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International Council for the
Exploration of the Sea

C.M.1975/F:2
Demersal Fish (Northern) Committee

REPORT OF THE SAITHE (COALFISH) WORKING GROUP

Charlottenlund, 3-7 February 1975

1. Participants

Mr N. Daan	Netherlands
M B. Fontaine	France
Mr K. Hoydal	Denmark
Mr T. Jakobsen	Norway
Mr B.W. Jones (Chairman)	U.K. (England)
Dr H.H. Reinsch	Federal Republic of Germany
Mr J. Richards	U.K. (Scotland)
Dr S.A. Schopka	Iceland
Mr D. de G. Griffith,	ICES Statistician, also took part in the Meeting.

2. Terms of Reference

The Working Group was asked "to assess potential catches for 1975 and if possible total allowable catches for 1976; and to consider the effect of introducing a minimum landing size".

3. Landings

A summary of landings by fishing areas since 1960 is given in Table 1. In the last three years landings have shown only small fluctuations with the average total catch being just under 600 000 tons. The increase since 1970 in landings from the West of Scotland is due to an increase in catches reported by France in 1973 and revised estimates of French catches in 1971 and 1972. Preliminary estimates of landings in 1974 by country and fishing area are given in Table 2. Tables 3-7 give similar data (taken from "Bulletin Statistique") for the main fishing areas for the period 1960-73.

4. Virtual Population Analysis

Since the last (1974) meeting of the Working Group (Doc. C.M.1974/F:2) additional data have become available of age compositions of catches for 1973 and in most cases provisional data for 1974 were provided. In some cases amendments have been made to the data used in previous assessments where additional data have become available. The assessments for the North Sea include catches in Division IIIa, and West of Scotland includes both VIa and VIb. No age composition data of the USSR catches in 1973 or 1974 were made available to the Working Group nor were preliminary estimates of the USSR landings for 1974.

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In the North Sea in recent years USSR landings have constituted about 50% of the total catches of saithe, and the absence of USSR data for the two most recent years limits the possibilities for updating the assessments for this area. In addition the Working Group considered that USSR age composition data for the North Sea for earlier years were inconsistent with the weights of fish landed. The Virtual Population Analysis (VPA) for the North Sea included in this Report is an alternative assessment to that given in the previous Report in that new age compositions have been prepared for USSR landings up to 1972 and estimates of age compositions for USSR landings, based on combined age composition of landings by England, Netherlands and Scotland have been included for 1973 and 1974. The USSR age compositions for the earlier years have been adjusted on the assumption that the landed weights were correct but that the numbers at each age were overestimated. The age distributions in each year were adjusted by a factor:

$$\frac{\text{Recorded weight of landings}}{\text{Calculated weight of landings}}$$

The calculated weight of landings was derived from the sum of products of numbers at age x mean weight at age.

For the other areas the earlier assessments were updated by the addition of data for 1973 and 1974. The estimates of fishing mortality rates from the VPA are given in Tables 8-12. In the North-East Arctic fishery mortality rates appear to have remained relatively steady ($F = 0.3-0.4$) although age groups 3 to 5 tend to suffer higher mortality rates than the older age groups.

The present alternative assessment for the North Sea (Table 9) gives lower values of fishing mortality in the recent years than in last year's analysis (about $0.2 - 0.3$ compared with $0.4 - 0.5$), and there is no marked trend of increasing fishing mortality. However, estimates of stock sizes at 2 years old (Table 13) are of a similar order of magnitude to those in the earlier analysis. A possible interpretation of these results is that in the earlier years only part of the North Sea saithe stock was being exploited, and as the landings have been increasing the fishery has been expanding to exploit a greater proportion of the total stock. Alternatively, there may have been a real increase in recruitment to the stock in recent years.

At Iceland the updated assessment shows little change from the previous one and the fishery has remained stabilized over the last few years with a fishing mortality of about $0.5 - 0.6$ on the fully exploited age groups.

At Faroe the fishing mortality estimates varied very little from 1964-1971 when the average value was $0.2 - 0.3$. From 1972 the increase in saithe landings from this area have been accompanied by an increase in the estimated fishing mortality to $0.5 - 0.6$.

