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International Council for the
Exploration of the Sea

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Demersal Fish Committee

REPORT OF THE SAITHE (COALFISH) WORKING GROUP

Charlottenlund, 13 - 17 February 1978

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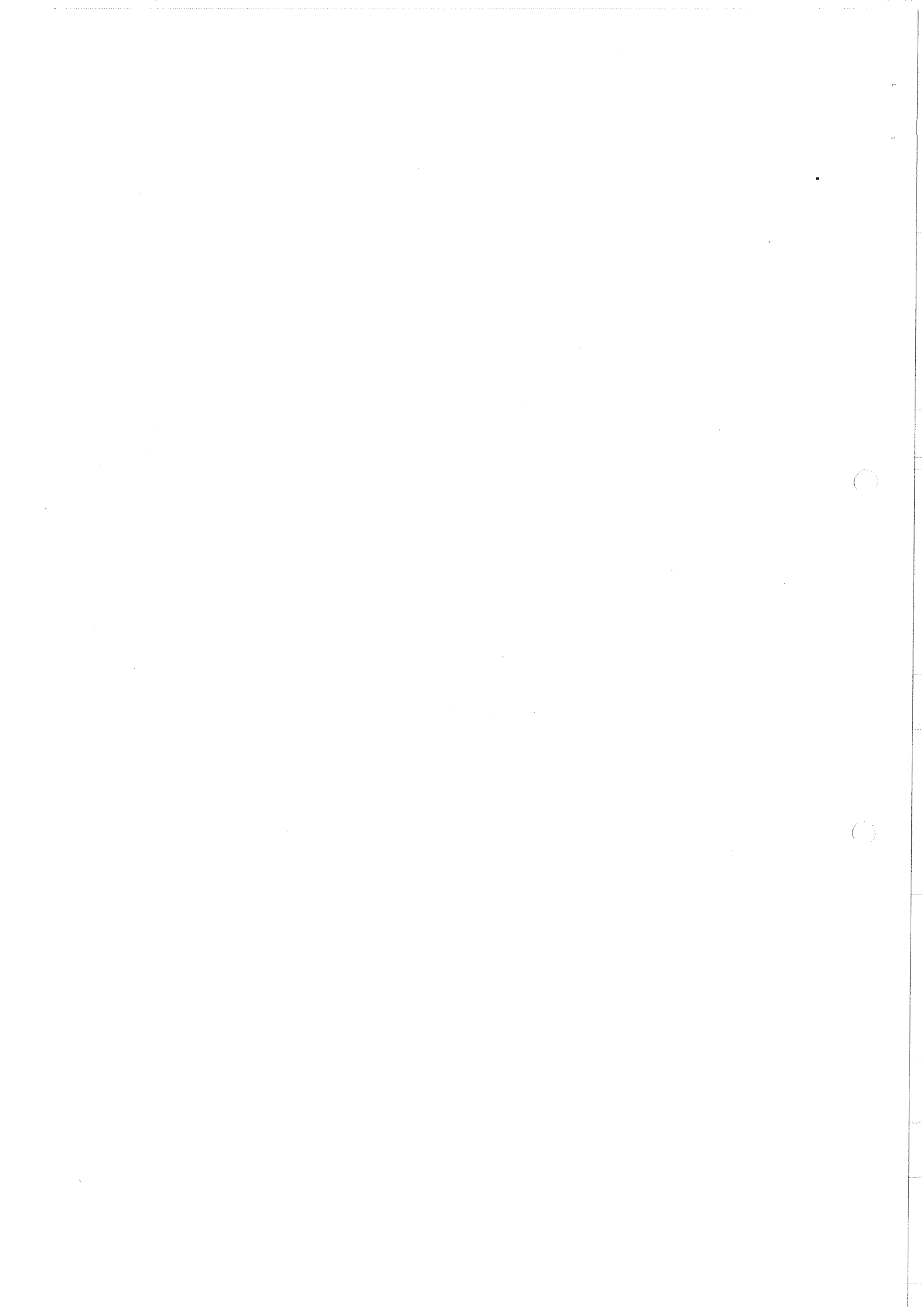
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REPORT OF THE SAITHE (COALFISH) WORKING GROUP

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V M Nikolaev, ICES Statistician, also participated in the meeting.

2. TERMS OF REFERENCE

At the 65th Statutory Meeting of ICES it was decided (C.Res.1977/2:20) that the Saithe Working Group should meet at Charlottenlund to:

- (a) assess TACs for 1979
- (b) identify and specify in detail shortcomings and gaps in data required for stock assessment work, and
- (c) review and update the "Review of Fish Resources" given in the Appendix to the report of the 1977 meeting of the Working Group (C.M.1977/F:3, Appendix).

3. LANDINGS AND CHANGES IN THE FISHERIES

From 1970 to 1976 total landings of saithe from the main fishing areas of the North-East Atlantic were in the range of 640 000 - 720 000 tons and averaged 675 000 tons over these seven years (Table 1). Preliminary reported landings for 1977 are 504 000 tons representing a fall in catches of 200 000 tons from the amount taken in 1976. To some extent the reduction in catch is due to a deterioration in some of the stocks, but a major factor affecting the fisheries in 1977 was the extension of the coastal state jurisdiction and the subsequent restrictions imposed on third countries which limited their access to the fishing grounds. Landings lower than in 1976 were recorded for all the main fishing areas except Faroe. Landings by country for each fishing area are given in Tables 2-6. In the North Sea significant quantities of saithe are taken as by-catches in the industrial fisheries of Denmark and Norway, and the estimated quantities landed in these fisheries are shown separately in Table 3. This year, for the first time, the landings from the Norwegian industrial fisheries were included in the assessments.

Changes in fisheries resulting from extended coastal state jurisdiction have made it more difficult than usual to estimate for 1977 both the overall levels of fishing mortality and the exploitation patterns. These difficulties are discussed in more detail in the following sections.

4. VIRTUAL POPULATION ANALYSIS (VPA) INPUT DATA AND RESULTS

4.1 North-East Arctic (Tables 7-9)

Provisional age compositions of landings in 1977 were available for Norway, England, Federal Republic of Germany and German Democratic Republic, accounting for 91% of the total landings for the area. During

1977 fishing by non-coastal states was restricted by quota. It was estimated that this resulted in a reduction in effort by third countries to about 50% of the 1976 level. This would be reflected in the fishing mortality predominantly on the older age groups. The 1977 input F values for the VPA have taken this into account. The F values assumed for age groups 1 and 2 were probably overestimates and produce low estimates of the size of the 1975 and 1976 year classes. No independent information is available on the strengths of these year classes and for catch predictions they are assumed to be of average abundance.

4.2 North Sea (Tables 10-12)

Age composition data were available from England, Scotland, Netherlands, Norway (human consumption), France, Federal Republic of Germany and the German Democratic Republic the landings of which countries accounted for 58% of the total catch from the area. Last year, separate age compositions were estimated for by-catches in the Danish industrial fishery for the years 1970-76. In 1977 the Danish industrial by-catch was reported to be only a small quantity (1 803 tons), and it was believed that the age composition was closer to that of landings for human consumption. Accordingly, the whole Danish catch was assumed to have an age composition equivalent to the summed age compositions for those countries for which age data were available. This year, for the first time, by-catches from the Norwegian industrial fisheries since 1972 were included in the assessments, and the age compositions were taken to be the same as those which were used for the Danish industrial by-catch. The quantities of saithe from the industrial fisheries appear very variable, but the Group noted that data on both quantities landed and their age compositions are very inadequate and no great reliance can be placed on them.

As a consequence of the relatively poor quality of the available data, and because of changes in the fisheries following extended jurisdiction, it has become more difficult than usual to estimate the overall level of fishing mortality and the exploitation pattern. However, limitations on fishing by non-coastal states have almost certainly resulted in a reduction in fishing mortality compared with 1976. In retrospect, however, it does appear that the 1976 F values assumed for VPA in last year's assessment were too low. The input F values used in the current assessment give 1976 F estimates which are not only higher than both the assumed 1977 values, as would be expected from the changes in the fishery, but are also higher than the input values used last year for 1976.

4.3 Iceland (Tables 13-15)

Age composition data for 1977 were available for landings by Iceland and the Federal Republic of Germany which, together, accounted for 94% of the total catch from the area. The input F values took account of a reduction in fishing effort and also the increase to 155 mm in the minimum trawl cod-end mesh size introduced in 1977.

4.4 Faroe (Tables 16-18)

Age composition data were available for landings by England, Scotland, Faroes, France and the Federal Republic of Germany whose catches accounted for 96% of the total catch from the area. There appears to have been little change in the amount of fishing on saithe at Faroe and the input F values for 1977 are the results of trial runs to produce a result with similar F values in the last two years.

4.5 West of Scotland (Tables 19-21)

In past years, age composition data have been available for England (from 1960) and Scotland (from 1972). Scottish landings from this

area have included a proportion of fish caught in the Clyde in which the younger age groups predominate. Thus, age compositions of Scottish landings would not be expected to be comparable with those of other countries. Accordingly, in earlier assessments it had to be assumed that landings by other countries had the same age compositions as English landings. Since 1971, landings by France have been increasing and have accounted for about half the total catch. It was recently suggested that French landings contained a larger proportion of older fish than English landings and the use of the English age composition was likely to bias the assessments. Attempts were made to correct for this in the current assessment. Length compositions were provided for French landings made in 1976 and 1977, and these were converted to age using English age/length keys. The resultant age compositions for France were then compared with the corresponding age compositions for both England and Scotland and the relative abundance of age groups was calculated (Table 22). The French-Scottish comparison was less variable and this was used to reconstruct age compositions for French landings for 1972-75 using Scottish age compositions and correcting for the different relative abundance of the age groups. As a result of this treatment of French landings, the current assessment cannot be compared with earlier ones, and within this assessment, the data series is only consistent for the period 1972-77. An age composition for 1977 was available for the Federal Republic of Germany.

