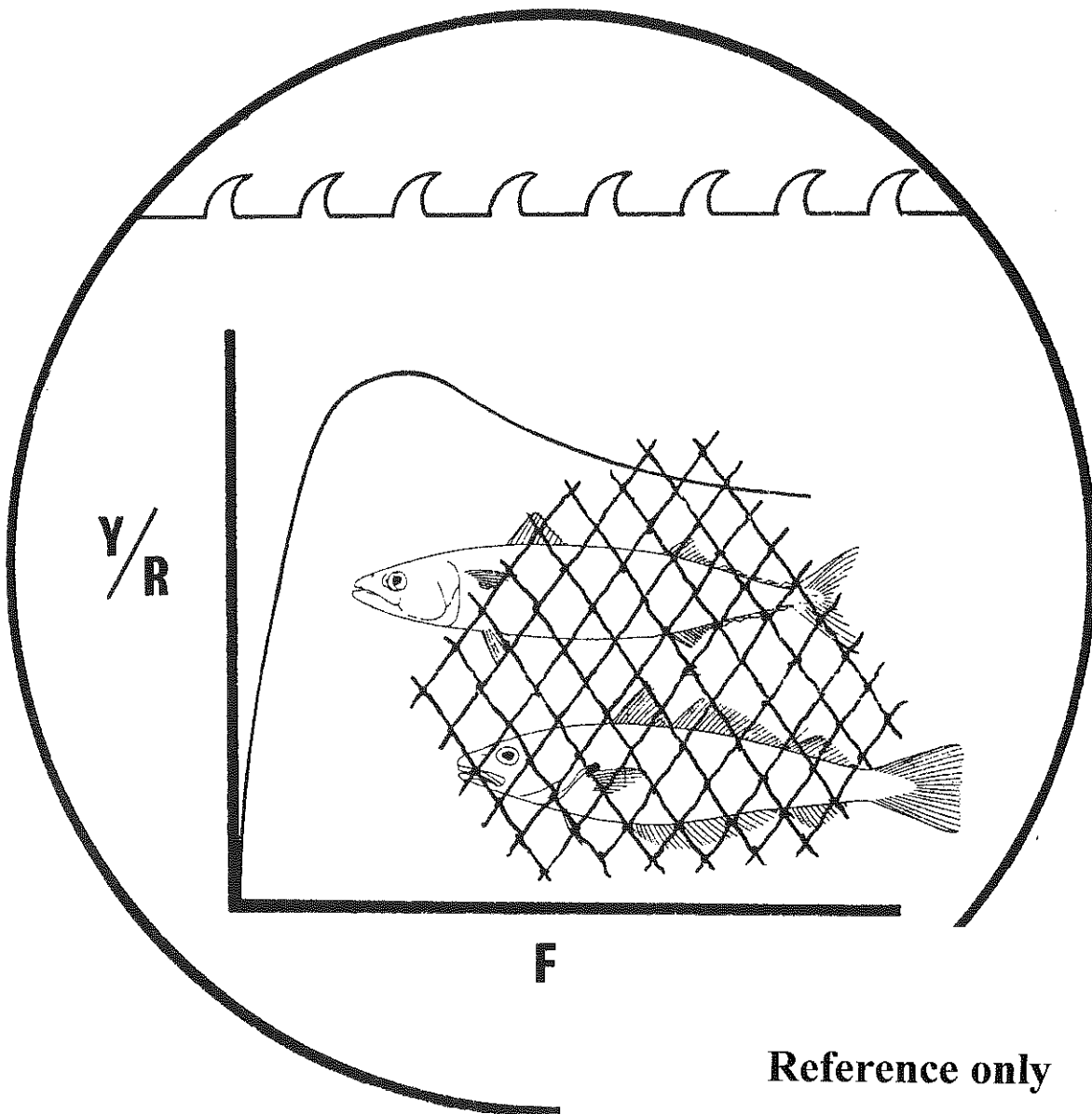


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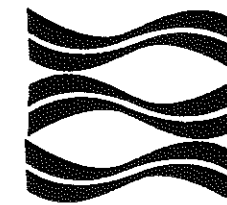


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Edward Fahy and Paul Gleeson

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Roinn na Mara
(Department of the Marine)

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A second assessment of the stock of megrim *Lepidorhombus whiffiagonis* in Divisions VIIb,c,j and k

by

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ABSTRACT

An assessment of megrim captured by Irish and joint venture (Spanish) vessels in Divisions VIIb,c,j,k is based on landings from both fleets and discards from Irish vessels targeting whitefish and *Nephrops*.

