

REVIEW ON THE DISTRIBUTION IN RELATION TO ZONES OF EXTENDED
FISHERIES JURISDICTION OF THE FOLLOWING SPECIES:

NORTH SEA HERRING
CELTIC SEA HERRING
DIVISION VIa HERRING
IRISH SEA HERRING
NORTH SEA SPRAT
SKAGERRAK, KATTEGAT AND
NORWEGIAN FJORD SPRAT
HERRING IN DIVISION IIIA SKAGERRAK
BLUE WHITING (Micromesistius poutassou)

Note: This Report has not yet been approved by the International Council for the Exploration of the Sea; it has therefore at present the status of an internal document and does not represent advice given on behalf of the Council. The proviso that it shall not be cited without the consent of the Council should be strictly observed.

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NORTH SEA HERRINGDistribution in relation to zones of extended fisheries jurisdiction1. General biology1.1. Spawning areas and larval drift

The main spawning areas of North Sea herring are shown in Figure 1. All these spawning areas belong to autumn- or winter-spawning herring. Small numbers of spring-spawning herring are found in the North Sea, but these fish do not make any significant contribution to the North Sea stock.

A distinction has been made between spawning grounds which are still in use at present, and areas where herring have not spawned in recent years. The most important spawning now occurs in the Orkney-Shetland area. Spawning along the north-east coast of England and in the eastern Channel has been very much reduced in recent years. On the Dogger Bank and Buchan grounds, spawning has ceased or has been at a very low level in recent years.

Larvae from the Orkney area are transported south and eastwards. The exact drift route is not yet exactly known. A major part of these larvae are transported across the North Sea towards the Skagerrak and Danish coasts. Some of the larvae hatched on the north-eastern coast of England will grow up along the English east coast, and some will be transported eastwards towards the German Bight. Larvae from the Channel spawning drift north along the Dutch coast and spend their earliest stages in the Wadden Sea.

1.2. Nursery areas

The nursery areas for the 0-group stages are widely distributed on the English east coast and on the Dutch, German and Danish North Sea coasts, and in the Skagerrak, as shown in Figure 1. As these fish grow and attain the 1-group stage, they move offshore into deeper water adjacent to the areas in which they spent their 0-group stage (Figure 2). Tagging experiments and studies of parasites have demonstrated an emigration of juvenile fish from the eastern central North Sea towards Division VIa. This also applies to juvenile herring of the Moray Firth.

1.3. Distribution and migration of adults

In their 3rd year of life, herring leave the nursery areas in the eastern North Sea and join the adult stock on its feeding grounds in the western North Sea. During the feeding season from May until August, adult herring are found from the Shetland Islands to the area off Shields. Spawning concentrations assemble in the Shetland/Orkney area in July/August. In September/October, spawning occurs in the Longstone area and off Whitby, and Flamborough Head. In December, there is some very limited spawning in the eastern Channel. In the years prior to 1970, many over-wintering herring were found in the Skagerrak and the north-eastern North Sea. These herring belonged to the Dogger Bank and north-western North Sea spawning populations. Since 1970, with the marked decline in these spawning populations, there have been very few over-wintering herring in the north-eastern North Sea.

2. Exploitation and management

2.1. Exploitation methods

The methods of exploitation remained largely unchanged until the second half of the 20th century. The main fishing was done by drift nets, and this fishing method never exploited the resources beyond their capacity. The maximum catch level during this period of exploitation was around 700 000 tons a year.

Although the development of bottom trawling for herring started between the wars, the use of echo sounders in conjunction with bottom trawls was introduced after the 2nd war, and this proved to be much more efficient than the drift net, which was almost completely abandoned during the 1950s. Bottom trawls were used effectively on the feeding ground (Fladen), but even more on the spawning grounds (Dogger Bank, Sandettié, off Seine Bay). In addition to the trawl fishery for human consumption, an industrial fishery for juvenile herring developed in the eastern North Sea in the early 1950s. The change from drift net to trawl net also meant a re-distribution of the North Sea catch. The countries with major traditional drift net fisheries lost a large share of their catch to countries using the new trawling method.

A second change in exploitation occurred around 1965. At this time, the purse seine was introduced in the North Sea herring fishery. The countries utilising this gear took over the main share of the North Sea catch in a few years, and reduced the total stock considerably. The large catches of herring taken by purse seine were, originally, only used for industrial purposes.

Along with the introduction of the purse seine, the trawl net was perfected to a high degree. The development of mid-water trawls and large pair-trawls meant that a second highly directive fishing method was introduced for herring.

2.2. Changes in stock size

The development of these highly efficient fishing methods, and the absence of adequate conservation measures led to continuous decline of most North Sea stocks after 1950. In addition to the changes caused by fishing, there have also been some changes which may have been caused by natural factors.

The decline in stock size did not happen simultaneously for all populations in the North Sea. The first decline took place in the population of the Southern Bight and eastern Channel. About 1955, this population showed evidence of a marked reduction and by 1964 had become almost extinct, as a result of excessive fishing. There was a small revival of the stock in the early 1970s, but a high fishing effort was immediately attracted and it was again reduced to a very low level by 1976.

The population on the Dogger Bank ceased to exist after 1965, also as a result of overfishing. In addition to the heavy fishing intensity on the spawning grounds, this stock experienced a concentrated fishing effort on its over-wintering area in the north-eastern North Sea and Skaggerak.

The Buchan stock declined about the same time and by 1965 had completely disappeared from its traditional spawning grounds off the coast of Aberdeenshire. This decline may not have been entirely due to fishing; possibly there was a relation between the reduction of the Buchan stock and the increase in the stock of autumn spawners around Orkney and Shetland in the mid-1960s.

In addition to these fisheries on the adult stocks from the mid-1950s, there was a major increase in exploitation of juvenile herring in the eastern Central North Sea.

By 1975, the total North Sea herring stock had been reduced to approximately 10% of its immediate post-war level.

After 1970, the overall recruitment to the North Sea population started to decline. Year classes 1972, 1974 and 1975 were very poor, while 1970, 1971 and 1973 were only of about average strength.

2.3. Management

The deterioration of the stocks led to the introduction of protection measures after 1970. From 1971 to 1974, closed seasons were in force and subsequent data suggest that these had little effect in reducing the exploitation rate on, or halting the decline of, the stock. After 1 July 1974, catch quotas were agreed between the various countries. However, the principle of TACs was probably accepted too late for realistic values to be readily accepted and as a result the final agreed figures have been too high to achieve the objective of rebuilding the stock. The TACs recommended by ICES, those agreed by NEAFC, and the actual catches taken, are given in Table 1.

Since October 1975, the Liaison Committee has been advising a total ban on directed herring fisheries, and maximum restriction of the herring by-catch in industrial fisheries.

2.4. Long-term sustainable yield

If the various sub-populations of the North Sea were given a chance to rebuild (for some sub-populations it may be too late), the annual sustainable yield could theoretically be 700 - 800 thousand tons. This is also the level of total annual catches that was obtained until the drastic changes in the stock occurred after 1960. The long-term yield, however, is very dependent on the pattern of exploitation. The figure of 700 - 800 thousand tons per year is based on a fishing mortality on 1-group of not more than 1/10th of that on adults. This would entail no directed fishery on juvenile herring and more restrictions on the by-catch in other industrial fisheries.

3. Distribution of catches in relation to economic zones

There have been considerable changes in the distribution of catches within the North Sea in recent years. In order to evaluate these changes in catch distribution, three years have been selected (1965, 1970 and 1975) to represent the catch distribution at different levels of population size.

The catch distribution by ICES areas for these years is given in Tables 2-4. As there is no more detailed information on catch distribution available from most countries, the split by economic zones has to be made according to the division by ICES areas.

In practice, Division IVa east is almost coincidental with the Norwegian zone, and Division IVa west almost entirely within the EEC zone. Division IVb contains several squares belonging to the Norwegian zone. In some years, considerable catches have been taken in these squares, but at present these cannot be quantified.

Appendix 1, Table 1 TACs recommended by the Liaison Committee, those agreed by NEAFC, and catches actually achieved.

Period	1974	1975	1976	1977
TAC advice Liaison Committee	310 + 15%	362 + 15% (Apr. 74) 136 000 (Apr. 75)	140 000 (Apr. 75) No directed fishery advised (Oct. 75)	No catch
NEAFC agreement	488 000 from 1.3.74 until 30.6.75 (Mar.74)		160 000 (Apr. 76)	?
Catch	No separate quota for 2nd half 75 330 628	364 709	183 243	

Appendix 1, Table 2 Distribution of North Sea catch by ICES Divisions in 1965.

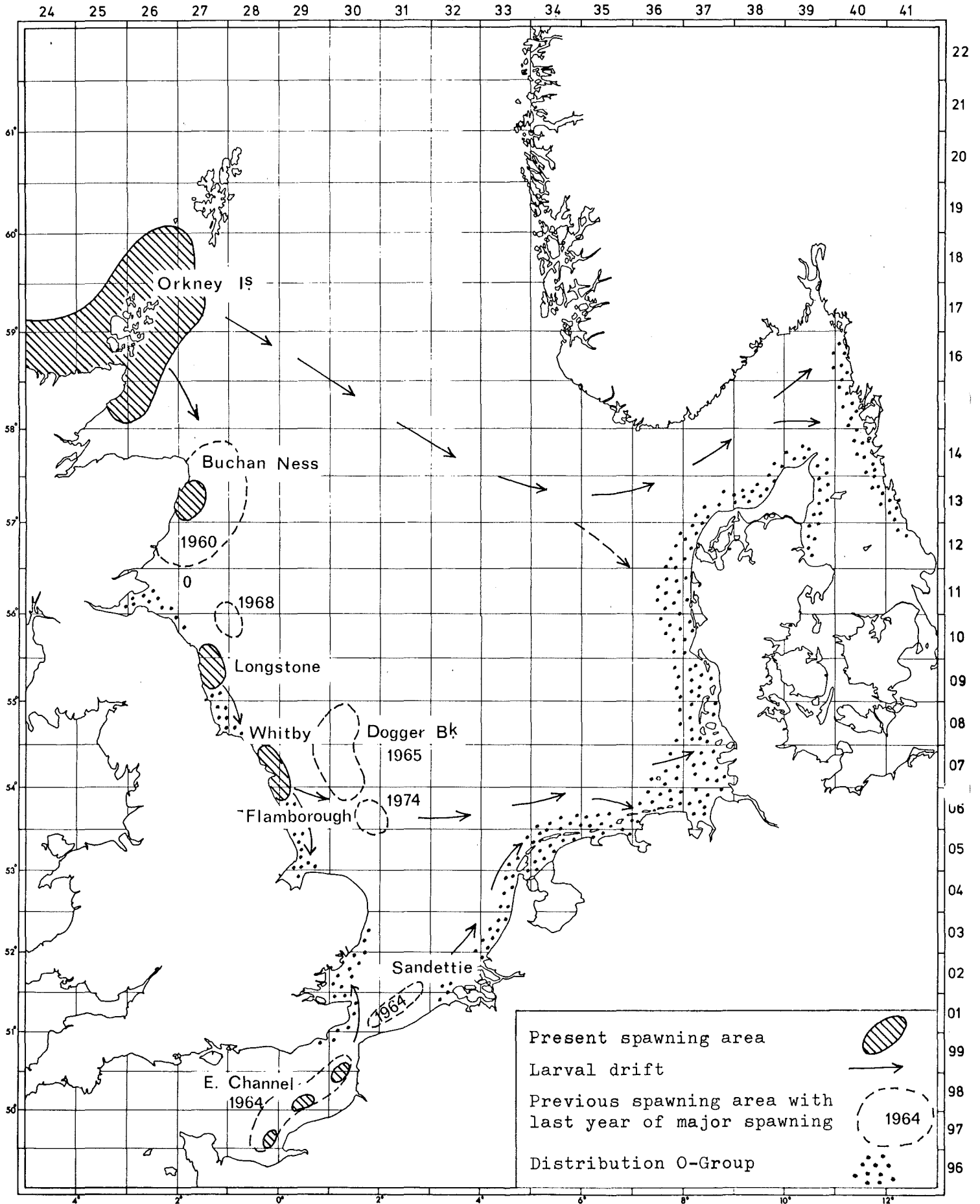
	IVa W	IVa E	IVb	IVc-VIIId,e
Belgium	227	-	47	502
Denmark	-	49 700	109 000	-
Faroe Isl.	3 111	-	-	-
France	2 009	5 294	7 037	2 140
German Democratic Republic	-	-	-	-
Germany, Fed.Rep.	4 489	23 428	48 529	586
Iceland	-	1 757	-	-
Netherlands	11 515	6 912	47 551	14 342
Norway	196 488	323 361	1 041	-
Poland	35 878	16 200	44 815	1 237
Sweden	-	132 182	-	-
UK(Engl.)	-	-	8 524	2 970
UK(Scotl.)	19 239	-	1 330	-
USSR	20 095	27 227	-	-
Total	293 051	586 061	267 874	21 777

Appendix 1, Table 3 Distribution of North Sea catch
by ICES Divisions in 1970.

