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• International Council for the
Exploration of the Sea
• <https://doi.org/10.17895/ices.pub.9416>

C.M.1977/F:5 - APPENDIX
Demersal Fish (Northern) Committee



REVIEW OF SOME FISH RESOURCES WITHIN THE NEAFC CONVENTION AREA

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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SOLE

North Sea Sole

ICES Sub-area IV

Life history

In general all sole stocks are restricted to wide coastal areas and seldom occur at distances over 200 miles from the coast. The main component of the North-East Atlantic sole population is distributed in the North Sea south of 57°N. A smaller stock is found in the Kattegat. The North Sea sole stock consists of a number of separate spawning sub-populations which spawn in the waters close to the coasts of Denmark, Federal Republic of Germany and the Netherlands. Spawning takes place in spring, when the fish migrate to spawning grounds from the overwintering area in the central part of the southern North Sea. The various sub-stocks of North Sea sole show real migration in contrast to all other stocks in the northeastern Atlantic area and the Mediterranean, where the soles form local concentrations with random movements throughout the year. The eggs are pelagic. The young fish spend the first one or two years in the shallow water close to the coast. The main nursery ground is the Wadden Sea inside the islands bordering the Danish, German and Dutch North Sea coasts. Recruitment to the adult stock takes place when the fish are about 2 years old. From its 2nd to its 10th year the sole grows from about 20 cm to about 40 cm. The sole mature for the first time when 3 years of age. Since 1962/63 the sole has shown an increase in growth rate as well as in fecundity which up to the present has not come to a halt. This increased growth is not density-dependent, but may be caused by increased availability of food by the effect of the chains of beam trawling on the bottom.

The fishery

From 1960 to 1976 the catches were as follows (in 000's tons):

1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
19	24	27	26	11	17	32	22	29	28	20	24	21	19	18	18	14

The North Sea sole fishery is carried out by beam trawl (Belgium and the Netherlands), otter trawl (Belgium, Denmark, England, Federal Republic of Germany and the Netherlands) and by gill nets (Denmark). The stock size has fluctuated considerably due to very great variations in the strength of recruiting year classes. The total catch in the late 1960s amounted to about 30 000 metric tons. The increase in yield since the mid-sixties is due to the recruitment of the very strong 1963 year class and to a rapid increase in the size and efficiency of the Dutch beam trawler fleet. In later years the Dutch catches have formed nearly 80% of the total inter-

national landings compared with 58% in 1960/62. In the early seventies the catches were declining in spite of the still increasing effort.

State of exploitation

The assessments carried out by the Council in 1971 showed that if recruitment remains constant at the level existing prior to 1971, then the catch and the stock size for the next years are going to decrease, unless fishing effort is reduced immediately to a level of 40% of the present value. In that case the stock size could be kept constant, while the catches would drop to about half their present level. If the fishing effort is reduced by a smaller amount both stock size and catch will decline. In 1973 the Council recommended to NEAFC that a total allowable catch for 1974 should be implemented as soon as possible in order to prevent a further rapid decline of the stock.

It was only in 1975 that a TAC was enforced. This TAC kept constant for 1976 and 1977 was considerably overshoot in 1975 and 1976 leaving the stock at a very low level. At this level there is a serious danger of decreasing recruitment. Average recruitment over the last 8 years is lower than average recruitment in the 1940s, 1950s and 1960s.

Irish Sea Sole

ICES Division VIIa

Life history

The Irish Sea sole population is mainly concentrated in the area between 53°30' and 54°30'N from the west coast of England to 05°00'W. During the winter the fish are widely dispersed, mainly over the western part of this area. In April-May there is an inshore spawning movement. Dispersal starts about mid-summer. The life history of the young fish is similar to that in the North Sea except that the estuaries of the rivers on the English west coast provide the nursery grounds. This is the slowest growing population of soles and the maximum size reached is also slightly less than that by soles of other stocks.

The fishery

From 1962 to 1976 the catches were as follows (in 000's tons):

1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
0.6	0.5	1.6	1.6	1.1	1.0	0.9	1.4	1.8	1.9	1.5	1.5	1.3	1.4	1.4

The Irish Sea sole fishery is carried out by beam trawlers (Belgium and the Netherlands and to a small extent England and Ireland) and by otter trawlers (Belgium, England and the Netherlands). Between 1951 and 1963 annual landings varied between 451 tons and 922 tons, caught mainly by British trawlers. Belgian trawlers started to fish intensively in the

Irish Sea in 1964, mainly because catch rates were at a low level in that year, and total landings rose. Although they fell again in 1966 they rose subsequently to their maximum recorded level in 1971. The increase in landings resulted mainly from a change to beam trawling by the Belgian fleet and the start of the Dutch fishery in 1970. In 1971 these two countries caught 81% of the sole landings from the Irish Sea. After 1971 catches dropped to the present level of 1 400 tons. In 1976 the Belgian and Dutch caught 69% of the total catch.

State of exploitation

It is estimated that the local maximum mortality rate on the stock lies between 0.4 and 0.7 (33-50% a year), at which levels the stock is almost fully exploited, and that the maximum sustainable yield from the stock is 13 000 tons a year. As year class size does not vary as much as in the North Sea, the total allowable catch for any year is likely to approximate the maximum sustainable yield.

Bristol Channel Sole

ICES Division VIIIf

Life history

This stock is distributed throughout the Bristol Channel. Its life history is similar to that of the other stocks, except that it spawns earlier, in February and March, off Minehead, Devon. The growth rate of the soles of this stock is faster than that of either the North Sea or Irish Sea soles and the maximum size recorded is slightly larger than for the two stocks.

The fishery

From 1962 to 1976 the catches were as follows (in 000's tons):

1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
0.6	0.3	0.6	0.6	0.5	0.7	0.6	0.7	0.8	0.8	0.5	0.8	0.7	0.6	0.5

The fishery is carried out mainly by Belgian beam trawlers and Belgian and Welsh otter trawlers. Landings have risen almost interruptedly from 342 tons in 1959 to 790 tons in 1970, mainly as a result of increased fishing intensity by Belgian vessels. Originally these were otter trawlers but are now almost entirely beam trawlers. In 1970 Belgian landings formed 68% of the total international catch from this stock. After 1970 the catch fluctuated, but has declined over the last three years despite a too high TAC for this sole stock.

State of exploitation

It is estimated that the total mortality rate for this stock lies between 0.27 and 0.34 (24-29%), at which levels the stock is almost fully exploited. The maximum sustainable yield approximates to 670 tons a year, but as there

is more variation in year class size than in the Irish Sea sole stock, but less than that in the North Sea stock, the total allowable catch is likely to vary from year to year. However, by keeping the TAC fixed at a too high level, an increase in fishing effort to meet the TAC will take place, leading the fishery to overfishing.

English Channel Sole

ICES Divisions VIIId and VIIe

Life history

The stock structure is rather complex, involving separate coastal populations along the English and French coasts (Pas-de-Calais and Seine Bay). There is no real movement outside the Channel.

The growth is quite similar to that for the North Sea sole in Division VIIId but with a low K and high W_{∞} in Division VIIe.

The spawning period is earlier than in the North Sea, being from March to early April rather close to the coast within the 30 m depth contour.

Postlarvae are found in Division VIIe March to June with a maximum in April.

The fishery

From 1962 to 1976 the catches were as follows (in 000's tons):

1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
0.9	1.0	0.7	1.0	0.2	1.1	0.8	0.9	1.2	1.4	1.4	1.5	1.4	1.3	1.7

The fishery is carried out by France, England and Belgium all exploiting more or less separate coastal populations.

Total catch in Division VIIe has increased rapidly since 1969 mainly due to increases in the English catch by a change from otter trawl to twin-beam trawling since 1967 at Brixham.

The catch approximately doubled between 1969 and 1971 in Division VIIId and has since remained fairly steady.

State of exploitation

The sole in Division VIIId is almost fully exploited at the present level of fishing mortality, 0.27 (24%) for females and 0.26 (23%) for males. In Division VIIe information is not complete, but here too the average fishing mortality is $F = 0.33$ (28%) suggesting that the stock is not over-exploited.

Gulf of Biscay Sole

ICES Sub-area VIII

Life history

Not much is known about the stocks of soles in the Gulf of Biscay. Taking the catch level into consideration, the abundance may be about twice to

three times that from the Irish Sea.

The fishery

From 1962 to 1975 the catches were as follows (in 000's tons):

1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
2.2	1.5	1.9	1.0	1.6	2.0	1.9	2.1	2.4	3.7	4.5	2.6	3.0	2.9

The fishery is concentrated on a few areas in the Gulf of Biscay where fishing with otter trawls is possible. The main countries fishing are France and Spain. The catch level increased since 1965 and reached a maximum in 1972 and has since decreased somewhat.

State of exploitation

Taking into account the scarcity of biological information, no definite statement can be made but from the recently increased catch level it is suggested that the stock is not overfished.

Portuguese Coastal Sole

ICES Sub-area IX

Life history

The only thing known about these sole stocks is that they form coastal stocks and that age reading by means of otoliths is progressively more difficult the more one goes to southern latitudes. The stock size may be compared with that in the Gulf of Biscay.

The fishery

From 1962 to 1975 the catches were as follows (000's tons):

1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
1.4	1.4	1.6	1.8	2.1	2.0	2.0	2.3	2.8	2.5	1.5	2.6	2.0	2.3

The fishery is fairly constant, with a maximum in 1969, 1970 and 1971. Whether this is the effect of an outstanding year class or not is not certain due to lack of information on age structure of the stocks. Spain and Portugal are the main countries participating in the fisheries.

State of exploitation

No accurate definition of the state of exploitation is possible due to lack of sufficient biological information. The steady catch level suggests, however, that these Portuguese stocks are not overexploited at present.

MEGRIM (Lepidorhombus whiffjagonis (Walbaum))

ICES Sub-Areas IV, VI, VII,
VIII and IX

Limited data on the biology and fishery for megrim exist for only Sub-Areas IV and VI. For all other areas, the only available data are those on landings as published in "Bulletin Statistique".

It should be pointed out that while the megrim landed from the North Sea and west of Scotland and Rockall are almost all L. whiffjagonis, it is likely that megrim landings from regions further south contain increasing quantities of L. boscii. Since, however, no detailed statistics exist, it is impossible to comment further on this point and all landings have been treated as "megrim".

Sub-Areas IV and VI

Life history

Spawning times and areas

Russell () states that megrim spawn "off the Scottish coast in May" and "off the Irish coast from March to May". These are the only available data.

Larval, post-larval and juvenile fish distributions

No relevant information exists.

Distribution of young and adult stock components

Megrim do not appear in the commercial landings (by Scottish vessels) until they are at least four years old. A few megrim of 3 or 4 years old have been caught by Scottish research vessels, but data are insufficient to accurately describe the distribution of the young pelagic stock components. The adult stock component is distributed in deep water close to the edge of the continental shelf. The stock extends across the boundary between the Norwegian and the EEC zones.

Migration

No data exist.

Exploitation and management

Exploitation

Figure (A) shows the landings of megrim from the North Sea by Scotland, Federal Republic of Germany, England and France from 1921 to 1975, while Figure (B)

shows landings by England, Scotland and France from Sub-area VI over the same time period.

Management

Apart from the adoption of a minimum landing size of 25 cm, no attempts have been made to manage the megrim fishery.

