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**THE HERRING FISHERIES OF IRELAND**

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## ABSTRACT

Not since Farran (1941) published his paper, entitled "The herring fisheries in Eire, 1921 - 1941" has an attempt been made to describe the herring fisheries of Ireland. The purpose of this paper, therefore, is to provide information about the various fisheries around the Irish coast in the decade from 1960 to 1969. For convenience, the coast has been divided into five areas, namely the east coast, the south coast, the southwest coast, the west coast and the northwest coast. The principle ports and major herring grounds, the type of boats and gear used, the seasonal abundance and total catch, the type of herring caught, with regard to size, condition, number per kilogramme and fat content, the present methods of disposal of the catch and any other relevant details are described for each area.

## INTRODUCTION

The relationship of the herring fisheries to the total sea fisheries of Ireland is shown in Table 1, where the annual landing of herrings in crans, their total value and average price per cran are compared with the total value of all wet fish landings and the percentage value of the total landings represented by herrings alone (Reports on the Sea and Inland Fisheries 1960-1969). Herrings make a large contribution to the total landings of all sea fish and have increased substantially in the years 1966/1969 following a drop in the middle "sixties". This decline was caused mainly by poor landings of herrings from the south coast fishery. The demand for herrings and their average value per cran has remained fairly constant. However, there has been considerable variation in value at different ports. Furthermore in recent years prices have been lowered by the sale of considerable quantities of herrings for industrial purposes.

Consumption of herrings in Ireland is very small and therefore the demand on the home market is easily satisfied, with the result that the major portion of the total catch is exported to the continent, mainly Holland, France, Western Germany and the U.K. Exports to the continent are mainly "rough packed" (i.e. salted and barrelled) with smaller amounts "klondyked" (i.e. lightly salted, iced and boxed), marinated, frozen or cured in various other forms. Herrings exported to U.K. are mainly "fresh" i.e. boxed and iced, with smaller amounts rough packed, subsequently to be smoked and sold as "reds" and re-exported to Mediterranean countries. Most of the herrings used on the Irish market are either fresh or kippered. Surplus landings of herrings or herrings not suitable for human consumption or processing are reduced to fish meal. A large amount of the herrings exported are subsequently graded, processed into more sophisticated forms and then re-exported to other European, Asian and North African countries. Because of the decreased landings of herrings from the North Sea and the North Atlantic due to overfishing, the demand for Irish herrings has increased considerably during the last few years. This demand will continue to rise unless there are substantial improvements in other herring landings, particularly from the North Sea catches.

Table 1. Figures relating to the Irish herring fishery, based on the annual Reports on the Sea and Inland Fisheries.

Year	Total landing crans	Total Value £	Average value per cran (s)	Total value (all fish) £	Percentage of total landings
1960	119,261	324,945	54	1,611,605	24.5
1961	71,451	209,710	58	1,357,242	15.5
1962	53,581	260,463	98	1,498,995	17.5
1963	47,341	193,068	82	1,413,690	13.7
1964	47,980	155,440	64	1,504,556	10.3
1965	60,159	251,521	84	1,700,373	14.8
1966	83,800	399,312	96	2,033,336	19.6
1967	133,030	499,280	78	2,152,772	23.2
1968	129,189	496,753	76	2,403,781	20.7
1969	194,925	783,973	80	2,995,550	26.2

For areas and places referred to in text, see Fig. 17

1. EAST COAST

Landings of adult herrings on the east coast have been very small in the last decade and details are given in Table 2.

Table 2. Landings of herrings (including small herrings for fish meal) on the east coast (crans).

Year	Crans	Year	Crans
1960	5,168	1965	301
1961	2,251	1966	107
1962	891	1967	687
1963	1,320	1968	396
1964	492	1969	21,968

These herrings were landed at Clogherhead, Mornington, Howth, Dun Laoire, Rosslare and Wexford. Most of the herrings landed at Clogherhead and Mornington consist of juveniles and were reduced to fishmeal. There is, now, no established adult herring fishery on this coast and any herrings taken are merely a by-catch in the main trawl fishery for other species.

