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Demersal Fish (Northern) Committee

REPORT OF THE WORKING GROUP ON FISH STOCKS AT THE FAROES

11 - 15 February 1974, Charlottenlund, Denmark.

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1. PARTICIPANTS

Mr N. Daan	Netherlands
Mr K. Hoydal (Chairman)	Faroe Islands
Mr B.W. Jones	U.K. (England)
Mr R. Jones	U.K. (Scotland)
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Mr D. de G. Griffith, ICES Statistician, also took part in the Meeting.

2. TERMS OF REFERENCE

At the 61st Statutory Meeting of ICES a Resolution (C.Res.1973/2:7) was passed recommending the establishment of a Working Group on Fish Stocks at the Faroes, to meet in Charlottenlund to undertake a study of the state of the demersal fish stocks in the Faroes region. The species mainly referred to in this Report are cod, haddock, saithe, blue ling, redfish, lemon sole, halibut and plaice.

3. ADMINISTRATIVE MEASURES AFFECTING THE FISHERY

A three-mile limit was in operation until 1959 apart from a readjustment due to a change in the base lines established by agreement with effect from 1 July 1955. From 27 April 1959 non-Faroese vessels were excluded from a six-mile zone and in addition during certain seasons of the year, from three areas between six and twelve miles which were reserved for line fishing only. From 1 March 1964 non-Faroese vessels' rights to fish in any part of the six-to-twelve-mile zone were withdrawn, and a new twelve-mile limit was redrawn from base lines running from headland to headland.

This effectively has meant a ban on trawl fishing inside the twelve-mile limit with the exception that in 1971 and 1973 a licensed trawl fishery by Faroese boats under 60 GRT has been allowed in the summer period.

Through the "Arrangement Relating to Fisheries in Waters Surrounding the Faroes", certain areas are to be closed seasonally to trawl fishing. At present little can be said about how this will affect the fishing pattern and the fishing mortality in the stock.

In the early sixties, the minimum trawl mesh size (for single braided manila) was increased to 80 mm. This was increased to 100 mm with effect from 1 January 1967 and this was further increased to 110 mm with effect from 1 January 1970. With effect from 1 January 1974 the mesh size has been increased to 130 mm.

4. STATE OF STOCKS IN THE FAROE AREA

4.1. COD

Introduction

There are two separate stocks of cod at Faroe, the main one on Faroe Plateau and a much smaller stock on Faroe Bank. All the evidence indicates that the two stocks are self-contained with no mixing between the stocks or with stocks outside the Faroe area. The Plateau stock is by far the more important and contributes the greater part of the catches from the Faroe area (Table 7.1.2, p.43). For this reason the assessments have been concentrated on the Plateau stock. Data for the Bank stock are less reliable and small errors in the division of catches between the two stocks result in big errors for the Bank stock but negligible errors for the Plateau stock.

Trends in Catch, Effort and Catch per Unit Effort

Since 1950 total landings from the ICES statistical Division Vb (Table 7.1.a, p.36) have fluctuated between 23 000 tons and 39 000 tons, with an average value of 30 000 tons. In earlier years, landings of up to 45 000 tons were recorded.

Fishing effort (Table 7.1.3, p.44) tended to increase in the post-war period reaching a maximum in the years 1960 - 61. This increase in fishing effort was accompanied by a decline in catch rates which reached a minimum level in 1962. Catch rates subsequently improved as the amount of fishing was reduced.

Estimates of Mortality Rates (Plateau Stock)

Fishing mortality coefficients were estimated from Virtual Population Analysis (V.P.A.) and estimates of coefficients of total mortality were available from age composition data per unit fishing effort from English landings.

Data for the V.P.A. were based on age compositions of landings by English, Scottish and Faroese vessels. The Faroese data were not available for Plateau and Bank separately, and it was assumed that 80% of Faroese landings came from the Plateau. Numbers of fish landed in each age group for England, Scotland and Faroe were summed and then raised to the landings for all countries combined (Table 4.1.1, p. 5).

Analyses were made using values for the coefficient of natural mortality (M) of 0.2 and 0.3. Estimates of fishing mortality coefficients from the analyses are given in Tables 4.1.2 and 4.1.3 (p. 6 and 7), where the assumed values of F in the oldest age group of each year class are also indicated. The trend in average F for age groups 5 - 8 is what would be expected from the trend in fishing effort over the same period. Maximum values of F were obtained in 1960 and 1961 when fishing effort reached its highest level. Subsequently F values decreased with a smaller increase again in recent years.

The relationship between fishing mortality and fishing effort has been examined in more detail in Figure 1 (p. 11). The fishing mortality coefficients (for M = 0.2) have been estimated for each country separately according to the ratios of the numbers of fish in the catches. The resultant values of F were averaged for each year (age groups 4 - 7 England, 3 - 7 Scotland and 5 - 8 Faroe) and average F was then plotted against fishing effort for each country separately. The same effort units were used for English and Scottish effort and a geometric mean regression line has been fitted. The correlation is significant at the 95% level and the intercept is close to zero. The correlation for the Faroese fishery is not so good, probably due to the difficulty in estimating fishing effort in the line fishery.

A calculation of yield per recruit was made for each country's fishery separately for values of F at each age averaged for the period 1968 - 70 (Tables 4.1.4 and 4.1.5, p. 8). The weight at age data used was derived from the mean length of age groups in the English landings converted to weight in kg using the relationship $W = L^3 \times 10^{-5}$. With an overall yield per recruit of 1.45 kg an average recruitment of 23.9 million one-year-olds would be required to provide total average landings of 34 584 tons. From the V.P.A. the estimated average year class strength for the appropriate year classes (1962 - 66) is 21.7 million.

In Table 4.1.6 (p. 9) estimates of the coefficient of total mortality (Z) calculated from annual age compositions per unit effort for the English fishery can be compared with values of Z (= F+M) from the V.P.A.

Recruitment and Year Class Strength

Estimates of year class strength as the numbers of one-year-old fish are given in Table 4.1.7 (p.9). Year classes 1960 to 1966 showed little variation in abundance with the exception of the very poor 1963 year class. The 1958 and 1959 year classes were of lower abundance. In recent years the data suggest that year classes from 1967 onwards have been of very low abundance. It should be remembered, however, that estimates of year class strength in the most recent years will be in error if incorrect values were assumed for fishing mortality in 1972 in the V.P.A.

Growth

Von Bertalanffy growth parameters were calculated for the Plateau and Bank stocks using mean length at age data from English landings and a least squares fit of the growth curve. The calculated values are given in Table 7.1.5 (p. 46).

Yield per Recruit and Age at First Capture

Yield in weight per recruit was calculated using the Beverton and Holt constant parameter model with the growth parameters given in Table 7.1.5 (p.46) and a natural mortality coefficient of 0.2. The results plotted as yield curves are shown in Figure 2 (p. 12).

Results of the V.P.A. estimates of fishing mortality indicate that full exploitation in the fisheries of the Plateau stock may not be reached until about 7 years of age. Cod are caught first in the Scottish fishery where the full exploitation rate is reached at about 3 years old. In the English fishery the full rate of exploitation is not reached until about 4 years. The equivalent age for the Faroese fishery is about 7 years. Thus fishing mortality increases with age over the range 1 - 7 years. The equivalent mean age at first capture as used in the Beverton and Holt equation would thus be in the range of 3 - 4 years. For a mean age at first capture of 3.5 years, the maximum yield per recruit is obtained at F = 0.4 for the Plateau stock. The mean value of F in the exploited phase as estimated from V.P.A. is about 0.5 and for this level of F the theoretical yield per recruit of 1.62 kg is about 1% below maximum. (This can be compared with the value of 1.45 kg per recruit obtained by the variable F model.)

For the Bank stock, which has a faster growth rate, optimum age at first capture for any given value of F is lower than for the Plateau stock.

Mesh Change Assessment

The effect on catches of the change in trawl cod end mesh size from 110 mm to 130 mm was calculated using a modification of the Gulland method developed by Mr K.P. Andersen. The method checks the assumptions on growth parameters and selection and recruitment curves, and states if they are consistent with the catches observed. Furthermore, it gives the changes in the fishery through the transition period after a change in selectivity, until a new equilibrium has been reached. All the computations were performed by Mr K.P. Andersen. The Working Group is indebted to Mr Andersen for his keen work on the mesh assessment problem, and hopes that a full description of the method and programmes involved will be made available to all those interested. The calculation used the same selection curve for both English and Scottish trawlers. Logistic curves were used to describe the normal selection ogives, and in addition a reverse logistic curve was applied to allow for the oldest fish not being available to the trawlers.

The results of the assessment indicate that the immediate effect would be a loss of about 4% in weight for the trawl fisheries with no change for the Faroese long-liners. The long-term effect would be no change for the trawl fisheries, a 4% gain for the Faroese long-line fishery with an overall net gain of 2%. The results are consistent with what would be expected from earlier assessments (Anon., 1967). Table 4.1.8, (p.10) gives some indication of the changes in the transition period until the new stable situation is reached.

Coincident with the introduction of the larger mesh size in 1974 will be the commencement of new regulatory measures for the Faroe fisheries. In addition to limiting catches, certain areas will be closed to trawlers at certain times of year. The system of closed areas will result in a major change in pattern of trawl fishing. Trawlers will be unable to work many of their traditional grounds at the preferred times of year. Such changes in the seasonal distribution of the trawl fleets are bound to have an effect on their catches and catch composition. In these circumstances it is likely to be impossible to distinguish any mesh change effects from the effects of changes in the pattern of fishing. Over the past history of the fishery a change in the distribution of fishing of comparable magnitude was the introduction of the 12-mile limit in 1964. One of the results of this change was a reduction of fishing mortality on the younger age groups of cod and haddock and this is clearly seen in the results of the V.P.A.

With recruitment at an average level a total allowable catch (T.A.C.) of 30 000 tons, as was adopted in the "Arrangement Relating to Fisheries in Waters Surrounding the Faroes", would be consistent with the present level of exploitation. It has been mentioned in an earlier section that the year classes 1967 onwards appear to be well below average abundance. Estimates for these recent years, however, could be subject to error if the values assumed for F in 1972 used in the V.P.A. were incorrect. If in fact there is a series of poor year classes recruiting to the fishery a lower T.A.C. would be advisable.

Table 4.1.1. Faroe Plateau Cod.
Total catch by all countries (thousands of fish) in each age group used for Virtual Population Analysis.

Year Class	1	2	3	4	5	6	7	8	9	10+
1949										6
1950									10	38
1951								50	61	40
1952							207	131	29	5
1953						200	171	78	22	2
1954					1 731	876	372	94	30	14
1955				858	513	232	93	48	41	7
1956			4 239	2 574	1 066	481	204	79	63	42
1957		2 002	4 027	1 331	855	284	158	48	33	27
1958	331	4 728	2 686	1 255	662	350	155	104	27	45
1959	859	3 093	2 500	1 280	630	363	197	64	11	3
1960	1 223	4 424	3 958	2 300	1 416	606	309	105	92	40
1961	815	4 110	3 021	2 564	1 339	847	452	203	44	71
1962	1 181	2 033	3 230	2 080	1 706	1 226	713	300	179	25
1963	122	852	970	860	945	477	244	114	25	
1964	162	1 337	2 690	2 663	1 538	752	510	154		
1965	53	1 609	3 322	3 300	1 685	1 451	596			
1966	127	1 529	3 106	2 172	1 287	1 021				
1967	34	878	1 163	821	596					
1968	68	402	757	810						
1969	35	328	1 176							
1970	78	875								
1971	44									
1972										

Derived from English, Scottish and Faroese catch in numbers.
Faroese catch on Plateau estimated as .8 x total Vb.