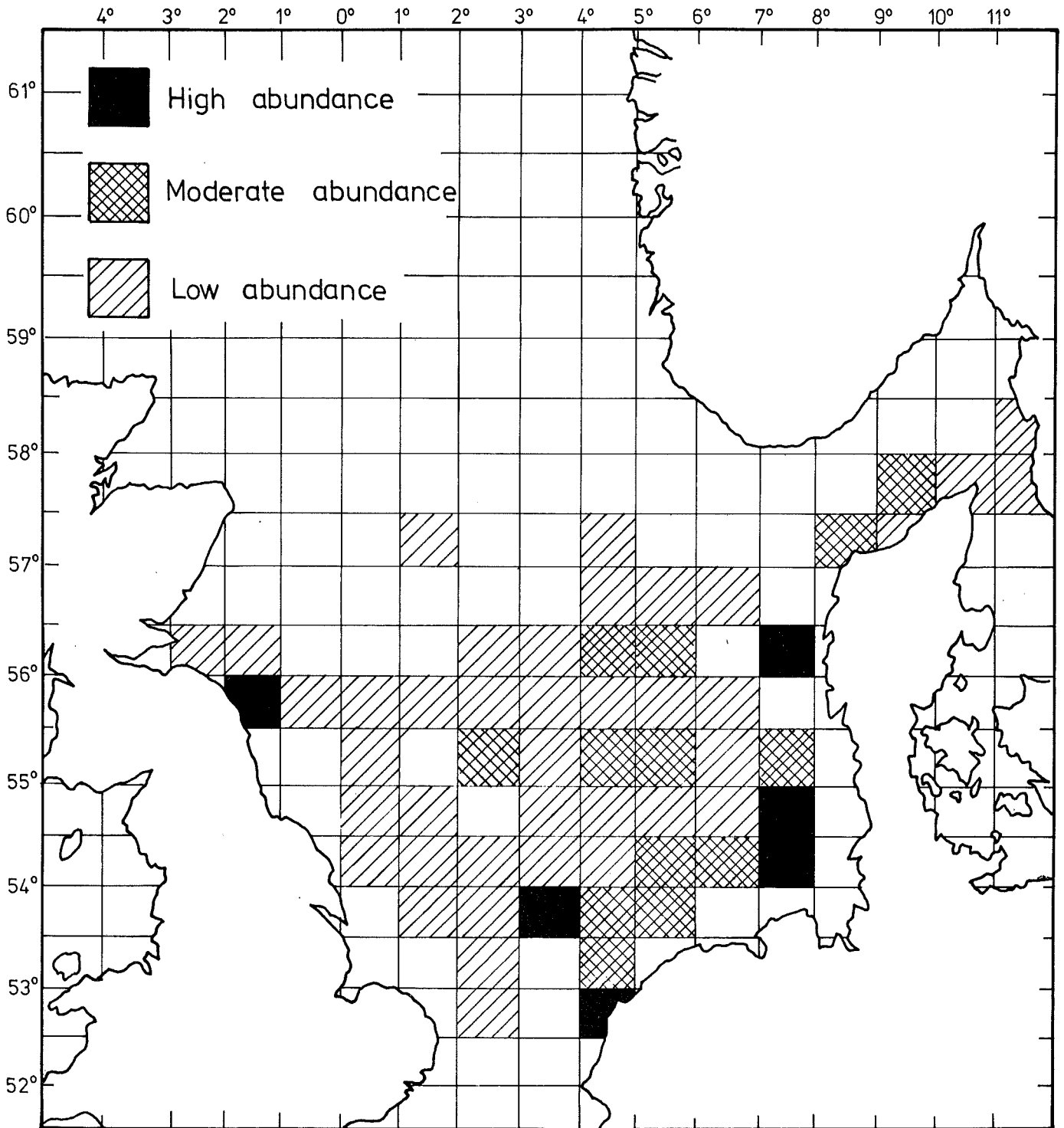
	IVa W	IVa E	IVb	IVc-VIIId,e	IIIa
Belgium	750	50	-	400	-
Denmark	61 423	1 800	70 108	-	30 107
Faroe Isl.	40 884	5 898	11 623	-	-
France	818	48	2 433	8 183	-
German Democratic Republic	-	-	-	-	-
Germany, Fed.Rep.	177	10	6 405	558	-
Iceland	20 587	1 220	1 144	-	6 453
Netherlands	177	281	28 815	16 945	-
Norway	160 784	3 501	28 817	-	7 581
Poland	2 069	123	2 836	29	-
Sweden	4 470	5 560	24 640	-	26 930
UK(Engl.)	-	-	8 731	971	-
UK(Scotl.)	17 767	1 929	2 189	-	-
USSR	17 066	1 012	-	-	-
Total	326 932	21 432	187 741	27 086	71 071

Appendix 1, Table 4. Distribution of North Sea catch by ICES Divisions in 1975.

	IVa W	IVa E	IVb	IVc-VIIId,e	IIIa
Belgium	-	-	-	2 361	-
Denmark	12 982	7 436	92 009	984	29 944
Faroe Isl.	19 722	-	9 662	-	8 342
France	595	-	4 958	14 157	-
German Dem.Rep.	-	-	2 607	-	-
Germany Fed.Rep.	1 459	-	4 273	6	108
Iceland	7 679	1 502	7 108	-	1 209
Netherl.	2 238	24	28 267	5 411	-
Norway	23 497	52	7 215	-	196
Poland	6 310	-	759	-	-
Sweden	-	-	3 500	-	12 348
UK(Engl.)	-	-	6 403	72	-
UK(Scotl.)	6 633	-	2 229	-	-
USSR	11 562	-	8 822	125	-
Total	99 679	9 014	177 810	23 116	52 129



Appendix 1, Figure 1 NORTH SEA HERRING (autumn spawners).



Appendix 1, Figure 2 NORTH SEA HERRING.
Distribution of juveniles as
1-ringers.

CELTIC SEA HERRING

Distribution in relation to zones of extended fisheries jurisdiction

1. General biology

1.1. Spawning areas and times, larval drift

The known spawning areas of Celtic Sea herring are situated off the south coast of Ireland (Figure 1). They are situated in shallow water within three miles of the Irish coast. The main spawning centres are Baginbun Bay, Ballycotton Bay and off Cork Harbour. The main Celtic Sea stock has been considered a winter spawning one with spawning taking place in November, December and January. However, during 1974, 1975 and 1976 the spawning time has changed and considerable spawning now takes place during September and October. The amount of spawning that occurs in January appears to have decreased.

Little is known about the larval drift, although it is believed that some larvae, particularly from the spawning areas in the eastern part of the Celtic Sea, are carried into the Irish Sea.

1.2. Nursery areas

Juvenile and immature herring are thought to remain inshore, in bays and estuaries along the Irish coast, until they recruit to the adult stock as three-year-old herring. Some immature herring, which probably originated from Celtic Sea spawning, are found in a well-established nursery area for 0- and 1-group fish in the north-western section of the Irish Sea (Molloy and Corten, 1975). Bantry Bay is also a nursery area for Celtic Sea herring (Molloy, 1968).

1.3. Distribution and migration of adults

The Celtic Sea herring is a stock which migrates inshore each autumn and winter to the spawning areas off the south coast of Ireland. When spawning is completed, the shoals move off shore and scatter over a large area of the Celtic Sea. During the spring and summer, they are found in an area extending from the Smalls to the Labadie and Jones Banks and also northwards towards the south coast of Ireland.

2. Exploitation and management

2.1. The early fishery in the Celtic Sea has been described by Burd and Bracken, who state "From 1920 to about 1930, the catches of herring from the area off the south coast of Ireland were made, in the main, by English drifters working on recovering spent and maturing herring during the period April to July. Later, a trawl and drift net fishery occurred during August and September in the region of the Smalls. At this period, no major effort was exerted on the spawning grounds off Dunmore. During this period, the maximum catch was 14 500 tons in 1928. The English drift net fishery began working on the spawning ground off Dunmore from 1933, from which time less effort was expended on the summer drift net fishery".

During the war, and in the post-war period, there was no summer drift net fishery. From 1950 to 1960, almost the whole of the catch came from the winter-spawning fishery by trawlers which took place from November to March. In 1957 and 1958, Dutch and German fleets began to exploit the inshore spawning grounds and as a result the total catch rose rapidly to 29 000 tons in 1958. In 1959, a baseline system was introduced which prohibited the Continental fleets from exploiting the inshore grounds. As a result of this, the total catch decreased during the middle sixties. In January 1966, the fishery limits off the Irish coast were

again changed, as a result of which vessels, other than those belonging to nations traditionally fishing in the area, were obliged to remain outside 12 miles. In spite of this, the effort in the Celtic Sea continued to rise and the total catch reached a maximum of 48 000 tons in 1969. This rise in catch was accompanied by a shift in the area fished by the Dutch fleet, who tended to increase their catches in the offshore areas - e.g., Labadie Bank and Smalls. In the mid-sixties, the fishery was also expanded westwards by Irish boats fishing inshore, which discovered new spawning grounds off Cork Harbour. After 1972, the total catch has declined continually. There has, however, been a slight increase in catch in recent years in this area by boats from other European countries (Table 1).

2.2. Molloy (1969) first drew attention to the fact that the exploitation rate on the Celtic Sea herring stock was above that giving the maximum sustainable yield per recruit. In subsequent years, a succession of meetings of ICES' Working Groups, and NEAFC ad hoc Study Groups, considering this stock, suggested stabilisation of catches at levels in the 25 - 30 000 ton range. However, no agreement was reached within NEAFC on a TAC for this stock until the 1974-5 season. The TACs suggested by the Liaison Committee for that and subsequent seasons, those agreed by NEAFC, and the catches actually taken are given in the text table below.

Group	1974-75	1975-76	1976-77	1977-78
TAC advised by Liaison Committee	25 000	19 000	6 500	6 500
TAC set by NEAFC	32 000	25 000	10 850	?
Catch actually taken	17 684	13 915	7 078	

It would appear that the TACs advised by the Liaison Committee in 1974-5 and 1975-6 were too high, largely due to over-estimation of recruitment; those set by NEAFC, in all seasons, much too high.

The only other management action taken by NEAFC in relation to this herring stock has been a prohibition on purse-seining (Recommendation 10), which came into force on 1 October 1971.

National conservation measures, in force within Irish fishery jurisdiction, are:

- (1) a prohibition on fishing from mid-day on Saturday to 4 p.m. on Monday.
- (2) no trawling allowed within 3 miles of any drift netting;
- (3) prohibition of landings for industrial purposes.

3. Distribution of catches in relation to economic zones

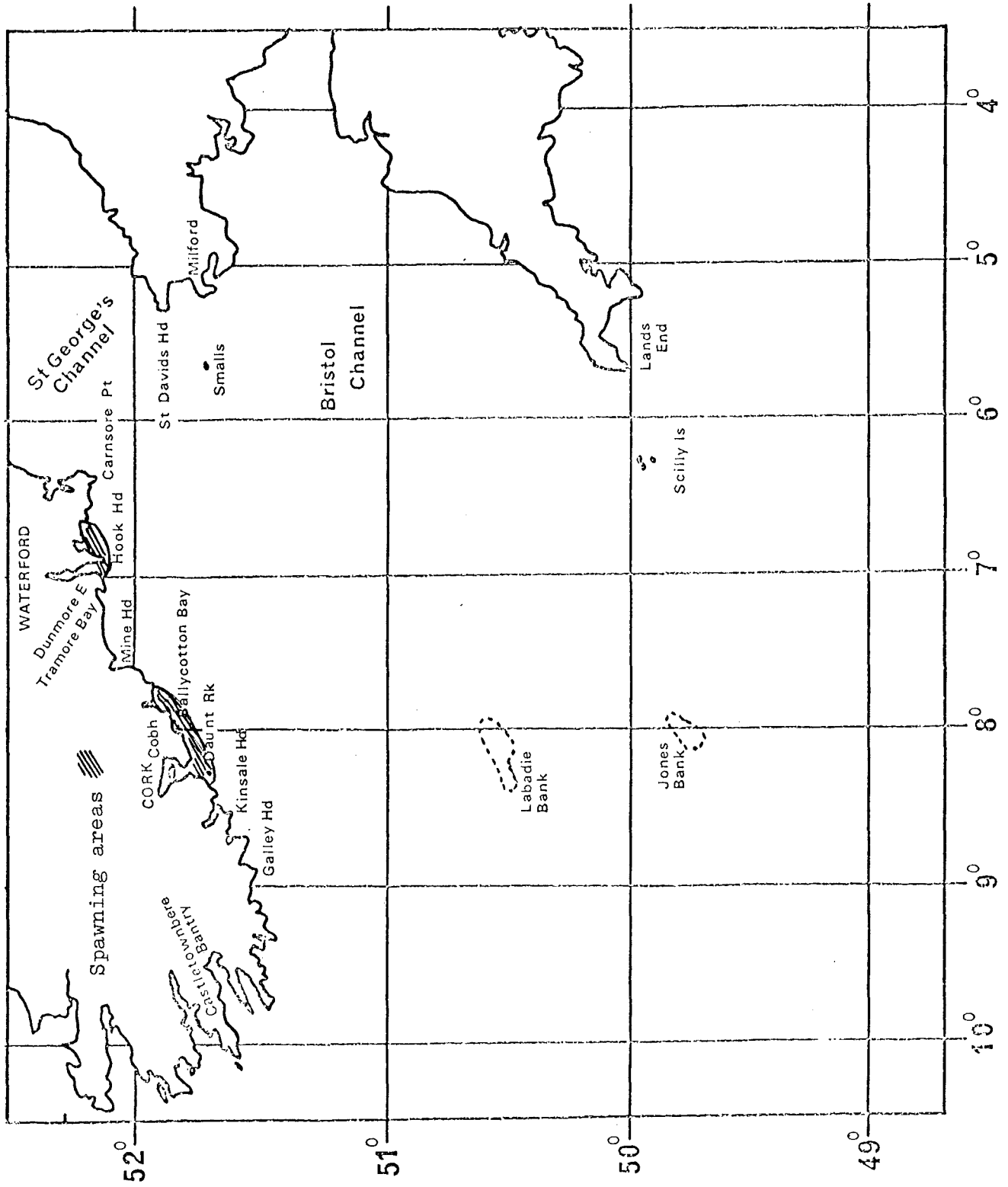
Catches of Celtic Sea herring have always been taken entirely within the EEC economic zone. Information is available about the distribution of the catches made by the Federal Republic of Germany, Netherlands and Irish fleets by ICES statistical rectangle. These catches have been summarised and are shown in Figures 2 and 3 for the years 1970 and 1973 in tons. In these years, the catches of those countries amounted to 85% and 75% respectively of the total catch. The catches from the remaining countries involved in the fishery are thought to come from approximately the same general area.