Samples of young herrings, used for fishmeal, have been examined regularly since 1968. The size range varies considerably, there being a tendency for small herrings (8 cm - 20 cm) to dominate the spring and summer landing. Larger herrings (20 cm - 25 cm) dominate the autumn and winter catches and considerable quantities of them were landed at Mornington from November 1969 to January 1970. They had been caught in the Lambay-Rockabill area and from the area between the south County Down coast and the Isle of Man.

However, most of the herrings landed throughout the year are immature and are recruits to an adult fishery which has not been properly identified. There is evidence to suggest that these immature fish contain potential winter and autumn spawners, although it is not yet known in what proportions they are mixed. These young winter herrings may join either the main winter spawning stock at Dunmore East or one of the small winter spawning populations that frequent the Irish Sea.

The boats used in this industrial fishery are in the 50-60foot class, although a small number of larger boats are periodically engaged. Most boats use paired bottom trawls and only occasional attempts have been made to use midwater trawls.

2. SOUTH COAST

The fishery along the south coast is the most important of the Irish herring fisheries at present, in quantity, quality and value of herrings landed. Herrings are landed principally at Dunmore East, but since 1966 substantial quantities have also been landed at Cobh, making it, in 1969, the most important herring port in the country after Dunmore East. Smaller landings have been made at Kilmore Quay, Passage East, Helvick, Ballycotton, Passage West and Kinsale. Herrings are only landed during the late autumn and winter months and the season generally lasts from early November to mid-February. Fishing is carried out close inshore in shallow waters (10-30 fathoms) mainly within the three mile limit and the most productive fishing grounds are in Baginbun Bay, off the south Wexford coast; off Mine Head and in Tramore Bay, Co Waterford; in Ballycotton Bay; around Capel Island and around the Daunt Rock, Co Cork. The total catch taken by Irish boats from this area and landed at Irish ports during the period 1960/61 to 1969/70 and the number of boats engaged in the fishery are shown in Table 3.

Table 3. Total catch and number of boats - South Coast Herring Fishery 1960/61 to 1969/70.

Season	Total Catch	No. of Boats	Season	Total Catch	No. of boats
1960/61	64,411	96	1965/66	20,542	45
1961/62	29,120	57	1966/67	47,560	50
1962/63	25,370	58	1967/68	63,343	58
1963/64	22,012	37	1968/69	70,781	59
1964/65	17,434	24	1969/70	96,934	73

Considerable changes have taken place in the type of boat and the gear used in recent years. The length of the boats used ranges from 50' to 85' the majority being in the 60 to 70 foot class. There is, however, a tendency for increasing numbers of larger and more powerful boats to be used each season. Nearly all the herrings landed by Irish boats are taken by either bottom or midwater trawls.

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Although some attempts have been made to introduce single midwater trawling, paired midwater trawls are the most successful and popular. Bottom trawls have dropped steadily in popularity during the last five seasons and are now only used when the herrings are ready to spawn. In 1965/66 bottom trawls produced 85% of all the landings but in 1969/70 contributed less than 27%. Midwater gear can now be used throughout the whole season, even when the herrings are on the bottom. The roughness of the ground prevents bottom trawling in areas other than Baginbun and Tramore Bays and the estuary of Waterford Harbour. Small amounts of herrings are also taken by small boats drift netting in Waterford Harbour and in Ballycotton Bay.

Considerable work has been carried out on the herrings that frequent this section of the coast (Bracken and Burd, 1965, Molloy, 1969). It is known that they belong to a winter spawning stock, which migrates inshore for the purpose of spawning. This spawning takes place over a prolonged period in well defined areas along the coast, the most important of these being in Baginbun Bay, in Ballycotton Bay and around the Daunt Rock. After spawning has taken place, these herrings immediately leave and are not fished by Irish boats until they reappear in the following autumn. They are, however, subjected to intense off shore fishing by Continental, particularly Dutch, fleets during the period May to November, over a wide area of the Celtic Sea. During the summer and early autumn months the herrings are recovering spents and filling fish which are feeding heavily and are rich in oil. Thus when first taken by Irish boats in autumn, they are in top condition, full and with a high oil content. As the season progresses, however, and the onset of spawning approaches, the herrings gradually change from "full" to "mazy" with a subsequent decrease in fat content. Due to the fact that there may be a number of groups present, each of which has a different spawning time, the condition and fat content will show considerable variations throughout the season, and spent fish may be found for a day or two in the catches on different occasions. The size of the south coast herring is fairly uniform throughout the season, although there is a tendency for smaller herrings to be more abundant in the catches during the early part of the season. These herrings are usually immature two year-olds but may on occasions contain small full and mature fish. The size range extends from 22.0 to 33.0 cm, but the majority of herrings are between 26.0 and 29.0 cm. The number of fish per kilogram varies according to size and condition but is fairly constant even though it was found that during the 1969/70 season the herrings landed at Cobh were slightly larger than those landed at Dunmore East. Table 4 gives the mean lengths and numbers of fish per kilogramme per month for the 1964/65 to 1969/70 period.

