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International Council for the
Exploration of the Sea

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REPORT OF THE SAITHE (COALFISH) WORKING GROUP

Copenhagen, 20-27 April 1982

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from 1978 to 1981, and a decline from 1976-78 which was reasonably consistent with the effort data and was therefore adopted by the Working Group. The terminal fishing mortality at age 1 was chosen in order to give a recruitment of 200 million fish in 1981. This recruitment is above the average recruitment in the years 1975-79 and was chosen because of the large catch of 1 year old fish in 1981.

This year the Working Group re-considered the age range over which average fishing mortality is calculated and agreed that the use of age groups 3 to 6 would be more appropriate for an index of fishing mortality than the ages 5 to 10, which were used previously. Indices of average fishing mortality quoted in this report are, therefore, not directly comparable with those given in last year's report.

The trend in fishing mortality is plotted in Figure 5.1.D.

5.4.2 Spawning stock biomass and recruitment

Spawning stock biomass (Table 5.5 and Figure 5.1.B) has fluctuated since 1976 between 270 000 tonnes and 335 000 tonnes. Figure 5.1.C shows recruitment at age 1. The year classes 1975-78 appear to be below the long-term average. In the predictions, the recruitment in 1982 to 1984 was assumed to be equal to the average recruitment of the year classes 1975 to 1978 ($R_1 = 148 \times 10^6$).

5.5 Yield per Recruit

The yield per recruit curve (Figure 5.2) was calculated using the average weight at age in the years 1979-81 and the current exploitation pattern (Table 5.7). F_{max} expressed as the average fishing mortality for ages 3-6 is 0.26. The present fishing mortality is estimated to be $\bar{F}_{(3-6)} = 0.37$.

5.6 Catch Predictions

Table 5.7 shows the input data used in the catch predictions. The agreed TAC for the North Sea in 1982 is 125 000 tonnes, and the predicted catch is 124 000 tonnes. The results of the catch predictions are shown in Table 5.8 and Figure 5.3 for a range of options for 1983.

6. ICELANDIC SAITHE

6.1 Landings

Landings of saithe from Division Va are shown in Figure 6.1.A and in Table 6.1. Since 1977, catches have been at a fairly stable level of 50 000 - 60 000 tonnes annually. Landings in 1981 were 59 000 tonnes.

6.2 Age Composition

Age composition data were available only for the Icelandic catches which accounted for 93% of the total landings in 1981. The total catch in numbers used as input for the VPA (Table 6.2) was calculated by raising the other catches with the Icelandic age composition data. The 1980 data were revised and updated.

6.3 Weight at Age

Weight at age data used for stock biomass calculations are given in Table 6.3. In 1979, several thousand specimens of saithe were measured and weighed, and the length/weight relationship was revised. The 1979 weight at age data were used for the period 1974-79, when the sum of products estimates were within 2% of the actual landings. In the period 1966-73, data from previous assessments were used unchanged.

Since 1979 the average weight at age has been declining. An average of the 1980 and 1981 data were used in the catch projections (Table 6.6).

6.4 Fishing Mortality and Stock Values from VPA

6.4.1 Estimates of fishing mortality (Table 6.4)

The big increase in redfish catches in 1981 implies that some effort was diverted from the saithe fishery. Therefore, the average of the relatively stable F values in the 1977-79 period, which were somewhat lower than the 1980 F values, have been used as input F for the VPA. The unweighted mean fishing mortality on the age groups 4-9 which accounts on average for about 90% of the catches, has been taken as a reference fishing mortality in the presentation of the assessments (Figure 6.1.D).

6.4.2 Spawning stock biomass and recruitment

Spawning stock biomasses are shown in Figure 6.1.B and Table 6.5. The spawning stock biomass increased from 122 000 tonnes in the early 1960s to a peak of 443 000 tonnes in 1969. This increase in spawning stock biomass was the result of higher year class strengths. Since 1969 the spawning stock has been declining, and in 1981 (174 000 tonnes) it was at a level similar to that in the mid-1960s.

The 1960-67 year classes were more abundant than the 1968-77 year classes (Figure 6.1.C and Table 6.5). The abundance of the 1979 year class at age 2 was assumed to be 42 million fish equal to the average for the year classes 1968-77. Accordingly, the input F for this year class at age 3 in 1980 was adjusted to produce this result. For the catch projections, abundances for 1980 and 1981 were also assumed to be 42 million fish (35 million at age 3).

