitment (millions)		
	2-ring		1-ring
	Assumption 1	Assumption 2	Assumption 3
1986	6,030	6,030	17,832
1987	7,360	6,760	10,000
1988	4,127	3,791	10,000

Age	Stock size (millions) at 1 January 1986		
	Assumption 1	Assumption 2	Assumption 3
1	-	-	17,832
2	6,030	6,030	6,030
3	3,192	3,192	3,192
4	2,220	2,220	2,220
5	687	687	687
6	232	232	232
7	81	81	81
8	37	37	37
9+	54	54	41

**Table 2.9.5** Catch and stock projections for total North Sea based on alteration assumptions listed in Section 2.9.3. ('000 tonnes.)

1986					1987					1988	
$\bar{F}_{2-9(u)}$	SSB	Catch			Management option	$\bar{F}_{2-9(u)}$	SSB	Catch			SSB
		1-ri	>2-ri	I				1-ri	>2-ri	I	
<u>Assumption 1</u> $F_{(1-ri)} = 0.5 \times F_{(1-ri)}$ in 1985, for both 1986 and 1987 = 0.085											
0.36	1,292	36	534	570	$F_{0.1}$	0.13	1,873	20	269	289	2,320
					$F_{max}$	0.33	1,646	20	625	645	1,732
					$F_{87} = F_{85}$	0.40	1,579	20	727	747	1,578
<u>Assumption 2</u> $F_{(1-ri)} = F_{(1-ri)}$ in 1985 for both 1986 and 1987 = 0.17											
0.33	1,314	70	500	570	$F_{0.1}$	0.13	1,864	39	256	295	2,270
					$F_{max}$	0.29	1,679	39	547	568	1,788
					$F_{87} = F_{85}$	0.40	1,565	39	719	758	1,527
<u>Assumption 3</u> $F_{(1-ri)} = F_{(2-ri)}$ in both 1986 and 1987											
0.31	1,331	97	473	570	$F_{0.1}$	0.12	1,862	22	240	262	2,288
					$F_{max}$	0.25	1,713	44	472	516	1,867
					$F_{87} = F_{85}$	0.40	1,554	67	714	781	1,471



**Table 3.2.1** HERRING in Division IIIa. Landings in tonnes  
1976-85. (Data mainly provided by Working Group  
members.)

Country	1976	1977	1978	1979	1980
Skagerrak					
Denmark	7,326	19,889	6,425	5,153	5,180
Faroe Islands	1,553	10,064	1,041	817	526
Germany, Fed.Rep.	6	32	28	181	-
Iceland	123	-	-	-	-
Norway (Open sea)	-	-	1,860	2,460	1,350
Norway (Fjords)	2,304	1,837	2,271	2,259	2,795
Sweden	6,505	8,109	11,551	8,140	10,701
Total'	17,817	39,931	23,176	18,974	20,552
<u>Kattegat</u>					
Denmark	41,749	38,205	29,241	21,337	25,380
Sweden	30,263	37,160	35,193	25,272	18,260
Total	72,012	75,365	64,434	46,609	43,640
Division IIIa					
Total	89,829	115,296	87,610	65,583	64,192
Unallocated	-	-	-	8,117	20,053
Grand total	89,829	115,296	87,610	73,700	84,245
Country	1981	1982	1983	1984	1985 <sup>1</sup>
Denmark	18,001	22,881	54,102	36,776	88,192
Faroe Islands	990	715	1,980	891	455
Germany, Fed.Rep.	199	43	40	-	-
Iceland	-	-	-	-	-
Norway (Open sea)	6,330	10,140	500	-	2,752
Norway (Fjords)	950	1,560	2,834	1,494	1,673
Sweden	30,274	24,859	35,176	59,195	40,349
Total	56,744	60,198	94,632	98,356	133,421
<u>Kattegat</u>					
Denmark	18,721	12,366	62,901	71,359	69,235
Sweden	38,871	38,892	40,463	35,027	39,829
Total	57,592	51,258	103,364	106,386	109,064
Division IIIa					
Total	114,336	111,456	197,996	204,742	242,485
Unallocated	57,000	35,344	-	-	-
Grand Total	171,336	146,800	197,996	204,742	242,485

<sup>1</sup> Preliminary.

**Table 3.2.2** Catch in numbers (millions) at age, for that part of Division IIIa, catch that was sampled in 1985.

Winter rings	Quarter				Total
	I	II	III	IV	
0	-	630	296	319	1,245
1	760	170	153	125	1,208
2	228.0	144.7	159.6	98.4	630.7
3	108.2	48.4	133.6	57.7	347.9
4	22.9	18.5	49.5	16.8	107.7
5	2.6	3.3	11.0	3.6	20.5
6	1.3	1.5	3.5	0.7	7.0
7	0.1	0.5	0.1	0.1	0.8
8+	-	0.2	-	-	-
Total (>2)	363.1	217.1	357.3	177.3	1,114.8
Tonnes covered by sampling	37,879	23,526	56,094	33,394	150,893

Industrial landings in the Skagerrak and the northern Kattegat in the second half of 1985 are not included.

**Table 3.3.1** Estimated abundance of herring in Division IIIa from acoustic surveys during August/September 1979-85.

Winter rings	Numbers at age (millions)						
	1979	1980	1981	1982	1983	1984	1985
0	577	482	1,840	6,171	1,424	1,004	6,515
1	611	477	698	2,349	3,526	1,992	1,111
2	1,067	434	1,260	989	1,160	2,069	1,132
3	93	473	44	221	413	756	73
4	13	84	22	31	122	126	11
5	4	28	2	8	13	34	1
6	-	3	0.6	1	-	2	-
Total	2,365	1,981	3,867	9,770	6,658	5,983	8,843
Biomass ('000 tonnes)				340	325	551	222
Biomass adult				123	185	403	9

Table 3.3.2 Estimated abundance (numbers at age in millions) of herring in Sub-divisions 22-24 from acoustic surveys during August-September 1984-85.

Winter rings	1984	1985
0	231	843
1	3,602	4,368
2	1,221	1,132
3	826	188
4	406	58
5	99	23
6	62	4
7	49	2
8	11	2
9	1	3
10+	10	1
Total	6,518	6,624
Biomass ('000 tonnes)	377,300	228,700
Biomass adult	262,000	23,609

Table 3.3.3 Estimated abundance (numbers at age in millions) of herring in Division IIIa from acoustic surveys during November/December 1982, 1983 and 1985. No survey was carried out in 1984.

Winter rings	November 1982	December 1983	November 1985
0	2,530	5,089	9,303
1	1,060	1,393	918
2	380	22	12
3	40	-	-
4	5	-	-
Total	4,015	6,504	10,233
Biomass ('000 tonnes)	168	153	215

Table 3.4.1. Length components of 1-group HERRING in Division IIIa from 1980-86. Mean lengths (cm) and proportions of spring- and autumn-spawned components are shown.

Year	Strata	Length components					
		Spring spawners				Autumn spawners	
		l (cm)	Proportion	l (cm)	Proportion	l (cm)	Proportion
1980	1	14.0	0.73			17.0	0.27
	2	14.6	0.14			16.2	0.86
	3	15.1	0.09				
	4					16.2	0.45
1981	1	12.9	0.34			16.9	0.66
	2					15.6	0.47
	3					16.3	0.24
	4					17.4	0.81
1982	1	13.9	0.15	15.5	0.85		
	2			15.5	0.60		
	3					17.2	1.0
	4					17.4	0.80
1983	1	14.3	0.27			17.0	0.73
	2	14.4	0.11			17.5	0.89
	3	13.8	0.58			17.3	0.42
	4	14.0	0.65			17.5	0.35
1984	1	13.5	0.55			16.3	0.45
	2	13.3	0.50			16.4	0.50
	3	13.9	0.26			15.4	0.74
	4	14.2	0.57			16.4	0.43
1985	1	14.1	0.82			16.9	0.18
	2	14.7	0.32			16.2	0.66
	3	14.8	0.91			17.8	0.09
	4	14.8	0.06			15.3	0.94
1986	1	13.3	0.30			14.0	0.70
	2	13.1	0.25			14.0	0.50
	3	11.5	0.04			14.4	0.96
	4	11.8	0.08			14.4	0.92

**Table 4.2.1** Celtic Sea and Division VIIj HERRING landings (tonnes), 1975-84  
(Data provided by Working Group members).

Year	France	German Dem.Rep.	Germany Fed.Rep.	Ireland	Nether- lands	Poland	USSR	Un- allocated	Total
1976	1,919	147	28	5,986	1,627	324	826	-	10,857
1977	106	-	96	5,533	1,455	-	-	-	7,190
1978	8	-	220	6,249	1,002	-	-	850	15,519
1979	584	-	20	7,019	850	-	-	3,705	12,178
1980	9	-	2	8,849	393	-	-	-	9,253
1981	123	-	-	15,562	1,150	-	-	-	16,835
1982	+	-	-	9,501	-	-	-	-	9,501
1983	495	-	-	10,000	1,500	-	-	10,187	22,187
1984	680	-	-	7,000	890	-	-	11,148	19,718
1985 <sup>1</sup>	622	-	-	11,000	-	-	-	4,601	16,223

<sup>1</sup> Provisional.

**Table 4.2.2** Celtic Sea and Division VIIj HERRING landings (tonnes) by season  
(1 April to 31 March). (Data provided by Working Group members).

Year	France	German Dem.Rep.	Germany Fed.Rep.	Ireland	Nether- lands	Poland	USSR	Un- allocated	Total
1976/77	1,317	147	36	5,864	1,324	257	826	-	9,771
1977/78	95	-	96	6,264	1,378	-	-	-	7,833
1978/79	8	-	220	8,239	1,002	-	-	-	7,559
1979/80	584	-	20	7,932	850	-	-	935	10,321
1980/81	9	-	2	9,024	292	-	-	3,803	13,130
1981/82	123	-	-	15,830	1,150	-	-	-	17,103
1982/83	+	-	-	13,042	-	-	-	-	13,042
1983/84	495	-	-	10,000	1,500	-	-	9,186	21,181
1984/85	680	-	-	7,000	890	-	-	14,009	22,579
1985/86 <sup>1</sup>	622	-	-	11,000	-	-	-	4,509	16,131

<sup>1</sup> Provisional.

Table 4.2.3 VIRTUAL POPULATION ANALYSIS

HERKING SOUTH AND SOUTH WEST OF IRELAND (FISH AREAS VIIG-J) (Seasonal catches.)

CATCH IN NUMBERS	UNIT: thousands										
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
1	12768	13317	8159	2800	11335	7162	39361	15339	11484	16456	14168
2	13429	11113	12516	13585	13913	30093	21285	42725	87253	78324	45117
3	17783	7286	8610	11948	12399	11726	21861	8728	22895	34672	28672
4	7333	7011	5280	5583	8036	6585	5505	4817	2735	13527	12677
5	9006	2872	1585	1580	2839	2812	4438	1497	1579	2066	1824
6	3520	4785	1893	1470	1316	2264	3436	1891	277	915	180
7	1644	1930	1043	540	1233	1184	795	1670	315	317	67
8	1136	1243	383	858	551	1262	313	335	790	195	137
9+	1194	1769	470	482	635	565	866	596	261	152	105
TOTAL	69313	51376	39944	38052	32957	63593	97860	77598	127589	146624	102947
Tonnes	15588	9771	7833	7559	10321	13130	17103	13042	21181	22579	16131
SOP	114	99	104	98	103	109	103	95	93	99	102

Table 4.4.1 VIRTUAL POPULATION ANALYSIS

M = 0.1 - adults

HERRING SOUTH AND SOUTH WEST OF IRELAND (FISH AREAS VIIIG-J)

M = 0.8 - 1-winter-ringers

Seasonal.

FISHING MORTALITY COEFFICIENT					UNIT: Year-1	VARIABLE NATURAL MORTALITY COEFFICIENT						26
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	
1	.17	.15	.10	.04	.10	.11	.22	.04	.03	.03	.07	
2	.34	.35	.27	.35	.45	.63	.80	.55	.49	.53	.17	
3	.68	.47	.44	.40	.55	.76	1.22	.30	.58	.53	.17	
4	.63	.55	.65	.51	.51	.56	.90	.87	.55	.72	.17	
5	.65	.48	.21	.36	.47	.27	.82	.59	.71	.76	.17	
6	.67	.73	.59	.27	.51	.71	.54	.91	.18	1.07	.17	
7	.52	.71	.50	.50	.55	1.07	.55	.49	.52	.28	.17	
8	.48	.57	.58	.38	.49	.60	.82	.40	.40	.30	.17	
9+	.48	.57	.58	.38	.49	.60	.82	.40	.40	.30	.17	
( 2- 7)J	.58	.58	.41	.36	.47	.67	.80	.70	.47	.51	.17	
( 2- 7)A	.60	.48	.56	.38	.49	.62	.92	.61	.51	.56	.17	

Table 4.4.2 VIRTUAL POPULATION ANALYSIS

HERRING SOUTH AND SOUTH WEST OF IRELAND (FISH AREAS VIIIC-J)

STOCK SIZE IN NUMBERS UNIT: thousands

BIOMASS TOTALS UNIT: tonnes

ALL VALUES, EXCEPT THOSE REFERRING TO THE SPAWNING STOCK ARE GIVEN FOR 1 April. THE SPAWNING STOCK DATA REFLECT THE STOCK SITUATION AT SPAWNING TIME, WHEREBY THE FOLLOWING VALUES ARE

USED: PROPORTION OF ANNUAL F BEFORE SPAWNING: .200

PROPORTION OF ANNUAL F BEFORE SPAWNING: .500

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1	136384	141090	118483	92213	155740	110454	289923	546121	572627	697619	503052	0
2	33697	37569	34736	47949	39881	67123	40493	104939	255403	294774	502833	126964
3	37633	27409	25288	37699	30695	22907	32272	16535	54315	130375	192451	231176
4	16597	17239	11566	14797	22739	16038	9648	8620	6717	27652	85090	146913
5	23111	7900	8963	5472	8021	12443	6280	3534	3252	3489	12243	54956
6	7511	7679	4429	6606	3453	4522	3591	3500	1781	1450	1203	9346
7	5376	3468	4235	2211	4577	1879	2008	4521	1202	1349	450	922
8	3719	4211	1269	2243	1439	2923	384	1064	2510	739	920	343
9*	5278	5992	1557	1597	1715	1305	1615	1893	629	615	705	1240
TOTAL NO	257503	249558	230557	211297	273361	229600	393416	690529	978896	1158321	898951	
SPS NO	146678	157946	133103	155212	151536	141505	175130	383248	437546	640240	648047	
TOT. BIOM	40351	39383	35313	35119	42577	37542	54740	90196	133304	138565	127438	
SPS BIOM	23101	23276	24517	25085	26535	25600	27679	43928	74500	86755	98609	



Table 4.6.1

List of input variables for the ICES prediction program.

## CELTIC SEA AND DIVISION VIII HERRING

The reference  $F$  is the mean  $F$  for the age group range from 4 to 7

The number of recruits per year is as follows:

Year	Recruitment
1986	214000.0
1987	214000.0
1988	214000.0

Proportion of  $F$  (fishing mortality) effective before spawning: .2000Proportion of  $M$  (natural mortality) effective before spawning: .5000

Data are printed in the following units:

Number of fish: thousands  
 Weight by age group in the catch: kilogram  
 Weight by age group in the stock: kilogram  
 Stock biomass: tonnes  
 Catch weight: tonnes

age	stock size	fishing pattern	natural mortality	maturity ogive	weight in the catch	weight in the stock
1	214000.0	.40	.80	.50	.104	.104
2	125964.0	1.00	.10	1.00	.152	.152
3	231176.0	1.00	.10	1.00	.189	.189
4	146915.0	1.00	.10	1.00	.214	.214
5	64956.0	1.00	.10	1.00	.230	.230
6	9546.0	1.00	.10	1.00	.250	.250
7	922.0	1.00	.10	1.00	.254	.254
8	545.0	1.00	.10	1.00	.262	.262
7+	1240.0	1.00	.10	1.00	.264	.264

Table 4.7.1

Effects of different levels of fishing mortality on  
catch, stock biomass and spawning stock biomass.

CELTIC SEA AND DIVISION VIIJ HERRING

Year 1986					Year 1987					Year 1988		
fac-	ref.	stock	sp.stock		fac-	ref.	stock	sp.stock		stock	sp.stock	
tor	F	biomass	biomass	catch	tor	F	biomass	biomass	catch	biomass	biomass	
.2	.15	135	111	16	.2	.16	134	111	16	131	108	
					.2	.17		110	16	130	106	
					.1	.14		111	15	133	110	

The data unit of the biomass and the catch is 1000 tonnes.

The spawning stock biomass is given for the time of spawning.

The spawning stock biomass for 1988 has been calculated with the same fishing mortality as for 1987.

The reference F is the mean F for the age group range from 2 to 7

Table 5.1.1 Catch in weight, Division VIA (North) HERRING  
1976-85.

Country	1976	1977	1978	1979	1980
Denmark	249	626	128	-	-
Faroes	4,017	3,564	-	-	-
France	1,481	1,548	1,435	3	-
German Dem. Rep.	279	-	-	-	2
Germany, Fed. Rep.	4,084	-	26	-	-
Iceland	3,273	-	-	-	256
Netherlands	16,573	8,705	5,874	-	-
Norway	5,183	1,098	4,462	-	-
Poland	390	-	-	-	-
Sweden	2,206	261	-	-	-
UK (England)	20	301	134	54	-
UK (Scotland)	53,351	25,238	10,097	3	33
USSR	2,536	-	-	-	15
Unallocated	-	-	-	-	-
<b>Total</b>	<b>01 93,642</b>	<b>41,341</b>	<b>22,176</b>	<b>60</b>	<b>306</b>

Country	1981	1982	1983	1984	1985 <sup>1</sup>
Denmark	1,580	-	-	96	-
Faroes	-	74	834	954	169
France	1,243	2,069	1,313	-	510
German Dem. Rep.	-	-	-	-	-
Germany, Fed. Rep.	3,029	8,453	6,283	5,564	6,065
Iceland	-	-	-	-	-
Netherlands	5,602	11,317	20,200	7,729	5,500
Norway	3,850	13,018	7,336	6,669	5,126
Poland	-	-	-	-	-
Sweden	-	-	-	-	-
UK (England)	1,094	90	-	-	-
UK (Scotland)	30,389	38,381	31,616	37,554	28,065
USSR	-	-	-	-	-
Unallocated	4,633	18,958	-4,059	16,588	502
<b>Total</b>	<b>51,420</b>	<b>92,360</b>	<b>63,523</b>	<b>75,154</b>	<b>44,933</b>

<sup>1</sup> Preliminary.

Table 5.1.2 VIRTUAL POPULATION ANALYSIS

HERRING IN THE NORTHERN PART OF VIA

CATCH IN NUMBERS

UNIT: thousands

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	238738	169947	801665	51170	309016	172879	69055	34836	22525	592	12867	36740
2	205454	572615	804097	235627	124944	202087	319604	47739	46284	225	1335	77961
3	359711	560348	219502	808267	151025	89066	101548	95834	20587	122	452	105600
4	139718	557745	63069	151484	519178	63701	55502	22117	40692	31	246	61341
5	55320	113391	85920	65071	82466	188202	25195	10083	6879	21	62	21473
6	205462	54571	37341	54642	49683	30601	76289	12211	3833	12	43	12623
7	27141	181592	13377	18242	54629	12297	10918	20992	2100	7	40	11583
8	32860	18042	100938	6506	22470	13121	3914	2758	6278	2	3	1309
9+	30651	36395	20465	32223	21042	13698	12014	1486	1544	0	1	1326
TOTAL	1295055	1864646	2146572	1401232	1314453	785652	654037	248056	150722	812	15049	329956

	1982	1983	1984	1985
1	13304	81923	2961	46523
2	250010	77810	253291	79428
3	72179	92743	66857	169681
4	95544	29262	46965	19866
5	58452	42535	20057	17397
6	25580	27318	15250	7578
7	11516	14709	12478	7861
8	13814	8437	5940	3787
9+	4027	3484	2629	2494
TOTAL	540426	583221	426426	554615

Table 5.1.3 HERRING in Division VIa (North).  
Scottish bottom trawl survey indices of 2-ringed herring catch rates and acoustic survey indices of the same year class.

Trawl survey year	Year class	Number of GOV hauls	2-ringer index	Acoustic estimate no of 1-ringers (millions)
1981	1978	9	1,237	-
1982	1979	10	2,361	-
1983	1980	12	11	-
1984	1981	12	12,456	28.1
1985	1982	17	98	-
1986	1983	12	359	1,016.4

Table 5.1.4 HERRING in Division VIa.  
Mean weights at age (kg)

Age (Rings)	weight in the stock	1970-71	weight in the catch 1982-84	1985(obs.)	1985(fit.)
1	0.097	0.090	0.090	0.075	0.069
2	0.164	0.121	0.140	0.111	0.105
3	0.208	0.155	0.175	0.129	0.134
4	0.235	0.175	0.205	0.172	0.161
5	0.246	0.186	0.231	0.190	0.182
6	0.252	0.206	0.255	0.195	0.199
7	0.253	0.212	0.270	0.202	0.213
8	0.269	0.224	0.234	0.220	0.225
9	0.292	0.224	0.295	0.238	0.231

Table 5.1.5 HERRING in Division VIa (North).  
Larval indices (numbers  $\times 10^{10}$ ) and spawning stock biomass ('000 tonnes) age 2 and older.

year	Larval index	Spawning stock biomass from LPE	from VPA
1973	244	204	413
1974	117	205	220
1975	33	126	125
1976	19	58	101
1977	79	183	73
1978	35	117	74
1979	107	94	104
1980	144	168	169
1981	215	234	173
1982	189	162	172
1983	67	71	146
1984	213	167	264
1985	271	266	243 <sup>1</sup>

<sup>1</sup>Predicted from (1973-85) regression  
 $Y = 18.9018 + 0.9725 x$  ( $r = 0.704$ ).

Table 5.1.6 VIRTUAL POPULATION ANALYSIS

HERRING IN THE NORTHERN PART OF VIA

FISHING MORTALITY COEFFICIENT

UNIT: Year<sup>-1</sup>

NATURAL MORTALITY COEFFICIENT = .10

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
2	.210	.491	.344	.575	.561	.817	.809	.335	.298	.001	.004	.326
3	.434	1.195	.532	.606	.797	.893	1.201	.534	.210	.001	.002	.368
4	.441	.905	.540	.624	.892	.838	1.009	.823	.403	.000	.002	.354
5	.442	.684	.498	.592	.915	.861	.852	.793	.580	.000	.001	.247
6	.328	.984	.445	.603	1.205	.950	.944	1.265	.712	.002	.001	.216
7	.625	.483	.608	.359	.864	1.023	.980	.652	.665	.002	.006	.212
8	.408	.899	.480	.597	.879	.855	.985	.628	.363	.001	.001	.228
9+	.408	.899	.480	.597	.879	.855	.985	.628	.363	.001	.001	.228
(2- )U	.413	.790	.461	.560	.872	.897	.966	.734	.478	.001	.002	.287
(2- )W	.345	.775	.383	.596	.854	.855	.902	.534	.327	.001	.003	.324
	1982	1983	1984	1985								
2	.651	.326	.228	.210								
3	.501	.447	.455	.210								
4	.570	.345	.380	.210								
5	.591	.488	.374	.210								
6	.414	.559	.237	.210								
7	.278	.436	.447	.210								
8	.373	.300	.280	.210								
9+	.373	.300	.280	.210								
(2- )U	.497	.436	.362	.210								
(2- )W	.568	.407	.277	.210								

## VIRTUAL POPULATION ANALYSIS

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BIOMASS TOTALS UNIT: tonnes

USED: PROPORTION OF ANNUAL F BEFORE SPAWNING: .670

PROPORTION OF ANNUAL $m$ BEFORE SPAWNING:	.670
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	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
2	1139845	1005375	2377348	503734	304536	377992	601305	175853	188004	264157	398884	293602
3	1069158	836365	556649	1859247	267130	157276	151157	242210	113653	126268	238805	359656
4	410581	626619	229134	290663	917631	117146	58240	41154	128441	85478	114136	215650
5	156204	239165	229348	147531	143519	340255	45846	19218	16350	77656	75505	103040
6	761763	90827	109179	120164	73815	52057	130138	17695	7365	8234	70246	68260
7	65558	495340	33711	63414	62461	20071	16214	45819	4519	3493	7484	65520
8	102721	31735	277133	15155	40036	23323	6512	6183	21606	2103	3154	6734
9+	95815	64016	36188	74953	37539	24871	19988	3331	5314	0	1051	6822
TOTAL NO	3401624	3390425	4385692	5146265	1366036	1113412	1031449	551463	486010	565439	909266	1117286
SPS NO	2821514	1917830	3162303	1974066	1001662	567460	528439	363120	365552	528519	848904	842059
TOT.BIOM	870874	721351	827190	656567	415235	237649	199997	112452	98964	111694	181045	235947
SPS BIOM	594746	404968	592175	413227	220202	125024	101432	72602	74014	104403	169044	178317

	1982	1983	1984	1985	1986
2	558801	293274	1304198	439678	1028000
3	191735	269142	191581	939706	322627
4	225328	105142	155673	110019	689224
5	136975	115359	67393	96346	30693
6	72860	68633	64100	41968	70665
7	49734	43582	36242	45335	30731
8	46482	34122	25500	20973	31930
9+	13550	34312	11286	15812	25513
TOTAL NO	1295514	963567	1855974	1706236	
SPS NO	834324	690370	1444214	1386232	
TOT.BIOM	265366	204695	342247	348417	
SPS BIOM	172545	146091	264386	283072	

Table 5.1.8

List of input variables for the ICES prediction program.

HEERING - DIVISION VIA NORTH

The reference F is the mean F for the age group range from 2 to 7

The number of recruits per year is as follows:

Year	recruitment
1986	1023000.0
1987	320000.0
1988	320000.0

Proportion of F (fishing mortality) effective before spawning: .6700  
 Proportion of M (natural mortality) effective before spawning: .6700

Data are printed in the following units:

Number of fish: thousands  
 Weight by age group in the catch: kilogram  
 Weight by age group in the stock: kilogram  
 Stock biomass: tonnes  
 Catch weight: tonnes

age	stock size	fishing pattern	natural mortality	maturity ogive	weight in the catch	weight in the stock
2	1023000.0	1.00	.10	1.00	.163	.164
3	322527.0	1.00	.10	1.00	.154	.208
4	639224.0	1.00	.10	1.00	.161	.235
5	83693.0	1.00	.10	1.00	.182	.246
6	70065.0	1.00	.10	1.00	.199	.252
7	39781.0	1.00	.10	1.00	.213	.258
8	31230.0	1.00	.10	1.00	.223	.269
9+	25315.0	1.00	.10	1.00	.231	.292



**Table 5.2.1** Monthly landings (tonnes) of HERRING from the Firth of Clyde (all fishing methods combined). (Data provided by the Working Group).

Month	1975	1976	1977	1978	1979	1980	1981
January	- <sup>1</sup>	- <sup>1</sup>	- <sup>1</sup>	4 <sup>1</sup>	4 <sup>1</sup>	6 <sup>1</sup>	15 <sup>1</sup>
February	68 <sup>1</sup>	7 <sup>1</sup>	- <sup>1</sup>	6 <sup>1</sup>	8 <sup>1</sup>	3 <sup>1</sup>	15 <sup>1</sup>
March	85	69 <sup>1</sup>	- <sup>1</sup>	7 <sup>1</sup>	13 <sup>1</sup>	8 <sup>1</sup>	14 <sup>1</sup>
April	369	521	530	246	12 <sup>1</sup>	4 <sup>1</sup>	32 <sup>1</sup>
May	283	436	44	245	4 <sup>1</sup>	2 <sup>1</sup>	25 <sup>1</sup>
June	203	281	640	238	336	114	429
July	354	332	494	376	466	656	982
August	240	473	601	587	450	645	511
September	515	541	559	581	374	559	106
October	811	598	556	653	263	79	- <sup>1</sup>
November	571	595	560	647	1 <sup>1</sup>	3 <sup>1</sup>	2 <sup>1</sup>
December	120	236	328	272	- <sup>1</sup>	2 <sup>1</sup>	4 <sup>1</sup>
Not known	44	50	35	-	-	-	-
Total	3,663	4,139	4,847	3,862	1,951	2,081	2,135

Month	1982	1983	1984	1985
January	2 <sup>1</sup>	+ <sup>1</sup>	- <sup>1</sup>	- <sup>1</sup>
February	16 <sup>1</sup>	1 <sup>1</sup>	- <sup>1</sup>	- <sup>1</sup>
March	1 <sup>1</sup>	1 <sup>1</sup>	- <sup>1</sup>	- <sup>1</sup>
April	2 <sup>1</sup>	- <sup>1</sup>	- <sup>1</sup>	- <sup>1</sup>
May	615	1 <sup>1</sup>	554	527
June	850	265	847	831
July	757	519	944	815
August	262	681	276	661
September	- <sup>1</sup>	604	246	187
October	- <sup>1</sup>	457	124	1 <sup>1</sup>
November	- <sup>1</sup>	1 <sup>1</sup>	- <sup>1</sup>	- <sup>1</sup>
December	1 <sup>1</sup>	- <sup>1</sup>	- <sup>1</sup>	- <sup>1</sup>
Not known	-	273 <sup>2</sup>	247 <sup>2</sup>	-
Total	2,506	2,803	3,238	3,022

<sup>1</sup> Subject to closure of directed fishery for whole or part of the month.