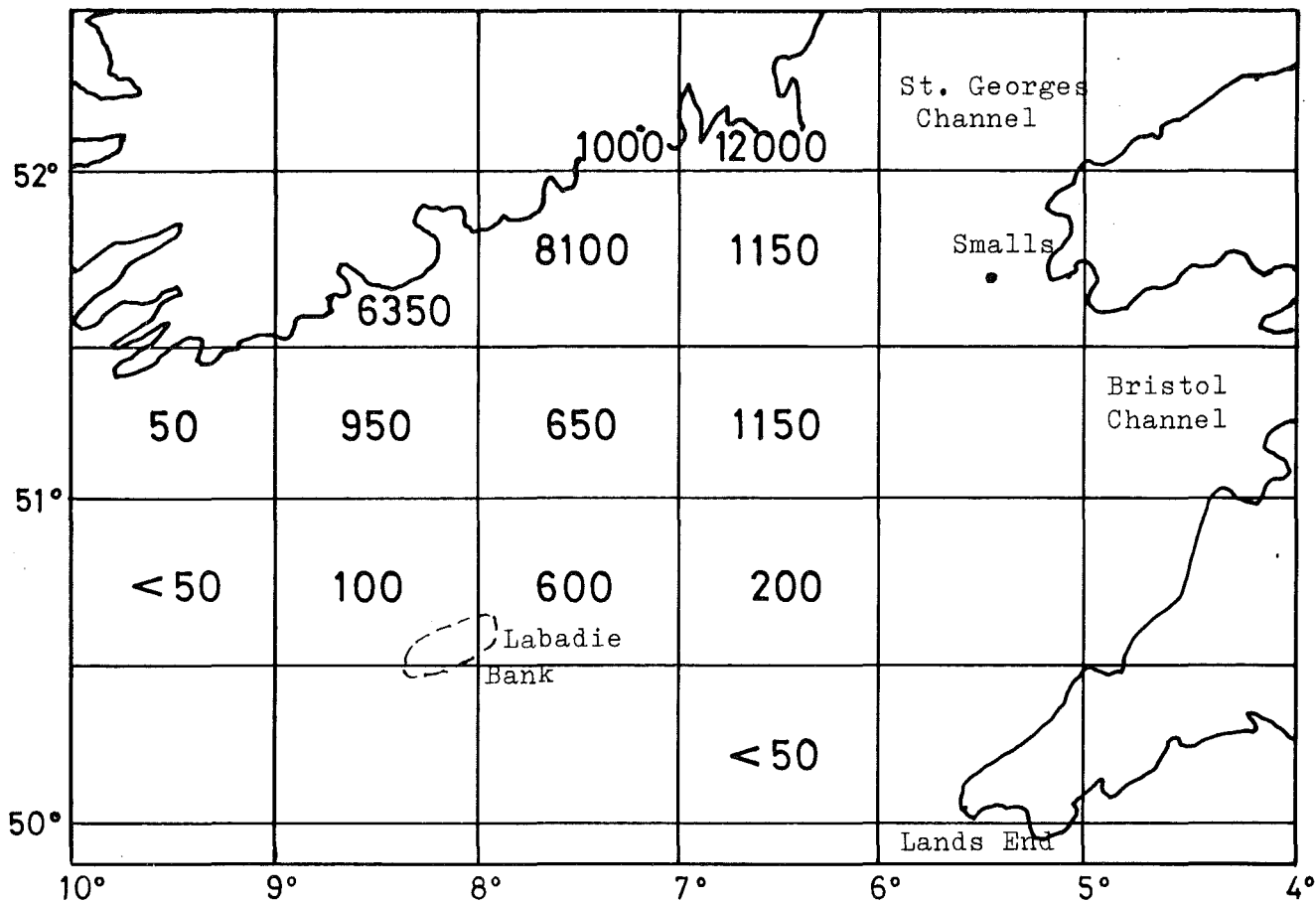
Appendix 2, Table 1 Catches of Celtic Sea Herring, 1951-76.

	Belgium	Bulgaria	France	German Dem. Rep.	Germany Fed. Rep.	Ireland	Nether-lands	Poland	United Kingdom	USSR	Total
1951	534	-	1 001	-	-	600	-	-	888	-	3 023
1952	1 792	-	762	-	-	845	-	-	681	-	4 080
1953	502	-	1 697	-	-	693	-	-	883	-	3 775
1954	2 251	-	14	-	-	1 386	-	-	1 287	-	4 938
1955	4 230	-	21	-	-	1 619	-	-	1 789	-	7 659
1956	2 539	-	226	-	-	3 348	-	-	2 289	-	8 402
1957	1 256	-	397	-	949	6 116	4 047	-	881	-	13 646
1958	708	-	967	-	11 743	7 869	5 813	77	1 922	-	29 099
1959	98	-	1 717	-	9 243	10 132	3 720	124	770	-	25 809
1960	-	-	1 083	-	60	14 935	1 463	-	73	-	17 614
1961	128	-	3 995	-	785	5 876	3 449	96	2	-	14 331
1962	249	-	7 755	-	475	4 502	4 154	56	-	-	17 191
1963	7	-	6 081	-	251	4 405	4 154	-	340	-	21 102
1964	-	-	4 894	-	-	3 375	10 018	-	744	-	15 141
1965	-	-	1 742	-	353	3 980	6 128	-	1 054	-	14 327
1966	-	-	5 506	-	1 143	6 891	7 198	-	197	-	31 454
1967	-	-	3 825	-	1 910	11 133	13 184	112	398	-	29 750
1968	-	-	2 637	-	1 662	9 480	15 679	300	598	-	30 186
1969	-	-	7 038	-	5 906	18 712	16 256	252	-	-	48 164
1970	-	-	3 629	-	1 481	24 702	7 015	1 191	220	-	38 236
1971	-	-	3 393	-	974	12 602	9 672	881	65	-	27 587
1972	-	-	7 327	-	393	20 109	6 758	751	-	618	35 956
1973	-	-	5 553	7	294	13 105	5 834	1 125	-	334	26 375
1974	-	-	2 261	-	433	13 991	2 105	954	-	-	19 744
1975*	-	-	1 924	-	361	8 430	2 825	512	24	1 054	15 130
1976*	-	-	2 157	147	28	3 705	1 627	324	-	826	8 817

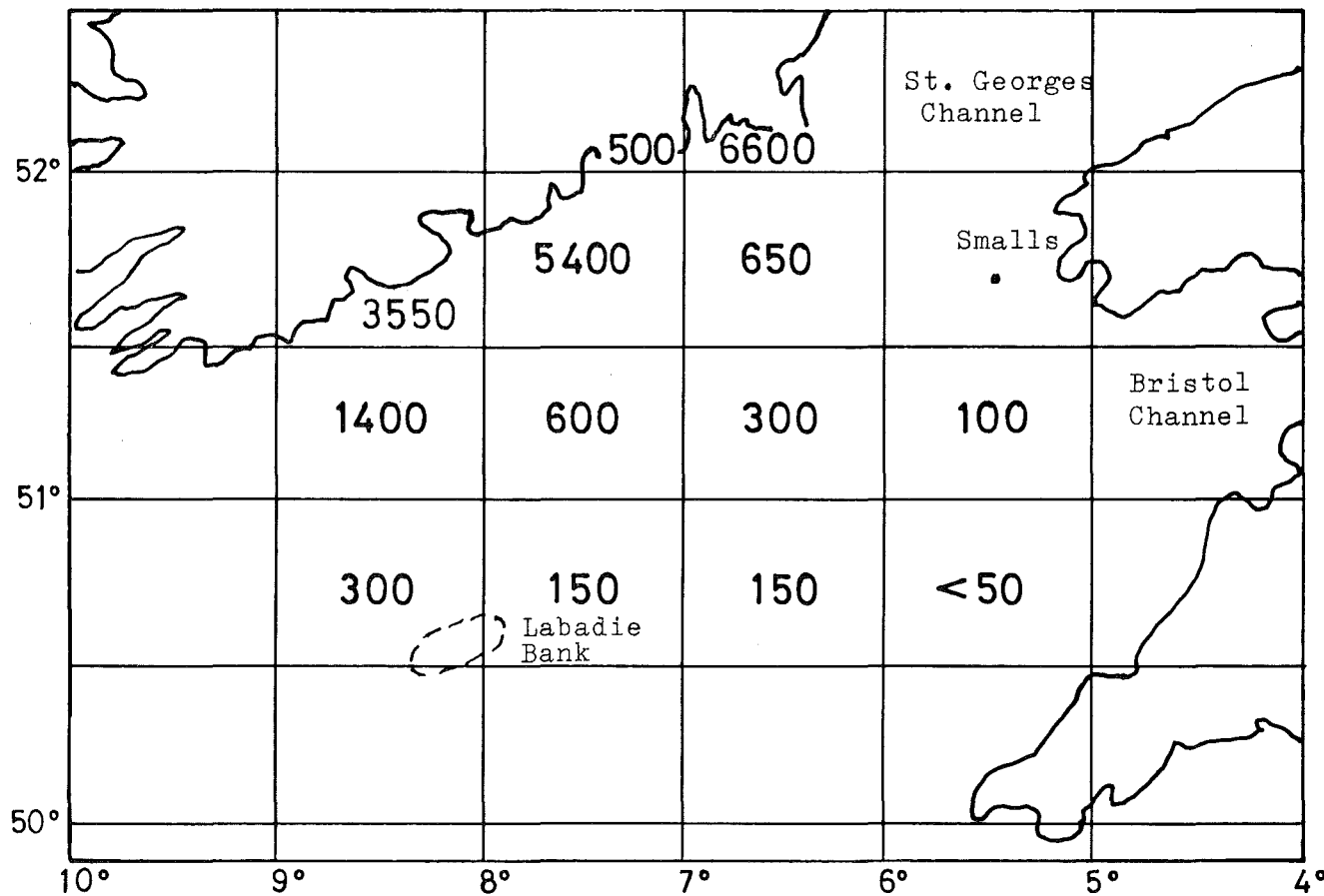
* Provisional

Appendix 2, Figure 1 Spawning areas of Celtic Sea Herring and locations mentioned in the text.





App.2, Fig.2 Celtic Sea. Distribution of German (F.R.), Dutch and Irish catches in 1970.



App.2, Fig.3 Celtic Sea. Distribution of German (F.R.). Dutch and Irish catches in 1973.

DIVISION VIa HERRINGDistribution in relation to zones of extended fisheries jurisdiction1. General biology1.1. Spawning areas and times, larval and drift

The herring population in this area, to the west of the British Isles, has, since the immediate post-war period, been predominantly composed of autumn-spawning fish. Apart from a small fishery in the Firth of Clyde, which is exclusively within UK territorial waters, there are now no fisheries in this region directed specifically at spring-spawning stocks. Accordingly, the Firth of Clyde fishery, with an average annual total yield of about 4 000 tons, has been controlled by UK national measures; management of the fisheries exploiting the herring population in the remainder of Division VIa has been based on the assumption that this can be considered as a management unit and has been done under the auspices of NEAFC. The information given below refers only to the latter population.

The spawning areas, as delineated by surveys for early larvae, are shown in Figure 1. Spawning of these autumn-spawning fish takes place from mid-August to mid-October, the peak tending to be earlier in the more northerly areas and later in the more southerly ones.

The drift of the larvae from these spawning grounds is not known in detail. There are indications that most of the larvae hatched on the grounds to the north and west of the Outer Hebrides are drifted along the north coast of Scotland and into the North Sea. There is little information on the drift from the spawning grounds to the north-west of Ireland, but it might be assumed that larvae spawned in this area are the main source of the juvenile herring found in the sea lochs along the west coast of Scotland.

1.2. Nursery areas

The known nursery areas for this stock would support this interpretation of larval drift. Although juvenile herring occur in the sea lochs along the west coast of Scotland, they do not appear to be sufficiently abundant there to account for the yield taken in the adult fisheries. Biometrical analysis and parasitological studies show that the juvenile herring occurring in the Moray Firth, and also perhaps in other nursery areas on the east coast of Scotland, are almost exclusively derived from, and recruit back to, the adult population in Division VIa; results from the Bløden tagging experiment show that juvenile fish which will recruit to the Division VIa population are also found, mixed with juveniles which will recruit to the North Sea stocks, over a wide area of the central North Sea and the Skagerrak. There is also a small nursery area in Bantry Bay. The distribution of the known nursery grounds for this herring population is shown in Figure 1.

1.3. Distribution and migration of adults

The return migration from the nursery areas in the North Sea takes place principally in the third year of life; but there is some evidence to suggest it may not be completed until the fish attain their fourth birthday. The majority of these herring spawn for the first time at 3 years of age, but recruitment to the spawning stock is also not complete before age 4. The fully recruited adult stock undertakes a seasonal migration from over-wintering areas in the Scottish coastal waters of the Minch, Donegal Bay and coastal waters northwest of Ireland to summer feeding grounds and spawning areas in more offshore waters. The period for

over-wintering in these coastal areas is October-March (Figure 1). Results of tagging experiments conducted in Division VIa and at Shetland suggest that there is little interchange of adult fish between these areas.

2. Exploitation and management

2.1. The total annual international catches in the period 1963-1975 taken in Division VIa (excluding the Clyde) and in that part of Division VIIb contained within Donegal Bay are as follows ('000 metric ton units):

1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
54	70	66	92	103	100	124	179	221	175	247	210	141	107

After a period of relatively stable annual catches, in the range 50-70 000 tons, in the 1950s and early 1960s, the catch increased markedly in 1966 and continued to increase in subsequent years to attain a figure of 246 000 tons in 1973. Since 1973, it has declined progressively in each year to about 107 000 tons in 1976.

2.2. The increase in catch in the period 1966-1973 can be largely accounted for by recruitment of the extremely strong 1963 year class in 1966 and by a sustained higher average level of recruitment in subsequent years. However, since 1970, the stock has also been exploited at a rate appreciably above the MSY per recruit level. The high catch levels of the 1970s are not therefore sustainable even on the assumption that the high level of recruitment of the last decade will continue. Accordingly, the Liaison Committee advised NEAFC in 1974 that this herring stock was being over-exploited and recommended TACs for 1974 and 1975 which would reduce the exploitation rate to that corresponding to the MSY per recruit. NEAFC adopted TACs for this stock for 1975 and 1976, but at levels considerably in excess of those recommended and which consequently did little to reduce the exploitation rate. Additional recommendations by NEAFC which are directed specifically at this herring stock are: (1) a seasonal closure of fishing in defined spawning grounds from 15 August - 30 September (Recommendation (17)); and (2) a minimum landing size of 20 cms (Recommendation (18)).

2.3. An estimate of the long-term sustainable yield from this stock is highly dependent on the assumption made about the long-term recruitment level. At the average recruitment level prior to 1966 the annual sustainable yield, with the optimum exploitation pattern, is about 65 000 tons; at the higher recruitment level since 1966 the yield would be about 150 000 tons.

Despite Recommendation (18), the current exploitation pattern, at least up to 1976, has departed to some extent from the optimum. In particular, appreciable catches of 0-group and 1-group herring which would recruit to this stock have been taken as a by-catch of the Moray Firth sprat fishery. There must also have been very significant numbers of potential recruits to Division VIa adult stock, taken at these ages as by-catches, in other areas of the North Sea. These cannot currently be quantified because of their admixture with North Sea recruits. However, the prohibition of directed fisheries on juveniles for reduction and tighter controls on levels of by-catch since October 1975 (Recommendation 8c) should have considerably alleviated this problem.

