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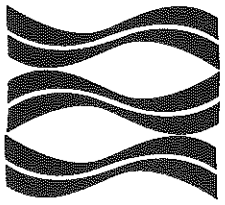

IRISH FISHERIES INVESTIGATIONS

Edward Fahy and Eoin Fannon

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The exploitation of megrim *Lepidorhombus whiffiagonis* by the Irish demersal fleet

by

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ABSTRACT

Two species of megrim occur in Irish waters but *Lepidorhombus whiffiagonis* constitutes the bulk of the catch by the Irish demersal fleet. Megrim is exploited as a by-catch of gadoid fisheries and is particularly associated with fisheries for *Nephrops*, angler and ray.

Over the past 25 years megrim landings from the ICES divisions adjoining Ireland have fluctuated between 6,000 and 21,000 tonnes but there has been a gradual upward trend of which Ireland has taken an increasing share, rising to 1,800 tonnes in 1980.

Spain exerts most influence in this fishery, being the location of the main market for megrim as well as having the greatest catching power. The most significant developments in the exploitation of megrim over the past twenty years are identified as the establishment of the European Exclusive Fishery Zone in 1977 and the entry of Spain to the Community in 1986.

The importance of division VIIa as a producer of megrim has declined and the main fisheries for the species are in divisions VIIg-k.

This assessment of the species is based on material gathered in 1989 and 1990 when length frequency data from the landings were collected from the west and south coasts. Lengths of approximately 8,000 megrim from landings from all divisions were collected in 1989, 28,000 the following year, and 1,400 were aged in the two years. Samples of the landings are comparable with graded exports from the fleet. The most intensive work was undertaken on a *Nephrops* and mixed whitefish fishery in VIIj.

Megrim discards (round) are estimated to weigh 13.2% of landings (gutted). Few megrim of less than 20 cm were captured and no 0 group megrim was encountered.

A growth curve is calculated for females and for females and males combined. For males the t_o value is outside the range of that parameter recorded elsewhere. Males are however a small proportion of the total, their higher mortality and slower growth giving them a skewed frequency distribution and reducing their contribution to the landings.

Catch curves provided values for Z of 0.45 and 0.49 for females and combined sexes. Yield per recruit curves indicate exploitation is close to F_{max} for females and on the negative slope for the sexes combined.

INTRODUCTION

Two species of megrim, *Lepidorhombus whiffiagonis* and *L. boscii* (four spot megrim), are landed into Ireland. *L. boscii* can be a high proportion (numerically, up to 40% in certain sampled landings) of the catch from the deeper waters of the shelf edge and is particularly characteristic of Spanish landings in the south west. Its abundance may also vary with latitude (Anon, 1990). *L. whiffiagonis* constitutes the bulk of the Spanish and almost all of the Irish catches and is the species which is considered here. The main centre of its distribution is said to be situated to the west of the British Isles. It is however found throughout the northeast Atlantic at depths of between 100 and 300 m (Aubin-Ottenheimer, 1986).

Megrim is exploited by bottom trawl in a mixed demersal fishery. In sub-area VI it tends to be a by-catch of a fishery directed on gadoids (Anon, 1990), but megrim is particularly associated with the fisheries for *Nephrops*, angler and ray in sub-area VII (Aubin-Ottenheimer, 1986).

Stock discrimination in megrim is not satisfactory. Dwivedi (1964), working on meristic characters, distinguished two forms concentrated around the Shetlands and the south of Ireland respectively. Dando (1970), on isoenzyme frequencies, proposed the existence of two biological groups in the same fishery. A further complication is the occurrence of black (effectively, spotted) megrim on the coasts of Ireland and England whose counterparts in other, less conclusively defined areas, are blonde. The latter achieve a higher price than the dark variety and their relationship with each other is uncertain; although colouration is likely to be a consequence of feeding and substratum, the possibility of genetic difference cannot be excluded (Aubin-Ottenheimer, 1986).

For practical purposes at present, there are no biological data available which indicate the existence of separate stock units within the waters around our coasts. For convenience, stocks have been designated according to current management (VI) and ICES working group (VII and VIII) areas (Anon, 1990). The purpose of this assessment is to consider a specific fishery, that of the Irish inshore demersal fleet, for megrim (Fig.1).

