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REPORT OF THE WORKING GROUP ON FISH STOCKS AT THE FAROES

Charlottenlund, 6 - 10 February 1978

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REPORT OF THE WORKING GROUP ON FISH STOCKS AT THE FAROES

1. PARTICIPATION

K Hoydal (Chairman)	Denmark (Faroes)
T Jakobsen	Norway
B W Jones	UK (England)
R Jones	UK (Scotland)
J Lamolet	France
H H Reinsch	Germany (Fed.Rep.of)

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

2. INTRODUCTION

2.1 Terms of Reference

At the 65th Statutory Meeting it was decided (C.Res.1977/2:19) that the Working Group on Fish Stocks at the Faroes should meet at Charlottenlund during 6-10 February 1978 to:

- (a) assess TACs for 1979 for cod and haddock,
- (b) further assess the effective mesh sizes in current use, and to estimate the effects of further increases in mesh size for these species,
- (c) plan and discuss the design of the International O-Group Survey at the Faroes in 1978,
- (d) identify and specify in detail, shortcomings and gaps in the data required for stock assessment work,
- (e) review and update data in the "Review of Fish Resources" given in the Appendix to the 1977 Working Group Report.

2.2 Management Changes and Changes in the Fishing Pattern around the Faroes

The "Arrangement Relating to Fisheries in Waters Surrounding the Faroes" was terminated in early 1977 and since then fishing by countries other than Faroes has been subject to quotas permitted by the Faroese authorities, and in addition access to certain fishing grounds has been restricted. On 1 January 1978 the minimum trawl cod-end mesh size was increased from 120 mm (synthetic) to 135 mm (irrespective of material).

Tables 13 and 14 show the changes in landings of cod (Faroe Plateau) and haddock (Total Div. Vb) by the various gears. It is clear that during the last four years the proportion of the catch of both species taken by longline has been increased substantially while the proportion taken by trawl has declined. Fishing effort by the United Kingdom trawlers in 1977 was reduced to about 60% of the level in 1975-76.

3. THE STATE OF THE STOCKS

3.1 Cod (Plateau Stock)

3.1.1 Trends in catch and effort

As in previous years the assessment has been made only for the Faroe Plateau cod stocks as data for the Faroe Bank are not sufficiently good for a separate assessment to be made for that stock.

Data on landings have been updated. Estimated landings of cod from the Faroe Plateau in 1977 were 35 000 tons compared with 39 917 tons in 1976. The equivalent figures for the total Division Vb were 36 000 tons (1977) and 42 129 tons (1976) (Table 1). Catches by Faroese vessels in 1977 were maintained at the same level as in 1976 (29 000 tons) but the landings by other countries, particularly by the United Kingdom, were appreciably lower in 1977 (7 000 tons in 1977 compared with 13 170 tons in 1976). The recruitment of the abundant 1972 and 1973 year classes has contributed to the high catches in 1975-77. High catch per unit effort was recorded for these years by Faroese long liners (Table 25).

3.1.2 Virtual population analysis (VPA)

Previous estimates of total numbers landed in each age group in 1976 have been updated and provisional estimates were prepared for 1977. Age composition data for 1977 were available for Faroes, United Kingdom (England) and United Kingdom (Scotland). French length compositions were converted to age compositions using the English age/length key. Landings by other countries were assumed to have the same age distribution as the combined English, Scottish and French landings.

Age compositions of the total catches from the Faroe Plateau used as input data for the VPA are given in Table 15. Values of fishing mortality coefficients calculated by VPA are given in Table 16 together with the values assumed for 1977 which were used to initiate the computation. Estimates of stock size as calculated by VPA are given in Table 17.

Recent changes in the fishery have made it more difficult than usual to estimate both the current exploitation pattern and the overall level of fishing mortality in 1977.

Following the extension of Faroese jurisdiction to 200 miles the amount of fishing by non-Faroese vessels has declined, and access to fishing grounds has been restricted. The amount of fishing by long-liners has been increasing and, especially in the latter part of 1977, increased inspection and enforcement activities are likely to have reduced the incidence of fishing with undersized trawl cod-end meshes. All these changes would be expected to affect the overall exploitation pattern and this has been taken into account in the F values for 1977, which were adopted for input into the VPA in which the values for ages 2 and 3 were reduced relative to those on the older ages.

3.1.3 Catch predictions and TACs

In making catch predictions the Group considered that the increase in the minimum trawl cod-end mesh size to 135 mm in 1978 would be expected to further affect the exploitation pattern, and accordingly the F values on one- and two-group fish have been reduced. The data used for the catch predictions are given in Table 22. A consequence of the changed exploitation pattern will be that the yield per recruit curve will be different from that given in the report of the 1977 meeting of the Group. The new yield per recruit curve is given in Figure 1, and on this curve the value of $F_{max} = 0.4$ (on fully exploited age groups). There is some uncertainty about the size of recent year classes and for the catch predictions average recruitment (16×10^6 at age 2) has been used for the 1974 and subsequent year classes. A number of catch predictions were made for differing rates of reduction in the level of fishing mortality. The resultant yield and corresponding spawning stock biomass estimates are given in Table 23.

It seems unlikely that there was any significant reduction in fishing mortality in 1977 and the recorded catch of 35 000 tons (Plateau only) was close to the prediction of 34 000 tons given in the previous report of the Working Group. The Group reiterates its advice of last year that fishing mortality on cod should be reduced to the F_{max} level. In the long term the main benefit would be from increased catch rates because the yield per recruit would be expected to increase only marginally. Spawning stock size would also be larger at a reduced level of fishing mortality, but there is no indication at present that the spawning stock size is being unduly reduced. Estimates of the spawning stock biomass at the beginning of a year for 1959-1980 are shown in Figure 5.

The TAC for 1979 would depend on the rate at which the reduction in fishing mortality could be achieved. The Working Group recommends a progressive reduction in fishing mortality to reach F_{max} in 1980. On this basis the following TACs are proposed:

Recommended TACs for Cod

Year	F	TAC (including 2 000 tons for Faroe Bank) (in tons)
1978	0.55	32 000
1979	0.45	27 000
1980	0.40	26 000 (subject to revision)

This advice follows that given last year with regard to the proposed reduction in fishing mortality. If the strategy is followed and it is aimed at achieving an $F = 0.55$ in 1978, the corresponding updated TAC is now 32 000 tons which is 2 000 tons greater than that given in the previous report of the Working Group. This difference results from the changed exploitation pattern used in this report.

If this revised TAC is adopted for 1978 the recommended TAC for 1979 would be 27 000 tons.

3.2 Haddock

3.2.1 Trends in catch and effort

The provisional catch in 1977 was 25 000 tons and this was similar to the catch in 1976. Both catches represent an increase in the catch level over that in the immediately preceding years (Table 2).

The proportion of the total catch taken by different gears have changed considerably in recent years. For example, over the period 1974-77 the proportion taken by long-liners (mainly Faroese vessels) rose from 25% to 69%. During the same period, the proportions taken by trawlers (mainly United Kingdom vessels) declined from 74% to 28% (Table 14).

Catch per unit effort data for the Faroese long-liners have shown increasing catch rates for the last three years (Table 25).

3.2.2 Virtual population analysis (VPA)

For the VPA input data (Table 18), the 1976 data were revised and provisional data for 1977 added. Age compositions were available for the Faroese, English and Scottish fisheries. The percentage age composition for other countries (France, Federal Republic of Germany, Netherlands and Norway) were assumed to be the same as that for the English and Scottish fisheries combined.

In choosing input values of F , different considerations were employed when dealing with the fully exploited age groups (4 years and older) than when dealing with younger fish.

For the fully exploited age groups, trial VPA runs suggested that the previously employed value of F of 0.6 might now be too high. After further trials, a value of 0.5 was selected as appearing more suitable.

For the younger fish (2 and 3 year old) it is appropriate to choose input values of F that are consistent with stock size estimates predicted on the basis of year class strength expectations. For example, Figure 3 shows the relationship between Scottish research vessel estimates of year class strength (as 1 year old fish) and the VPA estimates based on the numbers subsequently appearing as 3 year old fish in the fishery. Figure 4 shows a similar relationship, but using the VPA estimates of year class strength as 2 year olds. Using these relationships it was estimated that in 1977 the 3 year olds (1974 year class) should number about 30 million fish. Similarly it was estimated that the 2 year olds (1975 year class) should be about 19 million fish. To satisfy these stock estimates, the following F values were calculated:

F for two year olds in 1977 = 0.025

F for three year olds in 1977 = 0.20.

