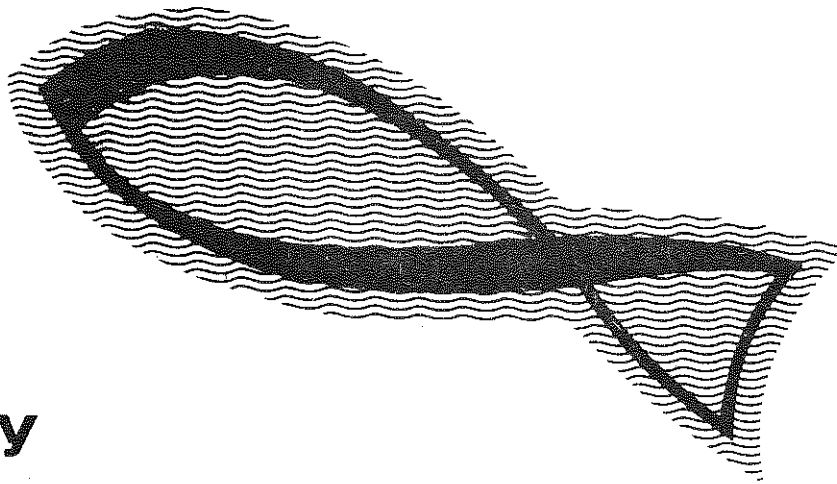




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iascaigh agus
foraoiseachta**

**The Donegal Mackerel
Fishery**



by

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Irish Mackerel landings have increased dramatically, from less than 2,000 tonnes in 1970 to nearly 30,000 tonnes in 1978. The development of this fishery can be ensured only if a satisfactory management plan is drawn up. To provide the basis for such a plan a major investigation of the Donegal stocks was launched by the Department of Fisheries in 1978 and will continue for some years. At the same time the fishery scientists of other countries are studying other parts of the same mackerel stock and their results are discussed at an annual meeting in Copenhagen. These results are the basis for the total allowable catch imposed by the EEC.

This Leaflet gives an outline of the recent history of the Irish mackerel fishery off Donegal and preliminary details of the current scientific results. Apparently, most of our mackerel spend the winter off Cornwall and move northwards for the summer. The peak in landings in autumn takes place when the shoals are moving south again for the winter. Young mackerel, less than a year old

are exploited in winter in the Cornish fishery but the Donegal catches are made up of fish most of which over 8 years old. The total stock of "Western" mackerel has been estimated to have decreased from 4 million tonnes in the early seventies to 2 million tonnes in 1980. Under the present system of fishing the TAC for 1981 should not exceed 353,000 tonnes if the fishery is not to be endangered. However, this catch could be increased considerably if the winter fishing off Cornwall were to cease and the fishing effort could be concentrated off Scotland and north-western Ireland in autumn.

In the early part of this century the Irish mackerel fishery was at least as important, if not more important than the herring fishery. However, after the collapse of the American market in the late twenties the fishery dwindled and landings remained at a very low level until the mid seventies. The total landings of Irish mackerel according to official reports since 1900 are shown in Fig. 1. For a considerable period prior to the mid seventies mackerel were landed more or less as a by catch and prices remained very low. However because of the restrictions imposed on the herring fisheries in recent years renewed attention has been paid to the mackerel resource and landings have started to increase. This increase has been particularly evident off the north-west coast where the establishment of a number of processing factories has created a new outlet for mackerel. The total Irish catch from off the northwest coast has risen dramatically from approximately 3,000 tonnes in 1974

to over 21,000 tonnes in 1979. The total catch taken by Irish boats from ICES Divisions VIa and VIb, and landed mainly at the Donegal ports of Killybegs and Burtonport are shown in Fig. 2.

