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Prospects for Fuller Utilization of U.K. Fish Meal Capacity

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by P. O. Johnson and R. S. Bailey

1. INTRODUCTION

Over the six years 1974-79 fish meal imports into the U.K. averaged 225 280 tonnes valued at £46.9 million per year and fish oil imports averaged 192 096 tonnes at a cost of £42.0 million (Table 1). In the same period, home production of fish meal averaged 71 771 tonnes and fish oils 14 970 tonnes (Table 2). Home production has decreased markedly since 1977-78, whereas the demand for imported products has remained firm. The decline in home production has resulted from a continuing decrease in the amount of available fish offal*, reflecting a decrease in whitefish landings, and from a decrease in the quantities of pelagic fish available for reduction.

Table 1 U.K. imports of fish meal and oil, 1974-79

	Fish meal			Fish oil		
	Tonnes	£(,000)	£/tonne	Tonnes	£(,000)	£/tonne
1974	200 000	36 409	182	145 268	30 346	209
1975	237 960	29 696	125	175 118	26 988	154
1976	253 482	51 725	204	214 668	43 537	203
1977	213 589	61 089	286	185 472	50 533	272
1978	191 520	46 940	245	217 265	53 083	244
1979	255 129	55 491	218	214 783	47 631	222
Mean	225 280	46 892	208	192 096	42 020	219

(Source: MAFF, Sea Fisheries Statistical Tables)

This leaflet provides information on the stocks of fish in seas around the British Isles which are potentially available for reduction to meal and oil, identifies in each case the problems in utilising them for this purpose, and makes an appraisal of the prospects of closing the gap between present U.K. levels of meal and oil production and the potential levels offered by existing capacities of U.K. meal plants.

* Throughout this leaflet, 'offal' includes waste from processing and surplus and condemned whitefish.

Table 2 U.K. production of fish meal and oil (tonnes), by years 1 April-31 March

	Meal	Oil
1974-75	86 652	14 229
1975-76	78 191	13 825
1976-77	84 357	17 824
1977-78	71 247	18 437
1978-79	59 468	15 071
1979-80	50 709	10 435
Mean	71 771	14 970

(Source: Association of Fish Meal Manufacturers)

2. U.K. MEAL PRODUCTION CAPACITY

The potential intake capacities of U.K. meal plants are summarised in Table 3. The conversion ratio of weight from fresh fish:meal is somewhat variable†, between 4.5 and 5.0:1, but, using a 4.5:1 conversion ratio, the potential annual production for all U.K. plants is about 214 000 tonnes of meal, which is almost equal to the amount currently imported, and well in excess of the 50 700 tonnes produced in the

Table 3 U.K. meal plant capacities in 1980

	Potential intake (tonnes per 24 hour day)	Annual capacity (assuming 260 days operation per year, 24 hours per day)
Scottish plants	2 120	551 200
English plants	1 590	413 400
Total	3 710	964 600
		(≈ 214 300 tonnes meal using a 4.5:1 conversion ratio)

(Source: Association of Fish Meal Manufacturers)

† The conversion ratio depends on the water content of the fish: for pelagic species this will be inversely proportional to the fat content, since fat plus water makes up a fairly constant proportion of the total body weight.

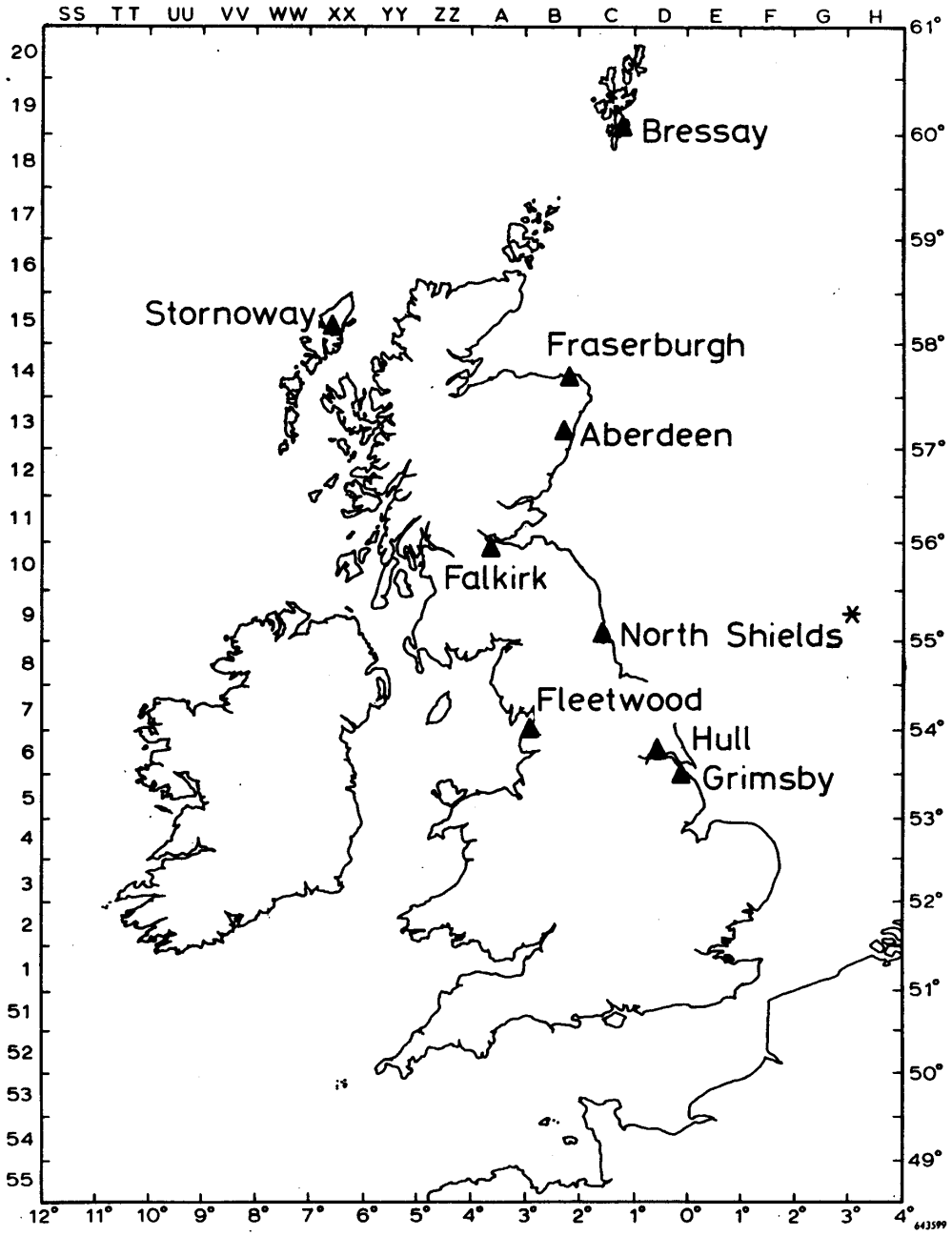


Figure 1 Locations of the principal U.K. fish meal installations.

* Plant temporarily closed.

Table 4 Landings (,000 tonnes) by U.K. vessels of species potentially usable for meal and oil reduction

	England and Wales	Scotland	Total	England and Wales	Scotland	Total	England and Wales	Scotland	Total	England and Wales	Scotland	Total
	Mackerel			Sprat			Scad			Pilchard		
1974	21.2	8.9	30.1	26.5	56.2	82.7	0.7	1.3	2.0	1.3	-	1.3
1975	31.6	16.8	48.4	36.4	22.4	58.8	0.5	0.2	0.7	1.5	-	1.5
1976	57.4	29.6	87.0	53.2	36.6	89.8	2.1	0.1	2.2	4.4	-	4.4
1977	132.4	54.2	186.6	54.8	42.3	97.1	1.4	0.1	1.5	10.8	-	10.8
1978	213.5	107.4	320.9	57.2	45.2	102.4	3.0	ø	3.0	10.4	-	10.4
1979	245.0	108.4	353.4	18.8	12.8	31.6	2.8	ø	2.8	9.9	-	9.9
1980	151.6	101.2	252.8	13.8	10.2	24.0	12.9	ø	12.9	9.4	-	9.4
	Sandeels			Norway pout			Blue whiting			Offal*		
1974	6.7	8.8	15.5	0.1	38.3	38.4	-	-	-	179.2	107.4	286.6
1975	0.4	13.2	13.6	-	33.2	33.2	0.4	0.3	0.7	159.4	101.3	260.7
1976	ø	18.7	18.7	0.1	25.4	25.5	0.4	1.6	2.0	145.6	113.9	259.5
1977	4.1	21.9	26.0	ø	7.4	7.4	1.5	3.0	4.5	116.7	109.2	225.9
1978	4.5	28.1	32.6	ø	5.8	5.8	4.7	1.6	6.3	92.7	98.5	191.2
1979	ø	13.4	13.4	-	3.0	3.0	2.9	1.5	4.4	78.0	92.5	170.5
1980	1.4	31.8	33.2	-	1.8	1.8	3.9	6.8	10.7	80.4	91.2	171.6
	Total Pelagic			Total other (sandeels, Norway pout, blue whiting)			Grand totals (excluding offal)					
1974	49.7	66.4	116.1	6.8	47.1	53.9	56.5	113.5	170.0			
1975	70.0	39.4	109.4	0.8	46.7	47.5	70.8	86.1	156.9			
1976	117.1	66.3	183.4	0.5	45.7	46.2	117.6	112.0	229.6			
1977	199.4	96.6	296.0	5.6	32.3	37.9	205.0	128.9	333.9			
1978	284.1	152.6	436.7	9.2	35.5	44.7	293.3	188.1	481.4			
1979	276.5	121.2	397.7	2.9	17.9	20.8	279.4	139.1	418.5			
1980	187.7	111.4	299.1	5.3	40.4	45.7	193.0	151.8	344.8			

(Source: MAFF and DAFS Sea Fisheries Statistical Tables; 1980 Figures are provisional)

* The potential offal yield is estimated as one half the total demersal landings excluding the species listed in this Table, livers and roes.