The assessment for the West of Scotland is influenced in the last three years (1972-74) by the inclusion of age composition data for the Scottish fishery in the Clyde. This fishery takes a greater proportion of young (2 and 3 year old) fish than the fisheries further off the coast. The Clyde fishery has been increasing in importance in recent years. This fishery exploits the younger fish which have an inshore distribution and it seems likely that the survivors migrate into the off-shore fishery as they grow. The fishing mortality rates on the older age groups have mainly been in the range $F = 0.15 - 0.30$ but on the younger age groups the mortality rates are higher having been about 0.3 and probably increasing in the last two years with the growth of the Clyde fishery.

5. The State of the Stocks

Table 14 gives estimates of the present levels of fishing mortality and average age at first capture for each area. Also shown are the values of ages at first capture which would give maximum yield per recruit at current levels of fishing mortality, and the optimum levels of fishing mortality for the present ages at first capture. The indications are that in none of the stocks is the fishing mortality excessive. In many areas, however, the yield could be improved by reducing the amount of fishing on the younger age groups.

6. Estimates of Total Allowable Catches (T.A.C's)

None of the saithe stocks appears to be seriously overexploited at present. However, as catch quota regulations have been introduced, or are being considered, for most of the other major demersal fish resources in the North Atlantic, there are obvious advantages in introducing catch quotas for the saithe stocks to prevent surplus fishing effort being diverted onto saithe and increasing exploitation above the optimum level.

The Working Group considers that, as exploitation levels are generally close to those giving the maximum sustainable yield for the present selection pattern, the present aim should be to set T.A.C's to stabilize the saithe fisheries at the exploitation levels of recent years, and at the same time to prevent any increase in, or preferably to reduce, the mortality on the younger fish. In considering Total Allowable Catches (T.A.C's) the Group based its calculations on the following area groupings:

North-East Arctic (Sub-areas I and II)

North Sea, Kattegat and Skagerak (Sub-area IV, Division IIIa)

Iceland (Division Va)

Faroe Islands (Division Vb)

West of Scotland and Rockall (Sub-area VI).

Landings of saithe from other ICES fishing areas are relatively insignificant.

Estimates of catches which are expected to be taken in 1975 and 1976, if fishing effort is maintained at its present level, have been prepared. Estimates of stock size and catch in numbers were calculated for 1974-76 from the 1973 catch data and estimates of fishing mortality. Catch in numbers at each age were converted into weight using mean weight-at-age data and summed to give an estimate of total catch for each year. Some difficulties were experienced in obtaining good agreement between declared landings in 1973 and landed weight calculated as the sum of products of numbers at each age times average weight at age. There are potential errors in weight-at-age data because of the different selection characteristics of the various national fisheries and even a weighted average of national weight-at-age data is subject to some error since the proportions of the total catch taken by the different countries are variable, and also because there is variation in the age structure of the stock. It is also possible that there are significant errors in the various national estimates of numbers of fish at each age in their landings. No information was available on the size of the year-classes which will be recruiting over the next few years and so average year-class strengths (year-classes 1958-68) of 2-year-old fish have been used in the calculations of predicted catches.

For the North Sea there is some doubt about the quality of some of the catch data and also no data for landings in 1973 and 1974 by the USSR (expected to be about 50% of the total landings) have been provided. As a result it has not been possible to prepare reliable catch predictions. The Working Group recommends that for the North Sea the TAC should be set at about the average of the catches in recent years, i.e. 200 000 tons. For the other areas the predicted catches

for 1975 and 1976 are tabulated below together with recommendations for T.A.C's.

Area	Estimated Catch at Present F (Tons)		Recommended T.A.C's (Tons) for 1976
North-East Arctic	1975	192 000	190 000
	1976	184 000	
North Sea	1975	-	200 000
	1976	-	
Iceland	1975	80 000	75 000
	1976	75 000	
Faroe Islands	1975	51 000	50 000
	1976	58 000	
West of Scotland	1975	29 000	30 000
	1976	22 000	

For the West of Scotland the average year-class strength used in the calculation of predicted catches is probably too low as estimates for recent year-classes have been tending to increase with the expansion of the fishery, and allowance has been made for this in the recommended T.A.C's.

At Iceland the predicted catches are appreciably below catch levels in recent years (average catch 1969-74 = 113 000 tons) and this is due to poorer recruitment in the last few years.