These values are lower than those given in the previous report which is consistent with effects expected from mesh size enforcements in 1977 and increased fishing by long-liners.

Estimates of fishing mortality calculated by VPA are given in Table 19 and calculated stock sizes are given in Table 20.

3.2.3 Current state of stock

Haddock landings in 1976 and 1977 were somewhat larger than they had been in the immediately preceding years and various factors may have contributed to this. These include the appearance of 3 good year classes (1972-1974), a possible decline in F values, and a change in exploitation pattern.

The decline in the trawl fishery and the increase in long-line fishery have presumably led to a change in the exploitation pattern equivalent to an increase in the age at first capture. The effect of this should have been the same as an increase in mesh size.

3.2.4 Catch predictions and TACs

In the catch predictions, it has been necessary to take account of the following factors:

- (a) the introduction of a 135 mm mesh size from 1 January 1978;
- (b) the relative strength of incoming year classes;
- (c) management objectives.

The increase in mesh size to 135 mm is expected to change the exploitation pattern by reducing the values of F on the youngest age groups. Estimates of this effect were made using theoretically-derived selection curves and an age/length relationship.

Selection curves were calculated using a selection factor of 3.4 and adopting slopes of 0.12 at the 50% points. An age/length relationship was constructed using $L_{\infty} = 83$, $K = 0.15$, and $t_0 = -1.6$.

It was estimated that with a 135 mm mesh, there should be a negligible catch of 2 year old fish. For 3 year old fish, the value of F should be about 40-50% of its previous value. On this basis, the value of F for 3 year olds from 1978 onwards was reduced from 0.2 to 0.1. For the 4 year and older fish, the F values should be unaffected.

The data used for the catch predictions are given in Table 22.

From Scottish research vessel estimates of year class strength, it is expected that both the 1975 and 1976 year classes should be below average. The relationship in Figure 3 was used to calculate the recruitment values of these year classes a 3 year olds in 1978 and 1979. This gave the following values:

For the 1974 year class in 1977: 30 million fish

For the 1975 year class in 1978: 18 million fish

For the 1976 year class in 1979: 12 million fish.

For the prognosis program a value was also needed for the strength of the 1973 year class in 1976. A value of 28 million fish was used which was taken from VPA.

TACs were calculated using two recruitment options. For one option, the estimates of year class strength given above were used. For the other option, an average recruitment value of 26.8 million 3 year olds were adopted for all year classes.

TACs were calculated for two management objectives: to maintain the F values at the 1978 level, and to adopt an F value for the fully exploited age groups equivalent to F_{\max} on the yield per recruit curve. To determine this, yield per recruit curves were calculated, using the exploitation pattern thought to be appropriate for the 135 mm mesh. From this curve (Figure 2), a value of F_{\max} equal to 0.55 was determined. This is larger than the value of 0.4 previously obtained using the pre-1978 exploitation pattern.

A summary of haddock TACs for the four options is given in Table 24. With a mesh size of 135 mm, the value of $F = 0.5$ on the fully exploited age groups is about 10% below the theoretical F_{\max} value of 0.55. This means that an increase in fishing effort in 1978 and 1979 of up to 10% (compared with the 1977 level) could be considered. In that event, the TAC in 1979 could be 1 000 tons higher than it would otherwise have to be (i.e., 24 000 tons instead of 23 000 tons and 21 000 tons compared with 20 000 tons).

Summary of Haddock TACs (in metric tons)

Year	F	TAC
1978	0.55	25.000
1979	0.55	21.000
1980	0.55	17.000 (subject to revision)

Allowance for the likelihood of poor recruitment causes the TACs to be reduced by 3 000 tons for both options. Although estimates of year class strength from research vessel data tend to be uncertain, the data base appears good enough to suggest that both the 1975 and the 1976 year classes are likely to be below average strength. This factor should therefore be taken into account and it is recommended that the TAC for 1979 should be 21 000 tons.

In the previous report of the Working Group a TAC of 17 000 tons was recommended for 1978. This was calculated taking into account a reduction in fishing effort (or F). In the new calculation the revised exploitation pattern was used and as a consequence it was not necessary to reduce fishing mortality. Thus a revised TAC for 1978 is 25 000 tons.

4. MESH ASSESSMENTS

Although the 1976 and 1977 length composition data for cod and haddock were at hand at the meeting, the Group was not able in the time available to perform any further mesh assessments. The model used in the mesh assessments last year has now been described by Hoydal (1977). This has explained some things, which did not emerge from last year's Working Group report, especially how assumptions on recruitment curves influence the estimates of effective mesh size in operation. Assumptions about recruitment could be important for cod, but probably not for haddock, although haddock assessments could be influenced by discarding.

Further, the Group felt, that in a situation with changing fishery pattern and management measures it would be difficult to make any reliable predictions of the long-term effects of any further changes.

The Group considered that increased enforcement by Faroese authorities in 1977 had probably resulted in the real mesh size being much closer to the legal mesh size than in former years.

5. INTERNATIONAL O-GROUP SURVEYS AT FAROES IN 1978

The French research vessel "Thalassa" and the Faroese "J. Chr. Svabo" will take part in the O-Group Surveys in Faroe waters this year. It was indicated that "Thalassa" will be able to spend 11 days for the O-Group Surveys, expecting to cover about 60 stations in mid-May. It was agreed to select the French stations at random as for the Faroese ones. The French cruise will mainly be aimed at covering O-group saithe, and some comparative experiments between the O-group gear and the Bongo (or stramin) net will be made, in order to try to determine the size range of O-group saithe.

"J. Chr. Svabo" will cover about 120 stations in late June and early July. The cruise will mainly be aiming at sampling cod and haddock.

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

It has already been mentioned that the uncertainty about future developments in the fishery in the Faroe Area pose problems to the assessment work.

For the data, it was noted that because of the increasing part taken by Faroese vessels, any success in the assessment work will depend on adequate Faroese sampling of age and length data.

The Group had difficulty with the lack of reliable recruitment data, especially for cod. Further O-Group Surveys are required in order to assess their value for making recruitment estimates.

Effort data are required from those fisheries for which they are not currently available.

7. REFERENCE

Hoydal, K. 1977. A method of mesh assessment making it possible to check growth parameters and evaluate effective mesh size in operation. ICES, Doc. C.M.1977/F:51 (mimeo.).

Tables 1-12. Catches in ICES Division Vb by country and species 1960-1977.
Metric tons, round fresh.

Table 1. Cod.

Year	Faroe Islands	France	Germany, Fed.Rep.of	Norway	Poland	UK England	UK Scotland	Others	Total
1960	8 723	-	451	-	-	13 476	16 300	-	39 220
1961	9 521	-	417	168	-	3 891	12 954	-	26 951
1962	6 751	100	301	505	-	5 521	11 052	-	24 230
1963	7 428	720	376	147	-	4 558	10 875	60	24 164
1964	8 888	989	1 162	333	-	5 845	7 791	50	25 058
1965	9 948	1 538	854	419	-	5 470	7 868	180	26 277
1966	7 957	1 120	669	314	-	4 871	7 855	132	22 918
1967	7 835	871	845	650	-	7 996	8 546	63	26 806
1968	13 763	2 519	1 180	686	-	7 096	8 524	-	33 768
1969	15 718	2 557	447	476	-	6 717	12 249	-	38 164
1970	15 245	2 616	225	238	-	3 707	9 790	-	31 821
1971	12 754	1 426	337	881	-	3 485	9 102	-	27 985
1972	12 143	1 462	262	266	-	3 019	6 483	-	23 635
1973	13 276	1 752	305	115	419	5 079	6 756	-	27 702
1974	13 237	551	292	446	320	3 708	8 019	60	26 633
1975	22 986	1 409	458	1 353	432	3 287	8 619	145	38 689
1976	28 959	1 607	247	1 283	496	3 056	6 403	78	42 129
1977*)	29 042	1 271	285	967	-	965	3 500	2	36 032

Table 2. Haddock.

