A second assessment of the stock of megrim Lepidorhombus whiffiagonis in divisions VIIb,c,j and k, with particular reference to the landings of joint venture vessels.

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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 targetting whitefish and Nephrops.

Fishing activity by the joint venture fleet is centred on the 200m depth contour. CPUE of joint venture vessels has declined since the Communities' Logbook was introduced in 1985.

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

Landings of L. whiffiagonis have similar length frequency distributions in the Irish middle distance and joint venture fleets. There are indications of what may be seasonal abundance in the discards and landings of Irish vessels fishing further 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 - though not significantly - larger than those coming from deeper waters. Growth parameters (sexes combined) were: Linf=51.2 cm, k=0.166 and t0=-0.9742.

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 1989-1990 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 division VIIj in
1990 (Fahy and Fannon, 1992). Here the exercise is repeated,
the emphasis on this occasion being on the medium depth 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.

Materials 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
undersized megrim in Division VIIj were also examined.
Discards from the fleet targetting Nephrops and from the
Irish middle distance fleet were examined in the course of
the year.

Logsheets from the Spanish joint venture fleet were analyzed
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 deep water fleet was worked out from the
information contained in logsheets covering 121,500 fishing
hours (Fig. 1). The fishing grounds straddle the 200 m 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 have their lowest

values in 1990, the most recent year for which all three have
been reported in the short time series. Inter-series
correlations are 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 four spot megrim
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
L. whiffiagonis	1072	212 g
L. boscii.	36	132

In these samples, L. boscii amounts to 2% by weight of the
medium depth megrim catch.

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

	Number	Av. weight
L. whiffiagonis	231	81 g
L. boscii	32	80 g

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 Tables 2. The
principal features of the samples are the small size of
megrim retained by two Panamanian registered vessels arrested
in 1991. Megrim landed by the Spanish joint venture fleet are
subdivided into those taken in the first and second halves of
the year; in contrast to the landings by the Irish fleet in
divisions VIIb,g and j, these do not show a reduction in size
as the year progresses, a characteristic of landings by the
Irish fleet already noted. Megrim captured by the Irish fleet
fishing in division VIa, are 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; 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 targetting 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 percentage of megrim are also within the same range (Fig 2).

Thus, megrim discards to landings in the first half of 1991 were 12.1:15.7 = 76.8%. In the second half of the year the ratio was 5.3:17 = 31.1% of landed weights. In all of these calculations megrim are landed gutted but the discarded weights are round.

There is 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

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t test comparisons are made of fish by age group where five
or more specimens of a given age group were present in either
sample. Female megrim deriving from the inshore fleet were
slighly 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, 1991).

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

Linf	49.17 cm
k	0.204
t0	-0.37

Using the average length at age thus provided (ages 0 to 12
inclusive), two of the growth parameters are:

Linf	41.19 cm
k	0.240

The value of Linf is thus very low and this is believed to be
a consequence of sampling; because the landings are made up
of predominantly smaller megrim and there is a wide range of
length at age, the key is biased towards smaller mean lengths
of the older fish. 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:

Linf	51.26 cm
k	0.166
t0	-0.9742

These parameters are 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	2.9507	-4.8742
Irish, gutted, second half	2.9230	-4.6149
Joint vent., gutted, first half	3.1180	-5.4194
Joint vent., gutted, second half	3.003	-5.0030
Irish, round, first half	2.8563	-4.5779
Irish, round, second half	2.6082	-3.6952

Landings

Provisional landings figures for 1991 are summarised in
Table 7.

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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 is -0.4597 (r = 0.9453). The previous value of this parameter was 0.49.

Yield per recruit

Two yield per recruit and biomass per recruit curves are 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 (tc) and age of recruitment (tr) (Fig 3), consistent with the capture of younger megrim close to the spawning grounds:

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

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 E.C. 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 targetting 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 problematical. 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) although 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 I.C.E.S. working groups,

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the estimation of discards provides uncertainty in population assessment of megrim.

That said and in spite of a larger estimate of discards on this occasion, the catch curve for megrim is similar to the previous one. 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 recuit curve.