Table 4.1.2. Faroe Plateau Cod.
Estimates of fishing mortality coefficientsfrom Virtual Population Analysis (M = 0.2)

Year	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972*
Age Group														
1	.02	.06	.05	.04	.05	.01	.01	.00	.01	.00	.01	.00	.01	
2	.18	.45	.34	.28	.25	.12	.12	.09	.08	.10	.13	.07	.05	.1
3	.49	.68	.50	.50	.42	.30	.27	.20	.26	.24	.29	.26	.18	.25
4	.48	.63	.50	.47	.53	.47	.44	.28	.27	.44	.39	.34	.29	.3
5	.65	.60	.59	.70	.48	.54	.60	.44	.39	.55	.50	.35	.34	.35
6	.43	.82	.61	.59	.54	.51	.69	.56	.56	.54	.60	.49	.58	.5
7	.68	.83	1.07	.52	.53	.65	.45	1.08	.62	.66	.71	.71	.72	.5
8	.29	1.36	1.27	.91	.57	.41	.42	.63	1.46	.44	.73	.76	.90	.5
9	.16	.68	1.54	2.06	.86	1.54	.67	.58	.33	1.20	.90	.33	1.70	.5
10+ *	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5
Average 5-8 yr	.51	.90	.89	.69	.53	.53	.54	.68	.76	.55	.64	.58	.64	

* Values of F shown for 1972 and for age group 10+ are assumed values.

Table 4.1.3. Faroe Plateau Cod.
Estimates of fishing mortality coefficients from Virtual Population Analysis (M = 0.3).

Year / Age Group	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972*)
1	0.01	0.05	0.04	0.03	0.03	0.01	0.01	0.001	0.004	0.002	0.01	0.002	0.01	
2	0.14	0.35	0.27	0.21	0.19	0.08	0.08	0.01	0.01	0.01	0.01	0.04	0.03	0.08
3	0.40	0.56	0.39	0.41	0.34	0.23	0.20	0.15	0.20	0.17	0.21	0.19	0.13	0.2
4	0.40	0.52	0.41	0.37	0.44	0.38	0.35	0.22	0.22	0.35	0.30	0.25	0.22	0.24
5	0.56	0.50	0.48	0.58	0.38	0.46	0.49	0.36	0.32	0.46	0.40	0.27	0.26	0.28
6	0.38	0.72	0.51	0.47	0.43	0.40	0.62	0.46	0.46	0.46	0.50	0.39	0.46	0.4
7	0.61	0.75	0.94	0.44	0.43	0.52	0.35	0.98	0.51	0.54	0.62	0.60	0.59	0.4
8	0.23	1.24	1.17	0.77	0.50	0.33	0.33	0.49	1.31	0.37	0.57	0.68	0.74	0.4
9	0.12	0.55	1.32	1.81	0.70	0.13	0.54	0.46	0.25	1.01	0.74	0.26	1.47	0.4
10+*)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Average 5 - 8 yr	0.45	0.80	0.78	0.57	0.44	0.43	0.45	0.57	0.65	0.46	0.52	0.49	0.51	

*) Values of F shown for 1972 and for age group 10+ are assumed values.

Table 4.1.4. Faroe Plateau Cod.
Estimates of average fishing mortality coefficients for the period 1968 - 70, sub-divided between the main countries.

Age Group	Average Fishing Mortality 1968-70			
	Total	England	Scotland	Faroe
1	.00	.00	.00	.00
2	.10	.02	.06	.01
3	.26	.05	.13	.05
4	.39	.07	.14	.13
5	.47	.07	.11	.24
6	.54	.06	.09	.32
7	.69	.09	.14	.35
8	.64	.07	.10	.40
9	.81	(.09)	(.13)	(.51)
10+	(.7)	(.08)	(.11)	(.44)

Table 4.1.5. Faroe Plateau Cod.
Estimates of yield per recruit taken by the main countries.

Age Group	N	Total F	$F/Z\ (1-e^{-Z})$	$\bar{W}$	Yield in Weight			
					E	S	F	Total
1	1 000	.00						
2	819	.10	.086	.98	13.8	41.4	6.9	69.0
3	607	.26	.208	1.93	46.3	121.8	46.3	243.6
4	383	.39	.295	3.10	63.1	126.1	115.6	350.3
5	212	.47	.343	4.12	44.9	68.9	152.8	297.5
6	109	.54	.382	5.18	23.7	36.6	127.1	215.5
7	52	.69	.457	6.38	19.7	30.4	77.4	151.8
8	21	.64	.433	7.66	7.7	11.2	43.9	69.7
9	9	.81	.510	8.52	4.3	6.3	24.7	39.2
10+	3	.7	.462	9.27	1.4	2.1	8.2	13.0
Yield per Recruit kg					0.225	0.445	0.603	1.450
Average Landings 1968-70 (tons)					5 840	10 188	14 909	34 584

Table 4.1.6. Faroe Plateau Cod.
Comparison of estimates of coefficients of total mortality (Z) from English catch per unit effort data and from Virtual Population Analysis.

From Catch per Unit Effort (Average 1967/8 - 1971/2)		From Virtual Population Analysis Average 1967-71		
Age Group	Z	Age Group	Z	
			M = 0.2	M = 0.3
		4	0.55	0.57
4-5	0.48			
		5	0.63	0.64
5-6	0.74			
		6	0.75	0.75
6-7	0.72			
		7	0.88	0.87
7-8	1.03			
		8	1.06	1.03

Table 4.1.7. Faroe Plateau Cod.
Estimates of year class strength as the numbers of one-year-old fish from Virtual Population Analysis.

Year Class	Stock Size (Millions)	
	M = 0.2	M = 0.3
1958	17.7	24.7
1959	15.4	21.0
1960	26.0	36.8
1961	25.6	37.8
1962	26.4	40.6
1963	10.0	15.7
1964	21.3	33.0
1965	28.2	45.3
1966	22.5	36.0
1967	9.7	15.5
1968	8.1	13.0
1969	9.2	14.2
1970	15.2	17.8

Table 4.1.8. Faroe Cod.
Effect of a change of trawl cod-end minimum mesh size from 110 mm to 130 mm.

Years after Change	Percentage Change		
	U.K. Trawlers	Faroese Long-Liners	Total All Gears
1	-4	0	-2
5	-1	+2	0
10	0	+3	+2
15	0	+4	+2

Figure 1. Faroe Plateau Cod. Relationship between annual estimates of the fishing mortality coefficient (M = 0.2) and fishing effort for England, Scotland and Faroe. Lines fitted by geometric mean regression (England and Scotland) and by eye (Faroe).

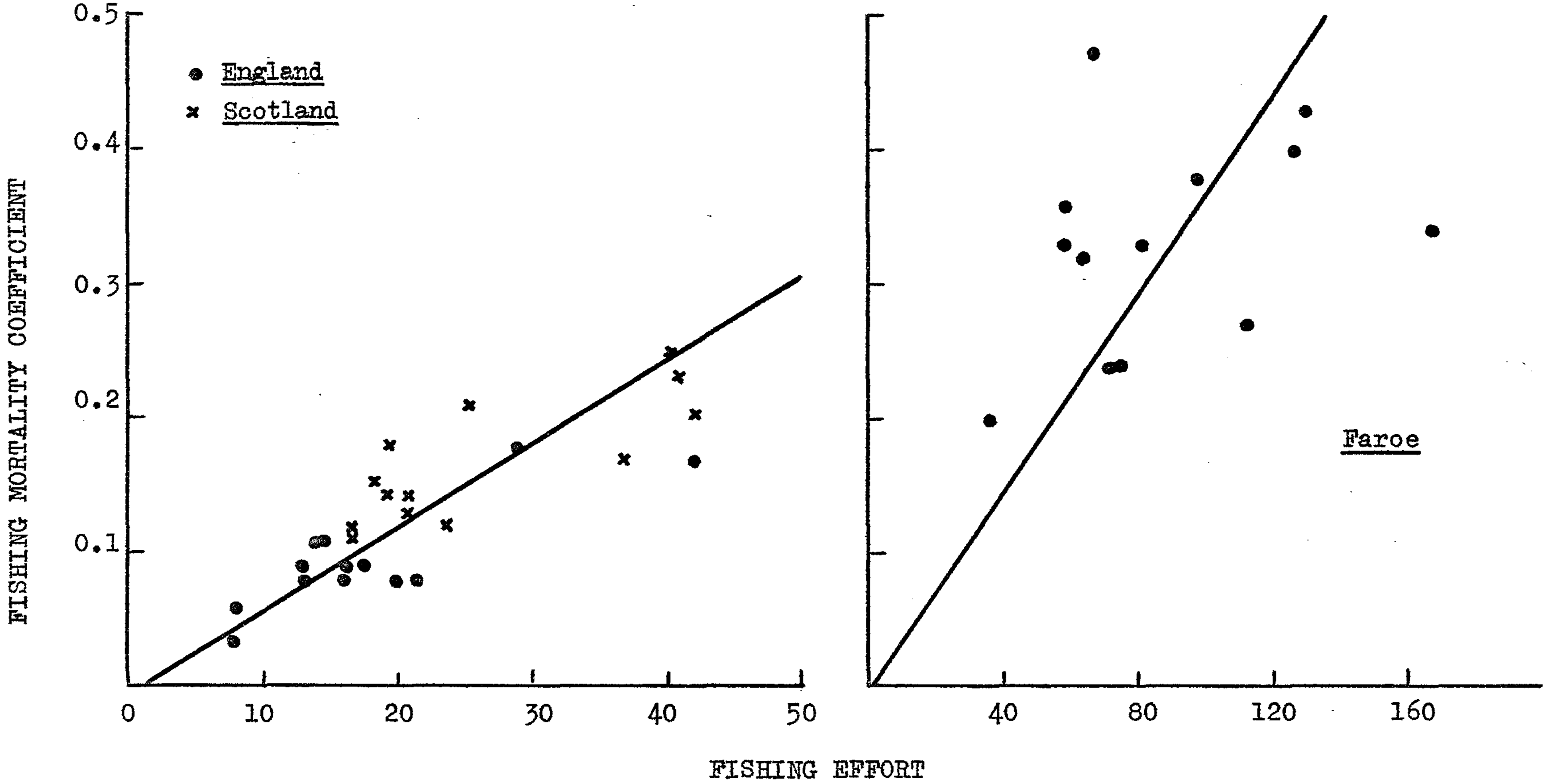
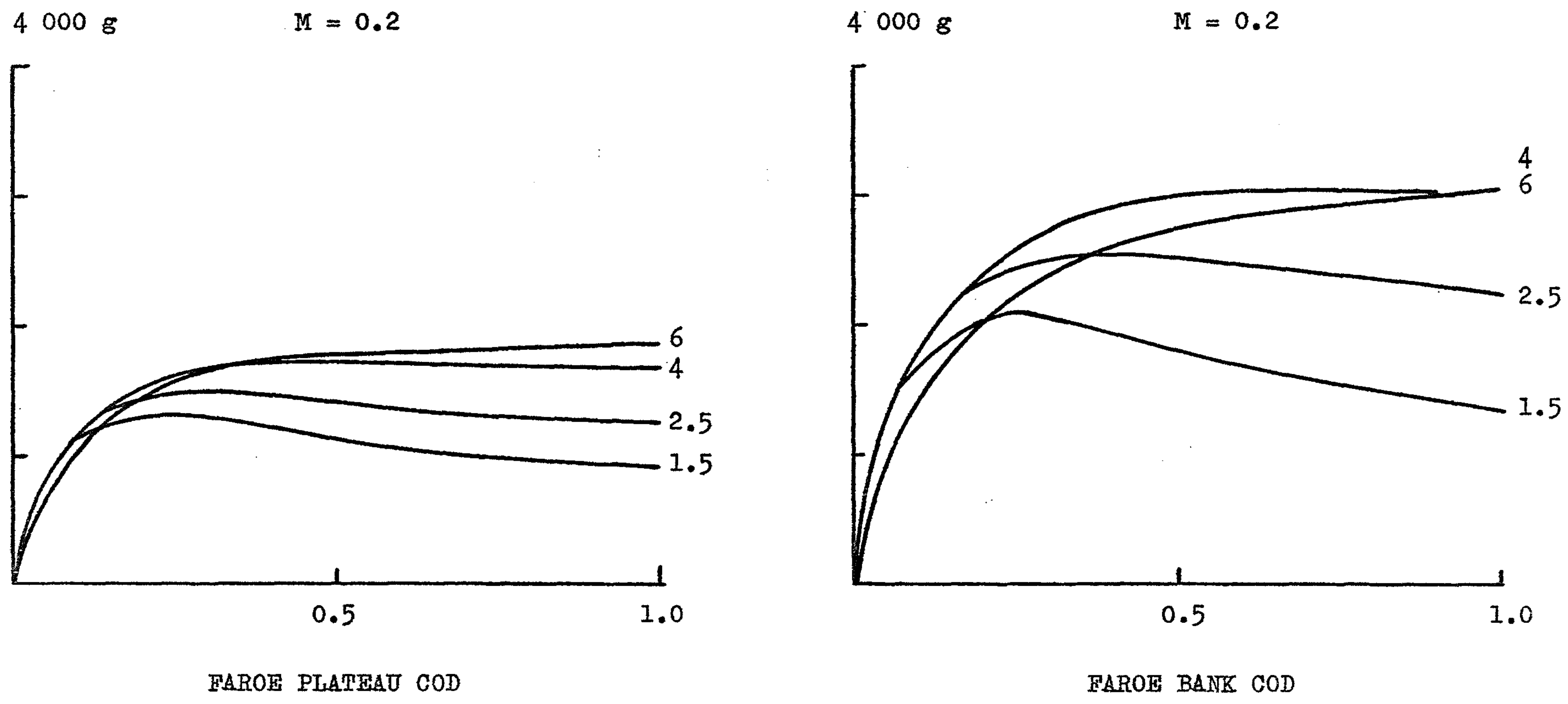


Figure 2. Yield per Recruit for different ages at first capture. Faroe Plateau and Faroe Bank stock.