Present state of the stocks

Scottish data suggest that the total instantaneous fishing mortality rate (2) is about 0.5 in the northern North Sea and 0.6 in Sub-area VI. Assuming $M = 0.1$ and arguing from yield-per-recruit considerations, the stock is probably slightly over-fished.

Sub-Areas VII, VIII and IX

Figures (C) - (H) show landings by various countries from each of Sub-areas VII (shown as VIIa/f, VIIb/c, VIId/e and VIIg/k), VIII and IX.

These are the only data existing for these areas.

Figure A. MEGRIM. North Sea.
(Sub-Area IV).
Landings 1921-75.

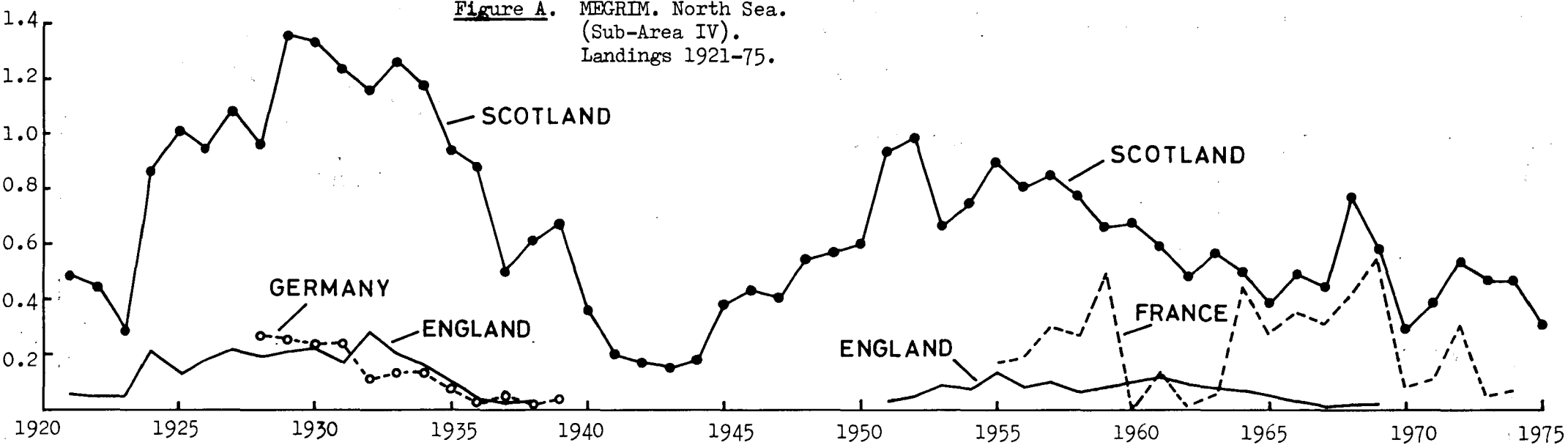
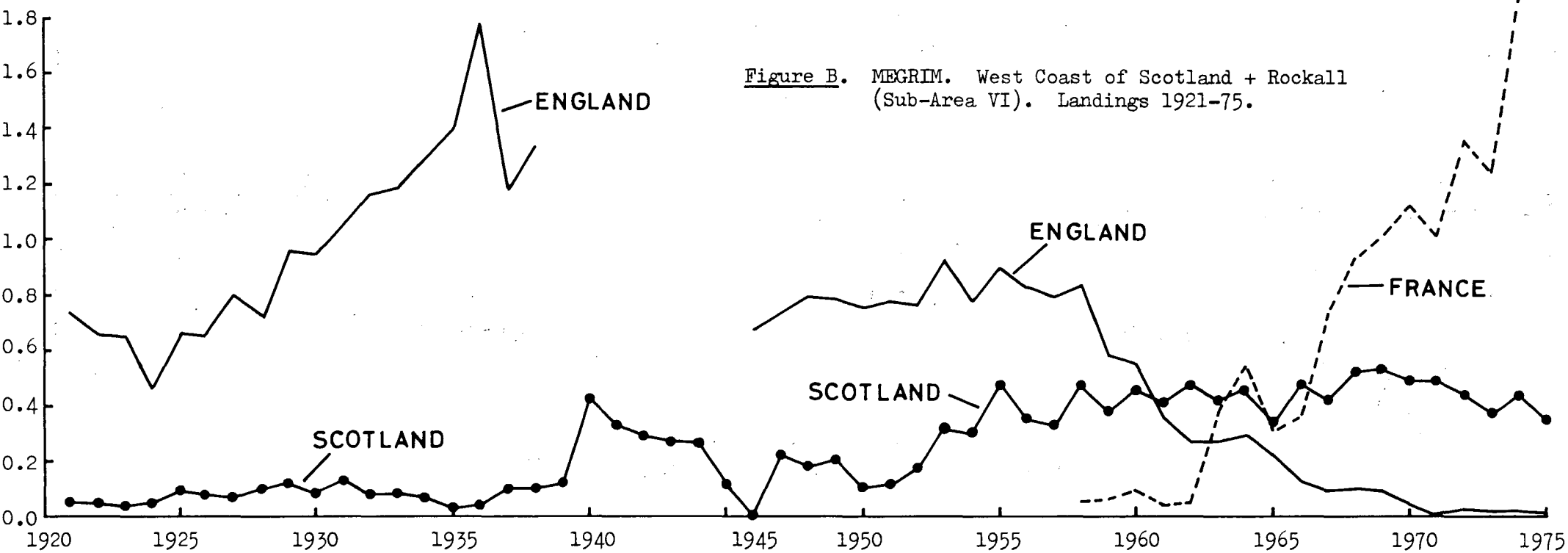
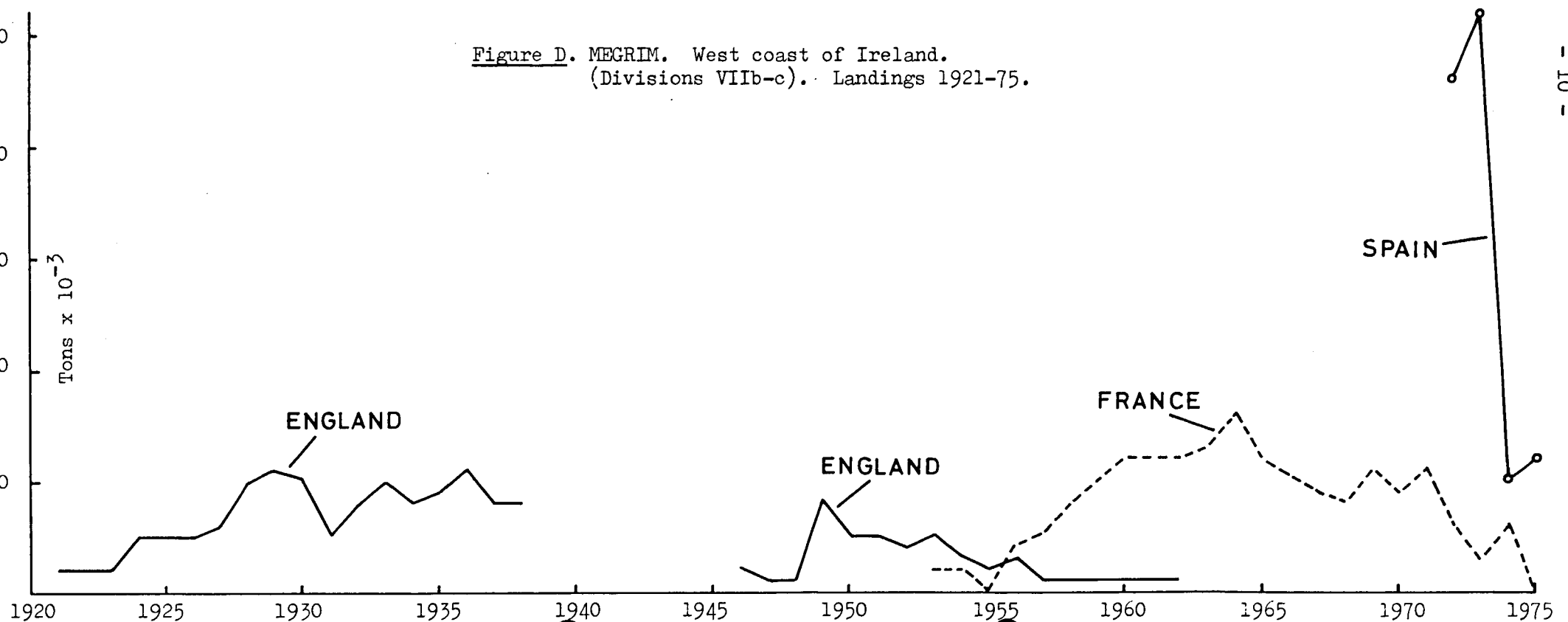
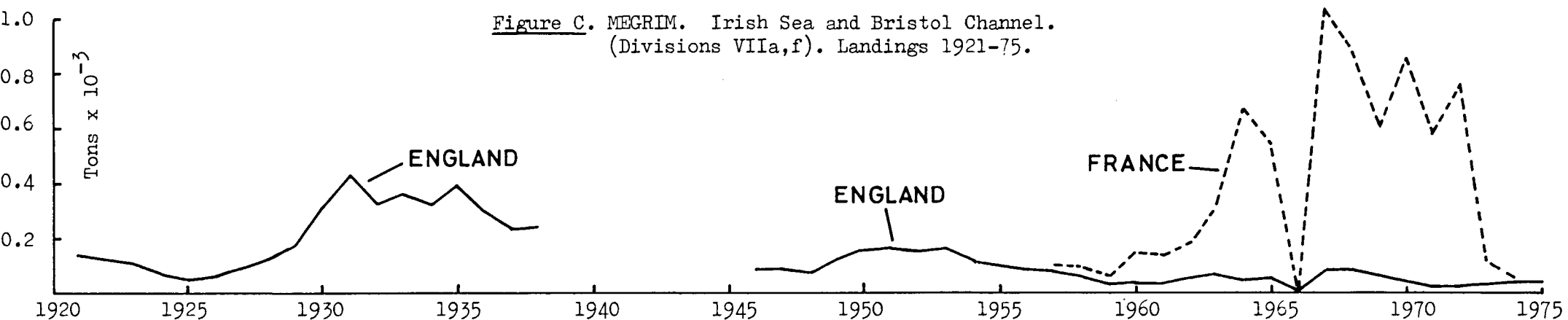
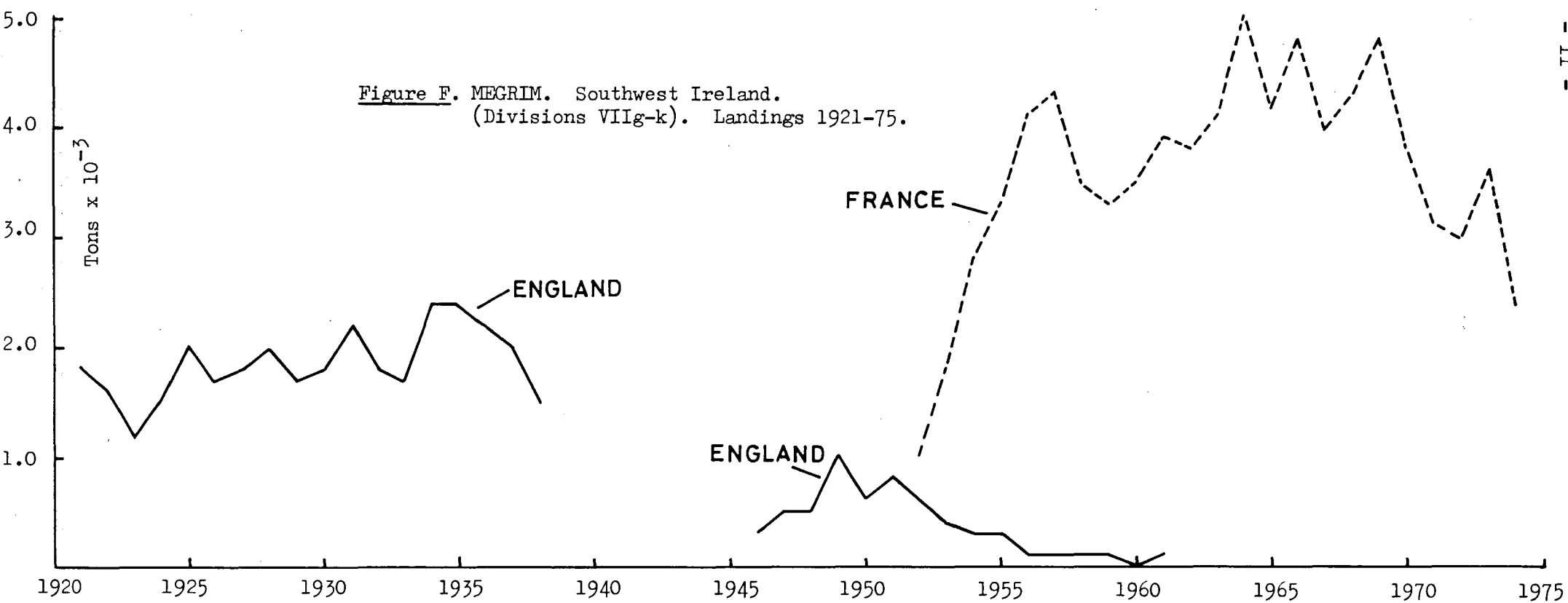
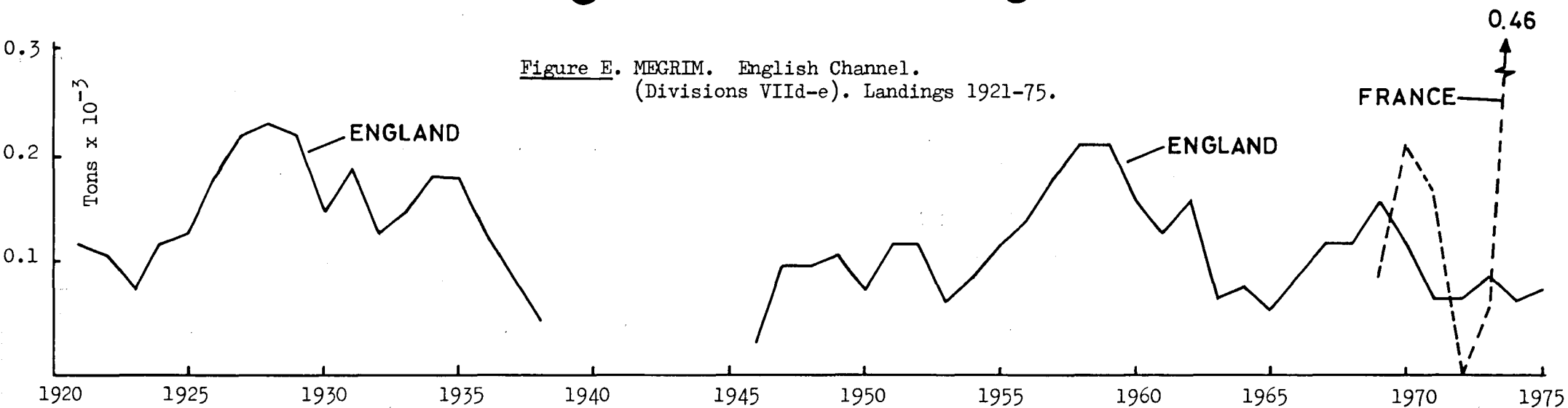
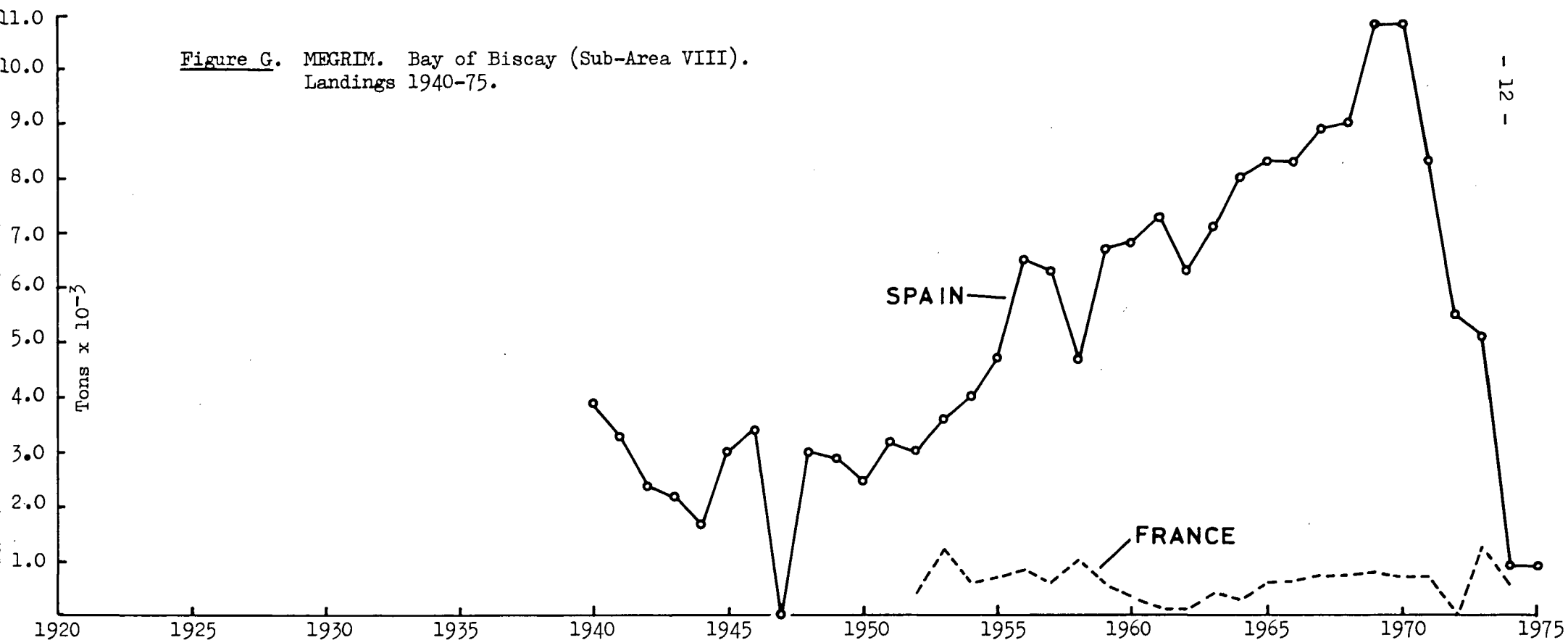