Table 4. Mean lengths and numbers per kilogramme per month.

Season	Oct.	Nov.	Dec.	Jan.	Feb.	Whole Season
1964/65 Mean-length (cm)	-	27.2	26.4	27.2	27.3	27.1
No./kilo	-	5.9	6.5	5.9	5.8	6.0
1965/66 Mean length (cm)	26.1	27.3	27.0	27.6	27.2	27.2
No./kilo	7.0	5.8	6.1	5.7	5.9	5.9
1966/67 Mean length (cm)	24.2	27.3	27.9	28.4	-	27.7
No./kilo	9.1	5.8	5.3	5.0	-	5.7
1967/68 Mean length (cm)	-	26.9	27.5	27.8	28.0	27.5
No./kilo	-	6.1	5.6	5.3	5.2	5.6
1968/69 Mean length (cm)	-	27.8	27.9	28.1	28.0	28.0
No./kilo	-	5.3	5.3	5.2	5.2	5.2
1969/70 Mean length (cm)	27.2	27.5	27.4	27.5	27.3	27.4
D/East No./Kilo	5.9	5.6	5.7	5.6	5.8	5.7
1969/70 Mean length (cm)	-	29.0	28.9	28.0	28.2	28.3
Cobh No./kilo	-	4.6	4.7	5.2	5.1	5.0

The fat content of these herrings shows considerable variation during the season. Average monthly fat contents based on samples analysed during the last five seasons, together with the monthly range were as follows:

Month	Average Fat Content	Monthly Range
October	16.2%	14.3 - 16.8%
November	15.9%	5.4 - 18.6%
December	12.9%	8.6 - 20.9%
January	9.2%	2.7 - 13.6%
February	8.6%	4.3 - 11.7%

These fat contents have been estimated from the moisture content of herring fillets, according to the method of Otto Wille, 1949. During each of the last three seasons an early spawning has taken place in Baginbun Bay. This has meant that "mazy" herrings have been present in the catches throughout the whole season with correspondingly low fat contents. Full clean herrings with high fat contents have been present for only short periods each year.

Most of the herrings landed are exported to the Continent, chiefly to Holland, Western Germany, U.K. and France. Smaller amounts are sent to Denmark, Norway,

and Sweden. Exports to the Continent are chiefly either rough packed or klondyked. Exports to U.K. are mainly fresh or rough packed. All herrings landed are sold by public auction. The prices paid are completely governed by Continental demand which is in turn governed by the catches in the North Sea and also to a limited extent by the amount of Scottish herrings arriving on the London market. During the last few seasons, fishing has often been restricted due to the lack of transport vessels (luggers) available to ship herrings to the continent from southern herring ports and because of the limited facilities for processing at these ports. The average seasonal price since 1966 has ranged from 70/- to 119/- per cran, but the daily prices for similar types of herring at any one port have on occasion varied by as much as 60/- per cran. The prospects for further expansion of this fishery are poor. The report by an assessment group, sponsored by ICES (1969) to examine the state of the herring stocks around Ireland and North-West of Scotland states that the total Dunmore stock will vary between 30,000 to 60,000 tons, depending on the annual rate of recruitment. Fortunately, recent recruitments have been exceptionally heavy. The present seasonal catch exceeding 33,000 tons (1969/70) is, however, considered too high and a continuation of catches of this magnitude, if coupled with a failure of recruitment, will lead to a collapse of the fishery. At present further increases of effort are unlikely to result in increased catches. The maximum amount of herrings which should be taken from this fishery in times of normal recruitment is estimated to be in the region of 25,000 tons.