4.2. HADDOCK

Introduction

As in the case of cod, there are stocks of haddock on Faroe Bank and Faroe Plateau that are believed to be independent of each other. Most haddock data have been collected from the Plateau stock and for this reason, as well as the fact that the greater part of the catches come from this area, assessments have been made for this stock only.

Total international landings of haddock have tended to increase in the long term over the period 1924-1963. During this period, landings increased from about 10 000 tons annually to about 24 000 tons annually. Since 1963, landings have decreased and in 1972 they were 16 000 tons (Table 7.1.b, p.36).

With regard to the landings by different countries, landings by Scottish vessels have followed a similar trend to the total landings, increasing to a maximum in 1962 and then declining. English landings increased from about 8 000 to 13 000 tons from 1924-1938. After the war, landings decreased from 11 000 tons to about 2 000 tons from 1946-1973.

Recorded Faroese landings were negligible before the war, but increased gradually after the war to a maximum of 12 000 tons in 1970. Since then Faroese landings have declined.

Landings per Unit Effort (Table 7.1.3 p.44).

For haddock there have been annual fluctuations, but no significant trend in the landings per unit effort during the past 20 years. Good year classes in 1961 and 1966 accounted for the increase in landings in 1963 and 1969.

The Virtual Population Analysis

The virtual population analysis has been based on estimates of the numbers of haddock of each age group landed each year by Scottish, English and Faroese vessels fishing at Faroe.

For Scottish vessels, samples for length and age composition have been taken monthly on Aberdeen fish market since 1950. For English vessels samples for length composition have been taken by the Lowestoft Laboratory for the years 1957-1972. Age compositions have been determined for these data using the Scottish age/length keys. For Faroese line vessels, samples for length composition have been supplied by the Fisheries Laboratory, Tórshavn in 1960, 1961 and 1969. These have been combined and converted into a single age composition using Scottish age/length keys and this has been used to derive an age composition for the Faroese landings for each year from 1957-1972.

By combining the numbers landed by Scottish, English and Faroese vessels estimates were made of the total numbers landed at each age by these nations. These are arrayed by year class and age in Table 4.2.1,(p.17). If required, these can be further raised, so as to be applicable to the landings by all nations, by increasing each number by 7%.

A V.P.A. was done for each year class separately (Tables 4.2.2 and 4.2.3, p.18 and 19). These Tables show values of F and stock numbers for each year class, arranged by year of capture.

Mean Values of F

Inspection of the values of F shows that these vary both with time and age. For the two youngest age groups sampled (i.e. the one- and two-year-old fish) values of F tend to be very small due to the fact that these age groups are only partially exploited. For fish more than 6 years of age the values are variable, and in any event unreliable, since these are dependent on the starting values adopted for F. For calculating annual values therefore, only the values for 3-6 year-old fish have been used and mean values for these four age groups are shown in Tables 4.2.2 and 4.2.3, (p.18 and 19).

To investigate the relationship between fishing mortality and fishing effort, the annual values of F were plotted against estimates of annual fishing effort. To make this comparison as meaningful as possible, the values of F were first sub-divided into estimates of F for each country separately. This was done by sub-dividing each value on the basis of the proportions of the total landings attributable to each country in each year. These annual values of F were then plotted against the respective national fishing efforts for each country separately.

Some results are shown in Figure 3 (p.23) based on values of F derived from the V.P.A. assuming M = 0.3. The relationship between F and effort (f) were found to be highly correlated. The geometric mean regressions were found to be as follows:

Scotland	F = .0017	f = 0.024
England	F = .0050	f = 0.025
Faroe	F = .0037	f = 0.112

Similar plots were tried starting with values of F from the V.P.A. based on values of M of 0.2, 0.4 and 0.5. In each case the results appeared similar to those in Figure 3. There appeared to be no good reason for accepting the results based on any one value of M as being better than the others so that no estimate of M could be obtained by this method. It was reassuring, however, to find such good correlations between the national values of F and their respective fishing efforts.

Mortality Rates of Haddock

Total instantaneous mortality coefficients (Z) have been estimated by various methods and the results are shown in Table 4.2.4 (p.20). Values based on the landings per unit effort in successive years using Aberdeen and English trawl data, gave values of Z for fish of 3-7 years of age of about 0.6 - 0.8. Estimates based on V.P.A. were very similar, although they tended to be a little lower for the younger age groups.

Recruitment

Estimates of year class strength for Faroe haddock are given in Table 4.2.5 (p.21). These include estimates based on research vessel estimates of haddock in their second year of life. There are also estimates based on the landings per 100 hours' fishing by Aberdeen trawlers of haddock in their fourth year of life. For comparison, absolute estimates are given of year class strength based on the V.P.A.

Of particular significance in recent years has been the occurrence of a good year class in 1966, followed by a sequence of average or less than average year classes. This has contributed to the decline in total haddock landings since 1969.

Estimation of Growth Parameters

Bertalanffy parameters have been calculated for Faroe haddock based on mean lengths of fish and each age landed on Aberdeen fish market for the period 1950-1971. Parameters obtained are given in Table 7.1.5(p.46). These values for the various parameters were used in subsequent Beverton and Holt yield per recruit assessments.

First Availability and Age at First Capture

Young haddock are widely distributed over the Plateau and the Bank and are thought to become available to trawling at an average age of 1 - 1 1/2 years nd a length of about 18-25 cm. With a mesh size of 130 mm, the 50% lengths and ages at first capture (i.e. the length, or age, at which 50% of the fish are retained (by the codend)) are 44.2 cm and 3.5 years for haddock. For this species, therefore, the age at first capture is mainly influenced by mesh size rather than by availability as in cod.

The Effect on Haddock Landings of an Increase in Mesh Size

Assessments of the effect of an increase in mesh size from 110 mm to 130 mm have been made using the same method as that used for cod. The results are given in Table 4.2.6 (p. 22). These show that in the first year after the change, Scottish and English trawlers could be expected to lose 32% and 28% of their catches. Faroese long-liners should benefit by 2%.

Values for intermediate years are given in the Table and it is shown that the long-term effect would be for Scottish and English trawlers to lose 20% and 16% respectively and for Faroese vessels to gain 22%.

revious estimates (Anon., 1966) took account of the possible effect of discards on the assessments. No recent discard data are available, but it should be noted that if discarding does occur, the losses experienced by trawlers should not be as great as indicated in Table 4.2.6 (p. 22). In the absence of the necessary data for calculating this effect, the trawl losses indicated should be regarded as overestimates.

The Effect of Fishing on Haddock

Assessments have been made of the relationship between yield and fishing mortality rate for Faroe haddock. Figure 4 (p. 24) shows yield per recruit curves calculated using the Beverton and Holt constant parameter formula. For haddock, the maximum yield per recruit is expected from a fishing mortality rate of 0.3 - 0.5. The present fishing mortality rate is about 0.5. This assessment indicates, therefore, that the yield per recruit is close to its theoretical maximum. Estimates of fishing mortality rate at each age from the V.P.A. show that these are not constant with age. This suggests that a more realistic estimate could be made by using a model in which F is varied with age in the way indicated by the V.P.A. This has been done using the values of F at each age calculated for the period 1970-1971. The effect on the landings of varying F at each age by various percentages was determined by the method of Jones (1961), and the results are shown in Figure 5 (p.25). Curves are drawn for values of

$M = 0.2$ and 0.3 and they confirm the conclusion from the constant parameter assessment that at present the yield per recruit is close to its theoretical maximum.

The Effect of the Closure of Certain Areas to Fishing

A large proportion of the haddock stock at Faroe is taken within the 100 fathom depth contour and much of this is within 20 miles of the present base-line. For this reason the closure of areas outside the current 12-mile limit will restrict the activities of trawlers to a smaller proportion of the region within the 100 fathom line. It is not possible to assess the effect of this with any certainty. It is possible, however, that it could lead to the reduction in fishing effort on at least some age groups, and possibly, therefore, to an alteration in the way in which the fishing mortality rate varies with age.

Table 4.2.1. Landings of Faroe Haddock (thousands). Faroe, Scotland, England combined.

	Age									
Year Class	1+	2+	3+	4+	5+	6+	7+	8+	9+	10+
1947										57.5
1948									93.9	104.5
1949								226.6	125.2	46.9
1950							585.2	293.5	97.8	27.8
1951						893.9	817.3	235.7	85.3	13.1
1952					1 615.2	1 298.8	720.5	243.2	59.2	21.7
1953				8 442.0	3 378.1	1 843.6	1 169.0	236.2	72.3	23.3
1954			7 130.2	5 679.4	2 055.8	1 559.0	838.3	270.1	74.7	7.3
1955		4 133.3	8 020.7	4 543.6	2 482.4	1 305.1	867.5	256.8	49.1	7.7
1956	44.7	6 255.3	7 662.8	6 655.2	1 937.3	1 406.6	859.7	198.4	42.5	9.2
1957	116.0	3 970.6	10 659.1	5 134.0	2 361.2	1 539.4	727.7	1 345.0	53.5	12.6
1958	524.5	6 060.9	7 330.3	5 232.5	2 242.3	1 119.8	672.5	179.8	51.8	11.7
1959	853.6	7 932.4	13 976.7	7 403.4	2 259.8	1 208.5	739.7	197.2	68.1	20.3
1960	941.2	9 631.1	8 907.4	3 898.5	1 442.5	1 111.8	630.5	230.2	113.9	10.3
1961	784.2	13 551.8	7 457.0	5 133.1	2 710.0	1 426.2	922.6	377.9	68.0	102.2
1962	356.2	2 284.1	4 285.6	4 804.3	1 784.9	1 525.8	1 223.9	325.7	146.7	94.8
1963	45.5	1 367.8	3 303.5	2 598.8	1 524.3	1 484.9	1 098.5	222.3	113.1	
1964	39.4	1 080.8	2 405.1	2 812.0	1 564.8	1 383.0	863.5	179.6		
1965	89.6	1 424.9	4 096.8	4 567.0	1 624.1	1 292.2	695.7			
1966	69.6	5 881.4	7 539.1	6 580.8	3 267.4	1 170.6				
1967	48.8	2 383.8	4 855.4	4 727.0	2 706.4					
1968	94.7	1 728.2	4 392.7	4 179.3						
1969	56.7	717.4	3 744.1							
1970	55.1	750.0								
1971	42.7									

Table 4.2.2. Faroe Haddock M = 0.2.
Virtual Population Analysis.
Numbers alive (millions) based on individual year classes.