Figure B. MEGRIM. West Coast of Scotland + Rockall
(Sub-Area VI). Landings 1921-75.

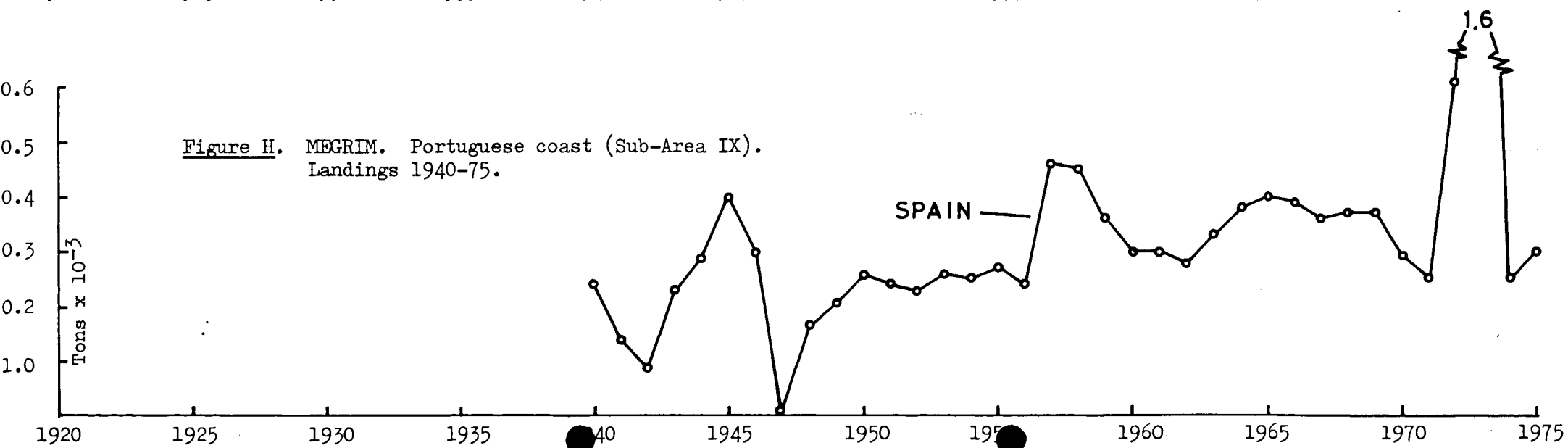








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BRILL (Scophthalmus rhombus (L.))

Distribution

The distribution of brill is similar to turbot, extending from the Mediterranean Sea to the coasts of Western Europe and including the western part of the Baltic Sea. The northerly limit of the species in the eastern Atlantic is in the region of Trondheim (Ehrenbaum, 1936).

Food

Brill feeds principally on crustaceans and fish.

Spawning

The spawning period of brill is from April to August in the North Sea and Irish Sea, and April to September in the western English Channel. The eggs of brill are planktonic, and have been found in the North Sea, British Channel and the Kattegat. Russell (1935a) recorded post-larvae off Plymouth in the months of April to September with a maximum occurrence in May. Post-larvae are never numerous in the catches and brill often occur in the surface layers (Petersen, 1894; Ehrenbaum, 1897).

Due to a lot of similarities with turbot (distribution, spawning period etc.) hybridisation is common and described by Smitt (1893-95).

Distribution and migration of young and adult brill

Not much information exists on the distribution and migration pattern of brill in the various areas. Figure 1a (Rae 1970) gives national catch per unit effort data for brill in the North Sea during the fishing period 1923-37.

The brill resembles the turbot in its distribution and depth range but is less plentiful throughout the North Sea (Figure 1a). In the Scottish area, both immature and adult brill are most commonly caught in the Moray Firth and on north coast grounds. As Figure 1b shows, it is also caught - though rarely - on grounds to the west of Scotland, from near Cape Wrath to Luce Bay, where in the 1960s, it would appear to have been slightly more plentiful than on the Scottish east coast. Figure 1b also demonstrates the apparent preference of the brill for the shallows of certain bays such as Naver Bay and the Kyle of Tongue on the north coast of Scotland, Broad Bay in Lewis and Luce Bay, where the average catch may be from one to two per hour's fishing.