1960	7 772	-	6	-	-	7 298	10 943	-	26 019
1961	8 454	-	22	-	-	2 765	9 590	-	20 831
1962	7 042	166	18	-	-	3 766	16 159	-	27 151
1963	6 336	792	22	-	-	4 655	15 766	-	27 571
1964	6 952	1 866	32	111	-	3 442	7 087	-	19 490
1965	6 673	1 939	8	119	-	3 385	6 355	-	18 479
1966	6 902	2 717	40	-	-	2 867	6 240	-	18 766
1967	5 246	1 091	30	-	-	2 347	4 656	11	13 381
1968	6 751	2 286	31	-	-	2 445	6 339	-	17 852
1969	11 122	3 314	45	-	-	1 976	6 815	-	23 272
1970	11 791	2 006	6	-	-	1 137	6 421	-	21 361
1971	10 488	790	1	-	-	2 323	5 762	29	19 393
1972	8 314	2 666	25	-	-	1 371	4 109	-	16 485
1973	6 018	3 508	46	-	1 190	2 426	4 788	-	17 976
1974	4 811	1 451	70	5	685	1 617	6 072	52	14 763
1975	8 757	2 277	173	56	544	2 426	6 078	383	20 694
1976	12 714	2 542	22	20	448	2 284	8 000	181	26 211
1977*)	19 938	921	41	83	5	911	3 500	32	25 401

*) Preliminary estimates.

Table 3. Saithe.

Year	Faroe Islands	France	Germany, Fed.Rep.of	Norway	Poland	UK England	UK Scotland	Others	Total
1960	685	-	2 583	-	-	6 437	2 140	-	11 845
1961	929	-	2 219	-	-	4 230	2 214	-	9 592
1962	2 494	620	985	-	-	3 724	2 631	-	10 454
1963	2 431	2 207	1 471	-	-	3 178	3 463	-	12 750
1964	1 338	6 458	6 294	+	-	4 329	3 309	-	21 728
1965	1 000	8 565	3 611	-	-	5 265	3 794	-	22 235
1966	1 167	9 967	4 772	2 498	-	3 321	3 581	66	25 372
1967	2 242	5 555	6 119	-	-	3 536	3 996	193	21 641
1968	2 629	424	7 532	-	-	5 123	4 778	-	20 486
1969	4 835	7 899	4 775	378	-	4 303	5 346	-	27 536
1970	2 694	11 036	2 249	1 495	-	3 066	8 608	-	29 148
1971	5 653	10 621	2 251	1 839	-	3 305	7 198	63	30 930
1972	5 646	28 346	3 613	470	-	2 453	6 225	-	46 753
1973	2 973	22 241	9 087	355	4 050	7 527	10 131	-	56 364
1974	3 726	19 428	6 661	1 660	1 925	3 827	8 302	630	46 159
1975	2 517	23 630	5 229	486	815	2 428	4 950	171	40 226
1976 ^{*)}	2 560	15 367	2 605	2 232	1 007	3 063	5 860	371	33 065
1977 ^{*)}	5 121	16 564	2 762	1 254	-	2 591	5 605	71	33 968

Table 4. Whiting.

1960	-	-	-	-	-	70	403	-	473
1961	222	1 200	-	-	-	50	257	-	1 729
1962	-	-	-	-	-	26	197	-	223
1963	-	-	+	-	-	33	285	-	318
1964	-	-	+	-	-	25	117	-	142
1965	-	1 421 ^{a)}	+	-	-	29	97	-	1 547
1966	-	225	-	-	-	28	139	-	392
1967	-	254	1	-	-	31	138	3	427
1968	-	80	1	-	-	46	172	-	299
1969	-	16 991	+	-	-	46	515	-	17 552
1970	-	73	-	-	-	35	251	-	359
1971	150	195	1	-	-	26	166	4	542
1972	-	194	-	-	-	137	139	-	470
1973	384	72	7	-	8	235	394	-	1 100
1974	167	791	3	-	-	89	750	293	2 093
1975	251	1 238	87	-	-	242	973	718	3 509
1976 ^{*)}	515	1 659	3	-	-	155	1 160	162	3 654
1977 ^{*)}	703	>158	6	-	-	145	798	11	1 821

^{*)} Preliminary estimates.

^{a)} Includes Iceland grounds (Va).

Table 5. Tusk.

Year	Faroe Islands	France	Germany, Fed.Rep.of	Norway	UK England	UK Scotland	Total
1960	1 306	-	32	734	135	1 260	3 467
1961	1 301	-	29	1 401	67	1 062	3 860
1962	1 902	-	21	1 134	54	1 405	4 516
1963	2 007	-	29	802	28	695	3 561
1964	2 775	-	137	875	30	799	4 616
1965	1 645	-	115	1 565	32	924	4 281
1966	1 488	-	87	1 221	21	482	3 299
1967	2 070	-	109	2 729	18	432	5 358
1968	2 798	-	91	2 906	23	549	6 367
1969	1 454	-	21	1 338	16	412	3 241
1970	1 028	-	19	1 475	11	515	3 048
1971	1 489	-	44	1 872	13	419	3 837
1972	1 918	-	139	2 421	16	386	4 880
1973	3 402	-	134	3 066	36	531	7 169
1974	1 541	-	137	1 841	22	403	3 944
1975	2 166	-	154	1 848	36	344	4 552
1976	2 548	-	70	2 868	29	496	6 011
1977 ^{*)}	3 060	-	43	1 997			

^{*)} Preliminary estimates.

Table 6. Ling.

Year	Faroe Islands	France	German Dem.Rep.	Germany, Fed.Rep.of	Norway	Poland	UK England	UK Scotland	Total
1960	520	-	-	895	400	-	629	855	3 299
1961	603	-	-	11	521	-	241	829	2 205
1962	450	387	-	9	326	-	247	572	1 991
1963	365	1 512	-	17	496	-	183	396	2 969
1964	480	2 844	-	48	736	-	322	632	5 062
1965	416	2 618	-	30	832	-	184	388	4 468
1966	416	1 827	-	39	2 115	-	276	496	5 169
1967	736	23	-	60	3 203	-	172	364	4 558
1968	1 209	177	-	68	3 340	-	152	679	5 625
1969	486	195	-	45	1 952	-	225	602	3 505
1970	699	578	-	42	1 737	-	164	883	4 103
1971	752	728	-	46	2 898	-	152	879	5 455
1972	1 572	866	-	74	3 958	-	146	772	7 388
1973	1 428	398	-	167	3 638	11	268	850	6 760
1974	1 004	296	9	131	2 395	4	308	575	4 722
1975	1 281	345	1	94	2 297	2	231	499	4 750
1976	1 500	1 070	-	61	3 116	-	220	579	6 546
1977*)	1 674	> 231	-	56	2 975	-	-	-	-

Table 6a. Blue ling.

1963	-	-	-	478	-	-	-	-	478
1964	-	-	-	2 493	182	-	-	-	2 675
1965	-	-	-	1 612	1 120	-	-	-	2 732
1966	-	-	-	850	430	-	-	-	1 280
1967	-	-	-	1 133	238	-	-	-	1 371
1968	-	-	-	1 858	788	-	-	-	2 646
1969	-	-	-	249	798	-	-	-	1 047
1970	-	-	-	335	2 612	-	-	-	2 947
1971	-	-	-	1 475	557	-	-	-	2 032
1972	-	-	-	2 779	1 203	-	-	-	3 982
1973	51	-	-	2 931	4 003	-	4	-	6 989
1974	43	390	-	1 808	1 554	-	3	-	3 798
1975	18	2 281	-	1 528	2 492	-	1	-	6 320
1976	48	10 475	-	896	1 519	-	+	-	12 938
1977*)	23	7 681	-	750	944	-	-	-	-

- Indicates no catch or species not separated.

*) Preliminary estimates.

Table 7. Lemon sole.

Year	Faroe Islands	France	UK England	UK Scotland	Others	Total
1960	-	-	351	1 026	-	1 377
1961	-	-	156	1 009	-	1 165
1962	-	-	187	910	-	1 097
1963	-	-	142	706	-	848
1964	-	27	112	305	-	444
1965	-	42	110	393	-	545
1966	-	49	99	297	-	445
1967	-	14	104	321	-	439
1968	-	20	84	404	-	508
1969	-	-	77	362	2	441
1970	-	-	68	424	-	492
1971	590	-	76	303	-	969
1972	300	-	35	244	-	579
1973	1 190	-	126	393	-	1 709
1974	607	-	137	503	-	1 247
1975	971	-	103	369	1	1 444
1976*)	813	-	120	312	-	1 245
1977*)	-	-	-	185	-	-

Table 8. Plaice.

