

An Roinn Iascaigh Agus Foraoiseachta

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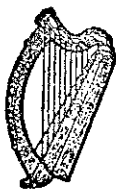
Length-Weight Relationships, Fat Content And
Parasitic Infestation Of Irish Mackerel

by

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and

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INTRODUCTION

Landings of mackerel by Irish vessels have increased dramatically in recent years. The total catch in 1982 amounted to 110 000 tonnes which was valued at about 8.5 million pounds, compared with only 8 500 tonnes, valued at 0.36 million pounds in 1974. The major cause of the increase has been the introduction of six large trawlers into the fleet around 1980 as a result of which the total catch jumped from 24 000 tonnes in 1979 to 80 000 tonnes in 1980. The main landings into Irish ports are made at Killybegs and Rathmullen, while smaller landings are made into Castletownbere and Galway. Since 1983 considerable quantities have also been landed into western Scottish ports. Most of the catches are taken off the west and northwest coast but again since 1983 the Irish fleet has successfully fished over a wide area extending from west of the Shetland Islands down to Cornwall.

Over 95% of the total catch is exported, mainly in the form of whole frozen fish. These fish are frozen either ashore or on freezer vessels and are then transported mainly to Nigeria and other African countries including Ivory Coast and Egypt.

It has become obvious that over the last few years exporters are becoming increasingly conscious of the necessity to provide certain specification about their products for various countries. These specifications concern the length, weight of individual fish, the presence or absence of food in the gut, the degree of infestation with parasitic worms and the fat content of the flesh. Exporters in general seem to require more information about the type of product with which they are dealing than in the more distant past. Considerable information about some of these topics, e.g. length, weight, fat content and parasitic infestation is obtained in the course of routine sampling for stock assessment purposes. The purpose of this paper therefore is to present this information in a form which may prove useful to exporters in anticipating the type of mackerel which may become available and in describing the type of fish available in a particular landing.

Fig. 1 Typical length distributions of catches, showing variations for selected months.

Length/Age

The total length is measured from the snout to the tip of the tail. Mackerel are considered to be a fast growing fish - e.g. mackerel which have been spawned in spring or early summer may reach about 20cm by the end of their first year. These small fish were heavily exploited in the fishery off Cornwall before a ban on fishing was introduced in the area. In recent years, 1984 and 1985, small mackerel have been located northwest of Donegal and it is now thought that there has been a change in the nursery area for juvenile fish. Most mackerel become sexually mature after two or three years and may live up to 15 or 16 years of age - by which time they may be over 45cm long. In general there is a considerable variation in the lengths of mackerel taken by Irish boats depending on the area and season of the fisheries. Shoals of large mackerel are taken during the months October to February as they migrate to and from the overwintering grounds. During the summer the large mackerel migrate far to the north so that the catches taken around our coasts consist mainly of small fish. In Fig. 1 the length distributions of catches taken during February, May, July and November 1984 are shown and demonstrate clearly the seasonal differences of the catches. These seasonal variations in length are typical of the pattern over the last few years.

Weight and numbers of fish per kilogramme

The average weight of individual fish increases throughout the life span - e.g. fish at the end of their first year (1 year old) may be about 45g, while a 2 year old fish may average about 150g. A fish about 15 or 16 years of age may weigh 1500g, while occasional specimens attain over 2000g. Considerable variation occurs in the weight of an individual fish throughout the year. In general fish are at their thinnest in March and April after winter but increase in weight as spawning approaches in spring and early summer. After spawning the fish feed voraciously, put on weight rapidly and are at their heaviest during October to December. Small mackerel which grow much faster than the larger fish may increase their weight by over 35% and large fish by 17% from the 1st to the 4th quarter.

The relationship between length and weight of fish landed in to the Donegal ports based on the years 1983-1984 are shown in the following text table. The relationships are shown for the 1st, 2nd and 4th quarters of the year. The average weights of fish are smallest in the 2nd quarter (i.e. April-June) because this period corresponds with the immediate post spawning period.