### 3. SOUTH WEST COAST

Landings of herrings in this area have been very small until recent years. In 1966, however, efforts were made to establish a regular fishery based at Castletownbere and since then catches have improved considerably, although they are still small compared with those made on the south and northwest coasts. The annual catch (in crans) from this area since 1960 is shown in Table 5.

Table 5. Annual catch (crans) on the south west coast.

1960	914 crans	1965	2,208 crans
1961	1,114 "	1966	2,487 "
1962	971 "	1967	6,849 "
1963	4,234 "	1968	5,357 "
1964	1,019 "	1969	4,322 "

Most of the landings have been made at Castletownbere with smaller quantities being landed at Schull, Union Hall, Baltimore, Bantry, Cahirciveen and Dingle. The largest catches are made during the months of September and October, but herrings may be available all the year round since they are regularly caught as by-catch in the white fish fishery. In February and March of 1970 good catches were also made by boats using midwater gear. The fishery so far has

been irregular because it is still in the initial stages of development and the number of boats engaged is small. Consequently, it is difficult to locate herrings and make regular landings. Also, weather conditions are often very poor in autumn and winter on this section of the coast and marketing facilities have not yet been properly organised. The more regular landings and better outlet for herrings at Dunmore East and Cobh entice boats away from the southwest coast from October to early November. Some catches are made by small boats using drift nets in Bantry Bay and around Baltimore.

Sampling of herrings from this area has been regularly carried out since 1966 and has confirmed the presence of a mixture of at least two races of herring (Molloy 1967, 1968). Because of this, and because of the irregularity of the fishery, it would seem better to describe the herrings landed at the three main ports of Castletownbere, Baltimore and Dingle separately, rather than combine them all for the whole area.

Castletownbere. There is evidence of both autumn spawning and winter/spring spawning races of herrings in the catches landed at this port. Small herrings landed throughout the summer and autumn appear to be recruits to an adult winter spawning stock of herrings which they join when they reach the age of maturity. Because of the presence of different races, the quality of the herrings landed is variable at times depending on where and on which race the boats are actually fishing. The quality is also affected by the oil content, which during the late summer and early autumn increases rapidly and thus herrings landed and not gutted tend to deteriorate quickly, especially if Blackgut is present, as it may be during August and September. Blackgut is caused by the presence in the gut of tiny hard shelled molluscs which the herrings consume in large quantities as part of their diet. These molluscs decay rapidly and produce trimethylamines which in turn cause the bodywall of the herrings to rot. The size of these herrings shows great variation, as can be seen from the numbers per kilogramme based on samples received during the last few years:-

Month	No. per kilogramme (range)
June	6.8 - 11.2
July	7.1 - 10.2
August	6.6
September	5.4 - 7.7
October	4.7 - 5.3

The fat content of these herrings can vary considerably according to which race dominates in the catches. The following figures, based on observations during the last few years, illustrates this point clearly:-



Month	Fat Content Range
April	5.4% (spents)
June	17.7% - 22% (full)
October	7.7 (spent) - 22.2 (full)

Little is known about the movements of these herrings. The small recruits to the winter spawning race dominate the catches taken in the white fishery during the spring and summer, at a time when the autumn spawning race are present in only small numbers. The autumn spawning herring increase in numbers and they mature and become full as the season progresses. During 1969, some of these herring spawned off the Gerhies in Bantry Bay where they were successfully fished for a period. Autumn spawning herrings are also found North of the Dursey Sound. After spawning, these fish tend to remain in the vicinity and have been taken as "spents" in Bantry Bay and around Dursey Island during December. In April 1967, large "mazy" fish (average size 28.1 cms or 5.2 per kilogramme) were taken by bottom trawl south of Bantry Bay. However, no market was available for these fish which were subsequently never relocated. Whether these are a separate spring spawning race is not yet known. It is interesting to note that in January and February, 1952, large shoals of herrings appeared in Kenmare Bay and good catches were made and landed at Sneem. These fish were reported to be large, full, and fat and presumably would have been "mazy" in the March-April period. In February and March mixed shoals of small and large "mazy" herrings were located in Bantry Bay and good catches were subsequently made by paired midwater trawls. These "mazy" fish appeared to use the same ground for spawning, off the Gerhies, as did the autumn spawning herrings.

