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CONSERVATION OF THE ISLE OF MAN HERRING STOCK

by

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1. INTRODUCTION

1.1 During the 1973 and 1974 fishing seasons a prohibition of herring fishing within 12 miles of the Isle of Man, was imposed as a conservation measure by the United Kingdom Government for the period 1 October to 17 November. The basis for this action was reported to ICES Pelagic Fish (Northern) Committee in 1972 (CM 1972/H:7).

The object of the prohibition was to reduce fishing mortality from the high values reached in 1972.

1.2 In 1973 it was expected that, provided effort was not divertrd to other months, the effect of the prohibition would be to reduce the catch and effort by one third and that fishing mortality would also be reduced. The observed reductions of catch and effort were of the expected order and fishing mortality can now be shown to have been reduced by about 21%.

1.3 The prohibition was repeated in 1974 but despite this the effort, catch and fishing mortalities have escalated.

1.4 With the establishments of Total Allowable Catches (TACs) for the Celtic Sea and area VIa it is likely that the Isle of Man stock will be subjected to further pressure from effort displaced from areas under quota. This paper discusses the problem of conservation of the Manx spawning stock and considers appropriate regulatory measures.

2. CATCH STATISTICS

2.1 The Isle of Man fishery is a summer fishery in the north Irish Sea. In recent times the herring have been taken by drifters, ring netters and trawlers (both demersal and pelagic, single and pairtrawl).

2.2 Table 2.2 gives the monthly catches of herring from the Manx fishing grounds since 1959. Prior to that year annual catches were of the order of 4,000-8,000 tons. The data include landings in the Isle of Man, Scotland, England, Northern Ireland and Eire. It has not been possible to include catches landed in any other countries because there is no way of separating catches of Isle of Man herring

from those of other stocks (eg Dunmore) reported internationally in the Bulletins Statistiques for Region VIIa. In any case, the total annual catch of Isle of Man herring taken by countries other than those listed above is estimated to be less than 1,000 tons.

2.3 A feature of 1974 was that herring of the Isle of Man stock were caught in all months of the year, including October, when the Manx grounds within the 12 mile limit were again closed to fishing. The total catch of 25 422 tons taken in 1974 was almost double that of the previous year and, in fact, the September catch alone was substantially greater than the whole of the annual catch in 1973.

Table 2.2 Manx herring: Catch in tons by months: 1959-74

Year	May/June	July	August	September	October	Total
1959	0	267	2383	3218	178	6045
1960	18	89	1974	2365	267	4712
1961	107	658	2240	2400	142	5547
1962	89	320	2774	3983	284	7450
1963	0	462	356	1245	249	2311
1964	0	36	0	462	89	587
1965	53	445	284	2276	1262	4338
1966	53	107	356	1600	551	2667
1967	36	196	267	3769	1618	5885
1968	87	249	1849	3503	1956	7645
1969	71	124	676	4836	3432	9139
1970	53	178	1618	8303	5494	15629
1971	87	711	2454	9086	6401	18758
1972	70	221	1929	10287	6801	19308
1973	62	578	2530	9901	0	13071
1974*	287	1047	5430	15722	1758	25422

*In 1974 the following catches were landed in other months of the year:

January	55 t
February	265 t
March	436 t
April	77 t
Nov	315 t
Dec	30 t

3. EFFORT

3.1 The distribution of effort by gear, as expressed in numbers of landings per month, are given in Table 3. Since 1964 trawler effort has risen sharply while drifter and ringnetter participation has virtually ceased. Only 141 tons were taken by drift net during 1974, trawlers taking 25 281 tons. After reaching very high levels in 1971 and 1972, the total number of trawler landings was reduced in 1973, following the introduction of the October closure. However, it rose again dramatically in 1974 and was by far the highest ever recorded; the total number of trawler landings in 1974 was some 143% greater than in 1973.

3.2 This increase was due in part to the fact that fishing continued throughout the year but there was also a large increase in the number of boats participating in the fishery; 152 boats made landings in the Isle of Man in 1974 compared with 97 in 1973. A new development in the 1974 fishery was the participation of 3 freezer trawlers, which took 1339 tons in August and September.

4. AGE COMPOSITION OF THE STOCK

4.1 The total catches of Isle of Man herring in Table 2.2 were converted to catches in number using sampling programmes on fish landed in the Isle of Man, Whitehaven and in Northern Ireland. Table 4.1 gives these catches in millions of fish per age group from 1964. It is seen that in 1974 the catches of both 1- and 2-ring fish were the highest annual catches of these age groups in any year since 1948.