Sahrhage (1967) caught only a total of 4 brill (mainly in the eastern part of the North Sea) during a bottom trawling survey in January 1962 and

1963 (72 and 77 $\frac{1}{2}$ hour trawling stations).

German (Fed.Rep.) catch statistics

In Table 1 the German catch statistics on brill for the last 10 years' period are given. There are several national sub-divisions (Figure 2) for the North Sea (IVa, b,c) including data on the catch per fishing days in each particular sub-division. The total number of fishing days is also indicated.

International catch statistics

In Table 2 the international catch statistics since 1965 to 1975 are given by countries. The present situation of the brill stock is closely linked to the trend in the sole fishery, since brill is distributed in the same area and is landed as a by-catch of the sole fishery. Also the picture of the international landings of brill in Division IVa, b,c during the last decade is comparable with the trend in the sole fishery: with increasing landings by the Netherlands (as a result of increasing effort), the catch of nearly all other countries decreased.

Length and age data

There seems to be no published information on length and age data of brill from any of the fishing areas.

Weber (unpubl.) has collected otoliths and length data during beam trawling surveys in the North Sea since 1975.

Length/weight data

The only information on length/weight of brill appears to be that of Lundbeck (1950-52):

Table 3. Weight of 78 ungutted brill (after Lundbeck, 1950-52):

cm	21-25	26-30	30-35	36-40	41-45	46-50	51-55	56-60	61-66
av.weight(g)	190	410	530	820	1050	1770	2190	2390	(3000)
min.weight	160	250	330	590	740	150	180	2000	-
max.weight	260	530	800	1100	1320	2000	2500	3200	-
K = $\frac{g \cdot 100}{l^3}$	1.38	1.76	1.43	1.44	1.28	1.55	1.43	1.20	(1.33)

General remarks

The state of the brill stock is closely linked with those of turbot, since both are mainly caught as by-catch in the plaice and sole fishery. Up to the end of the 1930s the brill landings of the North Sea amounted to

1 200 - 1 500 tons. From 1947 up to the end of the 1960s the landings were in the order of 300-700 tons. Since then, the effort and landings by the Dutch beam trawl have increased. As a result, the total landings have recently exceeded 1 000 tons.

<u>North Sea</u>			
	<u>Tons</u>		<u>Tons</u>
1930	840	1947	495
1931	809	1948	368
1932	1 222	1949	440
1933	1 340	1950	407
1934	1 339	1951	530
1935	1 396	1952	599
1936	1 515	1953	630
1937	1 335	1954	1 023
1938	1 026	1955	613
1939	463	1956	558
		1957	499
		1958	510
		1959	450
		1960	514
		1961	615
		1962	710
		1963	731
		1964	607
		1965	571

(see also Table 2)

REFERENCES

- BRABER, L. and de Groot, S.J., 1973. The food of five flatfish species (Pleuronectiformes) in the southern North Sea. *Neth. J. Sea Res.* 6 (1-2). Netherlands Inst. Fish Invest. IJmuiden.
- BUCHANAN-WOLLASTON, 1911. *Rep. N. Sea Fish Invest.* 1906-1908.
- CANU, Eugene, 1893. *Annales de la Station Aquicole de Boulogne-sur-Mer.* Vol.1, p.130.
- DAVEY, J.T. and Peachey, J.E., 1968. Bothriocephalus scorpii (Cestoda: Pseudophyllidae) in turbot and brill from British coastal waters. *J. mar. biol. Ass. UK.* 48 (335-340).
- DE GROOT, S.J., 1971. Bothriocephalus scorpii (Müller) in turbot Scophthalmus maximus L. and brill B. rhombus from the southern North Sea. *J. Fish Biol.* 3, 147-149.
- DE GROOT, S.J., 1969. Digestive system and sensorial factors in relation to the feeding behaviour of flatfish (Pleuronectiformes). *J. Cons. Perman. Int. Explor. Mer.* 32.
- DE GROOT, S.J., 1971. On the relationship between morphology of the alimentary tract; food and feeding behaviour in flatfishes (Pisces): Pleuronectiformes. *Neth. J. Sea Res.* 5 (2), 121-196.
- DEKHNİK, T.V., 1969. Black Sea fishes classified in relation to their modes of reproduction. *Voprosy Ikhtiologii* 9 (6) 1969. In Russian, translated in *Probl. Ichtyol.* 9 (6).
- EHRENBAUM, E., 1897. Eier und Larven der deutschen Bucht. *Wiss. Meeresunters. Abt. Helgoland NF* 2.
- EHRENBAUM, E. *Nordisches Plankton* 1905-1909.
- EHRENBAUM, E., 1936. *Handbuch der Seefischerei Nordeuropas.* Band II, Stuttgart 1936. Schweizerbart'sche Verlagsbuchhandlung.
- HILLIS, J.P. and Long, M., 1972. Abnormal flatfish from the Dingle area. *Irish Nat. J.* 17 (6).
- JONSSON, G., 1958. Some new species of fish in Icelandic waters. *Naturufroedin-gurinn* 38, 1968 (1969).
- LAHAYE, J., 1972. Cycles sexuels de quelques poissons plats des côtes Bretonnes. *Revue Trav. Inst. Pech. Marit.* 36 (2).
- LUNDBECK, J. Biologisch-statistische Untersuchungen über die deutsche Hochseefischerei. III. Das Körpergewicht und das Längengewichts-Verhältnis bei den Nutzfischen. *Ber. Dtsch. Meeresf. B.* XII, H. 3, 1950-1952.

- MASTERMANN, A.T. Third report on later stages of Pleuronectidae, Rapp. Reun. Cons.perm. Int. Explor. Mer (14)(4), 1912.
- M'INTOSH, 1892. Annual report fishery board f. Scotland X, 1892.
- M'INTOSH, 1894. Annual report fishery board f. Scotland XII, 1894.
- NELLEN, W. and G. Hempel, 1970. Beobachtungen an Ichtioneuston der Nordsee. Ber. dt. Komm. Meeresforsch. Bd. 21, N.S.:311-348.
- O'RIORDAN, C.E., 1966. Some variations of flounder, brill and turbot in the collections of the National Museum of Ireland. Dublin Irish Nat. J. 14: 208-209.
- PETERSEN, J.G., 1894. Report of the Danish Biological Station III. 1893, IV, 1894.
- POLL, M., 1947. Fauna de Belgique Poissons Marins. Bruxelles, 1947.
- RAFFALE, F., 1888. Mitteilungen aus der zoologischen Station zu Neapel. Bd. VIII.
- RAE, B.B., 1970. The distribution of flatfishes in Scottish and adjacent waters. Mar. Res. 1970 (No.2), 1-39 (1971), 48 refs. (Mar. Lab. Aberdeen).
- SAHRHAGE, D., 1967. Über die Verbreitung der Fischarten in der Nordsee. Teil II, Jan. 1962 and 1963. Ber. Dtsch. Wiss. Komm. Meeresforsch. XIX, Heft 2.

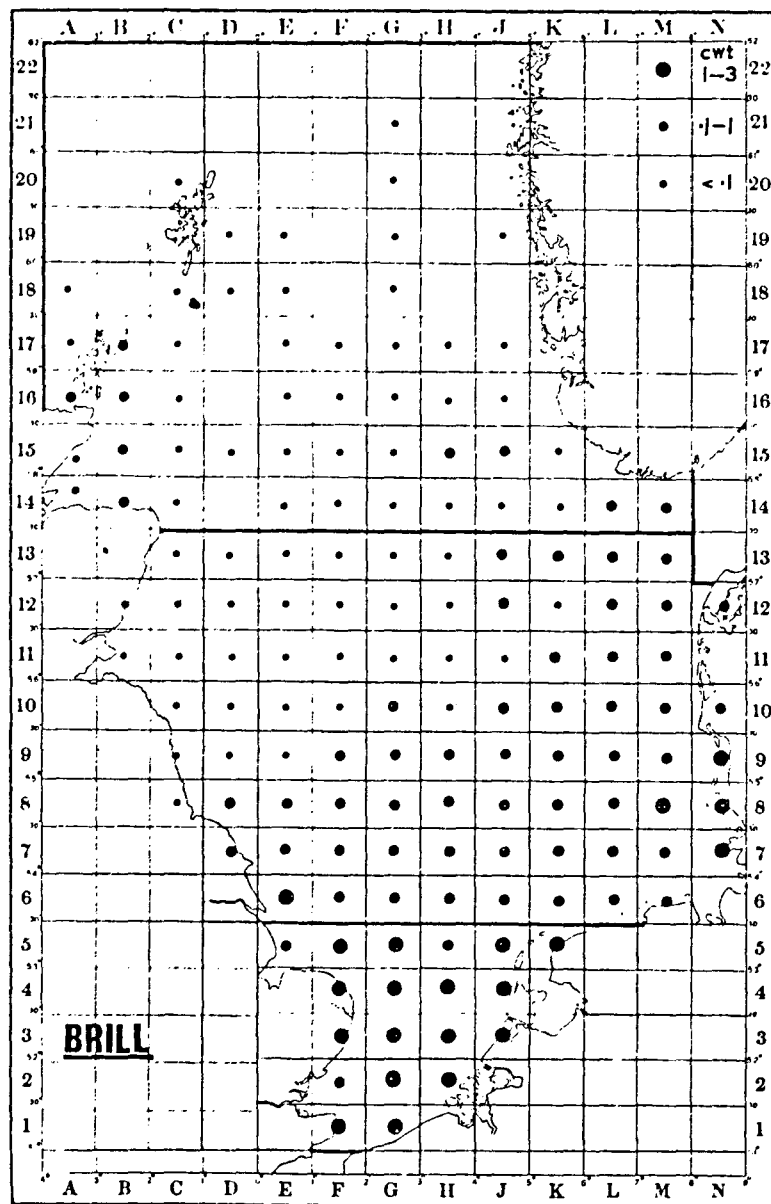


Figure 1a. Distribution of the brill in the North Sea; based on average catches per 100 hours' fishing by British trawlers, 1923-1937.