International landings

The increased landings off the north-west coast are part of an enormous expansion of the mackerel fishery which has taken place in recent years in the waters west of Ireland and Great Britain. Since 1968 the total catch has increased from 66,000 tonnes to over 605,000 in 1979. Details of the catches by individual countries are shown in Table 1. Over 50% of the total catch in 1979 was taken by the United Kingdom and came mainly from the fishery off Cornwall. However, considerable quantities were also taken from the Minches in that year because of increased exploitation in that area by the Scottish fleet.

Biological identity of mackerel stocks

At the present time the mackerel stock off the west of Scotland, Ireland and off Cornwall is known as the "Western Stock" as distinct from the "North Sea Stock" which supports the fishery in the North Sea. However while it is thought that these two stocks are separate biological units (which show a considerable degree of seasonal mixing in the northern part of their range) and which have been managed as such, the true stock structure may be much complex than this.

The "Western Stock" spends the winter off Cornwall where it is subjected to an intense fishery. In early spring the overwintering shoals break up and move onto the spawning grounds which are situated in the Celtic Sea and English Channel. This spawning migration appears to be a gradual one because spawning takes place over a prolonged period from February to July. After spawning the mackerel begin to feed voraciously and make long migrations in search of food. These feeding migrations take the shoals up the West coasts of Ireland and Scotland and into the North Sea. During these spring and early summer migrations the shoals, because they are hunting for food, are fairly dispersed. In the autumn the shoals commence their return journeys to their overwintering grounds. On this southward journey they are more concentrated and are intercepted and exploited by the fleets operating in the Minches and off the north-west coast of Ireland.

The Irish Fishery

Seasons The fishery off the north-west coast takes place in two main phases. The first phase exploits the shoals on their northward migration during May to July. The second phase takes place on their return journey to the overwintering grounds from October to December, is by far the more important of the two.

Location The area of fishing during the May-July period extends over a large area of the northwest coast because shoals are widely distributed. However during the October to December period shoals appear to be closer inshore and are first located off Aranmore Island.

They are then fished intensively as they migrate southwards along the coast and in recent years the last catches of the season were taken off Eagle Island and the Stags of Broadhaven.

Number of boats and type of gear

Approximately 30 pairs of boats, engaged in paired midwater trawling, took part in the fishery at the peak period in 1979. It was apparent however that the more powerful boats (greater than 700 hp) caught the major portion of the total landings. In addition these larger boats, because they are equipped with refrigerated tanks, have better storing facilities and are thus able to make longer trips.

Disposal of catch Considerable quantities of mackerel are now frozen by Donegal factories and are exported, either whole or as fillets, to continental Europe. Smaller quantities are exported to Nigeria. In addition some are now transhipped direct to factory ships from eastern European and other countries. However in spite of these outlets the major portion of the catch is reduced to fishmeal at Killybegs. or dumped.

Scientific Investigations

As is the case now with the more important Irish fisheries the total catches allowed each year (TAC) are regulated by the Commission of the EEC. These TACs are determined by the Commission as a result of advice received from the Advisory Committee of Fisheries Management (ACFM)

of the International Council for the Exploration of the Sea (ICES). The ACFM, in turn bases its advice on a report of the Mackerel Working Group which meets each year in Copenhagen. At the annual meeting of the Mackerel Working Group the scientific investigations carried out by each country are studied and co-ordinated and appropriate management proposals drawn up. Irish fisheries scientists participate in all these stages.

In order to have an input to this important Working Group and consequently to play a full part in the management of our own fishery a continuous mackerel sampling programme was initiated off the north-west coast in 1978. This sampling programme covers the entire fishing season and individual fish are examined for age, length, weight, sex and maturity. In addition fat content and numbers of mackerel per kilogram were estimated and the results distributed to interested bodies.

Age and length

The age of mackerel, as with herring, is determined by counting the numbers of winter rings on the otoliths. Mackerel ages are difficult to determine because of a combination of fast growth in their first year and the prolonged spawning period. This means that there is tremendous variation in the lengths of fish at each age group and consequently an elaborate and time consuming sampling programme must be carried out to determine accurate growth rates. The growth rate in the first year of life is such that mackerel born early in the year in February,

will have reached 16cm or 17cm by December and at this length they are already being exploited in the winter fishery off Cornwall.