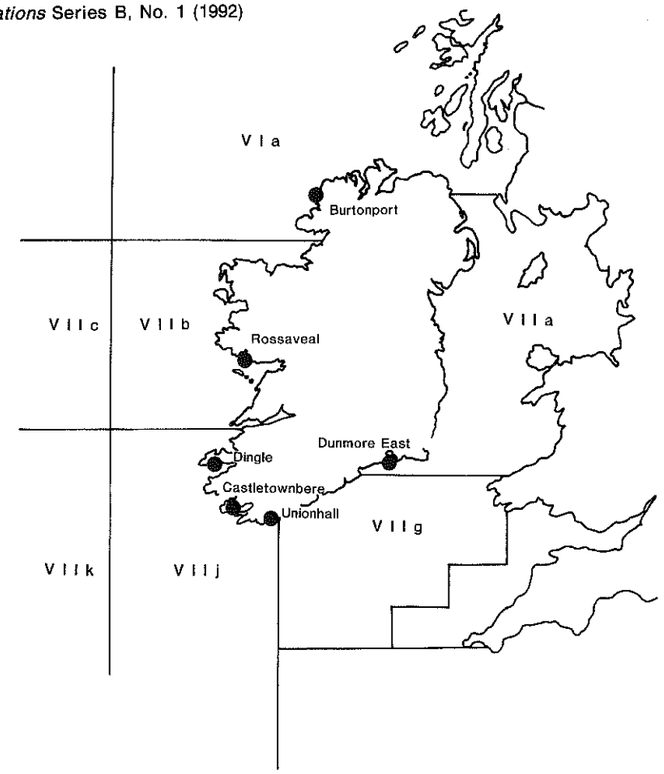

Fig. 1. ICES divisions and ports at which sampling of megrim took place in 1989 and 1990.

The fishery.

Landings of megrim from the ICES divisions adjoining Ireland have fluctuated over the past 25 years between 6,000 and 21,000 tonnes annually (Fig. 2). There is a gradual upward trend of which Ireland has taken an increasing share (*Bulletin Statistique*, 1966–1986; provisional data for 1987 from ICES).

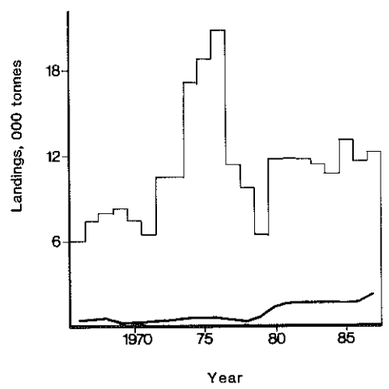

Fig. 2. Total reported landings of megrim from ICES divisions adjoining Ireland (histogram) and Irish landings (line), 1966–1987 inclusive.

Four nations, France, Spain, Ireland and the United Kingdom, take between 97% and 99% of these landings. The relative importance of the Irish Sea (division VIIa) (Fig. 3) as a producer of the fish has declined since the mid 1970's, coinciding with an increase in yield from divisions VIIg–k; in 1967 16% of landings came from division VIIa but in recent years this figure has declined to between 2 and 3% of the total. Division VIa accounts for one quarter of total landings, a yield which has grown from about 15% in the mid 1960's. Some 10% of megrim landings currently derive from division VIIb whose relative contribution to the total has fluctuated considerably. The largest producers of megrim are divisions VIIg–k which in recent years have accounted for about 70% of the total.

France would appear to have been the dominant producer of megrim, taking as much as 90% of the landings in the late 1960's. This proportion has been reduced to about 40% and Spain, which in some years in the late 1960's appears not to have reported any landings, in the following decade became the major exploiter of the species. (Spain's landings after 1977 are examined in the Discussion.) Ireland's interest in the species has also grown considerably since the late 1970's and our landings have increased from 100 to 2,000 tonnes per annum in the latest available statistics. For Ireland, divisions VIIg–k are the most significant source of the fish.

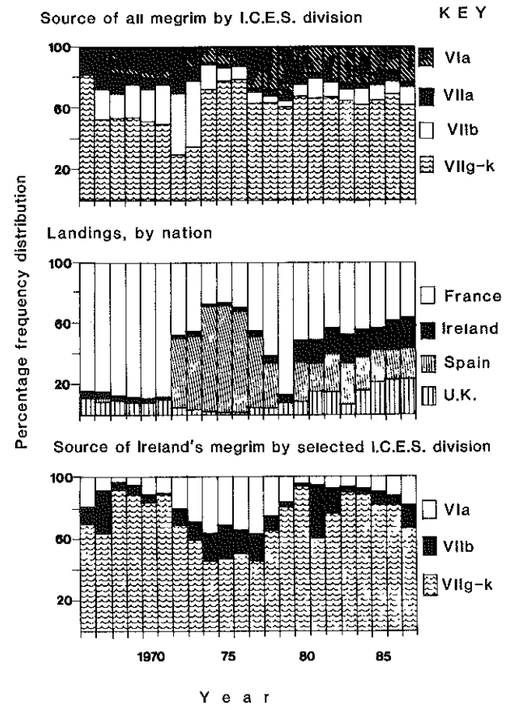

Fig. 3. Selected details of megrim landings from 1966 to 1987 inclusive.