For Faroe there is less certainty about the recent levels of fishing mortality and accordingly a relatively conservative T.A.C's has been recommended until more reliable estimates are available.

In all areas the stock of saithe is liable to vary as a result of migration of fish between the different fishing regions. It is known that, at times at least, very substantial migrations take place but, as no adequate quantitative data are available and as variations in migration from year to year cannot be predicted, no allowance has been made for migration in the present calculations.

7. Effects of a Minimum Landing Size for Saithe

If minimum landing sizes were to be introduced for saithe in the NEAFC region this species would have to be included with those listed in NEAFC Recommendation (4), and it would also become subject to Recommendation (5) which limits the amount of by-catch of Recommendation (4) species which may be taken in industrial landings from Mixed Fisheries (Recommendation 2).

This subject was considered by the Working Group at its 1973 meeting (Doc. C.M. 1973/F:10) and the general conclusions reached then still stand. At present the rate of exploitation on small fish is not excessive and there are now no important industrial fisheries based on saithe. Saithe is, however, taken as a by-catch in some industrial fisheries for other species such as the industrial fisheries for Norway pout in the North Sea. The inclusion of saithe in Recommendation (4) might help to reduce the by-catch in these fisheries not only of saithe but also of other protected species, if the by-catch of total protected species became increased above the proposed 25% maximum by including saithe as a protected species.

As has been mentioned in an earlier section some of the saithe fisheries would benefit from a reduction in fishing on the younger age groups. The development of any fisheries for very small saithe would have undesirable consequences for the established fisheries. The introduction of a suitable minimum landing size would help to prevent such fisheries developing and could help to reduce the fishing mortality on the youngest age groups in the established fisheries. Table 15 gives updated estimates of the percentages by weight in the various national landings of fish less than 30, 35 and 40 cm in length. Lengths of saithe corresponding to various retention percentages for different mesh sizes are given in Table 16.

From a biological point of view little benefit can be expected from a minimum landing size less than 40 cm. For the majority of fisheries a minimum landing size up to 40 cm would involve very little immediate loss. The fisheries which would suffer the greatest losses would be in the Norwegian coastal fisheries in the North Sea (44% of catch <40 cm), and in fishing areas I + IIa (18% < 40 cm). In the latter area it is the Norwegian fisheries in the southern part of the area (NEAFC Region 2, 80 mm minimum trawl cod end mesh size) that are affected to the greatest extent. The Scottish fisheries West of Scotland, especially the Clyde fishery, also have high proportions of fish below 40 cm (16% and 21% respectively).

Table 1. Summary of total landings of saithe from the main fishing areas (metric tons, whole weight). This table is based on 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.

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	158 110	58 669	60 257	20 550	13 596	351 182
1965	184 548	73 274	60 177	22 071	18 395	358 465
1966	201 860	95 940	52 003	24 597	18 534	392 934
1967	191 191	76 759	75 712	23 219	16 034	382 915
1968	107 181	98 179	77 549	19 704	12 787	315 400
1969	140 379	115 564	115 853	27 536	17 214	416 546
1970	260 404	179 296	116 601	29 148	14 538	599 987
1971	244 732	219 731	134 127	30 867	19 246	648 703
1972	214 386	219 264	111 301	46 702	24 003	615 656
1973	210 833	191 200	110 888	56 606	35 834	605 361
1974 ^{x)}	192 526	201 874	90 077	44 913	29 180	558 570

x) Preliminary estimate.

Table 2. Preliminary Estimates of Saithe Landings in 1974 (Metric tons, whole weight)

	I	IIa	IIb	IIIa	IV	Va	Vb	VI	VII	Total
Belgium					26	2 008		177	44	2 255
Denmark				5 124	3 149					8 273
Faroe Islands					359	2 227	3 776	6		6 368
France		20	114		25 566		20 924	16 239	153	63 016
German Dem.Rep.*)		(12 000)								12 000
Germany, Fed.Rep.	267	35 269	(732)	9	19 875	17 895	5 919	19		79 985
Iceland						56 000				56 000
Netherlands					12 839			211	47	13 097
Norway	12 513	123 580	10	1 100	13 150		1 606			151 959
Poland	199	2 322			22 203		1 925	125	1	26 775
Spain*)										
UK (England & Wales)	849	2 068	30		4 148	8 839	3 821	1 354		21 109
UK (N. Ireland)*)										
UK (Scotland)	57	96			14 326	3 108	6 942	11 049	10	35 588
Sub-Total	13 885	175 355	886	6 233	115 641	90 077	44 913	29 180	255	476 425
USSR*)		(2 400)			(80 000)					82 400
TOTAL		192 526		6 233	195 641	90 077	44 913	29 180	255	558 825

*) No data available for 1974. German Democratic Republic catches in the North-East Arctic assumed to be 12 000 tons.
 USSR catches assumed to be similar to 1973.
 Estimated catches in brackets.

