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A preliminary assessment of the state of the sole stocks in the Irish Sea and the Bristol Channel

by

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Following the depletion of the sole stocks in the North Sea, increasing attention has been paid in recent years to the alternative stocks in both the Irish Sea (ICES Division VIIa) and the Bristol Channel (ICES Division VIIf). This paper presents preliminary assessments for the separate stocks of soles which inhabit these two divisions, based on international catch and effort data and English length and age compositions.

ASSESSMENT USING CATCH AND EFFORT DATA

Total international catches

These were obtained for the most part from national statistics (for Belgium from 'Statistiek van de Zeevisserij', for France from 'Revue des Travaux des Pêches Maritimes' and for the UK (England) from 'Sea Fisheries Statistical Tables') because landings from divisions VIIa and VIIf are shown combined in Bulletins Statistiques. When it was necessary to use this last source the landings were allocated between divisions on the basis of either the pattern of subsequent fishing, if available from national statistics, or the geographical position of the country in question. In general the quantities involved were small. The data are shown in Table 1.

Catch per unit effort

For both divisions the catch per unit effort of English and Welsh first class trawlers (over 12.25 m) was used, for division VIIa based on fishing effort in statistical rectangle A6 in the months May to September inclusive, and for division VIIf based on fishing effort in statistical rectangles -1a, -1b and -2b for the months January to March, inclusive. Thus the catch-rate data, which are shown in Table 1, refer to both the main fishing areas and the main seasons for each of the two sole fisheries.

Total international effort

This was obtained by dividing total international catch by the catch-rate of English and Welsh trawlers (Table 1).

Assessment

The plots of catch-per-unit effort against total international effort (two-year running mean) are shown in Figs 1 and 2 together with the derived relationships between total yield and total international effort.

ASSESSMENTS USING LENGTH AND AGE COMPOSITIONS

Length compositions were available from the statistical rectangles and for the months described earlier from 1959 to 1970 for division VIIa (landings at Fleetwood) and from 1958 to 1970, with the exceptions of 1959 and 1969, for division VIIf (landings at Milford Haven). Age composition data were available for 1970 only.

Estimates of the total mortality coefficient, Z, were made using the formula:

$$Z = K \frac{(L_\infty - \bar{l})}{(\bar{l} - l_c)}$$

in which K = the von Bertalanffy growth coefficient,

L_∞ = the asymptotic length,

$\bar{l}$ = mean length of soles in the landings,

and l_c = 50 per cent selection length,

from Gulland (1969). In the absence of sufficient data from which the growth rate of either stock of soles could be estimated, values of K, L_∞ and l_c were taken from the Report of the North Sea Flatfish Working Group 1970, (Anon. 1970) as being 0.31, 39.2 cm and 23.2 cm respectively. The results are shown in Table 2.

Estimates of Z were also made using the catch-curve method and the age data for 1970 (Table 3). This method is not directly applicable to the whole set of data because there was a big increase in fishing effort in both divisions in 1964 (see Table 1), so that the cumulative fishing effort on the 1961 and previous year-classes, taking the age of recruitment as 3 years, is less than on subsequent ones. To allow for this an attempt was made to estimate Z separately from the two parts of each age composition. However, examination of the age data showed what appeared to be considerable variation in year-class size since 1961 in division VIIa, and since 1963 in division VIIf. The analyses were therefore limited to ages 10 to 14 years for the former division and ages 9 to 14 years for the latter, giving estimates of Z of 0.50 and 0.40 respectively.

DISCUSSION

As stated earlier, insufficient English age data are available to determine the growth parameters accurately for these two stocks so the yield curve calculated for North Sea soles (Fig. 3) has been used to evaluate the present state of the stocks.

Division VIIa

Both the estimate of Z from the age composition data and that from the catch-curve method indicate that Z is of the order of 0.5; the estimate of Z from the length composition data for 1970 is probably too high, the result of the influx of the large 1967 year-class depressing the mean length.
If M = 0.15, the stock is being exploited at or slightly above the level which will give the maximum sustainable yield. This agrees closely with the catch and effort assessment (Fig. 1) which shows that exploitation in 1969 was just below the level of the maximum sustainable yield, approximately 1 500 metric tons annually.

Division VIIf

The values of Z estimated from the length composition data (Table 2) do not increase as the fishing effort increases. The reason for this is probably partly due to year-class effects. The 1963 year-class, which was above average in this area, started to enter the fishery in 1966. As it grew through the fishery it would raise the mean length of the landings, because subsequent year-classes were average, result in ~~over~~ under estimates of Z and account for there being no apparent increase in the total mortality rate as fishing effort increased.