Baltimore. At the end of October, 1967, very large "mazy" herrings were taken off the Stags of Baltimore by boats using bottom trawls. These herrings spawned and vanished within a few days. Similar herrings were located in the same area in 1968 and were fished from the middle of October until the end of the month, by which time they had spawned and disappeared. They were successfully fished by bottom and midwater trawls and the catch rate from this area was high, indicating a good abundance of fish. It was possible to obtain only one sample of these fish which were found to belong to an autumn spawning race. The age distribution showed that over 60% of the fish exceeded seven years of age, while their average size was 30.3 cm (4.0 fish per kilogramme). Subsequent to the disappearance of these very large fish, smaller fish mostly three and four year-olds were taken by driftnets in the area. Both full and spent fish were present. In 1969 a number of boats were waiting for these large fish to reappear off the Stags of Baltimore, but the shoals failed to materialise. Bad weather in the area at the time may have prevented a proper search being made. It is interesting to note that small numbers of spent fish belonging to an autumn spawning component regularly appear in the catches off Ballycotton, during the early part of the fishery off the south coast. These fish have identical vertebral counts to those of the fish located off Baltimore.

Small herrings present in the Schull - Union Hall area in March 1967 were mostly immature one and two year-old herrings belonging to a winter spawning race.

Dingle. Herrings are landed at Dingle in small quantities throughout the year. It is not known whether they are more abundant at particular times of the year because recently no landings of any great extent were made. They are caught mainly in bottom trawls as by-catch but occasional landings have been made by paired mid-water trawlers. The lack of proper shore facilities and organisation would seem to prevent the establishment of a more successful fishery. The type of herrings landed are rather similar to those landed at Castletownbere and includes large and small herrings. Because of their high oil content during the summer months and the fact that Blackgut is sometimes present, the herrings are difficult to keep in good condition. Samples have been examined periodically from this area and the presence of two components noted. In June 1967, summer herrings consisted of medium sized fish, mainly three year-olds, belonging to a winter spawning race. These fish, taken by bottom trawls, had a fat content of 17.2%, numbered 7.7 per kilo and were mostly immature or recovering spent fish. Further samples obtained in October, 1967 were completely different, being large, full, belonging to an autumn spawning race, with an average size of 28.5 cm (i.e. approximately 4.9 fish per kilogramme) and on the point of spawning. It was obvious that they would have spawned in the immediate vicinity. Because of marketing difficulties, however no further fishing took place and the spawning ground remains unlocated. Samples were again obtained in May and June 1969, and these also belonged to an autumn spawning race. Six year old-fish were the dominant age group having vertebral counts and mean lengths similar to those of the corresponding age group (also dominant) on the north west coast. These fish were in excellent condition, with an oil content ranging from 9.4% in mid-May to 18.9% at the end of June. They would presumably remain in the area until spawning occurred in October.

Most of the herring landed from the southwest area are exported as "rough packed" from either Castletownbere or Baltimore for continental markets. Substantial amounts are barrellled ashore while quantities are also transported via luggers to Holland. Small amounts are sent to U.K. or to the Dublin market from Castletownbere as fresh herrings. Herrings unsuitable for processing or freshing are used for industrial purposes.

Catches of herrings from this area could be substantially increased if marketing arrangements were improved and a more intensive fishery took place. Location of spawning beds particularly off the Kerry coasts would also lead to improved catches.

#### 4. WEST COAST

Landings of herrings in this area have been very small during the past ten years. There is, in fact, no established fishery, although small quantities of herrings