<sup>2</sup> Landed in Northern Ireland and Isle of Man.

**Table 5.2.2** Monthly catches of Clyde herring in number at age ('000) in landings and discards, 1985.

Age (winter rings)	May		June		July	
	Landings	Discards	Landings	Discards	Landings	Discards
0	-	-	-	-	-	-
1	2	979	6	44	-	-
2	326	419	246	665	122	189
3	676	236	576	723	527	308
4	1,025	73	1,206	300	1,016	90
5	281	14	688	86	719	44
6	297	6	682	18	785	21
7	121	+	189	-	303	6
8	104	+	163	2	161	3
9	58	-	181	+	144	2
>10	70	-	56	+	55	1

Age (winter rings)	August		September		Total		
	Landings	Discards	Landings	Discards	Landings	Discards	Combined
0	-	-	-	-	-	-	-
1	-	23	-	21	8	1,067	1,075
2	45	728	86	127	825	2,128	2,953
3	411	507	337	117	2,527	1,891	4,418
4	479	74	319	9	4,045	546	4,591
5	835	32	101	6	2,624	182	2,806
6	754	6	85	-	2,603	51	2,654
7	246	+	52	-	911	6	917
8	205	+	42	+	675	5	680
9	61	-	9	+	453	2	455
>10	43	-	13	-	237	1	238

**Table 5.2.3** Number of days absent from port by pair-trawlers in the Firth of Clyde, 1974-85.

Year	Days absent
1974	2,982
1975	3,200
1976	3,026
1977	4,186
1978	4,377
1979	2,926
1980	2,170
1981	1,825
1982	1,881
1983	1,737
1984	1,401
1985	1,712

Table 5.2.4 VIRTUAL POPULATION ANALYSIS

CLYDE JERKINS

CATCH IN NUMBERS

UNIT: thousands

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	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
2	7551	6503	8983	5258	8841	1876	10480	7524	1796	4659	5633	2372
3	10333	1976	3181	4548	2817	2483	913	6976	2259	807	1592	2785
4	8745	4355	1684	1811	2559	1024	1049	1062	2724	930	567	1622
5	2306	3432	3007	918	1140	1072	526	1112	634	888	341	1158
6	741	1090	1114	1525	494	451	638	574	606	341	204	433
7	760	501	656	659	700	175	261	439	330	289	125	486
8	753	352	232	307	253	356	138	251	298	156	48	407
9	227	225	177	132	37	130	178	146	174	119	56	74
10+	117	131	132	114	59	67	100	192	236	154	68	18
TOTAL	31538	18615	19216	15272	16950	7634	14283	18326	9057	8543	8634	9355

	1982	1983	1984	1985
2	11311	10109	11829	2951
3	4079	5232	5774	4420
4	2440	1747	3406	4592
5	1028	963	1509	2806
6	603	555	587	2654
7	145	415	489	917
8	222	189	375	681
9	63	85	74	457
10+	53	38	80	240
TOTAL	20004	19333	24122	19716

Table 5.2.5 VIRTUAL POPULATION ANALYSIS

CLYDE HEKING

FISHING MORTALITY COEFFICIENT

UNIT: Year-1

NATURAL MORTALITY COEFFICIENT = .10

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
2	.695	.512	.531	.548	.772	.274	.515	.736	.138	.270	.258	.062
3	.585	.344	.449	.497	.566	.450	.186	.684	.449	.077	.119	.176
4	.813	.463	.489	.441	.512	.366	.309	.304	.552	.299	.064	.154
5	.609	.786	.595	.477	.487	.371	.289	.551	.267	.309	.152	.161
6	.433	.577	.560	.609	.453	.321	.350	.517	.564	.201	.097	.262
7	.593	.527	.730	.675	.554	.254	.277	.438	.563	.541	.095	.310
8	.763	.535	.565	.812	.526	.538	.291	.415	.462	.572	.142	.441
9	.500	.500	.500	.500	.500	.500	.500	.500	.500	.500	.300	.300
10+	.500	.500	.500	.500	.500	.500	.500	.500	.500	.500	.300	.300
(2-9)w	.666	.516	.528	.527	.633	.362	.424	.633	.551	.229	.174	.125
	1982	1983	1984	1985	1982-84							
2	.266	.196	.290	.300	.251							
3	.130	.169	.147	.150	.149							
4	.206	.068	.142	.150	.139							
5	.124	.105	.069	.150	.099							
6	.117	.082	.078	.150	.092							
7	.118	.090	.087	.150	.098							
8	.203	.198	.099	.150	.167							
9	.100	.100	.100	.150	.100							
10+	.100	.100	.100	.150	.100							
(2-9)w	.196	.149	.171	.165								

Table 5.2.6 VIRTUAL POPULATION ANALYSIS

CLYDE HERRING

STOCK SIZE IN NUMBERS UNIT: thousands

BIOMASS TOTALS UNIT: tonnes

ALL VALUES ARE GIVEN FOR 1 JANUARY

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
2	15747	16979	22824	15030	17156	8209	27251	15082	14598	21543	25939	41435
3	24411	7110	9206	12148	6813	7170	5648	14717	6536	11573	14883	18126
4	16406	12316	4560	5517	6685	3499	4136	4244	6721	3774	9642	11954
5	5286	6585	7010	2531	3095	3626	2195	2747	2833	3573	2533	8185
6	2189	2601	2716	3498	1421	1721	2265	1487	1433	1962	2328	1968
7	1777	1279	1322	1404	1722	818	1129	1445	802	724	1451	1912
8	1448	889	685	576	647	896	574	774	844	414	381	1194
9	604	598	471	551	231	346	473	388	463	481	226	299
10+	511	481	551	505	157	178	266	511	628	623	275	73
TOTAL NO	63178	48826	49143	39157	37927	26462	43917	41395	34858	44526	57658	85148
SPS NO	63178	43828	49143	39157	37927	26462	43917	41395	34858	44526	57658	85148
TOT. BIOM	18672	13322	12980	10590	10008	7257	11115	11010	9292	11552	15000	22059
SPS BIOM	18672	13322	12980	10590	10008	7257	11115	11010	9292	11552	15000	22059
	1982	1983	1984	1985	1986							
2	50853	59562	49206	11935	0							
3	35238	35265	44298	33303	8000							
4	15757	28010	26941	34599	25937							
5	9276	17132	23685	21142	26946							
6	6507	7417	8255	19997	16466							
7	1370	5077	6184	6909	15574							
8	1269	1102	4199	5131	5381							
9	695	938	818	3443	3796							
10+	535	419	380	1806	4090							
TOTAL NO	119531	147922	164463	138269								
SPS NO	119531	147922	164463	138269								
TOT. BIOM	22557	23725	33625	31873								
SPS BIOM	22557	23725	33625	31873								

Table 5.2.7      Weights at age (g) of Clyde HERRING by month in landings and discards, 1985.

Age (rings)	May		June		July	
	Landings	Discards	Landings	Discards	Landings	Discards
1	66	61	100	90	-	-
2	130	122	146	146	182	163
3	166	151	197	167	213	189
4	200	166	234	187	254	215
5	208	171	254	199	262	227
6	219	183	270	222	282	263
7	245	-	315	-	311	307
8	238	-	277	245	321	308
9	253	-	288	293	318	310
>10	262	-	310	293	283	280

Age (Rings)	August		September	
	Landings	Discards	Landings	Discards
1	-	128	-	119
2	177	159	199	160
3	220	185	216	181
4	248	208	255	215
5	270	206	263	204
6	285	226	306	-
7	325	245	313	-
8	306	258	300	272
9	340	-	272	272
>10	363	-	330	-

Age (Rings)	Whole Year (weighted means)			Values used for years prior to 1982
	Landings	Discards	Catch	
1	91	65	65	-
2	152	148	149	225
3	198	174	187	270
4	234	192	228	290
5	257	205	253	310
6	273	235	272	328
7	307	307	307	340
8	292	283	291	345
9	300	310	300	350
>10	300	280	300	350

**Table 5.2.8** Estimates of F allocated to landings and discards in Clyde HERRING, 1984-85.

Age (rings)	1984 F			1985 F			Mean proportion of F in landings and discards	
	Total	Landings	Discards	Total	Landings	Discards	Landings	Discards
2	0.290	0.112	0.178	0.300	0.084	0.216	0.33	0.67
3	0.147	0.117	0.030	0.150	0.086	0.064	0.58	0.32
4	0.142	0.132	0.010	0.150	0.132	0.018	0.90	0.10
5	0.069	0.067	0.002	0.150	0.140	0.010	0.95	0.05
6	0.078	0.078	-	0.150	0.147	0.003	0.99	0.01
7	0.087	0.087	-	0.150	0.149	0.001	0.997	0.003
8	0.099	0.098	0.001	0.150	0.149	0.001	0.99	0.01
9	0.100	0.100	-	0.150	0.149	0.001	0.997	0.003
>10	0.100	0.100	-	0.150	0.149	0.001	0.997	0.003

**Table 5.2.9** Input parameters for Clyde HERRING projections.

Age	Stock in no.		Catch in no. ('000) in 1986			Weight at age (g)		Spawn.stock at 1 Sep	Stock in no. ('000) at 1 Jan 1987
	('000) at 1 Jan 1986	F in 1986	Total	Landings	Discards	Landings	Discards		
2	19,350	0.25	4,082	1,347	2,735	152	148	176	19,350
3	8,000	0.125	895	609	286	198	174	207	13,636
4	25,937	0.125	2,903	2,613	290	234	192	254	6,388
5	26,946	0.125	3,016	2,865	151	257	205	260	20,711
6	16,466	0.125	1,843	1,825	18	273	235	306	21,517
7	15,574	0.125	1,743	1,726	17	307	307	313	13,148
8	5,381	0.125	602	596	6	292	283	300	12,436
9	3,996	0.125	447	447	-	300	310	272	4,297
>10	4,090	0.125	458	458	-	300	280	330	6,457
Tonnes			3,147	552					

Table 6.1.1 HERRING estimated catches in weight in Divisions VIa (south) and VIIf,c, 1975-84.

Country	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985 <sup>1</sup>
Belgium	12	-	-	-	-	-	-	-	-	-
France	47	-	-	-	-	-	353	19	-	-
German Dem.Rep.	890	-	-	-	-	-	-	-	-	-
Germany Fed.Rep.	924	221	100	5	-	2,687	265	-	-	-
Ireland	10,895	15,916	19,128	18,910	27,499	19,443	16,856	15,000	10,000	10,000
Netherlands	16,546	4,423	481	1,939	1,514	2,790	1,735	5,000	6,400	1,270
Poland	2,778	6	-	-	-	-	-	-	-	-
United Kingdom (N Ireland)	1	1	6	2	1	2	-	-	-	-
USSR	674	1	-	-	-	-	-	-	-	-
Unallocated	-	-	-	1,752	1,110	-	-	13,000	11,000	12,104
Total	32,767	20,567	19,715	22,608	30,124	24,922	19,209	33,019	27,400	23,374

<sup>1</sup>Provisional.



Table 6.1.2 VIRTUAL POPULATION ANALYSIS

HERRING IN FISHING AREAS VIIB,C AND LOWER VIA (W. COAST OF IRELAND, PORCUPINE BANK)

CATCH IN NUMBERS	UNIT: thousands											144
-----	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	155	883	1001	6423	3374	7360	16613	4485	10170	5919	2356	1620
2	35114	6177	23786	40390	29406	41308	29011	44312	40320	50071	40058	22265
3	26007	7038	20534	47589	41116	25117	37512	13396	27079	19161	64946	41794
4	13243	10856	5197	16863	44579	29192	26544	17176	13308	19939	25140	31460
5	3895	8826	11145	7432	17857	23718	23317	12209	10685	9349	22126	12312
6	40161	3936	10057	12383	8832	10703	15000	9924	5356	8422	7748	12746
7	2932	40555	4243	9191	10901	5909	3208	5534	4270	5443	6946	3461
8	1637	2286	47182	1569	10272	9378	3596	1360	3658	4423	4344	2735
9+	1911	2160	4305	50980	30349	32029	15703	4150	3324	4090	5334	5220
TOTAL	125135	22717	133444	193020	176836	184714	174304	112746	118150	126847	179498	134113
Tonnes	20306	15044	23474	36719	36589	38704	32767	20567	19715	22608	30124	24922
SOP	90	87	90	102	98	112	105	108	102	107	96	103
	1982	1983	1984	1985								
1	748	1517	2794	9606								
2	13133	43586	31481	15143								
3	17004	49534	28660	67355								
4	23220	25316	17854	12756								
5	13280	31782	7190	11241								
6	8121	18320	12636	7638								
7	4089	6695	5974	9185								
8	3249	3329	2608	7587								
9+	2375	4251	4020	2168								
TOTAL	100722	124432	162817	142679								
Tonnes	19209	32988	27450	23343								
SOP	103	100	97	98								

Table 6.2.3 Larval production estimates (LPE) from the HERRING Larval Survey Working Group (Anon., 1986b) and larval abundance indices (LAI) from Saville and Rankine (1985) for Divisions VIa and VIIb,c.

Year	VIa(S)		VIa (S) + VIIb,c	
	LPE	LAI	LPE	LAI
1972	8	-	-	-
1973	128	391	-	-
1974	125	355	-	-
1975	23	175	-	-
1976	27	32	-	-
1977	31	69	-	-
1978	16	136	-	-
1979	115	448	-	-
1980	45	151	-	-
1981	54	100	114	58
1982	64	86	101	76
1983	50	112	94	68
1984	23	72	40	36
1985	32	40	70	26

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Table 6.3.2 VIRTUAL POPULATION ANALYSIS

HERKINS IN FISHING AREAS VIID,C AND LOWER VIA (N. COAST OF IRELAND, PORCUPINE BANK)

STOCK SIZE IN NUMBERS UNIT: thousands

BIOMASS TOTALS UNIT: tonnes

ALL VALUES, EXCEPT THOSE REFERRING TO THE SPAWNING STOCK ARE GIVEN FOR 1 JANUARY; THE SPAWNING STOCK DATA REFLECT THE STOCK SITUATION AT SPAWNING TIME, WHEREBY THE FOLLOWING VALUES ARE USED: PROPORTION OF ANNUAL F BEFORE SPAWNING: .670  
PROPORTION OF ANNUAL M BEFORE SPAWNING: .670

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	253552	530945	503678	562012	531504	287868	427051	350753	630575	541950	275203	330238
2	109173	113750	237995	225004	158477	107150	124555	181033	154080	276737	239654	121794
3	147927	55533	97055	182005	105851	115486	115255	85181	121632	101724	202249	178820
4	103692	109165	52011	68555	125109	111072	80005	67477	64557	34556	73858	122002
5	26249	85771	88452	41724	45858	71054	72220	47839	44705	45634	57396	43013
6	309757	13245	09225	09460	50099	24570	41802	41908	51703	50571	52595	30985
7	12795	242104	12771	55082	51096	19352	12106	23617	28506	23606	19495	21961
8	0330	3749	183568	7535	59511	55890	11915	8026	16120	21739	16196	11061
9+	7313	8260	16475	175103	116913	122577	52052	14589	14729	20103	19887	21111
TOTAL NO	979645	1132526	1258838	1210925	1114653	956984	936801	322274	1107073	1146170	936931	880986
SPS NO	525885	554081	615841	665199	551575	502921	366544	366532	371485	482437	495993	423659
TOT. BIOD	254072	225242	236214	241957	217075	190938	167870	144259	179938	192154	175421	161870
SPS BIOD	145077	134355	142204	155219	123636	117067	85251	79429	81647	101138	104119	95533

	1932	1985	1984	1985	1936
1	276803	718574	111114	554970	0
2	147323	123381	321886	48107	153244
3	89071	116084	74775	213978	29179
4	122157	64457	53168	40524	129734
5	83557	83762	34557	55711	24579
6	26775	55549	45098	24265	21660
7	15974	16550	52905	29180	14717
8	16535	10576	8620	24103	17098
9+	14676	15505	17257	6287	18797
TOTAL NO	799926	1207417	704780	777726	
SPS NO	411526	327564	444218	502413	
TOT. BIOD	143777	196200	155491	124254	
SPS BIOD	91359	73694	91465	63477	

Table 6.6.1

List of input variables for the ICES prediction program.

JERKINS IN DIVISIONS VIA (SOUTH) AND VIIR

The reference F is the mean F for the age group range from 4 to 7

The number of recruits per year is as follows:

Year	Recruitment
1986	366000.0
1987	366000.0
1988	366000.0

Proportion of F (fishing mortality) effective before spawning: .6/0.0

Proportion of M (natural mortality) effective before spawning: .6/0.0

Data are printed in the following units:

Number of fish: thousands  
 Weight by age group in the catch: kilogram  
 Weight by age group in the stock: kilogram  
 Stock biomass: tonnes  
 Catch weight: tonnes

Age	Stock size	Fishing pattern	Natural mortality	Maturity ogive	Weight in the catch	Weight in the stock
1	355000.0	.10	.30	.00	.108	.129
2	152444.0	1.00	.10	1.00	.150	.169
3	29179.0	1.00	.10	1.00	.166	.210
4	12784.0	1.00	.10	1.00	.193	.236
5	24579.0	1.00	.10	1.00	.210	.261
6	21360.0	1.00	.10	1.00	.222	.273
7	14717.0	1.00	.10	1.00	.232	.283
8	17098.0	1.00	.10	1.00	.238	.290
9+	18797.0	1.00	.10	1.00	.242	.296

Table 6.6.2a

Effects of different levels of fishing mortality on catch, stock biomass and spawning stock biomass.

HERRING IN DIVISIONS VIA (SOUTH) AND VIIB

Year 1986					Year 1987					Year 1988	
fac-	ref.	stock	sp.stock		fac-	ref.	stock	sp.stock		stock	sp.stock
tor	F	biomass	biomass	catch	tor	F	biomass	biomass	catch	biomass	biomass
.3	.27	134	70	17	.2	.15	140	82	11	155	94
					.4	.40		69	25	136	66

The data unit of the biomass and the catch is 1000 tonnes.

The spawning stock biomass is given for the time of spawning.

The spawning stock biomass for 1988 has been calculated with the same fishing mortality as for 1987.

The reference F is the mean F for the age group range from 2 to 7

Table 6.6.2b

Effects of different levels of fishing mortality on catch, stock biomass and spawning stock biomass.

HERRING IN DIVISIONS VIA (SOUTH) AND VIIB

Year 1986					Year 1987					Year 1988	
fac-	ref.	stock	sp.stock		fac-	ref.	stock	sp.stock		stock	sp.stock
tor	F	biomass	biomass	catch	tor	F	biomass	biomass	catch	biomass	biomass
.4	.37	134	65	23	.2	.15	133	75	10	147	89
					.4	.40		63	23	131	62

The data unit of the biomass and the catch is 1000 tonnes.

The spawning stock biomass is given for the time of spawning.

The spawning stock biomass for 1988 has been calculated with the same fishing mortality as for 1987.

The reference F is the mean F for the age group range from 2 to 7

Table 7.1.1 HERRING. Total catches (tonnes) in North Irish Sea (Division VIIa), 1976-85.

Country	1976	1977	1978	1979	1980	1981
France	651	85	174	455 <sup>2</sup>	1	-
Ireland	3,205	3,331	2,371	1,805	1,340	283
Netherlands	989	500	98	-	-	-
UK	16,401	11,498	8,432 <sup>1</sup>	10,078 <sup>3</sup>	9,272	4,094
Other	-	-	-	-	-	-
Total	21,246	15,414	11,075	12,338	10,613	4,377

Country	1982	1983	1984	1985 <sup>5</sup>
France	-	48 <sup>2</sup>	-	-
Ireland	300	860	1,084	1,000
Netherlands	-	-	-	-
UK	3,375	3,025	2,982	4,077
Other	1,180 <sup>4</sup>	-	-	4,110 <sup>4</sup>
Total	4,855	3,933	4,066	9,187

<sup>1</sup> Includes 68.5 tonnes of spring-spawned herring.

<sup>2</sup> No data basis for allocation to stock.

<sup>3</sup> Additional unrecorded catch of 106 tonnes estimated.

<sup>4</sup> Unallocated.

<sup>5</sup> Preliminary.

Table 7.1.2 VERTICAL POPULATION ANALYSIS

FERRING IN THE NORTHERN IRISH SEA (GARY PLUS JOURNAL REELING)

CATCH IN HUNDREDS

UNIT: thousands

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
1	50350	54740	50283	15540	11770	5340	5150	5100	1505	1168	2429
2	40240	55150	57040	30950	30270	23760	15790	16050	12102	8424	10050
3	37410	23780	22090	15410	25470	19510	5200	5670	5598	7257	17336
4	10840	15220	5750	6780	4250	520	2790	2150	2620	3841	15287
5	7870	4530	4520	7740	2200	1780	2500	550	445	2221	7206
6	4210	2810	1460	1540	1050	970	530	1110	484	580	2651
7	2070	2420	970	670	400	500	290	140	255	229	867
8+	1540	1270	1120	550	270	230	240	380	59	479	724
TOTAL	147050	157750	156770	76730	51720	53110	29990	30910	25125	25979	54350



Table 7.1.3 North Irish Sea HERRING Division VIIa.  
Basic data on discards by Northern Irish and Manx  
vessels. No discards by Republic of Ireland.

Percentage of <u>total</u> catch by number discarded					
Month	%	Percentage age distribution of discards			
		1	2	3	4+
June	64.5	67	26	7	-
July	34.8	67	26	7	-
August	50.0	67	26	7	-

Month	Landed catch (no x 10 <sup>3</sup> )	% of total catch	Total catch
June	2,220	35.5	6,254
July	5,948	65.2	9,123
August	9,955	50.0	19,910

Month	No. of discards (10 <sup>3</sup> ) at age			Total
	1	2	3	
June	2,702	1,049	282	4,034
July	2,127	826	222	3,175
August	6,670	2,588	697	9,955
Total	11,499	4,463	1,101	17,164
Mean wt (kg)	0.087	0.125	0.157	
Total wt (tonnes)	1,000	558	173	1,731

Table 7.5.1 Trial VPA's on HERRING in North Irish Sea (Division VIIa).

Year		1978	1979	1980	1981	1982	1983	1984	1985
Declared catch (tonnes)		11,075	12,338	10,613	4,377	4,855	3,933	4,066	9,187
Input $F_{1985}$		Estimated fishing mortality from VPA at various input $F_{1985}$							
Age 1	Age 2+								
0.05	0.6	0.71	0.86	1.17	0.46	0.29	0.15	0.12	0.3
0.08	0.5	0.71	0.86	1.21	0.52	0.36	0.21	0.18	0.5
0.10	0.67	0.71	0.86	1.23	0.55	0.41	0.25	0.21	0.67
$F_1$	$F_{2+}$	Estimated SSB ('000 tonnes) at spawning time							
0.05	0.3	10.1	9.1	5.3	7.5	13.2	22.1	30.2	24.9
0.08	0.5	10.1	9.1	5.1	6.5	10.2	15.8	20.4	13.7
0.10	0.67	10.1	9.1	5.0	6.1	9.1	13.4	16.7	9.5
$F_1$	$F_{2+}$	Total biomass ('000 tonnes) at 1 January							
0.05	0.3	35.2	30.0	24.2	24.2	33.9	43.0	44.9	41.8
0.08	0.5	35.2	29.8	23.1	20.9	26.9	31.5	31.4	27.4
0.10	0.67	35.2	29.7	22.6	19.6	24.3	27.2	26.4	22.0
$F_1$	$F_{2+}$	Recruit 1-ring-fish (No. in millions)							
0.05	0.3	178	104	110	158	201	194	92	72
0.08	0.5	178	100	98	128	151	135	61	46
0.10	0.67	178	99	94	116	132	113	50	37

 $M_1 = 0.8$  $M_{2+} = 0.1$

Table 7.5.2      LIFETIME POPULATION ANALYSIS

MORPHING IN THE NORTHERN IZIS SEA (CHAY PLUS HOUSE REFRIG)

FISHING MORTALITY COEFFICIENT	UNIT: YEAR <sup>-1</sup>					VARIABLE NATURAL MORTALITY COEFFICIENT					
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
1	.176	.226	.206	.154	.175	.079	.047	.036	.010	.019	.050
2	.351	.394	.367	.214	.346	1.167	.447	.236	.159	.198	.300
3	.543	1.017	1.034	.565	.901	1.370	.365	.254	.157	.120	.300
4	.315	1.102	1.005	.915	.342	.365	.629	.375	.173	.118	.300
5	.961	.786	1.078	.682	.757	1.137	.552	.122	.118	.130	.300
6	.677	1.014	.699	1.010	1.037	.749	.497	.499	.236	.126	.300
7	.267	.750	.898	.720	.660	1.220	.500	.360	.180	.150	.300
3+	.330	.750	.990	.720	.360	1.220	.500	.360	.180	.150	.300
( 2- 700	.855	.977	.962	.817	.875	1.028	.498	.319	.167	.154	.300
( 2- 700	.868	.951	.990	.715	.366	1.171	.460	.287	.155	.119	.300

Table 7.5.3 VIRTUAL POPULATION ANALYSIS

HERRING IN THE NORTHERN IRISH SEA (MAX PLUS BOUENE HERRING)

STOCK SIZE IN NUMBERS UNIT: thousands

BIOMASS TOTALS UNIT: tonnes

ALL VALUES, EXCEPT THOSE REFERRING TO THE SPawning STOCK ARE GIVEN FOR 1 JANUARY; THE SPawning STOCK DATA REFLECT THE STOCK SITUATION AT SPawning TIME, WHEREBY THE FOLLOWING VALUES ARE USED: PROPORTION OF ANNUAL F BEFORE SPawning: .900

PROPORTION OF ANNUAL G BEFORE SPawning: .750

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1	260446	175657	231640	178117	135368	110495	157678	201554	194027	92155	72117	0
2	87827	97142	65607	34225	67773	38942	48356	67563	86794	86530	40645	30824
3	67327	55921	56698	22590	41255	27182	10775	26535	45928	66986	70112	27245
4	28290	25757	11093	11012	7770	15159	6249	5877	13650	36241	53737	46998
5	13235	3129	7155	5676	4290	5056	5674	5015	4203	14179	29143	36021
6	5947	4597	5652	2796	1631	1803	832	2957	2415	5530	10722	19535
7	3726	4115	1509	1564	724	531	771	485	1524	1725	2698	7187
8+	2924	2159	1553	712	525	340	658	1517	576	5609	2928	5771
TOTAL NO	472762	371458	557638	504673	229811	197488	226723	307323	353996	304604	282102	
SFS NO	25552	67751	52777	52449	55133	51171	46602	79242	127118	170065	147425	
TOTAL BIOD	56155	46360	40170	35182	56011	24221	24198	55931	42952	44853	41840	
SFS BIOD	15928	12029	8612	10110	9390	5345	7487	15167	22385	30230	24912	

Table 7.5.4

List of input variables for the ICES prediction program.

## HERRING - NORTH IRISH SEA

The reference F is the mean F for the age group range from 2 to 7

The number of recruits per year is as follows:

Year	Recruitment
1986	67739.0
1987	67739.0
1988	67739.0

Proportion of F (fishing mortality) effective before spawning: .9000

Proportion of M (natural mortality) effective before spawning: .7507

Data are printed in the following units:

Number of fish: thousands  
 Weight by age group in the catch: kilogram  
 Weight by age group in the stock: kilogram  
 Stock biomass: tonnes  
 Catch weight: tonnes

age	stock size	fishing pattern	natural mortality	maturity ogive	weight in the catch	weight in the stock
1	67739.0	.15	.80	.03	.077	.077
2	53324.0	1.00	.10	.83	.146	.146
3	27245.0	1.00	.10	1.00	.186	.186
4	46998.0	1.00	.10	1.00	.211	.211
5	36021.0	1.00	.10	1.00	.224	.224
6	19535.0	1.00	.10	1.00	.241	.241
7	7137.0	1.00	.10	1.00	.247	.247
8+	5771.0	1.00	.10	1.00	.273	.273

Table 7.5.5

Effects of different levels of fishing mortality on  
catch, stock biomass and spawning stock biomass.