6.5 Yield per Recruit

The yield and spawning stock biomass per recruit curves are shown in Figure 6.2. No changes in the exploitation pattern have taken place in recent years and, therefore, the average 1977-79 exploitation pattern has been used. The yield per recruit curve is flat-topped. F_{max} is about 0.39, and the present fishing mortality on age groups 4-9 is estimated to be $\bar{F}_{(4-9)} = 0.29$.

6.6 Catch Predictions

The input data for catch projections are shown in Table 6.6. The projections are based on the 1977-79 exploitation pattern also used as input to the VPA.

The recommended TAC for 1982 is 62 000 tonnes. Assuming the same effort on saithe in 1982 as in 1981, the expected catch in 1982 will be 67 000 tonnes. The associated spawning stock biomass in 1983 will be 184 000, and the total stock biomass about 350 000 tonnes. The results of catch projections for 1983 and total stock and spawning stock biomasses in 1984 are given in Table 6.7 and Figure 6.3.

Table 6.1 Nominal catch (tonnes) of SAITHE in Division Va, 1972-1981.
(Data for 1972 to 1980 from Bulletin Statistique)

Country	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981*
Belgium	2 250	2 131	2 371	1 638	1 615	1 448	1 092	980	980	532
Faroe Islands	857	1 467	1 712	1 366	3 267	3 013	4 250	5 457	4 930	3 547
France	-	-	94	32	51	-	-	-	-	-
German Dem.Rep.	3 471	-	-	-	-	-	-	-	-	-
Germany, Fed.Rep.	30 918	38 565	18 627	13 820	13 785	10 575	-	-	-	-
Iceland	59 945	56 567	65 169	61 430	56 811	46 973	44 327	57 066	52 436	54 905
Norway	-	-	-	6	5	4	3	1	1	2
Poland	150	-	-	-	-	-	-	-	-	-
Spain	-	-	-	-	-	-	-	-	-	-
U.K. (England & Wales)	13 152	11 874	8 845	8 643	6 024	13	-	-	-	-
U.K. (Scotland)	545	509	731	1 021	443	-	-	-	-	-
USSR	-	-	-	-	-	-	-	-	-	-
Total	111 288	111 113	97 549	87 956	82 001	62 026	49 672	63 504	58 347	58 986

*Preliminary

Table 6.2 Icelandic SAITHE.
Input catch in numbers ('000) for VPA.

	1966	1967	1968	1969	1970	1971	1972	1973	1974
2	31	196	1	20	18	7	49	25	111
3	940	1116	836	1572	287	476	565	219	1269
4	2090	3400	2605	4395	5622	3031	3786	1768	3404
5	3283	5591	3563	5706	4999	10221	6524	5155	2348
6	4117	4326	6318	6518	6126	6736	8646	7077	3164
7	1285	4931	3207	9136	6178	6694	4178	7372	3452
8	739	1200	3008	2796	5934	5045	3320	2616	3384
9	390	550	621	1843	1689	4272	2098	1635	1303
10	235	330	343	461	1191	959	1421	871	824
11	133	169	215	100	299	887	301	412	351
12	69	73	103	110	171	349	328	231	141
13	102	104	79	32	92	96	79	80	43
14	73	65	41	44	70	63	68	22	13
15+	93	126	95	32	86	131	73	23	20
TOTAL	13580	22177	21035	32765	32762	38967	31496	27506	19827

	1975	1976	1977	1978	1979	1980	1981
2	16	29	5	0	0	0	0
3	526	329	59	548	480	135	257
4	2997	3234	2099	1145	3764	2303	1550
5	2479	3045	2858	2435	1991	4634	4510
6	1829	2530	1801	1556	3616	2551	5464
7	3496	2154	1036	1275	1566	2419	1504
8	2994	2367	1068	961	718	1612	1470
9	1434	1530	1528	537	292	482	589
10	710	1064	958	575	669	245	192
11	325	295	538	476	589	132	67
12	176	191	166	279	489	102	175
13	100	94	71	139	150	59	130
14	36	68	12	91	72	29	136
15+	61	18	49	55	0	23	72
TOTAL	17179	16948	12248	10072	14396	14726	15916

Table 6.3 Icelandic SAITHE.
Mean weight at age of the stock (kg).