1960	64	-	62	209	-	335
1961	83	-	38	194	-	315
1962	26	-	73	164	-	263
1963	4	226	39	130	-	399
1964	11	131	64	99	-	305
1965	6	92	79	143	-	320
1966	1	108	106	161	-	376
1967	7	54	120	172	2	355
1968	102	28	158	170	-	458
1969	192	31	82	181	-	486
1970	288	-	59	205	-	552
1971	143	-	45	173	-	361
1972	130	+	50	111	-	291
1973	139	-	95	134	4	372
1974	89	44	43	115	-	291
1975	178	2	52	143	4	379
1976*)	113	43	26	97	1	280
1977*)	183	16	34	121	-	354

*) Preliminary estimates.

Table 9. Halibut.

Year	Faroe Islands	France	Germany, Fed.Rep.of	Norway	Poland	UK England	UK Scotland	Total
1960	218	-	58	439	-	686	1 397	2 798
1961	222	-	165	327	-	287	1 237	2 238
1962	137	-	11	299	-	325	1 126	1 898
1963	161	-	10	128	-	241	887	1 427
1964	174	-	63	110	-	239	792	1 378
1965	276	-	35	124	-	292	725	1 452
1966	169	-	36	120	-	248	636	1 209
1967	245	-	57	180	-	178	749	1 409
1968	267	-	64	90	-	130	698	1 249
1969	205	-	18	151	-	124	558	1 056
1970	296	-	10	182	-	74	514	1 076
1971	234	-	14	197	-	92	371	908
1972	212	-	35	155	-	60	256	718
1973	256	-	52	78	5	144	359	894
1974	141	-	54	56	4	105	218	578
1975	162	65	73	75	-	93	207	675
1976	300	-	37	164	-	88	248	837
1977*)	-	-	24	122	-	-	-	-

Table 10. Megrim.

Year	Faroe Islands	France	Germany, Fed.Rep.of	Norway	Poland	Spain	UK England	UK Scotland	Total
1960	-	-	-	-	-	-	9	21	30
1961	-	-	-	-	-	-	8	17	25
1962	-	-	-	-	-	-	6	19	25
1963	-	-	-	-	-	-	5	26	31
1964	-	50	-	-	-	-	5	20	75
1965	-	47	-	-	-	-	5	17	69
1966	-	237	-	-	-	-	5	14	256
1967	-	212	-	-	-	-	1	6	219
1968	-	250	-	-	-	-	3	6	259
1969	-	312	1	-	-	-	3	8	324
1970	-	99	-	-	-	-	1	9	109
1971	-	37	-	-	-	-	2	9	48
1972	-	38	-	-	-	-	3	10	51
1973	-	-	-	-	-	-	4	11	15
1974	-	-	-	-	-	10	8	12	30
1975	-	6	-	-	-	14	4	8	32
1976	-	8	-	-	-	6	3	11	28
1977*)	-	?	-	-	-	-	-	1	-

*) Preliminary estimates.

Table 11. Redfish.

Year	Faroe Islands	France	German Dem.Rep.	Germany, Fed.Rep.of	Norway	UK England	UK Scotland	Total
1960	-	-	-	2 295	-	276	60	2 631
1961	-	-	-	3 577	-	50	38	3 665
1962	-	-	-	2 237	-	52	49	2 338
1963	1	366	-	2 035	-	31	60	2 493
1964	-	705	-	7 119	-	41	43	7 908
1965	1	582	-	4 864	-	38	27	5 512
1966	-	-	-	3 180	-	8	40	3 228
1967	-	-	-	4 853	-	24	22	4 899
1968	1	-	-	6 613	-	43	10	6 667
1969	5	-	-	1 225	-	13	15	1 258
1970	-	-	-	2 020	-	13	20	2 053
1971	-	-	-	2 479	-	12	12	2 503
1972	-	-	-	4 027	-	40	13	4 080
1973	121	-	-	9 439	-	72	13	9 645
1974	28	300	1	7 328	10	74	24	7 765
1975	9	800	1	7 628	7	18	23	8 486
1976	33	-	-	5 255	17	13	46	5 364
1977*)	54	1 098	-	5 585	10	12		

Table 12. Angler (Monk).

Year	Faroe Islands	France	Germany, Fed.Rep.of	UK England	UK Scotland	Others	Total
1960	-	-	7	314	811	-	1 132
1961	-	-	11	167	695	-	873
1962	-	-	4	179	641	-	824
1963	-	-	2	160	618	-	780
1964	-	-	3	218	347	-	568
1965	-	-	-	212	326	-	538
1966	-	-	-	164	349	-	513
1967	-	-	-	118	308	-	426
1968	-	-	3	159	335	-	497
1969	1	26	1	175	429	-	632
1970	-	10	-	127	542	-	679
1971	-	-	-	132	532	-	664
1972	-	-	3	99	388	-	490
1973	535	-	6	193	414	-	1 148
1974	418	-	22	167	413	40	1 060
1975	456	19	7	125	347	90	1 044
1976	511	123	5	138	360	3	1 140
1977*)		?	2				

*) Preliminary estimates.

Table 13. Cod (Faroe Plateau). Catches by gear in metric tons and %.

	Longline	Handline	Trawl	Gillnet	Others	Total
1974	2 655	3 462	14 921	3 533	24	24 595
%	10.8	14.1	60.6	14.4	0.1	100
1975	6 011	4 600	18 523	6 954	15	36 103
%	16.6	12.7	51.3	19.3	0.1	100
1976	11 085	5 601	17 627	5 522	22	39 857
%	27.8	14.0	44.2	13.9	0.1	100
1977	11 060	4 992	14 118	4 491	240	34 901
%	31.7	14.3	40.4	12.9	0.7	100

Table 14. Faroe Haddock. Catches by gear in metric tons and %.

	Longline	Handline	Trawl	Gillnet	Others	Total
1974	3 685	108	10 950	19	1	14 763
%	25.0	0.7	74.2	0.1	+	100
1975	6 837	147	13 569	55	86	20 694
%	33.0	0.7	65.6	0.3	0.4	100
1976	11 091	228	14 851	37	4	26 211
%	42.3	0.9	56.7	0.1	+	100
1977	17 425	695	7 141	61	79	25 401
%	68.7	2.7	28.1	0.2	0.3	100

Table 15. Cod (Faroe Plateau). Catch in numbers by year and by age (thousands).

AGE	1959	1960	1961	1962	1963	1964
1	272.0	859.0	1223.0	815.0	1181.0	122.0
2	2002.0	4728.0	3093.0	4424.0	4110.0	2033.0
3	4239.0	4027.0	2686.0	2500.0	3958.0	3021.0
4	858.0	2574.0	1331.0	1255.0	1280.0	2300.0
5	1731.0	513.0	1066.0	855.0	662.0	630.0
6	200.0	876.0	232.0	481.0	284.0	350.0
7	207.0	171.0	372.0	93.0	204.0	158.0
8	50.0	131.0	78.0	94.0	48.0	79.0
9	10.0	61.0	29.0	22.0	30.0	41.0

AGE	1965	1966	1967	1968	1969	1970
1	162.0	53.0	127.0	34.0	68.0	35.0
2	852.0	1337.0	1609.0	1529.0	878.0	402.0
3	3230.0	970.0	2690.0	3322.0	3106.0	1163.0
4	2564.0	2080.0	860.0	2663.0	3300.0	2172.0
5	1416.0	1339.0	1706.0	945.0	1538.0	1685.0
6	363.0	606.0	847.0	1226.0	477.0	752.0
7	155.0	137.0	309.0	452.0	713.0	244.0
8	48.0	104.0	64.0	105.0	203.0	300.0
9	63.0	33.0	27.0	11.0	92.0	44.0

AGE	1971	1972	1973	1974	1975	1976
1	78.0	44.0	211.0	284.0	92.0	13.0
2	328.0	875.0	719.0	2460.0	3248.0	1552.0
3	757.0	1176.0	3111.0	1538.0	4600.0	6002.0
4	821.0	810.0	1586.0	2036.0	1821.0	4310.0
5	1287.0	596.0	705.0	1035.0	2318.0	1227.0
6	1451.0	1021.0	384.0	477.0	790.0	842.0
7	510.0	596.0	312.0	250.0	233.0	317.0
8	114.0	154.0	227.0	207.0	174.0	103.0
9	179.0	25.0	121.0	125.0	92.0	70.0

AGE	1977
1	38.0
2	593.0
3	2624.0
4	3430.0
5	1953.0
6	713.0
7	847.0
8	244.0
9	63.0

Table 16. Cod (Faroe Plateau). Estimates of fishing mortalities by year and by age and assumed values for 1977.