A further factor which may also account for the discrepancy between the value of Z = 0.22 for 1970, estimated from the length frequency data, and that of 0.40, estimated by the catch-curve method, is that both the English length data and the Belgian age data (de Clerck, 1970) indicate that recruitment to the Bristol Channel stock of soles occurs later than for the Irish Sea stock; l_c is probably greater than 23.3 cm, which would result in higher values of Z. Therefore the value of Z = 0.4, estimated by the catch-curve method, is probably valid for the fully recruited part of the stock; the average mortality rate would be less than this but higher than 0.22.
The catch and effort analysis (Fig. 2) indicates that the maximum sustainable yield from this stock is unlikely to exceed 700 tons which compares with an average annual yield between 1964 and 1969 of 618 tons. Reference to Fig. 3 indicates that the total mortality rate on the stock at this point is approximately 0.4, if M = 0.15.

Further developments

The catch and effort assessments do not take into account developments in either of the two fisheries since 1969. In 1970 the Dutch started to develop their sole fishery in division VIIa and caught a minimum of 240 tons of soles, and in 1971 at least 400 tons. This represents an increase in fishing effort of approximately 30 per cent above the 1969 level, depending upon both landings by other nations and catch rates.

In division VIIf reports indicate that there has been an increase in the numbers of trawlers fishing for soles, that an increasing proportion of them are fitted with beam trawls and that very rough grounds, not previously worked, are now being fished.

In both divisions, fishing effort has therefore almost certainly increased since 1969 and the diversification of grounds in division VIIf suggests that the younger age groups may now be more vulnerable to trawling. In order to avoid depletion of the sole stocks similar to that which has occurred in the North Sea, conservation of these two stocks is required.

In view of the limited nature of these two fisheries, in terms of area, of the nations which exploit them and of the size of the stocks, there is a good case for regulation by means of a quota system.

REFERENCES

ANON., 1970. Report of the North Sea Flatfish Working Group (1970). ICES CM 1970. Demersal Fish (Northern) Cttee, Doc. F:14 (mimeo).

De CLERCK, R., 1970. De Tongvisserij in de Ierse Zee. Het Visserijblad, No. 21, 1970, 1-4.

GULLAND, J. A., 1969. Manual of methods for fish stock assessment. Part 1. Fish population analysis. FAO Man. Fish. Sci. No. 4.

Table 1 Catch and effort data for the sole fisheries in divisions VIIa and VIIf

Year	Division VIIa					Ton 100 h (UK)	Hours fishing ('000's)	Division VIIf				Ton 100 h (UK)	Hours fishing ('000's)
	Landings (metric tons)							Landings (metric tons)					
	Belgium	France	UK (E & W)	Others	Total			Belgium	France	UK (E & W)	Total		
1947	0	0	409	7	416	0.79	525	0	0	288	288	0.96	301
8	50	0	901	13	964	1.91	506	11	50	484	545	1.91	286
9	0	0	827	16	843	0.97	869	76	0	483	559	1.41	397
1950	0	5	906	13	924	0.90	1 030	59	0	421	480	1.96	245
1	0	0	585	12	597	1.35	443	70	0	286	356	1.04	343
2	0	3	489	6	498	2.30	217	30	0	262	292	1.05	277
3	0	0	404	19	423	1.10	385	36	81	278	395	0.98	402
4	0	1	384	21	406	0.98	416	18	0	254	272	1.13	242
5	0	0	416	16	432	1.04	416	60	0	420	480	1.27	378
6	0	106	584	16	706	1.15	613	171	0	466	637	1.44	441
7	0	5	740	22	767	1.33	575	385	0	403	788	1.24	635
8	0	41	736	52	829	0.94	880	25	80	325	430	1.02	423
9	0	8	609	18	635	0.91	695	15	80	210	305	0.80	381
1960	0	53	511	25	589	0.96	615	29	37	250	316	1.04	304
1	70	30	422	25	547	0.69	792	240	30	225	495	0.94	527
2	40	45	462	37	584	1.08	540	335	45	214	594	0.75	791
3	64	38	321	97	520	0.63	822	174	54	121	349	0.50	699
4	938	215	378	40	1 571	0.55	2 850	471	68	110	649	0.37	1 774
5	1 025	203	341	43	1 612	0.36	4 449	498	64	75	637	0.28	2 283
6	407	166	279	21	873	0.43	2 031	248	75	111	434	0.25	1 765
7	307	225	307	34	873	0.52	1 670	451	83	208	742	0.48	1 531
8	332	125	444	33	934	0.45	2 096	289	179	126	594	0.24	2 425
9	841	97	298	54	1 390	0.54	2 554	289	194	167	650	0.41	1 575
1970						0.55						0.29	