HERRING - NORTH IRISH SEA

(Assuming the 1986 catch equals the TAC.)

Year 1986					Year 1987					Year 1988	
fac-	ref.	stock	sp.stock		fac-	ref.	stock	sp.stock		stock	sp.stock
tor	F	biomass	biomass	catch	tor	F	biomass	biomass	catch	biomass	biomass
.2	.20	40232	26757	6360	.2	.15	37915	26205	4420	37466	25838
					.3	.30		22920	3244	33483	19788
					.2	.20		25061	5756	36073	23633

The data unit of the biomass and the catch is tonnes.

The spawning stock biomass is given for the time of spawning.

The spawning stock biomass for 1988 has been calculated with the same fishing mortality as for 1987.

The reference F is the mean F for the age group range from 2 to 7

The F options in 1987 are  $F_{0.1}$ ,  $F_{85}$ , and  $F_{86}$ , respectively.

Table 7.5.6

Effects of different levels of fishing mortality on  
catch, stock biomass and spawning stock biomass.

HERRING - NORTH IRISH SEA

(Assuming the 1986 catch equals the 1985 catch.)

Year 1986					Year 1987					Year 1988	
fac-	ref.	stock	sp.stock		fac-	ref.	stock	sp.stock		stock	sp.stock
tor	F	biomass	biomass	catch	tor	F	biomass	biomass	catch	biomass	biomass
.3	.31	40222	24428	9000	.2	.15	35093	23950	4046	35111	23929
					.3	.30		20932	7547	31456	18352
					.3	.31		20746	7763	31231	18032

The data unit of the biomass and the catch is tonnes.

The spawning stock biomass is given for the time of spawning.

The spawning stock biomass for 1988 has been calculated with the same fishing mortality as for 1987.

The reference F is the mean F for the age group range from 2 to 7

The F options in 1987 are  $F_{0.1}$ ,  $F_{85}$ , and  $F_{86}$ , respectively.

Table 8.1.1 Catch in numbers, millions and catch in weights, tonnes.  
Icelandic summer-spawning herrings.

AGE	1969	1970	1971	1972	1973	1974	1975
1	4.520	2.003	8.774	0.147	0.001	0.001	1.518
2	78.410	22.344	13.071	0.322	0.159	3.760	2.049
3	8.274	33.965	5.439	0.131	0.678	0.832	31.975
4	5.178	4.500	13.688	0.163	0.104	0.993	6.493
5	10.015	2.734	3.040	0.264	0.017	0.092	7.905
6	2.841	4.419	1.563	0.047	0.013	0.046	0.863
7	1.389	1.145	3.276	0.028	0.006	0.002	0.442
8	1.179	0.531	0.748	0.024	0.006	0.001	0.345
9	0.609	0.604	0.250	0.013	0.003	0.001	0.114
10	0.424	0.195	0.103	0.009	0.003	0.001	0.004
11	0.286	0.103	0.120	0.003	0.001	0.001	0.001
12	0.139	0.076	0.001	0.001	0.001	0.001	0.001
13	0.109	0.061	0.001	0.003	0.001	0.001	0.001
14	0.074	0.051	0.001	0.001	0.001	0.001	0.001
JUVENILE	78.943	23.167	16.899	0.376	0.065	3.285	3.973
ADULT	34.504	49.564	33.176	0.780	0.929	2.448	47.739
TOTAL CATCH	20.913	15.779	10.975	0.310	0.255	1.274	13.280

AGE	1976	1977	1978	1979	1980	1981	1982
1	0.614	0.705	2.634	0.929	3.147	2.283	0.454
2	9.848	18.853	22.551	15.098	14.347	4.629	19.187
3	3.908	24.152	50.995	47.561	20.761	16.771	28.109
4	34.144	10.404	13.846	69.735	60.728	12.126	38.280
5	7.009	46.357	8.738	16.451	65.329	36.871	16.623
6	5.481	6.735	39.492	8.003	11.541	41.917	38.308
7	1.045	5.421	7.253	26.040	9.285	7.299	43.770
8	0.438	1.395	6.354	3.050	19.442	4.863	6.813
9	0.296	0.524	1.616	1.869	1.796	13.416	6.633
10	0.134	0.362	0.926	0.494	1.464	1.032	10.457
11	0.092	0.027	0.400	0.439	0.698	0.884	2.354
12	0.001	0.128	0.017	0.032	0.001	0.760	0.594
13	0.001	0.001	0.025	0.054	0.110	0.101	0.075
14	0.001	0.001	0.051	0.006	0.079	0.062	0.211
JUVENILE	9.573	22.321	35.502	33.011	18.438	12.764	22.889
ADULT	53.439	92.744	119.396	156.750	190.290	130.250	188.979
TOTAL CATCH	17.168	28.924	37.333	45.072	53.269	39.544	56.528

AGE	1983	1984	1985
1	1.470	0.421	0.111
2	22.422	18.011	12.800
3	151.198	32.237	24.521
4	30.181	141.324	21.535
5	21.525	17.039	84.733
6	8.637	7.111	11.836
7	14.017	3.915	5.708
8	13.666	4.112	2.323
9	3.715	4.516	4.339
10	2.373	1.828	4.030
11	3.424	0.202	2.758
12	0.552	0.255	0.970
13	0.100	0.260	0.477
14	0.003	0.003	0.578
JUVENILE	78.323	24.055	15.363
ADULT	194.960	207.179	161.356
TOTAL CATCH	58.665	50.292	49.092

Table 8.1.2 Weight at age, in grams, Icelandic summer spawners.

AGE	1969	1970	1971	1972	1973	1974	1975
1	82.0	85.0	88.0	96.0	90.0	80.0	110.0
2	157.0	169.0	165.0	177.0	199.0	189.0	179.0
3	195.0	216.0	237.0	278.0	257.0	262.0	241.0
4	264.0	263.0	273.0	332.0	278.0	297.0	291.0
5	284.0	312.0	301.0	358.0	337.0	340.0	319.0
6	304.0	329.0	324.0	379.0	381.0	332.0	339.0
7	339.0	338.0	346.0	410.0	380.0	379.0	365.0
8	372.0	357.0	368.0	419.0	397.0	356.0	364.0
9	379.0	378.0	390.0	470.0	385.0	407.0	407.0
10	390.0	396.0	409.0	500.0	450.0	410.0	389.0
11	376.0	408.0	412.0	500.0	450.0	410.0	430.0
12	401.0	425.0	420.0	500.0	450.0	423.0	416.0
13	409.0	430.0	442.0	500.0	450.0	423.0	416.0
14	414.0	450.0	450.0	500.0	450.0	423.0	416.0

AGE	1976	1977	1978	1979	1980	1981	1982
1	103.0	84.0	73.0	75.3	68.9	60.8	65.0
2	189.0	157.0	128.0	145.3	115.3	140.9	141.0
3	243.0	217.0	196.0	182.4	202.0	190.5	186.1
4	281.0	261.0	247.0	230.9	232.5	245.5	217.3
5	305.0	285.0	295.0	284.7	268.9	268.6	273.7
6	335.0	313.0	314.0	315.7	316.7	297.6	293.3
7	351.0	326.0	339.0	333.7	351.6	329.8	323.0
8	355.0	347.0	359.0	350.4	360.4	355.7	353.8
9	395.0	364.0	360.0	366.7	379.9	368.3	384.6
10	363.0	362.0	376.0	368.3	382.9	405.4	388.7
11	396.0	358.0	380.0	370.6	392.7	381.5	400.4
12	396.0	355.0	425.0	350.0	390.0	400.0	393.5
13	396.0	400.0	425.0	350.0	390.0	400.0	390.3
14	396.0	420.0	425.0	450.0	390.0	400.0	419.5

AGE	1983	1984	1985
1	59.3	49.3	53.2
2	131.7	131.4	146.0
3	179.7	188.6	219.0
4	218.1	216.8	265.8
5	259.9	244.9	285.3
6	308.6	276.9	314.6
7	328.7	314.6	334.6
8	356.5	321.7	365.0
9	370.2	350.7	388.2
10	406.9	333.8	400.5
11	436.6	361.9	453.0
12	458.6	446.3	468.9
13	429.9	417.4	432.8
14	471.5	392.3	446.7



Table 8.1.3 Proportion of mature herring in each group. Based on samples taken in Sept.-Dec. by purse seine and pelagic trawls.

AGE	1969	1970	1971	1972	1973	1974	1975
1	0.00	0.00	0.01	0.00	0.00	0.00	0.00
2	0.08	0.22	0.38	0.29	0.64	0.14	0.27
3	0.73	0.89	0.98	1.00	0.99	0.94	0.97
4	0.99	1.00	1.00	1.00	1.00	1.00	1.00
AGE	1976	1977	1978	1979	1980	1981	1982
1	0.00	0.00	0.00	0.00	0.00	0.00	0.02
2	0.13	0.02	0.04	0.07	0.05	0.03	0.05
3	0.90	0.87	0.78	0.65	0.92	0.65	0.85
4	1.00	1.00	1.00	0.98	1.00	0.99	1.00
AGE	1983	1984	1985				
1	0.00	0.00	0.00				
2	0.00	0.01	0.00				
3	0.64	0.82	0.90				
4	1.00	1.00	1.00				

**Table 8.2.1** Stock abundance and catches by age groups (millions) and fishing mortality rates for the Icelandic summer spawners.  $F'$  is the  $F$  in 1985 calculated from the January 1986 survey.  $F_p$  is the fishing pattern in 1985 calculated from the January 1986 survey.  $F_{85}$  is the fishing mortality in 1985 according to the new method. Rings are referred to the year 1985.

Rings in 1985	Acoustic survey estimate Jan 1986	Catches in 1985	$F'$	$F_p$	$F_{85}$
0	311.5	-	-	-	-
1	910.5	0.111	-	-	0.00013
2	274.2	12.800	0.04	-	0.038
3	141.8	24.521	0.15	1.0	0.16
4	109.5	21.535	0.17	1.0	0.16
5	538.5	84.733	0.14	1.0	0.16
6	84.6	11.836	0.13	1.0	0.13
7	50.9	5.708	0.10	0.8	0.13
8	20.5	2.323	0.10	0.8	0.13
9	33.5	4.339	0.12	0.8	0.13
10	33.2	4.030	0.11	0.8	0.13
11	19.6	2.758	0.13	0.8	0.13
12	7.5	0.970	0.12	0.8	0.13
13	7.0	0.477	0.06	0.8	0.13
14	1.4	0.578	0.33	0.8	0.13

**Table 8.3.1** Comparison of acoustic estimates obtained in December 1983, January 1985 and January 1986. The comparison is given in terms of fishing mortality rates in 1985 obtained from the three different surveys.  $\bar{F}$  is the mean fishing mortality rate in 1985 derived from the three different surveys.  $F_{85}$  is the fishing mortality rate in 1985 calculated by the new method.

Year class	Dec 1983	Jan 1985	Jan 1986	$\bar{F}$	$F_{85}$
1980	0.07	0.36	0.17	0.20	0.16
1979	0.12	0.21	0.14	0.16	0.16
1978	0.17	0.16	0.13	0.15	0.16
1977	0.17	0.16	0.10	0.14	0.13
1976	0.20	0.14	0.10	0.15	0.13
1975	0.17	0.25	0.12	0.18	0.13
1974	0.18	0.21	0.11	0.10	0.13
1973	0.35	0.30	0.13	0.26	0.13
>1973	0.12	0.12	0.12	0.12	0.13
F weighted	0.12	0.22	0.14	0.15	0.155

Table 8.3.2 Icelandic summer spawners. Fishing mortalities.

AGE	1969	1970	1971	1972	1973	1974	1975
1	0.107	0.064	0.140	0.002	0.000	0.000	0.007
2	0.849	0.947	0.647	0.006	0.002	0.011	0.019
3	0.591	1.020	0.554	0.010	0.014	0.012	0.107
4	0.657	0.661	1.542	0.025	0.009	0.024	0.112
5	0.722	0.779	1.193	0.083	0.003	0.009	0.238
6	0.829	0.726	1.354	0.040	0.005	0.009	0.097
7	0.920	0.855	2.009	0.059	0.006	0.001	0.098
8	0.899	1.014	3.213	0.055	0.015	0.001	0.165
9	0.857	1.717	2.353	0.628	0.008	0.003	0.146
10	0.943	0.655	1.963	0.485	0.253	0.003	0.012
11	1.219	0.548	0.989	0.223	0.080	0.112	0.003
12	1.110	1.204	0.008	0.016	0.097	0.097	0.141
13	0.799	3.564	0.035	0.027	0.018	0.119	0.119
14	0.700	1.000	1.000	0.040	0.010	0.020	0.150

AVERAGE WEIGHTED BY STOCK IN NUMBERS							
Ave 4-14	0.751	0.745	1.578	0.047	0.007	0.019	0.151

AGE	1976	1977	1978	1979	1980	1981	1982
1	0.001	0.002	0.018	0.004	0.013	0.002	0.002
2	0.055	0.039	0.065	0.124	0.076	0.022	0.017
3	0.042	0.166	0.127	0.170	0.224	0.107	0.160
4	0.143	0.134	0.121	0.229	0.303	0.177	0.336
5	0.153	0.263	0.143	0.186	0.310	0.272	0.347
6	0.230	0.193	0.332	0.169	0.172	0.299	0.443
7	0.147	0.332	0.292	0.339	0.269	0.141	0.512
8	0.120	0.266	0.710	0.171	0.404	0.197	0.169
9	0.187	0.184	0.492	0.411	0.130	0.478	0.396
10	0.228	0.325	0.501	0.242	0.579	0.092	0.747
11	0.367	0.059	0.632	0.417	0.557	0.740	0.278
12	0.004	1.130	0.043	0.081	0.001	2.175	1.651
13	0.183	0.004	0.605	0.168	0.388	0.158	1.915
14	0.150	0.250	0.250	0.250	0.350	0.350	0.500

AVERAGE WEIGHTED BY STOCK IN NUMBERS							
Ave 4-14	0.152	0.228	0.244	0.234	0.296	0.263	0.404

AGE	1983	1984	1985
1	0.007	0.001	0.000
2	0.100	0.094	0.038
3	0.163	0.183	0.160
4	0.230	0.201	0.160
5	0.286	0.176	0.160
6	0.272	0.129	0.160
7	0.256	0.170	0.130
8	0.263	0.099	0.130
9	0.118	0.117	0.130
10	0.214	0.071	0.130
11	0.515	0.023	0.130
12	0.087	0.057	0.130
13	1.534	0.048	0.130
14	0.300	0.130	0.130

AVERAGE WEIGHTED BY STOCK IN NUMBERS			
Ave 4-14	0.247	0.181	0.155

Table 8.3.3 Icelandic summer spawners. VPA stock size in number (millions) and spawning stock biomass at 1 July.

AGE	1969	1970	1971	1972	1973	1974	1975
1	46.823	33.785	70.348	88.011	407.632	124.926	215.633
2	143.018	38.074	28.666	55.320	79.496	368.727	113.040
3	19.396	55.372	13.369	13.576	49.750	71.780	330.063
4	11.242	9.721	18.075	6.949	12.160	44.371	64.158
5	20.344	5.275	4.541	3.499	6.133	10.904	39.204
6	5.263	8.942	2.190	1.246	2.916	5.533	9.779
7	2.409	2.079	3.914	0.512	1.083	2.626	4.963
8	2.073	0.869	0.800	0.475	0.436	0.974	2.374
9	1.104	0.763	0.285	0.029	0.407	0.389	0.880
10	0.724	0.424	0.124	0.025	0.014	0.366	0.351
11	0.422	0.255	0.199	0.016	0.014	0.010	0.330
12	0.216	0.113	0.134	0.067	0.011	0.011	0.008
13	0.207	0.064	0.031	0.120	0.060	0.009	0.009
14	0.154	0.084	0.002	0.027	0.106	0.053	0.008
JUVENILE	183.749	69.573	87.685	127.288	436.748	446.337	308.054
SP.STOCK							
BIOMASS	16.699	19.873	13.259	10.650	28.702	45.509	114.562

AGE	1976	1977	1978	1979	1980	1981	1982
1	569.448	416.223	152.736	228.810	252.618	1315.802	274.132
2	193.669	514.674	375.944	135.697	206.153	225.586	1188.417
3	100.335	165.880	447.776	318.737	108.443	172.902	199.718
4	268.278	87.072	127.161	356.728	243.247	78.420	140.516
5	51.885	210.322	68.905	101.908	256.601	162.502	59.444
6	27.972	40.291	146.325	54.049	76.592	170.226	112.059
7	8.028	20.109	30.063	94.954	41.307	58.346	114.269
8	4.070	6.272	13.055	20.323	61.228	28.567	45.861
9	1.820	3.267	4.351	5.806	15.493	36.977	21.232
10	0.688	1.366	2.459	2.407	3.483	12.313	20.752
11	0.314	0.496	0.893	1.348	1.709	1.766	10.160
12	0.298	0.197	0.423	0.430	0.804	0.886	0.762
13	0.006	0.268	0.058	0.366	0.358	0.726	0.091
14	0.008	0.005	0.242	0.028	0.280	0.220	0.561
JUVENILE	747.973	942.168	612.153	473.701	457.139	1595.920	1427.604
SP.STOCK							
BIOMASS	126.288	132.205	177.003	198.408	205.652	176.120	184.542

AGE	1983	1984	1985
1	235.021	398.987	972.078
2	247.613	211.258	360.619
3	1057.082	202.748	174.042
4	154.021	812.917	152.848
5	90.848	110.722	601.407
6	38.027	61.784	84.008
7	65.104	26.215	49.150
8	61.953	45.609	20.003
9	35.028	43.092	37.362
10	12.925	28.166	34.702
11	8.895	9.443	23.749
12	6.960	4.807	8.352
13	0.132	5.774	4.107
14	0.012	0.026	4.977
JUVENILE	863.183	644.627	1350.101
SP.STOCK			
BIOMASS	246.714	292.516	326.999

Table 8.4.1 Input parameters used in catch prediction for the Icelandic summer-spawning (Division Va) HERRING.

Rings	Stock in number ( '000) at	Proportional F	Mean weight in catch and spawning stock
	1 January 1986		
1	400,000	0.005	60
2	879,467	0.15	124
3	314,135	0.50	199
4	134,195	1.00	259
5	117,854	1.00	297
6	463,715	1.00	313
7	64,774	1.00	337
8	39,052	1.00	352
9	15,893	1.00	370
10	29,686	1.00	380
11	27,572	1.00	417
12	18,869	1.00	458
13	6,636	1.00	427
14	3,263	1.00	437

Figure 1.3.1

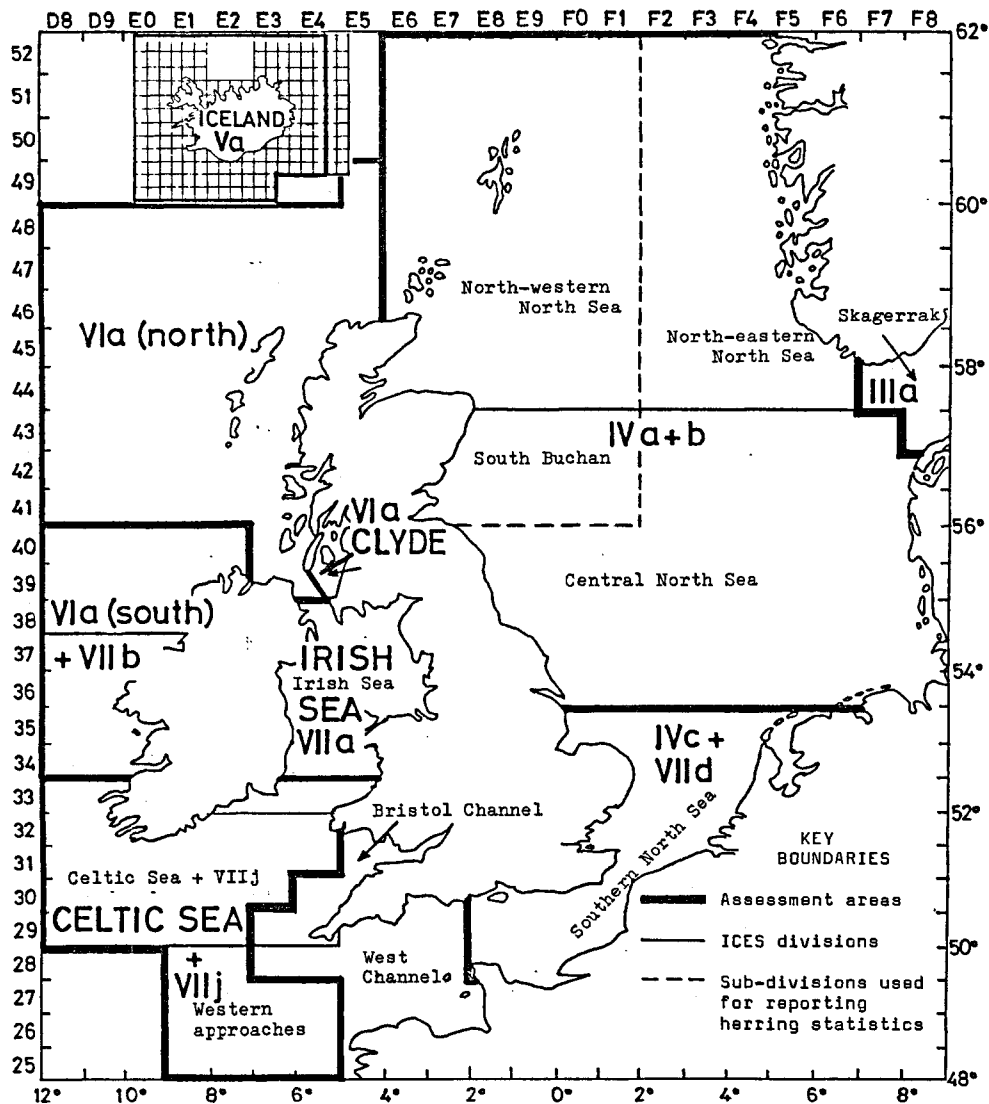
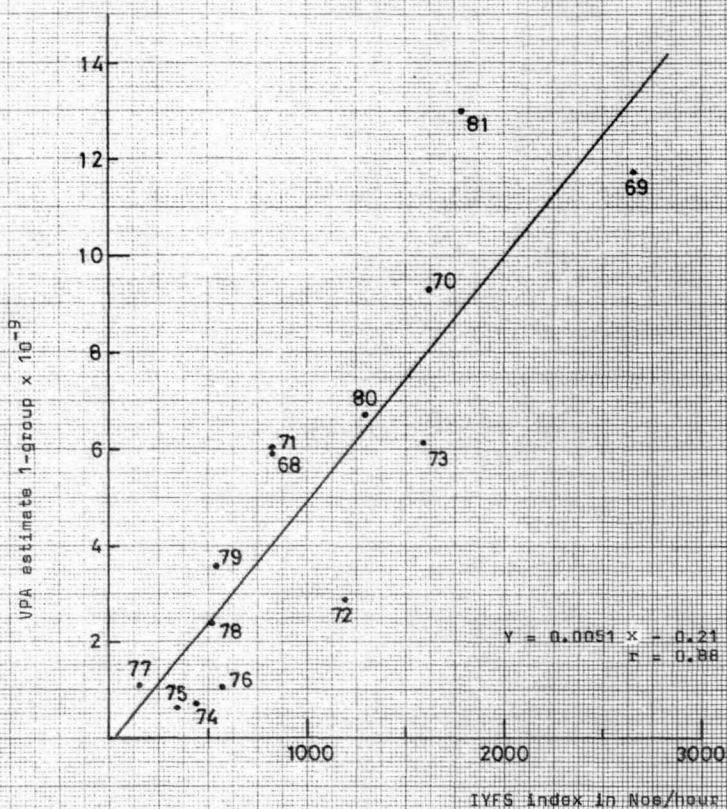
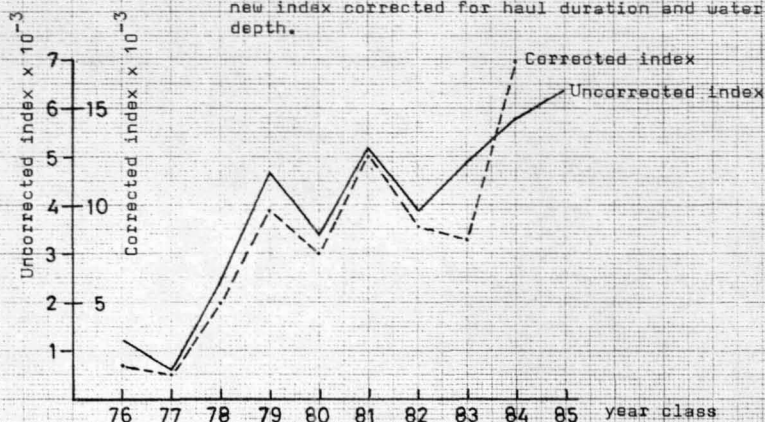


Figure 2.3.1 Regression VPA estimates of year class strength as 1-group on IKMI indices.



**Figure 2.3.2** Comparison between old IKMT index, and new index corrected for haul duration and water depth.



**Figure 2.3.3** Regression of VPA estimates of year class strength on IKMT indices.

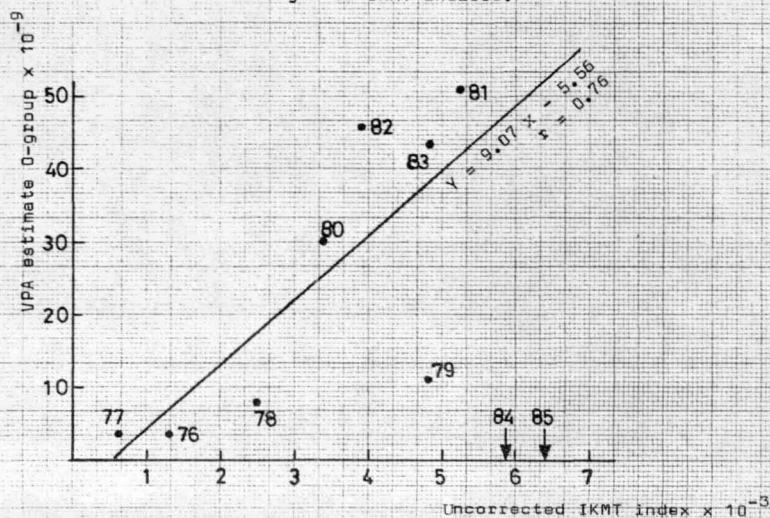




Figure 2.3.4 Regression of Downs recruitment (Nos. at age as 2-ringers in Divisions IVc and VIId VPA) on ln of Downs 0-group on English 0-group survey.