ø Less than 100 tonnes.

U.K. in the financial year 1979-80. If sufficient raw materials were available, the present gap between home capacity and production could be narrowed considerably without further expansion of existing plants. This production of meal, however, would require an additional supply of some 736 000 tonnes of fish per year, correctly distributed both geographically and seasonally. Most existing reduction plants are sited (Figure 1) to benefit preferentially from one or more of the present industrial fisheries, although there are no plants conveniently sited to cover the south-west of England fisheries. Thus most plants are assured of adequate supplies of fish, for about five months each year, discounting supplies of offal. The potential for lengthening the period during which supplies of industrial species are available depends on the distribution of underexploited resources and for this reason, even if the required supplies of fish are available, it may be unrealistic to suppose that full capacity could be achieved at all the existing plants.

3. FISHERIES POTENTIAL FOR MEAL AND OIL REDUCTION

The annual U.K. catches of species of fish which have been either entirely or partially used for reduction to meal and oil, together with an estimate of offal derived from white-fish landings, are given for the years 1974-80 in Table 4; herring have been omitted because of the present restrictions on herring fishing and the uncertainty about when they will be eased. Table 4 shows that recent landings of pelagic and industrial species and offal would satisfy only some two thirds of the total meal plant capacity even if the entire catch went for reduction. In 1980, the total landings of these species plus offal amounted to 516 400 tonnes, which represents a shortfall of 448 000 tonnes on full capacity operation.

In England and Wales, but not Scotland, there has also been a clear downward trend in the offal component of landings: it has decreased by about 40% between 1974 and 1980 in the U.K. as a whole. This has been offset by an overall increase in the catches of pelagic species of some 2.6 times between 1974 and 1980, which is largely accounted for by an eight-fold increase in mackerel catches. At the same time, catches of Norway pout have decreased, partly as a result of the conservation measure (the so-called Norway pout box) aimed at reducing the by-catch of young haddock and whiting taken unvoidably in this fishery, but probably mainly because the landing price for meal and oil reduction has not increased in proportion to that for other species with a higher oil content.

Catch potentials of the principal pelagic and industrial species in waters adjacent to the U.K. are better indicated by total international landings from these areas than by the U.K. landings alone. These are shown in Table 5. The U.K. share of each species ranged from very low for Norway pout, blue whiting, sand-eels and scad (horse mackerel) to moderate for sprat and relatively high for mackerel and pilchard.

4. UTILIZATION OF FISH FOR MEAL AND OIL REDUCTION IN THE U.K.

Of the species totals in Table 4, varying proportions have actually been used for reduction to meal and oil. These and the actual quantities for each year from

Table 5 1978 catches (,000 tonnes) within ICES Divisions adjacent to U.K. coasts, of species potentially usable for meal and oil reduction

Species/nation grouping	North Sea			West Scotland	West Ireland	Eastern English Channel	Western English Channel	Bristol Channel	South Ireland	Irish Sea	Totals	%
	North IVa	Central IVb	South IVc	VIa	VIIb, c	VIId	VIIe	VIIf	VIIg-k	VIIa		
Mackerel												
EC (excl. U.K.)	4.6	18.5	1.7	33.6	2.2	4.7	34.6	21.7	57.3	1.4	180.3	28.6
Third country	103.5	10.6	-	15.0	0.1	-	-	-	0.2	-	129.4	20.5
U.K.	2.4	1.4	ø	104.2	ø	ø	188.3	24.3	0.2	0.1	320.9	50.9
Totals	110.5	30.5	1.7	152.8	2.3	4.7	222.9	46.0	57.7	1.5	630.6	
Sprat												
EC (excl. U.K.)	ø	218.5	ø	0.8	-	ø	2.9	0.1	5.6	8.2	236.1	54.5
Third country	5.7	89.0	0.2	-	-	-	-	-	-	-	94.9	21.9
U.K.	18.2	69.9	0.1	12.1	-	ø	2.1	-	-	ø	102.4	23.6
Totals	23.9	377.4	0.3	12.9	-	ø	5.0	0.1	5.6	8.2	433.4	
Scad												
EC (excl. U.K.)	0.1	3.6	0.2	0.2	ø	1.5	-	2.2	9.7	0.7	18.2	58.7
Third country	1.0	-	-	0.1	0.1	ø	8.4	0.1	0.1		9.8	31.6
U.K.	ø	ø	ø	0.1	-	-	2.9	ø	ø	ø	3.0	9.7
Totals	1.1	3.6	0.2	0.4	0.1	1.5	11.3	2.3	9.8	0.7	31.0	
Pilchard												
EC (excl. U.K.)	-	-	-	ø	ø	0.1	3.1	0.5	2.1	ø	5.8	35.8
Third country	-	-	-	-	-	-	-	-	-	-	-	-
U.K.	-	-	-	ø	ø	-	9.9	0.5	ø	-	10.4	64.2
Totals	-	-	-	ø	ø	0.1	13.0	1.0	2.1	ø	16.2	
Norway pout												
EC (excl. U.K.)	160.0	0.9	-	4.5	ø	-	1.1	0.5	1.1	ø	168.1	48.3
Third country	154.9	0.9	-	18.5	-	-	-	-	-	-	174.3	50.0
U.K.	5.5	ø	-	0.3	-	-	-	-	-	0.1	5.9	1.7
Totals	320.4	1.8	-	23.3	ø	-	1.1	0.5	1.1	0.1	348.3	
Sandeels												
EC (excl. U.K.)	20.9	600.7	27.6	-	-	0.3	0.1	-	-	-	649.6	82.5
Third country	69.7	35.9	0.1	-	-	-	-	-	-	-	105.7	13.4
U.K.	28.1	3.9	0.5	-	-	-	-	-	-	-	32.5	4.1
Totals	118.7	640.5	28.2	-	-	0.3	0.1	-	-	-	787.8	
Blue whiting												
EC (excl. U.K.)	41.5	0.1	-	19.8	0.3	-	-	ø	ø	-	61.7	39.9
Third country	34.8	0.9	-	52.2	1.4	-	-	-	0.1	-	89.4	57.8
U.K.	-	-	-	3.6	-	-	-	-	-	-	3.6	2.3
Totals	76.3	1.0	-	75.6	1.7	-	-	ø	0.1	-	154.7	

(Source: ICES, Bulletin Statistique)

ø Less than 100 tonnes

Table 6 Landings (tonnes) in England and Wales: fish sold specifically for meal and oil reduction

Species		1974/75	1975/76	1976/77	1977/78	1978/79	1979/80	Period mean
Sprat	U.K.	22 494	28 437	34 349	44 355	21 695	12 628	27 326
	Foreign	958	3 703	1 057	330	2 456	253	1 460
Mackerel	U.K.	7 925	8 030	53 796	18 381	12 714	13 788	19 106
	Foreign	-	-	-	-	244	3 027	545
Scad	U.K.	267	338	1 906	1 654	785	5 824	1 796
	Foreign	-	-	-	41	170	60	45
Pilchard	U.K.	204	808	7 892	1 419	1 161	1 321	2 134
	Foreign	-	-	279	41	368	15	117
TOTAL PELAGIC		31 848	41 316	99 279	66 221	39 593	36 916	52 529
Sandeels	U.K.	6 682	366	-	3 658	4 466	-	2 529
	Foreign	4 592	2 720	3 800	2 608	1 924	1 156	2 800
Offal		163 664	159 865	144 424	103 531	98 610	90 933	126 838
GRAND TOTAL		206 786	204 267	247 503	176 018	144 593	129 005	184 696
% of total U.K. landings of each species								
Sprat		63.1	66.8	64.3	79.0	74.3	70.3	69.5
Mackerel		32.1	19.3	53.1	10.0	4.5	7.1	14.1
Scad		15.9	57.2	78.2	70.8	31.3	78.5	64.3
Pilchard		15.3	58.4	72.1	13.5	11.2	13.8	28.8

(Source: MAFF, unpublished)

1974 to 1979 are shown in Tables 6 and 7. A consistently high proportion of sprat landings (46-79%) have been used for reduction, while for other pelagic species the percentage has been more variable. In the case of mackerel, there was a trend towards a much smaller proportion used for reduction until the 1980-81 season when a lot of small fish unsuitable for human consumption outlets were landed. Overall, about 30% of the total pelagic landings have been used for meal and oil in the period 1974-80.

Table 7 Landings (thousand tonnes) by U.K. vessels in Scotland: fish sold specifically for meal and oil reduction

Species	1974	1975	1976	1977	1978	1979	Mean
Sprat	40	11	29	32	29	6	24.5
Mackerel	4	10	18	22	22	11	14.5
Sandeels*	9	13	19	22	28	13	17.3
Norway pout*	38	33	25	7	6	3	18.7
Whitefish offal	no data	93	88	84	74	65	80.8†
Total	(91)	160	179	167	159	98	152.6†
% of total landings of each species:							
Sprat	71	50	78	76	64	46	68
Mackerel	44	59	60	41	21	10	27
Sandeels							~100
Norway pout							~100

(Source: DAFS Sea Fisheries Statistical Tables)
* A small proportion may have been landed for purposes other than reduction, e.g. pet food.
†For 1975-79 only.