	1966	1967	1968	1969	1970	1971	1972	1973	1974
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12
4	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.76
5	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	2.73
6	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.29
7	5.38	5.38	5.38	5.38	5.38	5.38	5.38	5.38	5.54
8	6.55	6.55	6.55	6.55	6.55	6.55	6.55	6.55	7.27
9	7.64	7.64	7.64	7.64	7.64	7.64	7.64	7.64	8.42
10	8.63	8.63	8.63	8.63	8.63	8.63	8.63	8.63	9.41
11	9.52	9.52	9.52	9.52	9.52	9.52	9.52	9.52	10.00
12	10.29	10.29	10.29	10.29	10.29	10.29	10.29	10.29	10.56
13	10.97	10.97	10.97	10.97	10.97	10.97	10.97	10.97	11.87
14	11.55	11.55	11.55	11.55	11.55	11.55	11.55	11.55	13.12
15+	12.80	12.80	12.80	12.80	12.80	12.80	12.80	12.80	14.00

	1975	1976	1977	1978	1979	1980	1981
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	1.12	1.12	1.12	1.12	1.12	1.44	1.48
4	1.76	1.76	1.76	1.76	1.76	1.89	2.00
5	2.73	2.73	2.73	2.73	2.73	2.68	2.57
6	4.29	4.29	4.29	4.29	4.29	3.87	3.46
7	5.54	5.54	5.54	5.54	5.54	5.32	4.43
8	7.27	7.27	7.27	7.27	7.27	6.14	6.16
9	8.42	8.42	8.42	8.42	8.42	6.85	6.82
10	9.41	9.41	9.41	9.41	9.41	8.23	8.05
11	10.00	10.00	10.00	10.00	10.00	9.06	9.41
12	10.56	10.56	10.56	10.56	10.56	9.30	9.20
13	11.87	11.87	11.87	11.87	11.87	10.50	9.44
14	13.12	13.12	13.12	13.12	13.12	11.37	10.15
15+	14.00	14.00	14.00	14.00	13.12	11.67	10.76

Table 6.4 Icelandic SAITHE.
Fishing mortalities from VPA (M = 0.2)

	1966	1967	1968	1969	1970	1971	1972	1973	1974
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.01	0.02	0.02	0.02	0.00	0.01	0.02	0.01	0.06
4	0.03	0.07	0.05	0.10	0.09	0.06	0.11	0.09	0.23
5	0.13	0.11	0.10	0.16	0.17	0.24	0.19	0.21	0.17
6	0.18	0.24	0.17	0.25	0.26	0.35	0.33	0.32	0.19
7	0.22	0.35	0.29	0.40	0.40	0.49	0.39	0.51	0.25
8	0.24	0.32	0.37	0.43	0.49	0.67	0.48	0.45	0.47
9	0.22	0.29	0.27	0.41	0.51	0.81	0.67	0.47	0.42
10	0.23	0.30	0.29	0.33	0.51	0.62	0.71	0.65	0.46
11	0.23	0.26	0.32	0.13	0.37	0.92	0.51	0.46	0.61
12	0.17	0.19	0.25	0.27	0.34	1.02	1.13	0.73	0.28
13	0.29	0.43	0.32	0.12	0.39	0.32	0.68	0.97	0.28
14	0.20	0.30	0.30	0.30	0.40	0.50	0.40	0.40	0.40
15+	0.20	0.30	0.30	0.30	0.40	0.50	0.40	0.40	0.40
F(4- 9),U	0.17	0.23	0.21	0.29	0.32	0.44	0.36	0.34	0.29