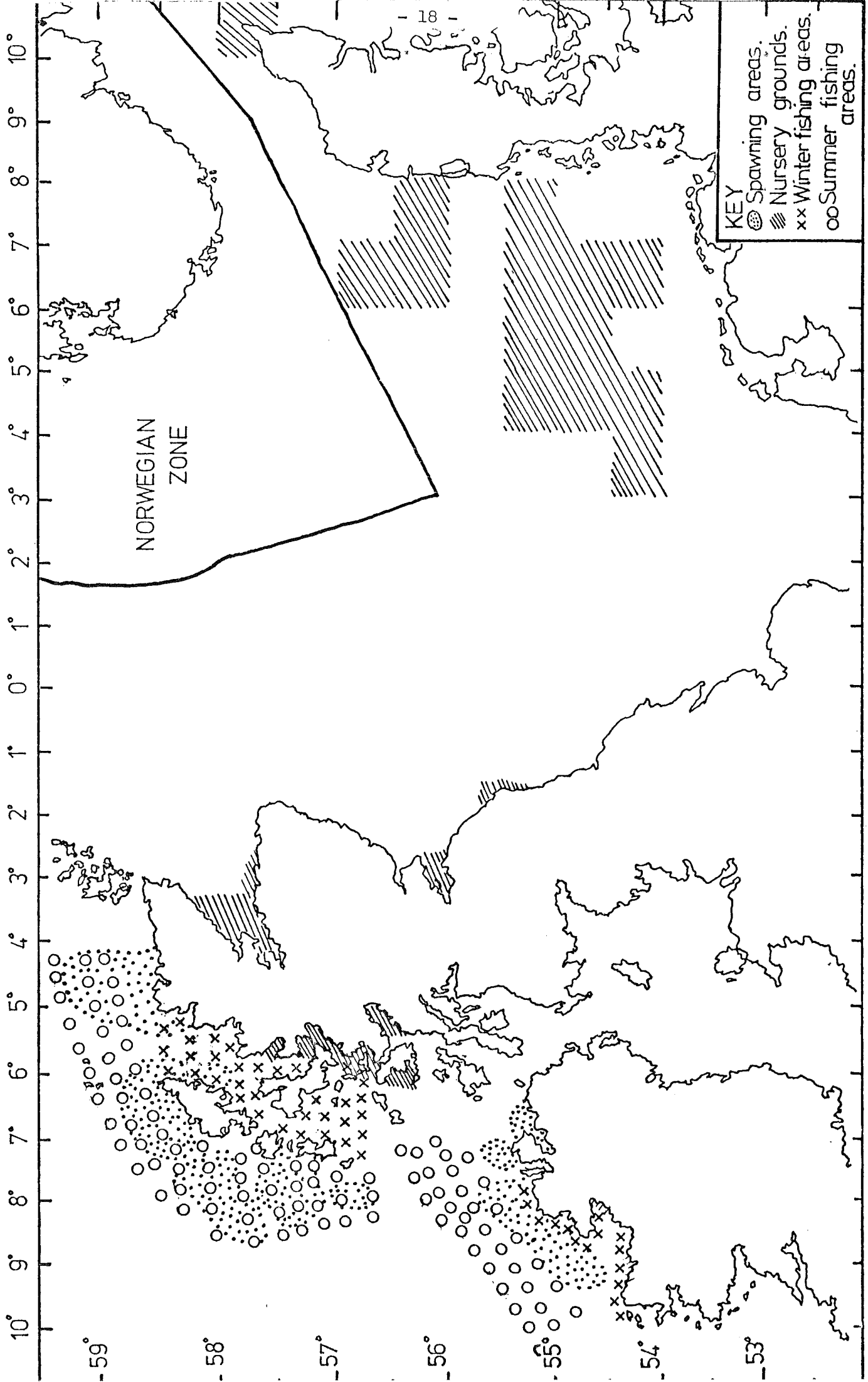
3. Geographical distribution of the fisheries

The distribution of the main fishing areas are shown in Figure 1. These are fairly clearly demarcated into two groups: (a) predominantly winter fisheries, close to the coasts of Scotland and north-west Ireland, fished by the UK and Ireland respectively; (b) predominantly summer fisheries (May-October) on more

offshore grounds in which a considerable number of other countries participate. Pelagic trawl and purse-seine are the main gears now used in both the inshore and offshore fisheries.

4. Distribution of catch in relation to economic zones

The spawning areas, adult distribution, and fisheries on the VIa herring stock are entirely contained within the extended fisheries jurisdiction of the EEC. The distribution of the juvenile stages of this stock also is predominantly contained within the EEC zone, but there may be some minor extension of the nursery area for this population into the Norwegian and Swedish areas of jurisdiction in Division IIIa.



Appendix 3, Figure 1 Spawning, nursery and fishing areas of Division VIa herring.

IRISH SEA HERRINGDistribution in relation to zones of extended fisheries jurisdiction1. General biology1.1. Spawning areas and larval drift

Herring fishing in the North Irish Sea is supported by two small autumn-spawning stocks called the Manx stock and the Mourne stock. Their spawning grounds are shown in Figure 1, together with spawning times and direction of larval drift. Larval drift varies from year to year with hydrographic and meteorological conditions; the general pattern shown in Figure 1 is based on rather few surveys.

1.2. Nursery grounds

The nursery grounds usually lie entirely within the North Irish Sea. Exceptionally 0-group herrings of the Manx stock may be found in the Firth of Clyde.

1.3. Distribution and migration of adults

From May to August, pre-spawning shoals of adult fish are usually found in squares 36 E4 37 E4 and in 37 E5 west of the Isle of Man. There is some mixing of Manx and Mourne stocks in 37 E4 at this time. In August and September, Manx herrings are found south and east of the Isle of Man, and Mourne herrings near the east coast of Ireland. The Mourne herrings remain off the Irish Coast until spent. The Manx herrings are distributed fairly widely between the east coast of the Isle of Man and the west coast of England from September to November, but most of them are near the coast of the Isle of Man (Figure 2).

Winter distributions of the adults of both stocks are imperfectly known; it is unlikely that they are exploited outside the Irish Sea. 0- and 1-group herrings are widely distributed in the North Irish Sea in winter.

2. Exploitation and management2.1. Manx stock2.1.1. Exploitation

Between 1948 and 1962, catches varied between 4 000 and 8 000 tons per year. Biomass of the exploited stock fluctuated between 13 000 and 31 000 tons. In 1963 and 1964, recruitment was poor and catches were low. Trends since 1965 may be seen in Figure 3 which gives biomass and catch of the exploited stock, fishing effort and fishing mortality. Up to 1964, drifters and ringnetters took most of the catch; from 1965 onwards, trawling increased in importance, and by 1970, trawlers accounted for over 90% of the catch. Effort and fishing mortality were high in 1971, 1972, 1974 and 1975.

2.1.2. Management

On a UK national basis, herring fishing within 12 miles of the Isle of Man coast was prohibited for 6 weeks from 1 October in 1973. This measure has been repeated in each subsequent year in an attempt to reduce effort at a time when fish congregating for spawning are highly vulnerable to trawling. In 1973, this action had the effect of reducing effort and fishing mortality by about 21% from the

previous high level (Figure 3). In 1974, however, effort, catch and fishing mortality rose sharply to the highest recorded levels. Consequently, a TAC of 18 000 tons was set for UK fishermen in 1975; although the TAC recommended by fishery scientists was 12 000 tons (ICES C.M.1975/H:40). The actual UK catch was 18 244 tons, that by other nations 6 259 tons, giving a total catch of 24 503 tons.

The 1976 TAC was set at 12 000 tons for UK; provisional figures give the UK catch as 16 401 and that of other countries as 5 501 tons, resulting in a total of 21 902 tons.

2.2. Mourne stock

2.2.1. Exploitation

Prior to 1969, the yield of the Mourne Fishery varied between about 500 and 1 500 tons. It was essentially a local fishery exploiting herring aged 2 rings and over by drift net and ring net. Trawling has displaced ring netting in recent years. An industrial fishery started in 1969 and small herring (0- and 1-) group became an important part of the catch. Such relevant data as are available are shown in Figure 4. This is a small stock on which fishing mortality has been heavy since 1971.

2.2.2. Management

Conservation measures, consisting of a closure of the fishery on the spawning grounds for two weeks in October each year, from 1973, and a $3\frac{1}{2}$ -day working week introduced in 1974 for the adult fishery, have been ineffective in reducing the fishing mortality on the Mourne stock. No restrictions have been enforced on the industrial fishery despite Recommendation 8(C) which became effective in October 1975.

3. Geographical distribution of the fishery

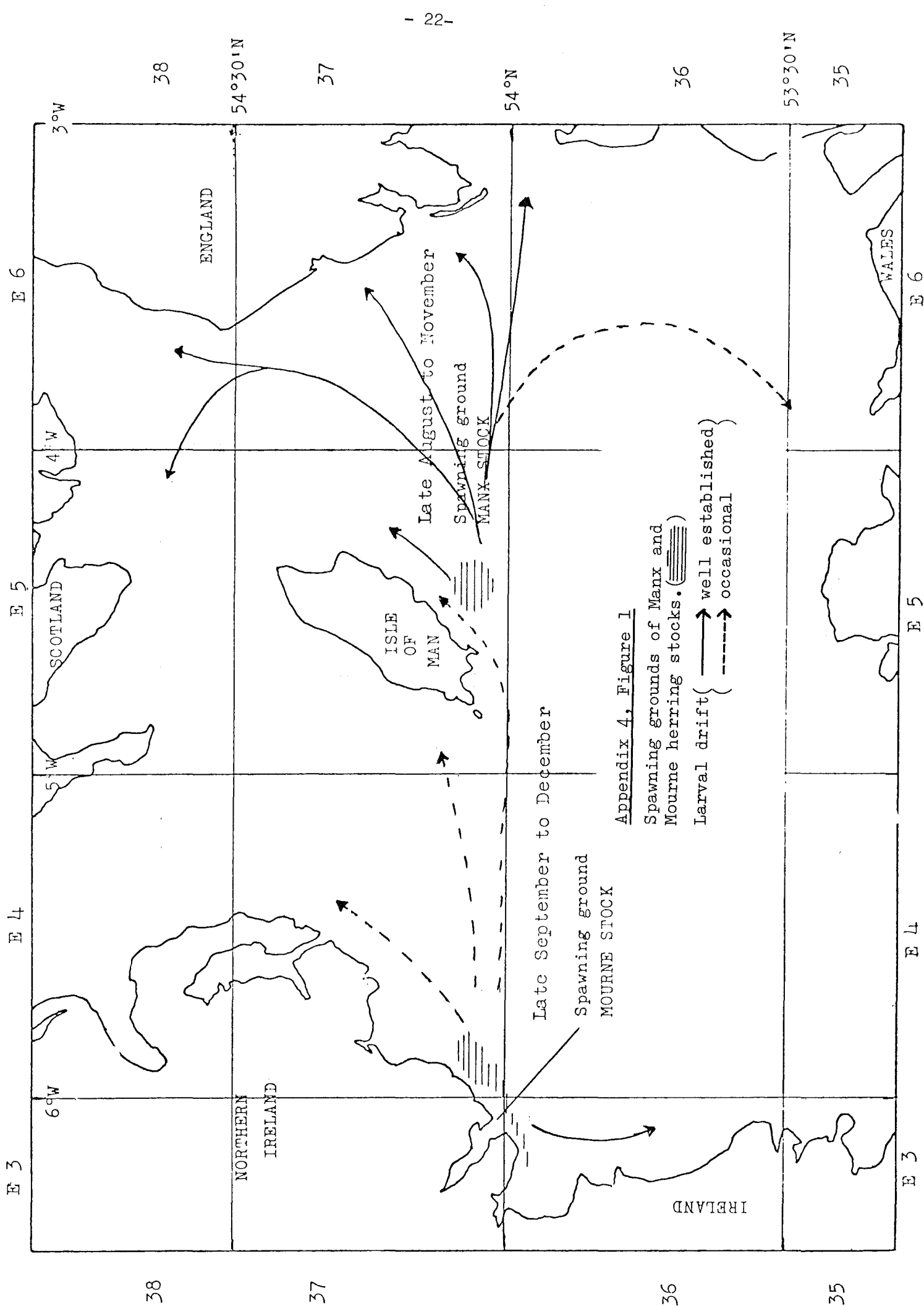
The fishery in the North Irish Sea is confined to the area bounded by the coasts of England, Scotland and Ireland between $53^{\circ} 30'N$ and $55^{\circ}N$. The Isle of Man lies approximately in the centre of this area. Nearly all the catch is taken in statistical squares 36 E4, E5, E6 and 37 E4, E5, E6. This fishery is entirely within the zone of the EEC and its associates.

Table 1 gives the proportion of the catch taken by vessels of different countries for the area of the fishery as a whole for the periods 1965-69, 1970-74 and in 1975-76.

Appendix 4, Table 1 North Irish Sea.

Catch of Herring (tons) and percentage of total catch by countries in different periods.