[illegible]

MEAN F FOR AGES ≥ 5 AND ≤ 7 (WEIGHTED BY STOCK IN NUMBERS)

WEIGHTED BY STOCK IN NUMBERS									
.58	.69	.62	.61	.49	.53	.56	.50	.42	.51

AGE	1969	1970	1971	1972	1973	1974	1975	1976	1977
-----	------	------	------	------	------	------	------	------	------

1	.01	.00	.00	.00	.01	.01	.01	.00	.00
2	.13	.07	.03	.05	.07	.12	.14	.13	.07
3	.31	.25	.17	.16	.24	.21	.33	.42	.35
4	.39	.38	.28	.27	.32	.25	.40	.60	.45
5	.44	.36	.41	.34	.41	.36	.49	.52	.60
6	.60	.40	.60	.66	.38	.53	.52	.33	.65
7	.52	.71	.53	.53	.43	.46	.54	.41	.65
8	.91	.43	.90	.30	.40	.58	.68	.50	.65
9	.50	.50	.50	.50	.40	.40	.55	.65	.65

MEAN F FOR AGES ≥ 5 AND ≤ 7 (WEIGHTED BY STOCK IN NUMBERS)

.50	.39	.51	.49	.40	.43	.51	.42	.62
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AGES-NATURAL MORTALITIES

[illegible]

Table 17. Cod (Faroe Plateau). Estimates of stock in numbers at beginning of year (thousands).

AGE	1959	1960	1961	1962	1963	1964
1	17556.5	15478.0	26448.9	25393.3	27697.1	10039.1
2	13148.8	14128.4	11897.1	20550.7	20054.5	21610.5
3	12084.0	8962.4	7328.5	6962.1	12847.0	12722.3
4	2616.9	8094.9	3740.2	3594.2	3460.3	6967.2
5	4030.7	1373.2	2688.5	1869.7	1818.0	1686.7
6	685.4	1752.6	664.9	1247.2	767.2	895.5
7	520.5	381.7	653.7	336.4	590.6	373.7
8	262.2	240.9	159.7	204.4	191.9	300.7
9	27.8	169.6	80.6	61.2	83.4	114.0

AGE	1965	1966	1967	1968	1969	1970
1	22224.8	27914.5	21019.8	9837.7	8632.9	13870.6
2	8109.2	18049.8	22806.6	17094.8	8023.7	7006.6
3	15860.0	5871.2	13571.9	17221.0	12617.2	5777.8
4	7700.8	10079.6	3933.6	8691.6	11110.3	7539.0
5	3642.0	4006.1	6381.6	2447.2	4726.8	6134.8
6	816.8	1714.3	2079.4	3692.5	1157.7	2490.8
7	419.9	344.4	860.6	944.8	1924.0	521.2
8	164.7	205.0	106.8	427.7	370.1	936.7
9	175.2	91.8	75.1	30.6	255.9	122.4

AGE	1971	1972	1973	1974	1975	1976
1	25020.7	14589.7	30175.3	33378.9	16729.0	11821.0
2	11324.7	20414.8	11905.3	24514.9	27071.8	13613.4
3	5373.8	8975.7	15924.4	9098.5	17853.2	19237.4
4	3684.2	3717.8	6289.2	10238.8	6064.6	10484.5
5	4222.7	2278.2	2315.5	3724.1	6551.2	3331.2
6	3509.6	2302.5	1329.9	1263.2	2119.7	3286.6
7	1364.5	1575.7	972.8	744.1	607.1	1028.0
8	208.9	660.4	756.4	516.6	385.1	288.5
9	497.8	69.5	402.3	415.6	237.8	159.9

AGE	1977
1	41946.9
2	9666.5
3	9746.9
4	10365.9
5	4728.8
6	1628.4
7	1934.4
8	557.3
9	143.9

Table 18. Faroe Haddock. Catch in numbers by year and by age (thousands).

AGE	1958	1959	1960	1961	1962	1963
1	116	525	854	941	784	356
2	6255	3971	6061	7932	9631	13552
3	8021	7663	10659	7330	13977	8907
4	5679	4544	6655	5134	5233	7403
5	3378	2056	2482	1937	2361	2242
6	1299	1844	1559	1305	1407	1539
7	817	721	1169	838	868	860
8	294	236	243	236	270	257
9	125	98	85	59	72	75

AGE	1964	1965	1966	1967	1968	1969
1	46	39	90	70	49	95
2	2284	1368	1081	1425	5881	2384
3	7457	4286	3304	2405	4097	7539
4	3899	5133	4804	2599	2812	4567
5	2360	1443	2710	1785	1524	1565
6	1120	1209	1112	1426	1526	1485
7	728	673	740	631	923	1224
8	198	1345	180	197	230	378
9	49	43	54	52	68	114

AGE	1970	1971	1972	1973	1974	1975
1	57	55	43	663	253	94
2	1728	717	750	3039	7446	7493
3	4855	4393	3744	7944	2562	8060
4	6581	4727	4179	1175	3324	2056
5	1624	3267	2706	2635	400	1363
6	1383	1292	1171	871	799	237
7	1099	864	696	969	489	347
8	326	222	180	139	534	234
9	68	147	113	66	67	399

AGE	1976	1977
1	40	
2	4671	426
3	8013	5080
4	6627	5651
5	1207	4191
6	1131	1039
7	298	765
8	660	284
9	249	229

Table 19. Faroe Haddock. Estimates of fishing mortalities by year and by age and assumed values for 1977.

AGE	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
1	.00	.01	.02	.02	.02	.01	.00	.00	.00	.00
2	.19	.11	.21	.19	.33	.38	.09	.07	.06	.07
3	.44	.39	.46	.42	.59	.57	.38	.24	.24	.20
4	.57	.48	.69	.43	.61	.74	.53	.48	.46	.31
5	.54	.42	.53	.44	.35	.57	.55	.38	.51	.31
6	.65	.65	.66	.60	.67	.41	.64	.62	.56	.56
7	.98	.98	1.22	.95	1.08	1.22	.35	1.05	1.01	.73
8	.86	.89	1.14	.90	.97	1.21	1.13	2.49	.94	.84
9	.80	.80	1.00	1.00	.80	.80	.80	.80	.80	.80

MEAN F FOR AGES ≥ 4 AND ≤ 6 (WEIGHTED BY STOCK IN NUMBERS)

.59	.52	.68	.48	.56	.67	.52	.50	.52	.37
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AGE	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
1	.00	.00	.00	.00	.00	.01	.01	.00	.00	.00
2	.15	.09	.07	.06	.03	.19	.17	.22	.13	.03
3	.28	.29	.28	.26	.55	.49	.25	.29	.38	.20
4	.37	.57	.45	.48	.42	.33	.39	.32	.41	.50
5	.30	.36	.41	.43	.56	.51	.18	.28	.32	.50
6	.48	.53	.63	.67	.27	.35	.28	.15	.39	.50
7	.89	.93	.99	1.09	.97	.37	.34	.19	.29	.50
8	.65	1.25	.69	.55	.69	.51	.36	.27	.66	.50
9	.80	.80	.80	.80	.60	.60	.50	.50	.50	.50

MEAN F FOR AGES ≥ 4 AND ≤ 6 (WEIGHTED BY STOCK IN NUMBERS)

.41	.55	.50	.51	.45	.41	.34	.27	.39	.50
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AGES-NATURAL MORTALITIES

[illegible]

Table 20. Faroe Haddock. Estimates of stock in numbers at beginning of year (thousands).