French landings per unit effort data were used to estimate the total international fishing effort on the West of Scotland saithe stock for the period 1971-77 (Table 23). Since fishing effort in 1977 appeared to be similar to that in 1972-73, a set of F -at-age values to initiate the VPA was chosen for 1977 which produced a reasonably similar set of values in 1972 and 1973. Having obtained the 1977 values, F at ages 1 and 2 were then adjusted to produce average recruitment (53 million fish at age 1) in 1976 and 1977. The level of fishing mortality estimated in this way is appreciably lower than that estimated in earlier assessments and for this reason estimated stock sizes are higher than was previously the case.

5. STATE OF THE STOCKS AND CATCH PREDICTIONS

5.1 North-East Arctic (Tables 24 and 29)

For the catch predictions the exploitation pattern was unchanged from that used as input into the VPA. No information is available on the strengths of recruiting year classes and average recruitment has been assumed for year classes 1975 and later. At the time of the meeting, there was no agreed TAC for 1978. If fishing effort in 1978 continues at the 1977 level, a fishing mortality of 0.5 on the fully exploited age groups would be expected to give a catch of 184 000 tons, but if fishing mortality was reduced to $F = 0.4$, in accordance with the Working Group's recommendation of last year, then the expected catch for 1978 would be 152 000 tons. The yield per recruit curve for the current exploitation pattern (Figure 1) gives a value of $F_{max} = 0.3$. For 1979, a reduction in F to $F_{max} = 0.3$ would be expected to give catches of 118 000 or 134 000 tons depending on whether F_{1978} was 0.5 or 0.4 (Table 29). If fishing mortality was maintained at $F = 0.5$ through 1978 and 1979, catches would be maintained at the 1977 level. Although a reduction in fishing mortality would result in reduced catches in the short term, they would increase again in the longer term, although the long-term yield, assuming average recruitment, for $F = 0.3$ would only be 4% higher than for $F = 0.5$ (194 000 tons compared with 187 000 tons). For all the options considered the decline in the spawning stock biomass from 1970-77 will be reversed, and by 1980 the biomass can be expected to reach a level which in the past years has resulted in the production of abundant year classes. It is proposed that

fishing mortality should be reduced to F_{\max} . An initial step in this direction could be made in 1979 by setting a TAC of 153 000 tons which would generate an $F = 0.4$.

5.2 North Sea (Tables 25 and 29)

As mentioned, the data base for the North Sea is rather poor compared with some of the other areas. The reported provisional 1977 catch was appreciably below that for 1976 and the fishing mortality on the fully exploited age groups was estimated to be 0.4. Of recent year classes, that of 1973 is known to be very abundant and will begin recruiting to the spawning stock in 1978. The size of subsequent year classes is not known with any certainty, and average recruitment (based on year classes 1971-75) has been used for year classes 1976 onwards. The yield per recruit curve indicates $F_{\max} = 0.25$, but in view of the uncertainty about the current exploitation pattern, this value should be treated with some caution.

No TAC has yet been agreed for 1978, but it is likely to be about 230 000 tons. This is the level of catch that would be expected if fishing effort was maintained at the 1977 level ($F_{1978} = 0.4$ gives a predicted catch of 223 000 tons). For 1979, an increase in fishing mortality above $F = 0.4$ could be expected to reduce the spawning stock. On the other hand, a reduction to $F_{\max} = 0.25$ would necessitate a substantial reduction in catch. In view of the uncertainties with regard to the present state of exploitation, it is proposed that fishing should continue at the estimated present level in which case a catch of 230 000 tons would be expected for 1979.

5.3 Iceland (Tables 26 and 29)

Catches at Iceland have been falling since 1971 as a result of recruitment to the stock of less abundant year classes than in former years. So far, there is no indication of any improvement in recruitment. For the catch predictions the abundance of the 1974 and subsequent year classes have been assumed to be equal to the average size of the year classes 1969-73 (i.e., continuing at a low level). The yield per recruit curve gives a value of $F_{\max} = 0.55$ whereas the current fishing mortality on the fully exploited age groups is estimated to be 0.4. If fishing mortality in 1978 and 1979 is permitted to rise above the current level, the spawning stock biomass would be expected to continue to decline, but this could be prevented if fishing mortality does not rise above 0.4 (Table 29). For $F = 0.4$ in 1978-80 the expected catch in each of these years is 58 000 tons.

5.4 Faroe (Tables 27 and 29)

The lower level of catches in the last two years compared with 1972-75 result from combination of reduced fishing and lower recruitment. Catch predictions have been made for two levels of recruitment of 29 000 000 at two years old (based on average of year classes 1964-73) and 26 000 000 (average for year classes 1970-73). The exploitation pattern used for 1978 and 1979 has been adjusted from that used for 1977 to take account of the increase in minimum trawl cod-end mesh size in 1978. The yield per recruit curve for this revised exploitation pattern gives a value of $F_{\max} = 0.45$. The results (Table 29) indicate that any increase in fishing mortality above the 1977 level would result in a continuation of the declining trend in spawning stock biomass. This decline could be halted if fishing mortality was maintained at the 1977 level. In view of the poorer recruitment in recent years, the Group considers it more prudent to base future management on predictions based on an average recruitment of 26 000 000 rather than 29 000 000 fish. On this basis and assuming no increase in fishing mortality in 1978-79, the predicted catch for 1979 is 31 000 tons.

5.5 West of Scotland (Tables 28 and 29)

As for the North Sea, the data base for the West of Scotland is less reliable than for the other areas, and because of the treatment of the French catches, the age composition data are only consistent from 1972. These revisions to the data have given a completely different exploitation pattern and this together with the changed catch age composition has resulted in much higher stock sizes than were previously estimated. The revised exploitation pattern has also resulted in a completely new yield per recruit curve and the current estimated fishing mortality on the fully exploited age groups ($F = 0.35$) is now below $F_{max} = 0.45$ on the yield curve. Recruitment for year classes 1975 and later has been assumed to be equal to the average for year classes 1971-1974. Estimates of spawning stock biomass indicate a slight declining trend since 1973, but at the present time it is difficult to assess whether this trend is significant. If fishing mortality in 1978 is maintained at $F = 0.35$, the expected catch for that year will be 31 000 tons which is about the same level as is now being considered for adoption as the 1978 TAC (30 000 tons). If this TAC is adopted for 1978 ($F = 0.35$) fishing mortality in 1979 would have to be reduced to $F = 0.21$ to prevent a further decline in spawning stock size in 1979 and the corresponding catch would be 20 000 tons. An increase in fishing mortality in 1979 to $F_{max} = 0.45$ would give a catch of 38 000 tons. Maintaining $F = 0.35$ through 1978 and 1979 would yield 32 000 tons in 1979 (Table 29). In view of the limited reliability of the assessment for this stock, it is suggested that the best management option would be to maintain the catch at the current level for 1978 and 1979 and set TACs for both of these years of 32 000 tons.

6. RECOMMENDED TACs FOR 1979

TACs recommended for 1979 are given below. These are dependent on the magnitude of catches taken in 1978.

Area	Recommended TAC 1979 (tons)	F_{1979}	Expected catch 1978 (tons)	F_{1978}
North-East Arctic	153 000	0.4	184 000	0.5
North Sea	230 000	0.4	223 000	0.4
Iceland	58 000	0.4	58 000	0.4
Faroe	31 000	0.35	31 000	0.35
West of Scotland	32 000	0.35	32 000	0.35

7. SHORTCOMINGS AND GAPS IN DATA REQUIRED FOR STOCK ASSESSMENT PURPOSES

The Working Group reviewed the quality of data available for saithe stock assessments and identified the following gaps and shortcomings:

- (a) North Sea industrial by-catches. - Data are inadequate in respect of both the quantities and the age compositions of catches taken in the industrial fisheries.
- (b) Effort data. - These are required for directed saithe fisheries.
- (c) Age composition data. - These are required for French saithe landings from the West of Scotland area.
- (d) Recruitment. - No information has been available to indicate the strength of year classes before recruitment. Although such data would be extremely useful, the Group considered that reliable indices of pre-recruit year class strength would be very difficult to obtain.

- (e) Weight at age data. - Changes in the minimum cod-end mesh sizes and changes in the distribution of catches between the countries fishing for saithe are likely to result in changes in the average selection of some of the age groups with a consequential alteration in the average weight at age. This should be kept under review as should changes in growth rate.
- (f) North Sea age composition data. - Some countries fishing saithe in the North Sea do not collect, or are not submitting, data for the age composition of their catches.

Table 1. Summary of total landings of Saithe from the main fishing areas (in metric tons, whole weight). This table is based on the biological data supplied to the Working Group and used in the assessments. These figures differ to some extent from the official Bulletin Statistique data, which are used for Tables 3-7.

(Includes industrial fishery by-catch by Denmark and Norway)

Year	Fishing area					Total
	NE-Arctic	IV+IIIa	Va	Vb	VI	
1960	136 006	31 515	48 120	11 845	8 349	235 835
1961	109 821	35 489	50 826	9 592	6 723	212 451
1962	122 841	24 559	50 514	10 454	7 159	215 527
1963	148 036	30 300	48 011	12 693	6 609	245 649
1964	198 110	58 669	60 257	21 893	13 596	352 525
1965	184 548	73 274	60 177	22 181	18 395	358 575
1966	201 860	95 025	52 003	25 563	18 534	392 985
1967	191 191	76 759	75 712	21 319	16 034	381 015
1968	107 181	98 179	77 549	20 387	12 787	316 083
1969	140 379	115 550	115 853	27 437	17 214	416 433
1970	260 404	222 100	116 601	29 110	14 538	642 753
1971	244 732	252 619	136 764	32 706	19 246	686 067
1972	214 386	245 801	111 301	42 186	29 225	642 899
1973	214 153	225 771	110 888	57 574	35 812	644 198
1974	261 223	272 944	97 568	47 188	36 298	715 221
1975	233 453	278 126	87 954	41 578	30 949	672 060
1976	242 486	319 758	82 003	33 067	41 432	718 746
1977*	182 052	195 953	61 957	33 968	30 083	504 013

* Preliminary.