	1965-69		1970-74		1975-76	
	Tons	%	Tons	%	Tons	%
France	nil	0	7 054	5.1	1 320	2.9
Ireland	2 584	7.0	19 101	13.9	8 675	18.7
Nether-lands	nil	0	1 259	0.9	1 619	3.5
United Kingdom	34 159	93.0	109 186	79.4	34 645	74.9
USSR	nil	0	945	0.7	26	0.1
Total	36 743		137 545		46 285	
Mean annual catch	7 348		27 509		23 142	



E 3

E 4

E 5

E 6

38

38

37

37

36

36

35

35

6°W

5°W

4°W

3°W

NORTHERN
IRELAND

ISLE
OF
MAN

ENGLAND

WALES

Late September to December

Spawning ground
MOURNE STOCK

Late August to November

Spawning ground
MANX STOCK

Appendix 4. Figure 1

Spawning grounds of Manx and
Mourne herring stocks. (▨)

Larval drift (———→ well established)
 (- - - - -→ occasional)

121

54°30'N

54°N

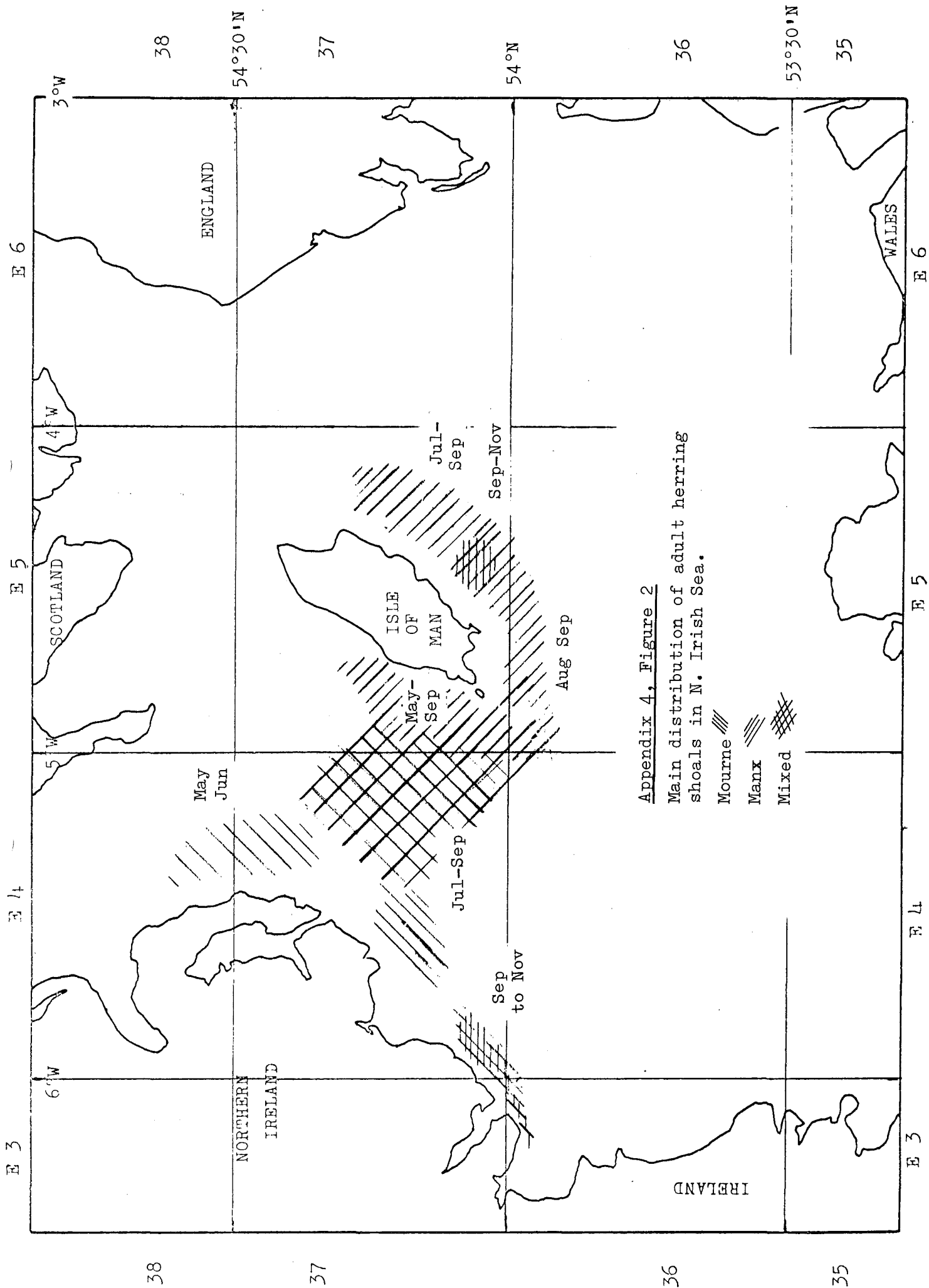
53°30'N

E 3

E 4

E 5

E 6

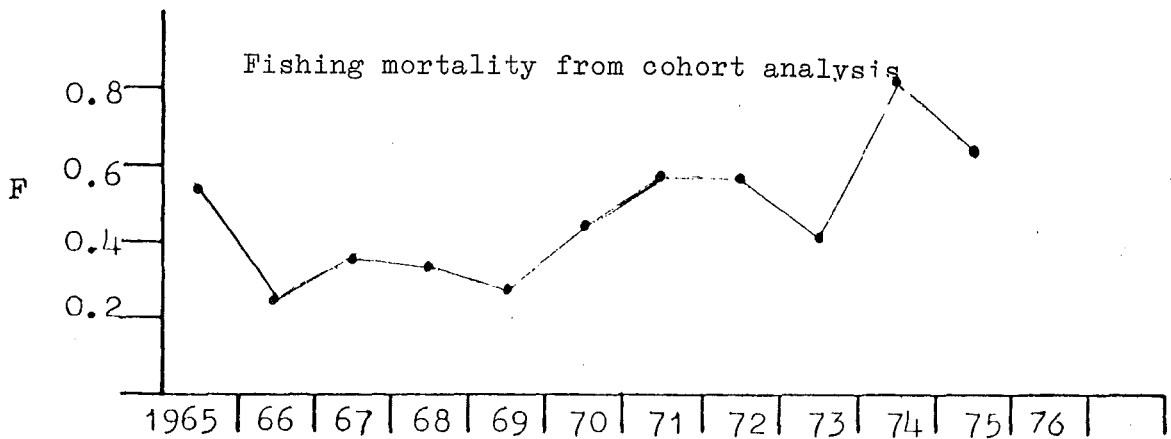
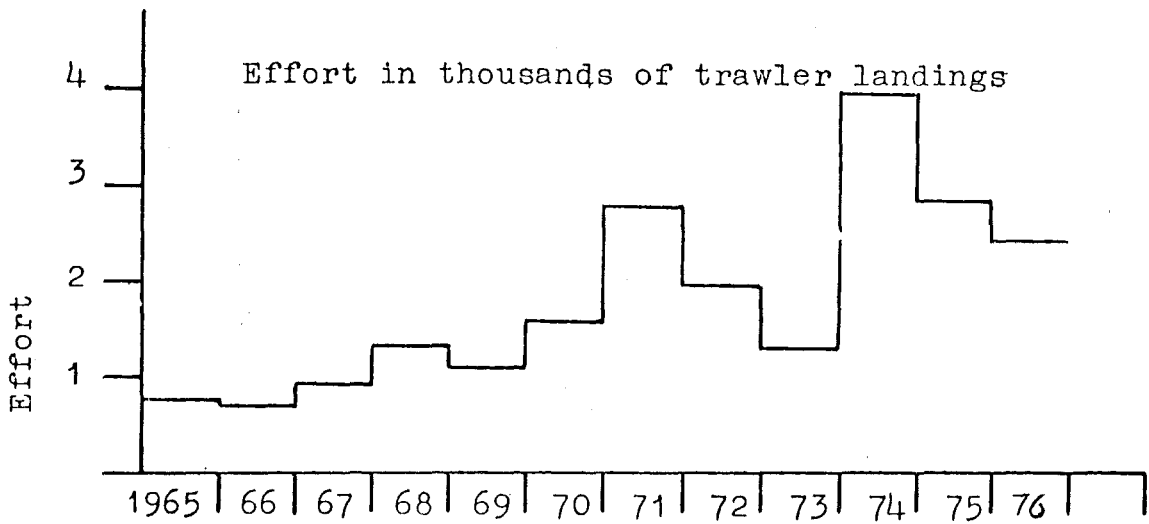
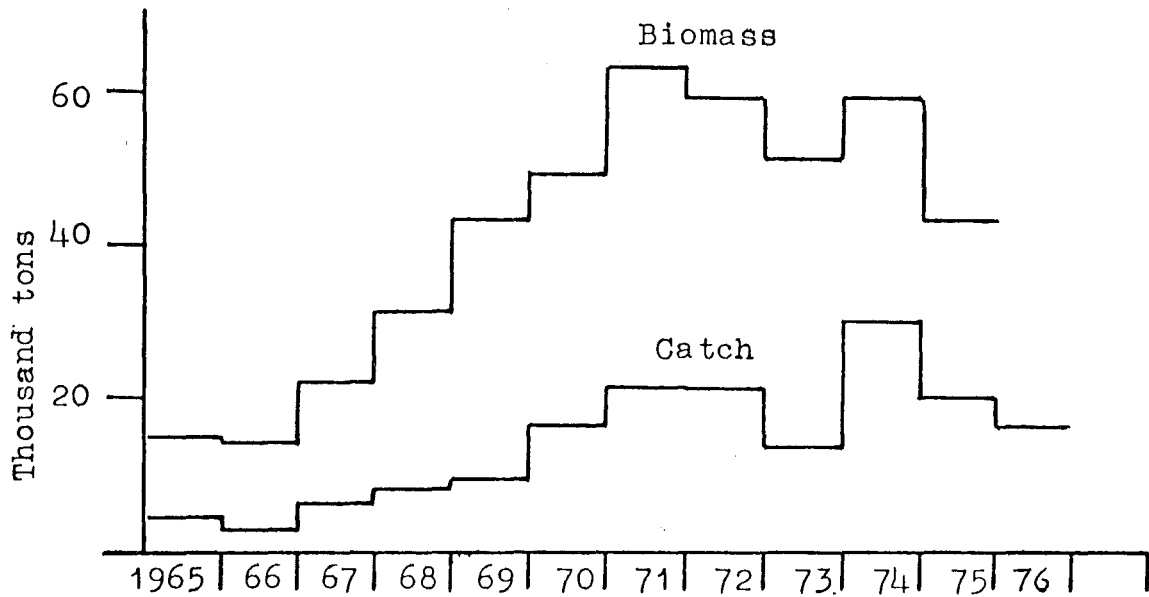


Appendix 4, Figure 2

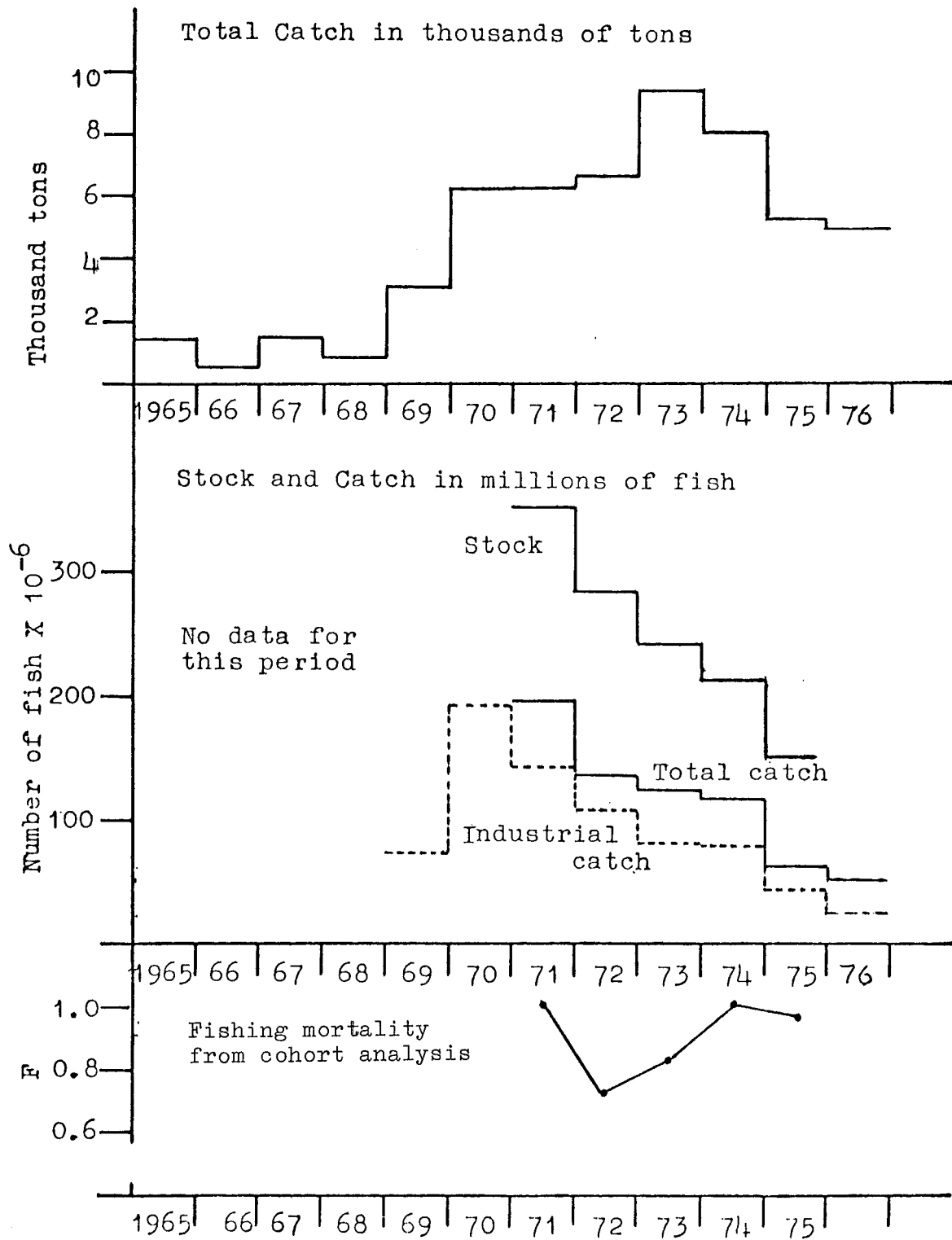
Main distribution of adult herring shoals in N. Irish Sea.

- Mourne
- Manx
- Mixed

Biomass and Catch in thousands of tons



Appendix 4, Figure 3 Division VIIa Irish Sea Herring.
Manx stock. - Biomass, catch, effort and
fishing mortality 1965-75.



Appendix 4, Figure 4. Division VIIa Irish Sea Herring. Mourne stock. Catch by weight and number, stock size and fishing mortality.

NORTH SEA SPRAT

Distribution in relation to zones of extended fisheries jurisdiction

1. General biology

1.1. Spawning areas and times, larval drift

The most important areas of sprat egg and larval distribution so far established, south of 62°N, are shown in Figure 1, together with an approximate boundary for the limits of spawning. Within this area as a whole, eggs and larvae have been recorded in most months of the year; although peak spawning times do vary in different parts of it. These are earliest in the southern and central North Sea (April - June), and later in Scottish waters (May - July). Little is known about larval drift. Localised concentrations of post-larvae are found in coastal waters and estuaries of Scotland, England and the continental coast, but sprats at this stage of the life-cycle can also be found over large areas of the open sea.

1.2. Nursery areas

There are no clearly defined nursery areas for North Sea sprat. Although 0-group fish may be found in coastal waters in considerable abundance, they also show a widespread distribution in the open sea. Their abundance and pattern of distribution varies considerably from year to year.