Although mackerel may live up to 15 or 16 years of age most of the growth has been completed by the time they are 6 or 7 years old. This means that the growth rings in the older fish are very closely grouped together and it is difficult to age these fish correctly. Because of this, fish which have more than 8 winter rings are grouped together. The percentage age distributions of the Irish catches landed from Div VIa and VIIb-c for 1978 and 1979 are shown below

Age (<u>winter rings</u>)	0	1	2	3	4	5	6	7	8	78	
1978	-	0.2	10.6	20.9	12.9	13.1	5.1	7.0	5.0	{ 25.4 }	4
1979	-	1.6	1.4	15.3	17.2	10.1	9.8	8.2	9.1	{ 27.4 }	

There was very little difference in the age distributions between these two areas - both were dominated by fish older than eight years. Mackerel spawned in 1975 were also well represented - constituting over 20% in 1978 and 17% in 1979.

Maturity Distribution

Samples obtained during January contained mostly maturing fish (Stage III) and recovering spents (Stage VIII). These fish, by April and May, had advanced and were filling (Stage IV) and full (Stage V). It is not known whether these fish would have spawned in this locality or would have migrated south to the known spawning grounds in the Celtic Sea.

Most of the fish examined in the main season (October to December) were either spents (Stage VII) or recovering spents (Stage VIII). Throughout the whole year immature fish never constituted more than 10% of the samples.

Fat content

As in other pelagic fish the percentage fat content is closely associated with the availability of food and the spawning period. Fat content appears to vary considerably throughout the year and P.D. Wallace and T.J. Hume have shown that, in general the fat content is highest in the last quarter of the year and lowest in the second quarter. They also have shown that the fat contents of mature and spent fish generally increase with size. Samples obtained from Donegal and analysed with ether extraction showed that fat content was 24% in December and approximately 6% in April.

Tagging

Tagging of mackerel has been successfully carried out for a number of years. The information obtained from a successful tagging experiment can help to determine the size of the total population and also help to provide information on migrations and growth rate. In the case of mackerel enormous numbers of fish must be tagged and liberated to obtain reliable information. Norwegian tagging experiments off the south west of Ireland commenced in 1966 and have been completed each year since then. In recent years approximately twenty to thirty thousand fish are tagged and liberated off Co Kerry during the Spring before the fish set off on their summer migrations. These fish are taken by a

chartered commercial purse seiner. The tag consists of a small piece of light metal, bearing a serial number, which is inserted into the body cavity of the fish. These tags are subsequently recovered from fish meal factories by magnets which are strategically placed along the production line.

Numbers of these tags from the Norwegian experiments were recovered from the fish meal factories in Killybegs and Mornington in 1978, 1979 and 1980. The numbers recovered in each year from successive tagging experiments are shown below.

Winter of recapture	Year in which tagging took place									Total recovered
	1971	1972	1973	1974	1975	1976	1977	1978	1979	
1978/79	2	-	1	3	2	4	7	9	-	28
1979/80	-	1	1	-	1	2	7	6	16	34

It is especially interesting to note that out of the total number of tags recovered, 15 (i.e. 24%) were originally tagged by the Norwegians in experiments carried out in the North Sea and Skagerrak.

Some limited tagging has also been carried out in 1978 and 1979 by Scotland in August and September in the North Minch, and three fish from these experiments were recovered two or three months later off Denegal.

Total stock size

There is considerable difficulty in determining the total size of the Western mackerel stock because of the lack of precise information about the degree of mixture between it and the North Sea stock. There are also

considerable inaccuracies in the reported catch statistics both in relation to areas where the catches are taken and also concerning the amounts which are never officially recorded. Estimates of total stock size based on age distributions and fish mortalities, however, indicate that the biomass of fish of three years and older was about 4 million tonnes in the early seventies and has since decreased to about 2 million tonnes in 1980. On the other hand an estimate of the total stock size based on a comprehensive series of egg surveys, carried out over the entire western area in 1977 by UK and France, was nearly three times higher than that obtained by the methods based on age-distribution and fishing mortality.