MATERIALS AND METHODS

Length frequency distributions of unsegregated landings of megrim were collected on a random basis in 1989 and 1990 from ports receiving landings from divisions VIa, VIIb, VIIj and VIIg. Length was measured to the nearest cm below and some of the material (from VIIj throughout the year and from VIa between July and September 1990 only) was sexed. Life data and otoliths were gathered from landings in VIIj in the two years. Discards from the *Nephrops* and mixed

demersal fisheries of VIIj were examined in 1990 and 1991. Details of graded exports of megrim are provided for comparison with the sampled landings.

Otoliths were mounted in resin for interpretation. The following material was aged:

	males (range) cm	females (range) cm
Gutted, from landings		
1989	221 (20 — 32)	436 (25 — 56)
1990	182 (17 — 34)	340 (23 — 56)
Round, from discards		
1990	89 (13 — 28)	137 (15 — 32)
Totals	492	913

The following weight at length relationships, derived from the life data, were used to raise samples to landings, discards and catches:

1990 data	Male, round	$\ln W = 2.71046 * \ln L = -4.08731$	
	Female, round	2.85853	−4.48312
	Male, gutted	2.77455	−4.30437
	Female, gutted	3.11533	−5.42048
1989 data	Sexes combined, gutted	3.09249	−5.38207

Discards from a *Nephrops*/whitefish trawl fishery, landed into Co-operative A in south west Ireland, were examined on fifteen occasions between April 1990 and February 1991.

RESULTS

Comparison of samples with landings.

Ireland's samples of megrim landings were considered comparable with Scottish samples of similar size range, collected by research vessel in 1989 (Anon, 1990). To test the comparability of samples with landings in sub-area VII, the length frequency distributions of all megrim from division VIIj were converted to weights using the appropriate formula and the resulting weight frequencies were set alongside quarterly weight frequency distributions of megrim exported from a Co-operative (Co-operative B) buying in fish from VIIj (Table 1). From the first quarter of 1988, when the exports in question commenced, there appears to have been a rapid deterioration in the proportion of the largest grades and a corresponding expansion in the contribution of smaller fish. It has been ascertained that sorting is approximate, carried out by eye; if grades 4 and 5 are combined, the later weight frequencies from the Co-operative in question are similar to those of the sampled landings. Co-operative B explained the relative reduction in heavier grades as resulting from an awareness by the fishermen that smaller fish were acceptable to the market and it is noteworthy that sample weight frequency distributions for 1988 from area VII are not unlike those in 1990 (Anon 1988).

Variations in the landings.

The length frequencies of megrim sampled by quarter in 1989 in all divisions of sub-area VII are set out in Table 2. Some smaller fish appear to enter the landings as the year progresses but, overall, there is no marked seasonal variation and the mean lengths of the sampled fish are very close. These findings do not provide a basis for disagreement with the interpretation of Aubin-Ottenheimer (1986) who identified the main factors altering capturability as reproductive migrations to the deeper water of the Celtic Sea in March and recruitment of the young fish in June and July.

Length frequency distributions of megrim sampled in 1990 from various divisions of sub-area VII and from VIa are set out in Table 3 for comparison. The mean lengths of all samples would appear to be 34 or 35 cm, with the exception of fish captured in VIIj whose mean length was 29 cm. The average weight of these fish was also lower, at 190 g, than fish sampled in all other divisions where average weights were either 290 or 300 g. The fishery which provided most of the census material in division VIIj, landing to Co-operative A, is targetted mainly on *Nephrops* and the use of a 70 mm cod end-mesh is widespread in this fleet.

Discards.

Discards from the *Nephrops* and whitefish fishery (n = 15) were examined between April 1990 and February 1991 inclusive. The average weights of fish discards are set out in Table 4, expressed as a percentage of the total landings and of megrim landings.