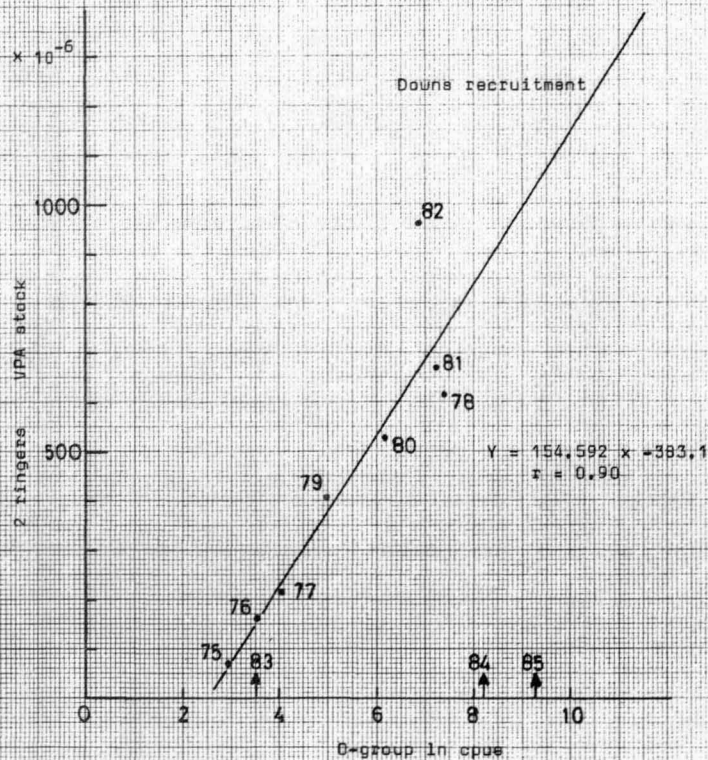
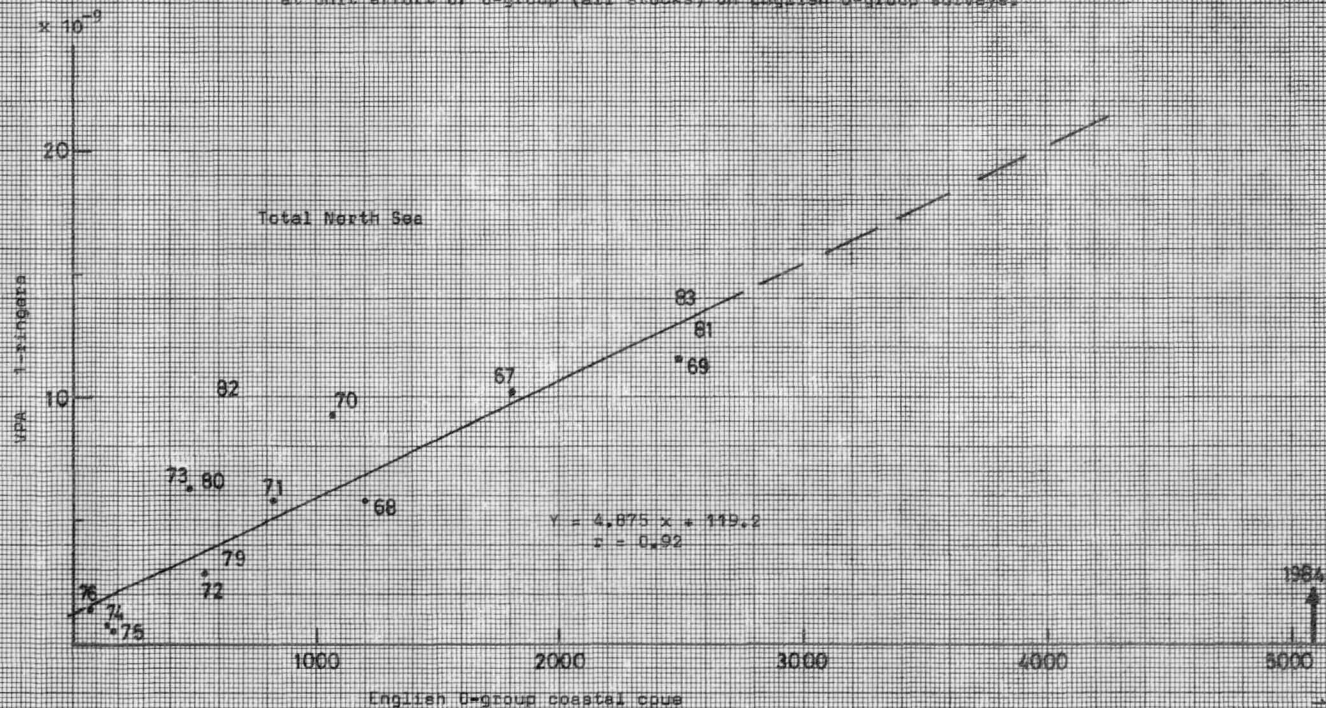


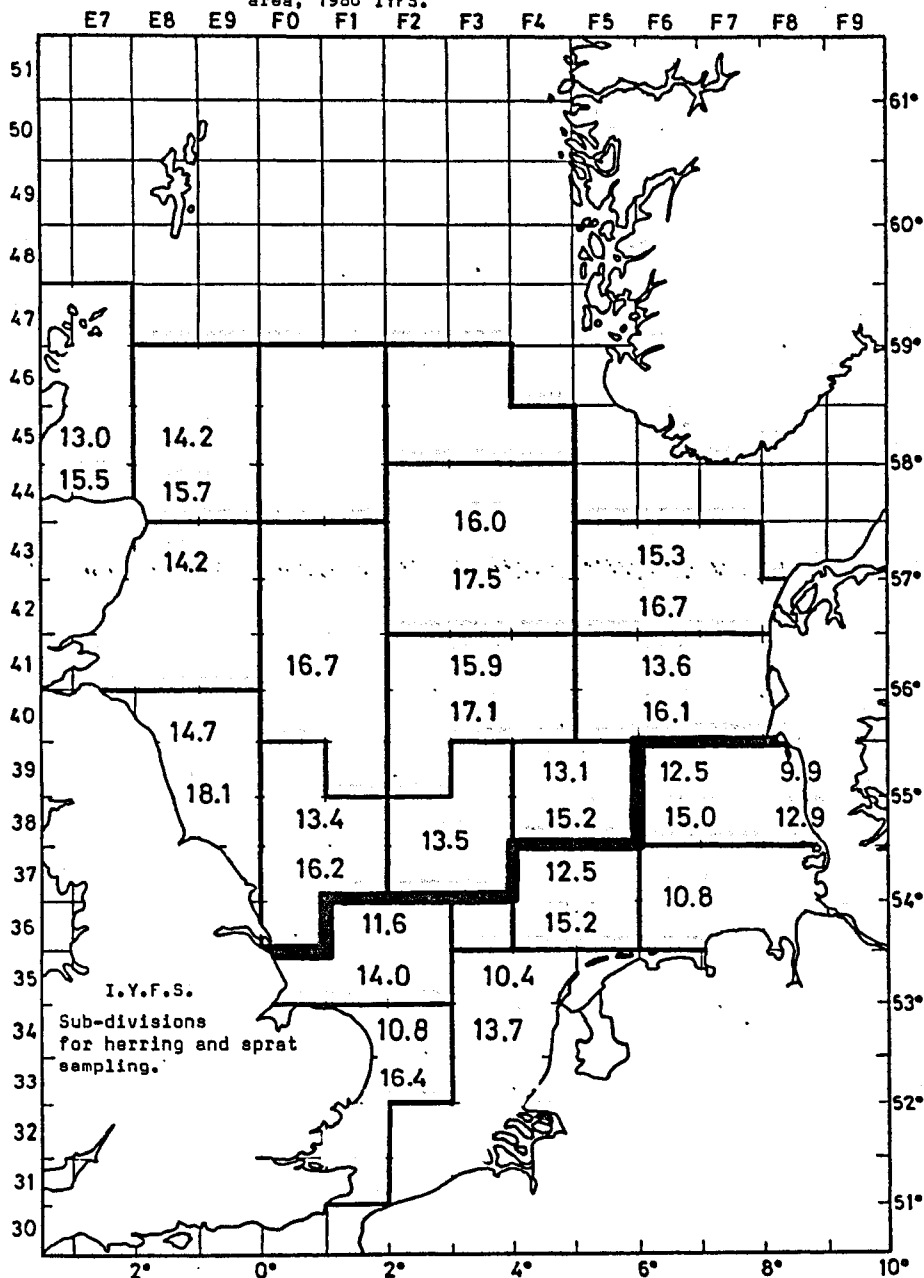
Figure 2.3.5 Regression of VPA abundance of 1-lingers (total North Sea) against catch at unit effort of 0-group (all stocks) on English 0-group surveys.



1984

163

170 Figure 2.3.6 Modal length groups of 1-group herring in each area, 1986 IYFS.



**Figure 2.3.7**

Cumulative percentage length distributions and extracted modes 1986 IVFS. Combined length distributions for area south of heavy line in Figure 2.3.6.

171

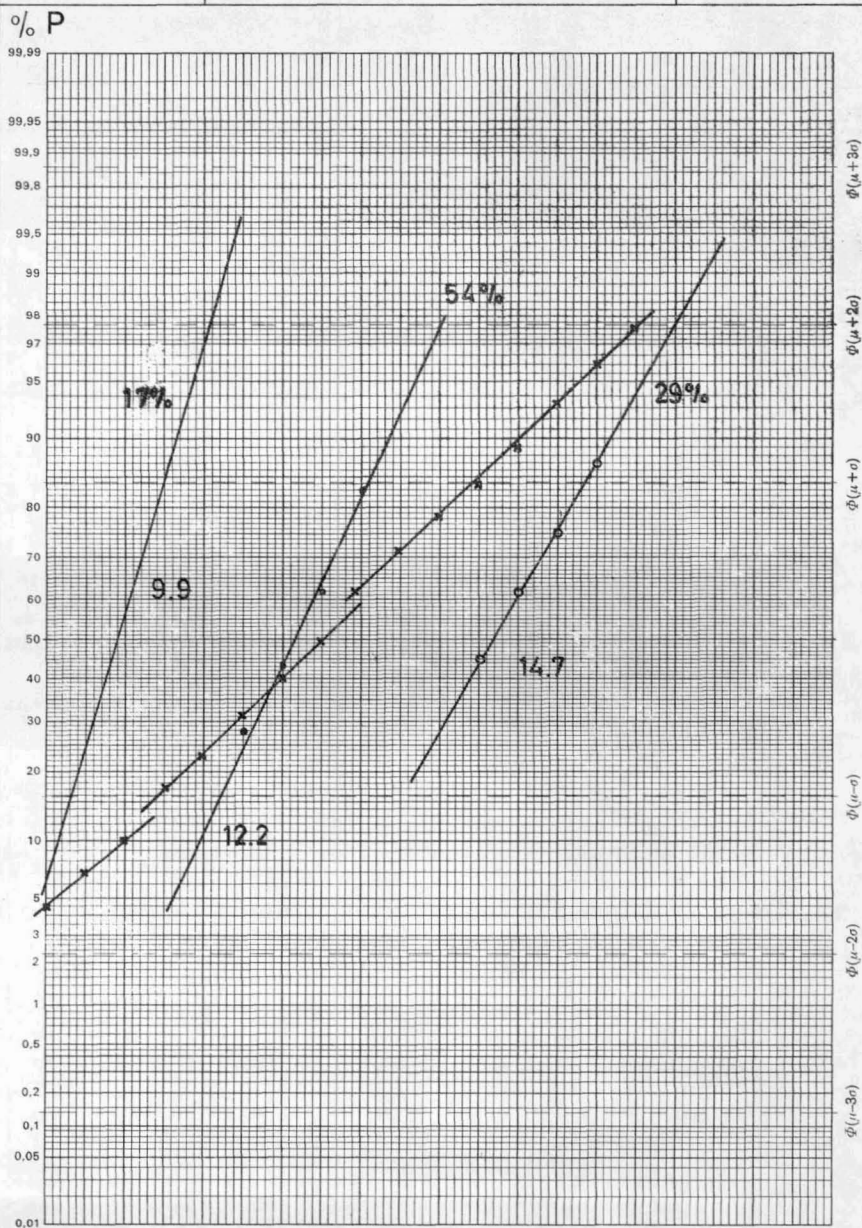
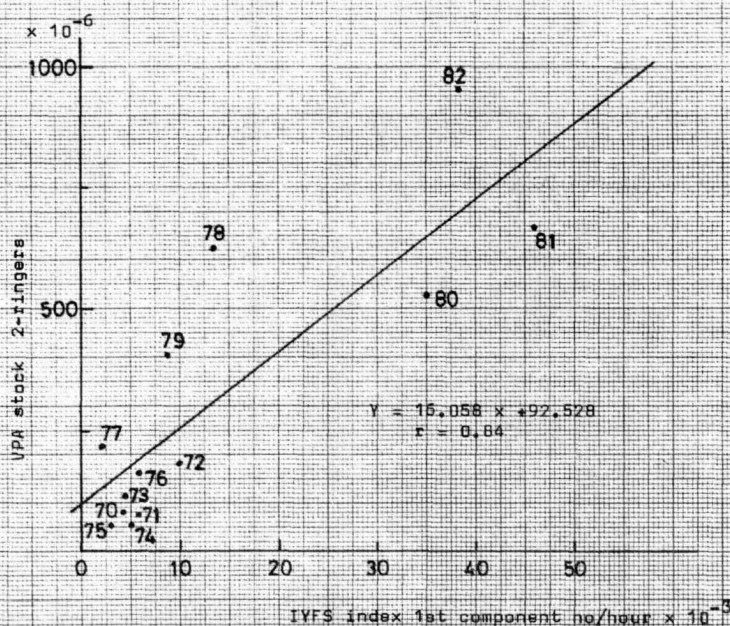


Figure 2.3.8 Regression of VPA estimate of 2-ringere in the Downs stock (Divs.IVc and VIId) against first length components in IVFS.





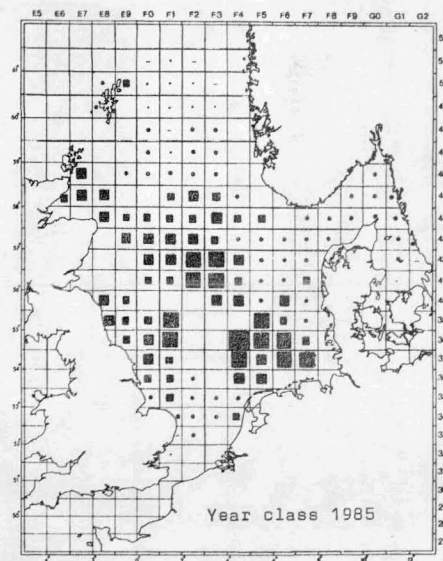
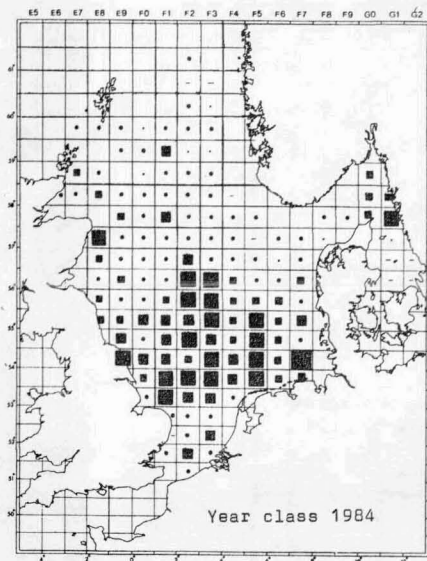
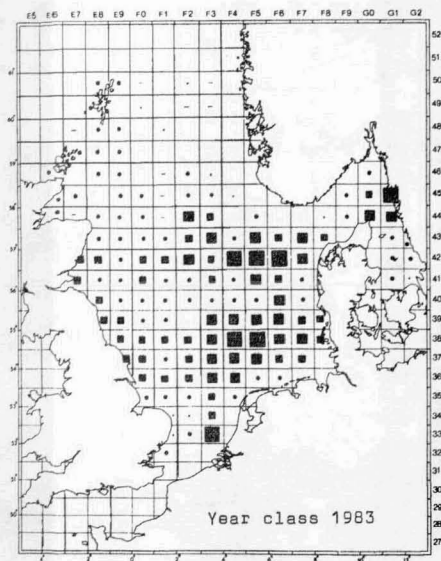
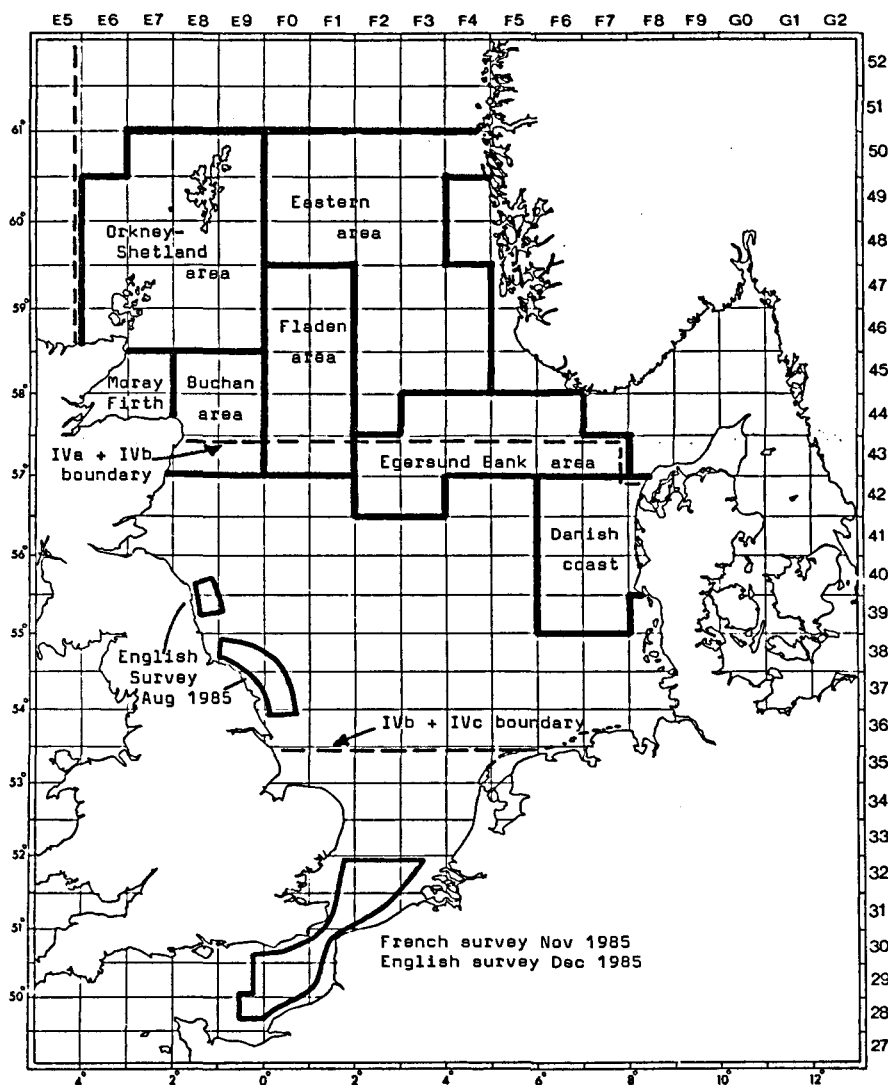


Figure 2.3.9 Herring larvae sampled by IKMT during the International Young Fish Surveys in 1984-86.

Figure 2.4.1 Area Sub-divisions used for presenting results of acoustic surveys (see Tables 2.4.1-2.4.6).



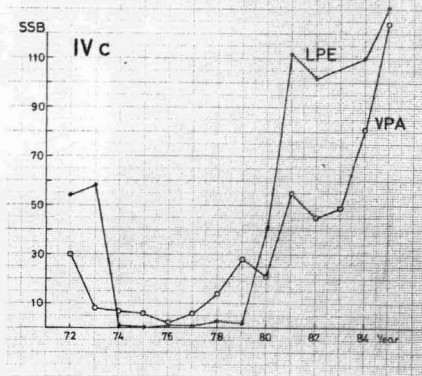
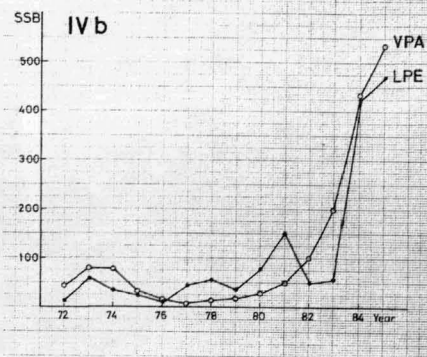
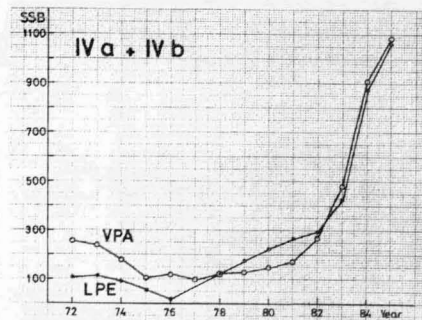
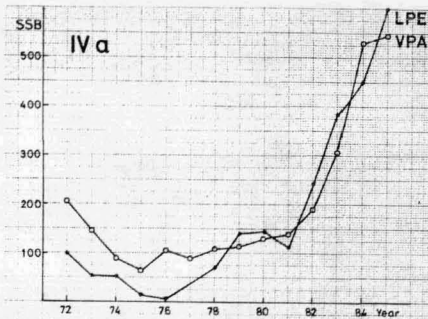
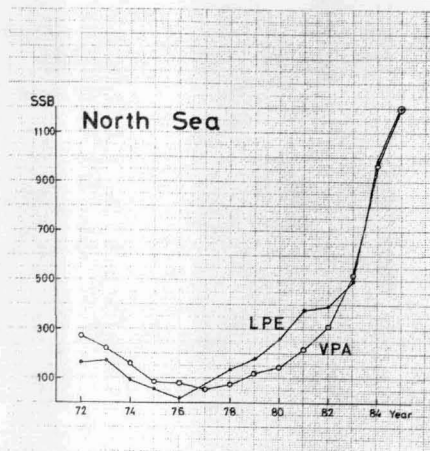
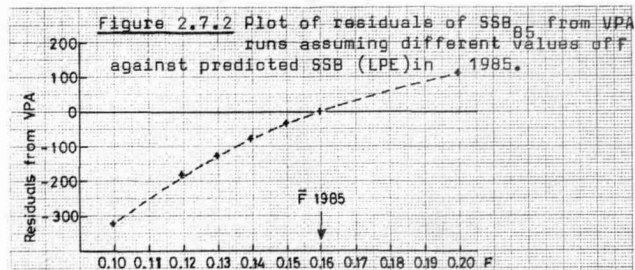
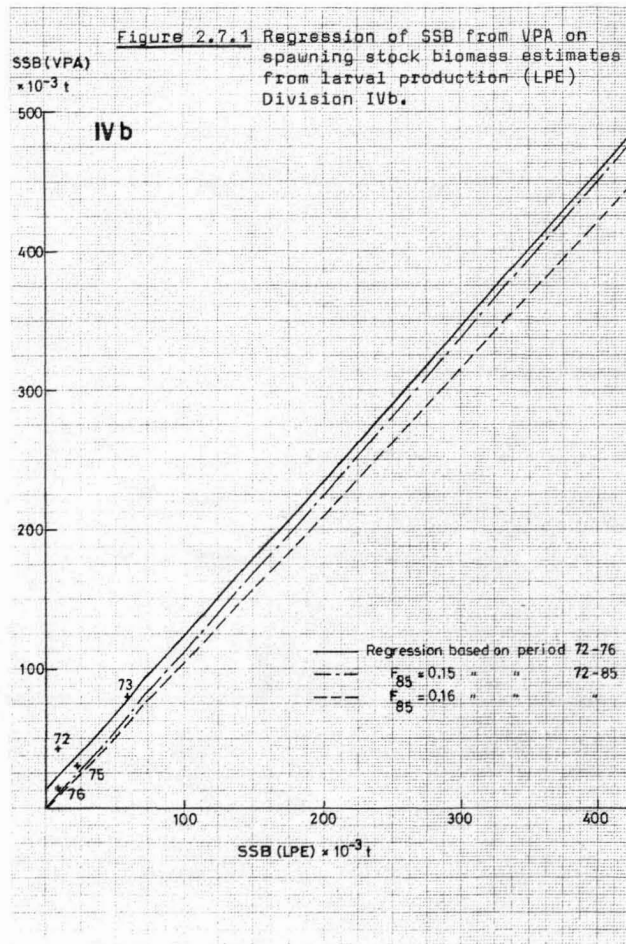


Figure 2.5.1 SSB ( $10^3$  tonnes) estimated from larvae production (LPE) and from VPA.





**Figure 2.7.3** Spawning stock biomass from VPA.

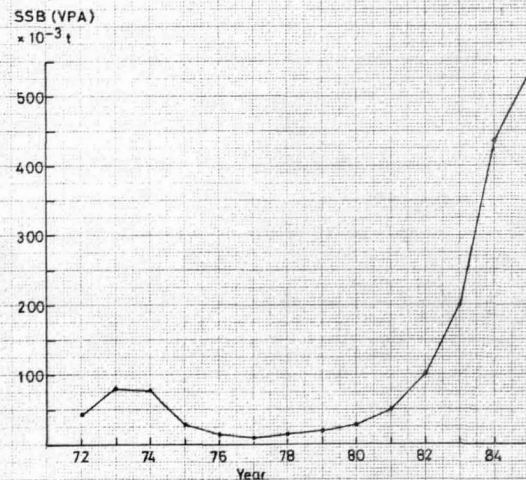
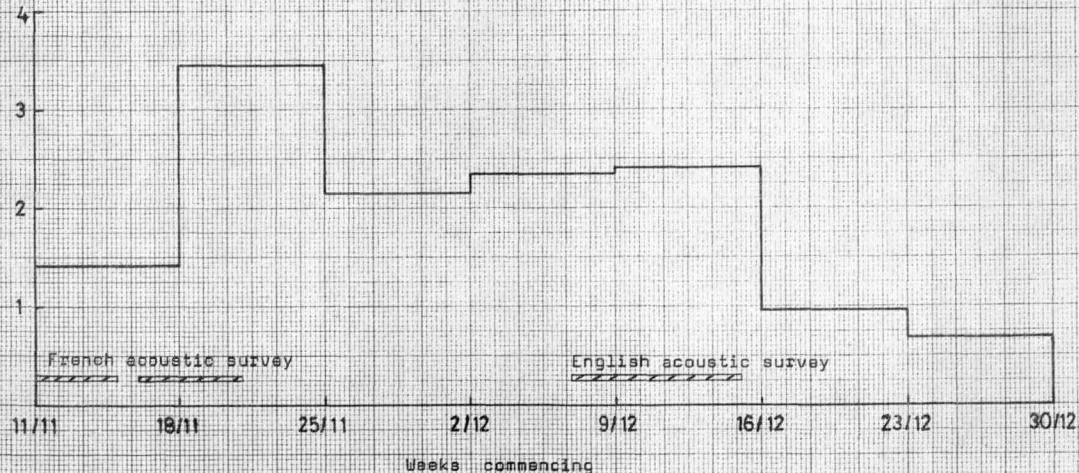


Figure 2.7.4 Trend in cpue of french trawlers in the Channel in Nov-Dec 1985.

Cpue (catch in tonnes  
per hour of research  
or fishing  
activity).