Table 2. Nominal catch (metric tons) of Saithe in Sub-area I and Divisions IIa and IIb, 1968-1977.
(Data for 1968-76 from Bulletin Statistique)

Country	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977*
Belgium	-	-	-	-	-	-	5	47	1	-
Faroe Islands	-	20	1 097	215	109	7	46	28	20	10
France	-	193	-	14 536	14 519	11 320	7 119	3 156	5 609	1 174
German Dem.Rep.	1 248	6 744	29 200	16 840	7 474	12 015	29 466	28 517	10 266	7 164
Germany, Fed.Rep.	4 753	4 355	23 466	12 204	24 595	30 338	33 155	41 260	49 056	19 728
Netherlands	-	23	-	-	-	-	-	-	64	-
Norway	96 641	115 140	151 759	128 499	143 775	148 789	152 699	122 598	131 675	132 120
Poland	-	-	-	6 017	1 111	23	2 521	3 860	3 164	-
Portugal	-	-	-	-	-	-	-	6 430	7 233	(1 000)
Spain	-	-	-	13 097	9 247	2 115	7 075	11 397	21 661	(4 100)
Sweden	-	-	-	-	-	-	-	8a)	-	-
UK (Engl.&Wales)	8 780	13 585	15 469	10 361	8 223	6 503	3 001	2 623	4 651	6 934
UK (Scotland)	2	-	221	106	125	248	103	140	73	100
USSR	-	-	43 550	39 397	1 278	2 411	28 931	13 389	9 013	9 722
Total	111 424	140 060	264 762	241 272	210 456	213 769	264 121	233 453	242 486	182 052

* Preliminary.

a) IIa includes smaller quantities taken in other areas than IIa, IV and IIIa,b,c,d.

Table 3. Nominal catch (metric tons) of Saithe in Sub-area IV and Division IIIa, 1968-1977.
(Data for 1968-76 from Bulletin Statistique)

Country	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977*
Belgium	94	135	36	44	59	55	33	81	127	55
Denmark ^{b)}	7 756	5 566	4 600	11 500	17 000	10 100	8 388	10 149	15 111	16 923
Faroe Islands	-	2	-	18	182	552	581	287	425	328
France	34 139	24 631	38 873	38 330	26 696	32 961	28 619	24 396	32 552	41 065
German Dem.Rep.	903	5 998	4 250	6 398	10 674	7 668	5 816	5 882	2 088	2 430
Germany, Fed.Rep.	6 066	7 242	6 022	4 217	8 665	12 003	20 589	18 622	38 698	26 325
Iceland	5	2	18	97	4	23	5	1	-	-
Netherlands	16 842	18 214	20 460	18 136	12 532	9 232	14 504	8 917	6 101	8 511
Norway ^{b)}	8 683	8 159	11 201	15 184	23 256	15 219	9 246	12 483	17 856	16 838
Poland	43	-	-	4	186	7 512	22 203	35 304	35 819	12 378
Spain	-	-	-	-	190	108	308	249	-	-
Sweden	8 212	4 322	1 921	4 523	3 899	1 876	1 187	913	1 212*	962 ^{a)}
UK (England & Wales)	3 925	3 819	2 664	3 162	3 744	3 378	4 353	3 472	6 300	6 495
UK (Scotland)	6 001	3 838	5 293	6 106	10 797	10 834	10 956	8 898	13 034	11 128
USSR	11 405	32 830	68 062	110 200	99 883	83 333	104 500	110 743	83 669	46 394
Sub-Total	104 074	114 758	163 400	217 919	217 767	194 854	231 288	240 397	252 992	189 832
BY-CATCH FROM INDUSTRIAL FISHERIES										
Denmark ^{b)}			58 700	34 700	22 600	24 400	38 800	27 800	53 684	1 803
Norway ^{b)}					5 434	6 517	3 469	9 878	13 082	4 932
TOTAL	104 074	114 758	222 100	252 619	245 801	225 771	273 557	278 075	319 758	196 567

* Preliminary.

a) From ICES Data Form 5.

b) Data for by-catch from industrial fisheries from national laboratories.

Table 4. Nominal catch (metric tons) of Saithe in Division Va, 1968-1977.
(Data for 1968-76 from Bulletin Statistique)

Country	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977*
Belgium	3 155	3 995	4 153	3 490	2 250	2 131	2 371	1 638	1 615	1 414
Faroe Islands	101	119	2 386	2 046	857	1 467	1 712	1 366	3 267	2 271
France	6 701	8 122	2 046	3 987	-	-	94	32	51	-
German Dem.Rep.	634	357	3 527	2 637	3 471	-	-	-	-	-
Germany, Fed.Rep.	17 327	34 732	27 806	40 628	30 918	38 565	18 627	13 820	13 785	10 487
Iceland	38 027	53 988	63 882	60 080	59 945	56 567	65 169	61 430	56 811	47 783
Netherlands	-	52	-	-	-	-	-	-	-	-
Norway	-	-	-	-	-	-	-	6	5	2
Poland	-	-	-	113	150	-	-	-	-	-
Spain	-	-	-	59	-	-	-	-	-	-
UK (England & Wales)	11 561	13 665	10 634	21 767	13 152	11 874	8 845	8 643	6 024	-
UK (Scotland)	982	1 605	2 402	1 743	545	509	731	1 021	443	-
USSR	90	65	-	5	-	-	-	-	-	-
Total	78 578	116 700	116 836	136 555	111 288	111 113	97 549	87 956	82 001	61 957

* Preliminary.

Table 5. Nominal catch (metric tons) of Saithe in Division Vb, 1968-1977.
(Data for 1968-76 from Bulletin Statistique)

Country	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977*
Belgium	-	-	-	-	-	-	-	-	6	-
Faroe Islands	2 629	4 835	2 694	5 653	5 646	2 973	3 726	2 517	2 560	5 121
France	424	7 899	11 036	12 394	24 006	22 676	20 457	23 980	15 367	16 564
German Dem.Rep.	-	-	-	-	-	-	130	26	-	-
Germany, Fed.Rep.	7 433	4 676	2 211	2 254	3 440	9 329	6 661	5 229	2 605	2 762
Netherlands	-	-	-	63	-	-	-	491	232	71
Norway	-	378	1 495	1 839	470	355	1 660	486	2 232	1 254
Poland	-	-	-	-	-	4 050	1 925	815	1 007	-
Spain	-	-	-	-	423	390	500	654	117	-
UK(England & Wales)	5 123	4 303	3 066	3 305	2 453	7 527	3 827	2 428	3 063	2 591
UK(Scotland)	4 778	5 346	8 608	7 198	6 225	10 131	8 302	4 950	5 860	5 605
USSR	-	-	-	-	-	-	-	-	16	-
Total	20 387	27 437	29 110	32 706	42 663	57 431	47 188	41 576	33 065	33 968

* Preliminary.

Table 6. Nominal catch (metric tons) of Saithe in Sub-area VI, 1968-1977.
(Data for 1968-76 from Bulletin Statistique)

Country	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977*
Belgium	27	40	34	29	125	191	209	21	95	-
Faroe Islands	-	-	-	-	-	4	6	6	7	-
France	3 481	8 109	5 140	12 017	17 718	18 970	22 802	19 946	29 216	20 880
German Dem.Rep.	283	-	-	-	-	-	-	8	3	-
Germany, Fed.Rep.	368	1 988	545	1 068	350	52	16	481	511	504
Iceland	-	-	1	1	-	+	-	+	-	-
Netherlands	59	14	7	32	638	67	124	702	547	637
Norway	-	-	-	-	-	2	22	10	17	5
Poland	1	-	-	2	-	394	125	164	91	-
Spain	-	-	-	-	1 302	1 980	1 862	1 882	1 012	?
UK (Engl. & Wales)	5 704	4 015	3 615	1 965	2 268	2 138	1 333	1 571	1 560	2 871
UK (N.Ireland)	21	13	19	24	6	14	3	12	13	8
UK (Scotland)	2 483	3 035	5 175	4 620	6 706	11 330	9 527	6 131	5 807	4 538
USSR	-	-	-	105	112	670	269	15	2 550	-
Total	12 787	17 214	14 536	19 863	29 225	35 812	36 298	30 949	41 432	29 443

* Preliminary.

Table 7. NE Arctic Saithe.
Input data - catch in numbers by year and by age (thousands).

AGE	1960	1961	1962	1963	1964	1965
1	1.0	1.0	1.0	43.0	1.0	18596.0
2	7381.0	4936.0	1246.0	2815.0	20308.0	30430.0
3	10509.0	17824.0	37266.0	42050.0	9001.0	37115.0
4	13083.0	9131.0	11131.0	28925.0	59601.0	5001.0
5	13545.0	12506.0	4421.0	5888.0	13154.0	26300.0
6	5064.0	3799.0	8290.0	4650.0	2718.0	10142.0
7	4883.0	1332.0	2427.0	3861.0	3472.0	2861.0
8	2401.0	968.0	1024.0	1099.0	2655.0	2110.0
9	1315.0	520.0	938.0	1075.0	1251.0	2733.0
10	743.0	405.0	451.0	697.0	1221.0	699.0
11	374.0	380.0	496.0	452.0	1056.0	990.0
12	282.0	194.0	299.0	384.0	795.0	568.0
13	202.0	79.0	229.0	328.0	462.0	444.0
14	144.0	63.0	182.0	136.0	365.0	699.0

AGE	1966	1967	1968	1969	1970	1971
1	1.0	1.0	281.0	110.0	1.0	497.0
2	7450.0	6952.0	5297.0	4090.0	25952.0	19842.0
3	22392.0	29664.0	25196.0	77333.0	43540.0	77019.0
4	54537.0	24836.0	18384.0	11949.0	62846.0	59280.0
5	13124.0	35956.0	5101.0	16939.0	13987.0	26961.0
6	12899.0	4125.0	8282.0	4747.0	16189.0	9556.0
7	4652.0	5616.0	787.0	4798.0	5122.0	9592.0
8	1374.0	2916.0	1913.0	1126.0	7950.0	2901.0
9	933.0	1413.0	900.0	1711.0	2504.0	4352.0
10	965.0	1397.0	577.0	675.0	3697.0	2195.0
11	472.0	849.0	391.0	202.0	1096.0	3136.0
12	560.0	629.0	239.0	140.0	757.0	1303.0
13	597.0	550.0	141.0	31.0	323.0	354.0
14	443.0	408.0	131.0	48.0	276.0	232.0