Table 3. Landings of Saithe from the North-East Arctic (I + IIa + IIb), by country, for the years 1960-1973. Metric tons, whole weight. (Data from Bulletin Statistique).

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973
Belgium	14	18	4	-	-	-	-	-	-	-	-	-	-	-
Faroe Is.	23	61	2	-	-	-	-	-	-	20	1 097	215	109	7
France	1 700	3 625	544	1 110	1 525	1 618	2 587	5 472	-	193	-	14 536	14 519	11 320
German Dem. Rep. ^(*)	-	-	-	-	-	-	813	304	70	6 744	29 362	16 840	7 474	12 015
Germany, Fed. Rep.	25 548	15 757	12 651	8 108	4 420	11 387	11 269	11 822	4 753	4 355	23 466	12 204	24 558	30 331
Netherlands	-	-	-	-	186	181	41	48	-	23	-	-	-	-
Norway	96 050	77 875	101 895	135 297	184 700	165 531	175 037	150 860	96 641	115 140	151 759	128 499	143 775	148 789
Poland	-	-	-	-	-	-	-	-	-	-	-	6 017	1 111	23
Spain	-	-	-	-	-	-	-	-	-	-	-	13 097	13 125	609
UK (England and Wales)	9 780	4 595	4 659	4 112	6 551	6 741	13 078	8 379	8 780	13 585	15 469	10 361	8 223	6 503
UK (Scotland)	-	20	-	-	-	5	-	-	2	-	221	106	125	248
USSR	-	-	912	-	84	137	563	441	-	-	43 550	39 397	1 278	2 411
Total	133 515	105 951	120 707	148 627	157 506	185 600	203 788	181 326	110 246	140 033	264 924	241 272	214 334	212 263

^(*) German Democratic Republic catch data taken from "Atlantic Fish Catches of the Socialist Countries, 1961-72" (Moscow, 1974).

Table 4. Landings of Saithe from the North Sea, Kattegat and Skagerrak (IV + IIIa), by country, for the years 1960 - 1973. Metric tons, whole weight. (Data from Bulletin Statistique).

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973
Belgium	108	51	154	132	140	126	161	74	94	135	36	44	55	55
Denmark	2 412	1 585	2 679	3 559	3 795	4 934	4 310	5 455	7 756	5 566	17 595	14 200	15 323	10 195
Faroe Is.	-	-	-	-	-	-	-	-	-	2	-	18	182	552
France	-	12 728	-	-	26 082	23 678	19 282	13 559	34 139	24 631	38 873	37 442	26 060	30 595
German Dem. Rep. ^{*)}	-	-	-	-	-	-	4 085	-	-	5 984	3 994	6 398	10 674	7 668
Germany, Fed. Rep.	8 381	3 138	2 960	2 773	3 391	7 736	7 462	7 036	6 066	7 242	6 022	4 217	8 665	12 003
Iceland	-	-	-	-	-	-	-	-	5	2	18	97	4	24
Netherlands	3 637	2 527	2 656	4 455	4 552	5 000	8 177	13 395	16 482	18 214	20 460	18 136	12 532	9 232
Norway	5 007	5 336	8 358	5 982	5 602	12 330	14 183	10 842	8 683	8 159	11 201	15 184	23 256	13 948
Poland	12	28	112	3	-	-	655	104	43	-	-	4	186	7 512
Sweden	2 135	2 262	2 670	3 206	3 356	6 574	3 643	6 318	8 212	4 322	1 921	4 523	3 895	1 876
UK (England and Wales)	4 215	4 153	3 407	3 821	4 143	5 573	6 172	5 408	3 925	3 815	2 664	3 162	3 744	3 378
UK (Scotland)	1 585	1 033	1 520	2 207	3 099	3 195	3 254	3 911	6 001	3 838	5 293	6 106	10 797	10 834
USSR	-	-	-	-	-	10	22 388	11 527	11 405	32 830	68 062	110 200	99 883	83 333
Total	31 500	33 325	24 414	30 178	58 159	73 160	93 772	77 669	103 171	114 744	176 139	219 731	215 264	191 200

^{*)} German Democratic Republic catch data taken from "Atlantic Fish Catches of the Socialist Countries, 1961-72" (Moscow, 1974).