1.3. Distribution and migration of adults

The area shown in Figure 1 can also be used to illustrate the distribution of adult fish during the spawning season. The migrations of these fish are not known in any detail, except that during the winter months, shoals aggregate into localised concentrations in coastal waters and further offshore, particularly in the western half of the North Sea. These are not spawning or feeding aggregations. These concentrations disperse in March as the mature fish move offshore for spawning and feeding. In summer, inshore surveys in UK coastal waters have shown that most of the population remaining there are immature fish.

2. Exploitation and management

The North Sea sprat has been exploited, on a small scale, in localised coastal fisheries for several hundred years. In the period 1903-1960, total annual catches, recorded in "Bulletin Statistique", only twice (1929 and 1959) exceeded 30 000 tons. In the 1960s, catches increased substantially, exceeding 100 000 tons in 1966. From 1971, there has been a marked, continuous increase in catch, culminating in a figure of 641 000 tons in 1975. Provisional statistics for 1976 show a slight reduction to 617 000 tons.

The first attempt to assess North Sea sprat was made by an ICES Assessment Working Group in February 1975. It was then recommended that, in view of the large increase in catches that had taken place over the previous 3 years, a precautionary TAC of 300 000 tons should be set for the North Sea (excluding the Norwegian fjord fisheries) in 1976. This approximated to the level of catch taken in 1974. This recommendation was not implemented and the total catch of North Sea sprat increased to 641 000 tons in 1975. A TAC of 650 000 tons was then recommended by the Liaison Committee, and implemented by NEAFC for 1976. Provisional figures suggest that 617 000 tons was in fact taken in that year.

The Liaison Committee in 1976 recommended a TAC for 1977 of 400 000 tons, based on the predicted long-term equilibrium catch. No agreement has yet been reached on the implementation of this recommendation.

3. Geographical distribution of the fisheries

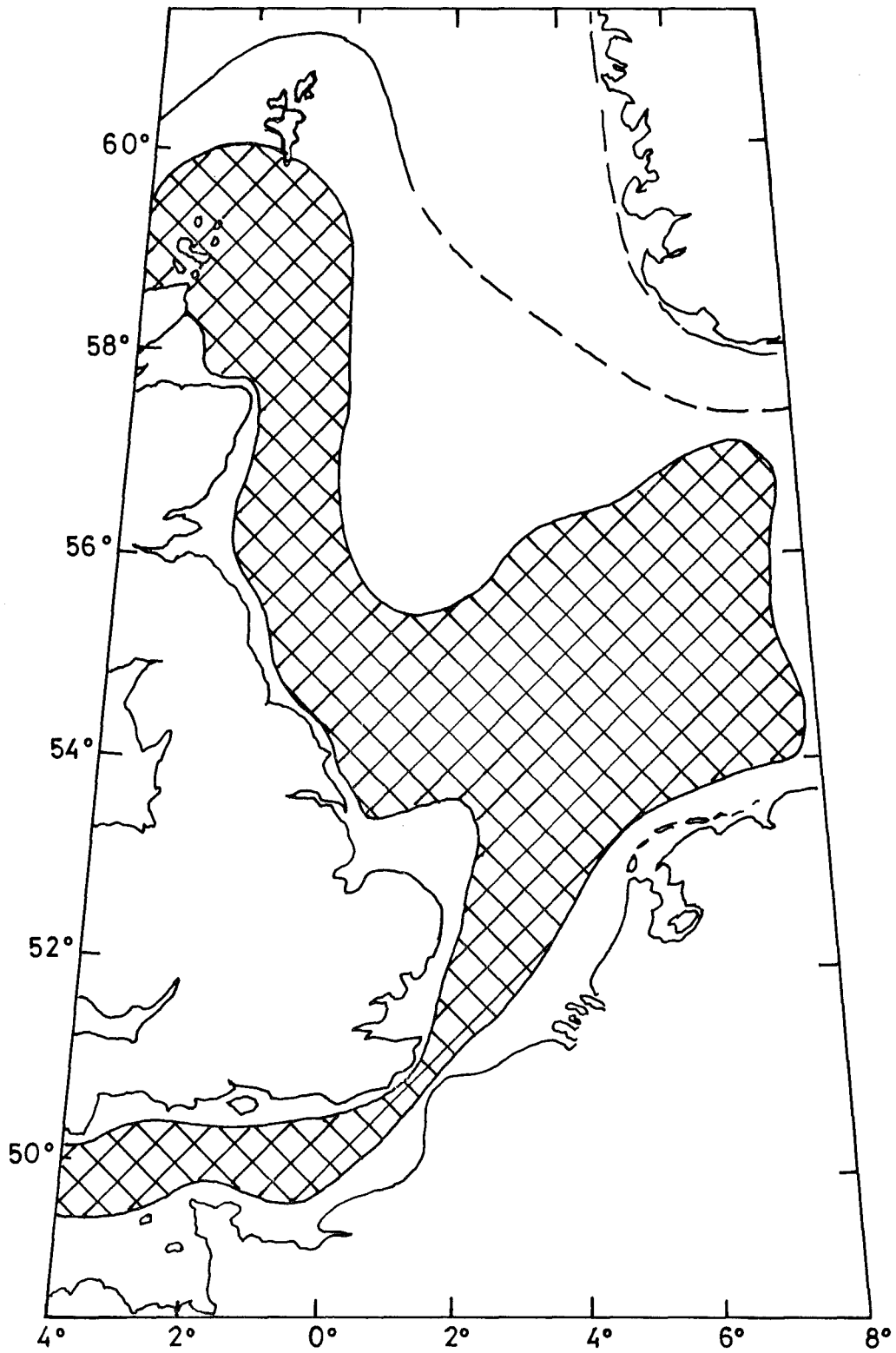
The distribution of the main fishing areas in the years 1974-76 are shown in Figure 2. Most of the fishing effort has been concentrated in the central North Sea between 53° and 57°N; mainly in the months July-November to the east of 3°E, and December-March to the west of this line. A more recent development has been a fishery on the Fladen Ground (57°-59°N), where most effort has been applied in the months October-December.

Very little sprat fishing has taken place in recent years in the southern North Sea, south of 53°N.

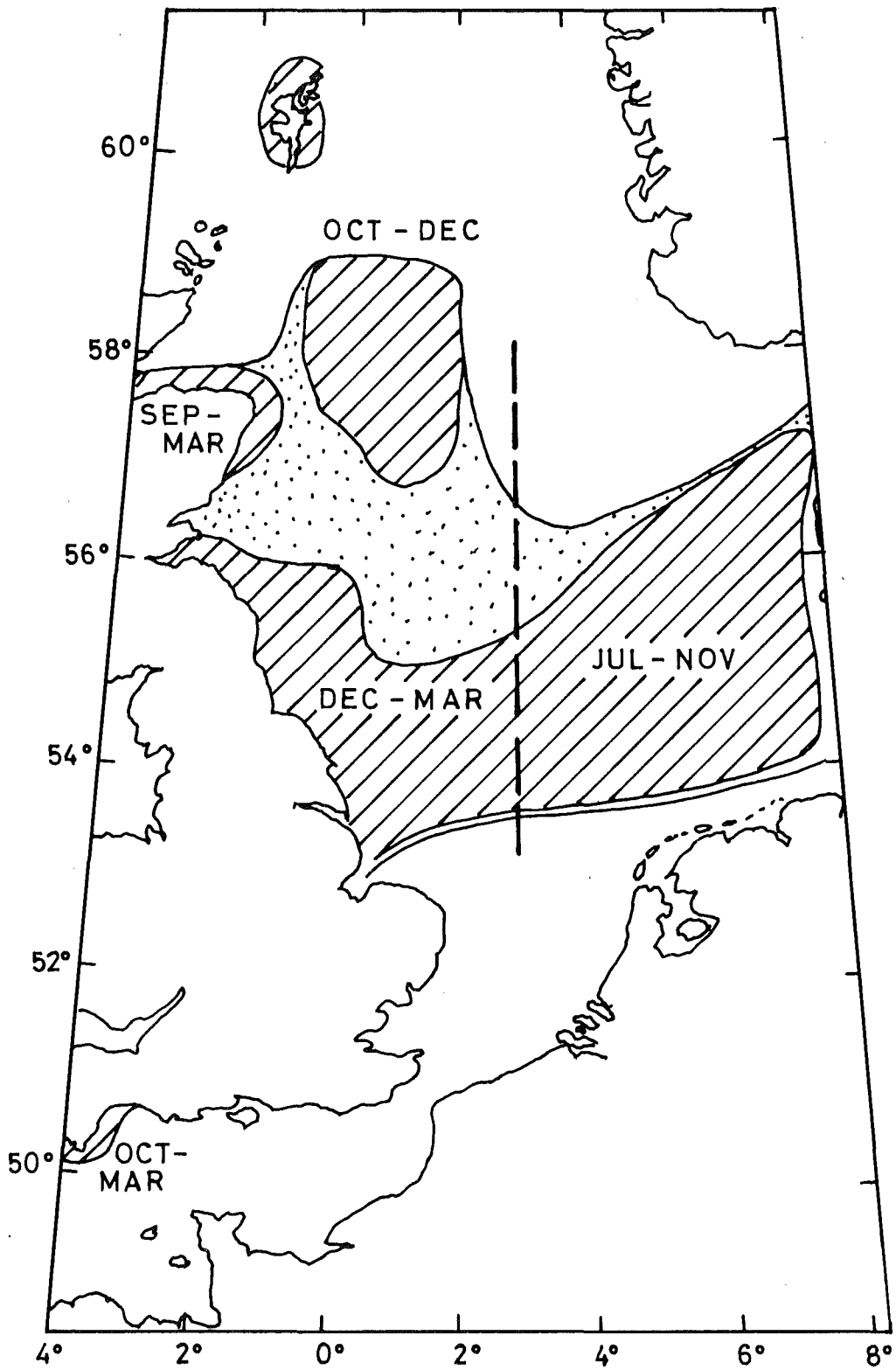
The main fishing gears used are mid-water trawls and purse-seines.

4. Distribution of catch in relation to economic zones

Over the 11-year period 1965-75, the only significant catches of sprats reported for the North Sea from outside the EEC zone are those taken in the Norwegian western coast fjords. These averaged 7 160 tons per year over this period; but are considered to be taken from the Skagerrak stock which is treated as a separate management unit. However, in 1976, approximately 4 500 tons were taken from the North Sea stock from within the Norwegian economic zone.



Appendix 5, Figure 1. North Sea Sprat.
Main areas of egg and larval
distribution.



Appendix 5, Figure 2. North Sea Sprat.
Main areas of fishing 1974-76.

SKAGERRAK, KATTEGAT AND NORWEGIAN FJORD SPRAT

Distribution in relation to zones of extended fisheries jurisdiction

1. General biology

1.1. Spawning areas and times, larval drift

The main spawning area in the region is located between the northern point of Jutland and the Swedish coast (Figure 1). It typically has a sharp northern boundary. Spawning also occurs on Jutland Bank in some years, but the Kattegat seems to be of little importance for spawning. There are other spawning areas of minor importance in the fjords along the Norwegian east and west coasts, in the Oslofjord, and in the Swedish archipelagoes and the Danish Limfjord and Isefjord.

Spawning starts about the end of April and lasts to the end of July with a peak in May and June. The eggs and larvae drift with the Baltic current eventually entering the archipelagoes and fjords along the coast of Sweden, and both east and west coasts of Norway. Current vortices in the Skagerrak carry many larvae back to their point of origin. Most of the sprat population in the Norwegian west coast fjords probably originate from larvae drifted from the Skagerrak and very few from local spawning within the fjords.

1.2. Nursery areas

0-group sprat are found in the fjords and archipelagoes of Norway and Sweden, but they have a wide distribution also in the open sea. The 1-group and older sprat remain within the Norwegian fjords, probably for their whole lives, whereas in the Swedish archipelago there is a seasonal migration to and from the coast.

1.3. Distribution and migration of adults

Figure 2 shows the distribution of adult sprat. In the Skagerrak and Kattegat, there is a migration in spring to the main spawning area shown in Figure 1, and thereafter dispersal over the whole region. During autumn, concentrations are formed in the coastal areas and archipelagoes along the Swedish and east Norwegian coasts. Along the Norwegian west coast, the adult fish appear to stay within the fjord system spawning where conditions are suitable.

2. Exploitation and management

For stock assessment purposes, the sprat in the Kattegat, Skagerrak and the Norwegian west coast fjords are considered as a single unit. Although the origin of the sprat in the Norwegian fjord north of 62°N and their relationship to the Skagerrak spawning stock is uncertain, it seems rational to consider them together for management purposes. Within the total area of distribution, there are local populations inside the skerries with different growth rates and age of spawning. They are, however, small and of negligible importance in relation to the main population.

The mean age of sprats in the catches in the Skagerrak and Kattegat remained very stable until pelagic trawls were introduced in the 1950s.

Although no detailed numerical assessments of this sprat stock have yet been possible, the Herring Assessment Working Group considered in 1976 that any further increase in fishing effort might reduce recruitment and recommended a TAC of 100 000 tonnes for 1977 for Division IIIa and the Norwegian fjords in Division IVa combined. At its 1977 meeting, this recommendation was revised to 80 000 tonnes for both 1977 and 1978.

3. Geographical distribution of the fisheries

Fisheries for sprat in this area are carried out by three countries. The landings from 1966-76 are tabulated in Table 1.

- a) A Danish trawl fishery throughout the year for industrial purposes mostly in the Kattegat;
- b) A Swedish trawl fishery in the Kattegat from October-March for canning purposes, continuing with purse-seines in the archipelagoes of the Skagerrak;
- c) A Norwegian purse-seine fishery in the west coast fjords from June-October for canning purposes. A northward shift in this fishery has taken place in the last 6-8 years. This fishery is almost entirely dependent on 1-group sprats.

4. Distribution of catch in relation to economic zones

Only Norway has hitherto declared an economic zone in the Skagerrak.

The fishery for sprat during the last decade has been located in the following way:

Norway almost totally within its economic zone close to the coast or within the fjords.

Denmark trawl fishery in the eastern Skagerrak and in the Kattegat.

Sweden purse seine fishery in the eastern Skagerrak, mainly close to the Swedish coast, and trawl fisheries in the Kattegat area.

Appendix 6, Table 1. Sprat. Landings in thousand tons 1966-76,
Division IIIa.