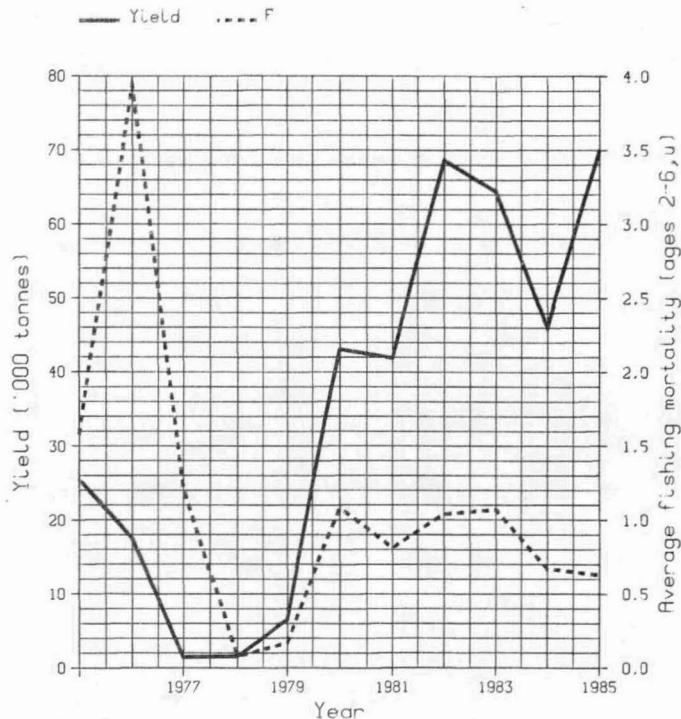
# FISH STOCK SUMMARY

## STOCK: Herring - IVc and VIId

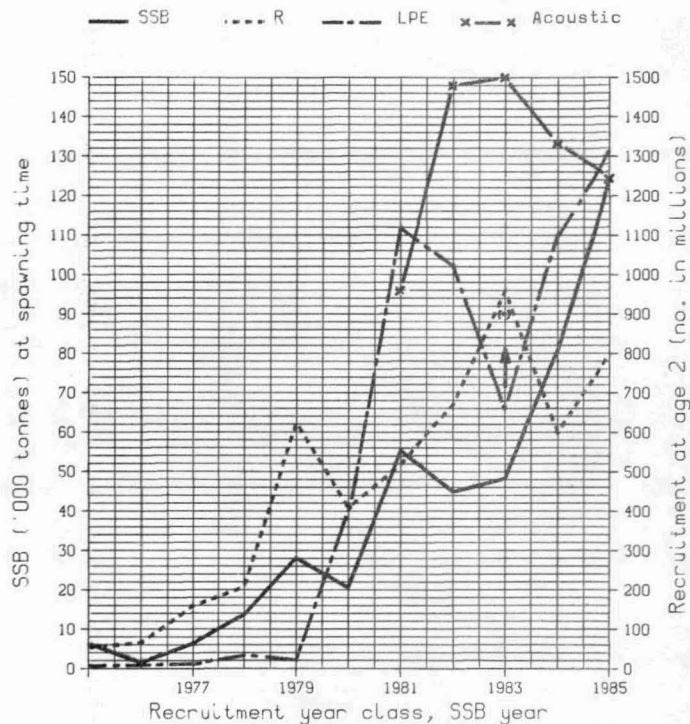
### 22-4-1986

Figure 2.7.5

Trends in yield and fishing mortality (F)

**A**

Trends in spawning stock biomass (SSB) and recruitment (R)

**B**

(. ) Likely to have been underestimated

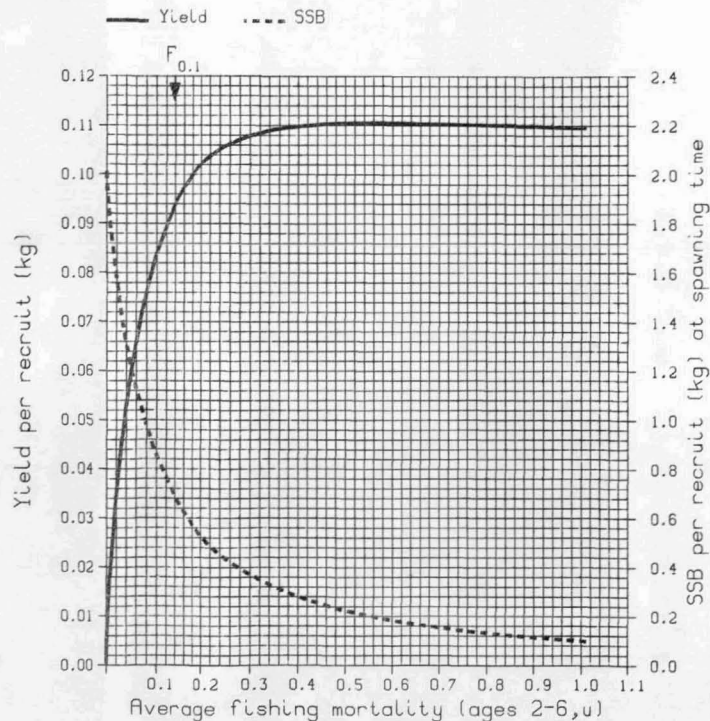
cont'd.

# **FISH STOCK SUMMARY** **STOCK: Herring - IVc and VIId**

**22-4-1986**

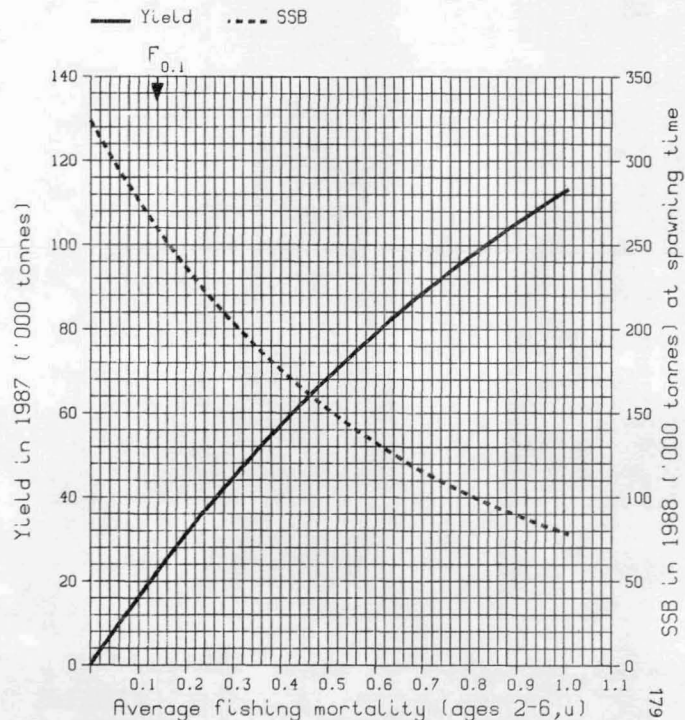
Figure 2.7.5 cont'd.

Long-term yield and spawning stock biomass



**C**

Short-term yield and spawning stock biomass  
assuming a catch of 70,000 tonnes in 1986



**D**

# FISH STOCK SUMMARY

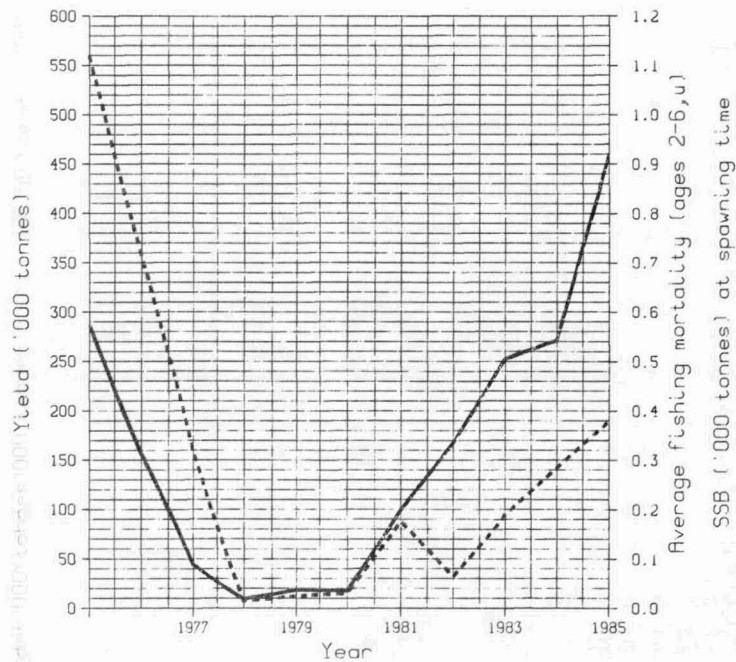
## STOCK: Herring - IVa and IVb

23-4-1986

Figure 2.9.1

Trends in yield and fishing mortality (F)

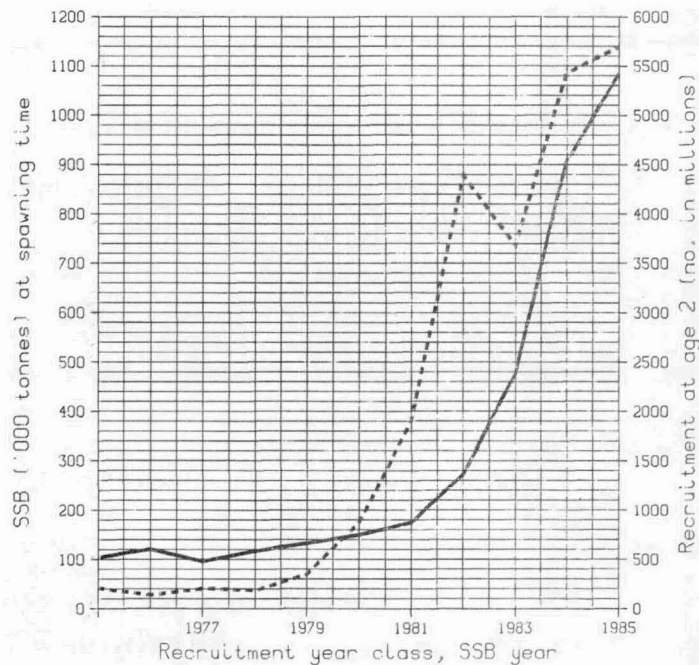
— Yield    - - - F



A

Trends in spawning stock biomass (SSB) and recruitment (R)

— SSB    - - - R



B

cont'd.



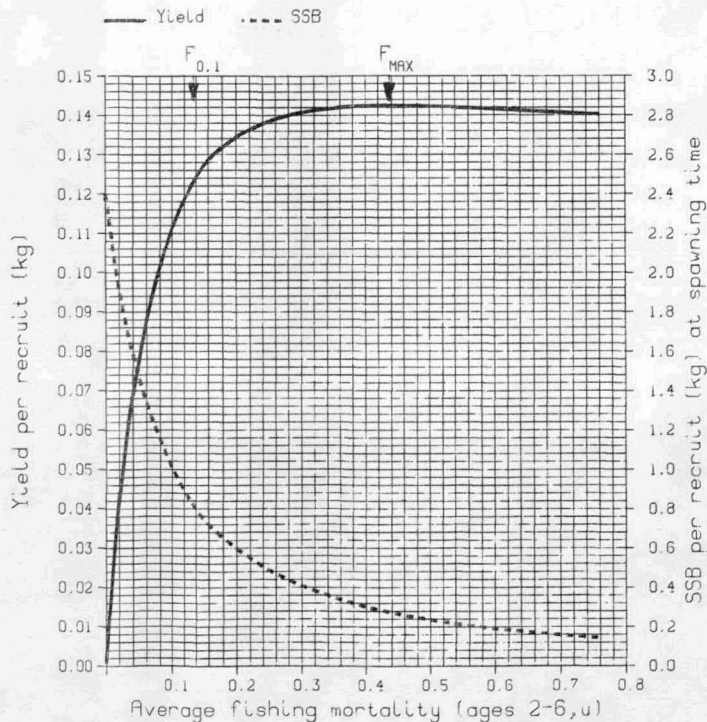
# FISH STOCK SUMMARY

## STOCK: Herring - IVa and IVb

23-4-1986

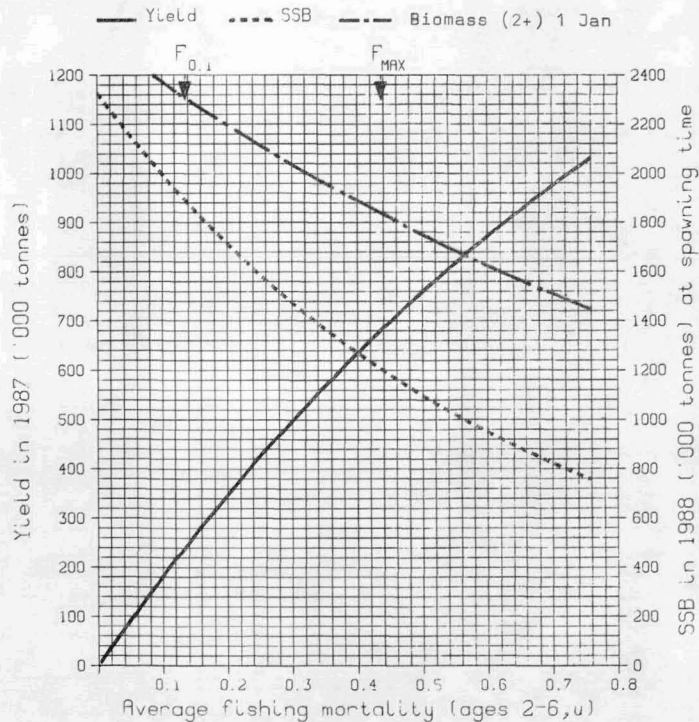
Figure 2.9.1 cont'd.