Table 4.1 Catch in millions of fish per age group (Age in winter rings)

Year	Total	1	2	3	4	5	6	7	8	9	10
1964	3.90	0.01	2.58	0.37	0.13	0.22	0.24	0.25	0.03	0.03	0.04
1965	30.79	0.31	20.78	6.78	1.03	0.46	0.63	0.41	0.31	0.02	0.06
1966	14.69	0.18	3.89	7.91	1.88	0.33	0.27	0.18	0.04	0.03	
1967	34.00	1.02	17.32	4.79	7.61	1.80	0.38	0.20	0.20	0.20	
1968	44.24	0.44	24.46	11.29	2.68	4.33	0.70	0.06		0.29	
1969	48.41	0.19	22.84	14.25	6.24	2.47	1.97	0.42	0.02		
1970	79.55	0.72	24.37	26.93	12.78	9.10	2.78	2.57	0.30		
1971	105.68	4.54	49.56	19.98	17.03	8.82	3.11	1.59	0.95	0.11	
1972	98.10	3.38	38.78	24.19	10.48	12.22	6.00	1.82	1.18		
1973	64.24	1.68	17.97	21.81	10.25	5.30	3.90	2.00	0.99	0.35	
1974	144.37	9.45	77.77	22.49	16.76	8.69	3.59	4.04	0.94		

4.2 In previous years annual stock sizes were calculated as at 1 May ie at the beginning of the normal fishing season. The same procedure was adopted for 1974 but the catches taken before 1 May have also been included. A small error will arise from this procedure, but it is not likely to be important because these early catches represent a very small percentage of the total catch of Manx herring taken during the main fishery in August to October.

4.3 For the calculation by cohort analysis, a fishing mortality of F = 0.8 has been assumed for 1974. Table 4.2 gives the stock sizes and fishing mortalities for the period 1964-72. This method can only give reliable estimates up to 1972. Because of the unrepresentative nature of the catches of 1-ring fish as an index of abundance of this age group, these have not been included in the calculation of stock sizes.

Table 4.2 (a) Stock in millions of fish

Winter rings	1964	1965	1966	1967	1968	1969	1970	1971	1972
Age 2	18.43	58.90	29.36	65.35	86.97	112.87	79.63	115.12	104.62
3	2.68	14.22	33.61	22.87	42.24	55.51	80.46	48.96	57.27
4	1.86	2.08	6.46	22.90	16.15	27.52	36.71	47.29	25.39
5	2.84	1.56	0.91	4.07	13.51	12.08	18.97	21.11	26.66
6	1.64	2.36	0.98	0.51	1.98	8.13	8.58	8.57	10.76
7	0.73	1.25	1.54		0.11	1.13	5.49	5.13	4.81
8	0.11	0.42	0.74	1.22		0.05	0.62		
9	0.24								
Total	28.53	80.79	73.60	116.92	160.96	217.29	230.46	246.18	229.51

(b) Fishing mortalities (M = 0.1)

2	0.16	0.46	0.15	0.34	0.35	0.24	0.39	0.60	0.49
3	0.15	0.69	0.28	0.25	0.33	0.31	0.43	0.56	0.58
4	0.08	0.73	0.36	0.43	0.19	0.27	0.45	0.47	0.57
5	0.09	0.37	0.47	0.62	0.41	0.24	0.70	0.57	0.65
6	0.17	0.33	0.34	1.42	0.46	0.29	0.41	0.48	0.87
7	0.44	0.42	0.13		0.74	0.50	0.67	0.39	0.51
8	0.36	1.43	0.06			0.60	0.68		
9	0.14								

Table 4.3 Annual stock sizes of recruits and total stock

Year	Stock in millions of fish		Year	Stock in millions of fish	
	Recruits (2-ring)	Total		Recruits (2-ring)	Total
1948	32.8	73.4	1961	40.8	85.8
9	53.9	93.8	2	20.2	64.0
1950	53.1	106.2	3	7.3	24.1
1	36.7	93.0	4	13.4	28.5
2	45.1	92.2	1965	58.9	80.8
3	59.8	120.0	6	29.4	73.6
4	58.6	134.2	7	65.4	116.9
1955	81.2	170.4	8	87.0	161.0
6	48.8	146.7	9	112.9	217.3
7	15.2	87.8	1970	79.6	230.5
8	3.4	56.1	1	115.1	246.2
9	74.8	109.6	2	104.6	229.5
1960	22.7	84.3			