Fishing activity by the joint venture fleet is centred on the 200m depth contour. Megrim CPUE has declined since 1985.

Lepidorhombus whiffiagonis constitutes the majority of the landings by joint venture vessels; *L.boscai* amounts up to 2% by weight of the landings from deeper waters. In catches of undersized megrim, *L.boscai* was 12% of the total.

Landings of *L. whiffiagonis* have similar length frequency distributions in the Irish inshore and joint venture fleets. There are indications of what may be seasonal abundance in the discards and landings of Irish vessels fishing inshore. Discards were calculated as 77% of landed weight in the first half of the year and 31% in the second.

Megrim with an inshore provenance were slightly larger than those coming from deeper waters. The following growth parameters were calculated: $L_{\infty} = 51.2\text{cm}$, $k = 0.17$ and $t_0 = -0.97$.

A catch curve derived from the combined landed and discarded megrim has a value of $Z = 0.45$, slightly less than the value calculated for the inshore Irish fleet (0.49). F is consequently in much the same position as in the 1989-90 assessment, on the negative slope of the yield per recruit curve.

INTRODUCTION

A first appraisal of the trawl fishery for megrim contained a population assessment based on the landings and discards of the inshore sector of the Irish fleet in ICES Division VIIj in 1990 (Fahy and Fannon, 1992). Here the exercise is repeated, the emphasis on this occasion being on the deepwater trawl fleet in 1991. Again, Division VIIj is the principal source of material and logsheets from Spanish joint venture vessels provide historical data. Additional information comes from Irish vessels, some of them using a larger trawl mesh than in the population work of 1990 and overlapping in their range with the Spanish boats.

MATERIAL AND METHODS

Length frequency data were collected from landings of megrim from Irish vessels at Burtonport, Rossaveal, Dingle and Dunmore East throughout the year. Quarterly aged samples were examined from the Irish fleet at Unionhall where small meshed nets are used for the capture of *Nephrops* and whitefish and at Castletownbere where a larger meshed cod end is used for the capture of whitefish. Length frequency data from Spanish megrim landings by the joint venture fleet were collected throughout the year at Castletownbere and quarterly samples from this source were aged. Some samples seized from Panamanian registered vessels arrested for retaining undersize megrim in Division VIIj were also examined. Discards from the fleet targeting *Nephrops* and from the Irish inshore fleet were examined in the course of the year.

Logsheets from the Spanish joint venture fleet were analysed from the introduction of the European Communities' Logbook in the second quarter of 1985. The composition of this small fleet has remained substantially similar in the interim. The location of the deep water fishery, described in terms of hours fishing per statistical rectangle, and the quarterly catch per hour's trawling up to the end of 1991 provide a short time series.

The joint venture fishery

The location of the fleet fishing medium depths was worked out from the information contained in logsheets