are taken in the white fish fisheries by boats from Galway at various times of the year. During the winter of 1969/70 one boat successfully used a midwater trawl to catch herrings in the "Sound" off Galway Harbour and reported good indications of herrings in that area. During the early "sixties" a small fishery developed off Achill Island and herrings taken from around Keem Bay were landed at Westport. This fishery which was carried out during early autumn, only lasted for three seasons and has since disappeared completely. During 1960, 1961, and 1962, it produced 7,500, 3,500 and 3,000 crans, respectively. The type of herring landed were mostly large, full, pre-spawning fish belonging to an autumn spawning race. It is possible that they belonged to the same race as that now taken off the Stags of Broadhaven (off Co Mayo) in the autumn and winter as spents and that during the period of the Westport fishery they had migrated southwards. In recent years continental fleets have begun herring fishing off the West coast. During 1968 the German fleet caught herrings in an area 52.5° to 53.0° N. latitude and 10° to 11° W. longitude, i.e. off the Clare coast. These herrings were taken during July and the same fleet again located herrings during August, this time off Clew Bay. The fishery was repeated in 1969 in the same areas. German scientists stated that these herrings were large clean full fish, high in oil content and in excellent condition. These herrings are within reach of Irish boats and if they were located at this time and proper marketing facilities provided ashore, a fishery could be established.

The herrings landed in Galway during the winter of 1969/70 were rather mixed, containing fair amounts of small herrings. They numbered approximately 5.8 fish per kilogramme with 6 year-old fish being the dominant age group. At that time they were nearly all either "spents" (stage VII) or recovering "spents" (Stage VIII) and had a low fat content (4.6%, January, 1970). The general appearance of these herrings, although only small numbers were examined, would suggest that they are closely related to the main autumn spawning stock that frequents the north west coast.

5. NORTH WEST COAST

Substantial quantities of herrings are landed in this area, the main herring ports being Killybegs, Burtonport and in recent years Sligo. Smaller landings are occasionally made at Inver, Teelin, Kincasslagh, Buncrana and Downings. The annual landings (crans) during the last ten years are shown in Table 6.

Table 6. Annual landings on North West coast

Year	Landings	Year	Landings
1960	21,195 crans	1965	36,222 crans
1961	31,674 "	1966	43,641 "
1962	22,583 "	1967	69,124 "
1963	20,474 "	1968	75,307 "
1964	25,583 "	1969	66,902 "

As can be seen, the landings have increased considerably during the last five years. Herrings are landed throughout the year but the main catches are made from the end of October to the middle of February. Fishing takes place over a large area extending from north of Burtonport down to Eagle Island off the Mayo coast, but the most important areas are off the Stags of Broadhaven, off Killala and Sligo Bays, along the north coast of Donegal Bay and in the Rathlin O'Beirne/Rosbeg area. The number of boats engaged in the fishery varies considerably. Killybegs is also an important white fish port and, therefore, boats tend to alternate between herring and white fish fishing. Most of the herring boats are 60' to 85' long and use paired midwater trawls and bottom trawls. Small amounts of herrings are taken by boats using ringnets and by small boats driftnetting. Herrings, landed during the summer and spring months, are mainly caught by bottom trawling, although some quantities are taken by midwater trawls used by boats working for the fish meal factory at Killybegs.

The fishery is based on different races which have separate characteristics but are on occasions found mixed in the same shoals (Molloy and Kennedy 1969, Kennedy 1970) These races were identified during the 1969/70 season as consisting of an autumn spawning stock, a winter spawning stock and a spring spawning stock. Very little is known about their migration pattern. During the last five winter seasons the autumn spawning race has dominated the catches, consequently the majority of herrings were either spents or recovering spents. This autumn spawning stock appears to extend over a very large area from Galway Bay possibly as far as the west coast of Scotland. Winter spawning herrings have not exceeded 20% of the total catches taken in the area since 1965. Spring spawners are not present in the catches except on rare occasions. After the main season when the shoals have disappeared, small quantities of herring are still taken by bottom trawlers. These herrings, predominantly autumn spawners, feed heavily during the spring and rapidly become rich in oil. They change from the recovering 'spent' condition, mature and improve in condition throughout the summer months, becoming full in August or September. Spawning takes place towards the end of September. Shoals are not located during the pre-spawning or spawning period, indicating that they move to some other area for this purpose.