Based on a count of boxes offered for auction at co-operative A, *Nephrops* is reckoned to account for one third of landings. On this basis the overall percentage contribution of taxa to the discards is estimated. Megrim weigh slightly less than hake but, their individual weights being considerably greater, they are far less numerous.

Estimated on the same basis, the number of boxes handled at auction, megrim are reckoned to constitute about 20% of all whitefish landings. Thus, megrim discards weigh approximately 13.2% (round) of megrim landings (gutted) (Table 4).

Length frequency distributions of megrim landings, discards (raised to their calculated weight) and catches are set out in Table 5. Megrim begin to feature in the catches at lengths of 20 cm, below which few are captured. Whether this is representative of the usual exploitation pattern is not known but Scottish surveys by research vessel recorded considerable fluctuations in the proportions of megrim of various lengths between 1981 and 1989 (Anon, 1990). The poor representation of megrim smaller than 18 cm in the present work is noteworthy in a situation where large numbers of juvenile hake, some of them as small as 8 cm, were captured. No 0 group megrim was encountered. The working group on hake concluded that the smallest size of capture of megrim was not known (Anon, 1990).

Biological criteria.

Observations on growth and sex ratio were made on megrim taken mainly in VIIj.

Growth.

Although the interpretation of megrim otoliths presents few difficulties, various assessments have shown wide disparities in outcome (Table 6). The range in length at age in this species is considerable (Fig. 4) and the results obtained on this occasion are not presented as being in any way definitive; megrim might indeed display considerable variation in growth rate depending on their location, year of capture and racial origin. Parameters obtained in this investigation are:

	Males	Females
L_∞	32.5	50.95
k	0.2070	0.1868
t_0	−2.92	−0.73

The growth of female megrim shows good agreement with some of the other assessments contained in Table 6 but the value of t_0 for males is outside the reported range of the parameter. The discrepancy may have resulted from sampling error (larger specimens of the earliest age groups might have biased the calculation). The smaller size of male megrim has been generally observed in growth assessments.

The joint growth curve was calculated using the combined length at age data of males and females collected in the two sampling years, both having been sampled on the same random basis. Its parameters are:

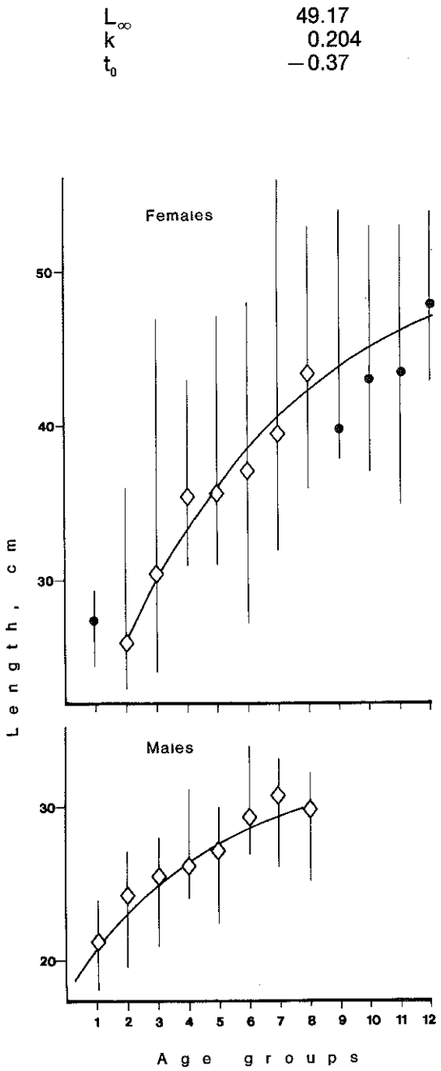

Fig. 4. Growth data for female and male megrim. Diamonds mark the mean lengths at age of more than 50 individuals (female) and more than 25 (male); the calculated growth curves are based on these measurements. Vertical lines indicate the range in length at a particular age.

Sex ratio.

The sex of megrim in 1990 was ascertained in division VIa and at two ports in division VIIj. The lower asymptote for male growth and, apparently, a lower life expectancy, has resulted in a skewed frequency distribution (Fig. 5).