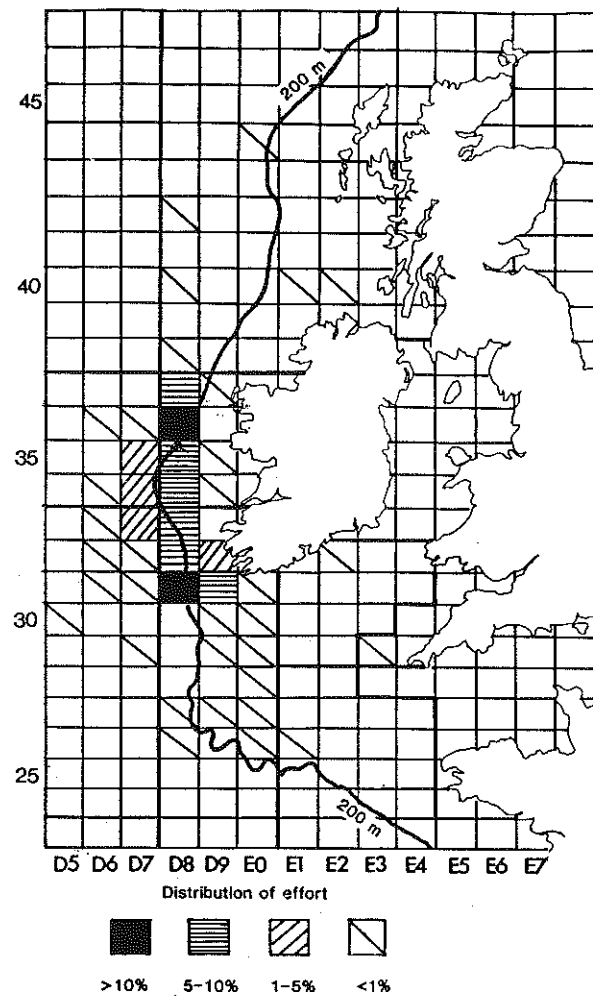


Fig. 1 The percentage distribution of fishing effort by the joint venture (Irish-Spanish) demersal trawl fleet from the second quarter of 1985 to the end of 1991 inclusive. Fishing areas are delimited by ICES grid; the total number of hours is 121,500.

covering 121,500 fishing hours (Fig. 1). The fishing grounds straddle the 200m depth contour and they are located in Divisions VIIb,c and VIIj,k. Catch per effort data from the logsheets are set out in Table 1 from which it will be clear that considerable fluctuation occurs within years, the first quarter providing heavier yields than the others. No doubt the annual index of CPUE depends to some extent on the proportion of landings to have been taken in this quarter.

For comparison, other annual indices, from Spanish and French fleets, though from a wider geographical range, are set out in Table 1 alongside those of the joint venture fleet. There is little agreement among the three but all had their lowest value in 1990, the most recent year for which all three had been reported in the short time series. Inter-series correlations were all non-significant ($P > 0.05$), closest agreement occurring between the Spanish joint venture and Spanish indices.

Species composition

Two species of megrim, *Lepidorhombus whiffiagonis* and *L. boscii*, occur in Irish waters. Only the former has been recorded taken by the Irish fleet although *L. boscii* have been observed in catches of Irish vessels landing elsewhere on the south west coast (Kevin Flannery, pers. comm.). Spanish vessels, fishing deeper, are known to encounter *L. boscii* frequently.

Samples of landings were purchased from Spanish vessels and examined in each quarter during 1991 under laboratory conditions where the confusion of species is not so easy. The following was their composition.

	Number	Av. weight
<i>L. whiffiagonis</i>	1,072	212g
<i>L. boscii</i>	36	132g

In these samples, *L. boscii* amounted to 2% by weight of the megrim catch from deeper waters.

Samples were also examined from two Panamanian registered vessels fishing in deep water in Division VIIIk. Their landings, of smaller megrim, acceptable to the Spanish market, were:

	Number	Av. weight
<i>L. whiffiagonis</i>	231	81g
<i>L. boscii</i>	32	80g

In this case, *L. boscii* amounted to 12% by weight of the total megrim sample.

Landings of L. whiffiagonis

Length frequency distributions of *L. whiffiagonis* from various sources in 1991 are set out in Table 2. The principal feature of the samples was the small size of megrim retained by the two Panamanian registered vessels arrested in 1991. Megrim landed by the Spanish joint venture fleet were subdivided into those taken in the first and second halves of the year; in contrast to the landings by the Irish fleet in Division VIIb,g and j, these did not show a reduction in size as the year progressed, a characteristic of landings by the Irish fleet