Table 5. Landings of Saithe from Iceland (Va), by country for the years 1960-1973. Metric tons, whole weight. (Data from Bulletin Statistique).

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973
Belgium	2 771	3 354	2 505	2 830	2 144	1 999	2 282	2 739	3 155	3 995	4 153	3 490	2 250	2 131
Faroe Islands	514	893	590	491	45	285	100	39	101	119	2 386	2 046	857	1 467
France	-	105	409	-	-	1) ...	500	5 803	6 701	8 122	2 046	3 951	-	-
German Dem. Rep. #)	...	-	-	-	-	-	154	202	634	357	3 527	2 637	3 471	-
Germany, Fed. Rep.	23 412	22 223	24 015	17 622	21 130	16 708	17 204	24 037	17 327	34 732	27 806	40 628	30 918	38 565
Iceland	12 703	13 675	13 469	14 758	21 665	24 866	21 022	29 021	38 027	53 988	63 882	60 080	59 945	56 342
Netherlands	-	48	87	401	309	409	25	-	-	52	-	-	-	-
Norway	59	-	-	11	4	-	-	-	-	-	-	-	-	-
Poland	-	-	-	-	-	-	-	-	-	-	-	113	150	-
Spain	-	-	-	-	-	-	-	-	-	-	-	59	13	-
UK (England & Wales)	8 454	9 016	8 767	11 262	13 899	14 472	9 857	13 694	11 561	13 665	10 634	21 767	13 152	11 874
UK (Scotland)	120	491	563	1 074	1 221	1 365	920	901	982	1 605	2 402	1 743	545	509
USSR	-	-	-	-	-	3	258	35	90	65	-	5	-	-
Total	43 039	49 795	50 385	48 449	60 417	60 107	52 322	76 471	78 578	116 700	116 836	136 519	111 301	110 888

1) Inc. in Vb₁

#) German Democratic Republic catch data taken from "Atlantic Fish Catches of the Socialist Countries, 1961-72" (Moscow, 1974).

Table 6. Landings of Saithe from Faroe Islands (Vb), by country, for the years 1960-1973.
Metric tons whole weight. (Data from Bulletin Statistique).

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973
Faroe Islands	685	929	2 494	2 431	1 338	1 000	1 167	2 242	2 629	4 835	2 694	5 653	5 646	2 973
France	-	-	620	2 207	6 458	8 565 ¹⁾	9 967	5 555	424	7 899	11 036	10 621	28 346	22 241
German Dem. Rep. ^{*)}	...	-	-	-	-	-	66	193	-	-	-	-	-	-
Germany, Fed. Rep.	2 583	2 219	985	1 415	6 459	3 557	4 963	5 797	7 433	4 676	2 211	2 254	3 440	9 329
Netherlands	-	-	-	-	-	-	-	-	-	-	-	63	-	-
Norway	-	-	-	-	+	-	2 498	-	-	378	1 495	1 839	470	355
Poland	-	-	-	-	-	-	-	-	-	-	-	-	-	4 050
UK (England & Wales)	6 437	4 230	3 724	3 177	4 329	5 265	3 321	3 536	5 123	4 303	3 066	3 305	2 453	7 527
UK (Scotland)	2 140	2 214	2 631	3 463	3 309	3 794	3 581	3 996	4 778	5 346	8 608	7 198	6 225	10 131
Total	11 845	9 592	10 454	12 693	21 893	22 181	25 563	21 319	20 387	27 437	29 110	30 933	46 580	56 606

1) Va included.

*) German Democratic Republic catch data from "Atlantic Fish Catches of the Socialist Countries, 1961-72" (Moscow, 1974).

Table 7. Landings of Saithe from West of Scotland and Rockall (Via + Vib), by country, for the years 1960-1973. Metric tons whole weight. (Data from Bulletin Statistique).