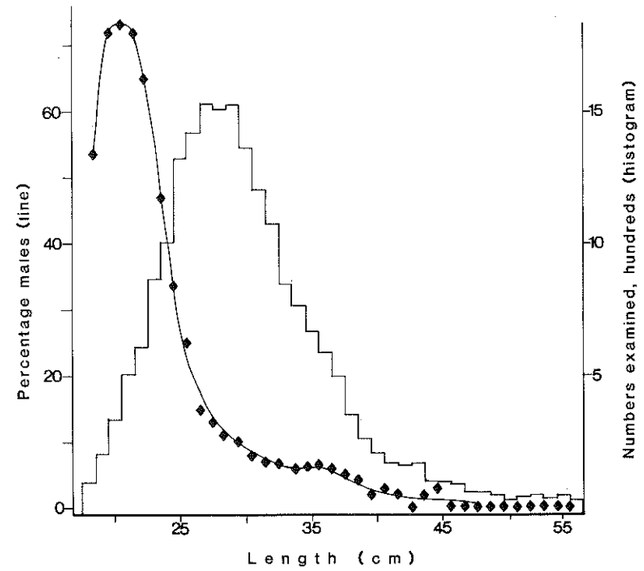

Fig. 5. Sex ratio of megrim sampled in divisions VIa and VIIj in 1990. The line is fitted by eye.

Survival.

Age at length keys, devised in 1990, were applied to megrim landings from VIIj, sampled in that year. These fish were segregated by sex and there was no adjustment of sex ratio.

In the discards females and males occurred in the ratio 134:223, their respective average weights being 126 and 89 g. Thus females to males were weighted 16.9:19.8 in the discard fraction. Length at age keys were applied to discard length frequencies and the sample weights were raised to the appropriate proportion of the landings (Table 7).

Age frequency distributions of megrim (catches, landings and discards) are set out in Fig. 6. Recruitment is assumed to be complete at age 3.5. Catch curves (calculated on discards and landings for ages 4 to 12 inclusive) provide the following values of Z:

Females, $Z = 0.45$
Males and females, $Z = 0.49$

There are no data on natural mortality in megrim but a value of $M = 0.2$ has been adopted in several studies, although $M = 0.3$ has been used for males (for example in Anon 1988).

Additional parameters used in the compilation of yield per recruit curves are the following:

	Female megrim	*Male and female megrim*
W_∞ (g)*	921	784
tc	2	1
tr	3.5	3.5

(*These values were obtained by integrating the weight:length relationship of gutted megrim with L_∞. The weight length data for round megrim were collected from discards, a large proportion of which are immature. The application of conversion factors was considered inappropriate in circumstances where both sexes contribute to the landings in varying proportions.)

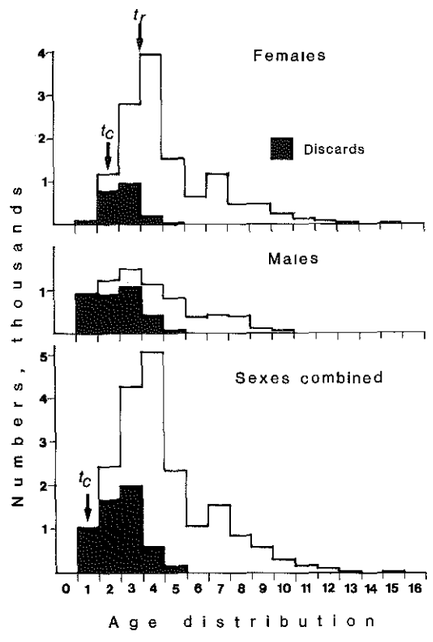

Fig. 6. Age frequency distributions of female, male and sexes combined in megrim landings from division VIIj. Discards are distinguished; *tr* and *tc* are indicated.

Because of the poor representation of males in the landings Y/R curves were drawn only for female and for female and male megrim combined (Figure 7). In common with similar assessments of the species in sub-area VII, values for F are close to F_{max}: for females the value is 0.25—slightly on the positive side—while for the sexes combined it is 2.9—on the negative slope.

DISCUSSION

Until 1984 megrim was a species of secondary importance in the E.E.C. (Aubin-Ottenheimer, 1986). Its exploitation had been increasing over the previous two decades but the entry of Spain to the Community revised its importance. The influence of Spain was exerted though its large catching power and its being the principal market for the species.

In 1984 a TAC regime was established to stabilize landings of megrim. In 1986 Spain was allowed a supplementary quota. The TAC was based on the traditional fishery and was "precautionary", not based on scientific assessment but on known landings over a period in which the fishery was sustainable. The regime established in 1984 was largely in anticipation of the entry of Spain to the Community.