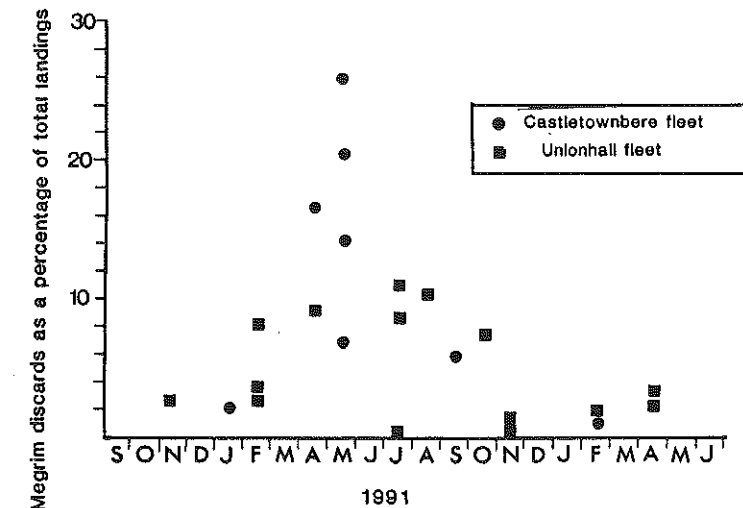


Fig. 2 Megrim discards as a percentage of total landings by two Irish metiers, November 1990 to April 1992 inclusive.

already noted. Megrim captured by the Irish fleet fishing in Division VIa were slightly larger than those landed from sub-area VII and this phenomenon has also been previously observed.

Discards

In the 1990 assessment of megrim, discards were calculated from trawl catches and a single figure was obtained covering the entire year. Megrim was separated from other fish species in the discards and expressed as a percentage of the total landed fish and crustacean weight (2.3%).

In a Co-operative to which landings were made from Division VIIj, prawns were observed to make up one third of the total. Megrim accounted for 20% of trawl-landed fish or, 13.2% by weight of all (fish and crustacean) landings. The ratio of discarded to landed megrim was therefore 2.3:13.2 = 17.4%.

Since the 1990 assessment was completed, the Co-operative in question has become computerised, providing an opportunity for a more accurate estimate (Table 3). The landings of megrim in the first half of 1991 averaged 15.8% of all trawl-caught (fish and crustacean) landings and 17.0% of all trawl-caught landings in the second half of the year.

Eighteen samples of discards from the two fleets were examined in 1991. In these megrim averaged 12.1% of landings in the first half of the year and 5.3% in the second (Table 4).

It is noteworthy that, in spite of the fact that the fleets in question were targeting different species and fishing a different mesh size, there was much overlap in the percentage of megrim in the total catch, although this tended to be lower in the *Nephrops* fleet. Because of the small number of discard samples it was necessary to pool their results but in the majority of these the percentages of megrim are also within the same range (Fig. 2).

Thus, megrim discards to landings in the first half of 1991 were 12.1:15.8 = 76.6%. In the second half of the year the ratio was 5.3:17.0 = 31.2% of landed weights. In all of these calculations megrim were landed gutted but the discarded weights were round.

There was considerable variability in the percentage of megrim contained by discard samples which may indicate a seasonal abundance (Fig. 2).

Growth

Although otolith structure in megrim is easily interpreted, there is considerable variation in the growth curves devised by various investigators (Fahy and Fannon, 1992). Growth curves are an essential and fundamental element of productivity studies and an objective of the work in 1991 was to seek evidence of environmental factors which might contribute to apparent differences in growth rate. The factor selected for investigation was depth, samples of female megrim being examined throughout the year from the joint venture fleet which usually trawls in the vicinity of the 200m contour and from the inshore home fleet based at Unionhall.

Details of aged female megrim are presented in Table 5. Pair t test comparisons were made of fish by age group where five or more specimens of a given age group were present in both samples. Female megrim deriving from the inshore fleet were slightly longer at any age from 3 to 9 years inclusive but there was no significant difference in length at age between fish captured by the two fleets.

For the purpose of devising a growth curve, male and female megrim from both fleets were amalgamated in a length at age key (Table 6a), this being appropriate preparation for an aged analysis of the population (Fahy and Fannon, 1992).