AGE	1958	1959	1960	1961	1962	1963
1	52449.7	43612.9	62616.8	47482.0	57937.6	36269.7
2	38834.8	42837.4	35233.5	50495.4	38025.1	46727.1
3	24678.6	26162.9	31492.0	23390.8	34199.1	22479.2
4	14210.3	13012.4	14542.6	16228.3	12575.1	15497.0
5	8824.3	6552.4	6581.8	5962.7	8681.5	5616.0
6	2951.5	4200.4	3520.5	3166.0	3144.6	4987.3
7	1419.0	1255.8	1791.5	1489.3	1424.7	1317.9
8	555.5	435.2	387.6	431.4	473.8	396.5
9	247.6	193.4	146.5	101.7	143.0	147.7

AGE	1964	1965	1966	1967	1968	1969
1	26945.4	23681.5	29667.1	56322.8	36080.5	34118.5
2	29373.4	22020.0	19353.2	24208.4	46050.3	29496.1
3	26092.6	21988.7	16794.3	14869.7	18534.4	32403.3
4	10433.1	14668.5	14147.0	10777.9	10008.8	11491.0
5	6080.6	5050.8	7409.6	7276.0	6488.6	5609.8
6	2591.5	2866.0	2840.3	3639.0	4353.1	3942.3
7	2702.2	1120.8	1265.9	1330.3	1702.9	2196.7
8	317.6	1558.8	320.5	379.1	526.4	572.9
9	97.1	84.0	105.8	102.4	134.7	225.2

AGE	1970	1971	1972	1973	1974	1975
1	15461.9	34444.8	23242.8	63110.6	52083.1	52359.7
2	27848.3	12607.9	28151.3	18991.1	51071.8	42413.5
3	21999.3	21241.0	9675.2	22371.1	12812.2	35107.4
4	19752.6	13645.7	13439.5	4569.8	11198.1	8184.9
5	5321.2	10271.9	6935.7	7254.0	2685.8	6185.1
6	3236.9	2899.4	5479.3	3256.0	3578.7	1838.7
7	1898.0	1413.8	1219.3	3433.3	1883.5	2211.6
8	709.6	577.5	391.1	379.7	1941.0	1102.8
9	134.5	290.1	273.8	159.8	186.3	1109.6

AGE	1976	1977
1	23286.0	110.4
2	42783.6	19028.8
3	27980.8	30817.8
4	21497.7	15715.5
5	4853.9	11655.2
6	3838.3	2889.5
7	1291.9	2127.5
8	1498.2	789.8
9	692.5	636.9

Table 21. Faroe Plateau Cod and Faroe Haddock.
Estimates of year class strength as millions of 2-year-old fish from VPA. Natural mortality $M = 0.2$.

Year class	Cod	Haddock
1955	-	35
1956	-	39
1957	13	43
1958	14	35.2
1959	12	51
1960	20	38.0
1961	20	47
1962	22	29
1963	8	22
1964	18	19
1965	23	24
1966	17	46
1967	8	29
1968	7	27
1969	11	12.6
1970	20	28
1971	12	19
1972	25	(51)
1973	27	(42)
1974	14	(43)
1975	10	(19)

Table 22. Input data for the prognosis.

Cod. ICES Sub-Division Vb1.

Age	Average weight (kg)	Relative F^*	Stock 1978 $\times 10^{-3}$
2	1.06	0.077	16 000
3	1.89	0.54	13 040
4	2.92	0.69	7 516
5	4.07	0.92	5 434
6	5.30	1	2 134
7	6.58	1	696
8	7.85	1	827
9	9.08	1	238
10+	10.27	1	62

Haddock. ICES Division Vb.

Age	Average weight (kg)	Relative F^*	Stock 1978 $\times 10^{-3}$
2	-	-	-
3	0.73	0.2	26 800
4	1.13	1	19 854
5	1.55	1	9 859
6	1.97	1	5 787
7	2.41	1	1 434
8	2.76	1	1 057
9	3.07	1	392
10+	3.55+	1	316

*.) Proportion of F relative to F on age groups subject to maximum exploitation.

Recruitment (at age 2)

Recruitment of 16×10^{-6} assumed for year classes after 1974.

For assumptions on recruitment, see text.

Table 23. Catch and spawning biomass predictions.
Natural mortality = 0.2.

Faroe cod

Year	F	Yield ^{*)}	Spawning biomass
<u>1 run</u>			
1978	0.65	34 000	68 000
1979	0.55	28 000	62 000
1980	0.45	24 000	62 000
<u>2 run</u>			
1978	0.55	30 000	68 000
1979	0.45	25 000	66 000
1980	0.40	24 000	71 000
<u>3 run</u>			
1978	0.55	30 000	68 000
1979	0.55	29 000	66 000
1980	0.40	25 000	65 000

^{*)} Not including Faroe Bank. For input values, see Table 22.

Table 24. Catch and spawning biomass predictions.
Natural mortality = 0.2.

Faroe haddock

Year	F	Yield	Spawning biomass	
<u>1 run</u>				
1978	0.5	22 000	77 000	
1979	0.5	23 000	78 000	
1980	0.5	23 000	79 000	Constant recruitment
<u>2 run</u>				
1978	0.5	24 000	77 000	
1979	0.55	24 000	76 000	
1980	0.55	24 000	76 000	
<u>3 run</u>				
1978	0.5	23 000	74 000	
1979	0.5	20 000	62 000	
1980	0.5	17 000	63 000	Varying recruitment
<u>4 run</u>				
1978	0.5	25 000	74 000	
1979	0.55	21 000	60 000	
1980	0.55	17 000	60 000	

For input values, see Table 22.

Table 25. Catch per unit effort by Faroes long-liners, 1975-77
(kg/1 000 hooks).

Months	Cod			Haddock		
	1975	1976	1977	1975	1976	1977
1	122	141	143	140	129	145
2	120	136	123	131	120	137
3	99	165	80	94	61	46
4	82	113	71	108	115	106
5	37	55	56	34	81	103
6	9	33	19	30	68	52
7	11	37	14	37	30	55
8	14	14	17	59	34	153
9	28	39	29	61	100	230
10	72	114	65	138	145	197
11	112	134	108	110	118	165
12	131	137	116	90	134	168

Figure 1. Faroe Plateau Cod.
Yield per recruit and spawning stock biomass
per recruit against fishing mortality on
fully exploited age groups.
Recruitment at age 2.

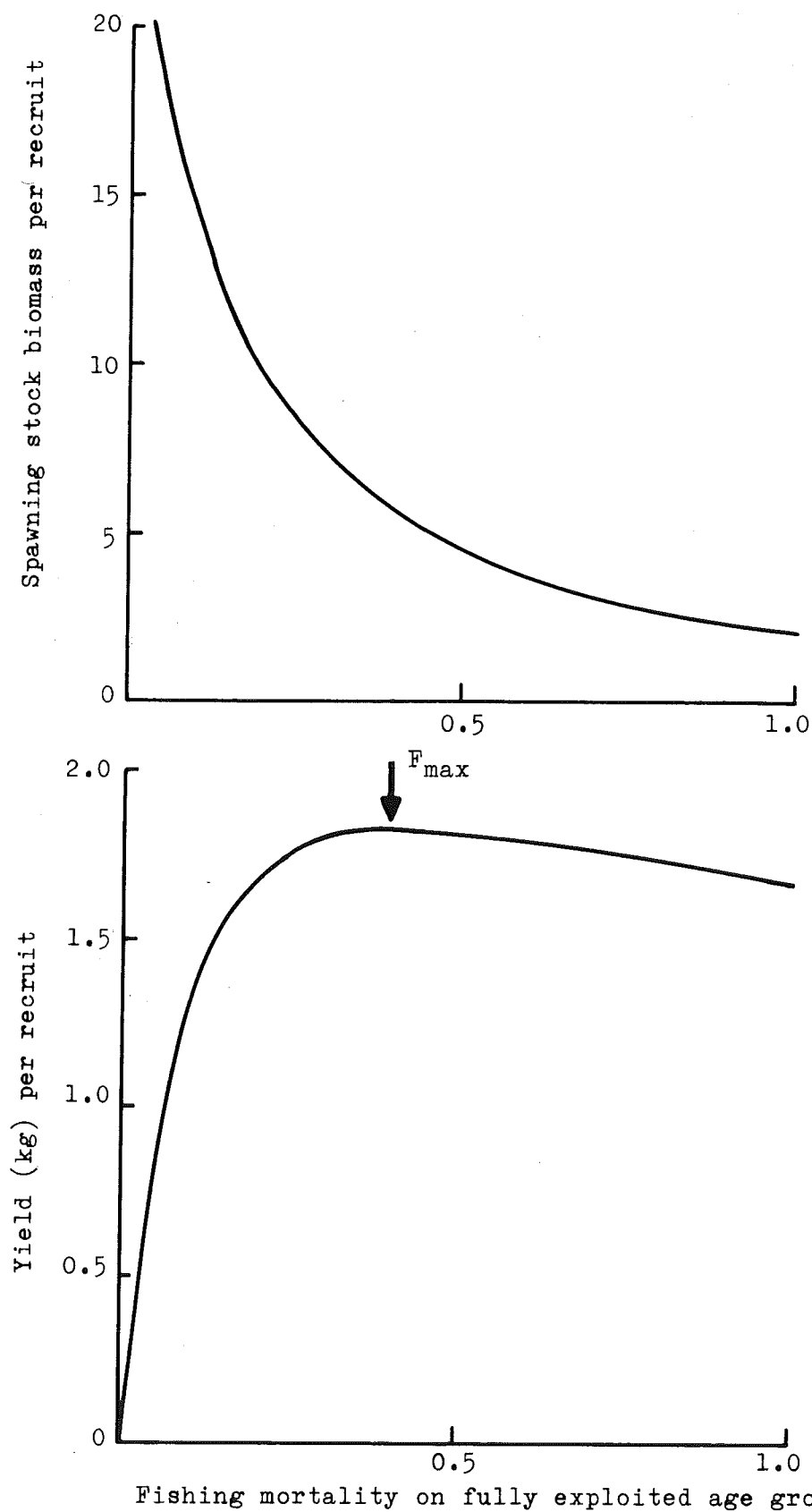


Figure 2. Faroe Haddock.
Yield per recruit and spawning stock biomass
per recruit against fishing mortality on fully
exploited age groups.
Recruitment at age 3.