AGE	1972	1973	1974	1975	1976	1977
1	1.0	194.0	1.0	1.0	52.0	65.0
2	11608.0	13829.0	21159.0	81601.0	54151.0	18000.0
3	65178.0	76296.0	36782.0	60832.0	125030.0	104267.0
4	52389.0	25206.0	44027.0	11691.0	30576.0	37410.0
5	29146.0	26911.0	15671.0	16366.0	7947.0	9351.0
6	10186.0	16031.0	20419.0	4436.0	8712.0	2308.0
7	5616.0	7114.0	12148.0	7808.0	3435.0	5180.0
8	3547.0	3935.0	4802.0	6789.0	3212.0	1640.0
9	1865.0	2871.0	3258.0	2914.0	2679.0	1750.0
10	2140.0	2610.0	2505.0	2350.0	1724.0	1042.0
11	1229.0	1565.0	1436.0	1937.0	1091.0	505.0
12	796.0	791.0	1444.0	1245.0	852.0	268.0
13	331.0	812.0	432.0	459.0	489.0	233.0
14	261.0	442.0	263.0	260.0	140.0	64.0

Table 9. NE Arctic Saithe.
Stock in numbers at beginning of year (thousands).

AGE	1960	1961	1962	1963	1964	1965
1	278440.9	413317.5	143768.2	439068.6	246785.1	324751.9
2	114955.7	227967.2	338394.8	117706.6	359440.2	202049.7
3	79376.8	87458.4	182186.8	275928.8	93828.3	275959.5
4	84568.8	55520.0	55571.6	115640.4	188042.1	68704.3
5	38821.1	57457.4	37234.9	35484.6	68688.4	100495.6
6	26756.0	19645.5	35796.3	26501.0	23751.3	44401.4
7	23075.1	17349.2	12666.2	21855.3	17511.7	16996.2
8	14491.3	14500.6	13002.8	8186.4	14418.3	11213.7
9	12760.0	9702.8	10998.8	9722.2	5712.4	9415.4
10	5918.5	9261.5	7474.7	8159.1	6990.9	3552.0
11	2551.2	4176.2	7217.1	5712.9	6051.5	4624.6
12	2063.8	1751.9	3076.5	5461.4	4269.6	4004.0
13	688.2	1435.6	1259.4	2249.2	4125.0	2780.2
14	873.6	382.2	1104.1	825.0	1546.1	2960.8

AGE	1966	1967	1968	1969	1970	1971
1	228658.6	446935.8	432677.4	475025.2	278108.0	374513.1
2	249104.3	187208.9	365919.2	353992.4	388818.4	227694.7
3	138018.6	197223.3	146998.1	294805.7	286130.7	294924.1
4	192498.6	92838.7	134756.8	97670.4	171901.5	195052.6
5	51739.0	108642.6	53703.7	93767.6	69197.8	84448.0
6	58654.3	30569.1	56710.1	39369.5	61525.1	44072.1
7	27235.1	36423.4	21311.5	38970.7	27955.0	35830.9
8	11339.7	18110.4	24763.5	16738.0	27582.8	18278.0
9	7282.3	8045.9	12202.0	18549.1	12688.0	15446.5
10	5255.5	5121.6	5315.6	9178.3	13643.9	8135.3
11	2279.2	3434.4	2938.7	3831.9	6905.6	7850.5
12	2896.0	1441.5	2048.9	2053.7	2955.0	4667.0
13	2766.6	1867.2	618.1	1462.1	1555.1	1739.3
14	1876.5	1728.2	1035.1	379.3	1169.1	982.7

AGE	1972	1973	1974	1975	1976	1977
1	152426.3	292400.9	602323.9	505367.4	173768.3	7206.4
2	306176.5	124795.2	239222.3	493140.2	413759.0	142222.5
3	168526.8	240197.7	89708.5	176777.7	330282.1	289967.3
4	172278.5	79633.2	128223.4	40545.2	90210.3	158462.2
5	106504.5	94042.1	42588.9	65518.6	22701.1	46449.0
6	44958.5	61025.4	52836.9	20832.8	38936.6	11464.5
7	27489.9	27651.2	35563.6	24980.7	13067.0	24045.6
8	20720.9	17455.1	16247.9	18228.1	13448.1	7612.9
9	12352.6	13771.9	10753.2	8992.9	8844.0	8123.5
10	8739.3	8433.8	8693.2	5880.5	4749.5	4837.0
11	4689.3	5232.0	4563.4	4868.7	2711.8	2344.2
12	3621.4	2735.3	2879.2	2448.1	2252.8	1244.1
13	2651.1	2249.2	1529.5	1069.7	894.5	1081.6
14	1105.5	1872.2	1114.0	864.4	465.4	297.1

Table 10. North Sea Saithe.
Input data - catch in numbers by year and age (thousands).

AGE	1960	1961	1962	1963	1964	1965
1	1.0	1.0	1.0	1.0	1.0	1.0
2	1186.0	599.0	133.0	862.0	9096.0	73.0
3	6961.0	4340.0	3587.0	1346.0	9345.0	13724.0
4	3642.0	7144.0	5196.0	4820.0	5563.0	13270.0
5	3003.0	2213.0	2472.0	4643.0	4521.0	7873.0
6	1586.0	1719.0	775.0	975.0	1615.0	1262.0
7	300.0	868.0	214.0	290.0	743.0	493.0
8	77.0	295.0	89.0	97.0	456.0	121.0
9	8.0	269.0	52.0	97.0	316.0	65.0
10	8.0	139.0	74.0	32.0	85.0	57.0
11	8.0	61.0	30.0	73.0	75.0	49.0
12	1.0	61.0	22.0	105.0	52.0	20.0
13	1.0	26.0	7.0	1.0	59.0	67.0
14	1.0	9.0	22.0	1.0	17.0	26.0

AGE	1966	1967	1968	1969	1970	1971
1	1.0	1.0	130.0	1628.0	626.0	390.0
2	12937.0	7606.0	5615.0	19813.0	2852.0	10147.0
3	11485.0	13874.0	15409.0	19285.0	37117.0	68102.0
4	27279.0	12787.0	19025.0	12488.0	74994.0	53348.0
5	4367.0	13104.0	9668.0	9889.0	12391.0	30131.0
6	3579.0	2085.0	5725.0	6045.0	10874.0	3717.0
7	727.0	1450.0	571.0	3952.0	3779.0	3874.0
8	272.0	470.0	446.0	730.0	1996.0	2682.0
9	193.0	294.0	346.0	489.0	600.0	1808.0
10	101.0	143.0	164.0	192.0	326.0	403.0
11	78.0	82.0	123.0	62.0	86.0	223.0
12	61.0	43.0	70.0	40.0	59.0	51.0
13	35.0	19.0	69.0	33.0	26.0	18.0
14	34.0	33.0	53.0	23.0	26.0	18.0

AGE	1972	1973	1974	1975	1976	1977
1	457.0	4231.0	3670.0	311.0	228.0	447.0
2	20434.0	30315.0	14750.0	72546.0	23125.0	29044.0
3	40294.0	47715.0	60680.0	51287.0	223680.0	38364.0
4	62533.0	33780.0	31803.0	23585.0	51407.0	59298.0
5	23124.0	24725.0	12431.0	9028.0	9852.0	15578.0
6	20826.0	15345.0	20595.0	6717.0	5111.0	4256.0
7	3635.0	8058.0	14504.0	12660.0	3309.0	2668.0
8	3113.0	1798.0	5028.0	8656.0	4842.0	2068.0
9	1901.0	1267.0	1427.0	3299.0	2978.0	1365.0
10	1110.0	1025.0	809.0	1100.0	1068.0	759.0
11	265.0	579.0	412.0	616.0	420.0	431.0
12	126.0	261.0	222.0	254.0	253.0	146.0
13	25.0	81.0	132.0	275.0	121.0	116.0
14	68.0	37.0	30.0	77.0	161.0	85.0

Table 12. North Sea Saithe.
Stock in numbers at beginning of year (thousands).

AGE	1960	1961	1962	1963	1964	1965
1	42164.5	60818.3	80890.5	196265.8	140159.6	186698.2
2	37065.8	34520.5	49792.9	66226.6	160688.0	114752.1
3	28507.9	29276.2	27722.1	40646.9	53443.3	123352.3
4	12259.2	17084.7	20060.4	19464.9	32063.7	35343.9
5	8508.8	6768.5	7599.0	11756.4	11605.4	21244.0
6	5014.5	4275.6	3557.1	4004.7	5470.1	5455.0
7	1813.2	2682.9	1962.5	2215.4	2402.6	3029.1
8	1518.8	1214.4	1418.2	1413.9	1552.5	1300.5
9	897.8	1174.0	729.1	1080.8	1070.1	861.8
10	288.9	727.8	719.4	550.1	797.4	592.5
11	108.0	229.3	470.8	522.3	421.5	576.2
12	175.0	81.2	133.0	358.4	361.8	277.6
13	47.7	142.4	12.8	89.1	199.2	249.4
14	4.2	38.1	93.2	4.2	72.0	110.1