	1975	1976	1977	1978	1979	1980	1981	1977-1979
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.02	0.01	0.00	0.01	0.01	0.01	0.01	0.01
4	0.20	0.17	0.09	0.08	0.09	0.07	0.09	0.09
5	0.26	0.32	0.23	0.14	0.18	0.16	0.18	0.18
6	0.19	0.46	0.32	0.19	0.32	0.38	0.28	0.28
7	0.33	0.35	0.35	0.39	0.29	0.37	0.40	0.34
8	0.37	0.38	0.30	0.63	0.40	0.55	0.40	0.44
9	0.37	0.32	0.46	0.24	0.40	0.52	0.40	0.36
10	0.42	0.53	0.34	0.31	0.53	0.68	0.40	0.39
11	0.33	0.31	0.56	0.29	0.60	0.19	0.40	0.48
12	0.71	0.32	0.29	0.64	0.54	0.19	0.40	0.49
13	0.33	1.13	0.19	0.42	0.87	0.11	0.40	0.49
14	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
15+	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
F(4- 9),U	0.29	0.34	0.29	0.28	0.28	0.34	0.29	

Table 6.5 Stock size in numbers ('000) and biomass (tonnes).

1 JANUARY

	1966	1967	1968	1969	1970	1971	1972	1973	1974
2	83697	73957	107652	81664	62534	54369	27001	28853	34138
3	70181	68497	60573	88137	66843	51182	28152	22554	23600
4	75013	56610	55073	48675	70741	54467	41474	22523	18268
5	30505	60019	43281	42759	55888	52847	41858	30542	16845
6	27003	22016	44098	32222	29851	24879	54071	28396	20365
7	7303	18401	14133	30413	20518	18929	14320	20127	10889
8	3767	4822	10636	8688	10702	11255	9500	7974	9875
9	2144	2419	2870	6108	4606	8357	4707	4802	4183
10	1236	1404	1486	1791	3265	2258	5035	1980	2466
11	713	800	853	908	1052	1606	991	1216	842
12	474	464	503	505	654	593	520	488	626
13	448	326	314	319	315	381	176	140	193
14	443	275	174	186	233	175	226	73	43
15+	564	534	402	136	286	364	243	76	66
TOTAL	304091	310540	341850	342392	313480	261603	206800	169743	148401
SPAWN. ST.	44096	51462	75471	81178	77480	68799	67794	65271	55550
Total biom.	556970	653452	703317	767441	762219	724398	612240	520033	434549
SSB	237125	282720	395749	442972	439244	399136	371773	357474	329978

	1975	1976	1977	1978	1979	1980	1981	1982	1970-1978
2	41064	25801	70906	56876	29780	45146	0**********		42460
3	27850	33606	21098	58048	46560	24382	36963	0	36990
4	18177	22326	27217	17220	47031	37092	19840	30030	32490
5	11893	12184	15366	20390	13066	35111	28781	14846	20424
6	11677	7507	7239	10009	14499	8904	24571	19682	19333
7	13824	7913	3878	4309	6793	8622	5000	15204	13412
8	10723	8177	4544	2245	2383	4154	4887	2744	8999
9	5052	6091	4570	2761	979	1307	1958	2682	5014
10	2256	2849	3612	2372	1777	539	638	1075	2677
11	1280	1210	1379	2097	1425	856	223	350	1297
12	376	756	725	648	1289	640	582	122	599
13	386	151	448	445	281	617	452	319	293
14	120	226	40	303	239	96	452	237	160
15+	203	60	163	183	0	76	239	380	183
TOTAL	144878	128856	161185	177903	160108	168143	124567		
SPAWN. ST.	45895	34939	26599	25369	29666	25812	38983		
Total biom.	389804	349450	301099	319291	347059	342203	342803		
SSB	294154	239256	187618	168305	176462	141455	174366		

1.12
1.96

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Table 6.6 Icelandic SAITHE.
Input values used for the catch prediction.

AGE	1982 STOCK SIZE	F-PATTERN	M	MATURITY OGIVE	WEIGHT IN THE CATCH	WEIGHT IN THE STOCK
3	34763.00	0.0077	0.200	0.0000	1.4600	1.4600
4	30030.00	0.0900	0.200	0.0000	1.9500	1.9500
5	14846.00	0.1800	0.200	0.0000	2.6200	2.6200
6	19682.00	0.2800	0.200	1.0000	3.6700	3.6700
7	15204.00	0.4000	0.200	1.0000	4.8800	4.8800
8	2744.00	0.4000	0.200	1.0000	6.1500	6.1500
9	2682.00	0.4000	0.200	1.0000	6.8400	6.8400
10	1075.00	0.4000	0.200	1.0000	8.1400	8.1400
11	350.00	0.4000	0.200	1.0000	9.2400	9.2400
12	122.00	0.4000	0.200	1.0000	9.2500	9.2500
13	319.00	0.4000	0.200	1.0000	9.9700	9.9700
14	237.00	0.4000	0.200	1.0000	10.7700	10.7700
15+	380.00	0.4000	0.200	1.0000	11.2200	11.2200