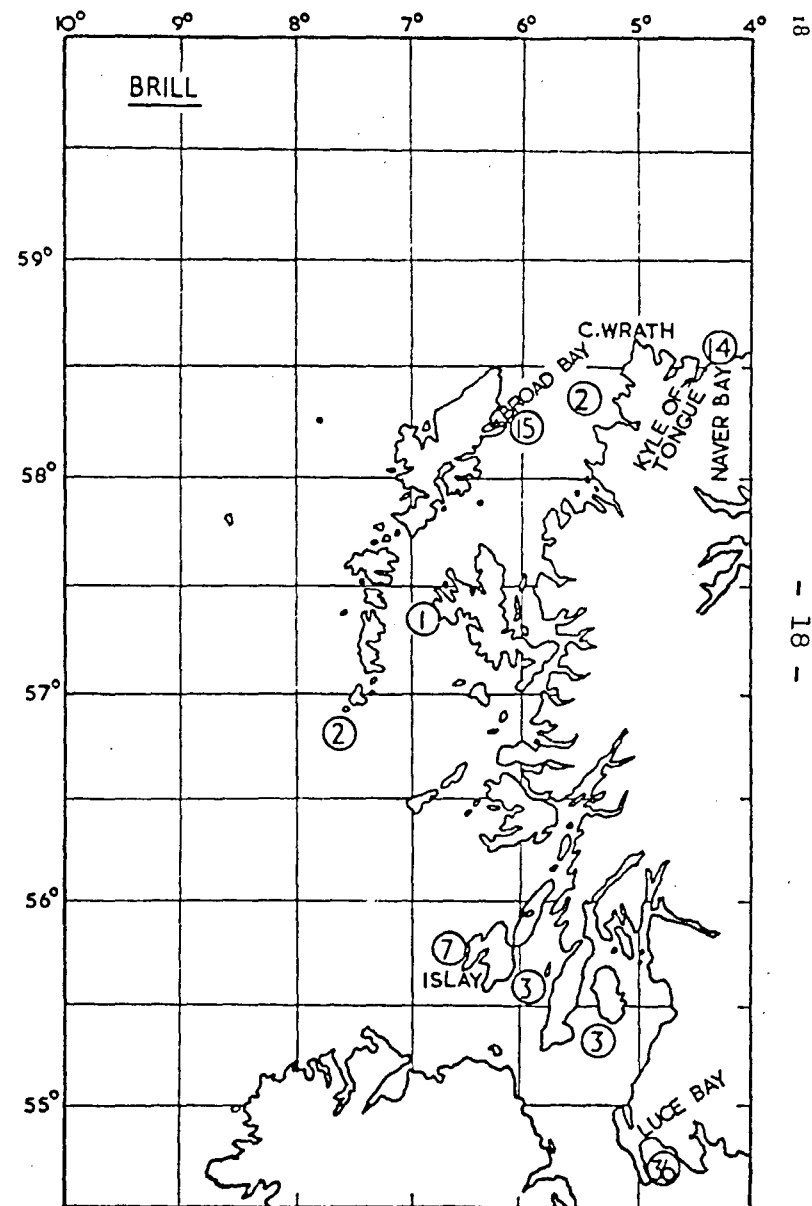


Figure 1b. Distribution of the brill on western Scottish grounds; based on the numbers caught by Scottish research vessels, 1922-1939 and 1951-1968.

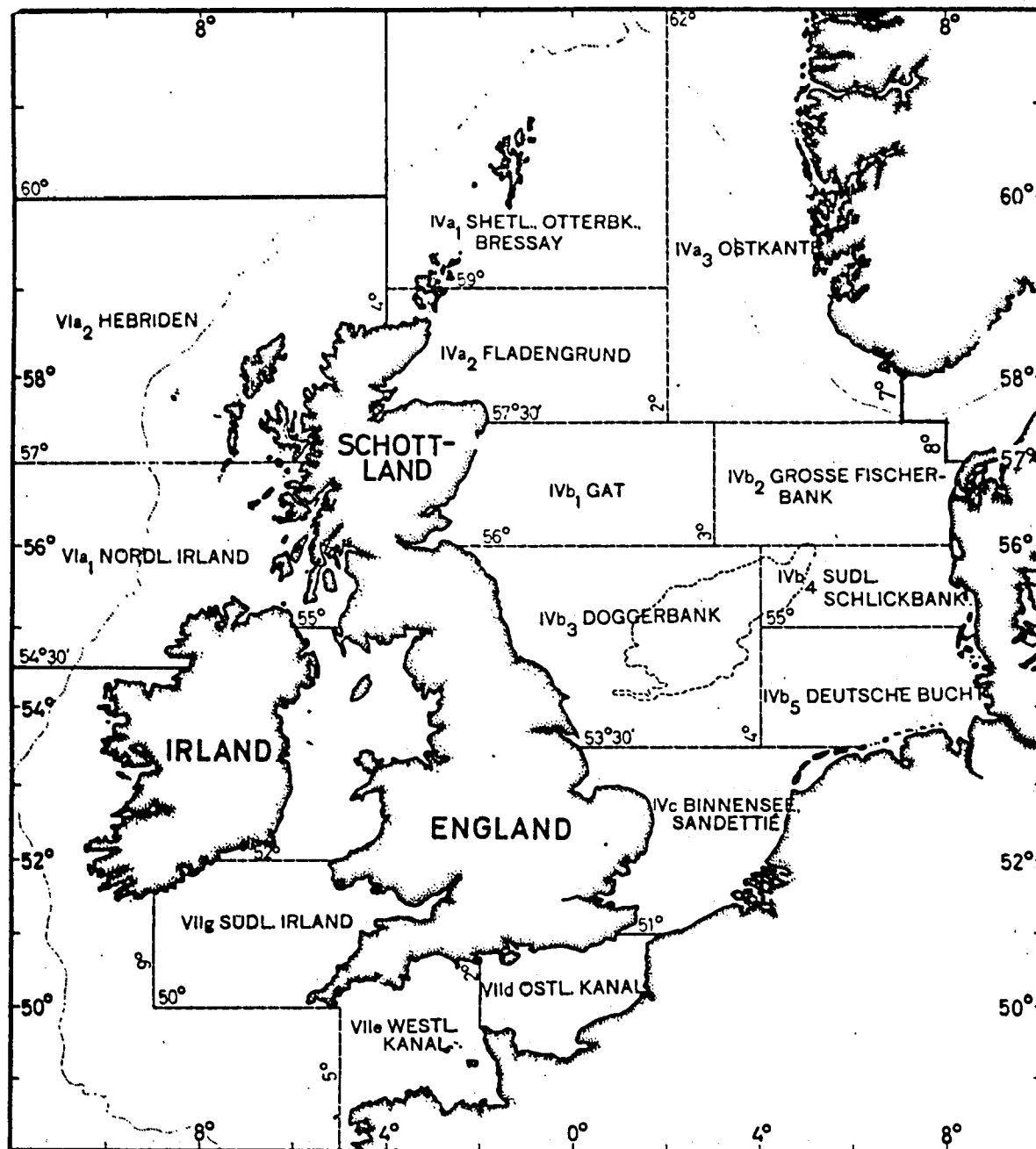


Fig. 2: German national subdivisions for IV a, b, c.

Table 1. Brill (North Sea, Divisions IVa,b,c). German landings nominal catch in tons by national divisions and catch per fishing day (kg) in 1966-1975.

Year	Landings in metric tons											Catch/fishing day (kg)										
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5	6	7	8	9	10	11
	North Sea IVa,b,c	Skagerrak	Kattegat	Division IVc	German Bight	Southern Schlick Bank	Great Fisher Bank	Dogger Bank	Gat	Fladen Ground	Ostkante											
1966	21.5	0	1.4	0	4.3	6.4	8.1	1.1	0	0	0.5	2	2	6	1	1	2	2	5	0	0	2
1967	19.9	0.2	1.5	-	8.0	5.5	4.9	1.2	0	0	0.3	1	5	5	-	1	1	2	3	0	1	2
1968	31.9	-	0.7	-	11.5	12.5	7.5	0.1	0.1	0	0.1	2	-	4	-	1	2	2	1	1	0	1
1969	32.7	-	-	0	12.4	12.8	6.0	1.3	0	0	0.2	2	-	-	1	2	3	2	5	0	0	0
1970	30.9	-	-	-	8.2	12.6	9.0	1.0	0	-	0.1	2	1	9	-	1	3	2	6	0	-	0
1971	24.2	0	0.9	0	10.4	7.5	6.3	0	-	-	0	1	5	12	0	1	2	2	1	-	-	0
1972	10.9	0	0.4	0	3.3	3.5	3.9	0	0	-	0	1	0	5	2	0	1	1	1	1	-	0
1973	7.8	0	2.6	0	3.0	2.3	2.5	0	0	0	0	1	2	18	0	0	1	1	1	0	0	0
1974	10.4	0	0	0	0.6	3.3	6.3	0	0	0	0.1	1	0	0	0	0	1	2	1	0	0	0
1975	11.5	0	2.1	-	1.9	6.3	3.1	0	0	0	0	1	0	10	-	0	2	1	0	1	0	0

Year	No. of fishing days	Monthly landings (to) Divisions IVa,b,c											
	Divisions IVa,b,c	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1966	12 322	0.7	1.2	1.1	0.8	3.1	4.1	2.8	2.0	0.9	1.5	1.3	0.9
1967	16 531	0.4	0.4	0.2	1.1	1.9	2.8	8.0	0.9	1.1	1.2	1.3	0.5
1968	10 936	-	0.11	0.1	0.3	2.6	4.2	1.0	0.8	0.9	0.9	0.3	0.1
1969	17 188	0.6	0.5	1.6	2.0	4.0	5.7	5.1	5.2	3.1	2.5	1.1	1.0
1970	14 728	0.9	1.3	3.3	3.1	2.5	6.3	4.2	2.4	1.3	2.0	1.9	1.2
1971	19 194	0.8	0.6	0.8	1.6	2.8	5.6	4.4	2.4	2.3	1.4	0.9	0.4
1972	19 788	0.4	0.6	1.4	1.0	1.8	2.0	1.6	0.6	0.6	0.6	0.2	0.1
1973	15 186	0.9	0.9	0.9	0.8	0.9	1.3	0.6	0.3	0.2	0.2	0.2	0.1
1974	12 647	0.2	0.4	0.3	2.9	1.8	0.9	0.9	0.5	0.3	0.7	1.1	-
1975	13 625	0.3	0.8	1.1	1.0	0.8	1.5	0.9	0.5	1.1	1.5	1.4	0.2

Table 2. International landings (nominal catch in tons) of Brill in Areas IIIa, IVa,b,c, VIa, VII, VIII in 1966-1975.

Country	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
	<u>IIIa</u>										<u>VIIa,f,b,c,g,k,d,e</u>									
Belgium	-	-	-	-	-	-	-	-	-	-	1	14	32	40	56	56	64	64	92	83
Denmark	187	106	100	99	97	104	120	131	200	167	-	-	-	-	-	-	-	-	-	-
France	-	-	-	-	-	-	-	-	2	-	686	98	-	159	311	391	452	251	-	-
Germany, Fed.Rep. of	1	2	1	1	1	1	1	3	-	2	-	-	-	-	-	-	-	-	-	-
Ireland	-	-	-	-	-	-	-	-	-	-	27	65	61	94	91	93	66	64	61	73
Netherlands	-	-	-	-	-	-	-	-	-	1	-	-	-	-	0	4	7	2	4	7
Spain	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	42	-	-	-
UK (England & Wales)	-	-	-	-	-	-	-	-	-	-	56	167	173	164	131	137	124	151	115	137
N. Ireland	-	-	-	-	-	-	-	-	-	-	19	17	51	20	18	17	16	13	-	10
Scotland	-	-	-	-	-	-	-	-	-	-	2	1	2	2	1	1	-	1	-	-
Total	188	108	101	100	98	105	121	134	202	170	791	362	319	479	608	699	771	546	272	310
	<u>IVa,b,c</u>										<u>VIIIa-e</u>									
Belgium	100	138	152	145	114	187	213	185	135	164	-	-	-	-	-	-	-	-	-	-
Denmark	63	29	43	47	42	72	65	55	68	76	-	-	-	-	-	-	-	-	-	-
France	53	46	-	-	96	58	34	50	-	-	114	138	-	59	188	202	138	309	-	-
Germany, Fed.Rep. of	26	27	40	38	35	45	15	13	15	20	-	-	-	-	-	-	-	-	-	-
Netherlands	264	137	274	364	386	720	665	710	904	925	-	-	-	-	-	-	-	-	-	-
Sweden	-	-	-	-	8	9	14	14	24 ^{a)}	-	-	-	-	-	-	-	-	-	-	-
Spain	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	82	-	-	-
UK (England & Wales)	118	103	111	101	75	90	46	30	36	33	-	-	-	-	-	-	-	-	-	-
Scotland	1	2	1	1	1	4	5	9	-	11	-	-	-	-	-	-	-	-	-	-
Total	625	482	621	696	757	1 185	1 057	1 066	1 182	1 229	114	138	-	59	188	202	220	309	-	-
	<u>IVa</u>																			
France	-	-	-	-	-	-	-	-	-	-										
Ireland	18	24	30	28	45	28	20	18	35	32										
UK (England & Wales)	12	7	10	10	9	7	5	5	5	5										
N. Ireland	-	-	-	-	-	-	-	-	-	10										
Scotland	8	8	7	5	3	3	3	3	-	4										
Total	48	51	47	46	62	54	31	26	40	51										

a) IVa includes IIIa.