Age \ Year	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
1	47.4	52.3	43.5	62.2	47.0	58.4	36.3	26.2	23.0	29.3	48.6	39.0	37.2	34.2	16.2
2	34.6	38.7	42.7	35.1	50.2	37.6	47.1	29.4	21.4	18.8	24.0	40.0	32.3	30.9	29.4
3	25.0	24.6	26.1	31.4	23.3	33.9	22.2	26.4	22.0	16.3	14.4	18.4	27.4	24.3	23.7
4	19.9	14.0	12.9	14.5	16.1	12.5	15.3	10.2	14.9	14.2	10.4	9.6	11.4	15.7	15.5
5	5.4	8.8	6.4	6.5	5.9	8.6	5.6	5.9	4.8	7.6	7.3	6.2	5.4	5.2	6.9
6		2.9	4.1	3.4	3.1	3.1	4.9	2.5	2.8	2.7	3.8	4.4	3.6	3.0	2.8
7			1.2	1.7	1.4	1.4	1.3	2.7	1.1	1.2	1.2	1.9	2.2	1.7	1.2
8				0.4	0.4	0.4	0.4	0.3	1.5	0.3	0.3	0.4	0.7	0.7	0.4
9					0.1	0.1	0.1	0.06	0.06	0.08	0.07	0.10	0.14	0.3	0.3
10															

Values of F (M = 0.2)

Age \ Year	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972*)
1	0.001	0.002	0.013	0.015	0.022	0.015	0.011	0.002	0.002	0.010	0.010	0.010	0.010	0.010	0.010	-
2	0.14	0.20	0.11	0.21	0.19	0.33	0.38	0.09	0.073	0.066	0.068	0.18	0.085	0.064	0.027	0.06
3	0.37	0.44	0.39	0.46	0.42	0.60	0.58	0.37	0.24	0.25	0.20	0.28	0.36	0.25	0.23	0.20
4	0.62	0.58	0.49	0.70	0.43	0.61	0.75	0.54	0.47	0.46	0.32	0.39	0.58	0.61	0.41	0.35
5	0.40	0.55	0.43	0.54	0.44	0.36	0.58	0.54	0.40	0.49	0.31	0.32	0.39	0.42	0.72	0.44
6		0.66	0.66	0.69	0.62	0.68	0.42	0.66	0.63	0.60	0.52	0.48	0.58	0.71	0.69	0.61
7			0.98	1.29	1.05	1.15	1.29	0.36	1.13	1.07	0.85	0.78	0.92	1.21	1.48	1.04
8				1.17	1.04	1.29	1.51	1.37	2.78	1.15	0.98	0.91	0.90	0.67	0.88	0.8
9					1.08	1.16	2.10	1.70	1.45	1.39	1.42	1.22	2.17	0.39	0.74	0.8
10*)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Mean 3-6 years		0.56	0.49	0.60	0.4[illegible]	0.56	0.58	0.53	0.44	0.45	0.34	0.37	0.48	0.50	0.51	0.40

*) Values of F shown for 1972 and for age group 10 are assumed values.

Table 4.2.3. Faroe Haddock M = 3.
Virtual Population Analysis.
Numbers alive (millions) based on individual year classes.

Age \ Year	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
1	67.4	77.9	61.4	86.1	64.8	82.2	56.2	41.0	35.4	43.6	69.6	64.7	55.1	49.7	21.2
2	45.3	49.9	57.6	45.0	63.0	47.2	60.3	41.3	30.3	26.2	32.7	52.1	49.2	41.9	39.7
3	30.7	30.0	31.6	39.3	28.2	39.9	26.8	33.1	28.7	21.3	18.5	23.0	33.6	34.4	29.6
4	23.4	16.7	15.4	16.9	20.1	14.6	17.7	12.3	18.2	17.6	13.0	11.6	13.5	18.5	21.3
5	6.4	10.2	7.5	7.6	6.9	10.5	6.4	6.9	5.8	9.1	8.9	7.4	6.2	6.2	8.1
6		3.3	4.7	3.8	3.5	3.5	5.8	2.9	3.2	3.1	4.4	5.1	4.2	3.3	3.2
7			1.4	1.9	1.5	1.5	1.4	3.0	1.2	1.3	1.3	2.1	2.5	1.8	1.3
8				0.4	0.4	0.4	0.4	0.3	1.6	0.3	0.4	0.5	0.8	0.8	0.4
9					0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.3
10															

Value of F (M = 0.3)

Age \ Year	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972*)
1	0.001	0.002	0.010	0.012	0.017	0.011	0.007	0.001	0.001	0.010	0.010	0.010	0.010	0.010	0.010	-
2	0.11	0.16	0.083	0.17	0.16	0.27	0.30	0.066	0.054	0.049	0.052	0.14	0.058	0.049	0.021	0.05
3	0.31	0.37	0.33	0.37	0.35	0.51	0.48	0.30	0.19	0.20	0.16	0.23	0.30	0.18	0.19	0.16
4	0.53	0.49	0.41	0.60	0.35	0.52	0.65	0.45	0.39	0.38	0.26	0.32	0.49	0.52	0.29	0.30
5	0.34	0.48	0.38	0.47	0.39	0.30	0.51	0.47	0.34	0.42	0.26	0.27	0.34	0.36	0.61	0.30
6		0.59	0.60	0.62	0.56	0.62	0.36	0.59	0.57	0.54	0.46	0.42	0.52	0.65	0.62	0.53
7			0.90	1.18	0.97	1.07	1.20	0.33	1.04	0.98	0.77	0.70	0.82	1.12	1.43	0.96
8				1.09	0.97	1.22	1.42	1.28	2.67	1.08	0.91	0.86	0.82	0.61	0.84	1.2
9					1.04	1.12	2.04	1.65	1.40	1.34	1.37	1.18	2.11	0.37	0.71	1.2
10*)						1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Mean 3-6 years		0.48	0.43	0.52	0.41	0.49	0.50	0.45	0.37	0.38	0.28	0.31	0.41	0.43	0.43	0.32

*) Values of F shown for 1972 and for age group 10 are assumed values.

Table 4.2.4. Faroe Haddock.
Estimates of total instantaneous mortality coefficient (Z) by different methods.

1			2			
			M			
Age	Aberdeen	English	0.1	0.2	0.3	Age
3-4	0.62	0.48	0.56	0.59	0.62	3
4-5	0.85	0.81	0.74	0.74	0.75	4
5-6	0.74	0.72	0.66	0.68	0.71	5
6-7	0.70	0.64	0.78	0.80	0.82	6
7-8	0.89	0.79	1.10	1.08	1.07	7
8-9	1.14	0.93	0.90	0.91	0.92	8

1: Comparison of mortality estimates (Z) derived from Aberdeen and English trawler landings per unit effort for the period 1957-1968.

2: Total mortality estimates (Z) from a Virtual Population Analysis due to vessels of all countries during the period 1958-1963.

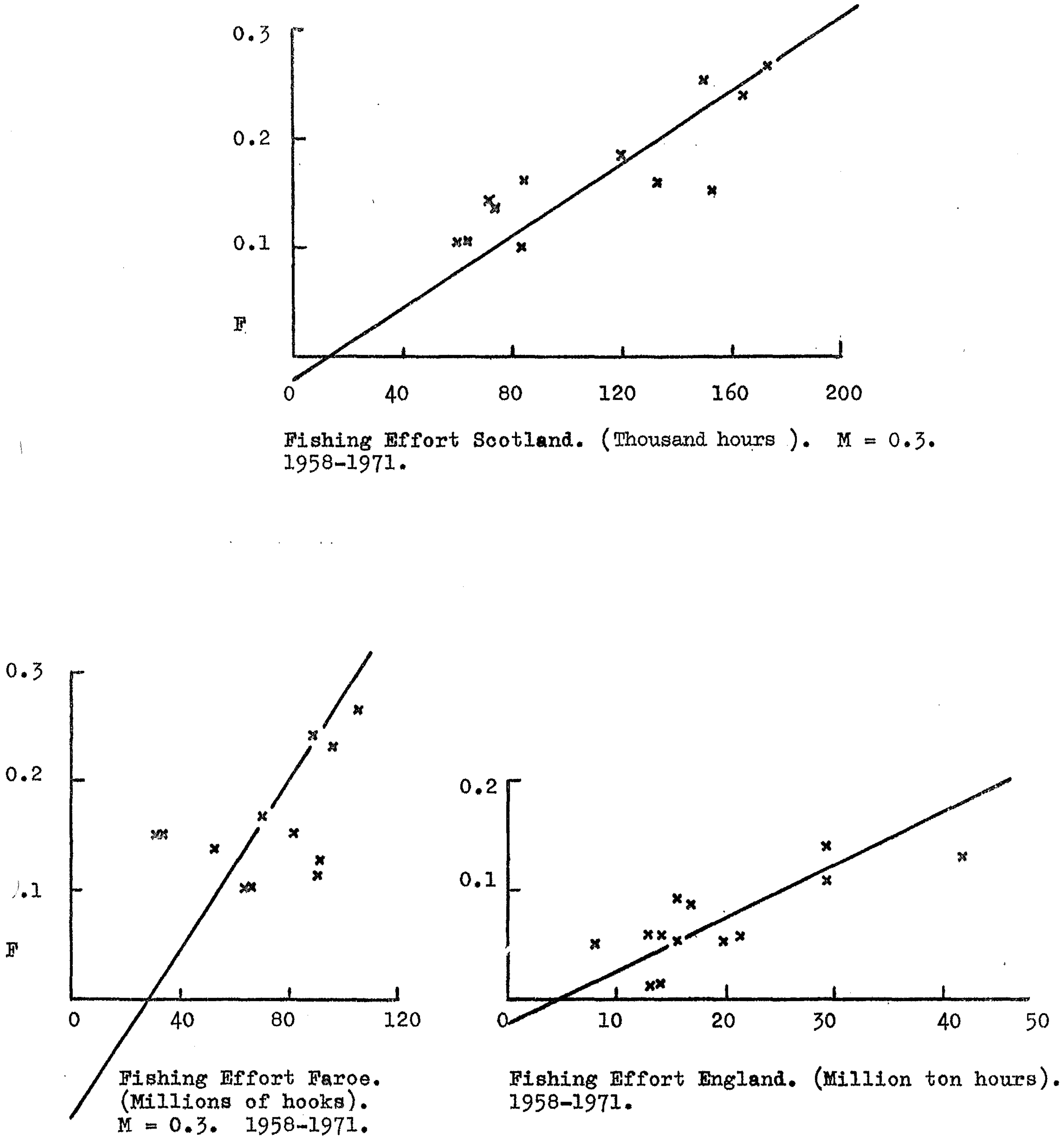
Table 4.2.5. Faroe Haddock.
Relative year class strengths.

Research Vessel Catches/10 hrs as 1 + Fish			
Year Class	Old Explorer	Year Class	New Explorer
1922	112	1957	3003
1923	179	1958	1500
1924		1959	2300
1925		1960	3800
1926	391	1961	6260
1927		1962	4000
1928	1350	1963	2700
1929		1964	375
1930	435	1965	68
1931		1966	3000
1932	2240	1967	1500
1933		1968	3500
1934	1197	1969	350
1935	4815	1970	2120
1936	35	1971	
1937	647	1972	3600 (Scotia)
1938	2221		
1939			
1946	253		
1947	38		
1948	1258		

Year Class	Aberdeen Trawler 4th Year Frequencies/10 hrs	From V.P.A. (millions) M = 0.2	M = 0.3
1947	170		
1948	360		
1949	320		
1950	270		
1951	330		
1952	220		
1953	890		
1954	430		
1955	380		
1956	450	47	67
1957	370	52	78
1958	310	44	61
1959	600	62	86
1960	380	47	65
1961	640	58	82
1962	320	36	56
1963	200	26	41
1964	190	23	35
1965	340	29	44
1966	590	49	70
1967	280	39	65
1968	300	37	55
1969	110		
1970			