Long-term yield and spawning stock biomass

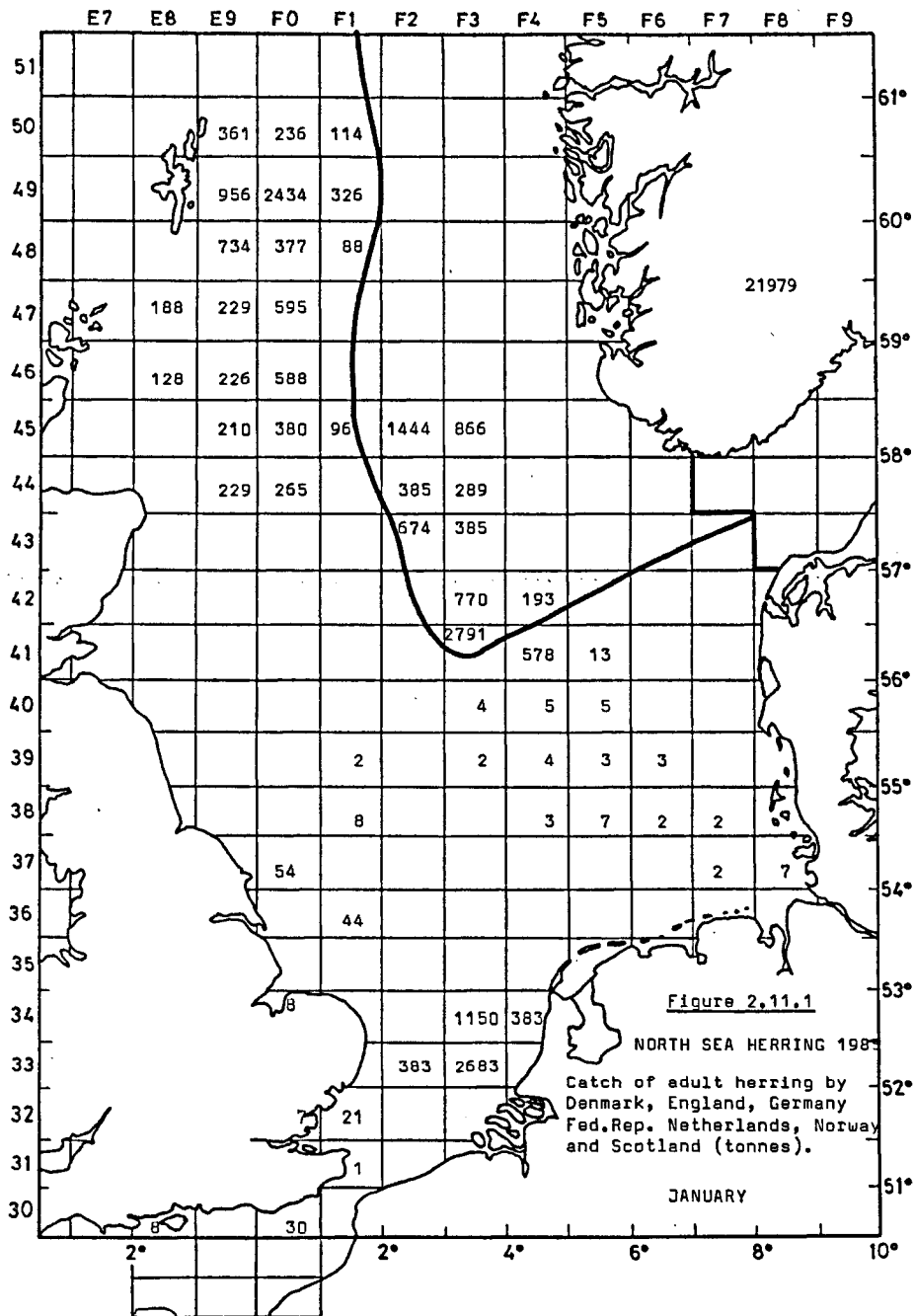


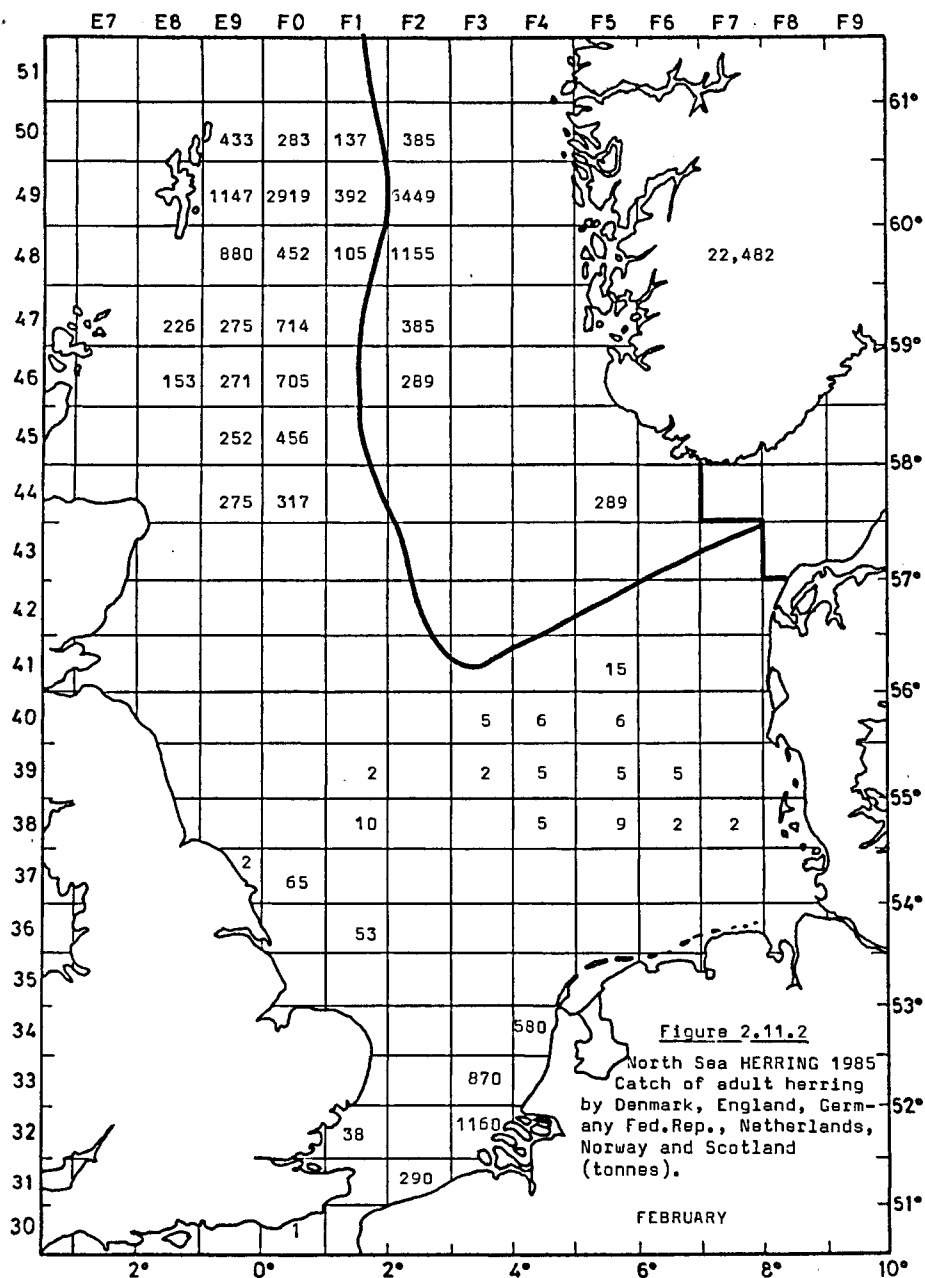
C

Short-term yield and spawning stock biomass

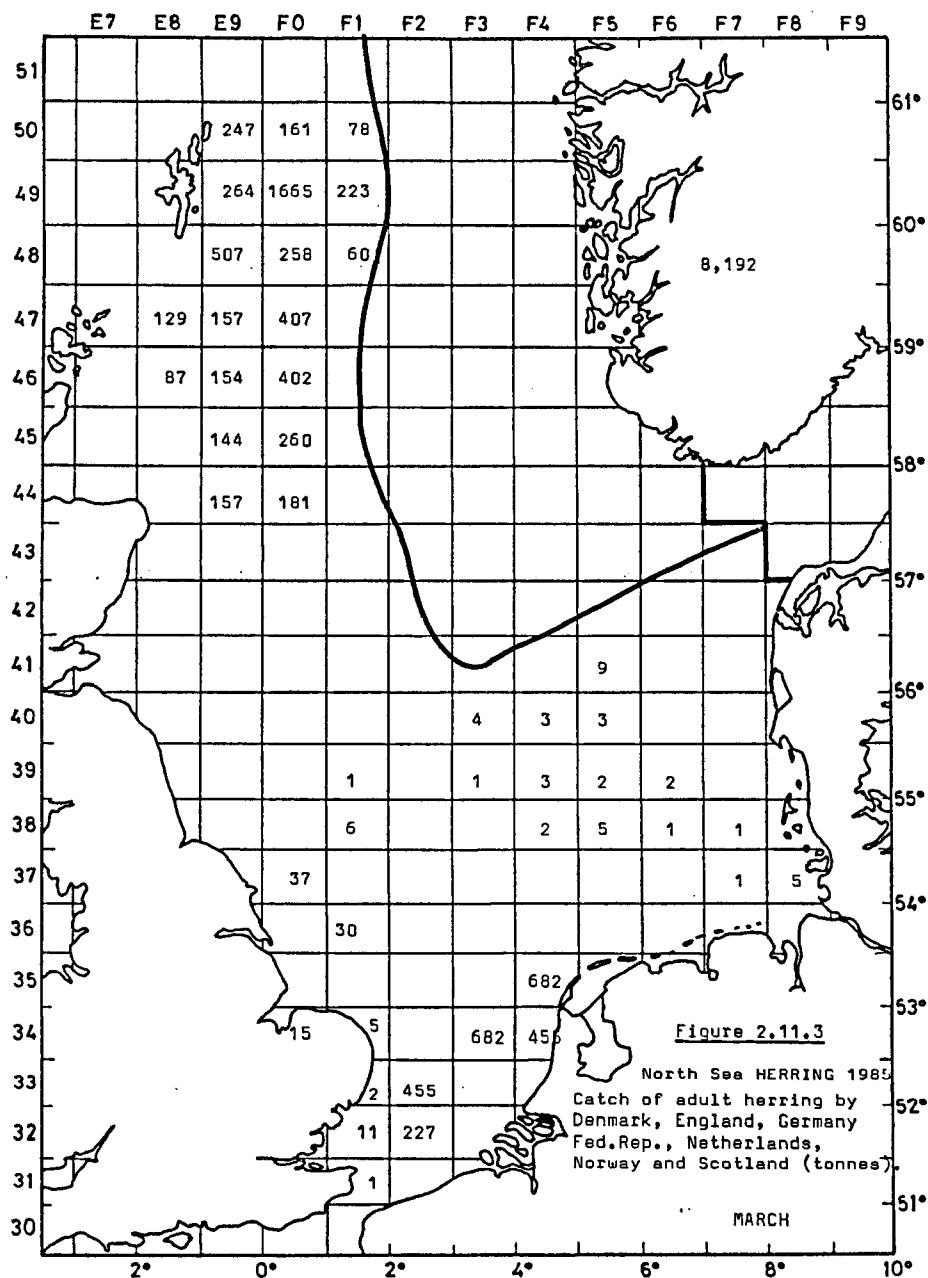


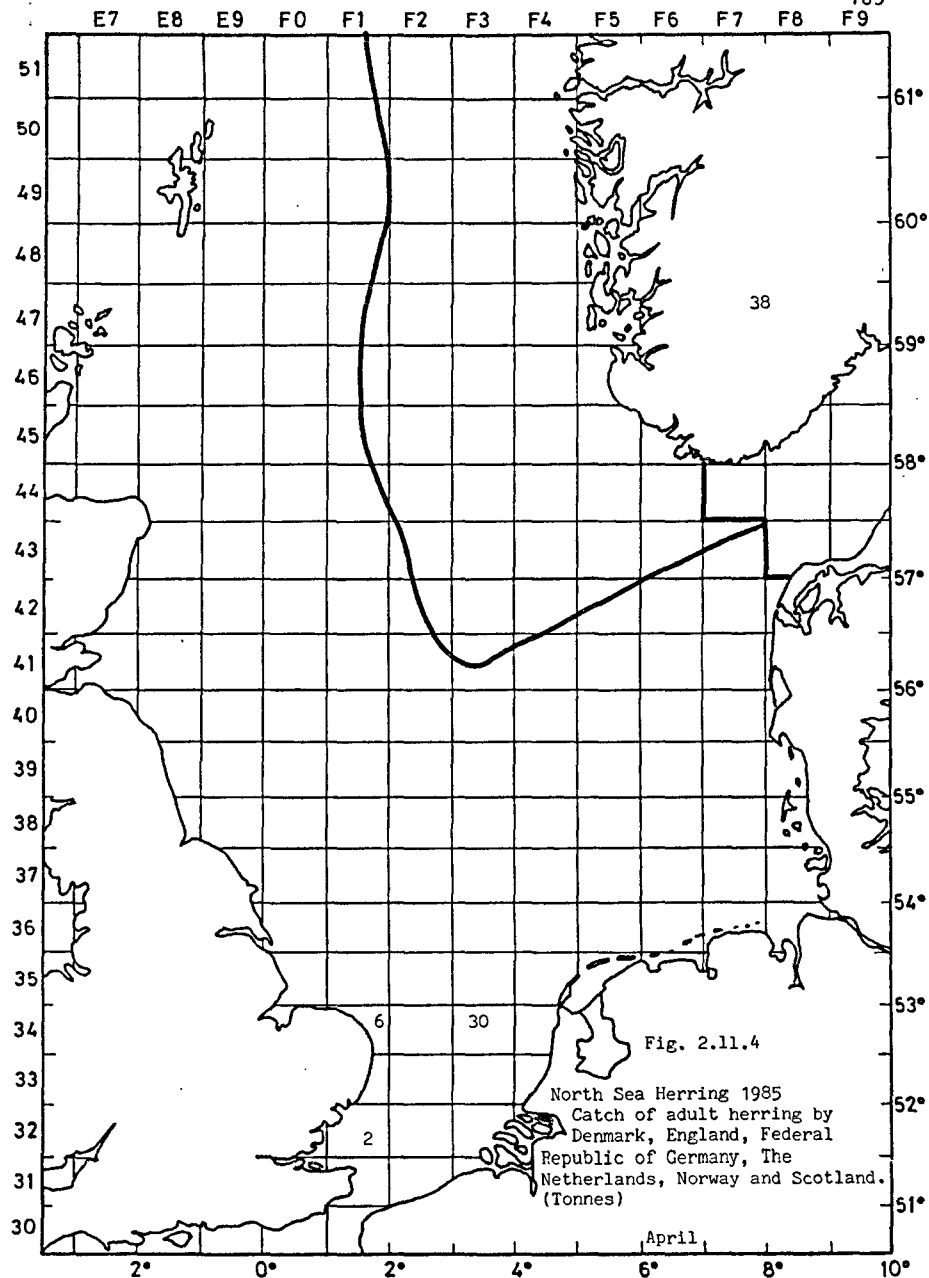
D

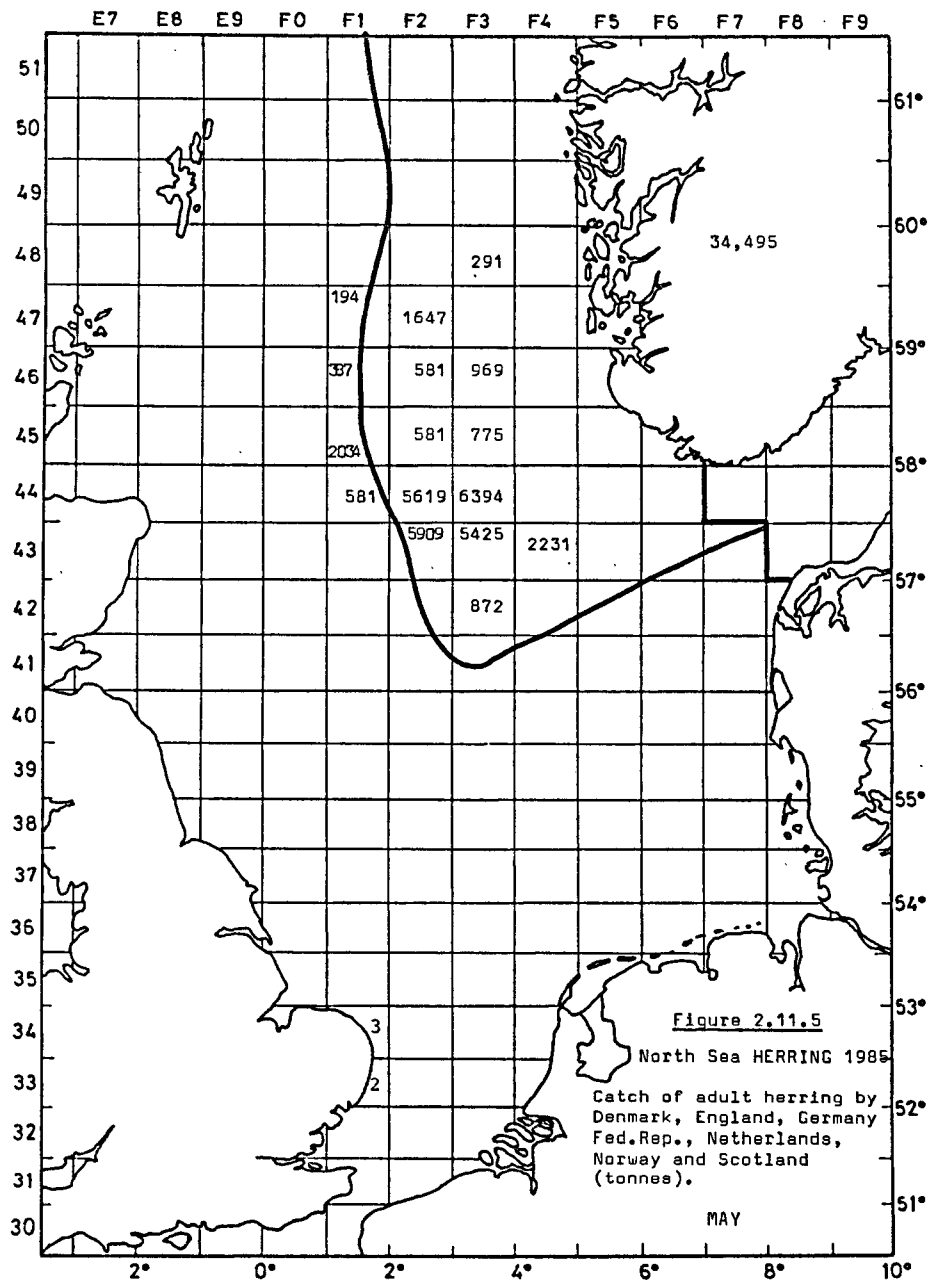


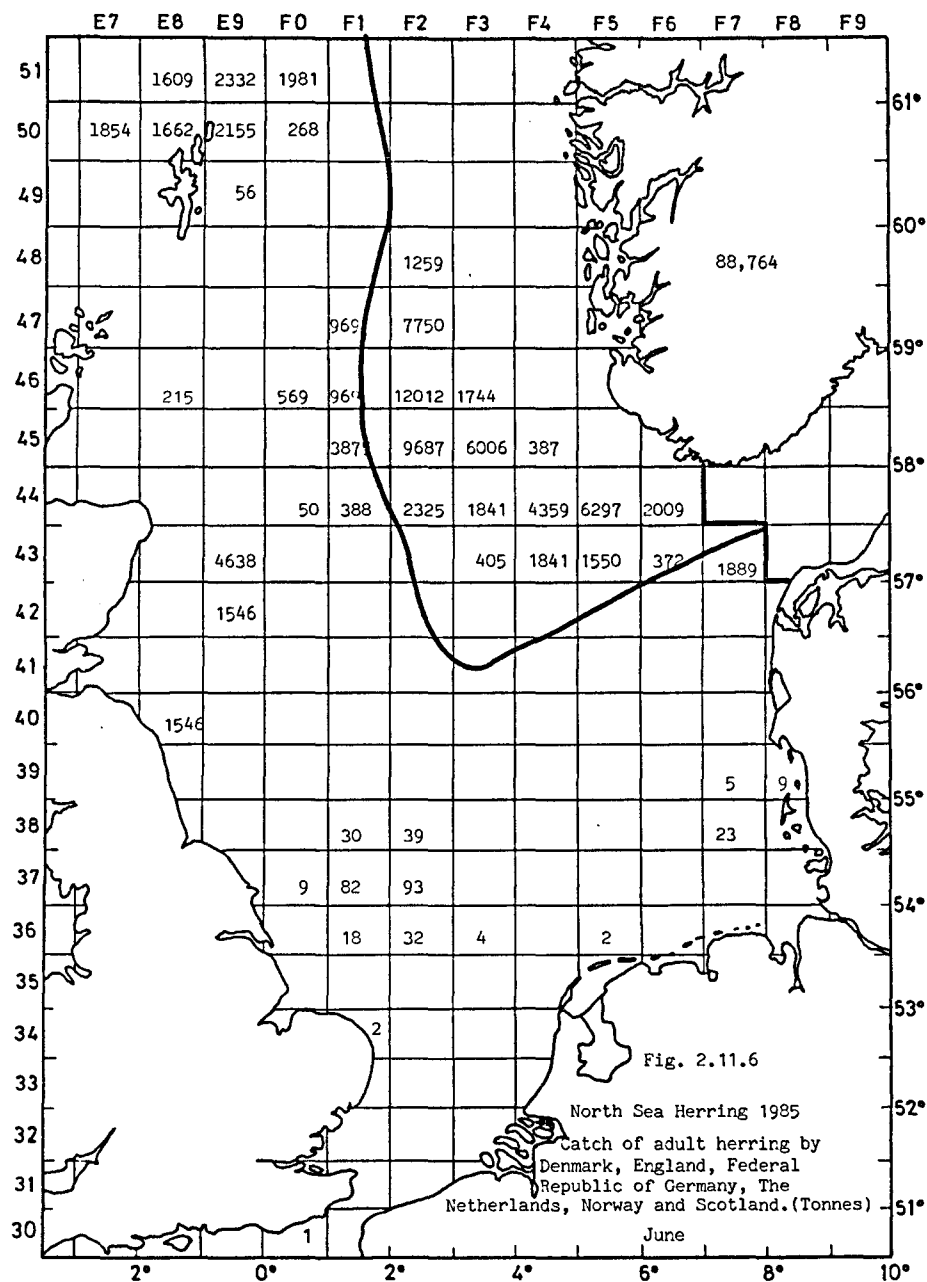


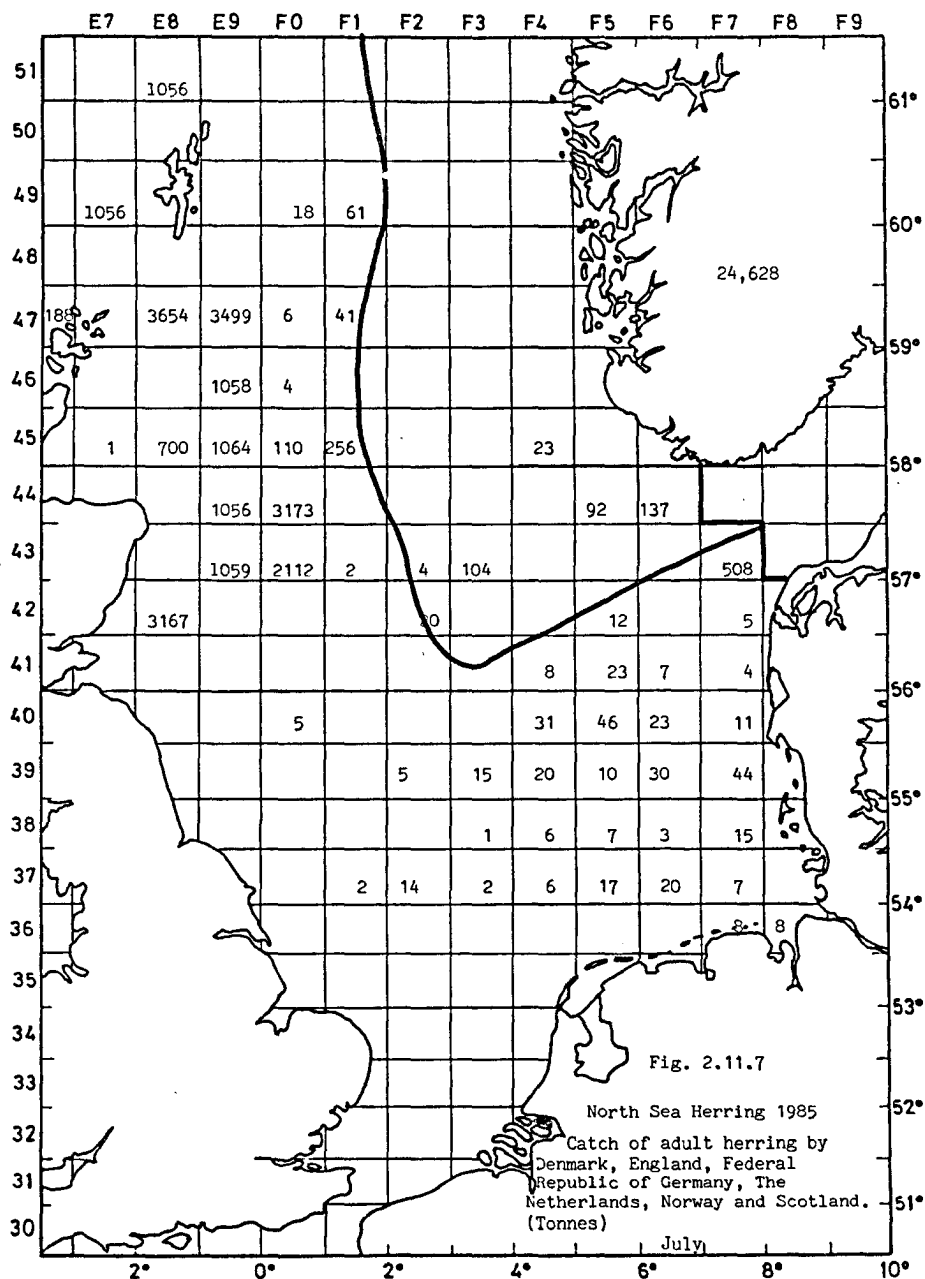


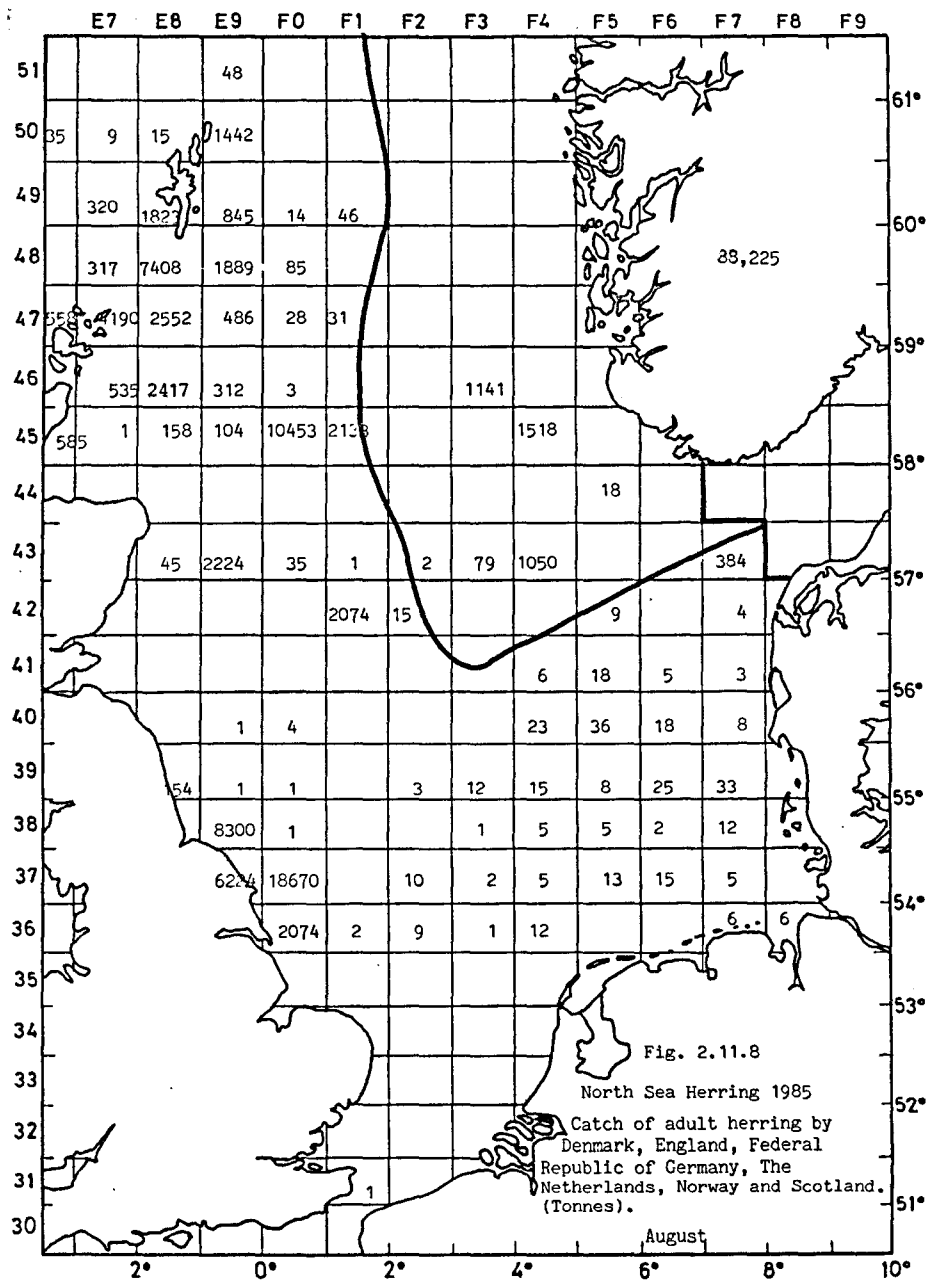


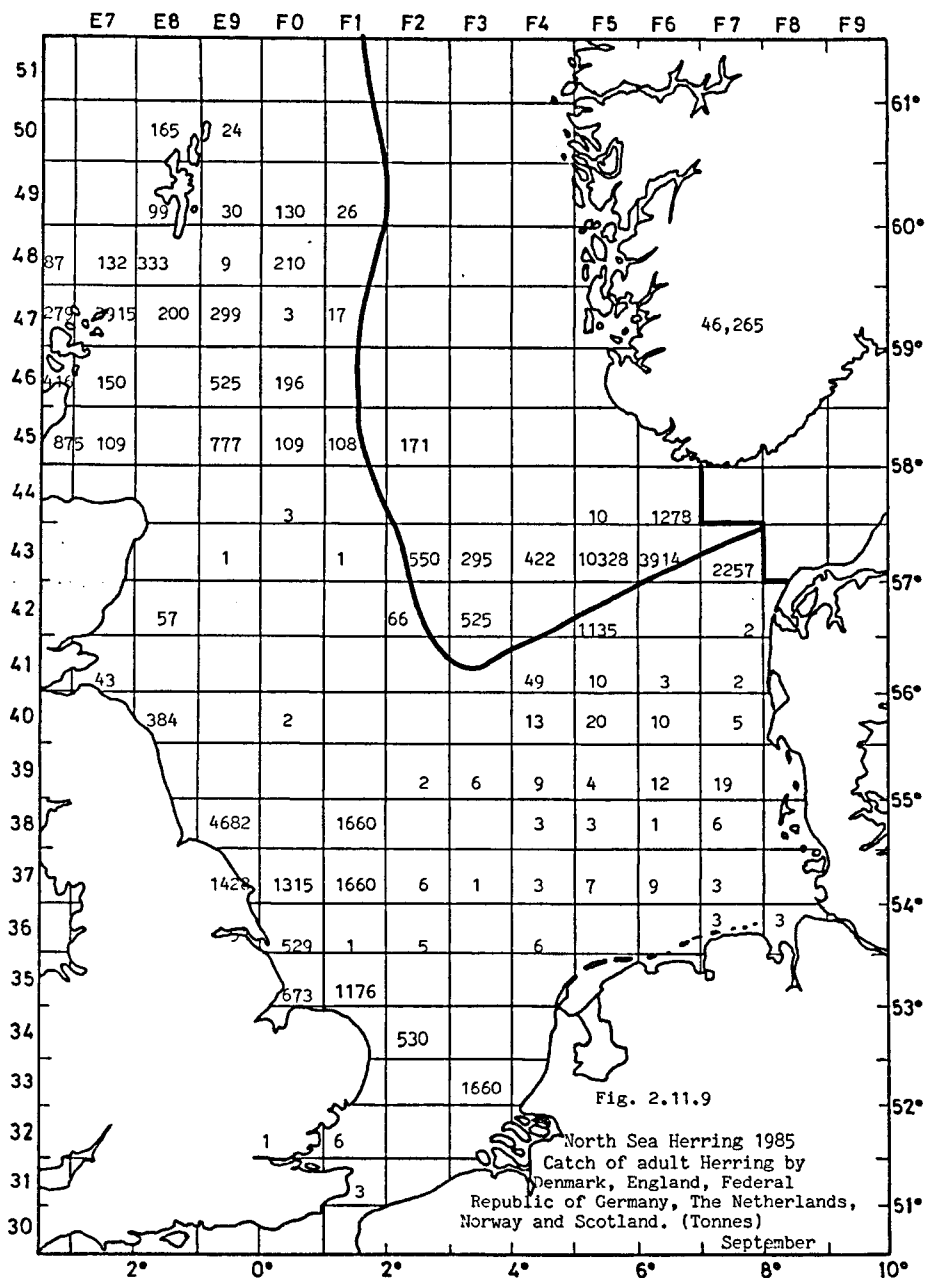


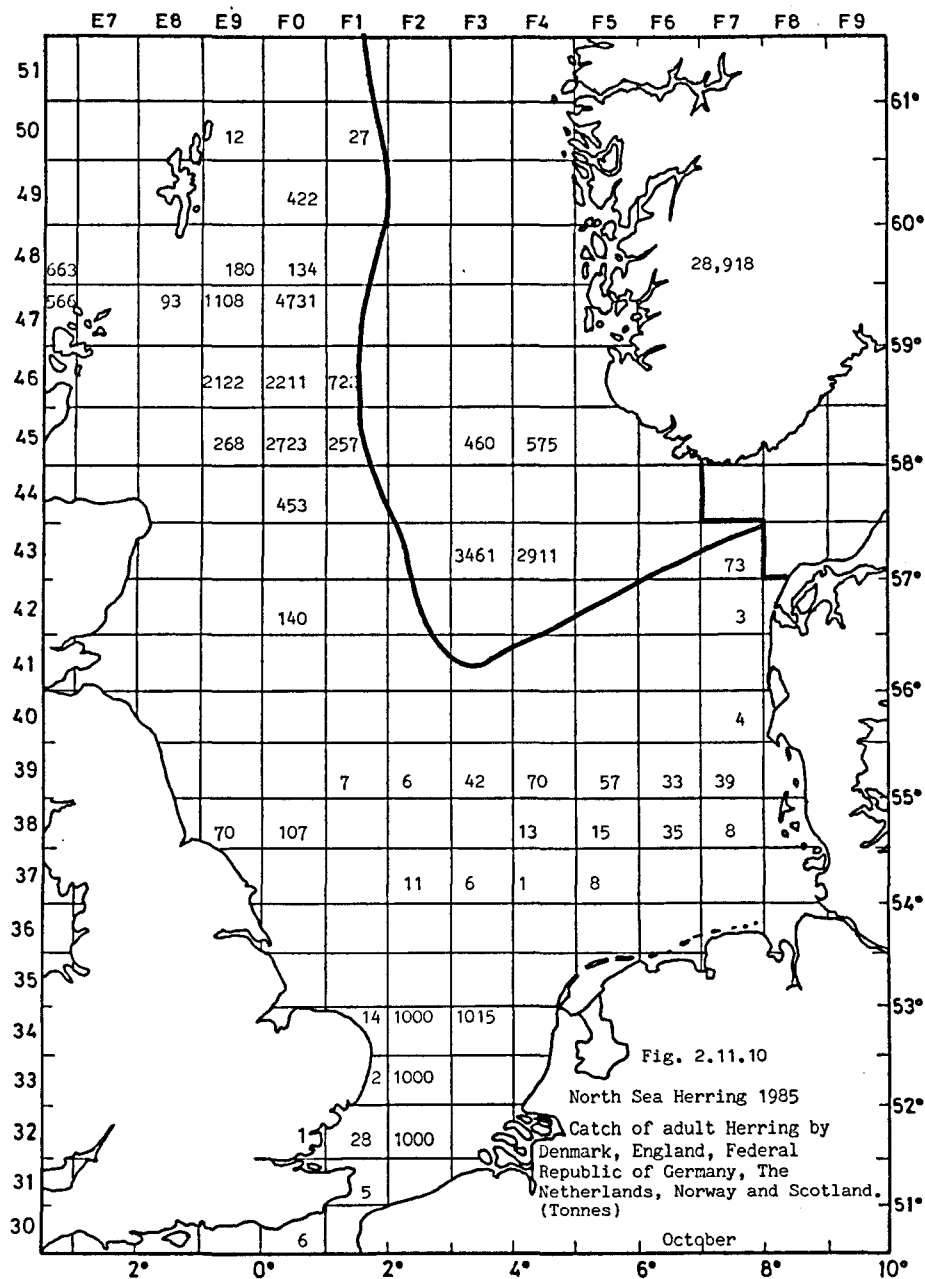




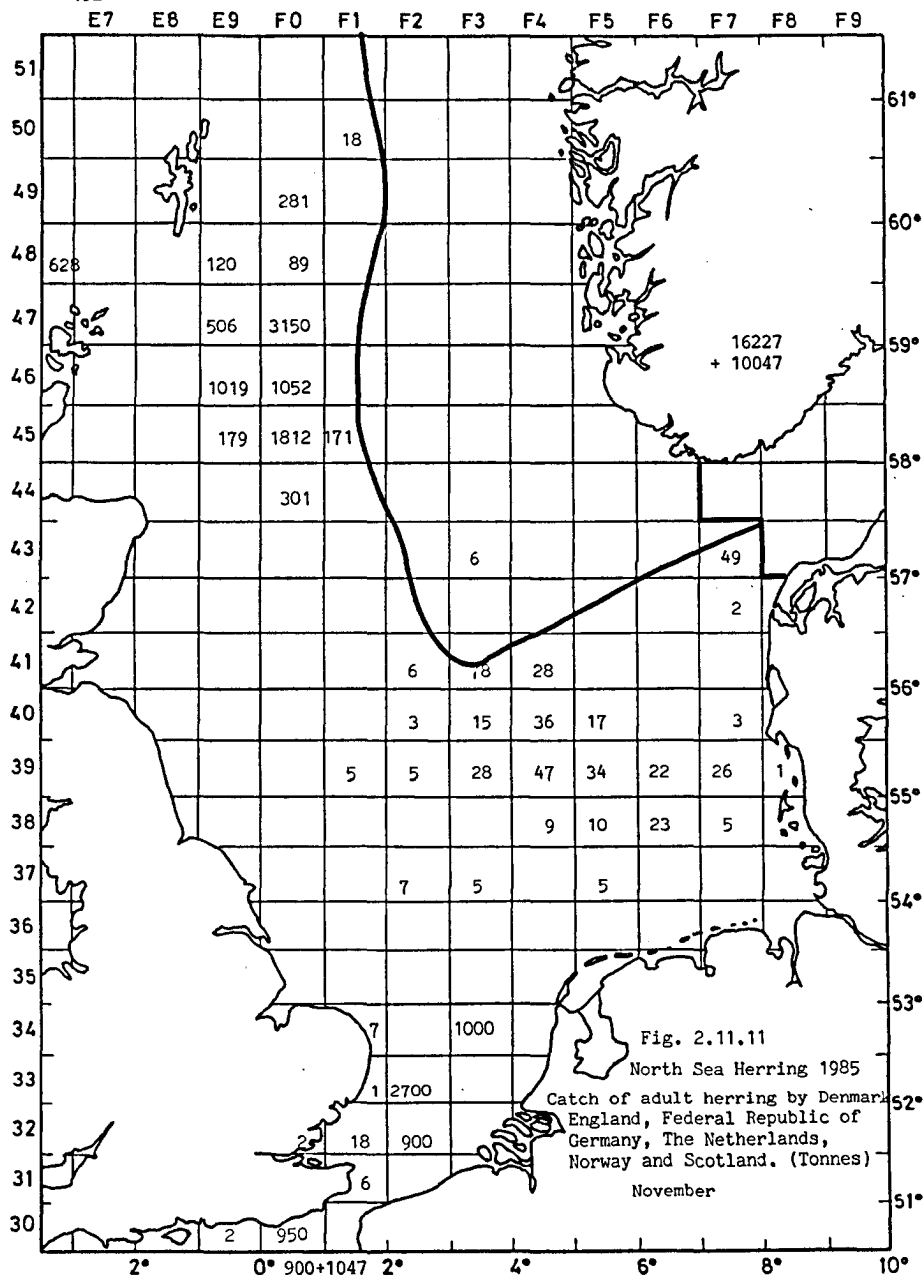












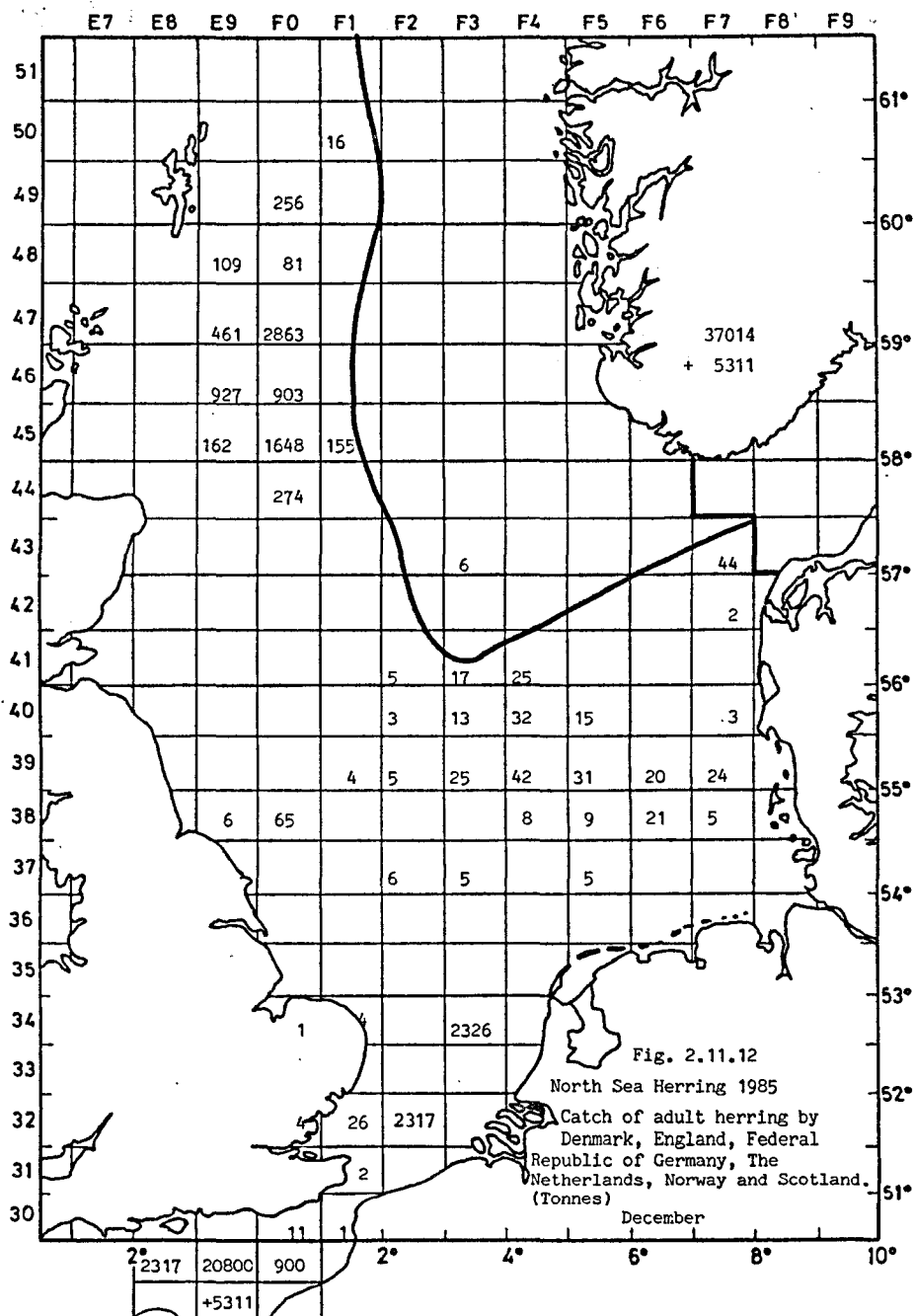


Figure 3.4.1 Regression of 1-group indices on 2-group indices of spring- and autumn spawners herring. Year classes indicated.