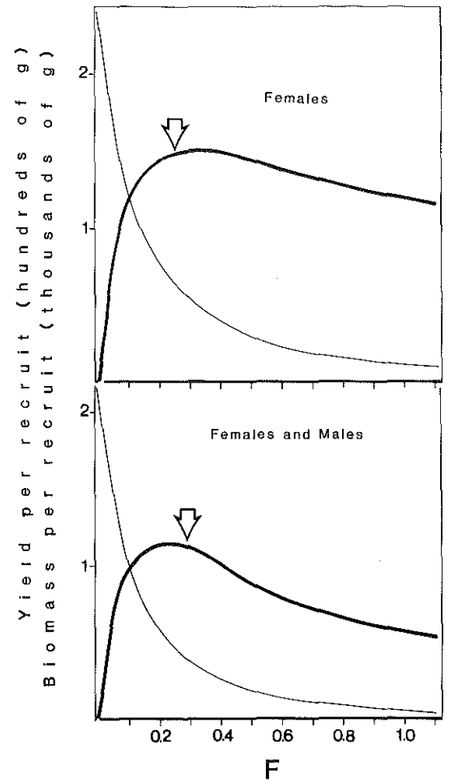

Fig. 7. Yield per recruit and biomass per recruit curves for megrim in division VIIj.

Geographic zone	*TAC (tonnes)*	*Quotas*	
Vb–VI	4,400	France	1,950
		U.K.	1,380
		Ireland	570
		Spain	500
VII	14,400	France	5,260
		Spain	4,330
		Ireland	2,390
		U.K.	2,070
		Belgium	390
VIIIa,b	2,020	Spain	1,120
		France	900

The review of Aubin-Ottenheimer on the development of fisheries for megrim in the North Atlantic is particularly useful and forms the basis of the following observations on the origin of the share taken by Spain whose landings rose from 12,000 tonnes in 1973 to 19,500 tonnes ten years later. These landings were reportedly made from sub-areas VI–IX inclusive (excluding division VIIa).

From 1977, the year in which the 200 mile Exclusive Fishery Zone for the Community was established, the provenance of Spain's megrim landings altered. Before that date 80% (from 10,000 to 12,000 tonnes) came from the Celtic Sea. After 1977 reported captures from the Gulf of Gascony and Galicia (sub-areas VIII and IX) greatly increased. Aubin-Ottenheimer (1986) considers this unlikely; prior to 1977 these areas accounted for only 8% of tonnage and a tenfold increase in landings after that date (to an annual mean of 16,000 tonnes) by a fleet of small coastal trawlers is improbable. She cites Rodriguez and Iglesias (1985) in support of her contention that almost all of the extra fish must have come from sub-area VII.

Keogh (1985) pointed out that Spain's percentage quota allocation of monk and megrim scheduled from 1986 onwards were as large as that nation could take as a by-catch of the hake fishery in 1985. A major increase in the Spanish megrim quota in sub-area VII was thus anticipated (from 17.5 to 30%) and this, in turn, would force down the Irish quota share of the TAC from 21.5 to 18.3%; on the basis of a 1985 TAC of 2,580 t, this would mean a reduction to 2,190 t. Keogh feared that the only way in which Ireland could increase its landings of megrim would be by a higher TAC. That, in turn, would mean an increase in quota for all nations and would put greater pressure on the species.

Until 1979 Ireland's production of megrim was small, varying between 200 and 450 tonnes annually. It increased sharply in 1980 to reach 1,700–1,800 tonnes. Direct landings from Ireland into Spanish ports commenced in 1979 with the establishment of Eiranova, in Castletownbere, Co Cork, augmented at a later date by Pesca Valencia in Caherciveen, Co Kerry. Landings of megrim directly to Spain greatly increased the price obtained; Aubin-Ottenheimer (1986) gives as an illustration the fact that 1 kg of megrim landed into Spain in 1983 fetched five times the price which it would have obtained in Ireland.

Additional circumstancial evidence for increasing pressure on megrim in the seas around Ireland can be adduced from several sources over the past decade:

Data from vessels landing into Concarneau in France suggest that between 1980 and 1984 catch per unit effort was high but in 1985 it suddenly declined to a lower level where it stabilized (Anon, 1990).

In division VIa, the failure of cod and haddock in recent years has forced fishermen to seek alternative targets. Fishing effort on megrim has intensified and there has been an incentive to under-report catches; recently reported landings from this division are not thought to reflect the actual landings (Anon, 1990).