Management

The total allowable catch recommended for the Western stock for 1979 was 435,000 tonnes. The total catch in that year, however, was approximately 606,000 tonnes. The TAC recommended for 1980 was set at 354,000 tonnes. The future management of the fishery depends greatly on how strictly the TAC is observed. However, if the catch in 1980 amounts to about 550,000 tonnes and recruitment remains at about the average of the level during 1972 to 1979 (i.e. a high level) the TAC in 1981 should not exceed 353,000 tonnes. There appears to be a real danger that at the present level of fishing these catches could not be sustained for very long. This arises mainly because the fishery off the Cornwall coast during winter catches very large numbers of

small immature mackerel - particularly during the main part of the season. It has been estimated that if the entire fishery on the Western stock could be managed in such a way that the main exploitation was changed from off Cornwall during the winter to Scotland and north western Ireland during the autumn the total catch could be increased by as much as 150,000 tonnes per year without increasing the mortality rate. This would arise because the total catch removed from the fishery would contain only larger older fish and the amount of individuals would be considerably less than that taken during the winter fishery.

Table 1. Nominal catch in tonnes of mackerel in the Western area (VI, VII and VIII).

(Data for 1969-77 as officially reported to ICES). From ICES Mackerel Working Group Report 1980.

Country	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Belgium	11	8	2	1	3	7	17	10	1	1	-
Denmark	-	-	-	-	-	-	-	3	698	8,677	8,535
Faroe Islands	-	-	-	-	635	8,659	1,760	5,539	3,978	15,076	10,609
France	31,356	42,899	33,141	35,354	41,664	37,824	25,818	33,556	35,702	34,860	31,510
German Dem. Rep.	9	130	93	214	1,733	2,885	9,693	4,509	431	-	-
Germany, Fed. Rep.	428	783	258	98	559	993	1,941	391	446	28,873	21,493
Iceland	-	90	86	74	52	-	21	10	-	-	-
Ireland	1,615	1,055	3,107	4,592	8,314	8,526	11,567	14,395	23,022	27,508	24,217
Netherlands	4,441	3,828	3,837	6,166	7,785	7,315	13,263	15,007	35,766	50,815	62,396
Norway	-	-	1,611	-	34,600	32,597	1,907	4,252	362	1,900	25,414
Poland	2,149	6,054	10,832	13,219	10,536	22,405	21,573	21,375	2,240	-	92
Spain	21,571	31,368	37,506	31,416	25,677	30,177	23,408	18,480	21,853	19,142	20,000
Sweden	-	-	-	-	-	-	-	38	-	-	-
UK (England & Wales)	2,692	3,374	4,791	6,923	13,081	21,132	31,546	57,311	132,320	213,344	244,293
UK (Northern Ireland)	279	243	315	57	93	75	30	95	97	46	25
UK (Scotland)	402	807	805	1,412	5,170	8,466	16,174	28,399	52,662	103,671	103,160
USSR	6,147	13,555	36,390	71,249	65,202	103,435	309,666	262,384	16,396	-	-
Unallocated	-	-	-	-	-	-	-	-	-	-	54,000
Total, ICES members	71,100	104,194	132,774	170,775	215,104	284,496	468,384	465,754	325,974	503,913	605,744
Bulgaria	-	-	-	-	4,341	13,558	20,830	28,195	-	-	-
Romania	-	-	-	-	-	-	2,166	13,222	-	-	-
Total	71,100	104,194	132,774	170,775	219,445	298,054	491,380	507,178	325,974	503,913	605,744