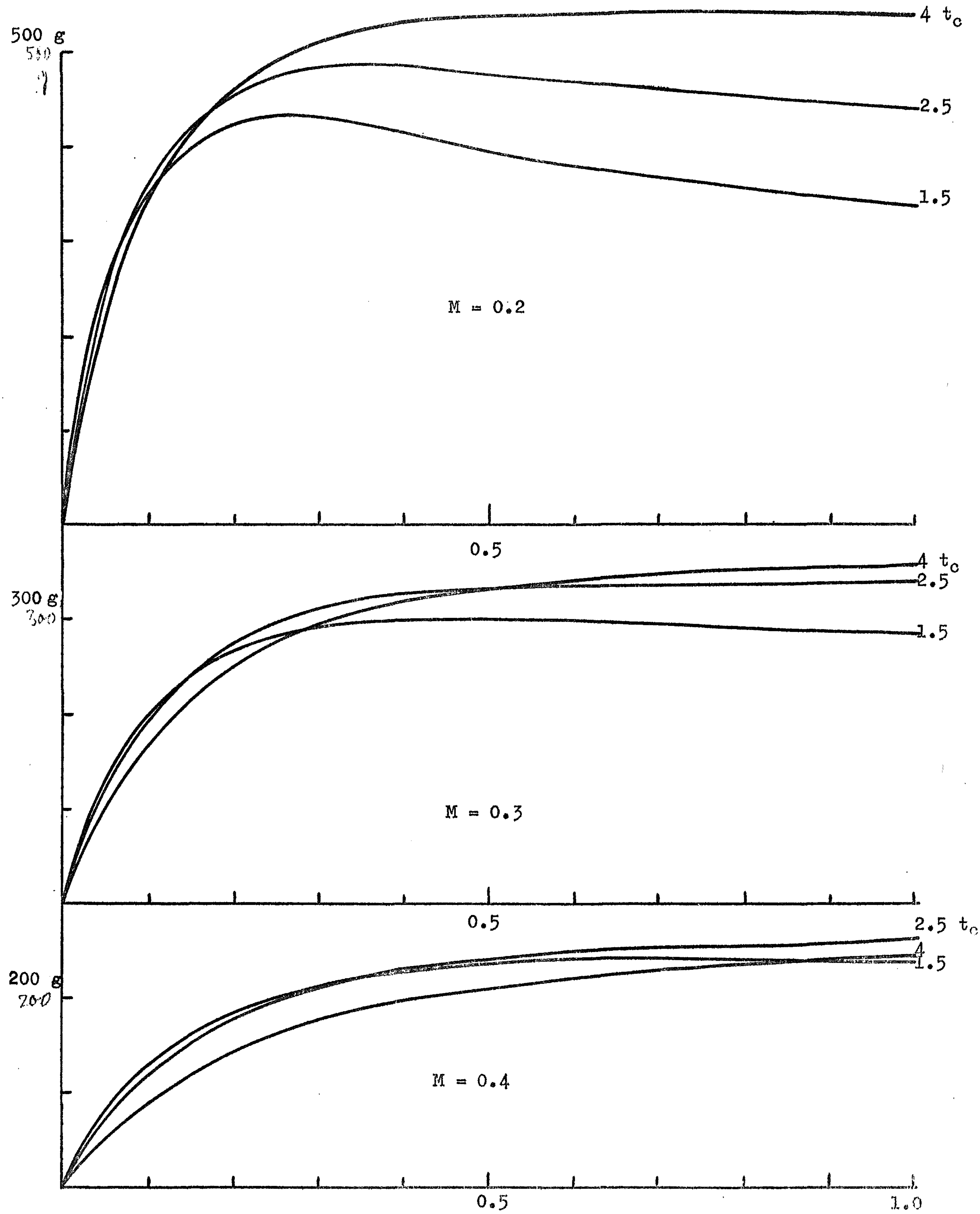
Table 4.2.6. Faroe Haddock.
Effect of increase in mesh size to 130 mm
(values show percentage changes).

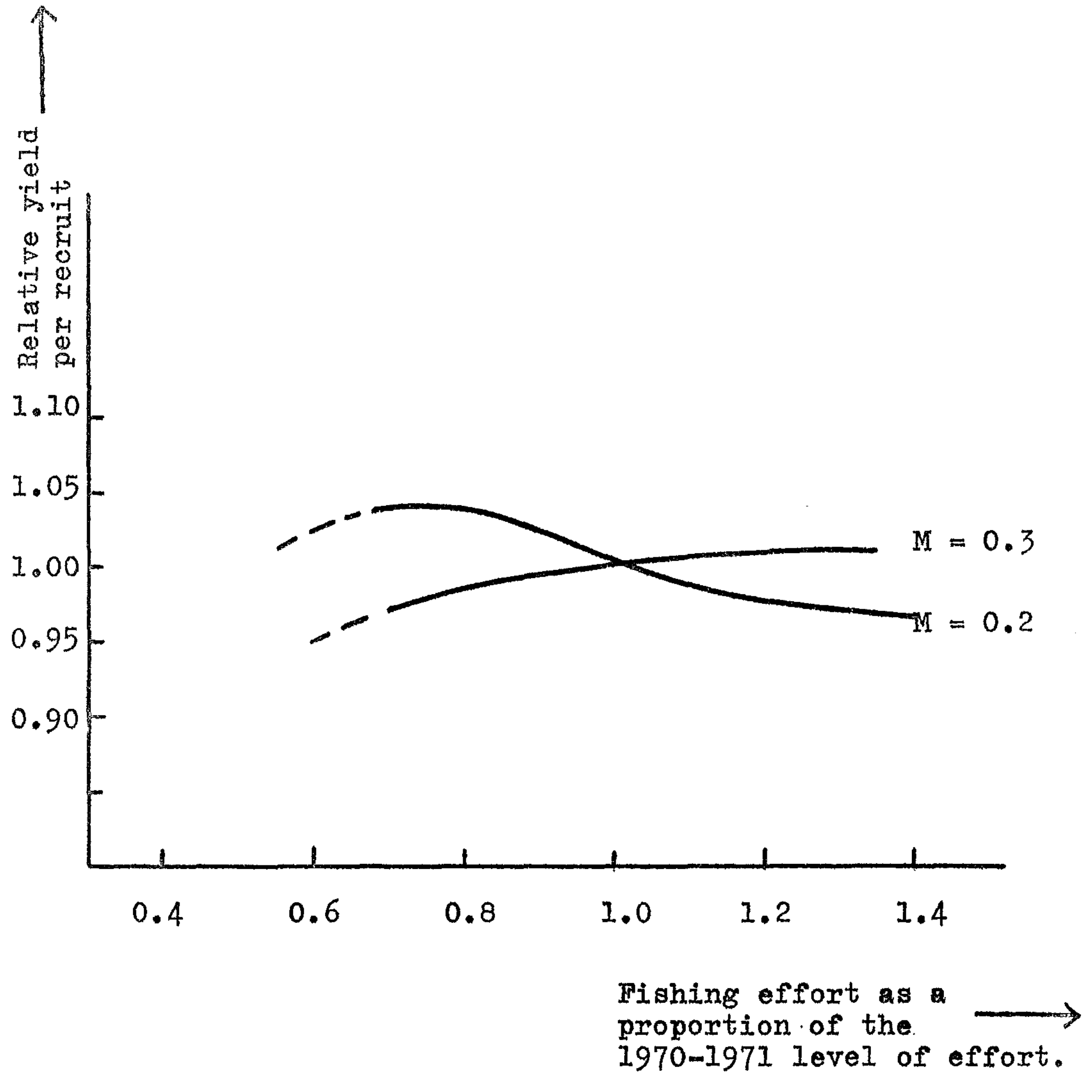
Gear / Years after Change	English	Scottish	Faroese	Total
1	-28		+ 2	-14
2	-23	-28	+ 8	- 9
3	-20	-24	+12	- 4
4	-17	-21	+16	- 1
5	-16	-20	+18	+ 1
Long Term	-16	-20	+22	+ 3



<u>Figure 3</u>. Faroe Haddock. Relationship between annual estimates of the fishing mortality coefficient (M = 0.3) and fishing effort for Scotland, Faroe and England. Lines represent geometric mean regressions.

Figure 4. Faroe Haddock. Yields per Recruit for different ages at first capture.





<u>Figure 5</u>. Faroe Haddock. Equilibrium yield curves against effort.

4.3. CATCH PREDICTIONS FOR VARIOUS ASSUMPTIONS FOR COD AND HADDOCK

The predictions have been made using a programme developed at the Danish Fisheries and Marine Research Institute. The programme demands estimates of:-

1. Values of F for each age group, as proportions of the maximum F;

2. Weight at age;

3. Numbers caught at each age in the initial year chosen;

4. Age of recruitment and the natural mortality rate (M).

It is also necessary to make assumptions about the fishing mortality and the numbers of recruits for each year.

In Table 4.3.1 (p.27) the input values for cod and haddock are given.

The values of F at each age have been estimated from the V.P.A. for the years 1968-1970 for cod and for the years 1970-1971 for haddock. Weights at age have been calculated using the Bertalanffy parameters referred to in the sections on cod and haddock. Age at recruitment has been taken as 1 year for haddock and 2 years for cod.

A run has been made for haddock using natural mortality of 0.2. A value of F_{max} of 1.0 has been assumed together with an average number of recruits from the V.P.A. of 43 million. The results are shown in Table 4.3.2 (p.28). Three runs have been made for cod. Values of M = 0.2 and F_{max} of 0.7 have been assumed on all three occasions, but the number of recruits has been varied - about an average value of 10 million fish, this being the average number of recruits for the period 1968-1971. According to the V.P.A. 20 million fish is about the average for the period before 1968. The results are given in Table 4.3.2 (p.28).

The predictions show that with the present pattern of fishery and recruitment there should be a reasonably stable fishery for haddock with average catches of about 16 000 tons.

For the cod stock the catches will also depend on recruitment and there are some indications of low recruitment since 1969. With low recruitment (10 million fish annually) the catches can be expected to decline. With an annual recruitment of 15 million fish, the fishery should remain at the current level. With an annual recruitment of 20 million fish, catches should improve and reach a higher level.

Both predictions suggest that the quotas set in the "Arrangement Relating to Fisheries in Waters Surrounding the Faroes", allowing a total catch of 30 000 tons of cod and 22 000 tons of haddock are too high for application to 1976.

Table 4.3.1. Input values for prognosis of catches of haddock and cod.

	COD		
Age	Proportions of Maximal F on Age Groups M = 0.2	Weight at Age in kg	Catches in Numbers in Initial Year 1971
1	0.0	0.551	1 223
2	0.14	1.05	3 093
3	0.37	1.88	2 686
4	0.56	2.897	1 331
5	0.67	4.046	1 066
6	0.77	5.277	232
7	1.0	6.542	372
8	1.0	7.805	78
9	1.0	9.042	29
	HADDOCK M = 0.2		
1	0.01	0.249	55
2	0.046	0.475	717
3	0.24	0.795	4 392
4	0.51	1.069	4 727
5	0.57	1.403	3 267
6	0.7	1.740	1 292
7	1.0	2.070	864
8	0.78	2.386	222
9	0.7	2.582	146

Table 4.3.2. Catch predictions.
Prognosis for the cod and haddock fishery under various assumptions. Initial year 1971.

Predicted catches in tons

COD

Year	1st run	2nd run	3rd run
1972	17 515	17 960	18 405
1973	14 895	16 789	18 683
1974	14 248	18 152	22 056
1975	14 560	20 259	25 959
1976	15 529	22 565	29 600

1st run recruitment 10 000 000 fishes
2nd run recruitment 15 000 000 fishes
3rd run recruitment 20 000 000 fishes

HADDOCK

Year	1st run
1972	16 716
1973	13 665
1974	13 198
1975	16 401
1976	18 735
1st run M = 0.2	

4.4. SAITHE

No new assessments on saithe were made by the present Working Group as the Faroe saithe had been included in the assessments of the Saithe Working Group which met in the previous week. A summary of the results are included here for convenience.

1. Provisional estimates of saithe landings in 1973 indicate that the catches have doubled since 1970-1971, the main increase being in the reported landings by French vessels.

2. From V.P.A. the recent level of fishing mortality on saithe is believed to be within the range 0.2 - 0.5, indicating that the stock is moderately exploited.

3. Average age at first capture is consistent with that required to give maximum yield at the estimated present rate of fishing mortality.

4. Under the "Arrangement Relating to Fisheries in Waters Surrounding the Faroes" future catches of saithe will be restricted but, because of the terms of the Arrangement, it is not possible to define the maximum catch which may be taken. However, it is expected that the overall catch in the near future will not increase by more than about 10%. For non-Faroese vessels the greater part of the fishery takes place outside the shallower areas of the Continental Shelf where the youngest age groups are generally not available. Thus any increase in fishing mortality due to trawl fishing would be expected to be confined to the older age groups and in these circumstances a moderate increase in fishing mortality would not be expected to be detrimental to the stock.

4.5. FLATFISH

Halibut

Total catches (Table 7.1.i.(p.40)) show a declining trend since the late fifties and early sixties when landings were between 2 000 and 3 000 tons. Faroese catches, however, have remained fairly stable during the whole period. Therefore, the reduced catches are considered to reflect a decrease in fishing effort in line fishery of all countries except those of Faroe, rather than a decrease in abundance. English tagging experiments of small halibut indicate that at first these fish spread over both the Faroe Plateau and the Bank, but at an older age halibut tagged on the Plateau tend to be returned from as far as Iceland, whereas halibut tagged on the Bank disperse mainly to the southwest (Bill Bailey Bank, Lowry Bank and Outer Bill Bailey Bank).