Life history

Dabs live on sandy bottoms at depths larger than those occupied by plaice.

In the North Sea dab are most numerous and along the coasts they occur in large quantities.

Spawning time is from January to August and spawning grounds are in the coastal areas. Spawning time is in winter in the Gulf of Biscay and the English Channel, and in the northern North Sea in spring and summer. In the southern North Sea spawning takes place at depths of 20-40 m.

Pelagic eggs are 0.7-1.0 mm and larvae metamorphise after two weeks. In the North Sea dab mature for the first time at a length of 15-20 cm, some even at a length of 10 cm.

The main food of dab, which is a real hunter, consists of echinoderms, gammarids, worms and molluscs.

The fishery

The catches over the period 1962-1974 were as follows (in 000's tons):

Sub-areas or Divisions	Skagerrak	North Sea	Sub- area VI	Sub- area VII	Gulf of Biscay	Total
	IIIa	IV			VIII	
1962	1.7	4.1	0.3	3.3	0.5	10.0
1963	1.6	4.6	0.3	3.4	0.5	10.4
1964	1.6	4.3	0.2	0.5	-	6.6
1965						
1966	1.8	5.1	0.2	0.4	-	7.4
1967	1.1	3.6	0.1	0.4	-	5.2
1968						
1969	1.4	4.1	0.3	3.6	0.5	9.9
1970	1.1	5.2	0.2	3.3	0.3	10.0
1971	1.2	6.5	0.2	4.1	0.1	12.3
1972	1.7	8.0	0.2	3.5	0.2	13.6
1973	1.4	9.8	0.2	4.2	0.1	15.8
1974	2.0	7.2	0.3	2.3	0.2	12.1

In most Sub-areas the catch level has remained fairly constant. Increase in catch is shown in the North Sea and in Sub-area VII in nearly all its Divisions. This may reflect some increase in stock level but as dab catches usually do not reflect stock abundance, vast quantities of dabs are discarded and on many fishing trips in the North Sea 100% of the dab catches are put overboard, which may only mean that fishermen are increasingly sorting out sized (15 cm and over) dabs for landings, especially when fishing on main species is not as good as it used to be.

Dabs have hardly any chance of surviving. Thus discarded dabs can normally be assumed to be dead.

State of exploitation

There is not much biological information on age structure of the dab populations. The discard problem too will make it very difficult to assess the state of the exploitation. Being a by-catch of the demersal fisheries, the dab in the North Sea should be liable to the same heavy fishing as the North Sea sole e.g. and thus the dab may be overfished in this area. For the other areas no information is available.

WITCH (*Glyptocephalus cynoglossus* L.) Fisheries in ICES
Fishing Areas III, IV, VI and VII

1. Life History

1.1 General

The witch is a rather deep-water flatfish, which is most abundant on fine, muddy sand or mud in depths of 50 m down to 300 m, although it is common enough down to depths of 1 460 m. It is less common closer inshore in shallow water, and is only rarely taken in less than 20 m depth. It seems to be relatively non-migratory. It is widespread and found at water temperatures of -1 to +10°C (Wheeler, 1969).

1.2 Spawning, egg, larval and post-larval distribution

The first description of the egg of the witch was given by Cunningham (1887). The eggs are buoyant, and 1.07 and 1.25 mm in diameter. Incubation takes seven to eight days at 8°-9.3°C (Ehrenbaum, 1905-09).

Spawning takes place from March to September. The main spawning period is probably earlier on the west side of the British Isles and is given for the Irish Sea as April and for the North Sea as July (Ehrenbaum, 1905-09).

Post-larval stages may be taken over the whole area of the distribution of the witch which shows a preference for the deeper waters (Henderson, 1961). Post-larvae were recorded all over the North Sea, round the north and west coasts of the British Isles and in the Celtic Sea.

1.3 Food

Food of the witch consists of bottom-living invertebrates: small crustaceans, starfish, molluscs and worms.

2. Exploitation and Management History, and Present State of the Stock

The witch grows relatively slowly, and for its size it is long-lived: eight to ten years in British waters, up to fourteen years in Icelandic waters. Females grow faster than males.

The exploitation history and present state of the stock are unknown.

No regulatory measurements have been applied to the witch, apart from the general restrictions on the mesh size of the trawls (minimum 75 mm).

3. Nominal Catch Statistics

Table 1 gives the annual catch in Sub-areas III, IV, VI and VII. About 70% of the witch catches are reported from the total North Sea, mainly

from Division IVa. In Divisions IIIa, IVa and IVb where the catches are partly taken by Sweden and Denmark, some or all of these catches could be taken outside the EEC limits.

In the absence of any biological information on mortalities or recruitment it is impossible to analyse the fluctuations in catches in terms of stock size.

4. References

Cunningham, 1886. Trans.R.Soc.Edinb., 33, Pl.II, Figs.4-8, egg and larva.

Ehrenbaum, 1905-09, Nordisches Plankton, 1, Fig.71, egg, larva and post-larva.

Wheeler, 1969. The Fishes of the British Isles and North-West Europe.
Macmillan, London.

Table 1. Annual catches (metric tons) of witch from Sub-areas III, IV, VI and VII.

Year	Total catch tons		Sound and Belt Sea	Katte-gat & Skager-rak	North Sea			NW coast Scotl. N.Irel.		Irish Sea Bristol Channel	West coast Irel. Porcupine bank	South coast Ire-land	Engl. Channel East & West	Bay of Biscay	Portu-guese waters
					South	Centr.	North								
		IIIId	IIIb,c	IIIa	IVc	IVb	IVa	VIa	VIIb	VIIa,f	VIIb,c	VIIg-k	VIIId,e	VIIIa-e	IXa,h
1966	5 801	-	+	175 ^{d)}	-	178	1 002	266	9	16 ^{g)}	g)	3 732 ^{g)}	-	1	-
1967	2 228	-	+	152 ^{d)}	1	211	1 061 ^{d)}	360	2	37	-	1	-	-	-
1968	2 284	-	-	185 ^{d)}	+	263	1 063	399	+	13	-	1	1	-	-
1969	1 987	-	-	156 ^{d)}	+	264	707	463	-	16	-	+	-	-	-
1970	1 531	-	-	118 ^{d)}	+	209	417	377	-	25	-	+	-	-	-
1971	1 782	-	-	162 ^{d)}	1	310	555	361	+	46	-	+	-	-	-
1972	1 674	-	-	235 ^{d)}	+	334	508	356	-	31 ^{x)}	-	+	-	-	-
1973	2 089	-	+	277 ^{d)}	+	372	1 056	313	-	6 ^{x)}	-	-	-	-	-
1974	1 609	+	-	304 ^{d)}	-	384	678	204	-	6 ^{x)}	-	+	-	-	-
1975	1 834	-	-	498	+	428	421	317	+	3 ^{x)}	+	+	-	-	-
1976	2 282	+	+	226	+	295	747	342	1	20	-	373	+	+	-

d) Sweden IIIa included in IVa.

g) France VIIa,f and VIIb,c included in VIIg-k.

x) Only VIIa Irish Sea.

LEMON SOLE (Microstomus kitt (Walbaum))

ICES Areas IV and IIIa

Life history

Spawning times and areas

The data tabulated below are from Rae (1965).

Region	Start	Spawning time maximum	End
Shetland	End of April	May/June	Start of September
Moray Firth	"	June/July	End of September
F. of Forth	Mid-May	Mid-June/August	Start of October
W. Central N. Sea	"	July/August	Start of November

Drift of eggs, larvae and pelagic juveniles

According to Rae (1965), at least some of the eggs spawned around the Hebrides in May, may drift into the North Sea. Eggs spawned within the North Sea are not thought to drift far from the areas in which they are spawned.

Distribution of young and adult demersal stock components

Lemon sole begin demersal life at a length of about 2.5cm. Almost nothing is known about the distribution of lemon sole during their first two years of demersal life, since very few have been caught at these ages. Scottish research vessel data indicate that young lemon sole live at depths between 13 and 150 metres on rough ground.

The main concentrations of adult lemon sole in the North Sea occur between the Moray Firth and the Firth of Forth off the east coast of Scotland. Very few lemon sole occur in the Norwegian zone of the North Sea.

Migration

Within the main area of concentration, the young and adolescent fish do not migrate and only about 20% of the adult fish marked in various experiments travelled distances greater than 30 miles. Even these movements did not usually take fish outside the main centre of density of the stock.

Exploitation and management

Landings of lemon sole from the North Sea by Scotland, England, Denmark, Belgium, and the Federal Republic of Germany for the period 1922 to 1975 are shown in Figure (A). Since 1950, total landings have shown no marked trend, fluctuating fairly widely at a mean value of about $4\frac{1}{2}$ thousand tons.

The age at which lemon sole caught around Shetland are first landed is 5-6 years, while the corresponding value for landings from the Scottish east coast is 3-4 years. These differences are due to differences in the growth rate of lemon sole in the two areas.

Apart from the adoption, by ICES member nations, of a minimum landing size of 25cm, no measures have been taken to conserve the lemon sole.