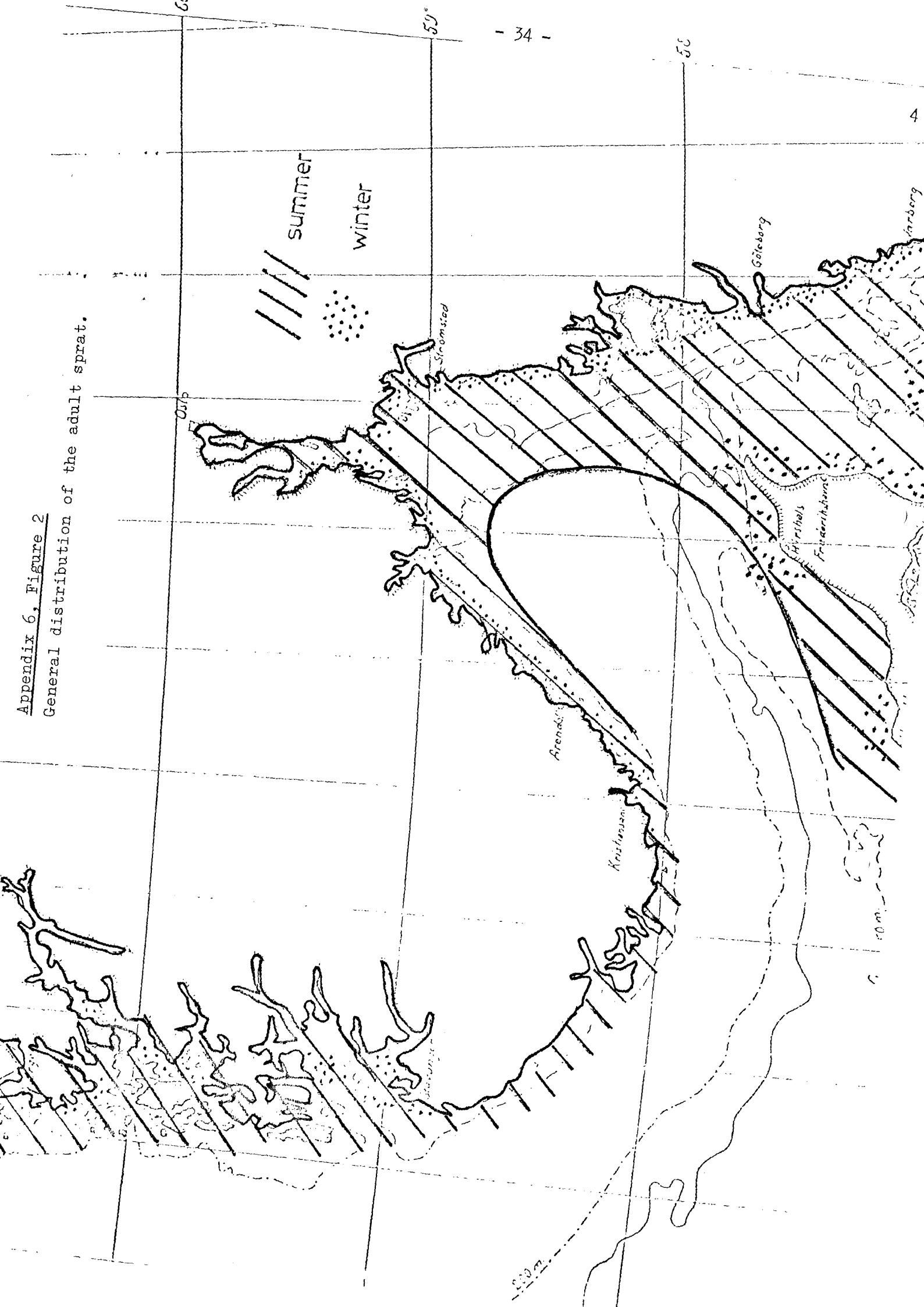
Year	Skagerrak			Kattegat	
	Denmark	Sweden	Norway	Denmark	Sweden
1966	2.1	2.0	1.0	2.5	2.3
1967	2.1	2.0	3.3	3.6	1.9
1968	0.5	3.1	2.1	2.6	1.5
1969	0.8	1.9	1.7	0.8	1.6
1970	1.1	2.4	2.4	3.1	6.0
1971	0.7	2.4	2.9	1.5	9.6
1972	0.8	3.3	2.4	1.4	17.9
1973	19.4	2.5	3.2	19.3	16.2
1974	17.3	2.0	1.4	31.6	18.6
1975	12.9	2.1	2.1	60.7	20.9
1976	12.8	2.6	0.8	27.9	12.6

Division IVa east. Norway, west coast fjords.

Year	Norway
1966	10.7
1967	10.2
1968	6.4
1969	11.8
1970	6.4
1971	4.4
1972	6.9
1973	8.8
1974	3.3
1975	2.4
1976	1.8

Appendix 6, Figure 2

General distribution of the adult sprat.



THE HERRING IN DIVISION IIIa SKAGERRAK1. The various stocks in the Skagerrak

1.1. Skagerrak is frequented by a number of herring stocks. Three stocks are known to spawn in the area, two of which are of only minor importance. For some stocks, the Skagerrak is an important nursery area. The Skagerrak is also part of the seasonal migration route of adult herring from the North Sea, the Kattegat and the Baltic. The adult herring fisheries in the Skagerrak are mainly based on these seasonal visitors. The young herring fisheries in the Skagerrak were to a large extent based in earlier years on recruits to the North Sea herring. In more recent years, the other stocks have constituted a major part of these catches of juveniles. The occurrence of the various stocks in the Skagerrak and their contribution to the fisheries in the area, are discussed in paragraph 1.2-1.5.

1.2. North Sea herring

In the 1950s and 1960s, overwintering herring of North Sea autumn spawners (Bank and Buchan Shetland spawners) played a major role in the Skagerrak fishery for adult herring. These herring concentrated in the area of the Egersund Bank from about October to March and penetrated into the western-most Skagerrak. In periods of high abundance, the over-wintering shoals of North Sea herring even reached inside the Swedish skerries. The famous "Swedish Herring Periods" are explained in this way. At the present low level of abundance of the North Sea adult herring, they are of negligible importance to the Skagerrak fishery.

Larvae from the northern North Sea, and perhaps even from the areas northwest of Scotland, drift into Skagerrak. Progeny of these stocks, in their first year of life, are found after metamorphosis in inshore waters in summer. Subsequently, they migrate into deeper water. These young herring seem to leave the Skagerrak in the following spring, i.e., at approximately $1\frac{1}{2}$ - $1\frac{3}{4}$ years of age. These juveniles derived from North Sea spawners are very often mixed, in this area, with progeny of spring spawners from both the Skagerrak and Kattegat.

1.3. Kobberground autumn spawners

This herring stock is now almost extinct. The herring used to spawn from the end of September until November on banks in the western part of the Kattegat. It migrated from the North Sea, through the Skagerrak, on its way to and back from the spawning area. In winter, it probably joined the over-wintering North Sea herring in the Egersund area. The Kobberground stock declined in the late 1960s, probably related to the heavy exploitation of over-wintering North Sea herring in the eastern North Sea and Skagerrak.

1.4. Skagerrak spring spawners

Spring spawners are found along the Norwegian southeast coast, in the Oslo fjord, and the Swedish west coast. They spawn in February-March. In addition, there is another group spawning along the Swedish coast in April-May, probably of the same origin as spring spawners from the Kattegat and the Belt Sea. A third spawning group in the Skagerrak is the so-called Jammer Bay spring spawners. Insufficient is known about these three local spring-spawning groups in relation to their life-cycle and their importance for the juvenile and adult fisheries in the Skagerrak.

1.5. Other herring stocks

Several other stocks spawning outside the Skagerrak spend part of their feeding or over-wintering periods in the Skagerrak. The more important of these stocks are:

1. Kattegat spring-spawners.
2. Spring-spawners of the western Baltic.
3. Longshore herring of the Danish west coast: (Limfjord, Nissum fjord, Ringkøbing fjord, Ho Bugt and even the river Elbe).
4. Local autumn-spawners from Kattegat.

These stocks form the main constituents of the catches of adult herring from the Skagerrak at present.

2. Exploitation

- 2.1. Total nominal catches of herring in 1966-76 are given in Table 2.1.1. The catches reached a maximum of 280 000 tons in 1967-8. A steep decline followed to about 68 - 80 000 tons in 1969-71 with a further decrease to 50 - 55 000 tons in the early 1970s. The preliminary catch figure of 17 000 tons for 1976 shows a very sharp decline in the catches, mainly due to the prohibition of the industrial fisheries (Recommendation 8C).
- 2.2. Monthly catches of the fisheries for adult herring (human consumption) are shown in Table 2.2.1. Comparing the two periods shown, it is obvious that the winter peak disappeared in recent years, and this again is primarily due to the decline of the over-wintering autumn spawning stock from the North Sea.

3. Management

For management purposes, the North Sea and Skagerrak have hitherto been regarded as one management area. As concerns restrictions on the herring fisheries in the Skagerrak under an international regime, reference should therefore be made to Appendix 1 of this report. The essential outcome of the assessment made there for the North Sea and Skagerrak stock is that, in the current depleted state of this herring population, over-wintering adult fish of the North Sea stock are too scarce in this area to provide the basis of a fishery. The catches of North Sea herring which have been taken in the Skagerrak in recent years have been very predominantly juvenile fish. The exploitation of these in the Skagerrak is likely to be reduced to a rather low level by NEAFC Recommendation 8C which prohibits a directed fishery on herring for industrial purposes.

Appendix 7, Table 2.1.1 Total herring landings in '000 tons.
Skagerrak 1966-76.

1966	144.7	1971	61.6
67	279.7	72	67.0
68	280.0	73	84.6
69	113.3	74	55.5
1970	71.1	1975	52.1
		1976	14.0

Appendix 7, Table 2.2.1 Percentage of annual catch landed
per month by the Danish human
consumption herring fishery in the
Skagerrak 1968-69 and 1975-76.

	Period 1968-1969	Period 1975-1976
Jan.	25.6	0.3
Febr.	6.2	1.6
March	5.7	1.5
April	2.7	1.3
May	1.3	3.6
June	0.9	14.4
July	12.7	43.2
Aug.	19.1	16.4
Sep.	7.1	8.1
Okt.	4.3	7.9
Nov.	7.8	1.0
Dec.	6.6	0.7

BLUE WHITING (MICROMESISTIUS POUTASSOU)

Distribution in relation to zones of extended fisheries jurisdiction

1. General biology

The blue whiting is a deep-water gadoid ranging in its distribution in the eastern Atlantic from approximately 35° - 80°N. Within this range there is as yet no clear evidence of differentiation into separate stocks, but the largest component undoubtedly occurs to the north of 50°N.

1.1. Spawning areas and larval drift

The major spawning areas as defined by the occurrence of eggs and small larvae in the plankton are shown in Figure 1. Spawning appears to begin in the south in March and progress northwards. In the main spawning area west of the British Isles, spawning lasts from March - late April with a peak in early April. Spawning north and east of the Faroe Shetland Channel probably occurs on a small scale because larvae have been found off the Norwegian coast north to about 72°N. Most of the known spawning areas are situated within the EEC zone, but spawning also takes place within the Faroese Icelandic and Spanish zones, and some may occur on a small scale in international waters. Some spawning also takes place in an area to the southwest of Iceland, as shown in Figure 1.

1.2. Nursery areas

From knowledge of current patterns, most larvae from the major spawning area probably drift northeastwards. The nursery areas for fish less than one year of age are not well-documented, but the juveniles from about one year of age make a considerable contribution to the industrial fisheries off the southwest coast of Norway and off southwest Iceland. Other sources suggest that the immatures are widely distributed around the oceanic banks, along the edge of the European continental shelf and off southern and west Iceland (Figure 1), that is in a number of national zones. Immature distribution south of 50°N is not adequately recorded.

1.3. Distribution and migration of adults

From an age of about 2-3 years onwards, the blue whiting recruit to the spawning population which undertakes an annual migration from the spawning areas west of the British Isles to feeding areas in the Norwegian Sea (Figure 2). Although a small proportion of the population remains in the south, the majority migrate north after spawning, reaching Faroe in May, the edge of the east Icelandic current in June, and subsequently dispersing widely to the east of Iceland and in the Norwegian Sea during the summer to feed. The northern and eastern limits of distribution vary according to sea temperature and in some years reach 80°N west of Spitzbergen and 35°E in the Barents Sea. In addition, part of the population finds its way into the Norwegian Deep, but no spawning has yet been recorded there. By November the fish are again concentrated off eastern Iceland and north of the Faroes. The spawning migration takes place in January and February. The seaward distribution west of the British Isles and south of Iceland is poorly defined, but echo-traces characteristic of blue whiting are recorded to at least 20°W in the area south of 60°N. There are also records of small populations in the northwest Atlantic. Migrations south of 50°N are not recorded and it is not clear what relationship the population in that area bears to the more northerly ones.

During the course of their life history, the main northerly population of blue whiting thus disperses from the EEC zone into Norwegian, Faroese and Icelandic zones, and possibly the international zone. As adults, they migrate annually from the Norwegian and Icelandic zones and the open area in the Norwegian Sea, through the Faroese zone to the EEC zone to spawn.

2. Exploitation and management

Blue whiting catch statistics are not yet recorded with sufficient consistency to tabulate landings with any accuracy. From data available to the ICES Statistician and additional data supplied by a number of scientists, blue whiting catches have been tabulated for the period 1966-76 in Table 1. Total recent landings, including landings from mixed industrial fisheries, as reported are as follows:

1970	32 900t
1971	64 800t
1972	34 400t
1973	38 000t
1974	35 600t
1975	95 600t
1976	108 300t

Without detailed reporting, it is not possible to define the fishing areas with any precision. Nevertheless, an attempt has been made to do so for 1975 and 1976 in Figure 3, excluding any exploitation in the northern parts of the Norwegian Sea and south of 50°N, for which no details are available.

Fishing in 1975-6 in the main spawning area was largely experimental and it cannot be assumed that a developed fishery will follow the same pattern. The main fishing occurred from March-May along the edge of the continental shelf west of Scotland and in May-June south of Faroe. There have for some years been important mixed industrial fisheries for Norway pout and blue whiting off the southwest coast of Norway in Division IVa and to the southwest of Iceland. For a number of years, Spanish vessels have also fished to the northwest of Spain. Finally, from 1969-71, the USSR made substantial catches to the east of Iceland.

Distribution of catches in relation to economic zones

Despite the lack of official statistics, an attempt has been made in Table 2 to allocate the reported catches in 1975 and 1976 to national zones. The main fisheries divided in this way are:

- a) the Norwegian industrial fishery in the Norwegian zone (40 - 44 000 t)
- b) the smaller Icelandic industrial fishery to the southwest of Iceland (1 - 10 000t)
- c) the multinational spawning fishery west of Scotland in the EEC zone (11 - 15 000t)
- d) the multinational post-spawning fishery south and west of Faroe in the Faroese zone (2 - 22 000t).