Table 2: Estimates of Z derived from the mean length in centimetres ($\bar{l}$) of sole landings at Fleetwood from division VIIa, and at Milford Haven from division VIIf, for areas and months described in text. L_∞ = 39.2 cm; l_c = 23.3 cm; K = 0.31. ND = no data

Year	Division VIIa		Division VIIf	
	$\bar{l}$	Z	$\bar{l}$	Z
1958	31.19	0.31	32.58	0.22
9	31.20	0.31	34.08	0.15
1960	31.65	0.29	ND	-
1	31.33	0.30	33.24	0.18
2	31.14	0.31	34.42	0.13
3	29.69	0.45	32.70	0.21
4	29.65	0.46	32.42	0.23
5	29.24	0.51	34.37	0.13
6	31.02	0.32	32.82	0.21
7	29.57	0.47	32.23	0.24
8	29.69	0.45	ND	-
9	29.46	0.48	33.59	0.17
1970	27.86	0.80	32.58	0.22

Table 3: Age composition of British landings of soles from the Irish Sea and Bristol Channel in 1970, in numbers per 100 hours' fishing

Age (years)	Division	
	VIIa	VIIf
2	38	20
3	465	276
4	266	88
5	52	84
6	531	58
7	26	126
8	26	14
9	202	23
10	87	21
11	74	19
12	88	7
13	25	2
14	12	7
15+	98	32