Plaice, Lemon Sole

Total catches of plaice have slightly increased over the period (Table 7.1.h, p.39). Lemon soles (Table 7.1.g, p.39) in contrast seem to be less exploited than in the early sixties. Since these species are taken only as a by-catch of the demersal fishery, biological information is limited and data on length and age composition are available only for some recent years.

Von Bertalanffy growth curves were fitted to Faroese and Scottish length at age data (Table 7.1.5 p.46). Faroese data were often inconsistent with the theoretical curve which may perhaps be due to the fishing pattern, because only the younger age groups are present in the catches. The Scottish data presented more realistic estimates of L-infinity as compared with the length range observed in the catches. Therefore, these have been selected for yield per recruit calculations for different values of fishing mortality and age at first capture (Figures 6 and 7, p.32 and 33).

Catch curves from Scottish data for recent years are plotted in Figures 8 and 9 (page 34), indicating the value of total mortality for plaice and lemon sole to be of the order of 0.3 and 0.4 respectively, and indicating low rates of exploitation. According to the catch curve, recruitment to the Scottish fishery is not complete until 6 years of age. Considering that the Faroese tend to fish the somewhat younger age groups, the mean age at recruitment can be estimated at 4 to 5 years old. The corresponding points on the yield per recruit curves are indicated in the figures. Although exploitation of the stock is very low, apparently not much gain can be expected from an increase in fishing effort on these species.

4.6 BLUE LING

This stock is exploited mainly by German trawlers and Norwegian long-liners. Catches have been reported by Germany since 1963 and by Norway since 1964. Varying amounts of blue ling have probably been included with common ling in earlier years. According to preliminary figures, the catches have been increasing since the mid-sixties. In Table 4.6.1 (p.31) total catches, catches per fishing day and estimates of total effort have been tabulated. Catch per unit effort has increased in 1971 and 1972 to almost twice the mean for the period 1963-1972 (mean CPUE = 1.1 ton/fishing day). It is not certain if this reflects a real increase in abundance or if it is the effect of a change in the fishing pattern due to effort being directed more towards blue ling.

The lack of sampling for biostatistical data in the blue ling fishery in the Faroe area has made it impossible for the Working Group to proceed any further in an analysis of the state of this stock.

It is not known if there is an interchange of the blue ling between the Faroe and other areas.

4.7 REDFISH

There is a German trawl fishery for redfish in the deeper waters around the Faroes. Germany is the only country catching any substantial quantities of this species in the area. Preliminary catch figures for 1973 indicate a catch of about 9 400 tons, which is about 600 tons less than the maximum catch which was recorded in 1955. Estimates of CPUE and total fishing effort given in Table 4.6.1 (p.31) do not show any clear trends, the CPUE's for 1971 and 1972 being about the average for the period 1963-1972 (mean CPUE = 3.3 tons/ fishing day).

No age and length data were available to the Working Group and nothing is known about possible connections between this stock and the redfish stocks in the open sea in the North Atlantic.

Table 4.6.1. Blue Ling and Redfish catches off Faroe Islands 1963 - 1972, and total effort from German catches per fishing day.

Year	German total catch in tons		German catch (in tons) per fishing day		Total effort for all countries	
	Blue Ling	Redfish	Blue Ling	Redfish	Blue Ling	Redfish
1963	478	2 493	1.0	4.1	-	608.05
1964	2 675	7 908	1.5	4.3	1 783.33	1 839.07
1965	2 732	5 512	1.2	3.5	2 276.67	1 574.85
1966	1 280	3 228	0.7	2.7	1 828.57	1 195.56
1967	1 371	4 899	0.8	3.3	1 713.75	1 484.55
1968	2 646	6 667	1.0	3.5	2 646.00	1 904.86
1969	1 047	1 258	0.4	1.8	2 617.50	698.89
1970	2 947	2 053	0.6	3.7	4 911.67	554.86
1971	2 032	2 503	1.9	3.1	1 069.47	807.42
1972	3 982	4 080	2.2	3.2	1 810.00	1 275.00

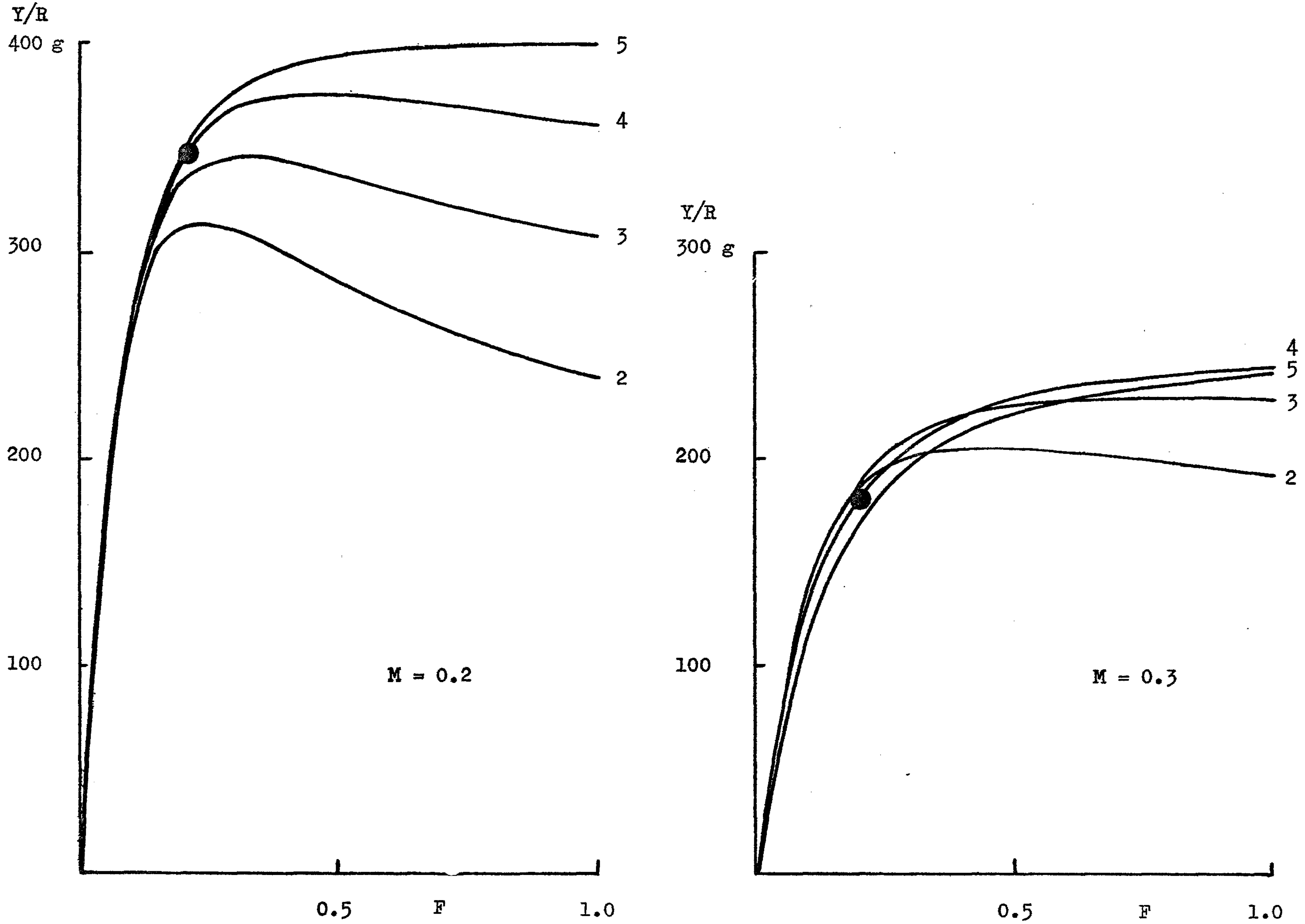
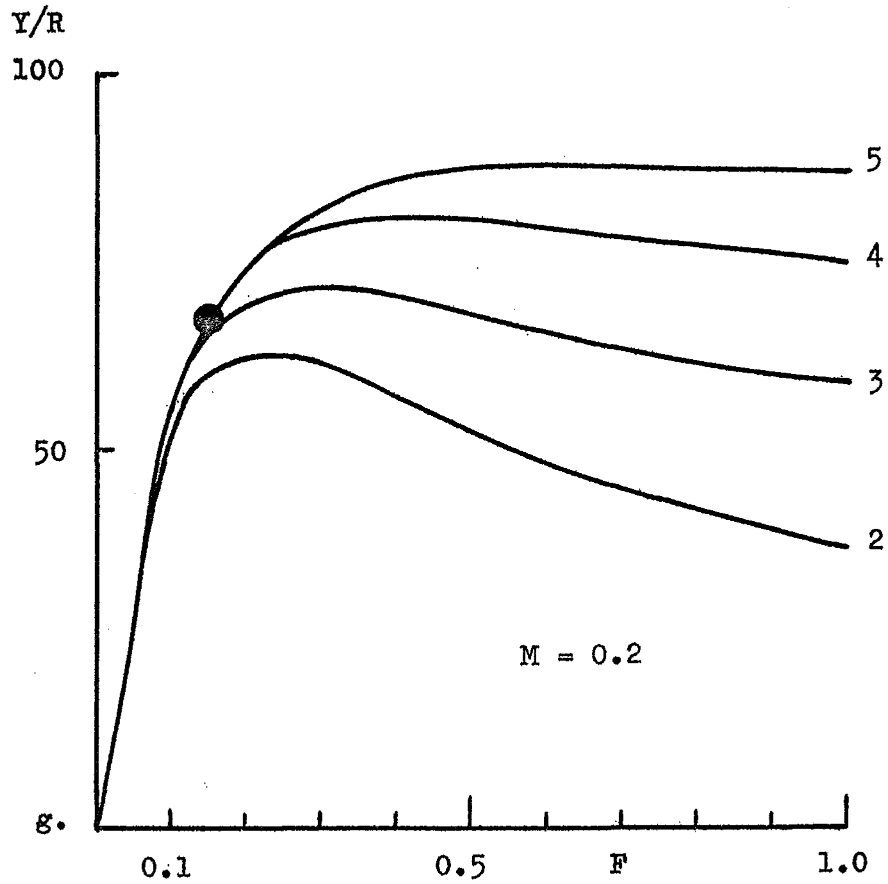


Figure 6. Yield per Recruit of Faroe Plaice. (Bertalanffy parameter derived from Scottish data 1972.) $W = .011 L^3$. Dots in``cate present level on the yield c``ve.