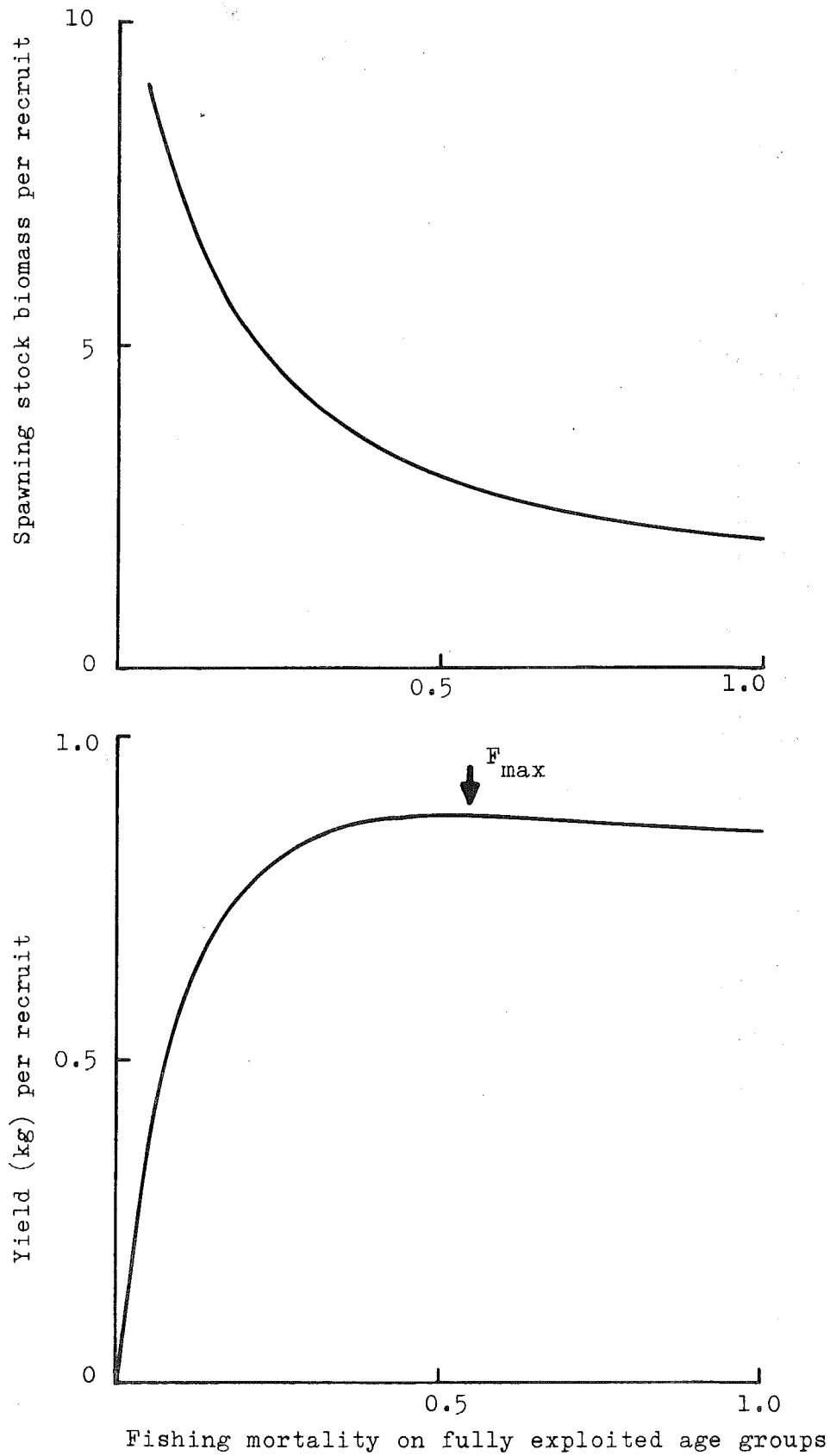


Figure 3. Faroe Haddock.
Relationship between research
vessel and VPA estimates of year
class strength (3 years old).

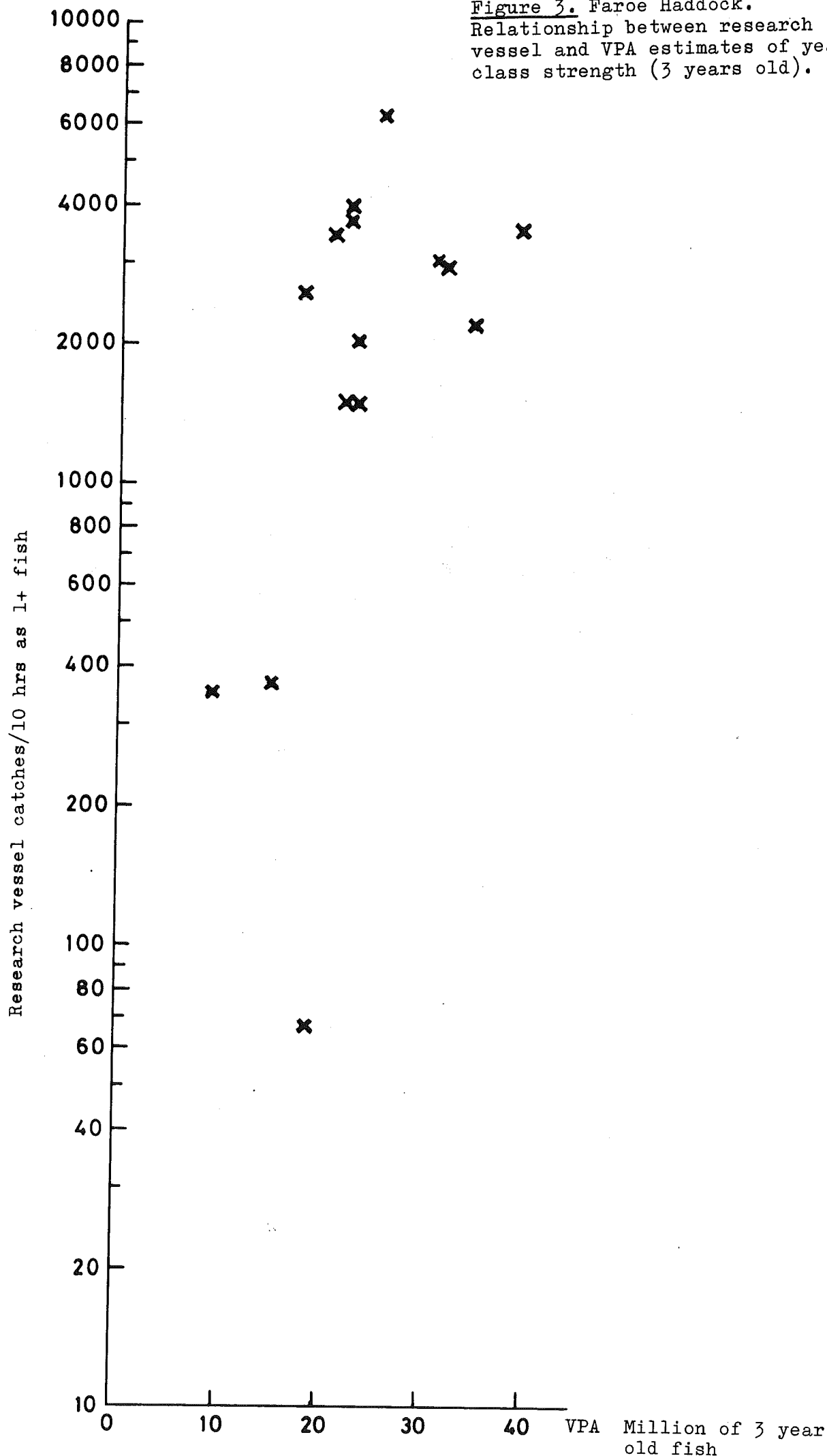


Figure 4. Faroe Haddock.
Relationship between research vessel
and VPA estimates of year class
strength (2 years old).