5. SEASONALITY OF THE FISHERIES

Landings of most pelagic and industrial fish species in the U.K. show marked seasonal changes. To achieve maximum utilization of reduction capacity throughout the year a continuous supply of raw materials is essential. Storage of fish for reduction is never likely to be economically feasible, so an important aspect in considering the potential of each species is its seasonal availability.

In the case of shoaling pelagic fish, seasonal changes in the fisheries are primarily due to changes in the distribution and shoaling habit of the species concerned. Mackerel, sprat, scad and pilchard typically concentrate in large, non-feeding shoal aggregations during the winter months, often fairly close to the coast. This aggregation generally commences in October-November and the shoals disperse again in March-April. In general, pelagic species become thinly dispersed in small shoals when spawning during the period March to July: the exact timing depends on area, tending to be earlier in the southern and western areas than in the north. After spawning, feeding shoals and aggregations develop in the late summer and autumn, usually in different areas from the winter aggregations. As a result of these seasonal changes in habit, most pelagic fish are at their peak availability for bulk capture in the winter months and at their lowest while spawning in spring and early summer. By late summer and autumn, some species once again become available for capture.

Table 8 Seasonality of pelagic and industrial fisheries in the U.K.: mean monthly and annual landings (,000 tonnes) by U.K. vessels over the period mid-1974-80 (England and Wales) and 1974-79 (Scotland)

Species	Fishery	Country of landing*	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Sprat	SW England	E + W	0.2	0.3	+	+	0	0	+	0.3	0.4	0.5	0.5	0.3	2.5
	NE/E England	E + W	11.1	7.6	3.1	+	0	0.4	1.3	0.1	0	0	1.9	10.7	36.2
	E Scotland	S	6.4	5.2	1.7	+	+	0	+	0	0.1	2.2	4.6	5.5	25.7
	Shetland	S	0.2	0.2	+	+	0	+	+	0	+	+	+	0.1	0.5
	Central North Sea (purse-seine)		0.1	+	0	0	0.3	0.8	0.7	0.2	0	0	0	+	2.1
	Minch	S	0.8	1.2	+	+	0	+	0	+	+	0.6	2.2	1.3	6.1
	TOTAL		18.8	14.5	4.8	+	0.3	1.2	2.0	0.6	0.5	3.3	9.2	17.9	73.1
Mackerel	SW England	E + W	26.7	30.1	12.9	3.7	0.4	0.3	0.3	0.4	0.7	5.2	25.3	27.1	133.1
	North Sea	S	+	+	+	+	+	+	0.2	1.4	0.3	+	+	+	1.9
	Minch	S	+	+	+	+	+	0.2	0.6	8.8	24.8	17.0	0.2	+	51.6
	TOTAL		26.7	30.1	12.9	3.7	0.4	0.5	1.1	10.6	25.8	22.2	25.5	27.1	186.6
Scad	SW England	E + W	0.7	0.5	0.6	0.2	+	+	+	+	+	+	0.2	0.1	2.3
	N North Sea + Minch	S	+	0	0	0	0	0	+	+	0.1	+	+	+	0.1
	TOTAL		0.7	0.5	0.6	0.2	+	+	+	+	0.1	+	0.2	0.1	2.4
Pilchard	SW England	E + W	2.1	2.6	0.6	0.2	+	+	+	+	+	+	0.4	1.4	7.3
TOTAL PELAGIC		E + W	40.8	41.1	17.2	4.1	0.4	0.7	1.6	0.8	1.1	5.7	28.3	39.6	181.4
		S	7.5	6.6	1.7	+	0.3	1.0	1.5	10.4	25.3	19.8	7.0	6.9	88.0
		U.K.	48.3	47.7	18.9	4.1	0.7	1.7	3.1	11.2	26.4	25.5	35.3	46.5	269.4
Norway pout	North Sea	S	1.0	1.9	1.3	0.4	0.5	1.1	1.4	2.0	1.0	2.0	2.0	1.0	15.6
	Minch	S	+	+	+	+	+	+	0.4	1.3	0.5	0.8	0.3	+	3.3
	TOTAL		1.0	1.9	1.3	0.4	0.5	1.1	1.8	3.3	1.5	2.8	2.3	1.0	18.9
Sandeels	S North Sea	E + W	0	0	0	0.2	0.6	0.7	0.2	+	0	0	0	0	1.7
	Shetland	S	+	+	0.2	1.7	2.6	3.5	3.6	3.4	1.7	0.6	+	0	17.3
	TOTAL		+	+	0.2	1.9	3.2	4.2	3.8	3.4	1.7	0.6	+	0	19.0
Blue whiting	W Scotland	S	0	0	0	0.3	0.6	+	+	+	+	+	+	+	0.9
	Faroe	S	0	0	0	+	0.3	+	0	+	0	0	0	0	0.3
	TOTAL		0	0	0	0.3	0.9	+	+	+	+	+	+	+	1.2
GRAND TOTAL		E + W	40.8	41.1	17.2	4.3	1.0	1.4	1.8	0.8	1.1	5.7	28.3	39.6	183.1
		S	8.5	8.5	3.2	2.4	4.3	5.6	6.9	17.1	28.5	23.2	9.3	7.9	125.4
		U.K.	49.3	49.6	20.4	6.7	5.3	7.0	8.7	17.9	29.6	28.9	37.6	47.5	308.5

(Source: MAFF and DAFS unpublished)
* E + W = England and Wales, S = Scotland.

The condition of the fish also varies seasonally and it is during the autumn and early part of the winter that they have their maximum fat content and are therefore of highest value for their oil yield. The fat reserves become depleted during the phase of minimum feeding during the winter.

Other species of fish used for reduction have somewhat different patterns of seasonal availability. Sandeels regularly emerge from the sand only during the spring and summer and so are at their peak availability from about May to August. Norway pout are available throughout the year but, being a short-lived fish, the stocks are supplemented each year in the late summer when the recruiting young fish first appear in the catches. Thus, in this species the period of maximum catch rates tends to be in the autumn-winter. Blue whiting is a migrant species available in the area to the west of the U.K. mainly in the spring. These seasonal patterns are dealt with in more detail in the accounts of individual species below.

The seasonality of the existing fisheries for fish used for meal production is shown in Table 8. In the case of Norway pout and sandeels, seasonal availability in the North Sea is better shown by the monthly landings by the international fleet (Figure 2). Exact monthly data on landings of blue whiting, in the area west of Scotland, by the international fleet, are not available, but information from research vessel surveys indicates that the main season is likely to be in the months March-May.

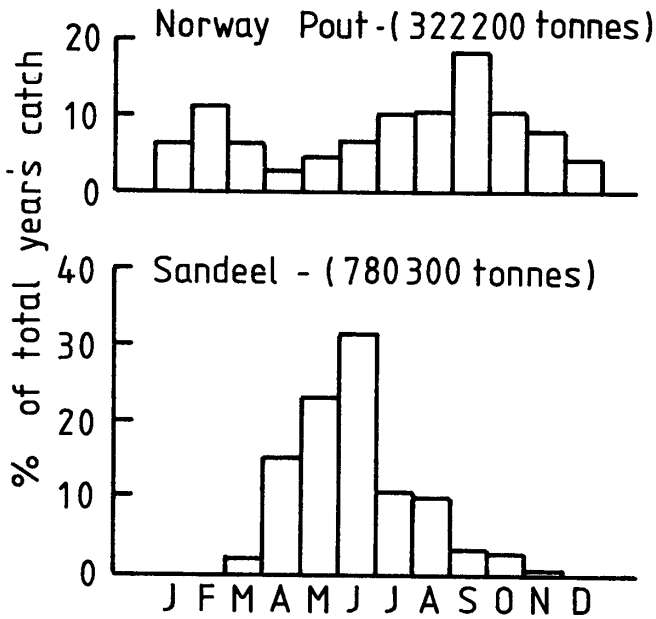


Figure 2 Seasonality of landings of Norway pout and sandeels from the North Sea in 1978: monthly percentages of year's total.

From Table 8 it is clear that in England and Wales by far the highest proportion of the catches of pelagic fish are taken from November to March. During the rest of the year an increased sandeel fishery in the southern half of the North Sea could provide supplies from April to July. The monthly landings in Scottish ports of fish suitable for reduction show a more even distribution. This is due to the combination of a large component of sandeels taken from April-October, a large summer-early autumn mackerel fishery in the Minch, a winter sprat fishery and,

to a lesser extent, a small year-round fishery for Norway pout. Nevertheless, in Scotland also landings for reduction are at a very low level in the spring, a time when blue whiting could potentially provide a considerable increase in landings.

6. THE POTENTIAL OF INDIVIDUAL SPECIES

Below is given, for each of the species so far considered, an outline of immediately foreseeable prospects and possible constraints on the quantities likely to be available for reduction. The series of charts in Figures 3-9 show for each species the main fishing grounds and seasons, and in some cases spawning area and migration, together with international and U.K. catches for the most recent year for which data are available. The distributions of catches are shown in the smallest areas for which data are available. The potential of some other species is also considered.