Average weight (gm) per length group (cm) and equivalent numbers per kilogramme per quarter

Length Group (cm)	Q 1	Q 2	Q 3
25-26	107 (9.3)	133 (7.5)	-
27-28	141 (7.1)	150 (6.7)	156 (6.4)
29-30	182 (5.5)	195 (5.1)	206 (4.9)
31-32	227 (4.4)	239 (4.2)	261 (3.8)
33-34	280 (3.6)	298 (3.4)	311 (3.2)
35-36	341 (2.9)	340 (2.9)	378 (2.6)
37-38	420 (2.4)	417 (2.4)	460 (2.2)
39-40	523 (1.9)	474 (2.1)	584 (1.7)
41-42	614 (1.6)	570 (1.8)	692 (1.4)
43-44	716 (1.4)	663 (1.5)	776 (1.2)
45-46	806 (1.2)	678 (1.5)	920 (1.1)

Fat content

Mackerel store fat throughout their bodies - mainly in the muscles and in the liver. In common with other fish the fat content varies considerably throughout the year. In addition there are considerable variations between individual fish depending on their sizes and the degree of ripeness of the reproductive organs. Mackerel have a prolonged spawning period, unlike herring, and the main spawning lasts from March to June. Since this period follows the winter when food is scarce and also because fat is used to produce milt and eggs, the fat content of the flesh is at a minimum during spring and early summer. However, as food becomes available in early summer the fat content rapidly rises and reaches a maximum by October and November. Finally, it gradually decreases during the winter months.

Fig. 1 Typical length distributions of catches, showing variations for selected months.

The results of all the sample examined are shown in fig. 2 for small, medium and large fish. These are based on samples of fillets examined since 1983. As can be seen there is a considerable variation between the fat content of the small and large fish particularly during the periods when the fat is at a maximum level i.e. during the main autumn and winter fisheries. During this period the average difference between large and small fish is about 10%. For this reason the average fat content of a sample may not be meaningful unless information on the relative quantities of fish in each size category is provided.

The fat content therefore should always be coupled with some information about the relative proportions of each size category or if possible separate fat contents should be given for each category.

The method used in analysing fat content is one developed by Foss Electric, Denmark and is based on the extraction of fat from minced fillets.

Infestation rates of *Anisakis* sp larvae in mackerel

Mackerel, in common with most other types of fish, are hosts to a number of different parasites. The most important parasites from a commercial point of view are the larval stages of the nematode worm Anisakis. The adult stages of these parasites are found in warm-blooded animals - e.g. whales, dolphins and porpoises which feed on fish. Anisakis is very resistant to extremes of temperature and can survive various processes including marinating. All larval Anisakis can be killed by subjecting individual fish to temperatures of -17 C for 24 hours. On a commercial scale, freezing of commercial block (45 kg) at -30 C for 16 hours followed by storage at -12 C killed nearly all larvae within 24 hours and any survivors within 1 week (Gustofon 1953). The presence of live Anisakis may occur in fish which have not been properly cooked and may therefore cause problems in humans. In live fish the larvae are found anywhere on the viscera but are mostly located in the mesenteries and the fatty deposits near the rectum. When the mackerel are dead the parasites tend to burrow into the muscles of the fillets and encyst there if they cannot escape. The number of larvae therefore found in the muscles will increase as the time increases between capture and freezing. It is important therefore that fish should be frozen to the correct temperature as soon as possible after capture.

Mackerel were examined to study the infestation rate of larval nematodes between November 1984 and March 1985, during the main mackerel fishery off the Northwest coast. Fish examined up to mid-December had been previously graded and frozen and the results can be used as an indication of the extent of infestation of frozen fish. Fish examined after this were fresh and ungraded and the results are probably more representative of the normal population.

In all cases fish were opened and the larvae were removed and counted, after a careful search of the body cavity and various organs. No attempt was made to locate any parasites which had migrated into the muscles. However, in the initial stages of the investigation some studies in this respect, using pepsin and hydrochloric acid digestion methods, indicated that some parasites had already lodged themselves in the fillets and were not visible to the naked eye. The results, therefore only give an indication of the total number of parasites present in each fish.