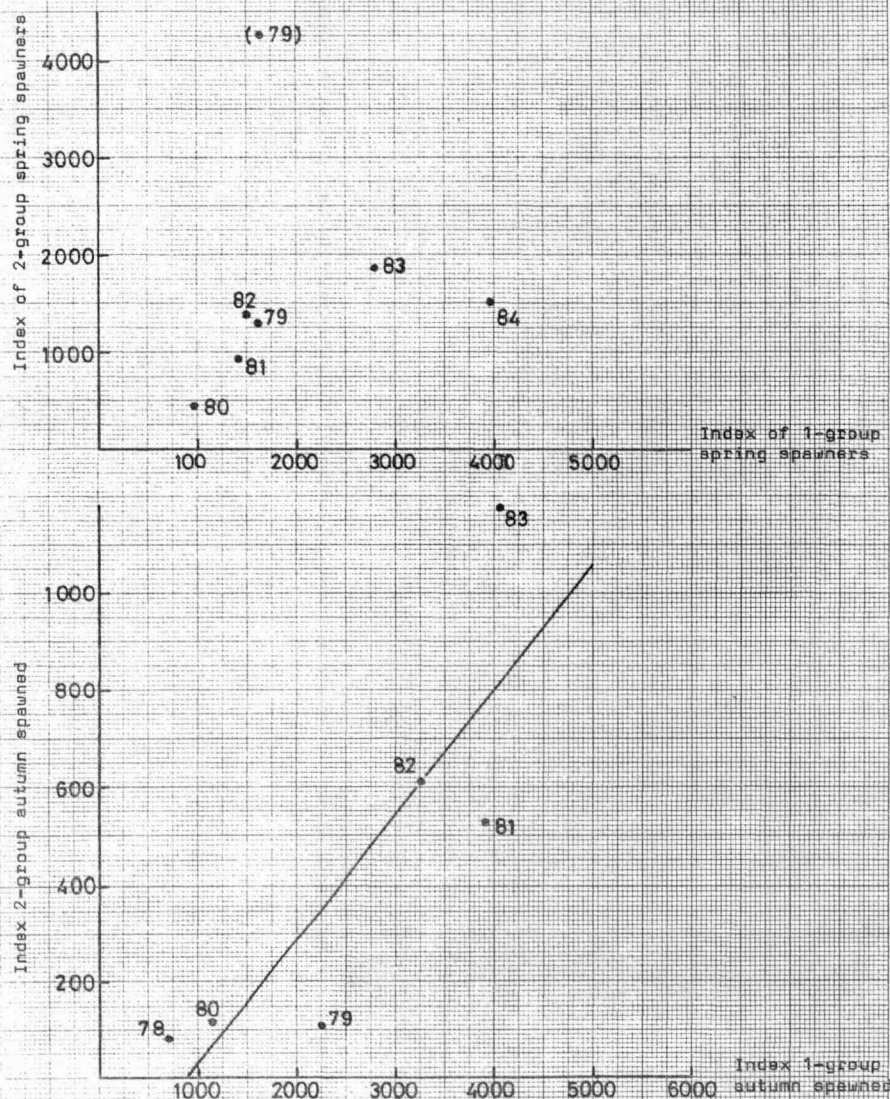
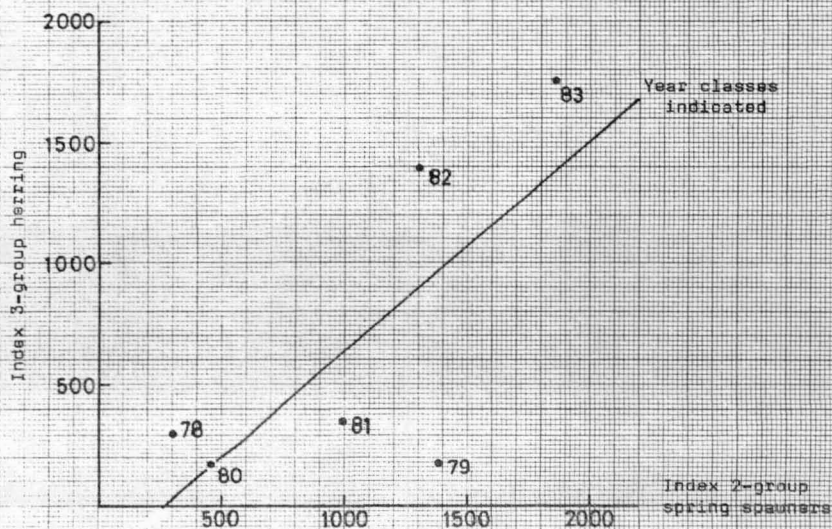
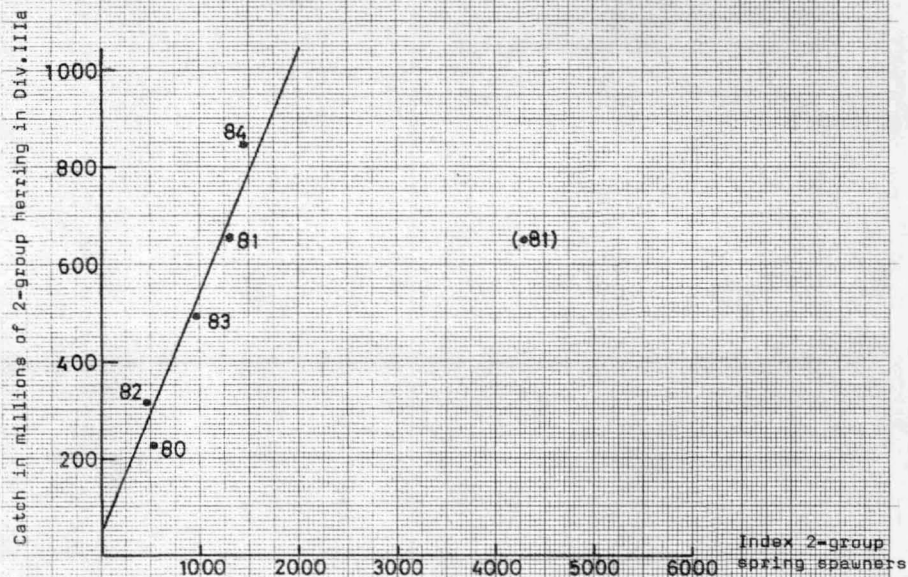


Figure 3.4.2 Regression on 2-group spring spawners on catches in millions of the 2-group and on the 3-group indices.



# FISH STOCK SUMMARY

## STOCK: Herring - Celtic Sea and VIIj

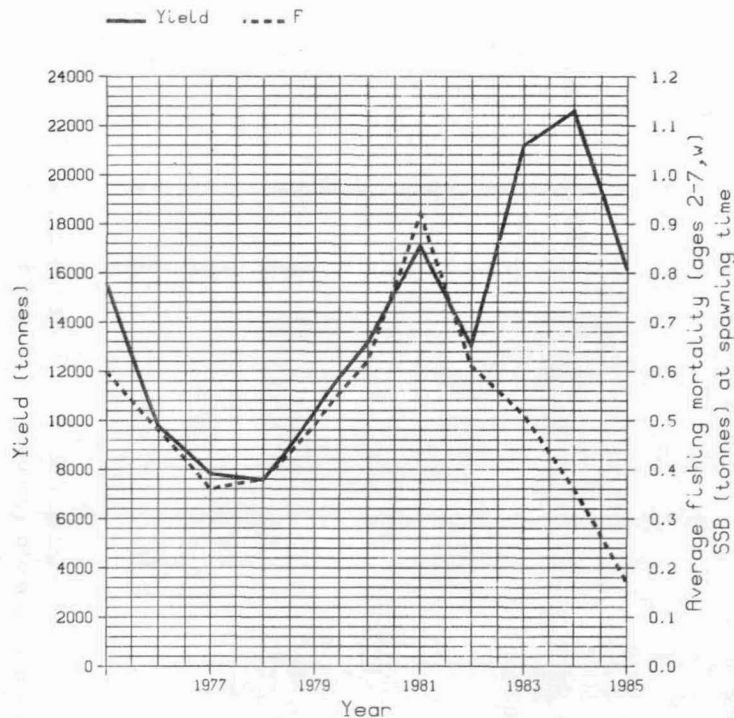
### 10-4-1986

Figure 4.7.1

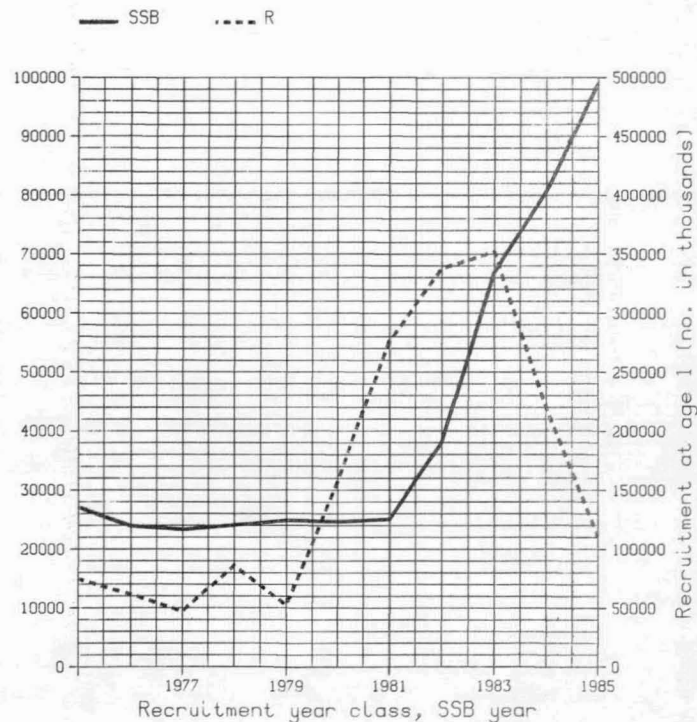
196

Trends in yield and fishing mortality (F)

Trends in spawning stock biomass (SSB) and recruitment (R)



**A**



**B**

cont'd.

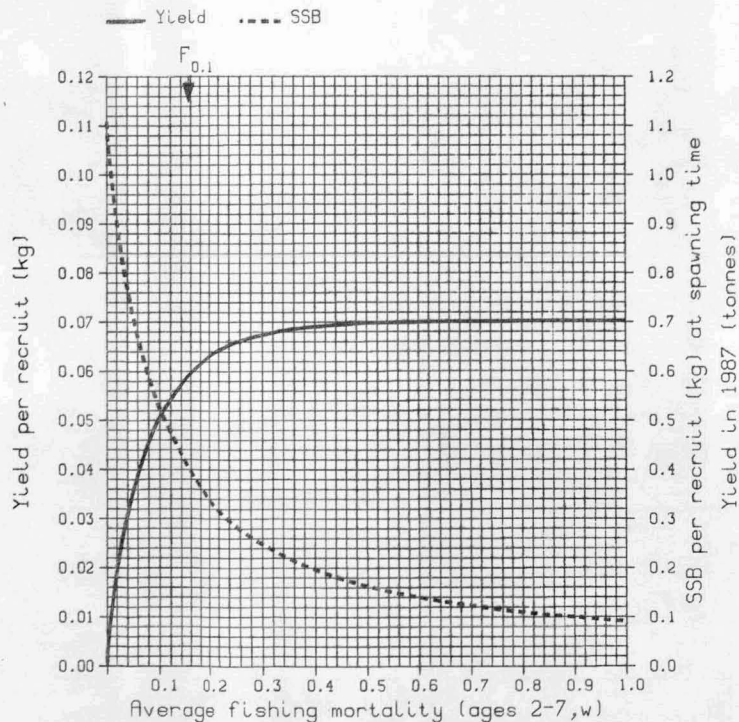
# FISH STOCK SUMMARY

## STOCK: Herring - Celtic Sea and VIIj

### 10-4-1986

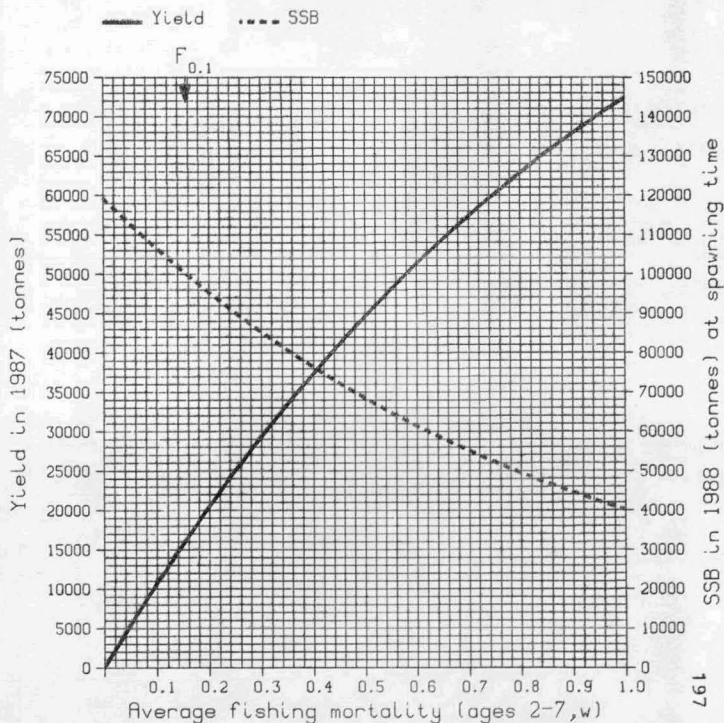
Figure 4.7.1 cont'd.

Long-term yield and spawning stock biomass



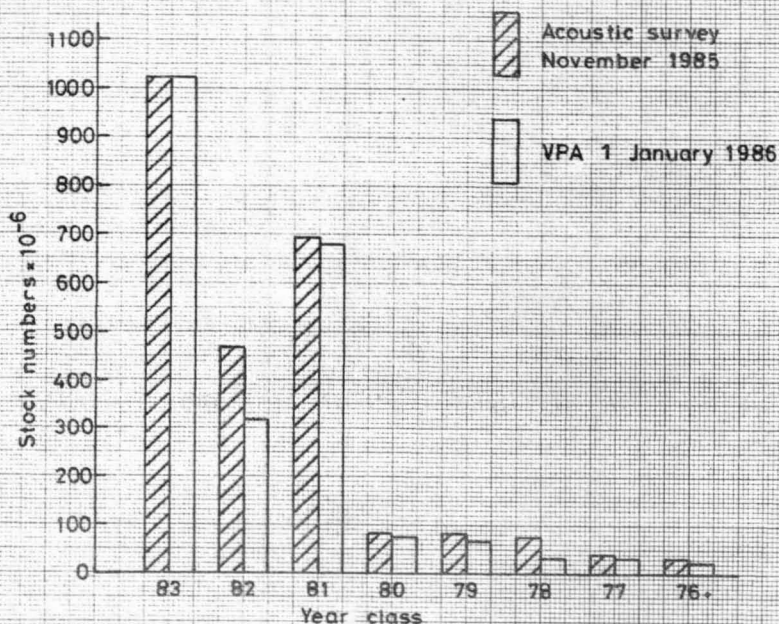
C

Short-term yield and spawning stock biomass



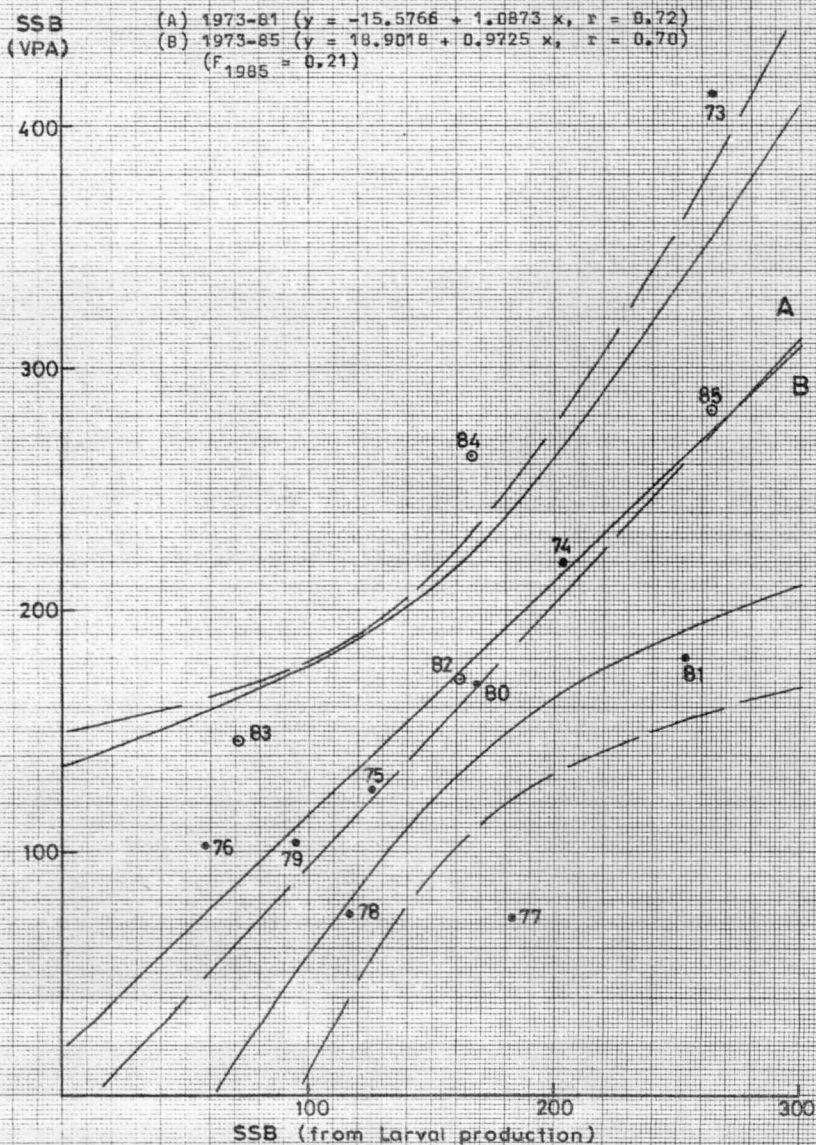
D



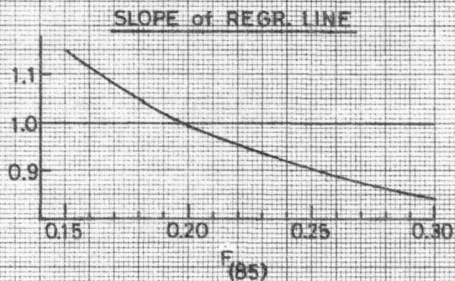
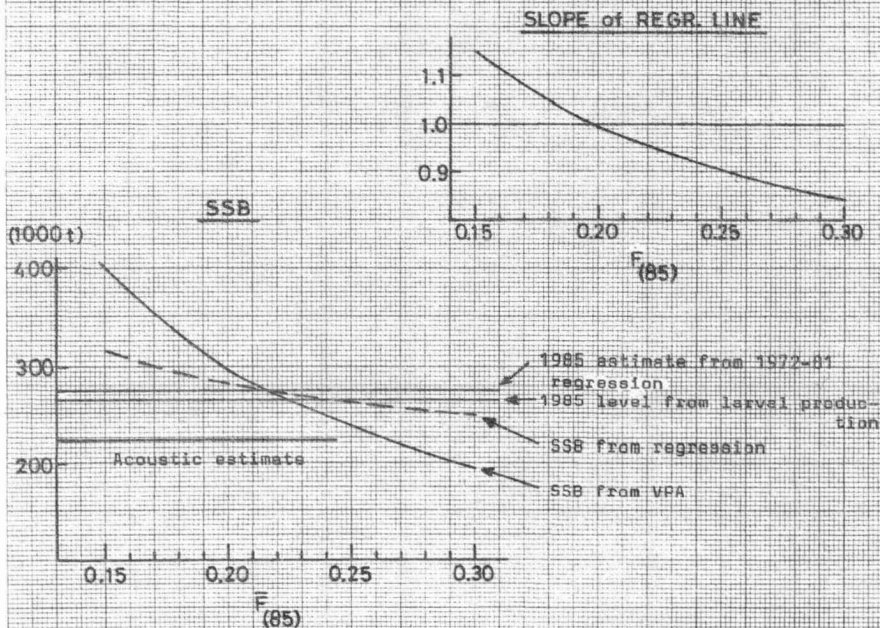
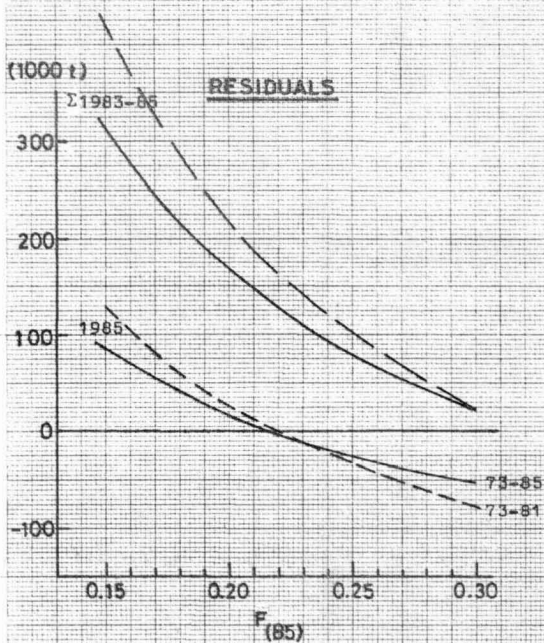


**figure 5.1.1** Comparison of year class numbers in Division VIa (North) calculated from an acoustic survey carried out in November 1985 and from a VPA relating to the situation on 1 Jan 1986. The VPA estimate of the 1983 year class was calculated from the 1-ringer catch in 1985 by applying the same exploitation pattern as in previous years, i.e. 20% of  $F$  on ages 2-7.

Figure 5.1.2 HERRING, VIA NORTH. Spawning biomass from larval production and from VPA. Points are labelled by years.







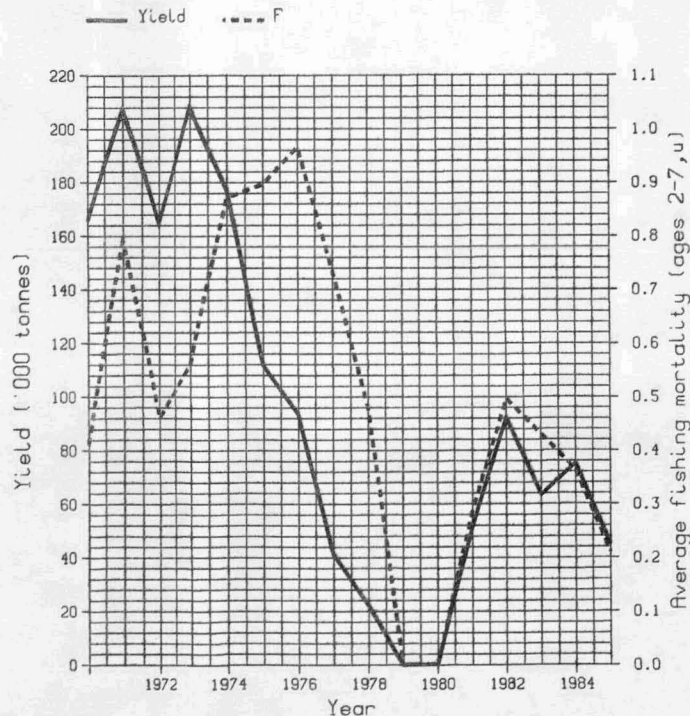
# FISH STOCK SUMMARY

## STOCK: Herring - Vla North

28-4-1986

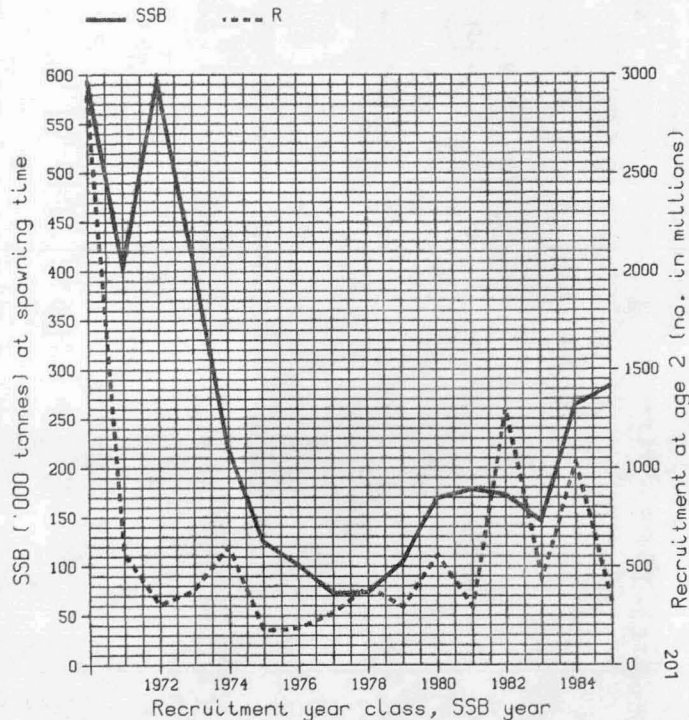
Figure 5.1.4

Trends in yield and fishing mortality (F)



**A**

Trends in spawning stock biomass (SSB) and recruitment (R)



**B**

cont'd.

Figure 5.1.4 contd.

# FISH STOCK SUMMARY

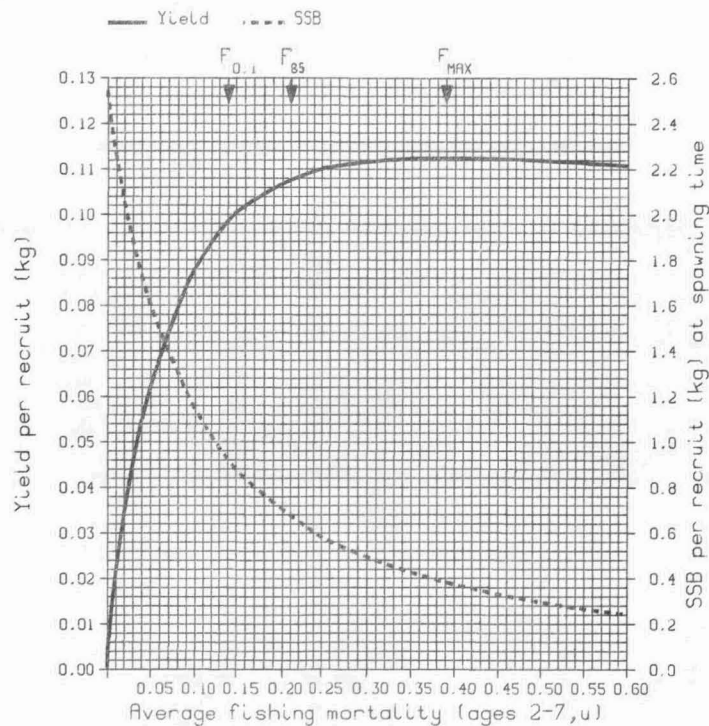
STOCK: Herring - VIa North

28-4-1986

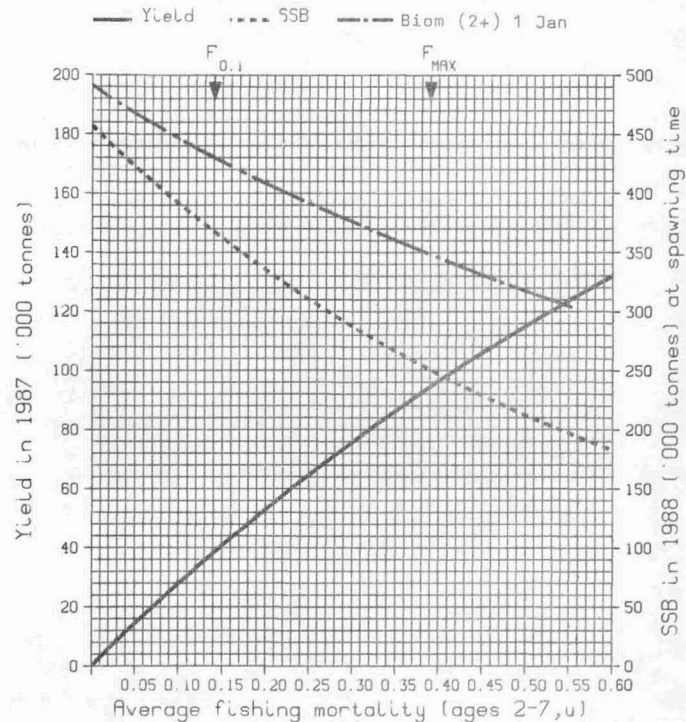
202

Long-term yield and spawning stock biomass

Short-term yield and spawning stock biomass



C



D

Figure 6.3.1 Trends in spawning stock biomasses produced with different input  $F$  values and trends in larval indices.