6.1 Mackerel (Figure 3)

Main seasons: Scottish waters (Minch), August-October
South-west England, November-March

Stock size estimate: Western stock, 1980, ca. 2 000 000 tonnes

Recommended 1981 TAC: 353 000 tonnes

The North Sea mackerel stock is in a depleted state and is not likely to provide significant quantities of fish for reduction in the next few years. In the continued absence of effective international management, the Western stock, exploited off south-west Britain in winter and in the Minch in autumn, may soon be in a similar condition. To safeguard the future prospects of these fisheries it is likely that Total Allowable Catches (TACs) will be maintained at moderate levels. For this reason it is unlikely that a large surplus of mackerel will be available to increase the quantities available for reduction (approximately 25 000 tonnes in the U.K. in 1979).

High proportions of the mackerel catches taken in recent seasons have been exported, mainly by trans-shipment to Eastern Bloc vessels. If more processing of mackerel were to be undertaken in the U.K., a significant offal component might become available for reduction.

6.2 Scad (Figure 4)

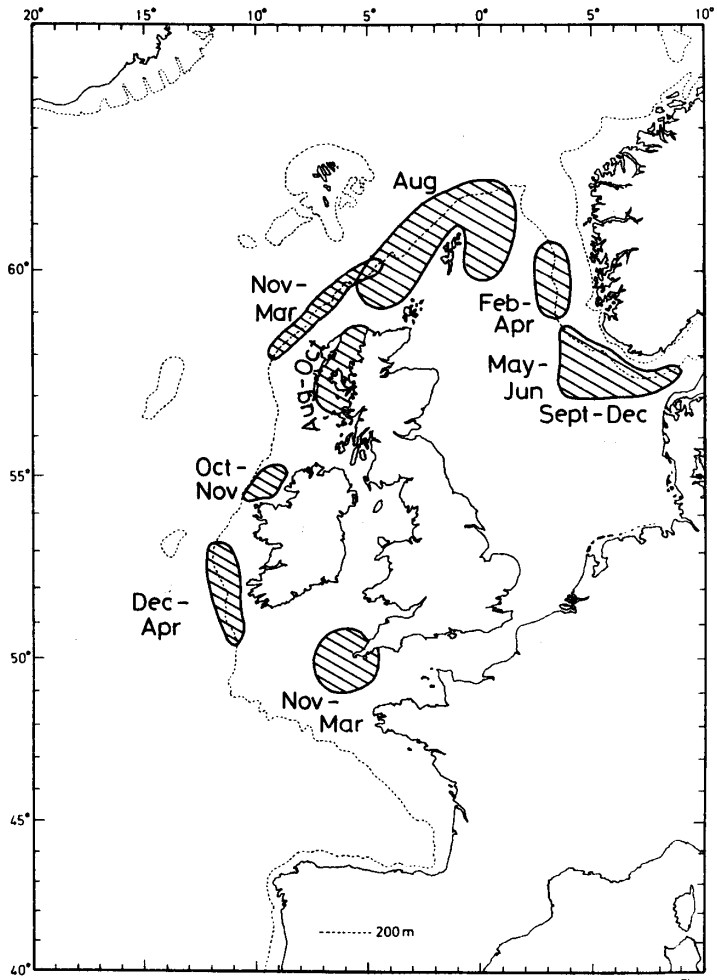
Main season: South-west England, November-April

Stock size estimate: English Channel-Southern North Sea from egg surveys, 1962-68, ca. 450 000 tonnes

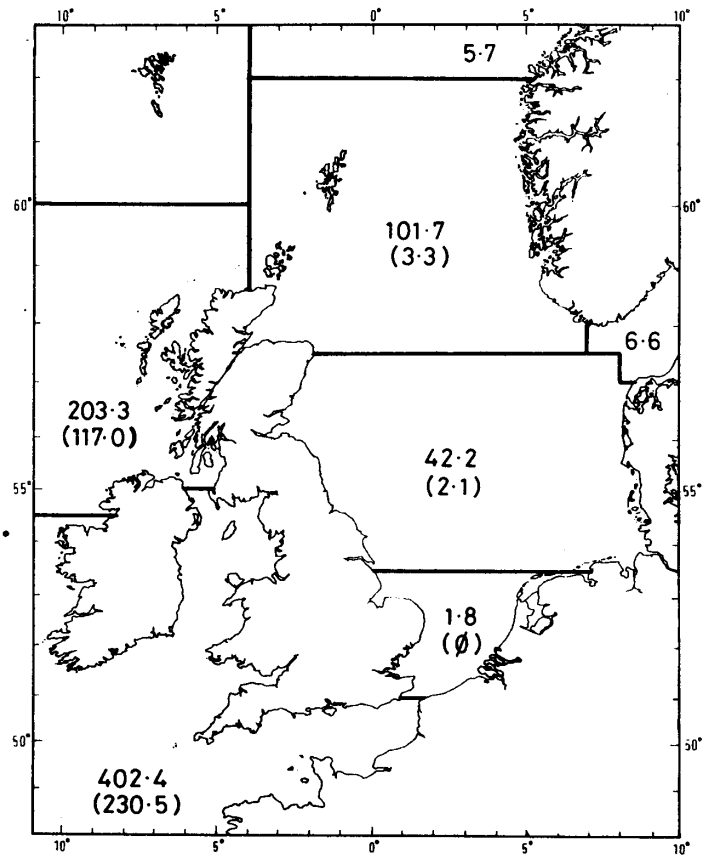
Western stock, from egg surveys, 1977, ca. 1 500 000 tonnes

Recommended 1981 TAC: 250 000 tonnes

The fishing season and to some extent the area coincide with those for mackerel. Despite the controls on mackerel fishing, however, there is at present little sign of a diversion of fishing effort onto this species, probably largely because the current price offered for scad is significantly less than that offered for mackerel for human consumption. There are marketing prospects for scad exported to West African countries, and this outlet might be expected to take a

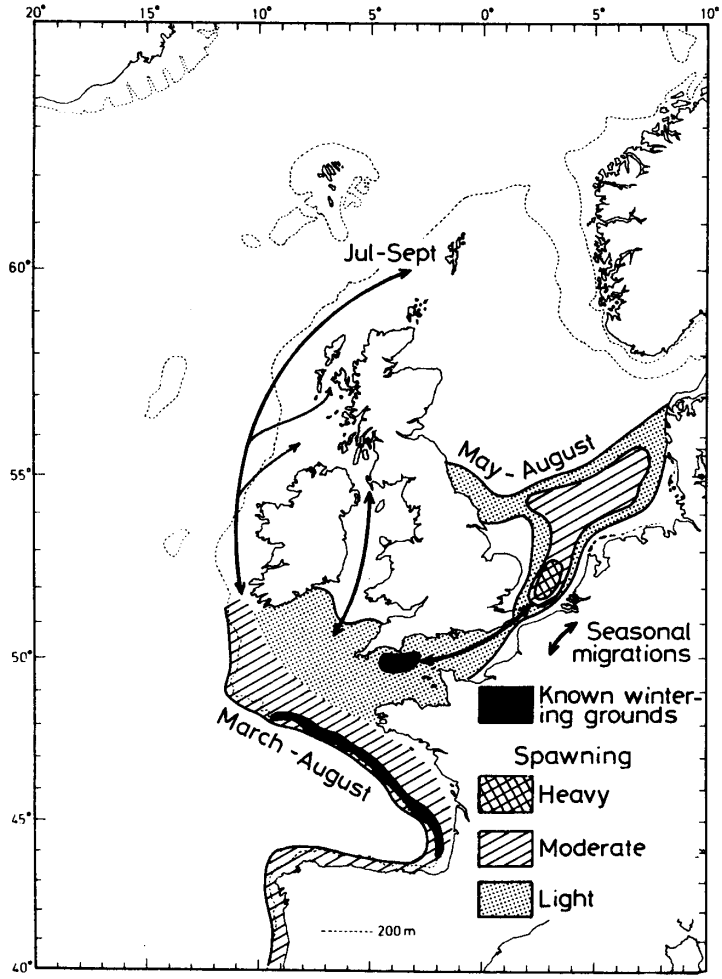


(a) Main fishing grounds and seasons

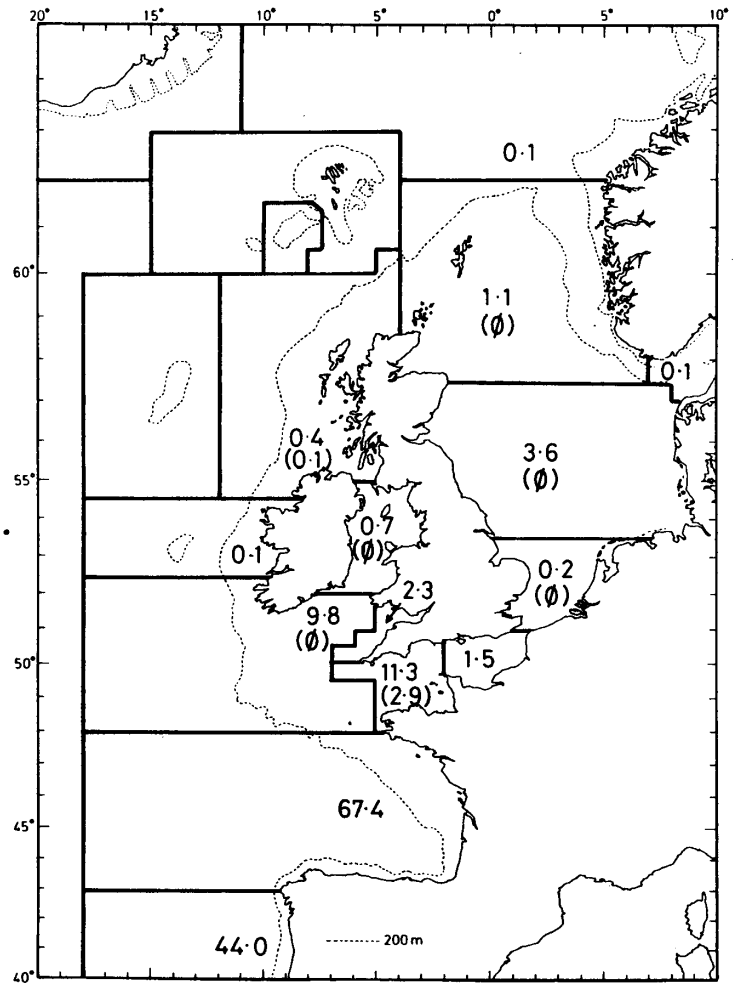


(b) 1979 catches (thousand tonnes) in areas around Britain; total international and, in parentheses, U.K.