Anon (1990) found the current fishing effort in sub-area VI to be on the negative slope of the yield per recruit curve, implying the stock was suffering from growth overfishing. A Y/R curve for female megrim in divisions VIIb–k and VIIIa,b indicated that F_{max} would be obtained with an increase of 50% in fishing mortality but the yield would rise by only 3% because of the flat-topped nature of the curve.

Anon (1989) also found the weight and value of megrim landings to be on the negative slope of the long term equilibrium curve.

The exploitation of megrim would, on these latest results, appear to be in keeping with recent findings elsewhere. Aubin-Ottenheimer (1986) concluded that the fishery was resilient, that variations in landings were weak, annual indices of abundance were stable and there was a good representation of large individuals in the captures. From this she concluded there was little chance of over-exploitation of megrim in the immediate future.

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TABLE 1. Percentage weight frequencies of megrim in exports originating mainly from Division VIIj and in samples of the fish collected between January 1988 and the end of 1990.

Grades	Definition of grade	1 1988	2 1988	3 1988	4 1988	5 1988	6 1989	7 1989	8 1989	9 1989	10 1990
1	>700 g	32	22	5	22	12	18	5	11	7	3
2	500–699 g	27	22	6	19	20	13	12	11	13	8
3	300–499 g	23	25	24	30	40	23	27	18	23	19
4	250–299 g	18	30	20	27	28	39	18	50	56	15
5	<250 g		2	45	3		6	38	9		55

SOURCES:

Column 1 Export figures, first quarter, 28 tonnes
Column 2 Export figures, second quarter, 133 tonnes
Column 3 Sampled figures, all year, 0.9 tonnes
Column 4 Export figures, third quarter, 23 tonnes
Column 5 Export figures, fourth quarter, 21 tonnes
Column 6 Export figures, second quarter, 119 tonnes
Column 7 Sampled fish, all year, 2.1 tonnes
Column 8 Export figures, third quarter, 91 tonnes
Column 9 Export figures, fourth quarter, 22 tonnes
Column 10 Sampled fish, all year, 3.2 tonnes

TABLE 2. Quarterly length frequency distributions of megrim samples, bulked from all divisions, in 1989.

Length (cm)	Qtr 1	Qtr 2	Qtr 3	Qtr 4
21			6	
22				
23			8	
24			38	
25			45	1
26			70	3
27			81	12
28		10	193	25
29		84	243	40
30	5	254	278	45
31	39	260	300	59
32	63	384	342	68
33	113	356	330	100
34	103	366	327	89
35	108	266	251	108
36	59	228	229	110
37	30	194	146	113
38	20	90	95	95
39	16	60	88	60
40	11	32	66	45
41	5	20	53	33
42	5	22	45	18
43	1	6	50	10
44	3	10	36	8
45	1	100	46	7
46	2	102	27	4
47	1	2	16	4
48	1	6	19	
49	1		8	2
50		4	3	1
51			5	3
52			3	
53			1	1
54				
55				1
56				
57			1	
58				
59				
Totals	587	2856	3449	1065
Average length	34.6	34.6	33.4	35.3

TABLE 3. Length frequency distributions of megrim (sexed and unsexed) from landings from various divisions sampled in 1990.

Length (cm	VIa	VIIj	VIIg	VIIb
11		4		
12		2		
13		6		
14	1	8		
15		20		
16	6	24		
17	4	38		
18	3	51		
19		98		
20		205		
21		335		
22		504		
23		607		3
24	11	855		32
25	40	978	1	40
26	84	1272	3	81
27	194	1312	17	115
28	267	1388	56	247
29	424	1280	140	306
30	473	1278	263	353
31	546	1075	369	366
32	518	935	510	380
33	639	741	590	347
34	590	543	599	324
35	598	459	527	287
36	486	421	428	225
37	495	336	315	186
38	391	294	184	120
39	269	214	132	89
40	228	143	85	81
41	187	112	64	61
42	140	98	50	51
43	134	89	23	57
44	94	117	22	45
45	78	59	69	58
46	72	60	57	52
47	88	44	6	23
48	34	38	8	31
49	50	28	3	10
50	48	20	3	8
51	24	12	3	8
52	16	7		4
53	4	3	1	3
54	6	5		
55		2	1	1
56		4		
57				1
Totals	7231	16022	4529	3995
Mean length (cm)	35	29	35	34
Numbers per tonne	3366	5376	3486	3659
Average weight (g)	300	190	290	290

TABLE 4. Component taxa of the *Nephrops* and whitefish fisheries in VIIj between April 1990 and February 1991, expressed as a percentage of prawns and whitefish landed and as a percentage of megrim landings.