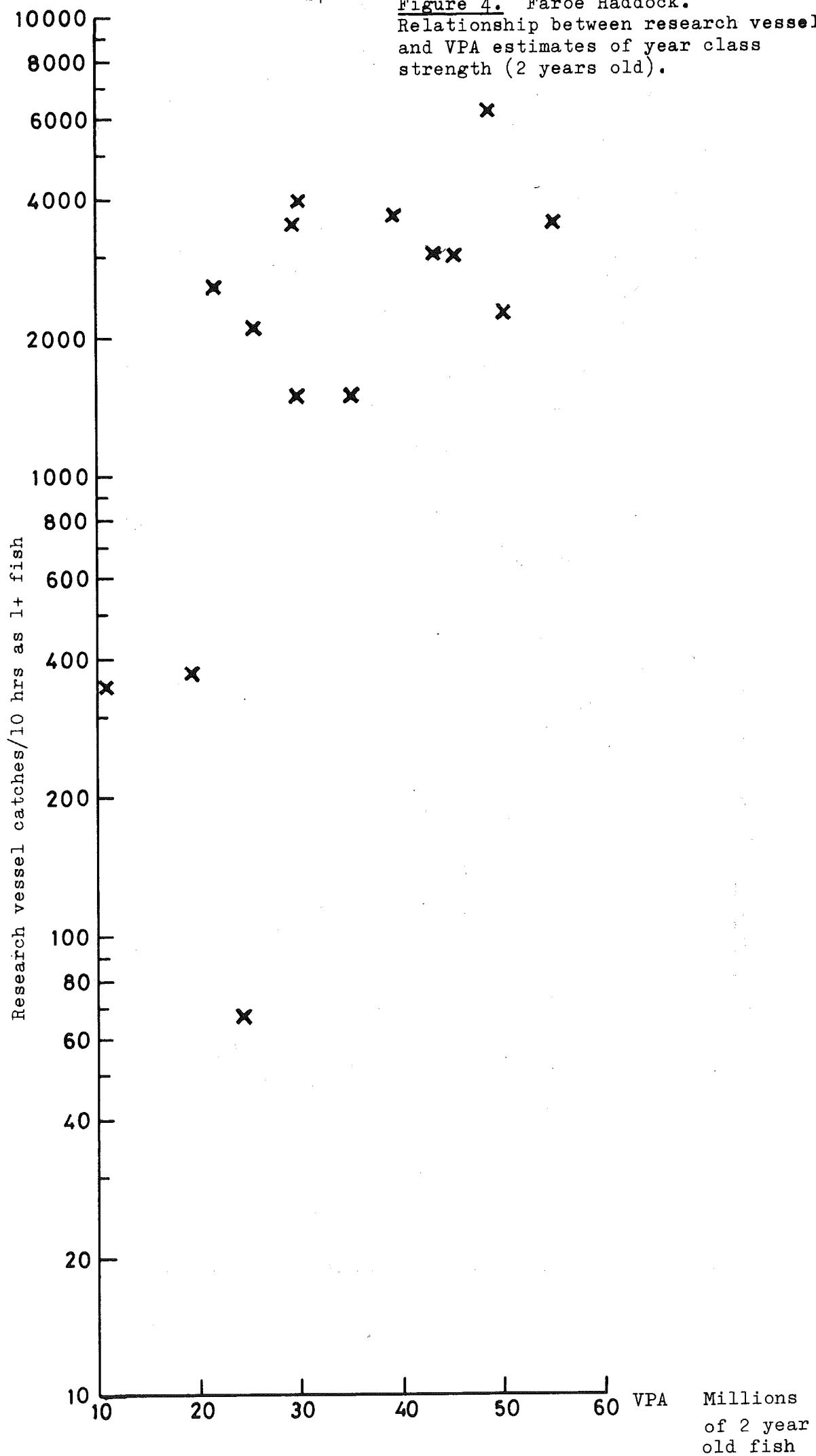
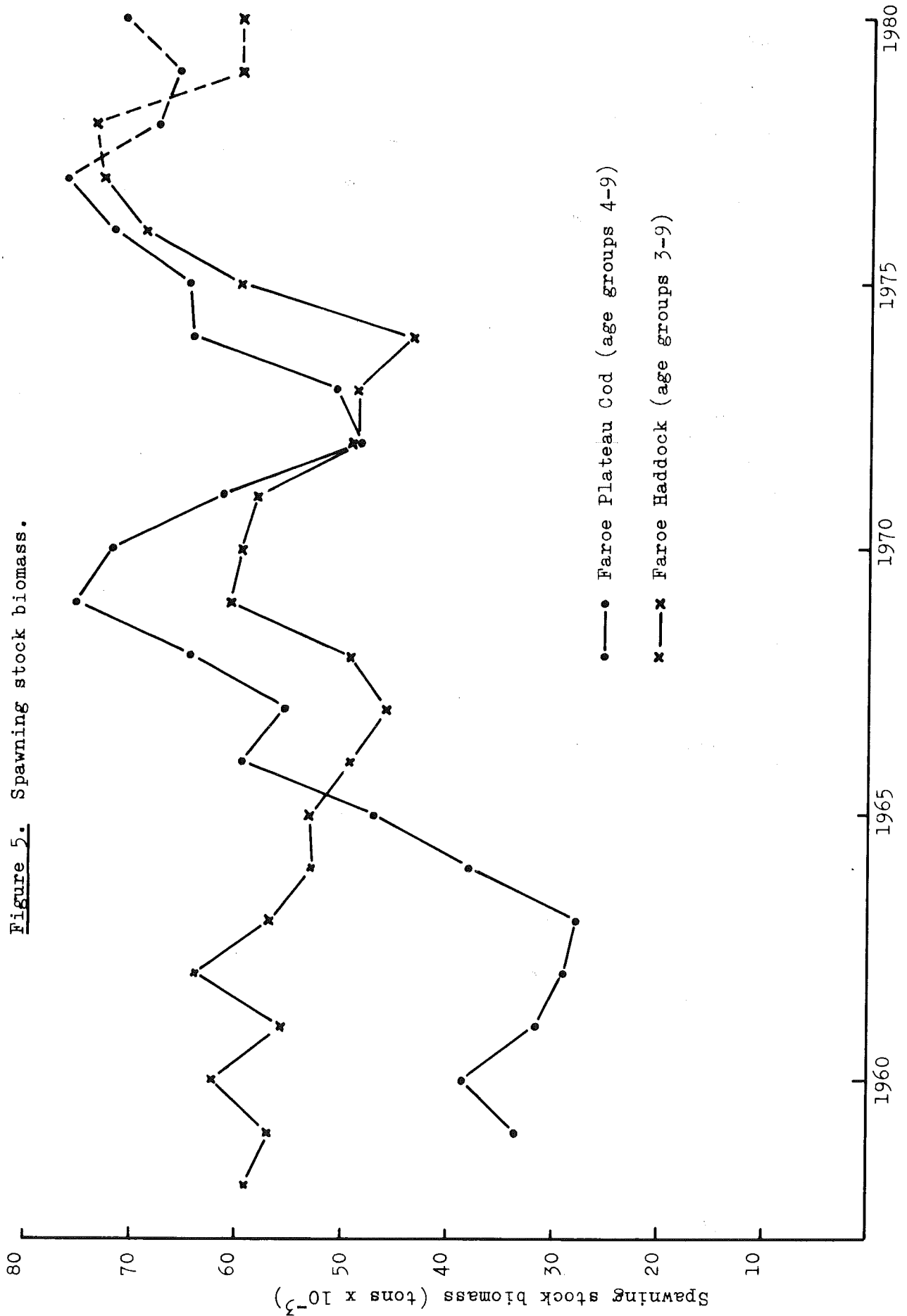


Figure 5. Spawning stock biomass.



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11
12
13

(1)

(2)

1
2
3
4
5

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