A total of 658 frozen graded mackerel and 456 fresh ungraded mackerel were examined. Fish were also measured (total length) because it has been shown that in other species the number of larvae increases as the fish gets older and bigger.

Results

The results of all samples, showing the number of fish examined, the percentage of fish infected with Anisakis the average number of Anisakis present per fish and per infected fish and the maximum number found per fish are shown in the following table.

Date	Location	Number Examined	% infected	Average/ fish	Average/ infected fish	Maxima
ov(frozen)+	N.W. Scotland	201	65	6.4	9.5	-
ov/Dec(")+	"	194	62	6.9	12.4	-
lov/Dec(")+	"	280	70	8.0	11.1	-
3 Dec	N.W. Scotland	71	78	9.7	12.4	103
8 Jan	Rhona	39	72	5.6	7.8	62
13 Jan	Rhona	33	95	9.0	9.5	120
16 Jan	Flannan Island	80	84	9.4	11.2	115
22 Jan	W.St.Kilda	20	80	5.0	6.2	17
28 Jan	Tory Island	22	95	3.6	3.7	16
6 Feb	Tory Island	84	93	6.8	7.3	77
26 Feb	Slyne Head	107	80	5.3	6.7	35

+Does not include some large fish.

Fig. 1 Typical length distributions of catches, showing variations for selected months.

In general the majority of fish (>70%) have some level of infestation. While the level of infestation may vary considerably in individual fish (0-103 larvae per fish) the average number per fish from different samples only ranged from 3.7 to 12.4.

The average number of Anisakis fish (non frozen) at different length groups showed no apparent increase as fish became larger. This is in contrast to the case in herring where, however, it has been shown that the average number of parasites present per fish increases consistently as fish get older and larger.