The previous investigation provided the following growth data for males and females combined:

L_{∞}	49.17cm
k	0.20
t_0	-0.37

Using the average length at age thus provided in this assessment (ages 0 to 12 inclusive) two of the growth parameters were:

L_{∞}	41.19cm
k	0.24

The value of L_{∞} was thus very low and this is believed to be a consequence of sampling; because the landings were made up of predominantly smaller megrim and there was a wide range of length at age, the key is biased towards smaller mean lengths of the older fish. This would also explain the higher value for k. To rectify this shortcoming, the aged fish were redistributed on the basis of 20 individuals of each centimetre length group having been aged (Table 6b). Growth parameters recalculated on this basis (ages 0 to 12 inclusive) provided the following:

L_{∞}	51.26cm
k	0.17
t_0	-0.97

These parameters were close to those used in the earlier assessment of the stock.

Weight: length relationships

The following weight at length relationships for the sexes combined were used to raise samples to landings and catches:

	Slope	Intercept
Irish, gutted, first half of year	2.95	-4.87
Irish, gutted, second half	2.92	-4.61
Joint vent., gutted, first half	3.12	-5.42
Joint vent., gutted, second half	3.00	-5.00
Irish, round, first half	2.86	-4.58
Irish, round, second half	2.61	-3.70

Landings

Provisional landings figures for 1991 are summarised in Table 7. Totals for the year were 485t and 1,956t in Divisions VI and VII respectively.

Survival

The length frequencies of sampled megrim were raised to landed weights and the discard samples were raised by the appropriate factor. The combined landed and discard length frequencies were distributed among age groups by the length at age key (Table 8). The catch curve was calculated for ages 3-15 inclusive; its slope was -0.45 ($r = 0.95$). The previous value of this parameter was -0.49 (Fahy and Fannon 1992).

Yield per recruit

Two yield per recruit and biomass per recruit curves were prepared; the first is a slightly modified version of the curve prepared by Fahy and Fannon (1992), the second postulates earlier first age at capture (t_c) and

age of recruitment (t_r) (Fig 3), consistent with the capture of younger megrim closer to the spawning grounds:

Winf (g) (gutted weight)	Curve 1	Curve 2
t_c	916	916
t_r	1	0
M	3	2
	0.2	0.2

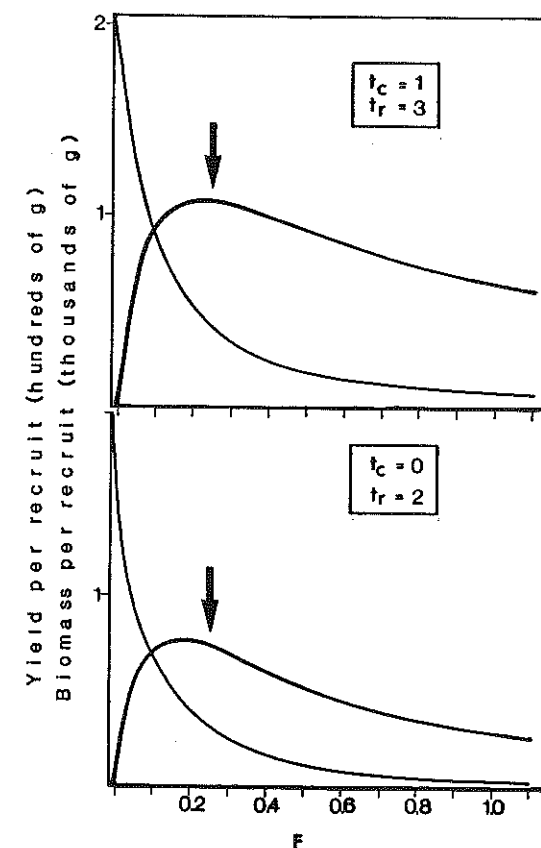


Fig. 3 Yield and biomass per recruit curves for megrim sampled in 1991. The position of F (Fishing mortality) is arrowed.

DISCUSSION

The landings of megrim from VIIb,c,j and k consist almost entirely of *L. whiffiagonis* of which slightly different length distributions are landed by different sectors of the Irish fleet and by vessels belonging to other EC nations and those registered outside the Community. Characteristics of the landings observed to date can be summarised as, slightly smaller megrim taken by the Irish inshore fleet targeting *Nephrops* and very small — legally sub-sized — megrim retained by Panamanian vessels landing into other European countries. Small megrim are acceptable to the market, their capture is probably unavoidable because megrim are retained at an early age by most cod-end mesh sizes in use and the smallest would probably be discarded already dead. The size range of megrim captured by the Irish whitefish boats is similar to that taken by the Spanish joint venture fleet.