Location of these grounds and of the main shoals prior to spawning could further increase catches in this area. These herrings when located in October are spents and remain in this condition for most of the main fishing season. Smaller amounts of winter spawning herrings are present in the catches during the November to February period. In the 1969/70 season these herrings spawned in January. This race would also appear to be present over a fairly wide area as they are taken in catches from both the Stags of Broadhaven and the Rosbeg areas. Spring spawning herrings appear in the catches made by Burtonport boats. These are very big, old fish and would seem to be almost completely unexploited by Irish boats. Very few spawning ("mazy" or stage VI) herrings are ever taken in this area, even though "full" (stage V) and recent spents (stage VII) are often taken. This would indicate that both winter and spring spawners spawn in the area, although the exact locations are not yet known. It

is interesting to note that shoals of small herrings taken in Donegal Bay in the summer are mostly potential recruits to the autumn spawning race.

Research cruises in this area in 1963 by the British research ship M.V. Clione found considerable quantities of recently hatched larvae during mid-October in two areas - one off Tory Island and the other in Donegal Bay. It was concluded from these results that the spawning grounds from which these larvae originated must have been very close to where they were found.

The mixture of races in the area means that there is considerable variation in average size of herring caught. This is particularly noticeable during the summer months, when young herrings are present in Donegal Bay. Similarly the average number of herrings per kilogramme shows a wide variation ranging from 4.2 fish per kg. for spring spawners at Burtonport to 9.0 for small herrings from Donegal Bay. The average number of herrings per kg. for autumn spawners per month in 1969 was as follows:

January	7.3	May	6.5	September	4.6
February	7.3	June	5.9	October	5.8
March	7.1	July	5.9	November	6.3
April	6.9	Aug.	4.8	December	6.6

Recruitment of young herrings to the adult stocks along the north-west coast has been known to fail for a succession of seasons. In 1970 the autumn spawning stock is completely dominated by one age group (six year-old fish) and very little recruitment appears to have taken place during the last four years. Both the spring and winter spawning races have a more evenly spread age distribution indicating that neither are subjected to as big a fluctuation in annual recruitment. Failure of recruitment particularly over a number of years, besides causing a decrease in the stock size, also causes the average size of herrings to increase by small amounts each year due to natural growth. However if extensive recruitment takes place the average size will suddenly drop. This happened in the 1966/67 season in this area when large quantities of small three year-old herrings dominated the catches. These small herrings were difficult to sell.

The fat content during the main fishing season is rather low, as the autumn spawners are mostly spents and recovering spents. During spring and summer, the fat content gradually rises and reaches a maximum during August. The average fat content based on samples received during the last three years are shown as follows:

Month	Fat content (%)	Month	Fat content (%)	Month	Fat content (%)
January	6.1	May	10.7	September	12.7
February	5.9	June	22.4	October	9.6
March	2.5	July	20.8	November	10.2
April	4.6	August	18.0	December	8.2

The variation is caused by changes in the different races, which have not been separated in the above figures.

Quantities of herrings from this area are reduced for fish meal both during the main season and during the remainder of the year. The remainder of the landings are cured, either rough packed, smoked or marinated, while quantities are also exported fresh to U.K. or consumed on the home market. Continental markets for cured herrings are mainly in France and Holland, although in recent years some herrings have been bought for the Norwegian market. The average price per cran is not an indication of the demand because of the quantities that are reduced for fish meal. Lack of outlets has also restricted catches in this area during the last few years. Because of the mixture of races it has not yet been possible to calculate the maximum sustainable yield of these stocks. However, it is thought that the fishery could withstand further increases in effort. The discovery of the spawning grounds for all races and a more intensive fishery for spring and winter spawners during January and February and for autumn spawners during July and August, coupled with increased outlets, would considerably boost landings from the northwest coast.

#### REFERENCES

- Burd. A.C & Bracken, J., (1965) "Studies of the Dunmore Herring Stock. I.A. Population Assessment". Jour. de Cons. Vol. XXIX No. 3
- Farran, G.P. (1941) "The Herring Fishery in Eire, 1921-1941". Journ. Dept. of Ag. Vol. XXII., No. 2
- Kennedy, T.D. (1970) "Herring Investigations of the northwest coast (1969/70)" Fish. Leaflet. No. 16 Dublin
- Molloy, J.P. and Kennedy T.D. (1969) "The winter herring Fishery of the Northwest coast of Ireland 1968-1969". Fish. Leaf. No 12., Dublin
- Molloy, John P. (1968) "Herring Investigations on the Southwest coast of Ireland, 1967". ICES. 1968/H: 14.
- Molloy, J.P. (1969) "A Review of the Dunmore East herring Fishery (1962-1968)". Irish Fish. Invest. Ser. B. (Mar), No. 6
- Otto, Wille, (1949) Band III. Handbuck der Fischkenswertigung, Lubeck, 1949.