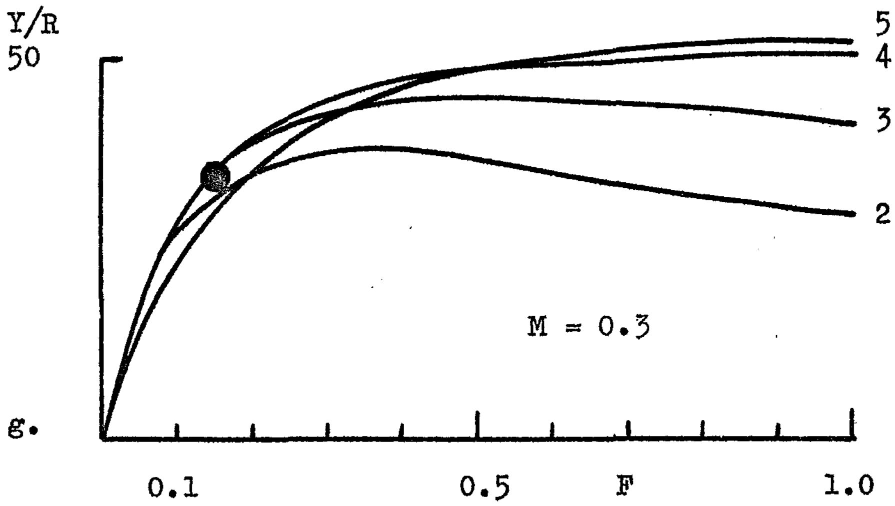
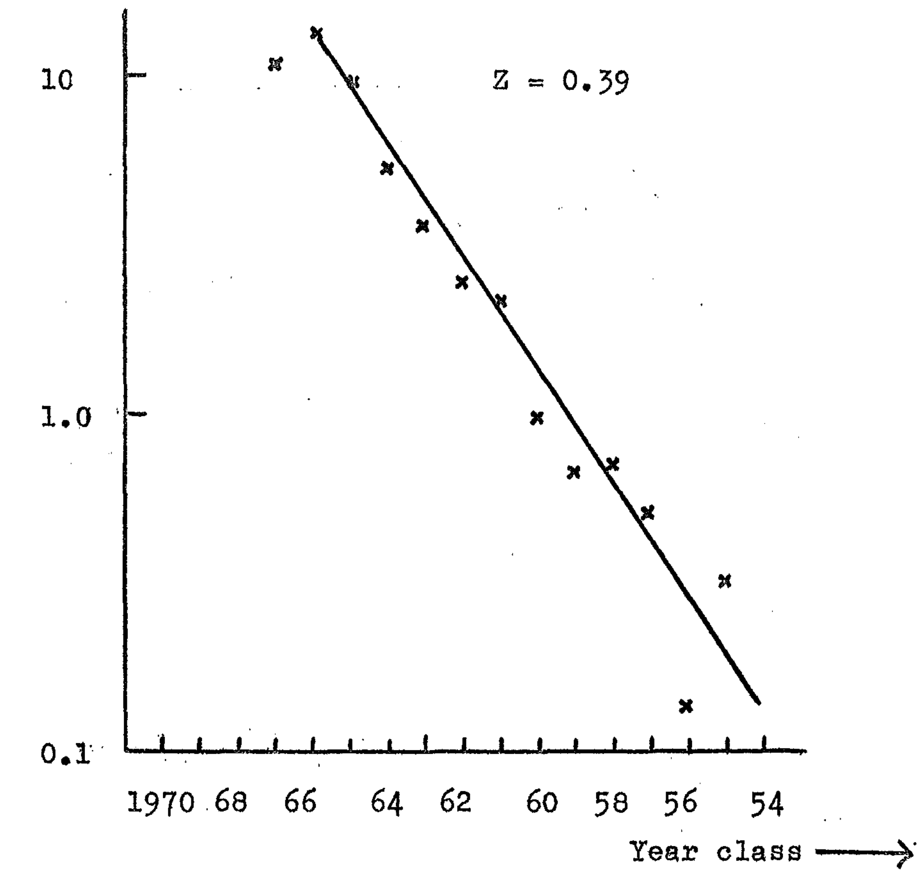


Figure 7. Yields per Recruit of Faroe Lemon Sole. (Bertalanffy parameters derived from Scottish data 1972.) $W = 0.0107 L^3$. Dots indicate present level on the yield curve.

Figure 8. Catch curve. Faroe Plaice 1972.



NUMBER LANDED (THOUSANDS)

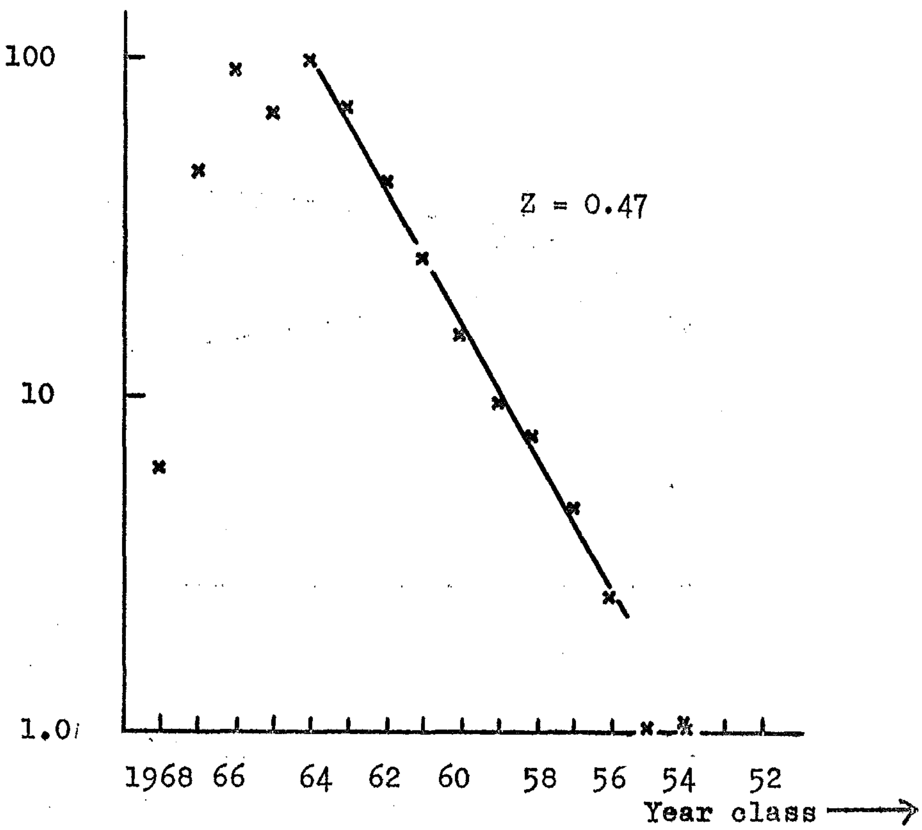


Figure 9. Catch curve. Faroe Lemon Sole 1972.

4.8. OTHER SPECIES

In Table 7.1.m. (p.42) catches for several species are given, including tusk, ling, angler, rays and skates, dogfishes, several species of flatfishes, catfishes and others. No data other than of catch were available to the Working Group, and thus no attempt was made to analyse the state of these stocks.

5. ADEQUACY OF DATA

Time has not allowed the Working Group to make any detailed study of the adequacy of data and sampling. From the Report it will be seen that for several species catch statistics only are to hand.

For redfish and blue ling German effort data are available, but no sampling of age and length composition. For the lemon sole and plaice stocks some Scottish and Faroese data for the most recent years were available for the length and age distribution, allowing estimation of growth parameters and yield/recruit curves. The most complete data were available for cod, haddock and saithe allowing estimates of mortalities, stock numbers, effects of changes in fishing effort and mesh size and predictions of catches. The agreement between independent estimates of mortality gave confidence in the results. However, it should be noted that the Faroese cod data in the former years have been taken from the spring long-line fishery for spawning cod only and are therefore not representative for the long-line fishery as a whole. Also, Faroese haddock sampling has been very scanty in former years.

To be able to assess the state of stocks other than those of cod, haddock and saithe in more detail and for continuing work on these three species, it will be necessary for all countries to sample their catches in order to estimate the numbers of fish of each size landed each year. In addition, age/length keys will be required for all years.

6. REFERENCES

Anon., 1967 Coop.Res.Rep. B, 1967.

Jones, R., 1961 Marine Research 1961, No.2.

Table 7.1.a. Catches in ICES Division Vb by country and species 1952-1972, metric tons, round fresh.

COD

Year	Faroe Islands	France	Germany	Norway	U.K. England	U.K. Scotland	Others	Total
1952	4 550	175	-	-	12 365	13 283	-	30 373
1953	4 137	-	-	-	12 469	10 535	-	27 052
1954	5 190	600	37	125	16 017	14 238	-	36 164
1955	7 902	700	216	-	17 223	12 380	-	38 421
1956	7 938	-	689	-	8 337	10 610	-	27 574
1957	6 920	-	1 085	-	10 067	13 413	-	31 485
1958	6 535	-	1 011	-	9 828	10 523	-	27 897
1959	4 676	-	697	-	10 087	10 522	-	25 982
1960	8 723	-	451	-	13 746	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	-	24 104
1964	8 888	989	1 162	333	5 845	7 791	-	25 008
1965	9 948	1 538	854	419	5 470	7 868	-	26 097
1966	7 957	1 120	669	314	4 871	7 855	130 xx)	22 916
1967	7 835	871	815	650	7 996	8 546	-	26 603
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 x)					5 167			

Table 7.1.b. HADDOCK

Year	Faroe Islands	France	Germany	Norway	U.K. England	U.K. Scotland	Others	Total
1952	3 225	-	-	-	7 714	6 653	-	17 592
1953	2 788	-	-	-	5 965	6 404	-	15 157
1954	2 645	-	1	-	6 069	6 832	-	15 547
1955	3 865	-	33	-	5 148	7 667	-	16 713
1956	4 221	-	20	-	5 937	7 512	-	17 690
1957	4 453	-	38	-	7 105	9 602	-	21 198
1958	6 850	-	19	-	7 637	9 573	-	24 076
1959	5 670	-	10	-	5 536	9 220	-	20 436
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	-	27 149
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	8	13 378
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	-	19 393
1972	8 314	2 666	25	-	1 371	4 109	-	16 485
1973 x)			46		2 464			

x) Preliminary estimates.
xx) USSR.

Table 7.1.c. SAITHE

Year	Faroe Islands	France	Germany	Norway	U.K. England	U.K. Scotland	Others	Total
1952	47	-	-	-	5 663	1 188	-	6 898
1953	9	-	-	-	6 087	1 088	-	7 184
1954	4	-	13	-	5 543	652	-	6 212
1955	89	-	484	-	5 643	1 018	-	7 234
1956	37	-	4 998	-	4 673	1 176	-	10 884
1957	979	-	21 082	-	3 869	928	-	26 858
1958	339	-	4 299	-	6 880	1 460	-	19 978
1959	536	-	6 781	-	5 688	1 540	-	14 545
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	-	25 306
1967	2 242	5 555	6 119	-	4 536	3 996	-	22 448
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*)			8 602	ca 200	7 460			

Table 7.1.d. WHITING

Year	Faroe Islands	France	Germany	Norway	U.K. England	U.K. Scotland	Others	Total
1952	-	-	-	-	332	1 300	-	1 632
1953	-	-	-	-	563	1 167	-	1 730
1954	-	-	-	-	522	716	-	1 238
1955	-	-	1	-	298	581	-	880
1956	-	-	+	-	213	415	-	628
1957	-	-	+	-	157	554	-	711
1958	-	-	+	-	167	333	-	500
1959	-	-	+	-	249	246	-	495
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 421a)	+	-	29	97	-	1 547
1966	-	225	-	-	28	139	-	392
1967	-	254	1	-	31	138	3xx)	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	-	542
1972	-	194	-	-	137	139	-	470
1973*)			7					

*) Preliminary estimates.
**) Denmark.
a) Includes Iceland grounds.

Table 7.1.e. TUSK

Year	Faroe Islands	France	Germany	Norway	U.K. England	U.K. Scotland	Others	Total
1952	187	-	-	1 007	92	387	-	1 673
1953	593	-	-	711	93	483	-	1 880
1954	560	-	7	511	95	401	-	1 574
1955	1 005	-	40	384	114	472	-	2 015
1956	818	-	58	484	83	586	-	2 029
1957	845	-	99	199	80	694	-	1 917
1958	812	-	48	1 068	106	1 066	-	3 100
1959	984	-	87	637	69	1 275	-	3 052
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*)			134	ca.2 800				

Table 7.1.f. LING AND BLUE LING

Year	Faroe Islands	France	Germany**)		Norway		U.K. England	U.K. Scotland	Others	Total
1952	56	-	-		679		489	540	-	1 764
1953	144	-	-		486		476	935	-	2 041
1954	122	-	1 247		414		474	479	-	2 736
1955	235	-	2 799		711		751	560	-	5 056
1956	277	-	2 025		1 036		533	749	-	4 620
1957	259	-	1 882		626		579	879	-	4 225
1958	616	-	2 115		795		589	823	-	4 938
1959	394	-	1 758		917		379	691	-	4 139
1960	520	-	895		400		629	855	-	3 299
1961	603	-	11		521		241	829	-	2 205
1962	450	387	9	B.Ling	326		247	572	-	1 991
1963	365	1 512	17	478	496	B.Ling	183	396	-	3 447
1964	480	2 844	48	2 493	736	182	322	632	-	7 737
1965	416	2 618	30	1 612	832	1 120	184	388	-	7 200
1966	416	1 827	39	850	2 115	430	276	496	-	6 449
1967	736	23	60	1 133	3 203	238	172	364	-	5 929
1968	1 209	177	68	1 858	3 340	788	152	679	-	8 271
1969	486	195	45	249	1 952	798	225	602	-	4 552
1970	699	578	42	335	1 737	2 612	164	883	-	7 050
1971	752	728	46	1 475	2 898	557	152	879	-	7 487
1972	1 572	866	74	2 779	3 958	1 203	146	772	-	11 370
1973*)			157	2 929	ca.3 000	ca.4 000				

*) Preliminary estimates.
**) 1954 - 1962 Ling and Blue Ling not separated.