AGE	1966	1967	1968	1969	1970	1971
1	145848.1	411274.5	418799.1	453305.3	237837.7	235771.6
2	152854.6	119409.4	336722.2	342766.2	369664.5	194159.6
3	93885.1	113479.4	90901.7	270614.2	262755.2	300079.8
4	88621.9	66516.8	80406.4	60552.3	204163.1	181690.9
5	17054.3	48083.0	42953.9	48730.9	38343.3	99983.6
6	10342.1	10039.6	27599.3	26475.4	31001.8	20280.4
7	3331.7	5259.7	6344.4	17447.0	16241.7	15637.8
8	2036.1	2074.0	3004.3	4679.4	10731.4	9900.6
9	955.6	1422.0	1275.5	2058.0	3173.8	6989.9
10	647.0	608.8	899.8	733.6	1245.4	2058.6
11	433.7	438.7	369.9	589.1	428.1	726.8
12	427.6	284.9	285.4	192.6	426.4	273.2
13	209.2	295.1	194.5	170.8	121.7	296.0
14	144.0	139.8	224.5	97.4	110.1	76.2

AGE	1972	1973	1974	1975	1976	1977
1	249497.7	326001.6	824773.3	221700.4	410864.0	49557.6
2	192681.2	203858.6	263086.5	671952.3	181232.0	336181.0
3	149807.4	139333.4	139602.1	202087.0	484752.8	127543.2
4	184458.0	86463.6	71308.1	60060.9	119376.0	197139.4
5	100874.4	94965.7	40555.5	29967.5	28065.1	51783.3
6	54821.7	61800.7	55540.8	22050.7	16434.0	14149.3
7	13259.0	26237.7	36809.5	27028.3	12026.6	8869.9
8	9322.0	7591.4	14251.9	17156.6	10826.5	6875.2
9	5697.3	4841.3	4599.2	7163.0	6329.1	4538.0
10	4098.6	2960.2	2825.6	2485.3	2918.6	2523.3
11	1322.9	2358.8	1505.0	1587.1	1051.9	1432.9
12	395.0	844.7	1410.9	862.2	748.0	485.4
13	177.7	210.4	457.4	955.3	477.9	385.6
14	226.1	123.0	99.7	256.0	535.3	282.6

Table 13. Iceland Saithe.
Input data - catch in numbers by year and by age (thousands).

AGE	1960	1961	1962	1963	1964	1965
2	271.0	530.0	145.0	402.0	73.0	41.0
3	1435.0	4271.0	1534.0	6134.0	3041.0	2003.0
4	3325.0	3936.0	4999.0	2314.0	11712.0	4825.0
5	2804.0	4879.0	3861.0	2518.0	3586.0	7589.0
6	1353.0	1961.0	3744.0	2902.0	2301.0	2158.0
7	828.0	588.0	1019.0	1869.0	1185.0	1324.0
8	709.0	311.0	419.0	797.0	559.0	642.0
9	504.0	240.0	280.0	329.0	237.0	353.0
10	172.0	246.0	245.0	271.0	145.0	164.0
11	68.0	130.0	143.0	254.0	107.0	102.0
12	39.0	116.0	83.0	193.0	92.0	85.0
13	35.0	24.0	28.0	75.0	59.0	81.0
14	49.0	20.0	15.0	22.0	33.0	52.0

AGE	1966	1967	1968	1969	1970	1971
2	31.0	196.0	1.0	20.0	18.0	7.0
3	940.0	1116.0	836.0	1572.0	287.0	476.0
4	2090.0	3400.0	2605.0	4395.0	5622.0	3031.0
5	3283.0	5591.0	3563.0	5706.0	4999.0	10221.0
6	4117.0	4326.0	6318.0	6518.0	6126.0	6736.0
7	1285.0	4931.0	3207.0	9136.0	6178.0	6694.0
8	739.0	1200.0	3008.0	2796.0	5934.0	5045.0
9	390.0	550.0	621.0	1843.0	1689.0	4272.0
10	235.0	330.0	343.0	461.0	1191.0	959.0
11	133.0	169.0	215.0	100.0	299.0	887.0
12	69.0	73.0	103.0	110.0	171.0	349.0
13	102.0	104.0	79.0	32.0	92.0	96.0
14	73.0	65.0	41.0	44.0	70.0	63.0

AGE	1972	1973	1974	1975	1976	1977
2	49.0	25.0	111.0	16.0	29.0	5.0
3	565.0	219.0	1269.0	526.0	329.0	65.0
4	3786.0	1768.0	3404.0	2997.0	3234.0	2064.0
5	6524.0	5155.0	2348.0	2479.0	3045.0	2760.0
6	8646.0	7077.0	3164.0	1829.0	2530.0	1793.0
7	4178.0	7372.0	3452.0	3496.0	2154.0	1054.0
8	3320.0	2616.0	3384.0	2994.0	2367.0	1078.0
9	2098.0	1635.0	1303.0	1434.0	1530.0	1543.0
10	1421.0	871.0	824.0	710.0	1064.0	967.0
11	361.0	412.0	351.0	325.0	295.0	541.0
12	328.0	231.0	141.0	176.0	191.0	168.0
13	79.0	80.0	43.0	100.0	94.0	72.0
14	68.0	22.0	13.0	36.0	68.0	12.0

Table 15. Iceland Saithe.
Stock in numbers at beginning of year (thousands).

AGE	1960	1961	1962	1963	1964	1965
2	40671.9	38531.8	102832.4	67822.2	115155.9	85764.8
3	30712.7	33054.6	31068.5	84061.1	55165.0	94215.7
4	26567.9	23850.3	23214.5	24052.3	63290.1	42421.1
5	12407.2	18755.8	15983.3	14510.9	17606.0	41277.6
6	5855.4	7637.2	10973.1	9616.0	9613.9	11188.8
7	4335.2	3577.7	4491.0	5628.0	5268.9	5803.1
8	3506.0	2804.3	2399.8	2760.8	2932.1	3248.4
9	2246.9	2232.6	2015.7	1587.6	1545.0	1897.6
10	960.4	1386.4	1611.6	1398.1	1003.9	1051.5
11	445.4	631.5	913.7	1098.8	900.8	691.3
12	169.8	303.4	400.1	619.3	671.3	641.1
13	141.9	104.0	144.6	252.9	333.9	466.7
14	207.6	84.7	63.5	93.2	139.8	220.3

AGE	1966	1967	1968	1969	1970	1971
2	81770.8	72700.1	110226.6	79680.6	64814.2	31167.7
3	70181.3	66920.3	59344.8	90245.0	65218.9	53049.1
4	75328.7	56610.7	53781.9	47832.4	72466.8	53137.5
5	30382.6	59786.9	43281.1	41681.8	35198.8	54259.8
6	26965.6	21915.8	43908.0	32222.1	28985.8	24315.3
7	7218.9	18369.9	14051.1	30257.9	20517.8	18222.0
8	3560.9	4753.8	10611.4	8621.0	16575.0	11254.7
9	2082.0	2250.7	2813.9	5987.4	4550.8	8254.1
10	1236.0	1353.6	1348.5	1745.4	3248.5	2213.3
11	713.2	800.5	811.7	795.9	1015.0	1592.9
12	474.1	464.2	503.4	471.4	561.5	562.6
13	448.3	326.1	314.3	319.5	287.1	306.3
14	309.2	275.3	173.7	186.4	232.7	152.5

AGE	1972	1973	1974	1975	1976	1977
2	27701.2	36963.5	45878.9	36101.5	17593.3	55169.2
3	25511.6	22635.5	30240.6	37462.2	29542.9	14378.0
4	43003.0	20377.0	18334.6	23613.5	30196.4	23890.6
5	40770.2	31793.7	15088.8	11947.8	16632.6	21807.5
6	35226.7	27505.5	21389.0	10239.3	7552.3	10877.2
7	13859.3	21071.6	16161.8	14662.1	6737.0	3915.1
8	8923.2	7597.9	10645.6	10127.7	8862.1	3583.9
9	4707.4	4332.4	3876.0	5680.6	5604.8	5129.8
10	2950.9	1979.6	2083.1	2005.3	3362.5	3214.8
11	954.9	1148.0	842.4	968.1	1005.6	1798.6
12	515.0	458.6	570.8	375.8	501.2	558.5
13	151.0	130.9	169.5	340.6	150.6	239.4
14	164.6	53.3	36.2	100.1	189.1	39.9

Table 16. Faroe Saithe.
Input data - catch in numbers by year and by age (thousands).

AGE	1960	1961	1962	1963	1964	1965
1	1.0	3.0	1.0	8.0	1.0	1.0
2	253.0	138.0	73.0	97.0	97.0	112.0
3	1647.0	183.0	562.0	614.0	684.0	996.0
4	383.0	379.0	542.0	340.0	1908.0	850.0
5	458.0	483.0	617.0	340.0	1506.0	1708.0
6	443.0	403.0	495.0	415.0	617.0	965.0
7	243.0	216.0	286.0	406.0	572.0	510.0
8	210.0	129.0	131.0	202.0	424.0	407.0
9	158.0	116.0	129.0	174.0	179.0	306.0
10	80.0	82.0	113.0	158.0	150.0	201.0
11	29.0	45.0	71.0	94.0	100.0	156.0
12	28.0	27.0	29.0	169.0	83.0	120.0
13	32.0	6.0	13.0	61.0	47.0	89.0
14	16.0	1.0	16.0	8.0	30.0	30.0

AGE	1966	1967	1968	1969	1970	1971
1	1.0	2.0	1.0	1.0	2.0	1.0
2	68.0	154.0	222.0	55.0	774.0	723.0
3	488.0	595.0	614.0	1191.0	1445.0	2857.0
4	1540.0	796.0	1689.0	2086.0	6277.0	3316.0
5	1201.0	1364.0	1116.0	2294.0	1558.0	5585.0
6	1686.0	792.0	1095.0	1414.0	1478.0	1005.0
7	806.0	1192.0	548.0	1118.0	899.0	828.0
8	377.0	473.0	655.0	589.0	730.0	469.0
9	294.0	217.0	254.0	580.0	316.0	326.0
10	205.0	190.0	128.0	239.0	241.0	164.0
11	156.0	97.0	89.0	115.0	86.0	100.0
12	94.0	75.0	59.0	100.0	48.0	54.0
13	52.0	38.0	40.0	36.0	46.0	13.0
14	34.0	11.0	29.0	30.0	15.0	18.0

AGE	1972	1973	1974	1975	1976	1977
1	1.0	4.0	5.0	1.0	1.0	1.0
2	217.0	1650.0	133.0	189.0	148.0	175.0
3	2714.0	2515.0	3504.0	2062.0	3178.0	1899.0
4	1774.0	6253.0	4126.0	3361.0	3217.0	3257.0
5	2588.0	7075.0	4011.0	3801.0	1720.0	2203.0
6	2742.0	3478.0	2784.0	1939.0	1250.0	1289.0
7	1529.0	1634.0	1401.0	1045.0	877.0	763.0
8	1305.0	693.0	640.0	714.0	641.0	616.0
9	1017.0	550.0	368.0	302.0	468.0	458.0
10	743.0	403.0	340.0	192.0	223.0	364.0
11	330.0	215.0	197.0	193.0	141.0	239.0
12	133.0	103.0	124.0	126.0	96.0	80.0
13	28.0	25.0	45.0	64.0	60.0	98.0
14	28.0	21.0	44.0	41.0	54.0	69.0

Table 18. Faroe Saithe.
Stock in numbers at beginning of year (thousands).