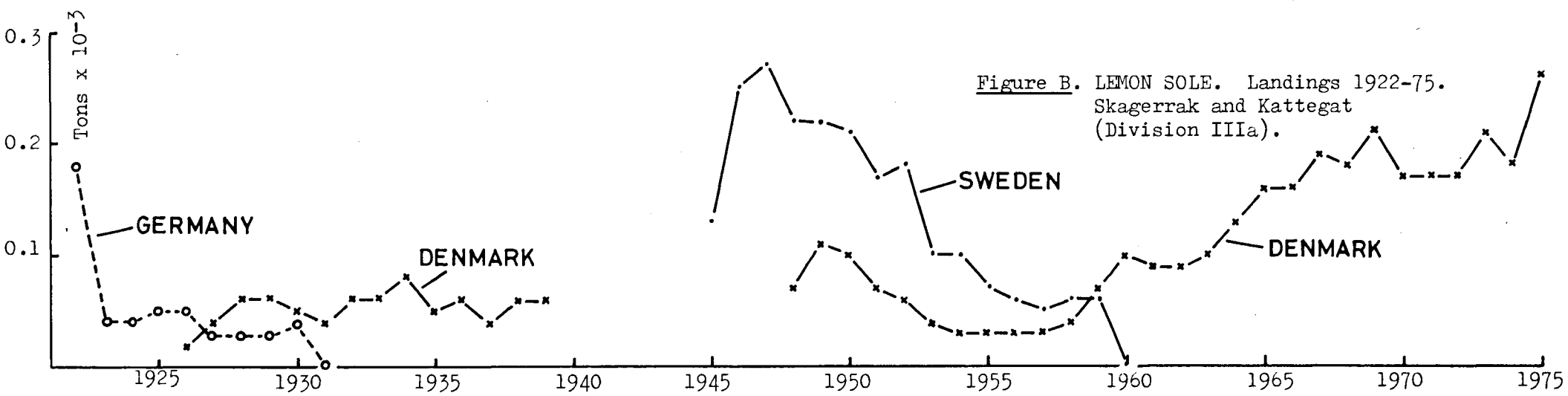
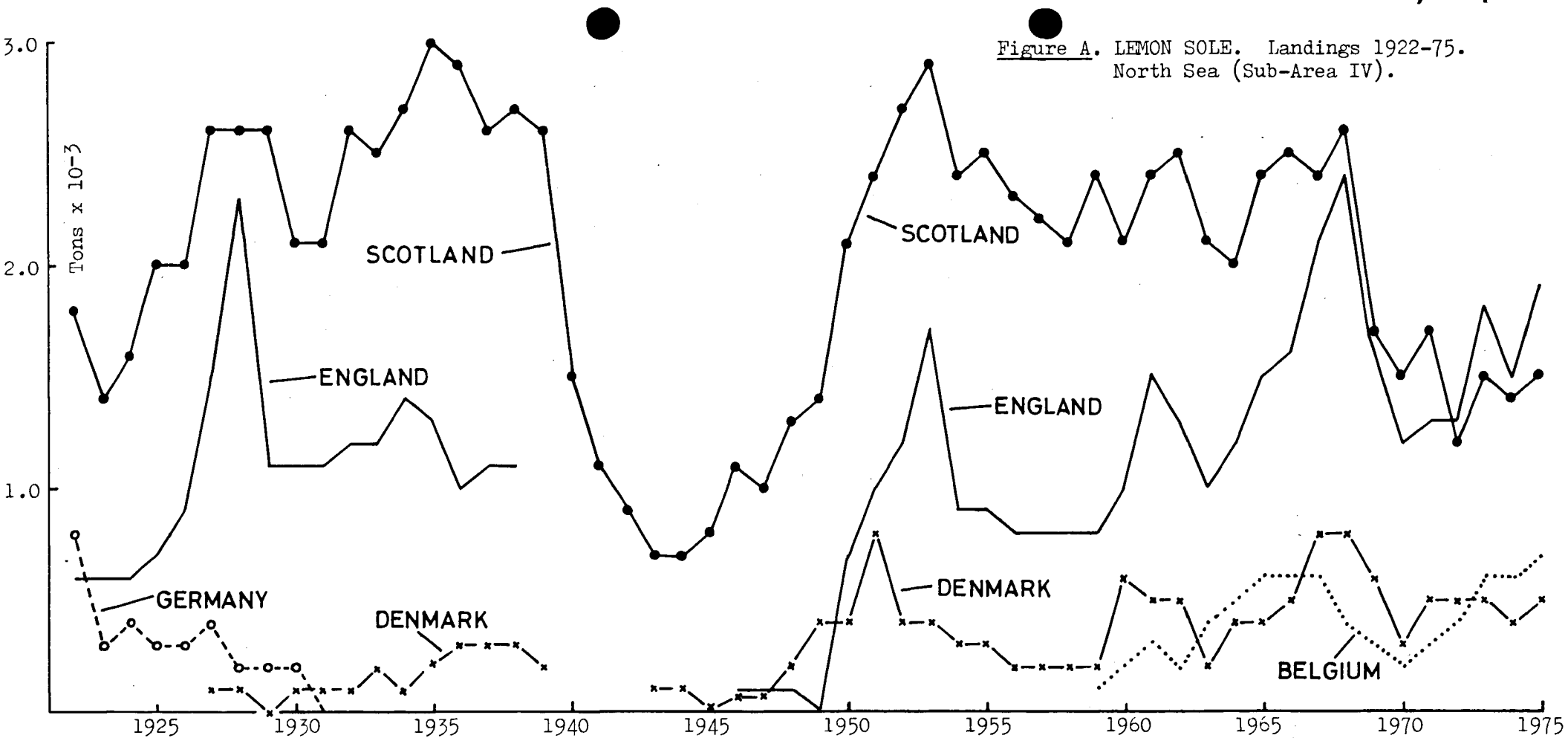
Present state of the stock

Landings-per-unit-effort by Aberdeen trawlers were relatively stable over the period 1920-1939. Between 1945 and 1955, landings-per-unit effort rose to about double the pre-war value and have fallen since then to a level slightly below that in evidence in the 1920's and 1930's.

Preliminary estimates of the total instantaneous fishing mortality rate (Z) for the lemon sole off the east coast of Scotland and in the vicinity of Shetland are 0.75 and 0.5 respectively. Assuming a value of $M=0.1$ and arguing on a yield-per-recruit basis, lemon sole in the northern North Sea are somewhat over-fished.

Division IIIa

Other than landings' statistics presented in "Bulletin Statistique", no data are available for the lemon sole in Division IIIa. Figure (B) shows the landings of lemon sole from Division IIIa for the period 1922-1975 by Federal Republic of Germany, Denmark and Sweden. Since 1960, Denmark is the only country to declare landings of lemon sole from Division IIIa. It is possible, however, that other countries land lemon sole, but do not separate them on their landing statistics. The current total international landing figure is about 250 tons per annum.



NORTH SEA PLAICE

General Biology

The spawning of the North Sea plaice occurs generally in areas less than 50 metres in depth, as shown in Figure 22. The most important spawning ground is in the Southern Bight, the others being situated south of the Dogger Bank, off the German Bight and off the northeast coast of England. Smaller spawning areas are found in the Moray Firth and the Firth of Forth (Harding et al., 1975).

Plaice also make a spawning migration from the southern North Sea to the eastern English Channel. There they join the spawning population of the resident English Channel plaice, and return to the North Sea when spawning has been completed (Houghton, 1976).

The spawning season lasts from December to April, although the peak occurs in January (Harding et al., 1975).

Distribution and Migrations

Nursery areas

The young fish spend the first one or two years of life in the shallow water close to the coast. The main nursery grounds are along the Danish, German and Dutch coasts (the Wadden Sea), but also along the English North Sea coast. In the German Wadden Sea, 0-group plaice first arrive in May. This immigration continues until November (Rauck, 1973), during which time they are taken as by-catch in the shrimp fishery, but from October the faster-growing juvenile plaice (those which arrived between May and July) emigrate offshore. The later arrivals remain in the inshore area during the winter, and appear as I-group plaice in the shrimp fishery the following year (Rauck, op.cit.).

As they grow, the plaice move out to deeper water, and join the adult spawning population at age 3-5 years.

Adult distribution

Plaice are found to a maximum depth of about 80 metres. In the North Sea they occur throughout the southern and central North Sea (Divisions IVc and IVb) but only in certain parts of the northern North Sea (Division IVa).

Exploitation and Management

The fishery

Throughout most of the early period up to World War II, the fleet

consisted of sailing trawlers, steam otter trawlers and small cutters. Fishing was undoubtedly concentrated in the southern North Sea, with a particular emphasis on the grounds adjacent to the nurseries. However, at least with the English steam trawl fleet, there was a considerable northern North Sea fishery, and although this was mainly directed at other species, plaice catches were made from the representative plaice grounds in Divisions IVb and IVa. As with World War I, World War II did not see a complete closure of the fishery, for the continental cutters continued to fish close in on the eastern side. Immediately after World War II, fishing recommenced with the return of the English fleet to the Southern Bight and the remainder of the cutters to the eastern grounds outside the mined areas. During the mid-1950s, however, fishing spread throughout the area of plaice distribution in Divisions IVc and IVb, and in the early 1960s in Division IVa. German and Danish vessels, possibly relatively unchanged in gear, size and power, are probably still fishing their traditional grounds in the eastern North Sea but the English fleet, which changed progressively to motor propulsion in the 1950s, has effectively left the Southern Bight for the central, southeast and northern North Sea, a steady decline in the number of English vessels probably being offset, particularly at Lowestoft, by increases in engine power, the use of heavy gear with synthetic nets and chains, and precision Decca-fix fishing. In addition, with the demise of the southern North Sea herring fishery during the 1950s, flatfish effort has been augmented by the rapid development of Dutch beam trawling, a method of fishing later taken up by Belgium too. Most of this new effort is concentrated in Division IVc, and the southerly portion of Division IVb (Bannister, 1975).

Stock fluctuations

In the period 1967-71, total stock biomass (ages 2 years and older as calculated from VPA) fluctuated around 700 000 tons, but although the strong 1972 year class reversed a downward trend from this level in 1974, the stock biomass appears to have been declining since then and has been forecast as 400 000 tons for the beginning of 1978 (Anon., 1977). However, the latest assessment indicates that there is currently no reason to suppose that the spawning stock is in danger.

Management

Regulation by mesh size and minimum legal landing size has been in force for some time, and TACs were introduced in 1975. Total allowable catches as recommended, together with those agreed on and the actual catch for each year, are shown below (quantities are given in '000 metric tons):

Year	Recommended TAC	Agreed TAC	Reported catch
1975	115	126	108
1976	85	99.9	109
1977	71	99.9	
1978	95		

Catch statistics

Annual catches in Divisions IVa, IVb and IVc for the period 1966-76, are given in Tables 1, 2 and 3, and the long-term trends are shown in Figure 2 (Bannister, op.cit.). Since 1966, 100-130 thousand tons have been taken each year from the North Sea.

Table 1 Nominal catch (metric tons) of PLAICE in Division IVa, 1966 - 1976
(Data for 1966-1975 from Bulletin Statistique)

Country	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976*
Belgium	15	4	5	7	3	1	3	3	+	1	-
Denmark ^{a)}	...	...	...	...	...	...	...	...	5 175	549	...f)
Faroe Islands	-	-	-	-	-	-	-	1	-	1	-
France	1 765 ^{b)}	1 467	55	56	9	-	-	-	-	1	...f)
Germany, Fed. Rep.	66	95	13	40	28	1	7	13	11	34	31
Netherlands	4	11	1	+	5	-	-	34	42	425	331 ^{g)}
Norway	33 ^{c)}	35 ^{c)}	38 ^{c)}	26 ^{d)}	22 ^{d)}	18 ^{d)}	19 ^{d)}	15	13	13	27 ^{b)}
Poland	-	-	-	-	-	-	-	1	-	153	40
Sweden ^{e)}	370	593	776	772	608	588	626	432	431	...h)	53 ^{b)}
U.K. (Eng. & Wales)	829	1 154	2 656	1 641	1 464	4 042	5 409	6 126	2 490	3 350	...f)
U.K. (Scotland)	2 789	2 982	3 078	2 570	2 427	2 436	1 750	2 142	2 076	1 615	1 907
U.S.S.R.	-	-	-	-	-	-	-	397 ^{b)}	-	-	-
Total	5 871	6 341	6 622	5 112	4 566	7 086	7 814	9 164	10 238	6 142	2 389

* Preliminary

a) 1966-1973 included in IVb

b) Includes IVb,c

c) 1966-1968 includes IVb,c

d) 1969-1972 includes IVb

e) 1966-1974 includes IVb and IIIa

f) Included in IVb

g) As reported on STATLANT 27A forms for 1976

h) Included in IVb

Table 2. Nominal catch (metric tons) of PLAICE in Division IVb, 1966 - 1976
(Data for 1966-1975 from Bulletin Statistique)