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973
Belgium	94	6	15	61	10	-	168	31	27	40	34	29	125	191
Denmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Faroe Islands	-	-	-	-	-	-	-	-	-	-	-	-	-	4
France	41	33	434	415	2 780	5 059	7 550	7 092	3 841	8 109	5 140	3 300	6 268	20 972
German Dem. Rep. ^(*)	-	-	-	-	-	-	25	-	283	-	-	-	-	-
Germany, Fed. Rep.	122	23	155	15	135	119	62	368	368	1 988	545	1 068	350	52
Iceland	-	-	-	-	-	-	-	-	-	-	1	1	-	-
Netherlands	-	-	-	-	+	12	+	54	59	14	7	32	638	67
Norway	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Poland	-	-	-	-	-	-	-	-	1	-	-	2	-	394
Spain	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sweden	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UK (England & Wales)	6 456	4 484	4 359	4 072	7 455	9 012	7 693	5 796	5 704	4 015	3 615	1 965	2 268	2 138
UK (N. Ireland)	-	43	9	20	22	36	31	17	21	13	19	24	6	14
UK (Scotland)	1 656	2 130	2 187	2 026	3 194	4 157	3 005	2 676	2 483	3 035	5 175	4 620	6 706	11 330
USSR	-	-	-	-	-	-	-	-	-	-	-	105	112	670
Total	8 349	6 724	7 159	6 609	13 596	18 395	18 534	16 034	12 787	17 214	14 536	11 146	16 473	35 834

^(*) German Democratic Republic catch data from "Atlantic Fish Catches of the Socialist Countries, 1961-72" (Moscow, 1974).

Table 8. Saithe. North-East Arctic.(I+IIa+IIb).

Estimates of fishing mortality from Virtual Population Analysis (M = 0.2)

Year Age	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
1															
2	.07	.02	.00	.03	.06	.17	.03	.04	.02	.01	.07	.11	.03	.10	.10
3	.16	.25	.26	.18	.11	.15	.19	.17	.20	.34	.18	.36	.54	.29	.40
4	.19	.20	.25	.33	.41	.08	.34	.33	.15	.14	.51	.42	.40	.40	.40
5	.50	.27	.14	.20	.24	.32	.31	.39	.10	.20	.24	.40	.35	.34	.40
6	.26	.25	.29	.22	.13	.30	.25	.15	.15	.13	.31	.23	.29	.32	.30
7	.26	.10	.25	.22	.25	.20	.22	.17	.04	.12	.20	.28	.24	.31	.30
8	.20	.08	.10	.17	.23	.24	.14	.21	.08	.07	.29	.15	.17	.24	.30
9	.12	.06	.10	.15	.30	.38	.16	.21	.09	.09	.23	.24	.16	.19	.30
10	.15	.05	.07	.10	.26	.28	.23	.37	.13	.09	.30	.26	.20	.31	.30
11	.18	.11	.08	.09	.21	.34	.31	.32	.17	.06	.21	.41	.29	.20	.30
12	.16	.13	.11	.08	.23	.17	.33	.87	.14	.08	.33	.35	.19	.28	.30
13	.39	.06	.22	.17	.13	.19	.27	.63	.48	.02	.27	.21	.17	.27	.30
14 = F _I	.20	.20	.20	.20	.30	.30	.30	.30	.30	.30	.30	.30	.30	.30	.30

Table 9. Saithe North Sea (IV + IIIa)
Estimates of Fishing Mortality from Virtual Population Analysis ($M = 0.2$)