Figure 3 Mackerel



(a) Distribution and migrations



(b) 1978 catches (thousand tonnes) in ICES statistical Divisions; total international and, in parentheses, U.K.

Figure 4 Scad

considerable proportion of the catch. During the development of a fishery for this species, however, it seems likely that significant quantities would be available for reduction.

Prospects for fishing scad in other areas, such as the Celtic Sea, and at times other than the winter months have yet to be satisfactorily established. There is evidence of a northward migration to the west of the British Isles in the summer. In some years considerable quantities of scad have been taken around Shetland and to the west of Scotland, particularly by Norwegian vessels. The data on international landings from these areas, given in Table 9, suggest that the extent of the migration is very variable. Exploratory commercial voyages carried out specifically for this species in June-July 1980 failed to find any concentrations in the areas north and west of Scotland, although exploratory bottom trawling to the north-west of Ireland located concentrations with catch rates ranging up to about 4 tonnes per hour. On the basis of the evidence available, it is unlikely that a regular fishery for scad could be carried out in the seas around Scotland.

Table 9 International landings (tonnes) of scad from the northern North Sea (ICES Division IVa) and west of Scotland (ICES Division VIa)

	N. North Sea			W. of Scotland			
	Norway	Faroe	Scotland	Norway	Faroe	Scotland	Netherlands
1970	0	0	0	0	0	0	0
1971	23 149	0	0	24	0	0	0
1972	6 381	0	0	0	0	0	0
1973	16 765	3 644	1 681	3 909	1 681	0	0
1974	20 695	772	0	18	0	0	0
1975	2 174	156	2	869	2	187	0
1976	0	116	2	0	2	85	0
1977	450	130	0	0	0	105	0
1978	1 024	3	0	0	0	0	0
1979	524	0	+	0	0	39	6 910

(Source: ICES Bulletin Statistique)

6.3 Sprat (Figure 5)

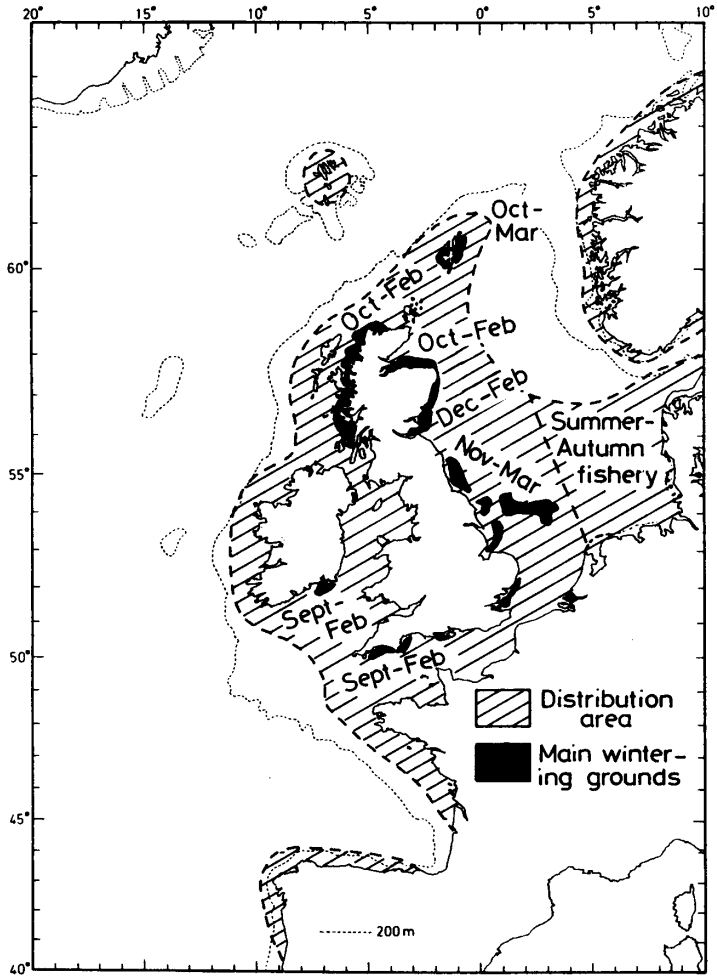
Main seasons: Western North Sea, November-March (midwater trawl)
June-October (purse seine)

South-west England, September-February
West of Scotland, October-February

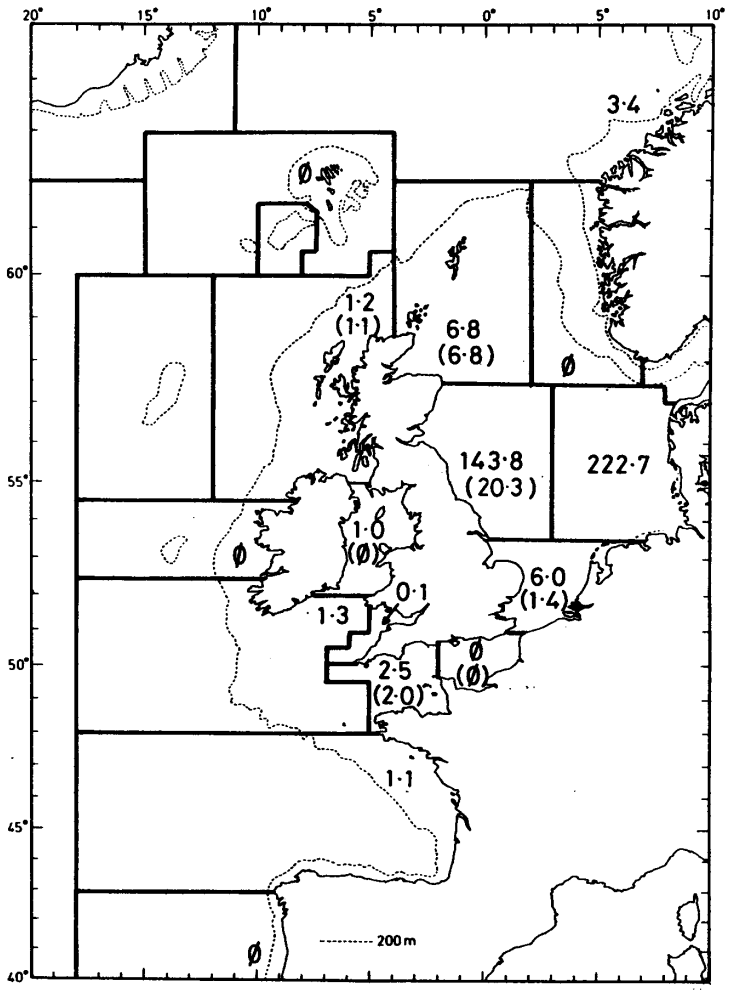
Stock size estimate: North Sea, from acoustic survey, 1980
ca. 1 000 000 tonnes

Recommended 1981 TAC (North Sea): 400 000 tonnes

Constraints on the North Sea sprat fishery in the next few years are likely to be determined by TAC regulations aimed at preventing stock collapse. In addition, regulations limiting the allowable by-catch of herring in the sprat catches (currently 10% by weight) are likely to have an impact on the practicability of sprat fisheries in some areas, particularly those inshore along the east coasts of England and



(a) Distribution and fishery areas



(b) 1979 catches (thousand tonnes) in ICES statistical Divisions; total international and, in parentheses, U.K.

Figure 5 Sprat

Scotland. It is not, however, possible to predict in advance of each season what the effect is likely to be, because it depends on relative recruitment levels for the two species.

The size of sprat stocks to the south-west and west of Britain are not known, but they are likely to be substantially smaller than those in the North Sea. Whereas the North Sea stock is now subject to a regulation restricting the total annual catch, it is likely that the stock to the west of Scotland could sustain a modest increase in exploitation. A full assessment for this area has not been made, but the size and age of sprats caught there are on average higher than in the North Sea. There is consequently little evidence that the current landings from the west of Scotland (average 6 000 tonnes) have had a significant effect on the stock.

Overall it is unlikely that the North Sea sprat stock can sustain a fishery larger than the present total international fishery; thus there is unlikely to be a significant potential for increasing catches from this area for reduction to meal and oil. To the west of Scotland a moderate increase may be possible, perhaps up to an additional 10 000 tonnes per year. In the past few years, herring by-catch rates in sprat catches taken in the west of Scotland fishery have tended to be lower than those in the North Sea.

Owing to the short life-span of sprats, the fisheries depend heavily on incoming recruitment which varies from year to year. In each area, therefore, the fisheries fluctuate markedly. There have been indications in recent seasons of a decline in abundance of sprats in the western half of the central and northern North Sea, while the population in the southern North Sea and eastern English Channel has increased. It is not yet clear whether this is likely to be a short-term or long-term change, but the changed distribution makes it difficult to predict the availability of sprats in their traditional east coast wintering areas.