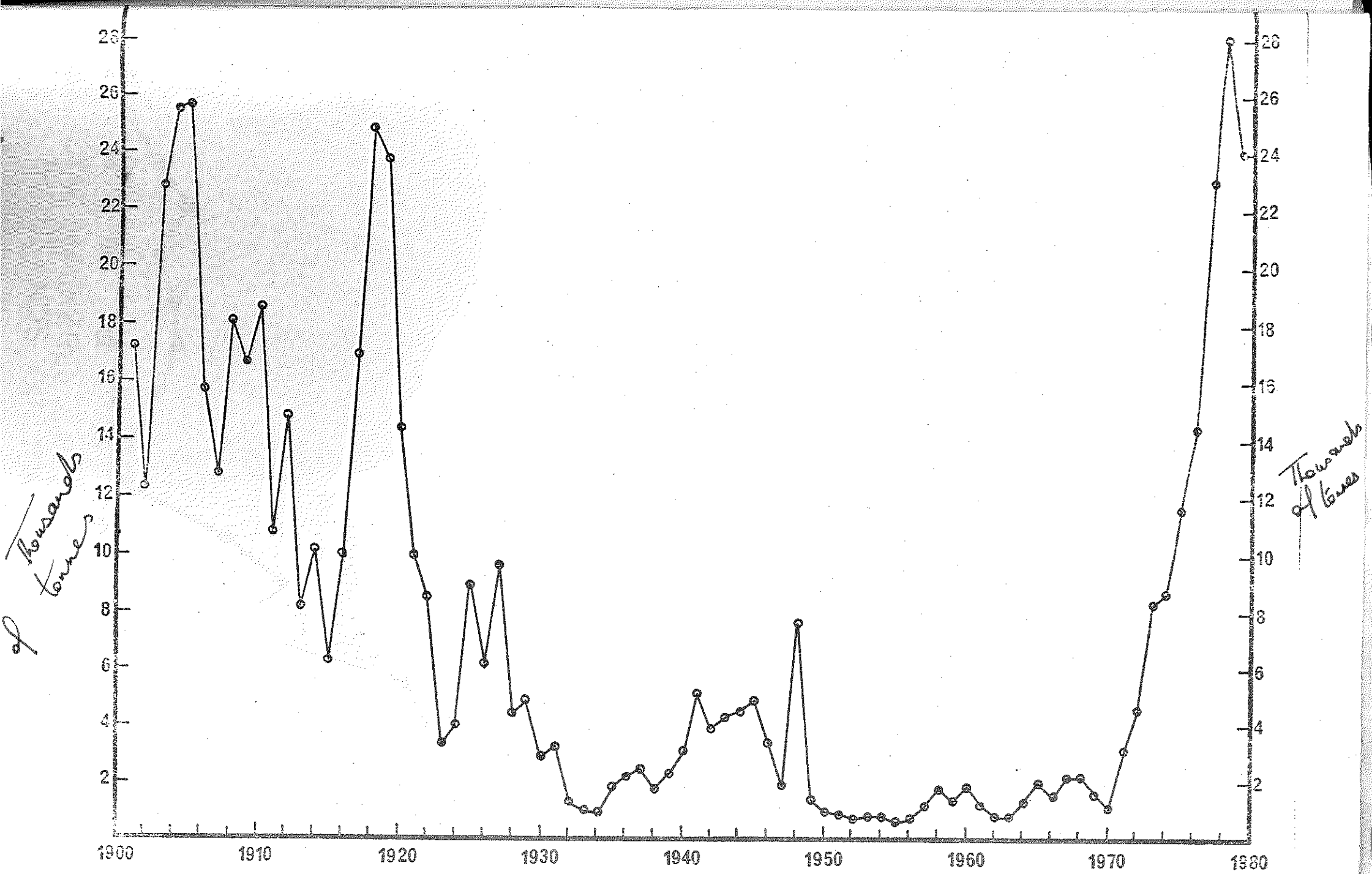


Fig.1. TOTAL IRISH MACKEREL CATCH. 1900—1979. THOUSANDS OF TONNES.