Age \ Year	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
1	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00	.00	.06	.01
2	.04	.02	.00	.01	.06	.00	.08	.06	.02	.07	.02	.12	.16	.23	.20
3	.31	.18	.15	.04	.16	.11	.12	.12	.16	.07	.13	.20	.34	.42	.45
4	.40	.62	.33	.30	.21	.37	.34	.19	.23	.19	.31	.25	.36	.35	.45
5	.50	.46	.45	.56	.50	.51	.20	.27	.23	.19	.28	.31	.25	.29	.40
6	.45	.60	.29	.32	.38	.25	.47	.14	.21	.23	.30	.18	.45	.23	.40
7	.19	.48	.13	.17	.43	.19	.23	.55	.06	.22	.23	.19	.23	.16	.30
8	.05	.29	.08	.08	.42	.11	.15	.22	.19	.09	.17	.22	.24	.13	.30
9	.01	.27	.07	.12	.42	.10	.27	.25	.25	.27	.12	.21	.25	.13	.30
10	.02	.20	.11	.06	.15	.12	.21	.33	.21	.24	.31	.10	.23	.12	.30
11	.08	.27	.06	.15	.20	.12	.24	.27	.52	.12	.17	.47	.10	.18	.30
12	.00	1.52	.14	.31	.15	.07	.21	.21	.39	.32	.18	.13	.77	.06	.30
13	.01	.09	.71	.01	.29	.30	.18	.09	.59	.32	.32	.10	.08	.69	.30
14 = F_I	.01	.10	.10	.20	.20	.20	.25	.25	.40	.40	.40	.40	.40	.40	.40

Table 10. Iceland (Va) Saithe
Estimates of Fishing Mortality from Virtual Population Analysis (M = 0.2)

Year Age	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
1															
2	.01	.02	.00	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
3	.05	.15	.06	.08	.06	.02	.01	.02	.02	.02	.01	.01	.02	.00	.02
4	.15	.20	.27	.11	.23	.13	.03	.07	.05	.10	.09	.07	.13	.10	.10
5	.29	.34	.31	.21	.25	.23	.13	.11	.09	.16	.17	.22	.23	.27	.20
6	.29	.33	.47	.40	.31	.24	.18	.25	.18	.25	.25	.34	.31	.41	.30
7	.24	.20	.29	.45	.28	.29	.22	.35	.29	.41	.39	.47	.38	.47	.40
8	.25	.13	.21	.38	.24	.24	.26	.33	.37	.45	.51	.64	.46	.44	.40
9	.28	.13	.17	.26	.18	.23	.22	.31	.28	.41	.54	.86	.62	.43	.40
10	.22	.22	.18	.24	.17	.19	.23	.30	.33	.34	.51	.66	.83	.57	.40
11	.18	.26	.19	.29	.14	.18	.23	.26	.33	.15	.39	.91	.58	.61	.50
12	.29	.54	.26	.42	.16	.16	.17	.19	.25	.28	.41	1.10	1.14	.96	.50
13	.32	.29	.24	.39	.22	.21	.29	.43	.32	.12	.39	.41	.84	1.00	.60
14 = F _I	.30	.30	.30	.30	.30	.30	.30	.30	.30	.30	.40	.50	.60	.60	.60

Table 11. Faroe Vb Saithe.
Estimates of fishing mortality from Virtual Population Analysis ($M = 0.2$).

Year Age	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
1															
2	.03	.01	.00	.01	.00	.01	.00	.01	.01	.00	.02	.02	.01	.03	.01
3	.19	.03	.05	.04	.06	.06	.03	.03	.04	.04	.07	.10	.10	.11	.10
4	.07	.06	.10	.04	.15	.09	.12	.05	.12	.19	.32	.20	.10	.29	.20
5	.12	.11	.13	.08	.25	.19	.19	.12	.12	.24	.21	.48	.29	.61	.40
6	.16	.14	.16	.12	.21	.26	.29	.15	.16	.22	.24	.19	.57	.66	.60
7	.15	.11	.14	.19	.25	.27	.35	.27	.17	.24	.21	.19	.62	.68	.60
8	.15	.11	.09	.14	.30	.28	.32	.29	.29	.29	.24	.15	.62	.55	.60
9	.16	.11	.16	.17	.18	.37	.33	.25	.31	.45	.25	.15	.69	.51	.60
10	.16	.11	.15	.29	.21	.31	.46	.30	.29	.53	.35	.18	.76	.56	.60
11	.20	.13	.14	.18	.30	.35	.42	.33	.27	.45	.37	.22	.85	.45	.60
12	.18	.29	.11	.55	.24	.71	.38	.29	.42	.56	.34	.39	.64	.61	.60
13	1.73	.05	.22	.36	.29	.44	.80	.21	.31	.50	.55	.13	.44	.20	.60
14 = F_I	.20	.20	.20	.20	.30	.30	.30	.30	.30	.40	.40	.40	.60	.60	.60

Table 12. Saithe: West of Scotland (VI).