4.4 Table 4.3 gives the numbers of 2-ring recruit fish and total stock for each year from 1948-1972. The previous reports (CM 1972/H:7) considered recruitment to the Manx stock during the years 1948-69 on the basis of the numbers of 2-ring herring estimated by cohort analysis. It was stated that the average stock of 2-ring herring during the relatively stable period from 1948-66 was 40.1 million fish, while the yearclasses entering the fishery in 1967, 1968 and 1969 had a mean stock level over twice as large at 88.4 million fish. It can be seen in Table 4.3 that the most recent yearclasses recruiting in 1970, 1971 and 1972 have been exceptionally strong ones, and that during the latter period the mean stock level has, in fact, been 99.8 million fish. It is clear that, as a result, the total stock size during the years 1967-72 also increased very substantially.

Table 4.4 Estimates of total effort and fishing mortality

Year	Catch/ trawler landing	Catch tons	Equivalent trawler effort	F
1964	3.57	587	164	0.16
5	5.97	4338	727	0.57
6	3.92	2667	681	0.23
7	6.91	5885	851	0.35
8	5.48	7645	1395	0.34
9	7.94	9139	1151	0.26
1970	11.12	15629	1405	0.45
1	7.71	18758	2433	0.56
2	10.61	19308	1820	0.56
3	10.01	13071	1306	
4	7.72	25422	3294	

4.5 The catches per trawler landing have been used to calculate estimates of annual total effort (these are given in Table 4.4). The annual weighted mean estimates of fishing mortalities as obtained from Table 4.2 are also given. The relation between fishing mortality and total effort is shown in Figure 1 where the data have been fitted using a functional regression (Ricker, 1973). From this regression and the equivalent trawler effort for 1973 and 1974, fishing mortalities in these years have been estimated as

F_{73} 0.42

F_{74} 0.87

The October fishing ban in 1973 resulted in a reduction of both catch and effort of about 30%. It can now be established that fishing mortality was also reduced in that year from F = 0.56 in 1972 to F = 0.42 in 1973. Despite the continuation of this ban in 1974 the fishing mortality increased substantially in that year,

while the total catch increased by more than 2 times. The increased catch was largely supported by the very high recruitment of the 1971 yearclass.

4.6 From these estimated fishing mortalities in 1973 and 1974 the stocks at 1 May for these years and 1975 have been calculated (Table 4.5). The stock of fish older than 2-winter rings in 1975 will be the lowest since that of 1968. The stocks of older fish for each year since 1968 are given in Table 4.6. The equivalent biomass is also given.

Table 4.5 Stocks in 1973, 1974 and 1975

Age in winter rings	Millions of fish		
	S_{73}	S_{74}	S_{75}
2	54.79	139.62	?
3	66.49	40.38	52.96
4	31.25	30.09	15.32
5	16.16	15.60	11.41
6	11.89	6.45	5.92
7	6.10	7.25	2.44
> 7	4.09	1.69	3.39

Table 4.6 Stock size in millions of fish 3-winter rings and over

Years	x 10^6	Years	x 10^6	Biomass (tons)
1968	73.99	1972	124.89	30 000
1969	104.42	1973	135.98	13 000
1970	150.83	1974	101.46	23 000
1971	131.06	1975	91.44	21 000

5. CONSERVATION OF THE MANX STOCK

5.1 The higher catches of 1974 were achieved despite the prohibition of the fishery from 1 October. In the absence of this prohibition catches and fishing mortalities would undoubtedly have been far higher.

5.2 The most effective way of controlling fishing mortality on the Manx spawning stock of herring is at the time of their aggregation for spawning within the 12 mile fishing limits. At other times of the year Manx herring occur in mixed catches to the west of the Isle of Man. While regulation by catch quota is a distinct possibility, there is a major problem in the inability to forecast recruitment, which provides a major part of the catch.

5.3 The changes which have occurred in the level of recruitment to the Manx stock during the years since 1948 make it difficult to decide what recruitment level to set for calculating a TAC.

5.4 It is concluded that fishing mortality in 1975 should be reduced from the high level reached in 1974 by the order of F = 0.3. This would reduce fishing mortality to the mean for the period 1968-71 (F = 0.4) when the stock was fully exploited.

5.5 To reduce fishing mortality to the required level a reduction in catch, from the 1974 figure, of about 9000-10000 tons is probably required.