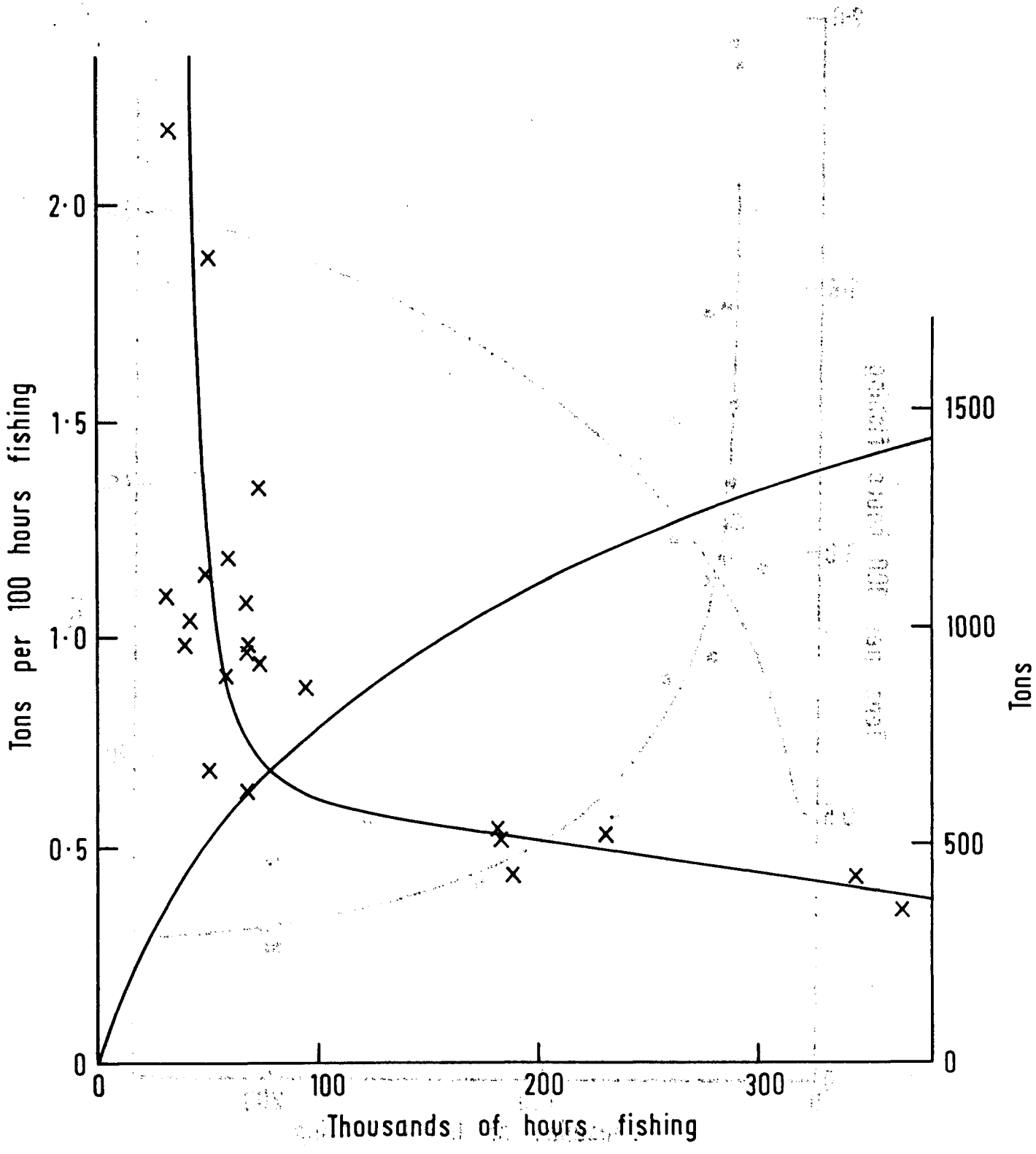

Figure 1 Relationship between catch per unit effort by British trawlers, in tons per 100 hours fishing, and international fishing effort in hours fishing by British trawlers (2-year running mean), and derived relationship between sustainable yield and effort, for Irish Sea soles.

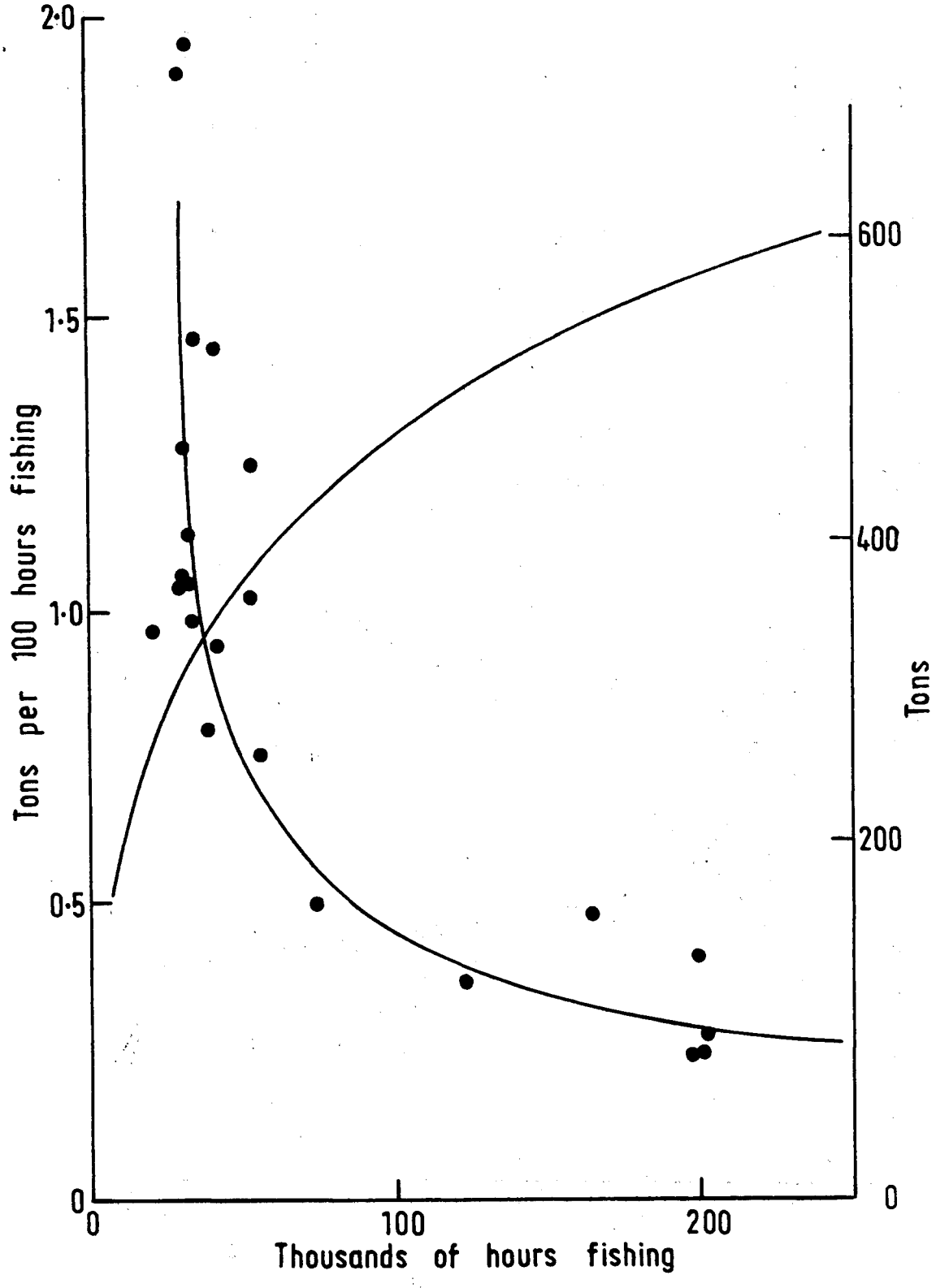

Figure 2 Relationship between catch per unit effort of British trawlers, in tons per 100 hours fishing, and international fishing effort in hours fishing by British trawlers (2-year running mean), and derived relationship between sustainable yield and effort, for Bristol Channel soles.