YEAR	RECRUITMENT
83	35000.00
84	35000.00

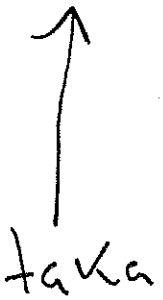

Table 6.7 Catch predictions and management options. Area: Division Va (Iceland)
Species: SAITHE

1981		1982				1983					1984	
Total landings	$\bar{F}(4-9)$	Stock biomass	Spawning stock biomass	$\bar{F}(4-9)$	Total landings	Management option for 1983	Stock biomass	Spawning stock biomass	$\bar{F}(4-9)$	Total landings	Stock biomass	Spawning stock biomass
59	0.29	353	205	0.29	67	$\bar{F}_{0.1}$	349	184	0.15	36		212
						$\bar{F}_{max}$			0.39	85		160
						$\bar{F}_{83} = \bar{F}_{81}$			0.29	66	343	181
						$\bar{F}_{83} = 0$			0.00	0	416	249
						$\bar{F}_{83} = 0.2\ \bar{F}_{81}$			0.06	15	400	233
						$\bar{F}_{83} = 0.5\ \bar{F}_{81}$			0.15	36	377	212
						$\bar{F}_{83} = 1.5\ \bar{F}_{81}$			0.44	92	349	155
						$\bar{F}_{83} = 2.0\ \bar{F}_{81}$			0.58	114	295	133

Weights in thousands of tonnes

Recruitment 1982-84 R_3 = 35.0 millions 79-81

Stock biomass = fish at age 3 and older

Spawning stock biomass = fish at age 6 and older

Exploitation pattern 1982-83 based on 1977-1979 average

Figure 6.1 Icelandic SAITHE.