AGE	1960	1961	1962	1963	1964	1965
1	18876.0	30563.5	21993.5	31958.8	30113.2	35100.0
2	10476.5	15453.5	25020.6	18005.9	26158.4	24653.7
3	10906.8	8349.0	12527.6	20419.2	14654.3	21329.1
4	6852.9	7446.4	6670.3	9749.5	16163.5	11380.6
5	4848.1	5265.1	5754.6	4972.4	7675.3	11514.0
6	3294.4	3556.3	3875.2	4155.3	3764.3	4929.0
7	1946.6	2298.1	2548.4	2726.7	3027.9	2526.4
8	1707.2	1374.8	1686.8	1828.7	1866.8	1964.3
9	1197.7	1208.5	1009.2	1262.9	1315.1	1147.2
10	723.4	838.3	884.9	710.1	877.2	915.5
11	177.9	520.2	612.4	622.6	439.3	583.2
12	183.7	119.5	385.3	437.4	425.1	269.8
13	41.8	125.2	73.6	289.3	206.8	273.4
14	97.1	6.1	97.1	48.5	182.0	127.1

AGE	1966	1967	1968	1969	1970	1971
1	27962.8	55104.5	44801.6	49894.3	45963.8	35065.8
2	28736.5	22893.1	45113.9	36679.6	40849.1	37630.2
3	20083.5	23466.1	18604.2	36735.6	29981.0	32745.5
4	16563.8	16002.4	18675.2	14677.5	29001.4	23242.2
5	8550.9	12172.7	12383.3	13766.9	10137.9	18099.6
6	7888.5	5919.0	8736.7	9132.2	9206.1	6897.2
7	3167.3	4942.3	4132.6	6166.3	6203.5	6206.5
8	1609.7	1869.1	2975.1	2889.7	4042.3	4269.2
9	1242.2	979.0	1105.3	1846.9	1836.1	2652.6
10	664.4	752.7	606.4	676.6	991.8	1218.8
11	568.8	360.0	445.6	381.4	339.8	595.4
12	337.3	325.6	207.7	284.7	209.1	200.9
13	113.6	191.8	199.2	117.1	143.5	128.0
14	144.0	46.6	122.8	127.1	63.5	76.2

AGE	1972	1973	1974	1975	1976	1977
1	31908.1	28217.2	30612.8	25785.7	7976.7	1103.9
2	28708.5	26123.2	23098.7	25059.1	21110.7	6529.9
3	30156.1	23308.6	19899.2	18791.5	20346.0	17150.3
4	24233.3	22242.4	16816.3	13138.1	13526.5	13796.1
5	16042.2	18240.2	12596.4	10060.3	7737.0	8183.1
6	9808.0	10804.0	8600.8	6715.5	4833.2	4788.0
7	4741.7	5568.2	5726.3	4545.0	3757.6	2834.2
8	4335.4	2510.9	3092.3	3429.3	2781.7	2288.1
9	3072.6	2378.5	1433.5	1956.1	2165.5	1701.3
10	1878.0	1603.8	1452.9	843.0	1329.5	1352.1
11	850.1	872.6	950.9	883.9	517.6	887.8
12	397.5	400.6	521.2	601.4	550.2	297.2
13	116.0	206.2	235.5	315.3	379.0	364.0
14	93.1	69.8	146.3	152.3	200.6	256.3

Table 19. West of Scotland Saithe.
Input data - catch in numbers by year and by age (thousands).

AGE	1960	1961	1962	1963	1964	1965
1	1.0	1.0	2.0	1.0	1.0	1.0
2	244.0	109.0	524.0	156.0	118.0	230.0
3	1154.0	718.0	925.0	1487.0	2136.0	3328.0
4	871.0	1003.0	1161.0	690.0	2340.0	3060.0
5	1406.0	321.0	540.0	328.0	700.0	1757.0
6	331.0	475.0	172.0	216.0	340.0	512.0
7	131.0	189.0	250.0	73.0	158.0	272.0
8	100.0	75.0	90.0	149.0	42.0	92.0
9	92.0	111.0	36.0	50.0	49.0	69.0
10	4.0	87.0	71.0	5.0	37.0	37.0
11	3.0	24.0	18.0	24.0	25.0	47.0
12	1.0	13.0	13.0	16.0	7.0	6.0
13	1.0	6.0	7.0	3.0	15.0	12.0
14	1.0	1.0	7.0	1.0	3.0	34.0

AGE	1966	1967	1968	1969	1970	1971
1	1.0	1.0	2.0	1.0	1.0	1.0
2	67.0	385.0	49.0	337.0	32.0	371.0
3	2831.0	2053.0	2435.0	1993.0	2857.0	1342.0
4	4896.0	2885.0	2287.0	4643.0	2335.0	4305.0
5	1217.0	1934.0	1198.0	1506.0	1805.0	1833.0
6	692.0	269.0	621.0	509.0	599.0	1051.0
7	135.0	454.0	148.0	571.0	241.0	450.0
8	38.0	91.0	126.0	106.0	196.0	350.0
9	26.0	44.0	29.0	80.0	41.0	290.0
10	12.0	28.0	22.0	22.0	57.0	50.0
11	12.0	14.0	11.0	18.0	20.0	89.0
12	7.0	11.0	7.0	8.0	20.0	21.0
13	5.0	8.0	4.0	8.0	12.0	29.0
14	5.0	6.0	2.0	4.0	4.0	10.0

AGE	1972	1973	1974	1975	1976	1977
1	67.0	29.0	590.0	20.0	74.0	168.0
2	6311.0	1917.0	7602.0	2297.0	4184.0	1529.0
3	9988.0	8293.0	7546.0	9200.0	9943.0	5989.0
4	1788.0	7631.0	1526.0	3272.0	3087.0	3261.0
5	2053.0	1410.0	2504.0	1157.0	2334.0	2381.0
6	916.0	1847.0	388.0	1117.0	1405.0	1029.0
7	2871.0	1224.0	793.0	956.0	778.0	814.0
8	689.0	1061.0	1137.0	886.0	596.0	570.0
9	136.0	325.0	721.0	316.0	670.0	430.0
10	120.0	269.0	564.0	208.0	367.0	439.0
11	23.0	186.0	288.0	186.0	451.0	397.0
12	30.0	147.0	207.0	184.0	203.0	149.0
13	8.0	45.0	24.0	205.0	198.0	82.0
14	6.0	48.0	81.0	27.0	210.0	150.0

Table 21. West of Scotland Saithe.
Stock in numbers at beginning of year (thousands).

AGE	1960	1961	1962	1963	1964	1965
1	13076.7	27431.8	19975.2	55788.0	42723.3	34439.1
2	6977.7	10705.4	22458.4	16352.5	45674.5	34978.0
3	5976.7	5492.6	8666.4	17914.2	13247.4	37288.5
4	2743.6	3855.0	3850.0	6261.6	13325.8	8922.8
5	3572.1	1465.1	2255.2	2110.3	4504.6	8804.0
6	1297.8	1666.3	910.8	1361.1	1432.4	3057.7
7	760.2	765.1	937.8	591.0	919.9	867.2
8	714.3	504.5	456.6	543.3	418.1	610.9
9	1641.6	494.8	345.5	292.9	311.0	304.4
10	159.7	1261.0	305.3	250.4	194.8	210.5
11	58.3	127.1	954.0	186.1	200.5	126.2
12	158.8	45.0	82.5	764.8	130.7	141.6
13	18.6	129.1	25.2	55.8	611.7	100.7
14	14.3	14.3	100.3	14.3	43.0	487.3

AGE	1966	1967	1968	1969	1970	1971
1	56178.5	52162.7	55825.3	33435.9	62671.0	53504.3
2	28195.5	45994.1	42706.3	45704.1	27374.1	51309.8
3	28429.8	23024.0	37309.1	34920.7	37115.0	22383.1
4	27528.1	20724.0	16999.1	28349.2	26792.3	27810.1
5	4562.6	18131.4	14368.4	11857.2	19030.0	19829.9
6	5627.5	2642.5	13101.3	10683.4	8350.9	13953.0
7	2042.5	3983.8	1921.0	10166.0	8287.5	6296.8
8	466.0	1550.4	2852.4	1439.3	7807.9	6567.6
9	417.3	347.2	1187.3	2221.7	1082.8	6215.6
10	187.2	318.2	244.6	945.9	1746.7	849.5
11	139.0	142.4	235.3	180.5	754.6	1378.6
12	61.2	103.0	104.0	182.7	131.5	599.7
13	110.5	43.8	74.4	78.8	142.4	89.7
14	71.7	86.0	28.7	57.3	57.3	105.7

AGE	1972	1973	1974	1975	1976	1977
1	49377.2	73386.2	49505.6	38833.3	52596.2	51578.4
2	43804.7	40366.1	60057.4	39998.9	31776.0	42995.3
3	41673.8	30179.7	31318.9	42320.8	30675.6	22246.3
4	17114.8	25142.8	17262.1	18859.9	26376.3	16198.3
5	18892.2	12400.6	13737.9	12756.9	12495.8	18812.9
6	14582.5	13617.0	8881.9	8994.1	9401.2	8130.4
7	10475.7	11112.7	9484.7	6921.6	6357.2	6431.6
8	4749.4	5998.6	7995.0	7050.2	4805.7	4503.7
9	5061.3	3267.9	3956.3	5521.6	4973.9	3397.5
10	4827.2	4021.0	2382.5	2590.2	4235.5	3468.6
11	650.4	3843.8	3049.4	1443.7	1933.1	3136.8
12	1048.4	511.7	2979.2	2237.0	1014.4	1177.3
13	472.1	831.3	287.0	2252.4	1665.5	647.9
14	47.4	379.3	640.0	213.3	1659.3	1185.2

Table 22. West of Scotland Saithe.
Data for estimation of numbers by age in the
French landings.