Table 7.1.g. LEMON SOLE

Year	Faroe Islands	France	U.K. England	U.K. Scotland	Total
1952	-	-	373	753	1 126
1953	-	-	361	462	823
1954	-	-	365	580	945
1955	-	-	307	480	787
1956	-	-	192	548	740
1957	-	-	343	678	1 021
1958	-	-	292	670	962
1959	-	-	358	752	1 110
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	441
1970	-	-	68	424	492
1971	590	-	76	303	969
1972	300	-	35	244	579
1973	-	-			

Table 7.1.h. PLAICE

Year	Faroe Islands	France	U.K. England	U.K. Scotland	Total
1952	115	-	79	140	334
1953	13	-	53	113	179
1954	27	-	78	142	247
1955	81	-	57	129	267
1956	19	-	57	145	221
1957	+	-	75	189	264
1958	4	-	75	157	236
1959	5	-	83	149	237
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	345
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					

Table 7.1.i. HALIBUT

Year	Faroe Islands	France	Germany	Norway	U.K. England	U.K. Scotland	Total
1952	243	-	-	420	467	720	1 850
1953	149	-	-	437	414	663	1 663
1954	226	-	13	561	433	735	1 968
1955	335	-	428	560	554	866	2 743
1956	390	-	57	187	407	901	1 942
1957	374	-	125	366	557	1 165	2 587
1958	616	-	112	390	580	1 165	2 863
1959	404	-	125	180	593	1 261	2 563
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*)			52	ca. 70			

Table 7.1.j. MEGRIM

Year	Faroe Islands	France	Germany	Norway	U.K. England	U.K. Scotland	Total
1952	-	-	-	-	5	12	17
1953	-	-	-	-	4	19	23
1954	-	-	-	-	5	11	16
1955	-	-	-	-	5	21	26
1956	-	-	1	-	2	13	16
1957	-	-	3	-	3	12	18
1958	-	-	1	-	4	10	15
1959	-	-	1	-	5	6	12
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	-	-	3	8	324
1970	-	99	-	-	1	9	109
1971	-	37	-	-	2	9	48
1972	-	38	-	-	3	10	51
1973							

*) Preliminary estimates.

Table 7.1.k. REDFISH

Year	Faroe Islands	France	Germany	U.K. England	U.K. Scotland	Total
1952	-	-	-	20	10	30
1953	-	-	-	139	16	155
1954	-	-	2 114	87	2	2 203
1955	-	-	10 020	151	2	10 173
1956	-	-	5 018	25	7	5 050
1957	-	-	5 217	27	7	5 251
1958	-	-	4 451	58	13	4 522
1959	-	-	3 440	38	11	3 489
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						

Table 7.1.l. ANGLER (MONK)

1952	-	-	-	86	376	462
1953	-	-	-	69	320	389
1954	-	-	-	85	344	429
1955	-	-	3	157	338	498
1956	-	-	3	157	429	589
1957	-	-	3	214	631	848
1958	-	-	+	263	580	843
1959	-	-	13	269	629	911
1960	-	-	7	314	811	1 132
1961	-	-	11	167	695	873
1962	-	-	4	179	641	824
1963	-	-	-	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	2	99	388	490
1973 x)			6			

x) Preliminary estimate.

Table 7.1.m. Other Species.

Year	Dab	Turbot	Witch	Various Pleuro-necti-forms	Hake	Pollack	Various Gadiforms	Cat-fishes	Conger Eel	Gurnards	Dogfishes	Rays and Skates	Non-teleost fishes	Various Unidenti-fied Fishes
1952	114	2	4		74	53		133	4	63	898	397		146
1953	198	3	4		90	12		113	5	42	686	508		137
1954	259	1	1		62	4		136	2	18	662	348		293
1955	192	4	3		26	7		174	2	21	579	485		802
1956	129	2	2		15	2		242	2	10	526	518		568
1957	126	1	3		18	3		259	3	13	524	485		552
1958	107	2	3		20	3		217	1	24	754	450		326
1959	114	3	1		26	5		222	2	17	738	471		645
1960	261	3	6		41	8		348	9	29	1 089	659		499
1961	119	2	6	8 771	39	4	679	231	2	22	720	564	3	190
1962	121	2	51	341	167	5	345	202	4	18	663	475	12	1 209
1963	108	+	50	379	270	6	605	364	2	9	1 166	473	30	838
1964	56	18	27	264	144	4	2 365	145	2	15	1 070	616	2	615
1965	68	13	27	660	123	8	1 711	97	4	10	1 140	657	1	554
1966	54	7	10	537	103	5	1 269	67	10	7	376	537	591	1 501
1967	68	3	12	227	48	2	1 298	86	8	9	359	481	393	98
1968	105	+	1	580	311	12	2 850	89	15	30	330	551	1	2 007
1969	203	1	2	51	361	20	1 101	56	18	21	400	621	946	2 160
1970	56	1	4	48	36	6	3 132	92	13	2	174	534	94	127
1971	49	1	1	11	28	5	1 937	100	5	5	153	400	129	176
1972	45	+	2	417	56	3	3 975	209	16	324	97	380	541	823

Table 7.1.2. Quantity of Cod, Haddock and Saithe landed ('000 cwt) from the Faroe Plateau and the Faroe Bank by British trawlers landing in Scotland.

Year	COD		HADDOCK		SAITHE	
	Plateau	Bank	Plateau	Bank	Plateau	Bank
1961	187.6	3.3	162.6	3.2	35.3	1.1
1962	162.6	6.4	274.6	7.4	42.3	1.6
1963	159.8	6.3	263.1	12.1	54.0	2.8
1964	106.4	6.2	118.8	4.6	51.8	2.4
1965	110.9	4.0	107.0	3.3	60.1	2.0
1966	115.3	6.3	102.0	6.7	54.2	4.4
1967	122.1	8.2	76.1	4.9	58.8	6.7
1968	115.2	11.8	101.0	8.8	68.4	9.9
1969	180.9	8.3	103.6	6.2	81.9	4.3
1970	132.6	15.1	94.8	16.4	123.1	18.1
1971	120.5	11.4	86.2	12.9	103.7	14.3
1972	82.3	10.8	49.5	18.7	88.0	14.0

Table 7.1.3. Faroe Division Vb. Fishing Effort and Landings per Unit Effort.

Year	Estimated Total Effort			Landings per Unit Effort		
	Cod (1)	Haddock (1)	Saithe (2)	Cod (3)	Haddock (3)	Saithe (4)
1950	54	45	34	666	303	160
1951	65	54	41	544	272	212
1952	65	59	32	511	298	216
1953	53	53	28	511	286	260
1954	56	55	27	641	283	227
1955	59	56	30	654	299	245
1956	58	49	42	474	363	259
1957	64	58	146	494	367	182
1958	76	79	53	368	304	243
1959	74	82	71	352	248	203
1960	118	141	74	331	199	161
1961	108	106	42	250	196	230
1962	101	92	56	239	295	186
1963	90	80	60	267	343	214
1964	80	78	80	315	250	267
1965	81	75	64	336	246	344
1966	63	70	91	363	268	279
1967	52	61	76	510	218	277
1968	74	71	51	464	252	399
1969	71	87	76	537	269	359
1970	79	85	68	405	252	427
1971	65	61	68	435	316	454
1972	72	79	189	328	209	247

(1) British Units = Million Ton-hours

(2) English Units = Million Ton-hours steam + motor trawl

(3) Tons per Million Ton-hours, British Trawlers

(4) Tons per Million Ton-hours, English Trawlers

Table 7.1.4. TOTAL DEMERSAL. Faroes[1]. Total Landings.

Round fresh weights in '000 metric tons.

Year	England	Scotland	Faroes	Others	Total
1924	55.3	13.7	4.9	-	73.9
1925	45.5	9.5	7.9	0.7	63.7
1926	44.2	16.7	6.4	1.1	68.3
1927	46.9	18.0	8.2	1.0	74.0
1928	40.9	12.7	5.0	3.0	61.6
1929	38.3	9.2	2.2	1.2	51.0
1930	42.3	12.8	2.6	3.2	61.2
1931	58.6	17.3	1.8	1.4	79.1
1932	61.6	17.6	5.3	1.0	85.4
1933	55.6	15.8	2.6	0.8	74.9
1934	53.0	15.0	2.3	0.1	70.4
1935	53.8	15.2	2.0	0.1	71.2
1936	54.1	18.7	1.6	1.0	75.4
1937	39.0	15.2	3.7	1.3	59.3
1938	40.6	14.8	3.5	0.4	59.2
1946	32.8	19.7	-	-	52.4
1947	31.7	22.7	-	0.1	54.5
1948	15.0	21.5	-	-	36.5
1949	21.6	26.5	-	-	48.1
1950	27.2	32.4	-	0.4	60.1
1951	32.8	31.3	-	1.9	65.9
1952	28.8	25.9	8.4	1.3	64.4
1953	27.6	22.9	7.9	1.6	59.9
1954	30.5	25.7	8.9	5.8	70.9
1955	31.2	25.2	13.5	17.2	87.1
1956	21.2	23.8	13.7	15.2	73.9
1957	23.5	29.5	13.8	31.3	98.1
1958	26.9	27.0	15.8	14.7	84.5
1959	23.9	27.0	13.1	14.9	78.9
1960	31.0	36.6	19.6	8.0	95.3
1961	12.5	31.1	21.3	19.8	84.7
1962	14.7	35.6	19.2	9.1	78.6
1963	13.6	34.5	19.1	14.4	81.6
1964	15.1	21.9	20.8	34.5	92.3
1965	15.6	21.9	20.2	35.9	93.6
1966	12.4	20.6	18.3	36.2	87.5
1967	15.1	20.5	18.5	29.1	83.2
1968	15.8	23.1	27.7	33.9	100.5
1969	14.2	28.1	34.2	47.1	123.6
1970	8.7	28.7	32.1	29.7	99.2
1971	9.9	25.4	32.1	29.2	96.6
1972					

1) Plateau and Bank combined.

Table 7.1.5. Estimates of Bertalanffy Growth Parameters[1].

Species	Source	Year	L_∞	$s^2_{L\infty}$	K	s^2_K	t_o	s^2_{to}	Notes
Haddock xx)	Scotland	1950 - 1972	82.7	13.5	.149	.00039	-1.55	.119	♂ + ♀ 1^+ excluded
Cod xx), Bank stock	England	1959 - 1972	111.7	1.6	.354	.00042	0.46	.00114	♂ + ♀ 1^+ excluded
Cod xx), Plateau stock	England	1959 - 1972	129.9	68.3	.131	.00043	-1.21	.12	♂ + ♀ 1^+ excluded
Plaice	Faroe	1967	56.5	8.6	.476	.043	0.45	.422	♂
Plaice	Faroe	1967	69.8	7.9	.248	.0020	-0.24	.248	♀
Plaice	Scotland	1972	83.4	7.1	.113	.00014	-1.18	.155	♂ + ♀ 3^+ included
Plaice xx)	Scotland	1972	84.8	14.1	.105	.00026	-1.55	.485	♂ + ♀ 3^+ excluded
Lemon Sole	Faroe	1967	36.7	53.6	.222	.138	-2.55	84.21	
Lemon Sole xx)	Scotland	1972	44.0	0.67	.175	.00043	0.05	.368	♂ + ♀ 4^+ excluded
Lemon Sole	Scotland	1972	44.6	0.70	.159	.00026	-0.54	.242	♂ + ♀ 4^+ included
Lemon Sole	Faroe	1961	36.9		.223		-2.32		♂ x)
Lemon Sole	Faroe	1965	33.3		.591		1.20		♂ x)
Lemon Sole	Faroe	1966	41.9		.253		-0.55		♂ x)
Lemon Sole	Faroe	1961	38.7		.372		-0.15		♀ x)
Lemon Sole	Faroe	1965	50.9		.072		-8.67		♀ x)
Lemon Sole	Faroe	1966	40.4		.359		-0.14		♀ x)

x) From mean variance data. xx) Estimates used for yield calculation.

1) The estimation is done according to a programme running at the Danish Institute of Marine Research, Charlottenlund. By an iterative process a least square fit of the growth curve to the observed data is found.