There is also in some years a summer fishery east of Iceland.

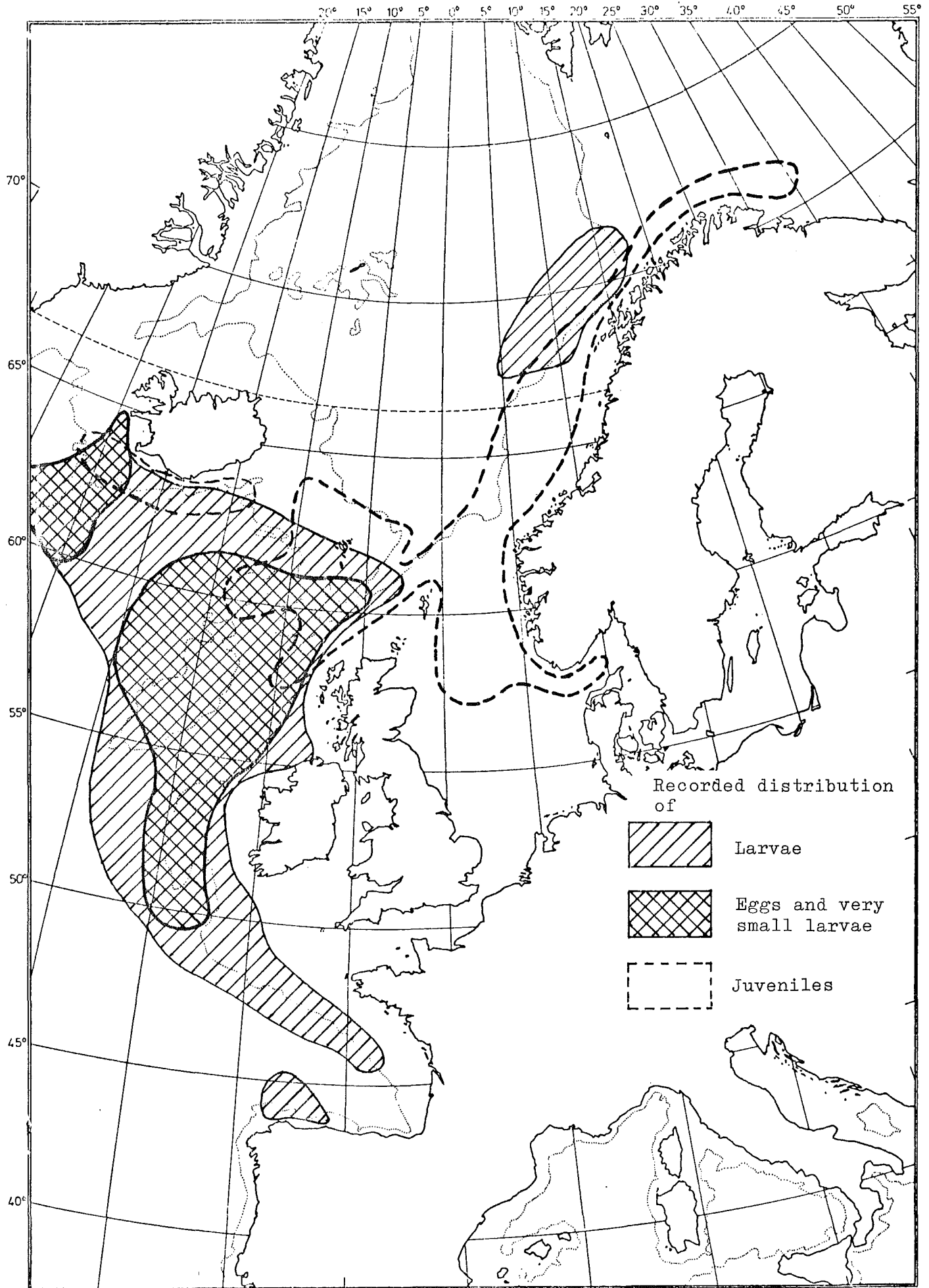
From the details of its life-history, it is clear that successful management of the blue whiting stock or stocks will ultimately depend on a high degree of international co-operation. In particular, the fact that immature fish are distributed in different zones from the adults, which themselves migrate between zones, is likely to have considerable bearing on the management of the exploitation pattern. It is clear, however, that present exploitation takes a small fraction of the maximum sustainable yield which is estimated to be at least one million tonnes from an estimated spawning stock of at least 15 million tonnes.

Appendix 8, Table 1 Landings of Blue Whiting (in thousand metric tons)
by ICES statistical areas, 1966-76.

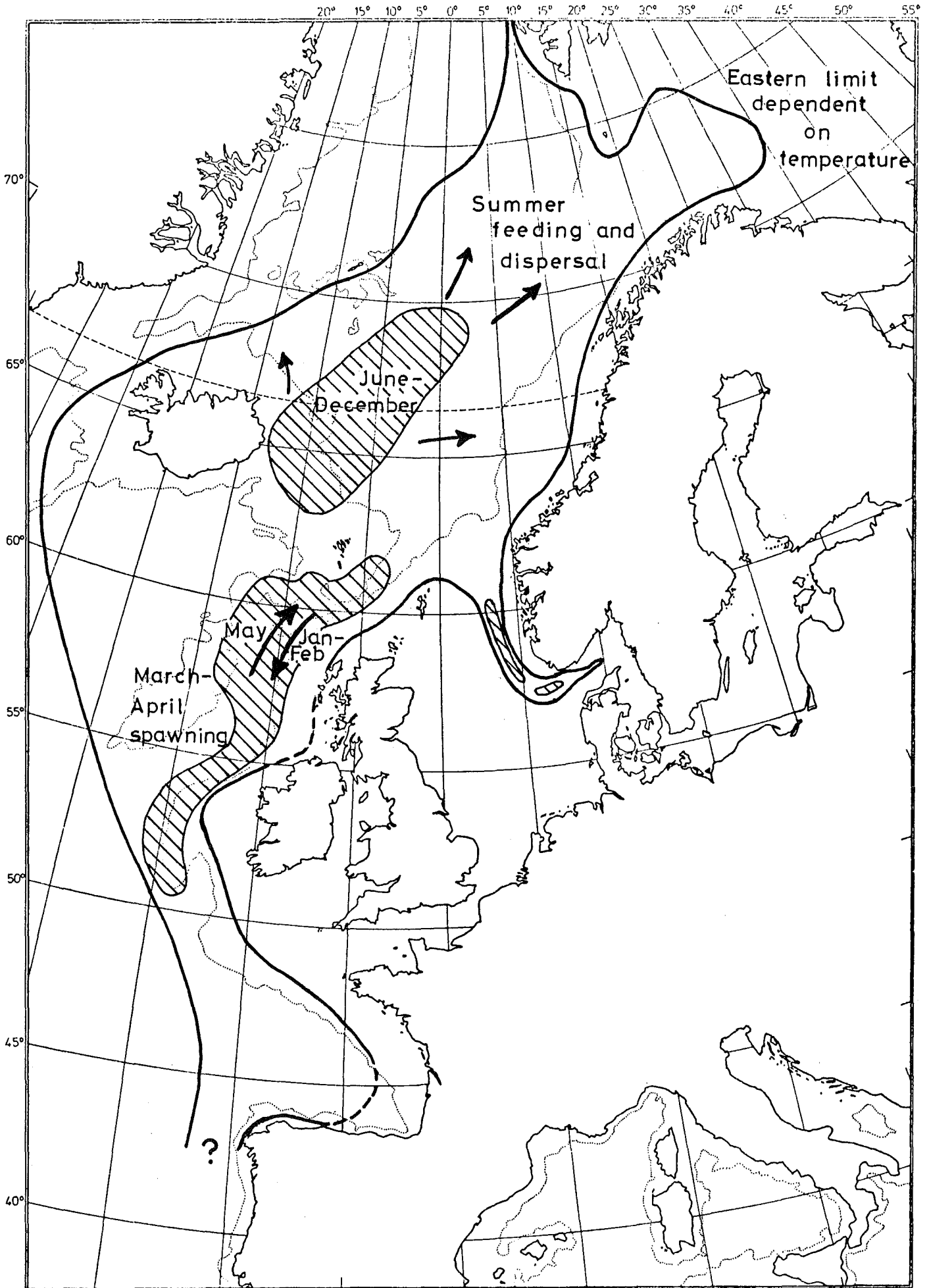
	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
I Barents Sea	-	-	-	-	+	-	-	-	-	+	+
IIa Norwegian Sea	-	-	-	10.1	14.8	31.0	+	0.9	+	7.2	2.7
IIb Near Island	-	-	-	-	-	0.4	-	+	+	2.5	+
IVa Northern North Sea	?	?	?	?	?	0.6+	0.2+	5.9+	3.1+	38.9	41.0
IVb Central North Sea	-	-	-	-	-	-	0.1	+	0.1	+	
Va Iceland	-	-	0.1	+	1.0	4.9	0.6	2.9	5.2	1.5	10.3
Vb Faroe	-	-	-	-	-	-	+	2.8	0.4	2.5	37.1
VIa West of Scotland	-	-	-	-	-	6.4	11.3	11.7	14.0	26.8	15.7
VIIb Rockall	-	-	-	-	-	+	0.3	+	+	+	+
VIII West of Ireland	-	-	-	4.2	0.4	12.0	3.9	0.8	0.7	1.2	1.0
VIII,e Channel	-	1.9	-	-	-	-	+	0.1	-	+	
VIIIg-k SW approaches	-	-	-	-	6.4	9.5	13.7	8.6	8.1	10.5	0.4
VIII Biscay	19.7	19.6	19.7	16.4	9.8	?	4.1	3.8	3.8	4.0	
IX	0.9	1.6	1.1	0.6	0.5	?	+	+	+	0.3	
X	-	-	-	-	-	-	-	0.2	-	-	
Total	20.6	23.0	20.9	31.3	32.9	64.8	34.4	38.0	35.6	95.6	108.3

Appendix 8, Table 2 Landings of Blue Whiting ('000 tons) by national zones in 1975 and 1976.

	1975	1976 (provisional)
Economic zone		
EEC	38.5	17.1
Faroe	2.5	37.1
Iceland	1.5	10.3
Norway	48.6	43.7
Spain	4.3	?

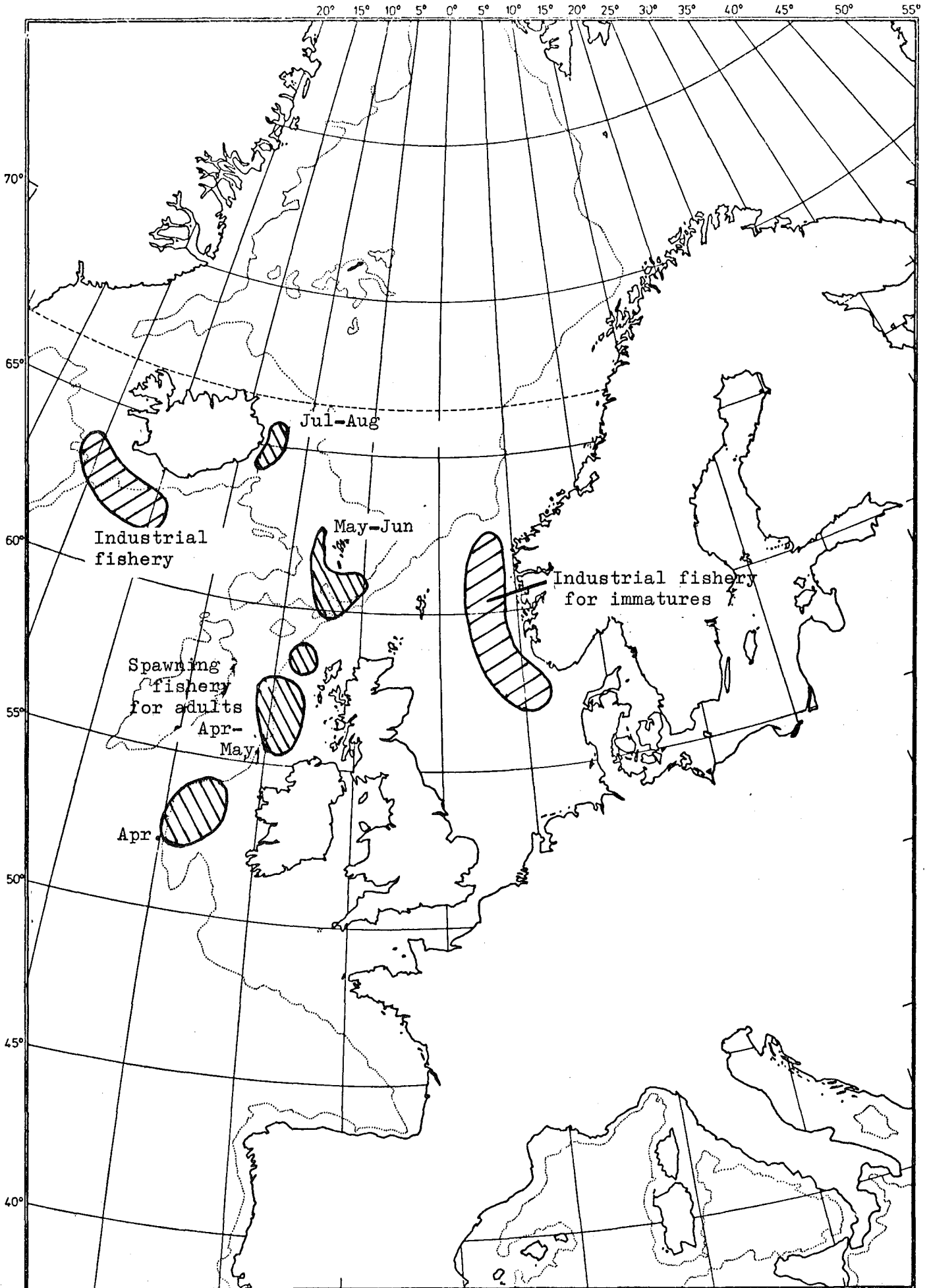


Appendix 8, Figure 1. Blue Whiting. Spawning and nursery areas.



Appendix 8, Figure 2.

Blue Whiting.
Adult distribution and migrations.



Appendix 8, Figure 3. Blue Whiting.
Fishing Areas 1975-76.