Ratio of number landed by France to
number landed by Scotland.

Age	1976	1977	Mean 1976, 1977
1	0.04	0.08	0.06
2	0.34	0.40	0.37
3	2.37	0.37	1.37
4	1.50	2.75	2.12
5	5.71	3.20	4.46
6	6.18	5.18	5.68 (13.50)
7	7.28	8.67	7.98
8	11.47	9.55	10.51
9	5.51	6.05	5.78
10	24.36	10.02	17.44
11	37.11	7.45	22.28
12	30.20	84.00	57.10 (25.00)
13	8.12	14.67	11.40 (25.00)
14	26.00	14.00	20.00 (25.00)
15	8.67	44.50	26.59 (25.000)

Figures in brackets are interpolated values and were used
in the estimation of French landings.

Table 23. West of Scotland Saithe.
Calculation of total international fishing
effort, 1971-1977.

Year	Tons/100 horse power days Lorient trawlers	Total landings	Total effort	Relative effort
1971	0.26	19 863	7 396	0.76
1972	0.27	29 225	108 241	1.08
1973	0.29	35 812	123 490	1.23
1974	0.32	36 238	113 244	1.13
1975	0.30	30 949	103 163	1.03
1976	0.32	41 432	129 475	1.29
1977	0.30*	30 083	100 277	1.00

* Data for January-September only.

Table 24. North-East Arctic Saithe.
Data used for catch predictions.

Age group	Stock number 1978 (thousands)	Proportional fishing mortality (1978-80)	Average weight (kg)
1	342 000*	0.02	0.25
2	277 220*	0.3	0.34
3	195 353*	1.0	0.71
4	143 994	0.6	1.11
5	96 112	0.5	1.63
6	29 617	0.54	2.33
7	7 310	0.54	3.16
8	15 029	0.54	4.03
9	4 758	0.54	4.87
10	5 077	0.54	5.63
11	3 023	0.54	6.44
12	1 465	0.54	7.11
13	778	0.54	7.82
14	676	0.54	8.92
15+	1 109	0.54	9.5

* Recruitment based on the average for year classes 1959-73.

Table 25. North Sea Saithe.
Data used for catch predictions.

Age group	Stock number 1978 (thousands)	Proportional fishing mortality (1978-80)	Average weight (kg)
2	328 515*	0.25	0.45
3	243 370	1.00	0.75
4	133 564	1.00	1.16
5	108 192	1.00	1.79
6	28 419	1.00	2.48
7	7 765	1.00	3.38
8	4 867	1.00	4.20
9	3 773	1.00	4.91
10	2 490	1.00	5.65
11	1 384	1.00	6.45
12	786	1.00	7.16
13	266	1.00	8.07
14	211	1.00	9.00

* Recruitment based on the average for year classes 1971-75.

Table 26. Iceland Saithe.
Data used for catch predictions.

Age group	Stock number 1978 (thousands)	Proportional fishing mortality (1978-80)	Average weight (kg)
3	29 000*	0.01	1.12
4	23 507*	0.25	1.96
5	17 699	0.38	3.05
6	15 368	0.50	4.34
7	7 291	0.88	5.38
8	2 259	1.00	6.55
9	1 967	1.00	7.64
10	2 815	1.00	8.63
11	1 764	1.00	9.52
12	987	1.00	10.29
13	307	1.00	10.97
14	131	1.00	11.55

* Recruitment based on the average for year classes 1969-73.

Table 27. Faroe Saithe.
Data used for catch predictions.

Age group	Stock number 1978 (thousands)	Proportional fishing mortality (1978-80)	Average weight (kg)
2	29 000*	0.0	.67
3	23 734*	0.2	1.22
4	18 118	0.86	1.88
5	8 335	1.0	2.62
6	4 721	1.0	3.40
7	2 762	1.0	4.18
8	1 635	1.0	4.95
9	1 320	1.0	5.69
10	982	1.0	6.38
11	780	1.0	7.02
12	512	1.0	7.62
13	171	1.0	8.15
14	210	1.0	8.64
15+	148	1.0	10.00

* Recruitment based on the average for year classes 1964-73.

Table 28. West of Scotland Saithe.
Data used for catch predictions.

Age group	Stock number 1978 (thousands)	Proportional fishing mortality (1978-80)	Average weight (kg)
1	53 000*	0.010	0.48
2	43 101*	0.114	0.52
3	22 246*	1.000	0.85
4	16 204	0.714	1.15
5	18 754	0.43	1.66
6	8 105	0.43	2.42
7	6 412	0.43	3.24
8	4 490	0.43	4.23
9	3 387	0.43	5.06
10	3 457	0.43	5.77
11	3 127	0.43	6.36
12	1 174	0.43	6.78
13	646	0.43	7.44
14	1 182	0.43	7.86
15	350	0.43	8.00

* Recruitment based on average for year classes 1971-74.

Table 29. Saithe.
Catch predictions results.

Year	F	Catch ('000 tons)	Spawning stock ('000 tons)	F	Catch ('000 tons)	Spawning stock ('000 tons)	F	Catch ('000 tons)	Spawning stock ('000 tons)
<u>NE ARCTIC</u>									
1977	0.5	182	235	0.5	182	235	0.5	182	235
1978	0.5	184	246	0.5	184	246	0.5	184	246
1979	0.4	153	329	0.5	185	329	0.3	118	329
1980	0.3	127	409	0.5	189	388	0.3	133	430
<u>NORTH SEA</u>									
1977	0.4	183	242	0.4	183	242	0.4	183	242
1978	0.4	223	362	0.4	223	362	0.4	223	362
1979	0.4	239	392	0.25	155	392	0.5	278	392
1980	0.4	242	415	0.25	180	482	0.5	265	376
<u>ICELAND</u>									
1977	0.4	62	200	0.4	62	200			
1978	0.4	58	199	0.5	71	199			
1979	0.4	58	197	0.5	67	185			
1980	0.4	58	193	0.5	63	173			
<u>FAROE*</u>									
1977	0.35	34	98						
1978	0.35	32	85	.45	39	85	.55	46	85
1979	0.35	31	84	.45	36	76	.45	33	69
1980	0.35	31	83	.45	34	70	.45	32	65
<u>WEST OF SCOTLAND</u>									
1977	0.35	30	170						
1978	0.35	31	157						
1979	0.35	32	146						
1980	0.35	31	142						

* Recruitment based on average for year classes 1970-73.

Table 30. Estimates from Virtual Population Analysis of population size (millions) at 1 year old of each year class (estimates of year class size of the most recent year classes are less reliable).

Year class	NE Arctic	North Sea	Iceland	Faroe	West of Scotland
1959	278	42	47	19	13
1960	413	61	125	31	27
1961	144	81	83	22	20
1962	439	196	140	32	56
1963	247	140	105	30	43
1964	325	187	100	35	34
1965	229	146	89	28	56
1966	447	411	134	55	52
1967	433	419	97	45	56
1968	475	453	79	50	33
1969	278	238	38	46	63
1970	375	236	34	35	54
1971	152	249	45	32	49
1972	292	326	56	28	73
1973	602	825	44	31	50

Table 31. Spawning stock biomass ('000 tons) at the beginning of each year.

Year	NE Arctic		North Sea	Iceland	Faroe	West of Scotland
	Ages:	6+	5+	*	5+	5+
1960		333	49	117	56	25
1961		312	50	126	60	23
1962		360	48	141	67	22
1963		358	60	144	70	21
1964		351	66	146	77	25
1965		375	84	183	89	37
1966		407	93	240	90	36
1967		388	156	320	99	62
1968		436	199	398	112	84
1969		478	253	455	128	105
1970		570	276	445	126	134
1971		517	379	426	148	166
1972		471	466	380	157	189
1973		502	508	360	155	192
1974		474	458	311	133	189
1975		343	347	273	116	181
1976		301	245	231	100	179
1977		235	242	200	98	170
1978		246	362	199	85	157

* Proportional recruitment to the spawning stock at Iceland:

<u>Age group</u>	<u>% mature</u>
4	5.1
5	34.4
6	79.9
7	98.1
8+	100

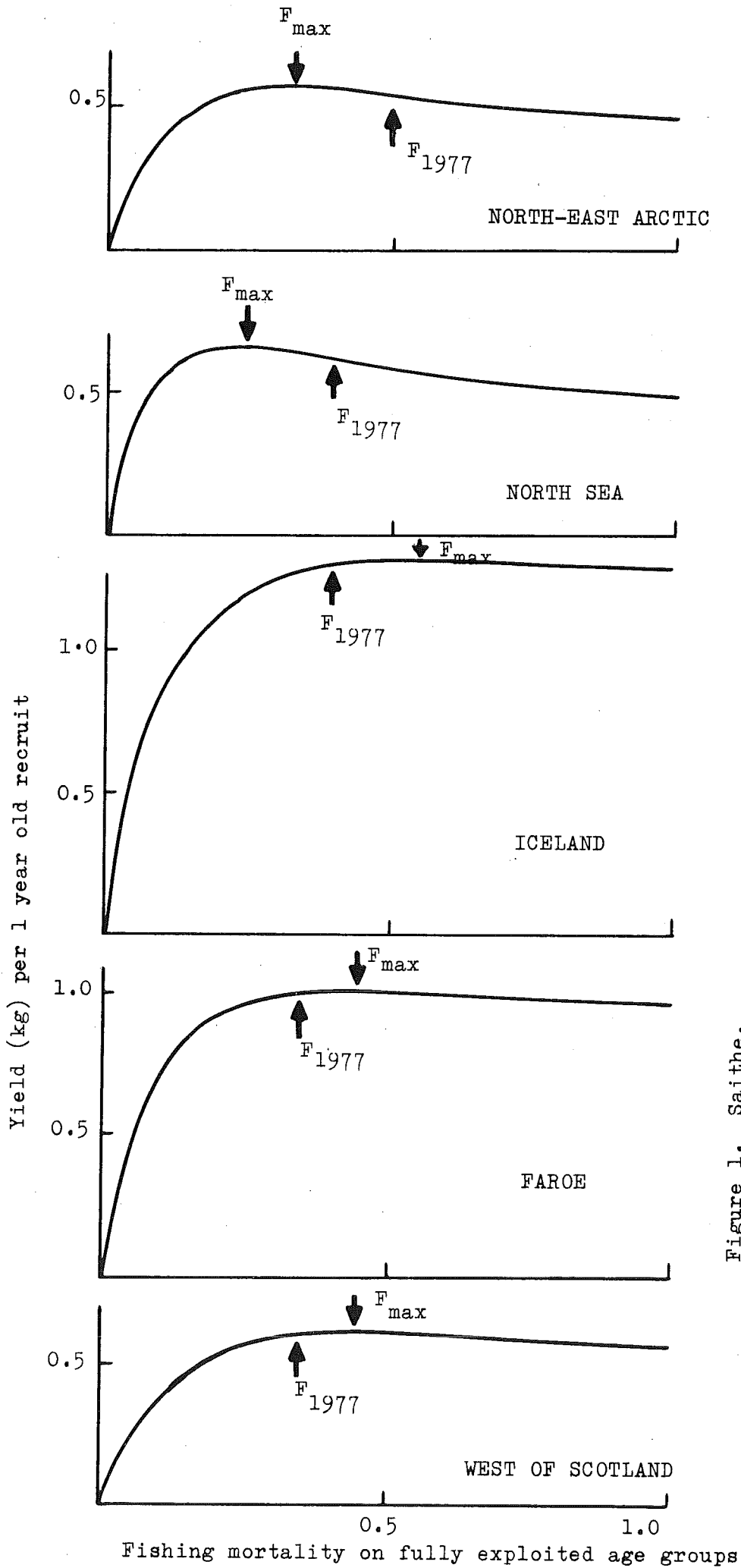


Figure 1. Saithe. Yield per 1 year old recruit curves for exploitation patterns estimated for 1978-79.

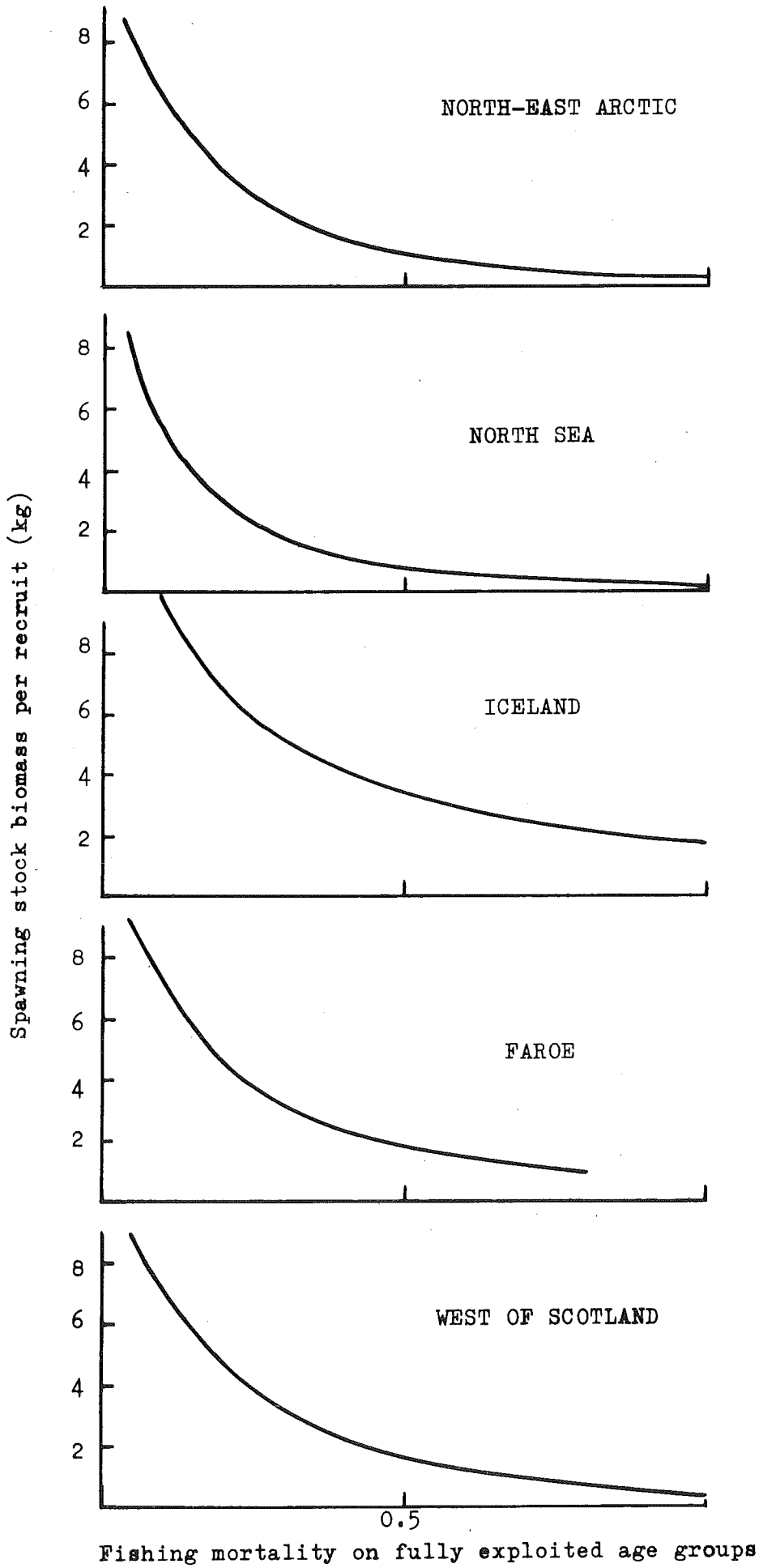


Figure 2. Spawning stock biomass per 1 year old recruit for the exploitation patterns estimated for 1978-79.

APPENDIX

REVIEW OF FISH RESOURCES - DISTRIBUTION OF THE NORTH SEA SAITHE CATCHES
IN RELATION TO ZONES OF EXTENDED FISHERIES
JURISDICTION

The Working Group reviewed the available data relating to the distribution of saithe catches between the Norwegian and the EEC zones of the North Sea. These data are summarised for inclusion in the "Review of Saithe Stocks within the NEAFC Convention Area". These data were originally contributed during an EEC-Norway consultation meeting in Oslo on 8 November 1977. The quantities include landings from the statistical Division IIIa where appropriate.

Country	Year	EEC Zone	Norwegian Zone	Total
Denmark ¹⁾	1976	43 400	25 400	68 800 (Includes by-catch in industrial fisheries)
Norway ¹⁾	1976	4 000	25 173	29 173 " "
Germany, Fed.Rep. ²⁾	1974	9 164	11 416	20 580
	1975	9 199	9 410	18 609
	1976	No complete data, but saithe now being fished by cutters which will shift balance towards EEC zone		
England & Wales ¹⁾	1974	4 267	83	4 350
	1975	3 185	275	3 460
Scotland ¹⁾	1974	9 543	1 413	10 956
	1975	8 089	800	8 889
France ³⁾	1976	24 852	7 700	32 552
Belgium ³⁾	1976	110	10	120
Netherlands ³⁾	1976	1 377	4 672	6 049
USSR ⁴⁾		37 600	73 100	110 700

- Based on:
- 1) Statistical rectangle data
 - 2) Log book data
 - 3) National returns to EEC
 - 4) Fishing distribution charts published in "Annales Biologiques" and information given to Norway

For USSR it was noted that the "Annales Biologiques" charts of distribution of fishing related to the years 1971 and 1973 and for these years accounted for 73% and 81% of the total USSR landings from the area. It is possible that the unaccounted proportion of USSR fishing and also fishing by the German Democratic Republic and Poland were distributed similarly to the "Annales Biologiques" charts for USSR.

The above data relating to the division of saithe catches between Norwegian and EEC zones relate to various years. To estimate an overall percentage figure in each zone the proportions given above have been applied to the 1976 landings with the following result:

Country	Total IV + IIIa tons	Norwegian Zone		Notes
		%	tons	
Belgium	127	8.3	11	
Denmark	68 795	36.9	25 385	4
Faroe	425			1
France	32 552	23.7	7 700	
German Dem.Rep.	2 088	66.0	1 378	2
Germany, Fed.Rep.	38 698	53.1	20 565	3
Netherlands	6 101	77.2	4 710	
Norway	30 938	86.3	26 699	4
Poland	35 819	66.0	23 641	
Spain	-	-	-	
Sweden	1 212			1
UK (England and Wales)	6 300	4.6	289	5
UK (Scotland)	13 034	11.2	1 488	5
USSR	83 669	66.0	55 250	
TOTAL	319 758	52.3	167 116	

Notes

1. Excluded from overall total.
2. % in Norwegian zone assumed same as USSR.
3. % in Norwegian zone based on average 1974-75.
% in 1976 is likely to be lower.
4. Includes by-catches in industrial fisheries.
5. % in Norwegian zone based on average 1974-75.