Country	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976*
Belgium	1 408	1 314	1 255	1 017	1 155	1 572	2 393	3 639	3 764	4 466	1 635
Denmark ^{a)}	29 055	28 287	30 369	35 227	32 807	22 278	24 494	23 266	14 639	22 170	25 169 ^{h)}
France	... ^{b)}	146	141	153	22	-	1	155	-	12	228 ^{h)}
Germany, Fed. Rep.	4 300	5 195	5 237	5 017	5 491	3 292	4 282	5 436	3 222	4 006	4 091
Netherlands	4 846	7 438 ^{e)}	12 629 ^{f)}	19 968	24 863	24 396	33 101	36 987	37 577	37 985	34 652 ^{j)}
Norway ^{c)}	...	...	...	...	...	...	...	-	-	-	...^{b)}
Sweden ^{d)}	...	...	...	...	...	...	...	...	...	358 ^{g)}	... ^{b)}
U.K. (Eng. & Wales)	25 104	28 803	25 942	28 024	32 668	27 938	25 681	23 849	20 996	16 504	23 912 ^{g)} ^{k)}
U.K. (Scotland)	2 567	2 727	2 732	2 411	2 276	1 774	1 660	2 673	1 926	1 651	1 374
U.S.S.R.	-	-	-	-	-	-	-	... ^{b)}	9	-	29
Total	67 280	73 910	78 305	91 817	99 282	81 250	91 612	96 005	82 133	86 829	91 090

* Preliminary

a) 1966-1973 includes IVa

b) Included in IVa

c) 1966-1972 included in IVa

d) 1966-1974 included in IVa

e) Not including 8 655 tons caught mostly in IVb, rest in IVc

f) Not including 3 096 tons caught mostly in IVb, rest in IVc

g) Includes IVa, c

h) Includes IVa, c (from Data form 5)

j) As reported on STATLANT 27A forms for 1976

k) A difference between the total U.K. catch reported on Data form 5 and Scottish catches reported on Recommendation 12 forms

Table 3. Nominal catch (metric tons) of PLAICE in Division IVc, 1966 - 1976

(Data for 1966-1975 from Bulletin Statistique)

Country	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976*
Belgium	5 067	5 460	4 316	3 452	3 202	3 500	3 135	2 491	2 438	1 687	1 326
Denmark	-	-	-	-	-	-	-	-	-	12	...d)
France	...a)	117	1 114	1 121	1 375	1 380	1 061	1 200	519	523	...d)
Germany, Fed. Rep.	35	+	-	14	+	3	29	2	+	+	-
Netherlands	20 832	13 801c)	17 510c)	19 452	21 212	20 106	18 947	20 927	16 819	12 883	11 474e)
Norwayb)	...	...	...	-	-	-	-	-	-	-	...a)
Sweden	-	-	-	-	-	-	-	-	-	...d)	...a)
U.K.(Eng. & Wales)	1 045	1 017	971	684	707	596	552	425	368	436	...d)
U.K.(Scotland)	-	-	-	-	-	-	-	-	-	-	+
U.S.S.R.	-	-	-	-	-	-	-	...a)	30	-	8
Total	26 979	20 395	23 911	24 723	26 496	25 585	23 724	25 045	20 174	15 541	12 808

* Preliminary

a) Included in IVa

b) 1966-1968 included in IVa

c) See footnotes "e" and "f" in Table 12.

d) Included in IVb

e) As reported on STATLANT 27A forms for 1976

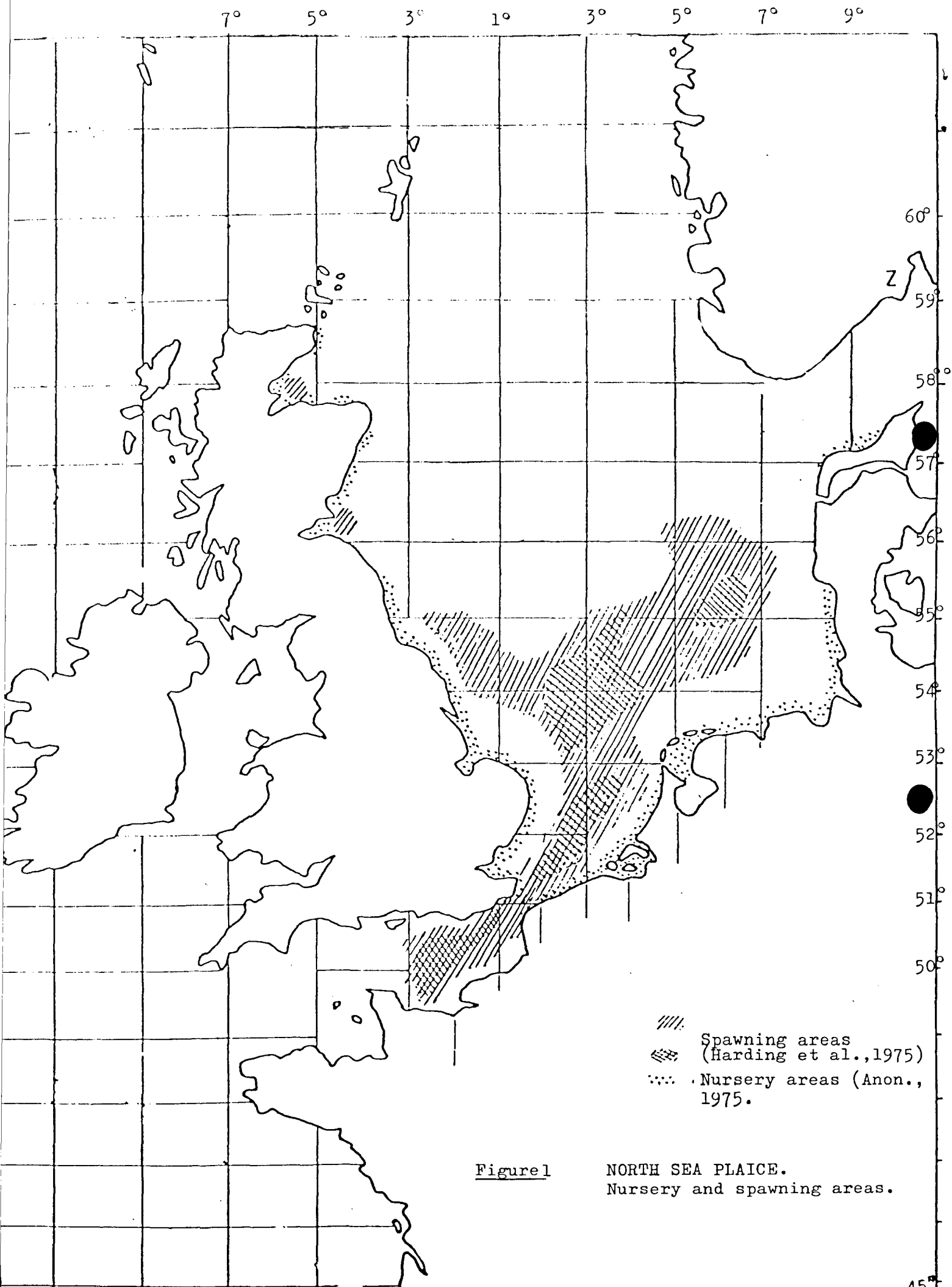


Figure 1

NORTH SEA PLAICE.
Nursery and spawning areas.

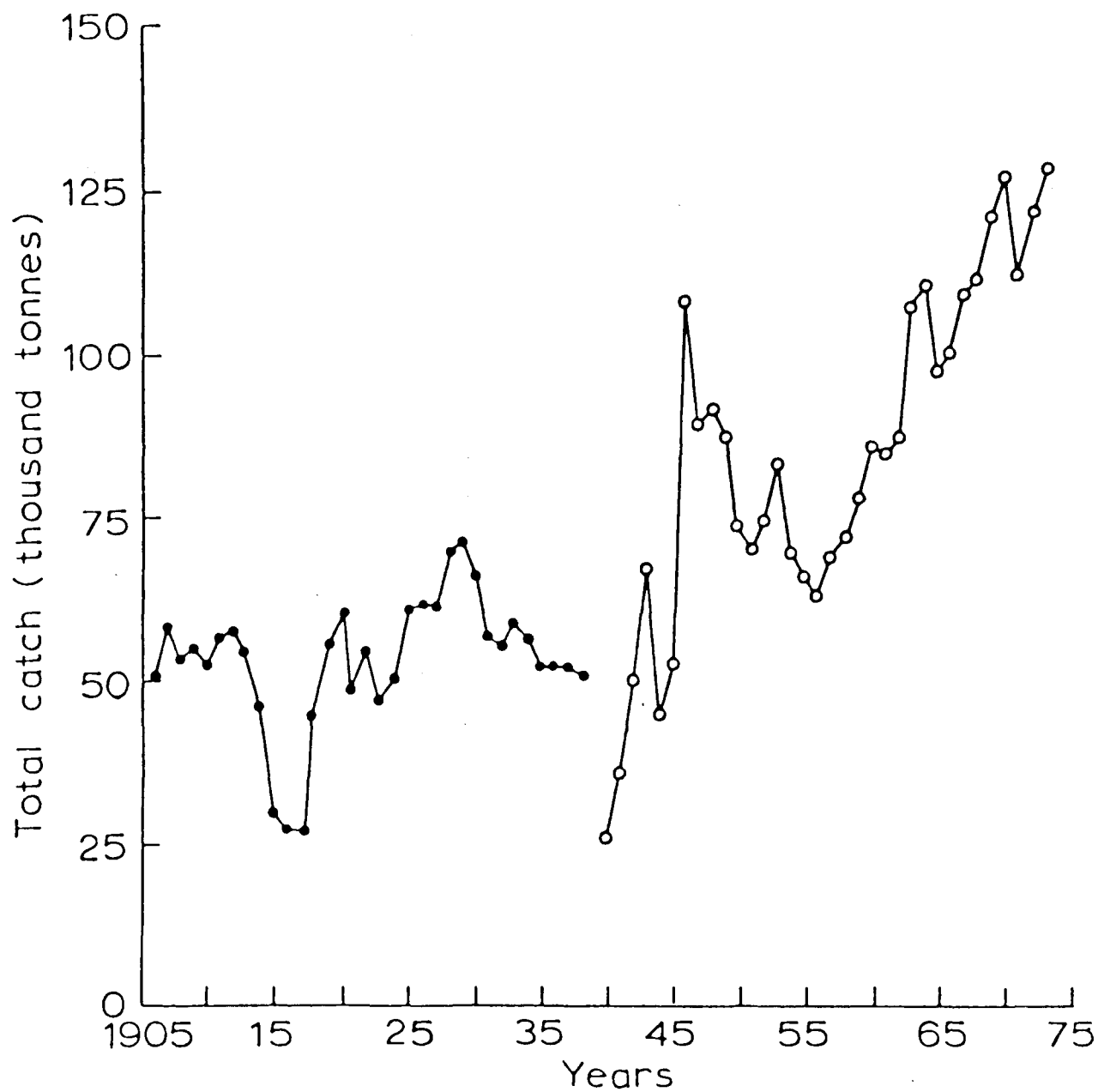


Figure 2

Trend in the total catch of PLAICE
from 1906.

Source: Bannister (1975).