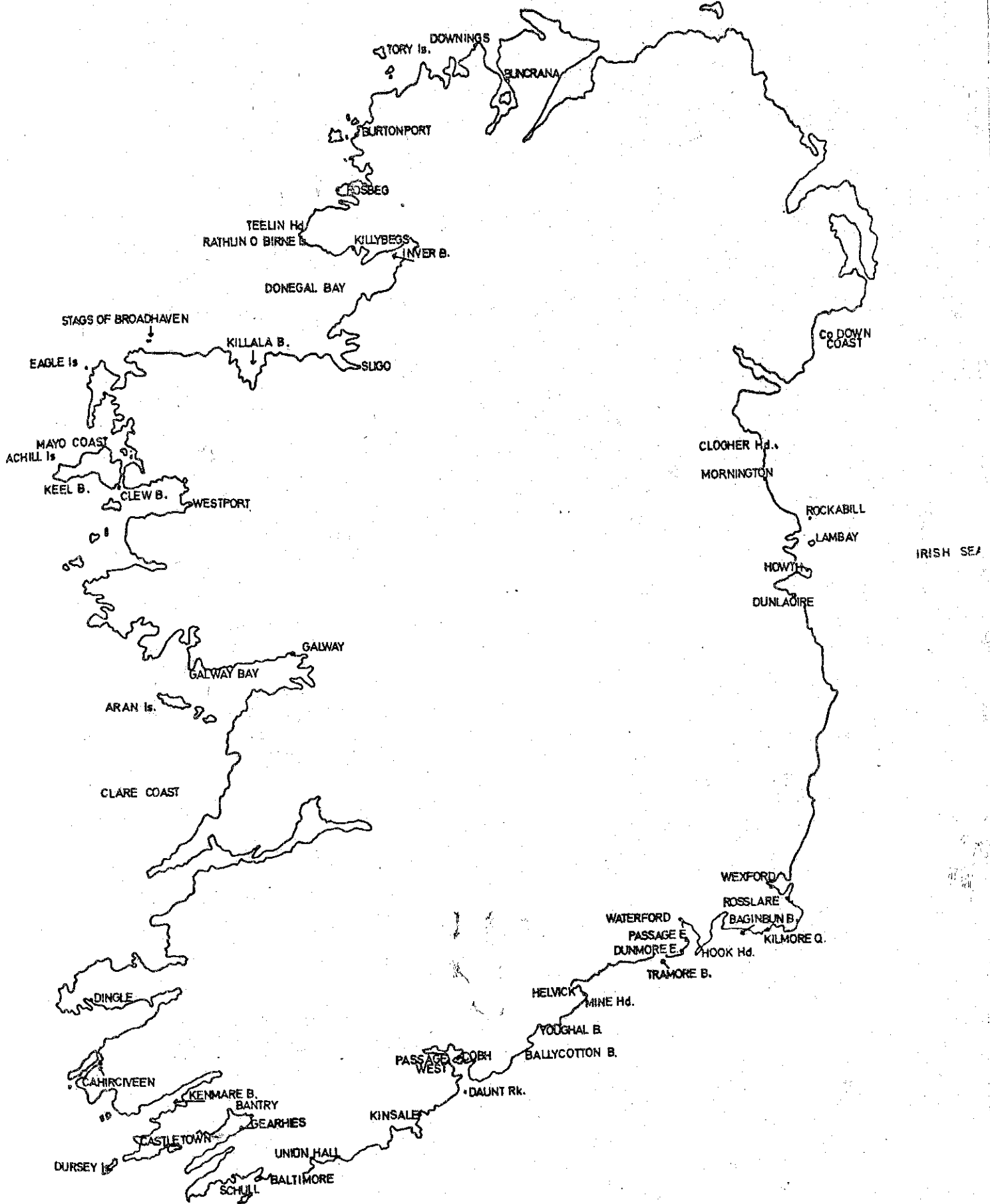


Fig.1 AREAS AND PLACES MENTIONED IN TEXT.