Table 8 shows that for a few years there were purse-seine landings of sprats from the central North Sea in the period May to August; this indicates that there may be some scope for an increase in U.K. fishing for sprats during the summer. The sprats caught in this fishery have tended to be large and fairly oily, and the herring by-catch has been low.

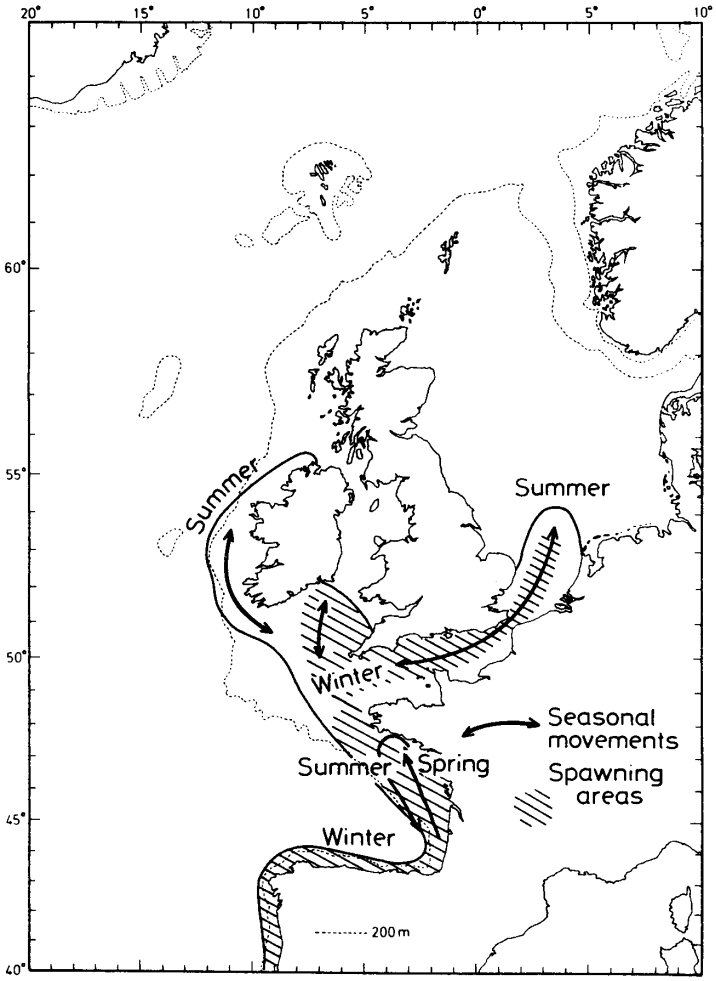
6.4 Pilchard (Figure 6)

Main season: South-west England, November-March

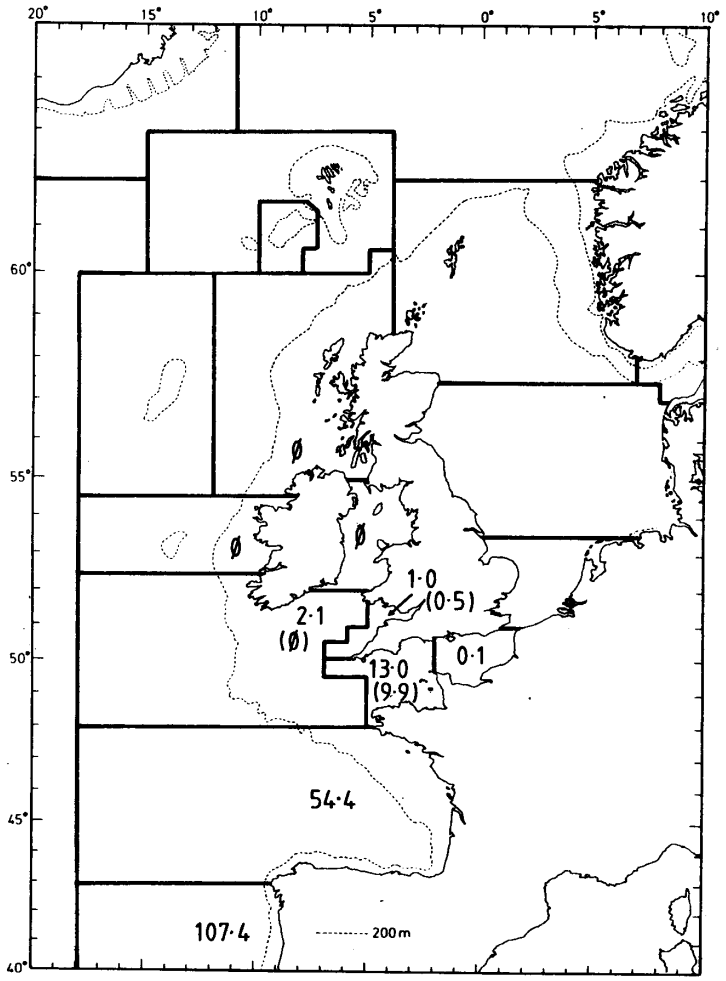
Stock size: No recent estimates, but may be at least 500 000 tonnes, which could conservatively yield 50 000 tonnes per year

Recommended 1981 TAC: no recommendation

At present there are no restrictions on fishing for pilchards. The same problem arises as in the case of scad, i.e. that the season coincides with that for mackerel in this area. However, some mackerel fishing effort has been diverted on to pilchard over the last few seasons, the catch reaching 10 000 tonnes in each of the years 1977-79. Consumer outlets are at present limited: some have been exported to Germany, small amounts are canned and some are used for petfood. There are thus some prospects for expansion of a meal outlet, although catches will be dependent, as for scad, on the amount of effort that is diverted from the mackerel fishery. Both long- and short-term fluctuations in availability of pilchards are likely to occur in the area around Cornwall.



(a) Distribution, spawning areas and seasonal migrations



(b) 1978 catches (thousand tonnes) in ICES statistical Divisions; total international and, in parentheses, U.K.

Figure 6 Pilchard

6.5 Sandeels (Figure 7)

Main season: Shetland, April-October
West-central North Sea, April-July

Stock size estimate: 1977, 2 450 000 tonnes

Recommended 1981 TAC: 571 000 tonnes

Since there is at present no evidence of overexploitation of the North Sea sandeel stock, the potential exists for a large-scale expansion of a fishery on the grounds extending from the western Dogger Bank to the Norfolk Banks. This fishery has never been prosecuted on a large scale by U.K. vessels because prices of sandeels for reduction have often not been competitive with the financial returns that could be gained from other forms of fishing during the sandeel season. In some years, most or all of the sandeels landed at Humberside ports have been from Danish vessels. The Scottish fishery in Shetland waters has been carried out on a much larger scale, because the grounds are relatively close to an existing fishmeal plant. Since 1974 is has developed to a level of 25-30 000 tonnes per year. During the sandeel season, which is longer than that in the central North Sea, the local Shetland fish meal plant is running at full capacity and this is at present the main factor limiting catches in this fishery.

Expansion of sandeel fisheries in the U.K. will depend not only on the quota allocated to U.K. vessels from the total allowable catch, but also on their profitability relative to that of alternative contemporary fisheries. Research vessel surveys have demonstrated the existence of substantial concentrations of sandeels in areas other then those already fished, such as Smith Bank in the Moray Firth, Scourie Bank in the North Minch and the area west of Dubh Artach in the South Minch. Furthermore commercial exploratory voyages in 1980 found localised concentrations of sandeels around North Rona, near the Flannan Islands and south-east of Barra Head, catch rates ranging up to 6 tonnes per hour. Further exploration may indicate other areas that could support a fishery. Sandeel fisheries in most areas are noted for the low level of whitefish by-catch.

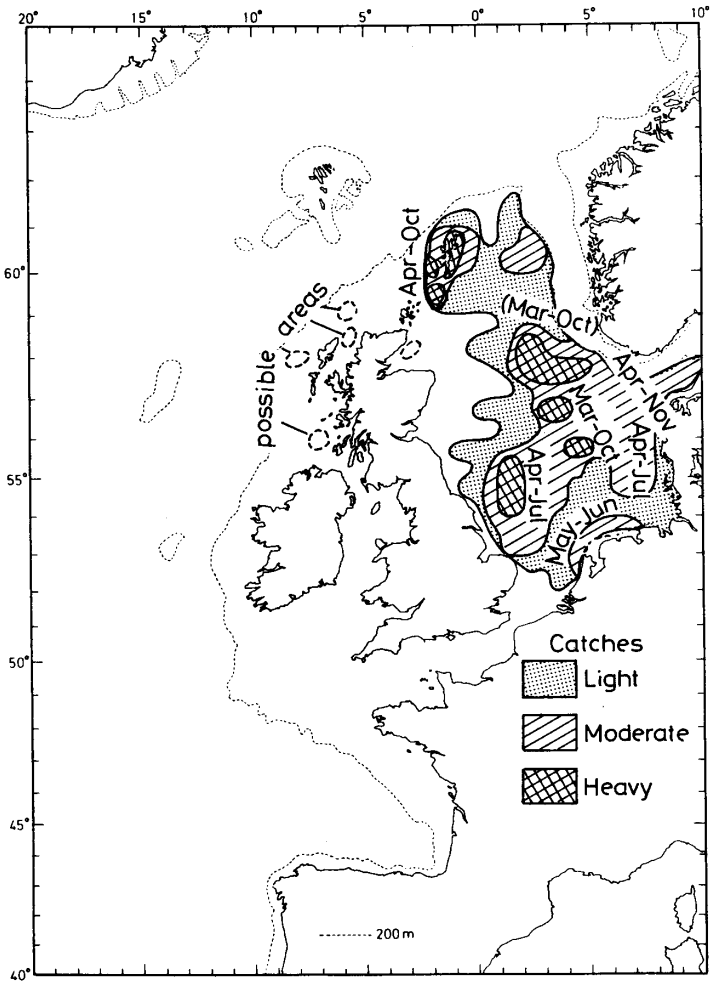
6.6 Norway pout (Figure 8)