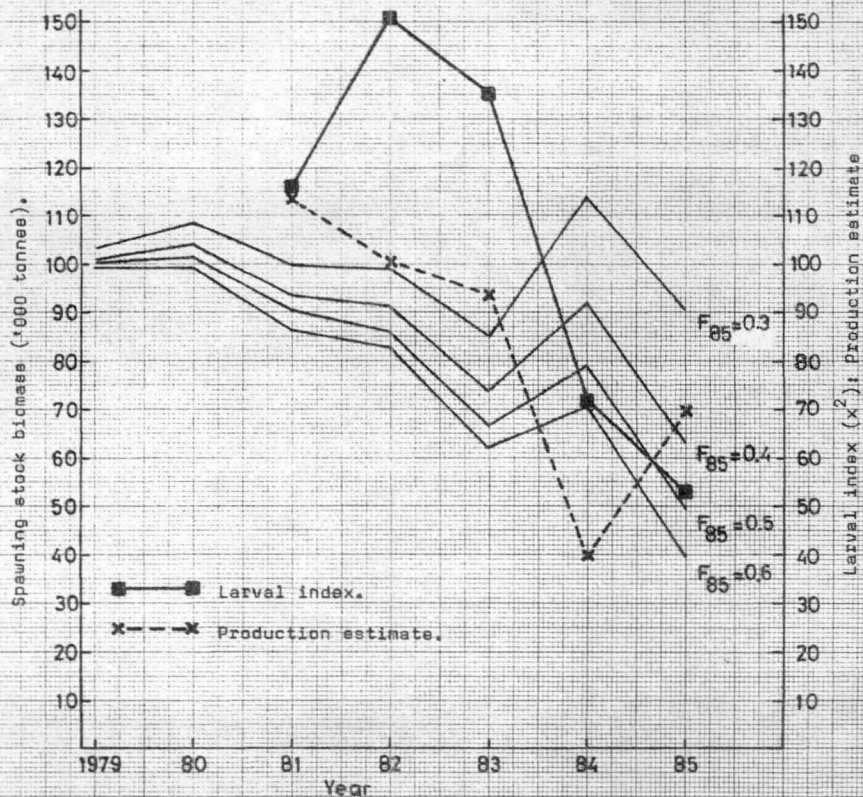
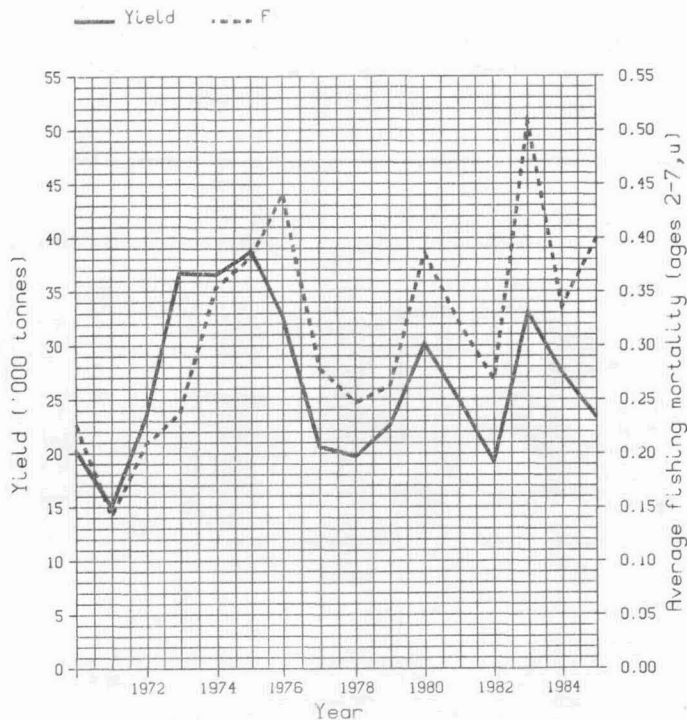


Figure 6.3.2

# **FISH STOCK SUMMARY** **STOCK: Herring - VIa S and VIIb** **25-4-1986**

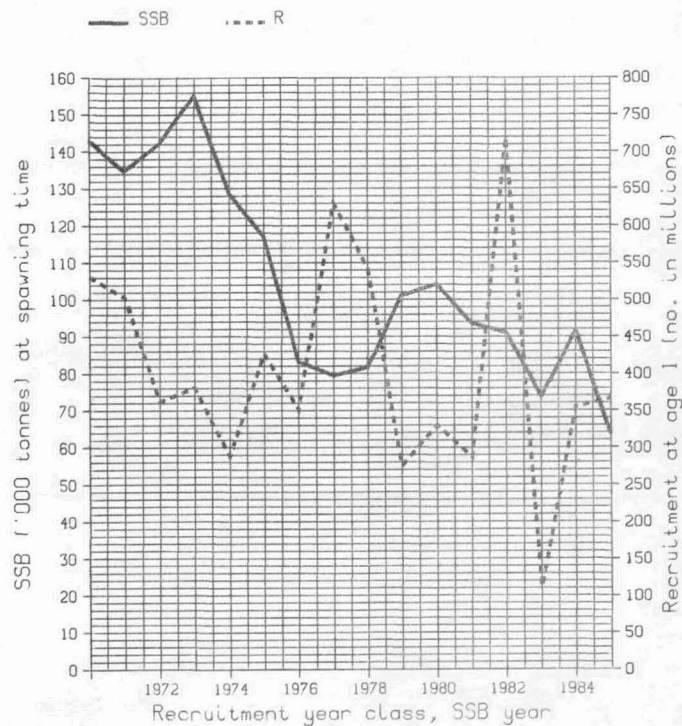
204

Trends in yield and fishing mortality (F)



A

Trends in spawning stock biomass (SSB) and recruitment (R)



B

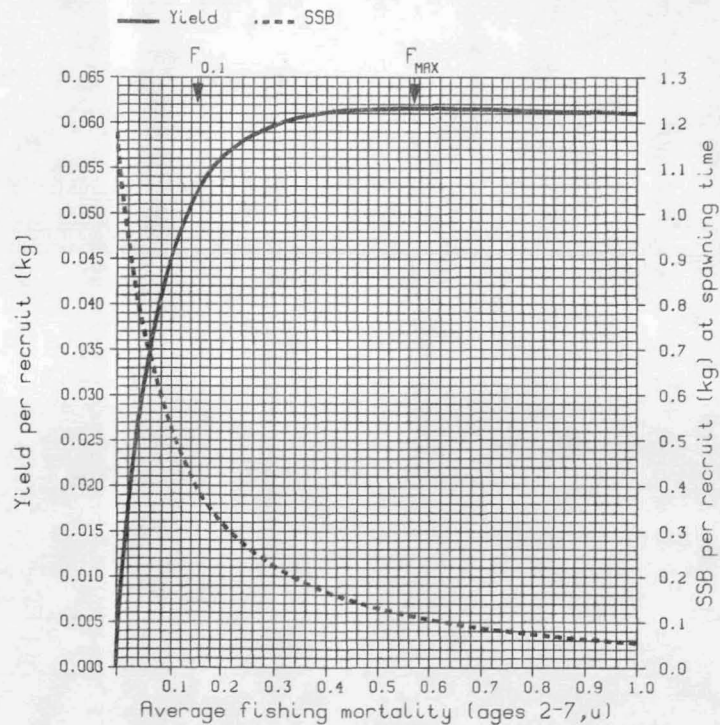
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Figure 6.3.2 cont'd.

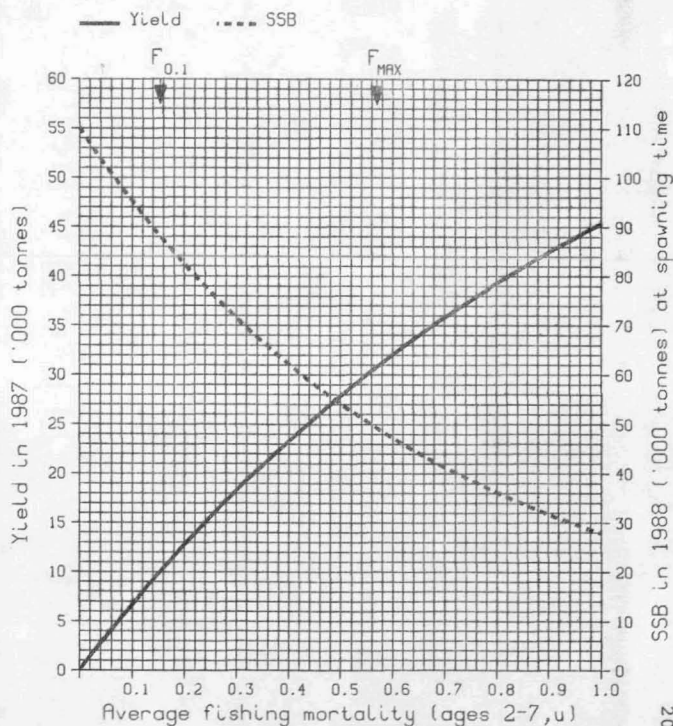
# **FISH STOCK SUMMARY** **STOCK: Herring - Vla S and VIIb** **25-4-1986**

Long-term yield and spawning stock biomass



C

Short-term yield and spawning stock biomass



D

Figure 7.5.1 HERRING in the North Irish Sea (Vila).  
Spawning stock and recruits. Data from  
VPA with  $F_{1985} = 0.3$ .

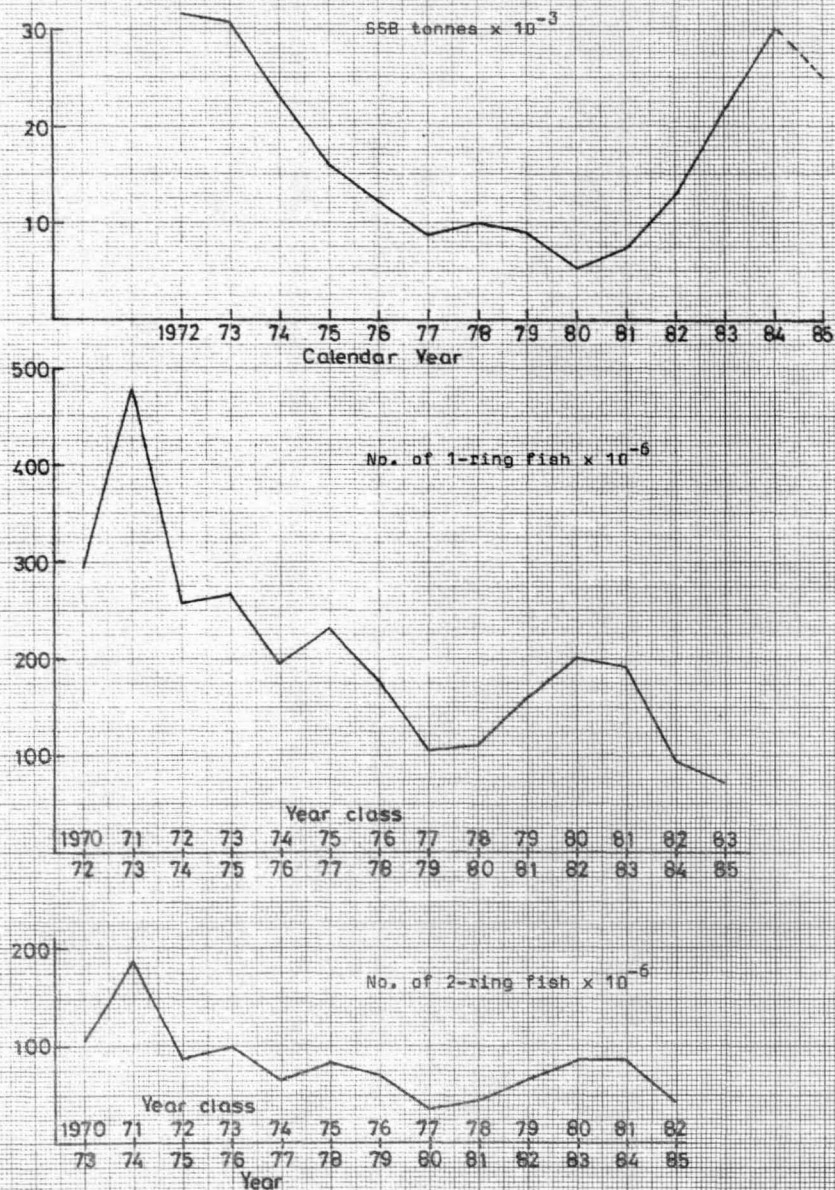
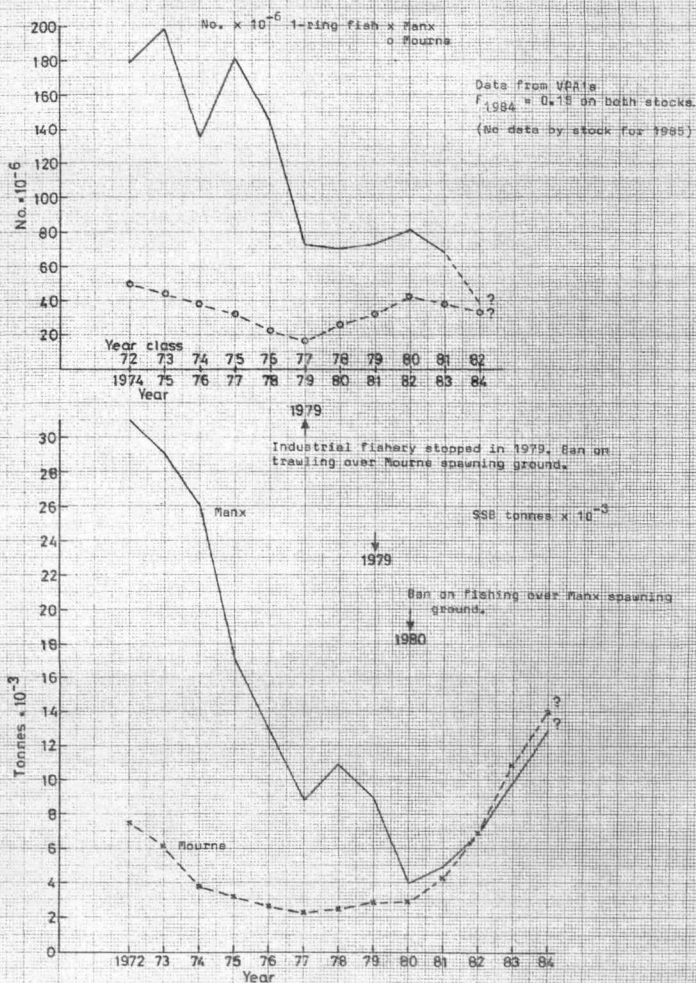


Figure 7.5.2 MANX & MOURNE HERRING. Stock and recruitment trends, Division VIIa, 1972-84.





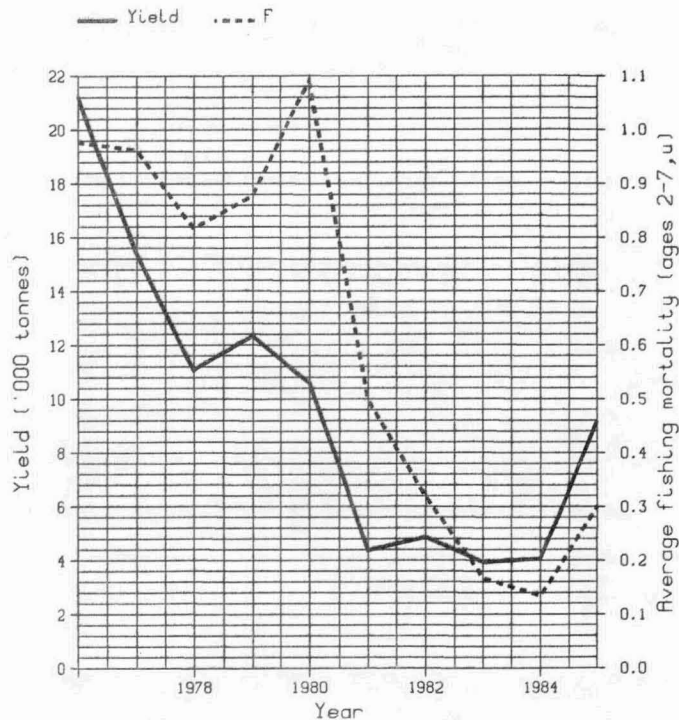
# FISH STOCK SUMMARY

## STOCK: Herring - Northern Irish Sea

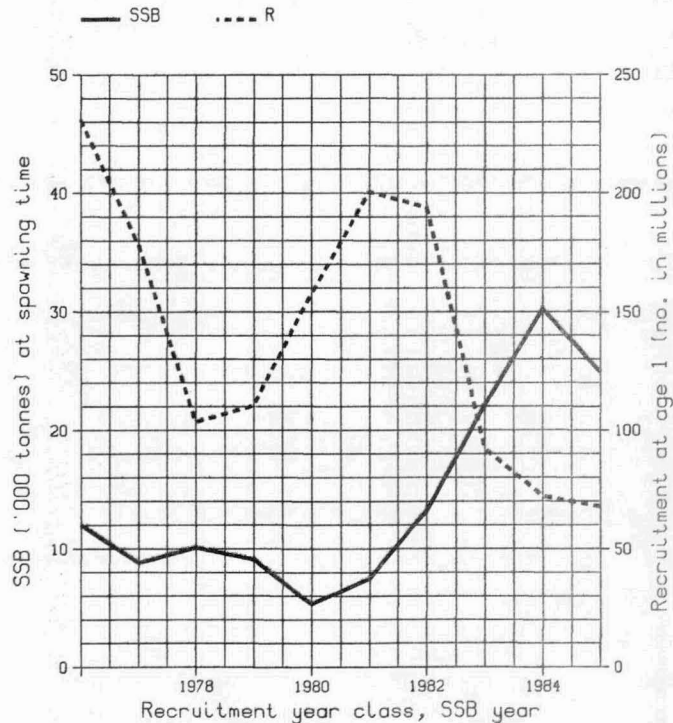
### 25-4-1986

Table 7.5.3

Trends in yield and fishing mortality (F)

**A**

Trends in spawning stock biomass (SSB) and recruitment (R)

**B**

cont'd.

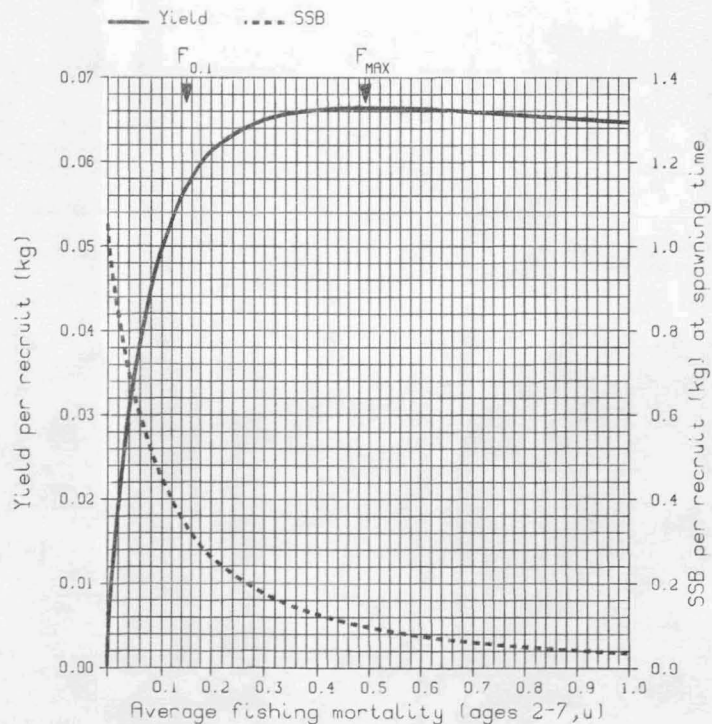
# FISH STOCK SUMMARY

## STOCK: Herring - Northern Irish Sea

25-4-1986

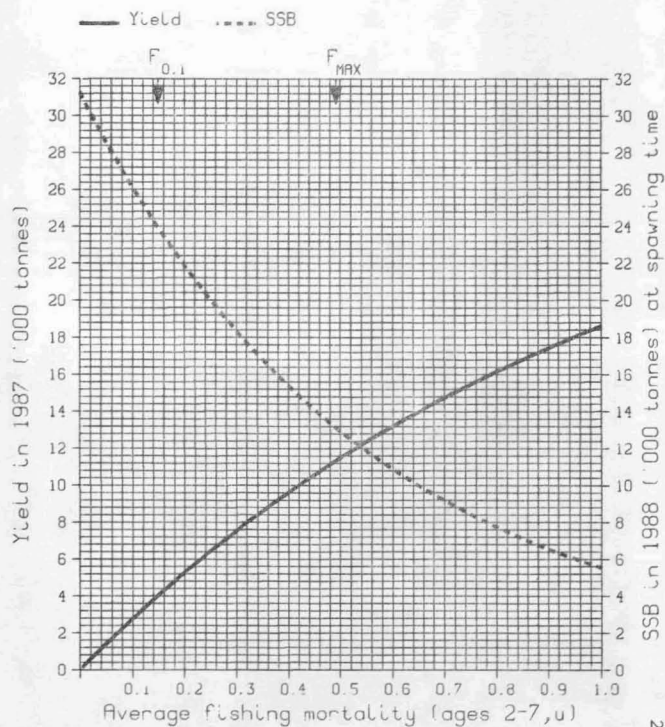
Table 7.5.3 cont'd.

Long-term yield and spawning stock biomass



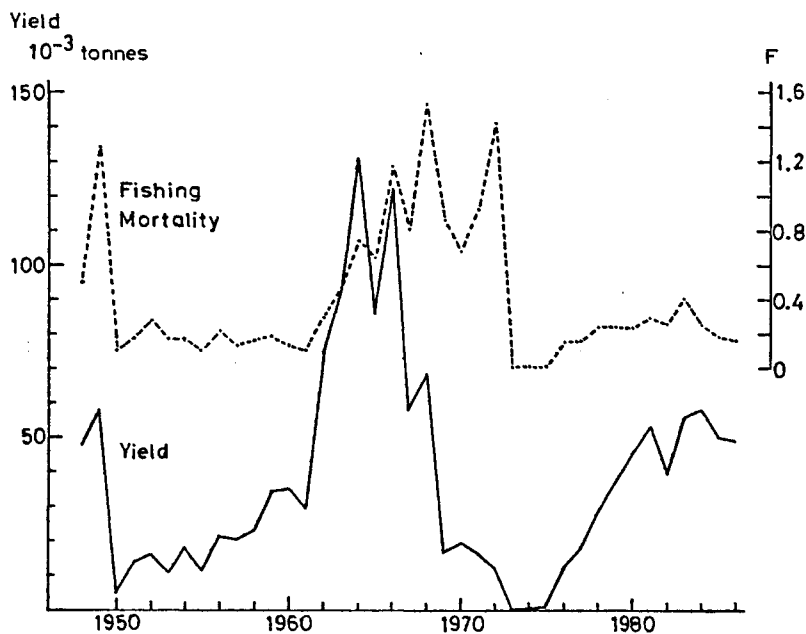
C

Short-term yield and spawning stock biomass



D

Figure 8.4.1 Trends in yield and fishing mortality (F).  
Icelandic (Division Va) summer-spawning herring.



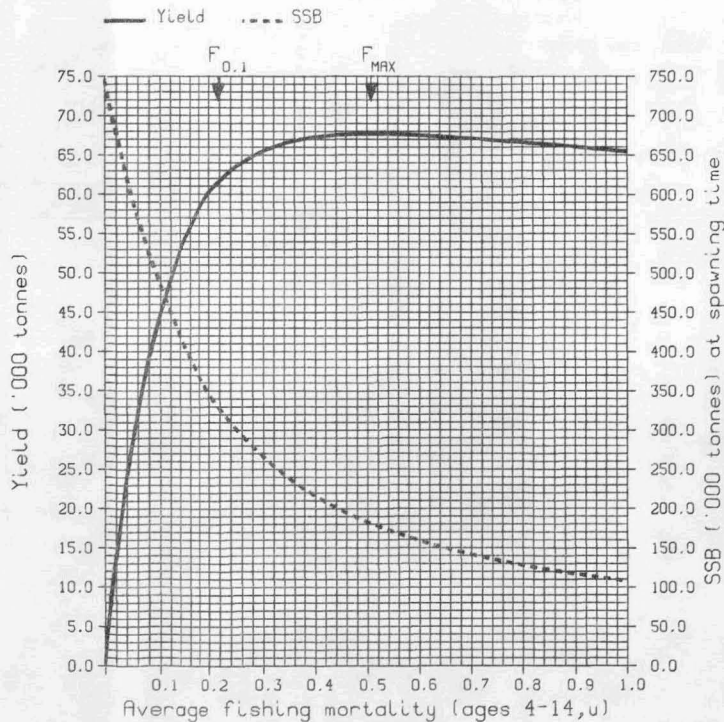
# FISH STOCK SUMMARY

## STOCK: Herring - Va (summer)

07-4-1986

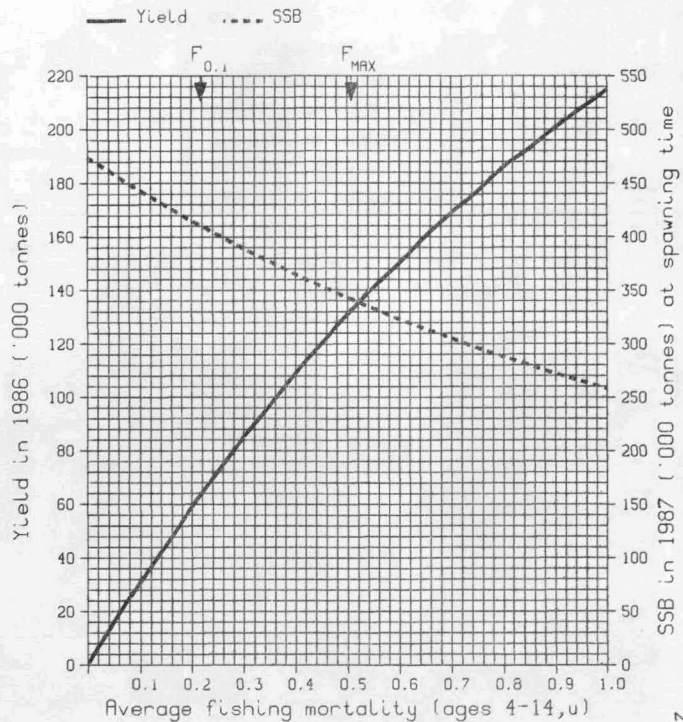
Figure 8.4.2

Long-term yield and spawning stock biomass



C

Short-term yield and spawning stock biomass



D

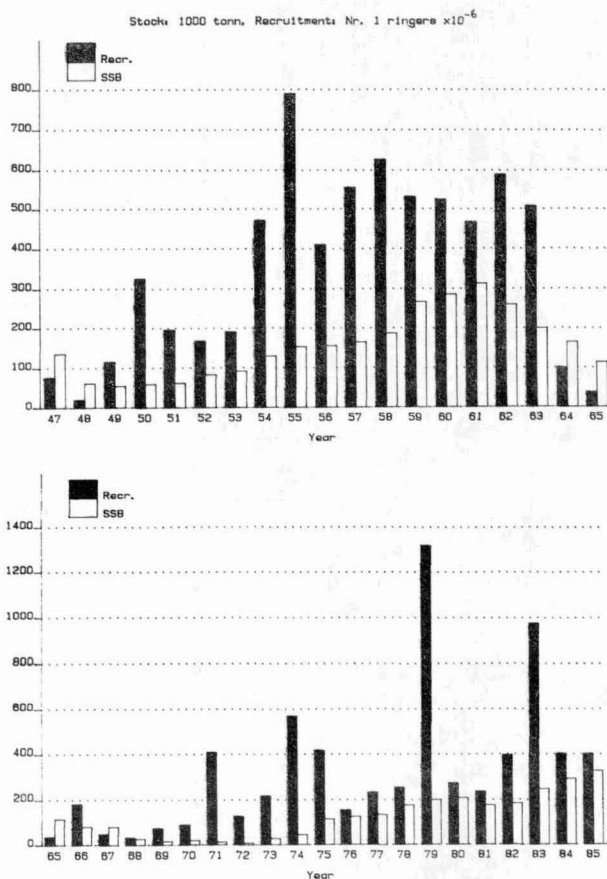


Figure 8.4.3 Trends in spawning stock biomass (SSB) and recruitment (Recr.). Recruitment year class, SSB year.  
(Note different scale in different sections of graph).