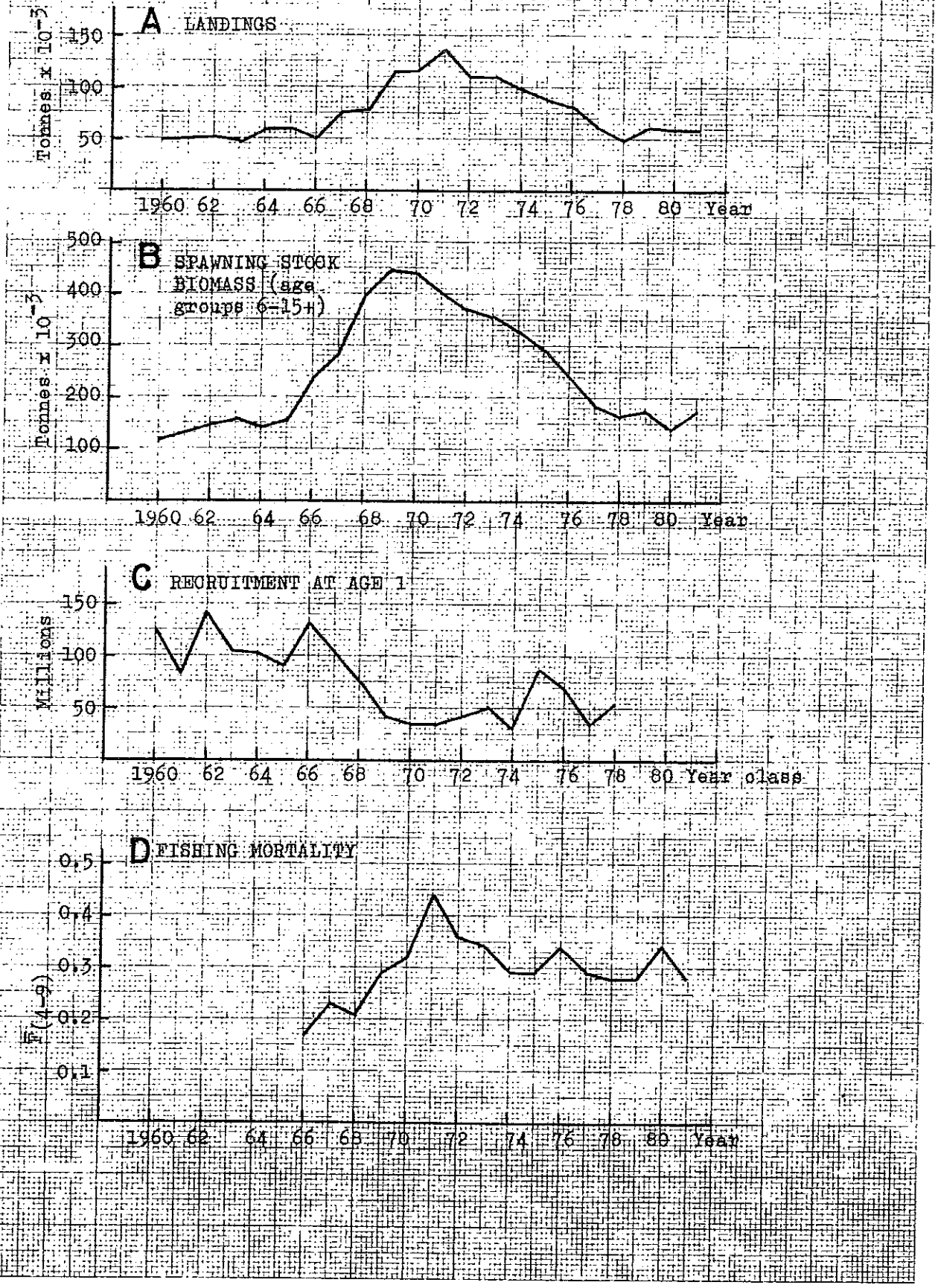

Figure 6.2 Icelandic SAITHE.
Yield and spawning stock biomass per 3 year old recruit.

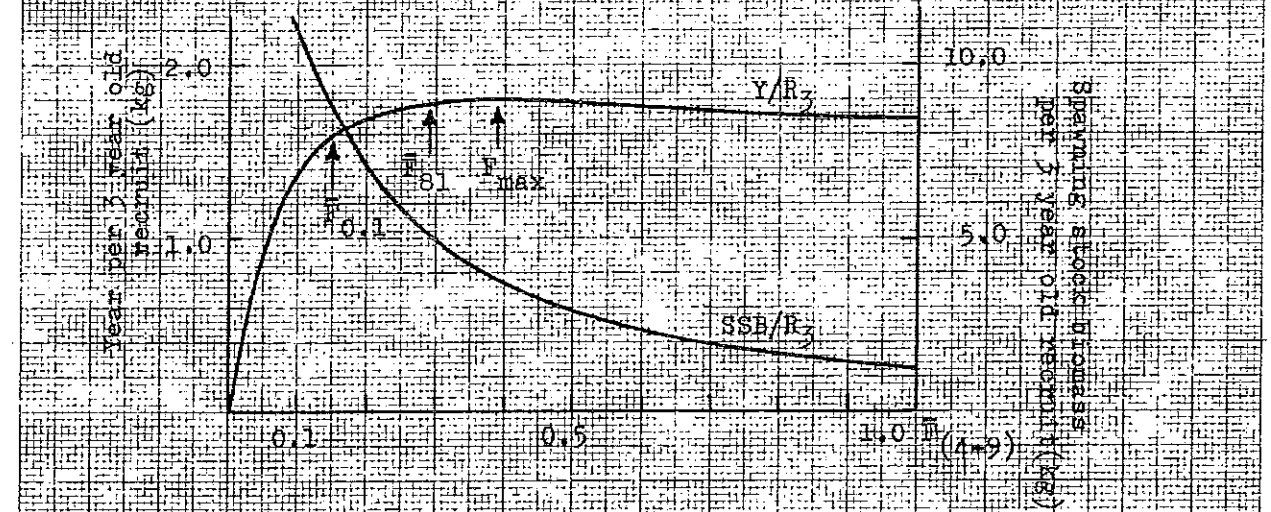

Figure 6.3 Icelandic SAITHE.
Catch projections for 1983 and spawning stock biomass at 1 January 1984.