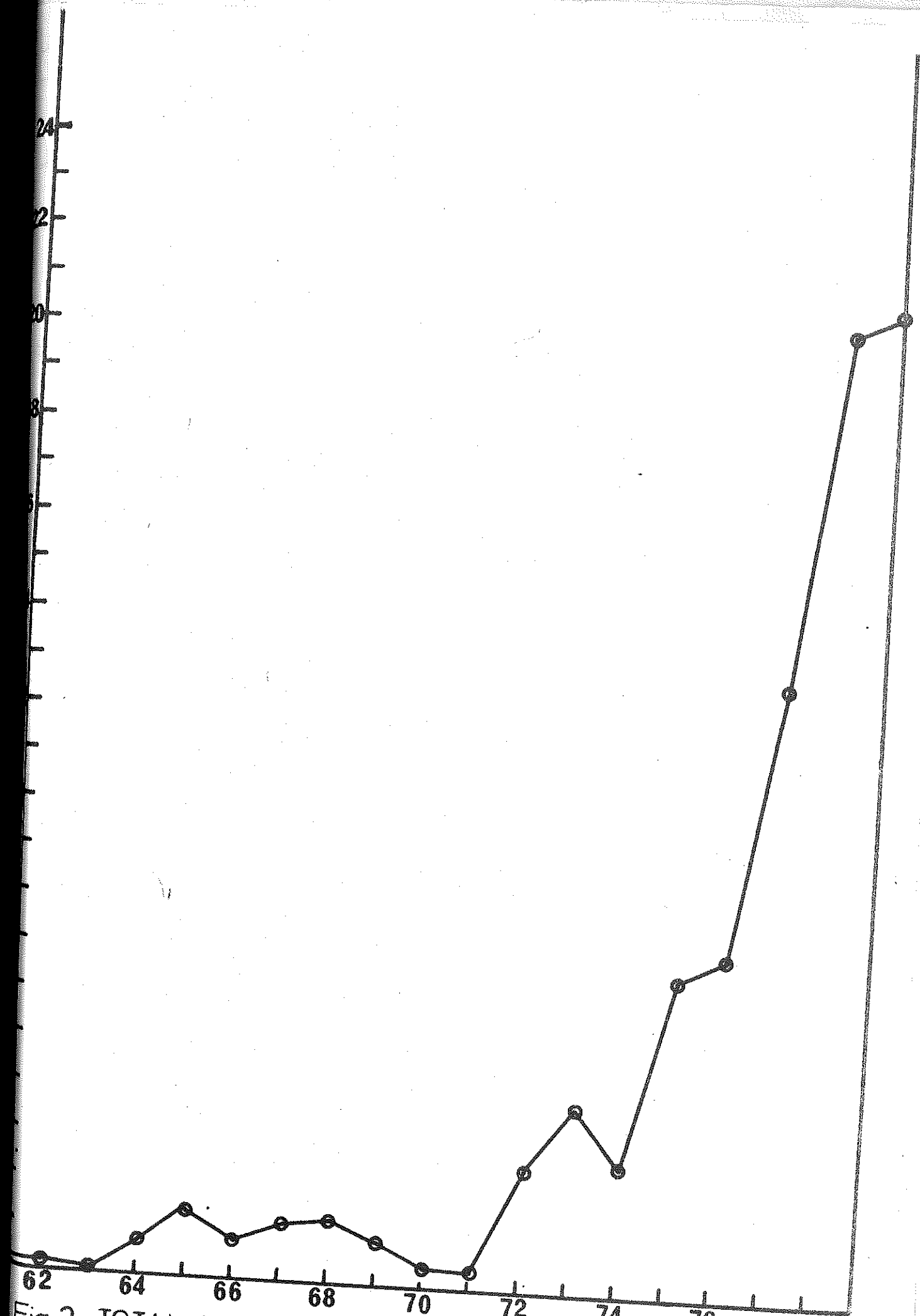


Fig.2. TOTAL MACKEREL CATCH Div. VIa and VIIb only.
THOUSANDS OF TONNES