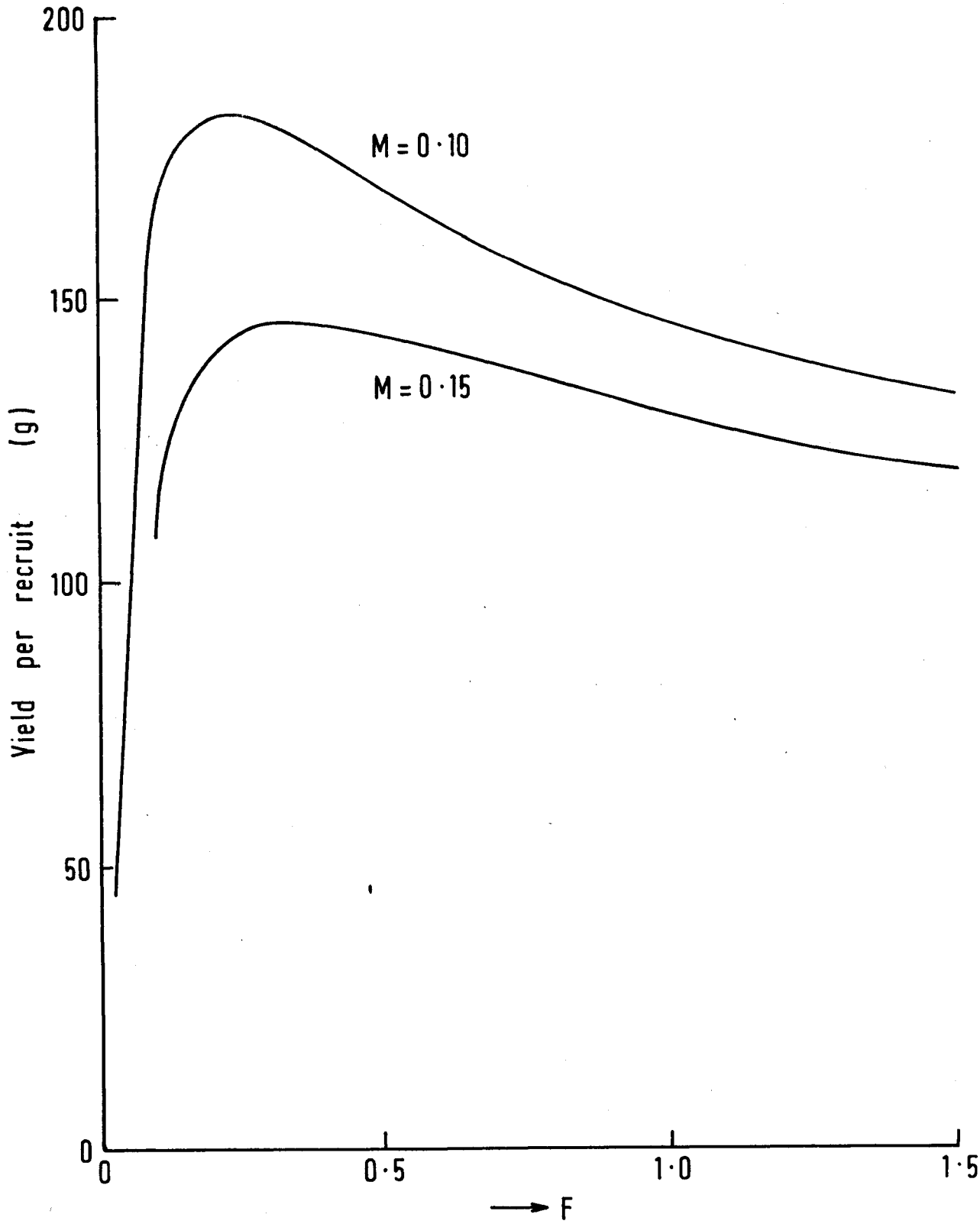

Figure 3 Yield curve for North Sea soles.