Estimates of fishing mortality from Virtual Population Analysis ($M = 0.2$)

Year Age	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
1															
2	.04	.02	.03	.01	.00	.01	.00	.02	.00	.01	.00	.02	.23	.11	.40
3	.27	.14	.17	.12	.22	.16	.19	.15	.13	.15	.15	.14	.29	.84	.60
4	.49	.39	.36	.19	.28	.57	.36	.30	.26	.39	.26	.35	.29	1.11	.50
5	.62	.34	.38	.16	.29	.35	.47	.23	.20	.27	.26	.34	.19	.51	.50
6	.36	.44	.31	.26	.25	.36	.21	.18	.11	.12	.16	.24	.26	.37	.40
7	.33	.36	.44	.21	.30	.33	.15	.22	.14	.14	.08	.18	.22	.46	.30
8	.23	.32	.29	.51	.18	.29	.07	.15	.09	.14	.06	.15	.20	.27	.30
9	.15	.42	.25	.26	.31	.49	.12	.11	.06	.07	.08	.13	.16	.18	.30
10	.05	.21	.52	.05	.32	.41	.15	.19	.07	.06	.07	.12	.14	.14	.30
11	.09	.46	.06	.33	.36	.85	.23	.25	.11	.08	.07	.15	.32	.18	.30
12	.02	.65	.48	.07	.15	.14	.28	.33	.19	.11	.11	.10	.27	.30	.30
13	.19	.17	.90	.19	.09	.41	.16	.61	.19	.35	.23	.24	.22	.24	.30
14 = F_I	.30	.30	.30	.30	.30	.30	.30	.30	.30	.30	.30	.30	.30	.30	.30

Table 13.

Estimates from Virtual Population Analysis of Population Size (millions) at 2 years old of each year-class. Estimates of year-class size of the more recent year-classes are less reliable than those of earlier year-classes.

Year-class Area	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
North-East Arctic	115	225	349	121	383	210	263	193	366	368	406	233	405	180	212
North Sea	37	36	50	84	183	137	181	137	308	368	324	163	178	170	72
Iceland	41	38	103	67	114	87	85	74	112	70	51	32	60	90	123
Faroe Islands	10	14	24	17	25	22	25	21	40	30	38	45	32	56	5
West of Scotland	8	8	18	14	31	22	19	27	19	28	14	26	29	42	28

Table 14. Estimates of present Fishing Mortality rates and mean ages at first capture, with corresponding values for maximum yield per recruit.

Area	Estimates present Fishing Mortality	Present Mean Age at First Capture (years)	Optimum Mean Age at (years) Capture for Present F	Optimum F at Present Age at First Capture
North-East Arctic	0.3 - 0.4	3.0	5.5	0.3
North Sea	0.3 - 0.4	3.0	5	0.3
Iceland	0.5 - 0.6	5.0	6	0.5
Faroe Islands	0.4 - 0.6	4.5	5	0.4
West of Scotland	0.3 - 0.5	3.0	5	0.4

Table 15. Percentages by Weight of Saithe less than 30, 35 and 40 cm in Length in the Landings from the Different Areas¹.

Country	Length	Percentage by Weight				
		I+II	IV	Va	Vb	VI
England	30	0	0	0	0	0
	35	0	0.1	0	0	0.1
	40	0.2	2.4	>0.1	0.1	1.4
Faroe	40			0		
Germany, F.R.	30	0	0	0	0	
	35	0	0	0	0	
	40	>0.1	0.3	0	0	
Iceland	40				0	
Netherlands	30		0			
	35		0.1			
	40		1.0			
Norway	30	0.9	1.3			
	35	5.8	8.8			
	40	18.1	43.5			
USSR	30	<0.1	0			
	35	0.6	0.2			
	40	6.6	2.8			
Scotland	30		0		0	0.1
	35		0.2		>0.1	7.9
	40		4.3		0.4	20.9
					<u>Clyde</u>	<u>North Coast</u>

*) Averaged for 1971-73, except USSR and Netherlands (1970-72) and Scotland (1972-73).

Table 16. Lengths of Saithe Corresponding to Different Rates of Retention. Selection Factor: 3.8.

% Retention	Mesh Size (mm)		
	80	130	145
5	18.4	37.4	43.1
25	26.2	45.2	50.9
50	30.4	49.4	55.1
75	35.0	54.0	59.7
95	41.2	60.2	65.9