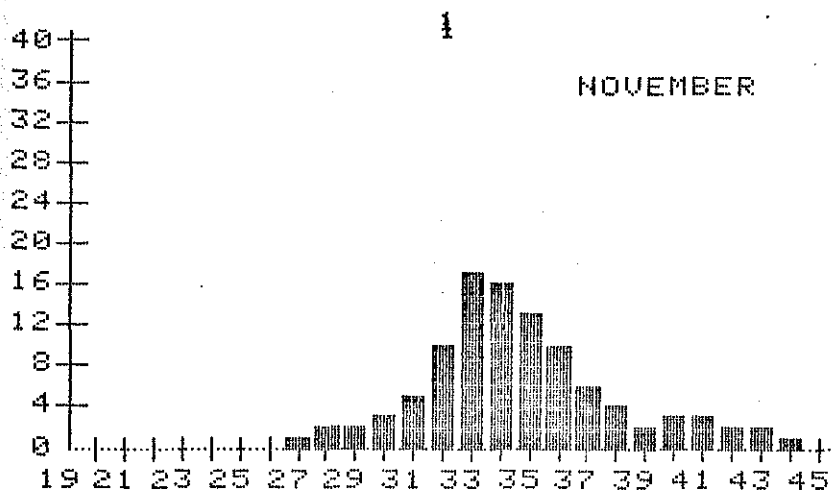
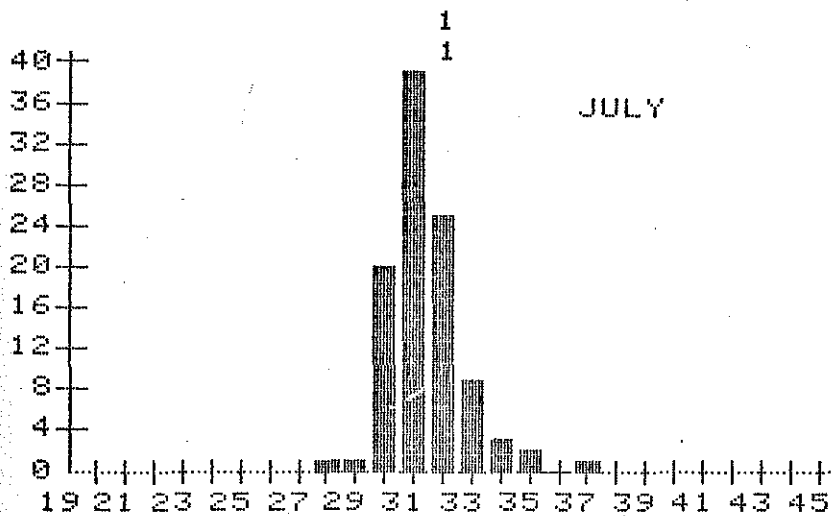
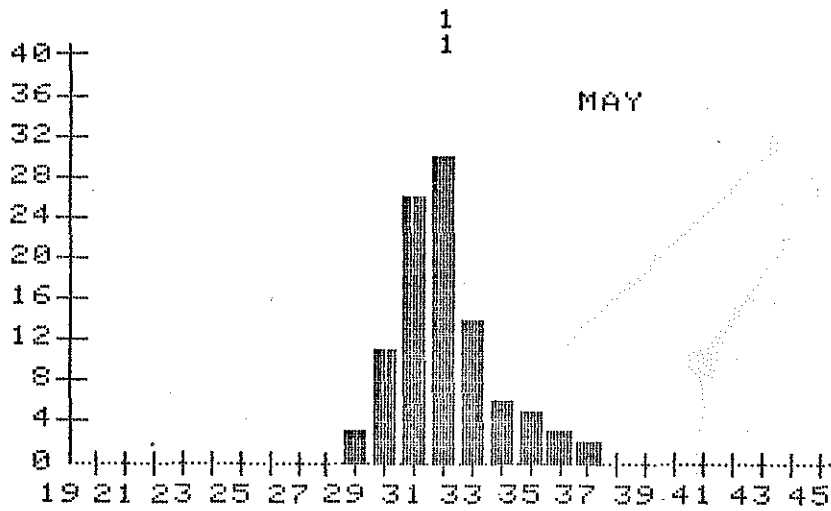
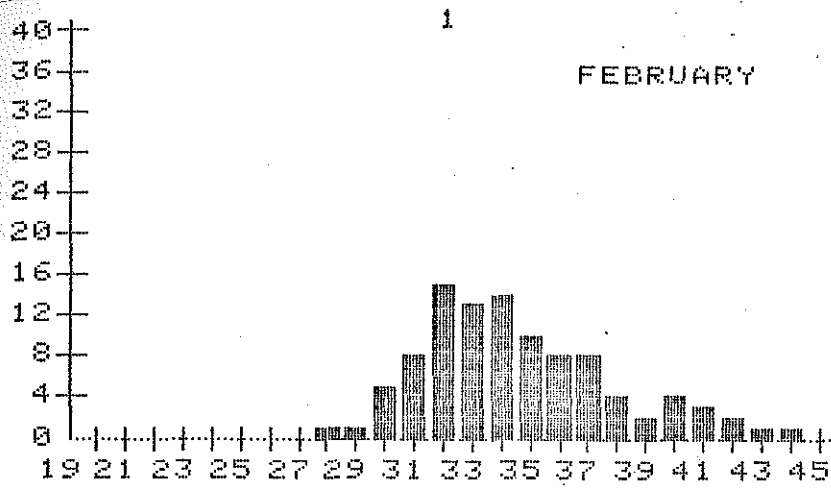
Average numbers per fish

Length Group (cm)	Number per fish
30-31	1.5
32-33	6.6
34-35	8.5
36-37	9.6
38-39	5.9
40-41	5.4
42-43	2.2
44-45	8.3
46	5.0

Despite an extensive search of available literature no references could be found to the levels of infestation of Anisakis in mackerel from other areas. It would appear, however, that even though most fish do contain these parasites the infestation rate per individual fish may be low and if fish are quickly and properly frozen after capture no dangers to human health should arise.

REFERENCES

Gustafon, P.V., 1953 The effect of freezing on encysted Anisakis larvae. J. Parasit., Vol. 39.



LENGTH (CM)

Fig. 1 Typical length distributions of catches, showing variations for selected months.

AVERAGE MONTHLY FATCONTENT