5.6 A reduction of this order might be achieved if the period of prohibition of fishing within 12 miles was extended to about 14 September.

5.7 A similar result might be expected if a TAC of about 12 000 tons was set for Manx herring (based on the average recruitment level during the last 10 years). A higher TAC would be possible if the most recent higher recruitment level was expected to continue, but the lower value would be preferable as it would permit a correction to be made in 1976 should recruitment in 1975 be better than that predicted.

5.8 In the event of a recruitment failure, or even a return to the long term level of recruitment, a more severe restriction in fishing would be required in 1976.

5.9 The UK Government has been advised of the need for conservation action in 1975 and it will again introduce a national regulation in order to protect the stock. At the forthcoming mid-term meeting of NEAFC it may ask for international regulation of fishing on this stock.

Table 3 Manx herring: Number of landings in each month (all ports: Isle of Man and elsewhere)

Year	May-June			July**			August			September			October			Total		
	Drift	Ring	Trawl	Drift	Ring	Trawl	Drift	Ring	Trawl	Drift	Ring	Trawl	Drift	Ring	Trawl	Drift	Ring	Trawl
1964	17		10	10			1				1	64			44	28	1	155
1965	140		3	127	39		36	30		27	76	243		4	226	330	139	473
1966	153			166	2		186	1	21	149		351			138	654	3	515
1967	54			162			142	4		34	42	483			205	426	46	723
1968	143			158	4		181	45	173	47	41	603			384	529	93	1161
1969	97			100			154	32	29	43	39	604			367	394	71	1004
1970	65			96	9		49	67	91		16	773			454	210	92	1318
1971	86		5	59	27	119		32	339			1239			681	145	59	2373
1972	60		12	68		29	64		198	10		974			584	202		1797
1973	71		1	65	4	74	68		273	4		930				208	4	1278
1974*	44		76	23		192	16		818	6		1633			192	89		3102

**One purse seine landing in Northern Ireland

*In 1974 the following landings were made in other months of the year (Freezer trawler landings have not been included)

	Trawl
January	3
February	49
March	54
April	13
November	69
December	3

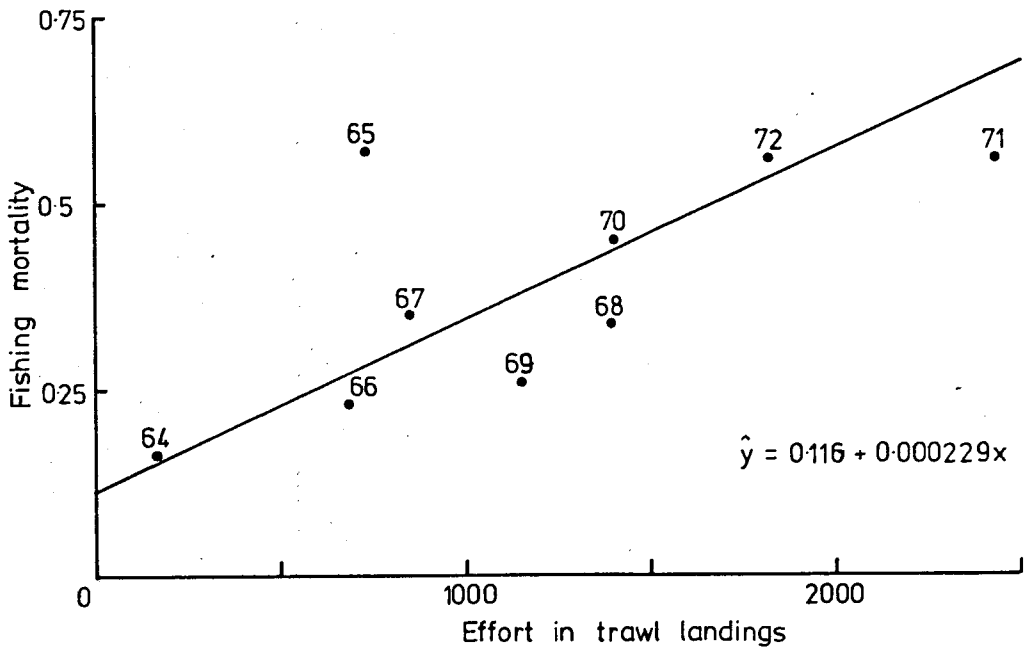

Fig. 1 Functional regression of fishing mortality on effort.