Main season: North-western North Sea, June-March with peaks in September and February

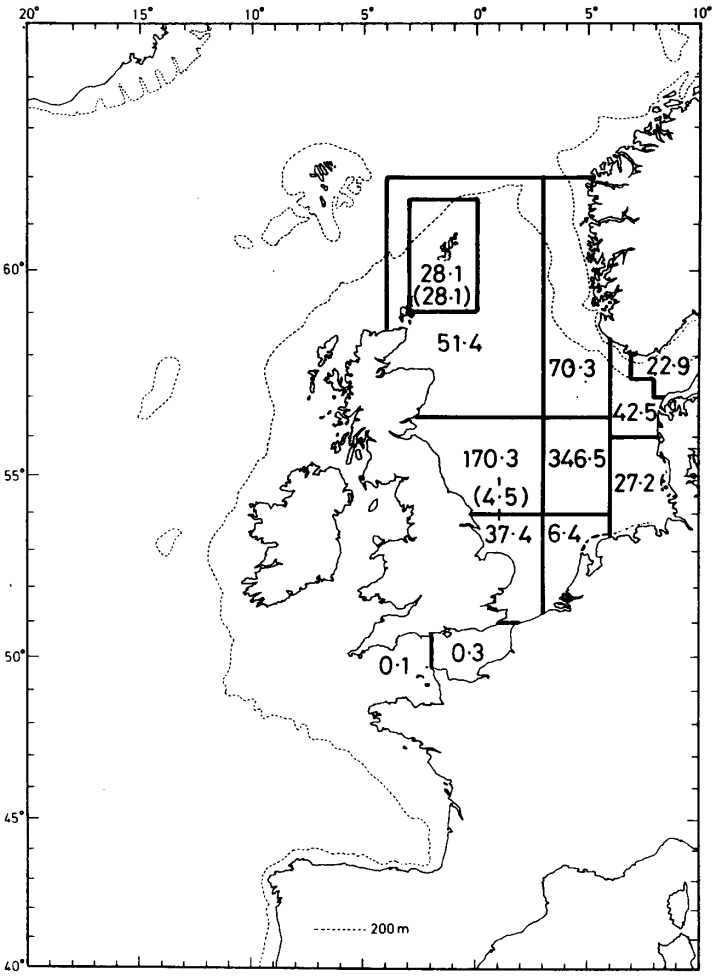
Stock size estimate: North Sea, 1977, 630 000 tonnes (minimal estimate based on ICES assessment)

Recommended 1981 TAC: no recommendation

Landings of Norway pout in the U.K. have been made almost entirely by Scottish vessels fishing in the North Sea between latitudes 57^{o} and 61^{o}N and in the North Minch. Under an EC regulation, fishing for this species will be prohibited from 1981 within the area of the 'Norway pout box' (Figure 8a). Some pout fishing areas will remain open to U.K. vessels outside the limits of the box around Shetland and further offshore in the northern North Sea. In all areas, however, there will be a requirement to put back into the sea catches with a by-catch of more than 10% by weight of protected species (mainly haddock and whiting). The likelihood that any major increase in landings of Norway pout could be taken from the North Sea by U.K. vessels is therefore not great.

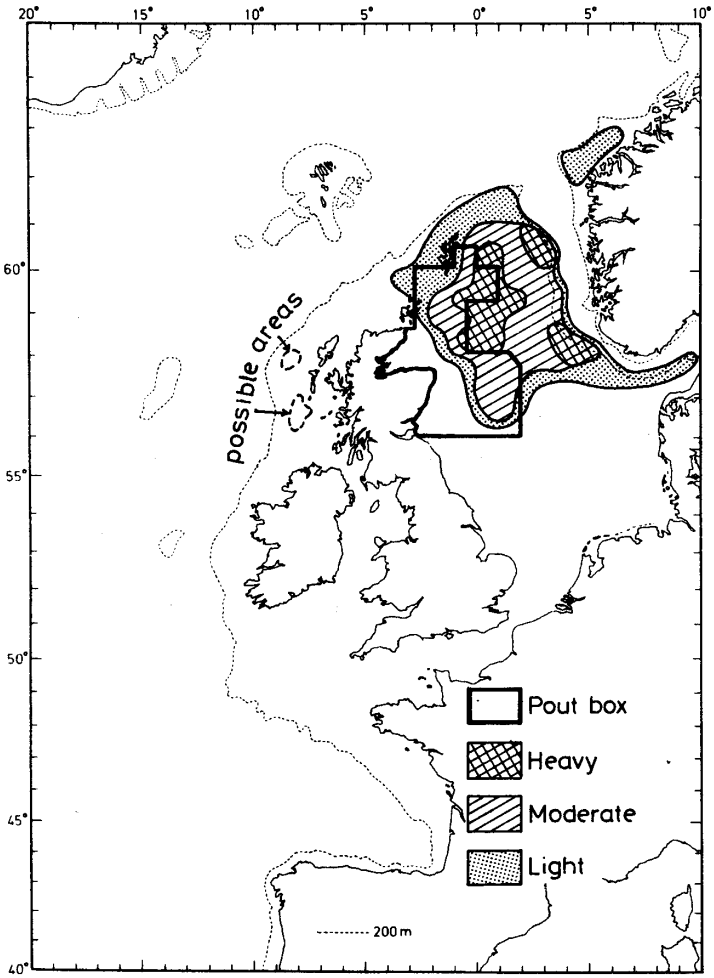


(a) Main fishing grounds and seasons

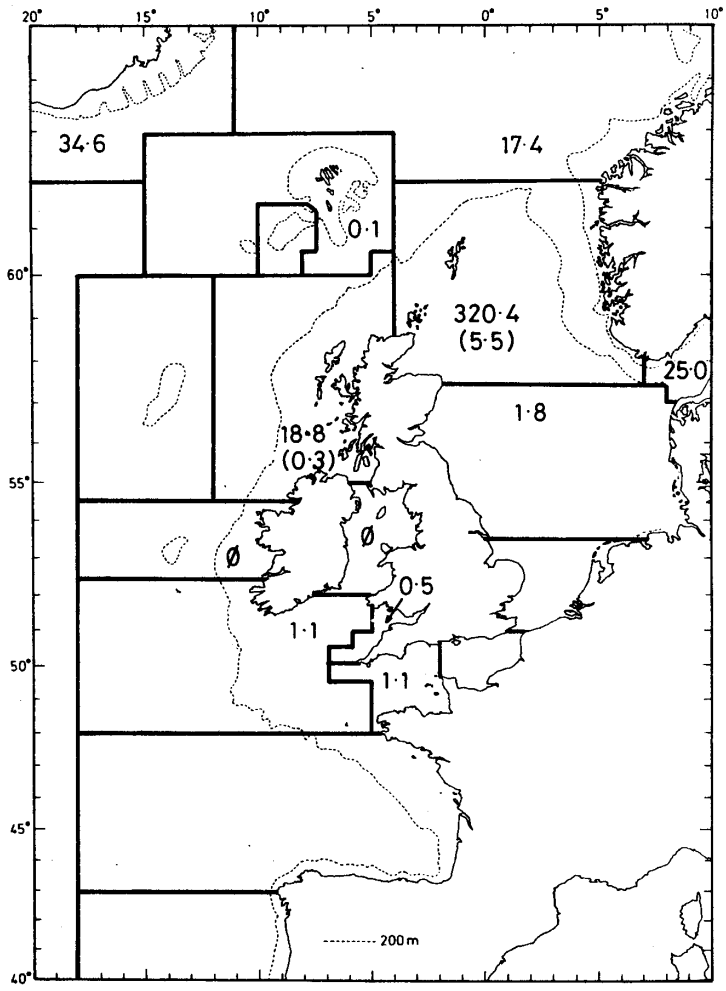


(b) Distribution of 1978 catches (thousand tonnes); total international and, in parentheses, U.K.

Figure 7 Sandeels



(a) Main year-round fishing area (peak period July-Oct) and 'Norway pout box'



(b) 1978 catches (thousand tonnes) in ICES statistical Divisions; total international and, in parentheses, U.K.

Figure 8 Norway pout.

For some years there has been a Norway pout fishery in the North Minch by Scottish vessels, and in the past two years, Danish and Faroese vessels have fished for Norway pout to the south and west of the Outer Hebrides. The total landing by Faroese vessels in 1979 was approximately 20 000 tonnes, mainly from an area south-west of Barra Head where catch rates of 1.4-6.6 tonnes per hour were reported. There is little information on by-catch rates of protected species in this area, but on the basis of the few samples available, it would appear to be on average less than 10%. The fishery in 1979 lasted from about August to December. The U.K. fishery in the Minch has relatively low by-catch rates. On this basis it is at present difficult to assess whether a fishery for Norway pout uncontaminated by protected species could be sustained on a significant scale in these areas. The stocks of Norway pout to the west of Scotland, however, are probably quite large judging by the widespread distribution of the species recorded on research vessel surveys. Furthermore, some good catches were made on commercial exploratory surveys carried out in 1980 in the area of Stanton Banks, a maximum catch rate of 25 tonnes per hour being caught in one haul which contained a low by-catch of protected species.