The use of discard data from the Irish whitefish/*Nephrops* boats is more problematic. For one thing there are indications of what may be a seasonal abundance which might represent an inshore migration during the late spring and summer; it is an explanation which may be reinforced by the absence of a seasonal change in length frequency of the landings by vessels fishing deeper. The paucity of 0 group megrim has been noted in catches by the Irish fleet (Fahy and Fannon, 1992) and this age group would be expected to be more abundant in deeper water, closer to the spawning grounds. All-weather, deeper fishing joint venture boats might be expected to take larger proportions of the younger age groups than vessels fishing closer inshore. In keeping with what has been stated by recent ICES working groups, the estimation of discards provides uncertainty in population assessments of megrim.

That said and in spite of a larger estimate of discards on this occasion, the catch curve for megrim is similar to that calculated by Fahy and Fannon (1992). This is at least partly due to the wide range of age groups in the discarded fraction of the catch. The other parameters in the yield curve are not unlike those used in the first assessment.

The exploitation of megrim is, as indicated in the previous assessment, on the negative slope of the yield per recruit curve. The time series of catch per unit effort data is too short to attempt to reconcile it with the yield per recruit curve.

REFERENCES

Anon (1991) Report of the Working Group on the assessment of the stocks of hake *ICES CM 1991/Assess: 20*.
 Fahy, E and E. Fannon (1992). The exploitation of megrim *Lepidorhombus whiffiagonis* by the Irish demersal fleet. *Irish Fisheries Investigations*. B38: 18pp.

Table 1. Catch per effort of megrim by the Spanish joint venture fleet and by Spanish and French fleets in sub-area VII and in divisions VIIa,b. The Spanish and French data are taken from Anon 1991.

Year	Quarter	Joint Venture CPUE Quarterly (kg/hr)	CPUE Annual (kg/hr)	Spanish CPUE Annual (kg×100/day)	French CPUE Annual (kg/day)
1985	1				
	2	41.22			
	3	21.62			
	4	13.39	20.55	45.27	120.64
1986	1	51.15			
	2	13.59			
	3	18.52			
	4	23.02	23.97	52.18	74.16
1987	1	22.18			
	2	16.06			
	3	8.43			
	4	5.59	12.83	44.93	105.45
1988	1	17.96			
	2	13.58			
	3	14.36			
	4	5.31	13.01	46.43	108.24
1989	1	23.98			
	2	16.93			
	3	8.79			
	4	6.53	12.11	45.52	82.02
1990	1	18.31			
	2	9.18			
	3	6.94			
	4	6.57	9.76	34.46	64.77
1991	1	37.44			
	2	5.81			
	3	5.96			
	4	6.56	12.18		

Correlation of CPUE indices from 1985 – 1991 inclusive:

	r	P
Joint venture/Spanish	.73	n.s.
Joint venture/French	.18	n.s.
Spanish/French	.29	n.s.

Table 2a. Length frequencies of megrim landings sampled in 1991, from various sources.

Length cm	Panamanian arrested	Spanish Joint venture. First half	SOURCES			Irish Via Second half
			Spanish Joint venture. Second half	Irish VIIb,j,g First half	Irish VIIb,j,g Second half	
Raw data						
10						
11						
12						
13						
14						
15						
16	1					
17	2					
18	8					
19	16				1	
20	21	1			7	
21	39	2			29	
22	41	6		2		48
23	41	4	2	8	87	5
24	25	12	1	21	118	1
25	11	39	5	43	216	7
26	12	86	11	96	329	18
27	7	101	15	153	405	44
28	4	92	19	206	438	64
29	1	98	16	316	483	62
30	1	81	13	437	489	140
31		120	19	476	429	125
32	1	81	17	566	477	194
33		95	16	592	373	163
34		90	15	492	340	134
35		68	19	454	300	190
36		64	8	398	263	164
37		59	8	315	207	148
38		46	9	201	176	132
39		35	2	183	128	121
40		34	6	103	71	101
41		21	5	55	67	96
42		12	1	45	43	51
43		21	2	38	39	44
44		7	4	26	39	40
45		14		28	46	41
46		11	4	22	26	21
47		10	2	18	34	18
48		9	3	12	24	10
49		2	1	14	16	12
50			1	12	19	12
51		1	3	4	8	3
52		4		7	7	3
53				1	2	1
54						1
55						1
56						
57						
58						
59			1			
Totals measured	231	1,326	228	5,344	5,784	2,167
Average weight (g)	81	259	261	272	299	349