Taxon		Total landings	Megrim landed (=13.2% of total)
Merluccius merluccius	hake	2.9	21.2
Hippoglossoides platessoides	long rough dab	2.8	21.1
Trisopterus spp	pout	2.4	17.8
Lepidorhombus whiffiagonis	megrim	2.3	17.2
Limanda limanda	dab	1.7	12.5
Eutrigla gurnardus	grey gurnard	1.6	12.2
Callionymus sp	dragonet	1.3	10.0
Pleuronectes platessa	plaice	1.2	8.9
Merlangius merlangus	whiting	1.0	7.6
Microstomus kitt	lemon sole	1.2	7.5
Glyptocephalus cynoglossus	witch	.6	4.7
Scyliorhinus caniculus	dogfish	.5	3.9
Clupea harengus	herring	.4	3.0
Phycis blennoides	greater fork-beard	.3	2.3
Micromesistius poutassou	blue whiting	.3	1.9
Atherina presbyter	sand-smelt	.2	1.5
Pollachius virens	saithe	.2	1.4
Trachurus trachurus	scad	.2	1.1
Raja clavata	roker	.1	1.1
Lophius spp	angler	*	1.1
Raja batis	common skate	.1	.5
Zeus faber	john dory	*	.3
Scomber scomber	mackerel	*	.2
Gadus morhua	cod	*	.2
Mullus surmuletus	red mullet	*	.1
Raja montagui	spotted ray	*	.1
Raja circularis	sandy ray	*	*
Raja naevus	cuckoo ray	*	*
Buglossidium luteum	solenette	*	*
Sprattus sprattus	sprat	*	*
Capros aper	boar fish	*	*
Molva molva	ling	*	*

* Signifies present, less than 0.1%

TABLE 5. Length frequency distribution of sexed megrim from VIIj in 1990, landings, discards and catches.

Length (cm)	Landings	Discards	Catches
10			
11	4		4
12	2		2
13	5	15	20
14	7		7
15	18	74	92
16	21	31	52
17	34	29	63
18	45		45
19	87	45	132
20	182	340	522
21	297	549	846
22	447	671	1119
23	539	582	1121
24	759	529	1288
25	868	888	1756
26	1129	768	1897
27	1165	349	1514
28	1232	152	1384
29	1136	138	1274
30	1135	77	1211
31	954	61	1016
32	830	16	846
33	658		658
34	482		482
35	408		408
36	374		374
37	298		298
38	261		261
39	190		190
40	127		127
41	99		99
42	87		87
43	79		79
44	104		104
45	52		52
46	53		53
47	39		39
48	34		34
49	25		25
50	18		18
51	11		11
52	6		6
53	3		3
54	4		4
55	2		2
56	4		4
Total	14315	5312	19627

TABLE 6. Growth parameters of megrim as given by various authors.

Author	Males			Females		
	L_∞	k	t_0	L_∞	k	t_0
Conan et al (1981)	—	—	—	50.9	.21	. 18
Rodriguez et al (1985)	39.4	.29	.14	63.1	.11	−.07
Aubin-Ottenheimer (1986)	39.5	.34	.06	59.6	.14	−.5
Moguedet et al (1988)	43.7	.14	−1.76	65.2	.09	−1.87
Peronnet et al (1989)	44.8	.14	−1.76	66.8	.11	−.33
Alperi (1990) in 1983	32.3	.38	−.77	52.3	.17	−1.58
in 1984	34.3	.26	−.72	49.6	.17	−.82
This work	32.5	.21	−2.92	51.0	.19	−.73

TABLE 7. Landings, discards and catches of megrim from division VIIj in 1990.

Ages	Landings		Discards		Catches		
	female	male	female	male	female	male	male and female
1			106	925	106	925	1031
2	418	363	767	880	1185	1243	2428
3	1846	437	910	1060	2756	1497	4253
4	3739	754	184	413	3923	1167	5090
5	1519	683	48	60	1567	743	2310
6	656	385			656	385	1041
7	1146	411			1146	411	1557
8	473	383			473	383	856
9	478	100			478	100	578
10	233	61			233	61	294
11	132				132		132
12	65				65		65
13	27				27		27
14							
15	6				6		6
Totals	10738	3577	2015	3338	12753	6915	19668
Weights (kg)	2766	402	254	297	3020	699	3719
Mean weight (g)	258	112	126	89	237	101	189

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