6.7 Blue whiting (Figure 9)

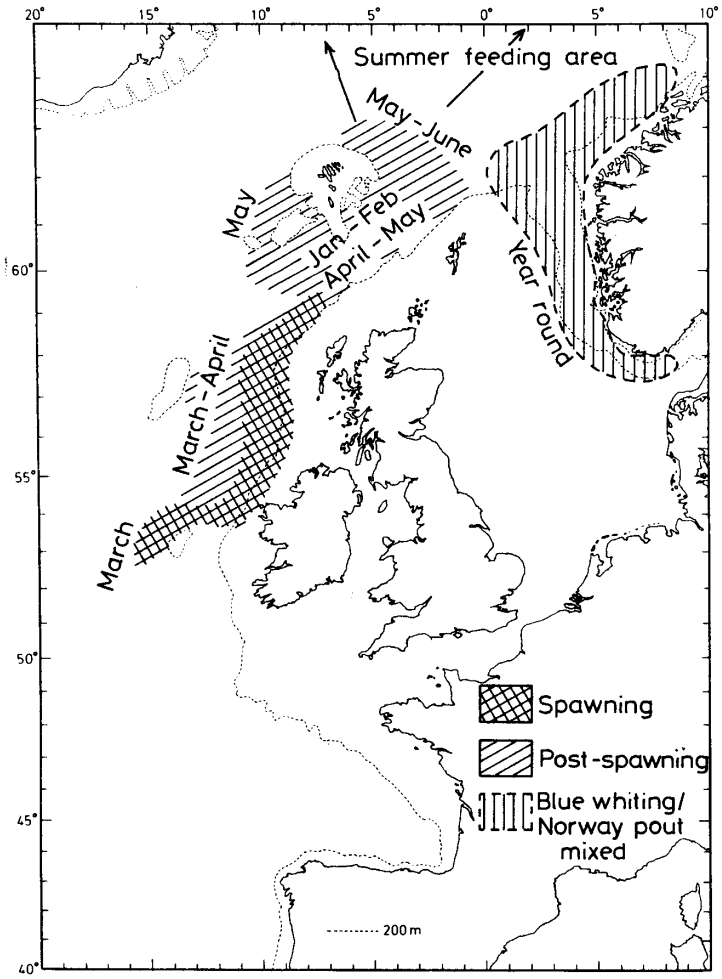
Main season: West of Scotland and Ireland, March-April
Faroe Bank-Faroe Plateau, January-February and May-June

Stock size estimate: 1980, ca. 8 000 000 tonnes

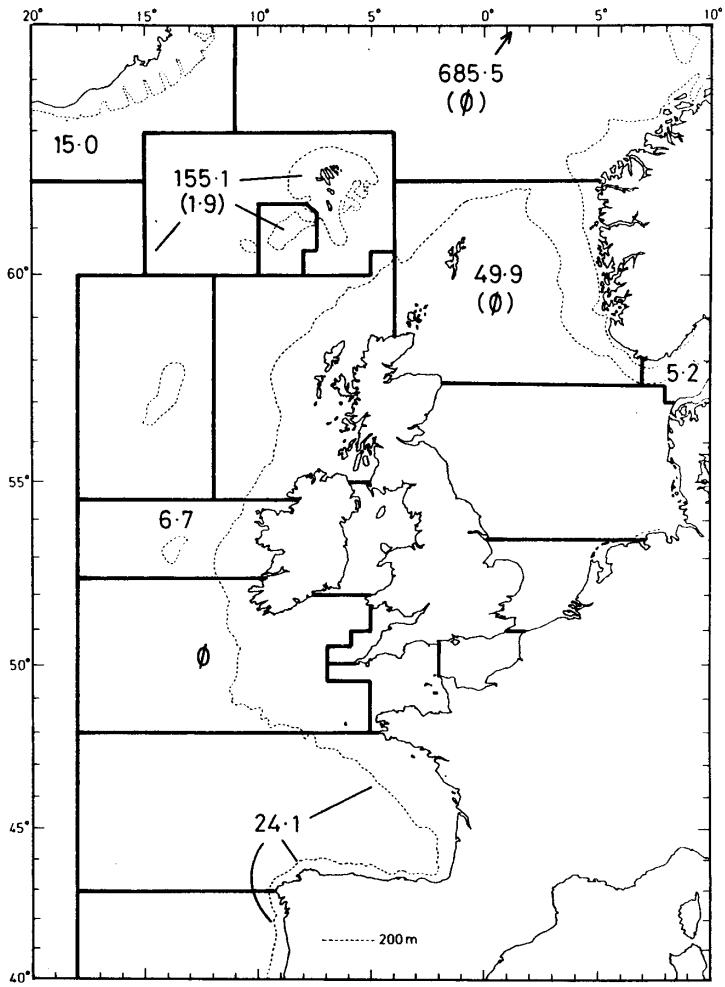
Recommended 1981 TAC: no recommendation. (The international catch in 1979 was 1 100 000 tonnes.)

The fishery for blue whiting which takes place in offshore waters is essentially suitable only for relatively large vessels (over approximately 100 feet) which are capable of working in exposed areas where shelter is not available. The economics of employing vessels in this size group purely for industrial fishing have yet to be proved, particularly at a time when the price differential between meal and human consumption outlets is large. In the 1978 season, £30 per tonne was offered for blue whiting for fish meal, £80 per tonne for petfood and £120-145 per tonne for human consumption outlets, although the latter were and still are very restricted. In 1980 the price offered for reduction had risen to only £34 per tonne.

Another drawback to the development of this fishery by U.K. vessels is the relatively poor quality of the fish at the time of year when they are most readily available for capture to the west of the British Isles (April). At this time the fish are aggregated west of the British Isles for spawning, immediately after which their fat content is usually less than 1%. The relatively short but intensive catching season poses some problems because the quantity that could be used for reduction will be restricted by the reduction capacity available. It may be possible to extend the fishing season earlier, i.e. January-March, if fish can be located in sufficient concentration during their southward migration past the Faroe Islands and through the Faroe-Shetland channel; the condition factor and oil content would also be expected to be higher then. The major expansion of the international fishery in 1979 was mainly due to a greatly increased catch by the USSR (643 000 tonnes) fishing on feeding concentrations in the Norwegian Sea during the summer and autumn.



(a) Fishery areas



(b) 1979 catches (thousand tonnes) in ICES statistical Regions and Divisions; total international and, in parentheses, U.K.

Figure 9 Blue whiting

6.8 Other species

In addition to the species dealt with above, there are a number of other demersal species that inhabit the area west of Scotland, mainly in deeper water along the edge of the continental shelf. The most abundant of these are two species of silver smelts (Argentina) and the silvery pout (Gadiculus). The stocks of these species are of unknown size, but since their area of distribution is limited to depths of about 180-460 metres, it is not thought likely that the stocks would support large fisheries. Local concentrations of these species have been found on research vessel surveys, but further exploratory surveys would be required before their potential yields and the geographical and seasonal extent of a fishery for them could be determined.

7. CONCLUSIONS

The above account suggests a number of resources which might be tapped to increase home fish meal production. Most of these stocks, however, have been known to exist for a considerable time, and it is appropriate to ask why they have not already been exploited for this purpose. The main reasons are:

1. Low first-sale value in relation to costs of exploitation. For example, there is a large blue whiting resource but a recent economic evaluation of its potential for reduction indicates that steaming distances are probably too great for an industrial fishery to be economically viable. Successful industrial fisheries in the U.K. have tended to be based close to the reduction plants (e.g. sprats, sandeels).

2. Seasonality of the fisheries and inhospitability of fishing grounds. Some resources, particularly blue whiting, are available in quantity for relatively short periods of the year. The fishing grounds, moreover, are suitable only for large vessels (over 100 ft) that can work in bad weather conditions.

3. By-catch problems. In several cases (Norway pout and sprat in particular) the target species overlap in their distribution with protected species of greater traditional importance in the U.K. Particularly in recent years, the increased need for conservation measures to protect the by-catch species to reduce exploitation on the immature stages has tended to place rather severe restrictions on industrial fishing.

Considering all these problems, the stocks of greatest potential for increased meal production are:

1. Sandeels. The North Sea fishery at its current level is, according to ICES, showing no evidence of overexploiting the stock, and by-catches of protected species tend to be very small. So it is likely that there could be some expansion in the central and northern North Sea, both in present fishing areas and in unexploited areas. There may also be scope for fisheries to the west of Scotland and in other areas of the north-western North Sea.

2. Blue whiting. The stock is large and the U.K. could legitimately take a higher proportion of the total catch than at present if the practical and economic problems can be overcome.

3. Scad. Although there may be some competition from other markets for this species, the present level of landings could probably be appreciably increased, especially from the south-west of Britain in winter.

4. Sprat. Some increase in exploitation to the west of Scotland may be possible, but in the North Sea fisheries the amount of effort deployed will be affected by permitted levels of herring by-catch. In some years it may be possible to develop offshore summer fisheries with purse-seiners.

5. Norway pout. Although the opportunities for increased U.K. fishing for Norway pout in the North Sea are likely to be limited, it is possible that some expansion may be possible on grounds to the west of Scotland.

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