Table 2b. Percentage length frequencies of megrim landings sampled in 1991 from various sources, to the nearest 1%.

Length cm	Panamanian arrested	Spanish Joint venture. First half	SOURCES			Irish Via Second half
			Spanish Joint venture. Second half	Irish VIIb,j,g First half	Irish VIIb,j,g Second half	
10						
11						
12						
13						
14						
15						
16						
17	1					
18	3					
19	7					
20	9					
21	17					1
22	18					1
23	18		1			2
24	11	1				2
25	5	3	2		1	4
26	5	6	5	2		6
27	3	8	7	3		7
28	2	7	8	4		8
29		7	7	6		8
30		6	6	8		8
31		9	8	9		7
32		6	7	11		8
33		7	7	11		6
34		7	7	9		6
35		5	8	8		5
36		5	4	7		5
37		4	4	6		4
38		3	4	4		3
39		3	1	3		2
40		3	3	2		1
41		2	2	1		1
42		1		1		1
43		2	1	1		1
44		1	2			1
45		1		1		1
46		1	2			1
47		1	1			1
48		1	1			1
49						
50						
51			1			
52						
53						
54						
55						
56						
57						
58						
59						

Table 3. Megrin as a percentage of landings by two fleets in 1991.

Quarter	Landings	
	Fleet 1	Fleet 2
1	11	23
2	16	13
3	15	18
4	13	22

Fleet 1 targets largely *Nephrops* and whitefish
 Fleet 2 is mixed whitefish, larger mesh, fishing deeper

Table 4. Megrin discards expressed as a percentage of landings by two fleets in 1991.

Quarter	Mean	Range	Number of observations
1	4.9	2.8- 8.1	3
2	15.7	6.9-25.9	6
3	7.3	.5-10.9	6
4	2.7	2.0- 7.0	3

Table 5. Length at age of female megrim taken by the Spanish joint venture and the inshore Irish trawl fleets.

Age (years)	Mean (cm)	Irish		Spanish		t	P	
		S.D.	Numbers	Mean (cm)	S.D.			Numbers
2	26.50	1.50	15	26.80	2.40	8	.19	n.s.
3	28.60	2.60	56	25.40	2.90	25	1.84	n.s.
4	30.20	3.00	57	28.30	4.00	44	.93	n.s.
5	32.80	3.30	58	30.10	3.80	71	1.35	n.s.
6	34.60	3.40	70	32.60	4.90	73	.89	n.s.
7	34.70	2.90	46	32.90	3.70	48	.91	n.s.
8	36.00	3.70	25	32.50	4.70	32	1.53	n.s.
9	36.30	3.90	11	36.20	6.50	26	.04	n.s.
10	34.00	6.50	5	36.10	6.90	26	.54	n.s.
11	37.50	6.80	4	36.30	4.80	17	n.t.	
12	36.10	4.20	2	38.40	6.50	12	n.t.	

n.s. = not significant.
 n.t. = not tested

Table 6a. Length at age key for megrim, sexes combined: raw data.

Length	Age Groups															
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
10	4															
11																
12																
13																
14																
15																
16		11	1													
17		12														
18		12	1													
19		20	7	1		1										
20		8	8	3	1	1										
21		2	8	10	3	1										
22			14	11	6	1	2	1	1							
23			16	14	9	6		1	1							
24		1	20	20	7	7	3	2								
25			15	25	18	10	2		3	1	1					
26		1	11	18	19	14	7	4	2	1	2					
27			6	18	12	13	10	4	5		1					
28			3	16	12	15	8	3	2	1	2	1				
29			1	8	15	15	11	7	1	3		1	1			
30			2	9	9	11	8	8	3	1	1	1		1		
31				2	11	15	8	6	7	3	1	1				
32				2	6	18	10	6	6	3	4				1	
33				2	5	8	11	13	3		1	3	2	1		
34					3	9	12	10		4	1	2	1			
35				1	4	5	14	9	4	2	1	1	1			
36					3	5	18	6	3	2	1	1	1	1		
37					2	8	5	6	5	2	2	2	1			
38					1	1	5	14	5	4	4	4	1			1
39					2	4	7	4	3	2	1	1	1			
40						3	6	3	1		5	2		1		
41						1	5	4	2	1	1	1	1			
42							3	1	1		1	1	1			
43							1		1	2		1				
44							2			2	1					
45									1	2		1				
46									1		1		2	1	1	
47										1		2	1	1	1	
48										1	1				1	
49										1						
50											1		1			
51											1			1		
Totals	4	67	113	160	148	172	158	112	61	35	34	24	15	7	1	
AV LT (to nearest cm)	10	18	23	26	28	30	33	33	33	36	36	37	39	42	38	

Table 6b. Length at age data for megrim, sexes combined: standardized at 20 readings per cm length interval.

Length	Age Groups															
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
10	20															
11																
12																
13																
14																
15																
16		18	2													
17		20														
18		18	2													
19		14	5	1		1										
20		8	8	3	1	1										
21		2	7	8	3	1										
22			8	6	3	1	1	1								
23			7	6	4	3										
24			7	7	2	2	1	1								
25			4	7	5	3	1		1							
26			3	5	5	4	2	1	1		1					
27			2	5	3	4	3	1	1							
28			1	5	4	5	3	1	1		1					
29				3	3	5	5	3	2		1					
30			1	3	3	4	3	3	1							
31				1	4	6	3	2	3	1						
32				1	2	6	4	2	2	1	1					
33				1	2	3	4	5	1			1	1			
34					1	4	6	5		2		1				
35					2	2	7	4	2	1						
36					2	3	9	3	2	1	1	1	1			
37					1	5	3	4	3	1	1	1	1			
38					1	1	3	8	3	2	2	1			1	
39					2	3	6	3	3	2	1	1				
40						3	6	3	1	5	2			1		
41						1	6	5	3	1	1	1	1			
42							9	3	3			3	3			
43							4		4	8		4				
44							8			8	4					
45									5	10	5					
46									4	4		8	4			
47										4	4	8	4	4		
48										7	7		7			
49										20						
50											10		10			
51											10			10		
AV LT (to nearest cm)	10	18	22	25	28	31	36	35	38	44	45	42	45	48	38	

Table 7. Provisional landings (tonnes) of Megrim to Ireland in 1991.

Sub-area	By quarters			
	1	2	3	4
VI	75	180	155	75
VII	304	481	588	583
	By half year			
VI		255		230
VII		785		1,171
	By fleet			
Irish		832		1,121
Joint venture (estimated)		208		280

Table 8. Age distribution of megrim landed and discarded by the Irish and joint venture fleets in 1991.

Age	Numbers in hundreds						catches
	Quarters 1 & 2		Quarters 3 & 4		All Year		
	landings	discards	landings	discards	landings	discards	
0		901			901	901	
1	141	11,959	27	1,106	168	13,065	13,233
2	641	28,903	913	8,523	1,554	37,426	38,980
3	3,404	16,369	5,193	14,188	8,597	30,557	39,154
4	5,612	9,006	5,587	5,356	11,199	14,362	25,561
5	9,007	9,014	5,875	5,965	14,882	14,977	29,859
6	9,920	4,184	6,852	727	16,772	4,911	21,683
7	5,541	1,051	7,607	1,011	13,148	2,062	15,210
8	1,937	411	6,380	95	8,317	506	8,823
9	1,196		4,974		6,170		6,170
10	567		4,566		5,133		5,133
11	480		3,082		3,562		3,562
12	254		2,218		2,472		2,472
13	220		884		1,104		1,104
14	115		29		144		144
15	78		44		122		122