References

Anon (1991) Report of the Working Group on the assessment of the stocks of hake I.C.E.S. C.M. 1991/Assess:20.

Fahy, E. and E. Fannon (1992) The exploitation of megrim Lepidorhombus whiffiagonis by the Irish demersal fleet. Irish Fisheries Investigations. Series B No 38: 18pp.

Table 1. Catch per effort of aegria by the Soanish ioint venture fleet and bv Spanish and French fleets in sub-area VII and in divisions VIIIa,b. The Soanish and French data are taken from Anon 1991.

Year	Quarter	Joint venture CPUE monthly (kg/hr)	Joint venture 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	16.96			
	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	109.24
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/Soanish	0 .73	n.s.
Joint venture/French	0 .18	n.s.
Soanish/French	0 .29	n.s.

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

Length cm	Panamanian arrested	Spanish Joint venture, First half	Spanish Joint venture, Second half	Irish VIIb.j.a First half	Irish VIIb.j.a Second half	Irish VIa Second half
			SOURCES			
10						
11						
12						
13						
14						
15						
16	1					
17	2					
18	9					
19	15				1	
20	21	1			7	
21	39	2			27	
22	41	4		2	48	
23	41	4	2	8	87	5
24	25	12	1	21	119	1
25	11	39	5	43	216	7
26	12	86	11	96	329	19
27	7	101	15	153	405	44
28	4	92	19	206	438	64
29	1	98	16	316	483	62
30	1	91	13	437	459	140
31		120	19	476	429	125
32	1	81	17	566	477	194
33		95	16	592	373	163
34		96	15	492	340	134
35		68	19	454	300	190
36		54	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	3	19	34	18
48		9	3	12	24	10
49		2	1	14	15	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	1326	228	5344	5784	2167
Average weight (g)	81	259	261	272	299	349

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

Length cm	Panamanian arrested	Spanish Joint venture, First half	Spanish Joint venture, Second half	Irish VIIb.a.j First half	Irish VIIb.a.j Second half	Irish VIa Second half
			SOURCES			
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	1
27	3	9	7	3	7	2
28	2	7	8	4	8	3
29		7	7	6	8	3
30		6	6	8	9	6
31		9	8	9	7	6
32		6	7	11	8	9
33		7	7	11	6	8
34		7	7	9	6	6
35		5	8	8	5	9
36		5	4	7	5	9
37		4	4	6	4	7
38		3	4	4	3	6
39		3	1	3	2	6
40		3	3	2	1	5
41		2	2	1	1	4
42		1		1	1	2
43		2	1	1	1	2
44		1	2		1	2
45		1		1	1	2
46		1	2			1
47		1	1		1	1
48		1	1			
49						1
50						1
51			1			
52						
53						
54						
55						
56						
57						
58						
59						
Totals measured	98	99	98	97	98	99

Table 3. Megrim as a proportion of landings
of 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. Megrim 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	0.5-10.9	6
4	1.-	0.5 0.9	3

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

	IRISH			SPANISH				
Age (years)	Mean (cm)	S.D.	Numbers	Mean (cm)	S.D.	Numbers	t	P
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	4.70	73	.89	n.s.
7	34.70	2.90	46	32.90	3.70	49	.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	5.50	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.t.= not tested.

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

AGE GROUPS

LENGTH	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTALS
10	4																4
11																	
12																	
13																	
14																	
15																	
16		11	1														12
17		12															12
18		12	1														13
19		20	7	1		1											29
20		8	8	3	1	1											21
21		2	8	10	3	1											24
22			14	11	6	1	2	1	1								36
23			16	14	9	6		1	1								47
24		1	20	20	7	7	3	2									60
25			15	25	18	10	2		3	1	1						75
26		1	11	18	19	14	7	4	2	1	2						79
27			6	18	12	13	10	4	5		1						69
28			3	16	12	15	8	3	2	1	2	1					63
29			1	8	15	15	11	7	1	3		1	1				63
30			2	9	9	11	8	8	3	1	1		1				53
31				2	11	15	8	6	7	3	1	1					54
32				2	6	18	10	6	6	3	4				1		56
33				2	5	8	11	13	3		1	3	2	1			49
34					3	9	12	10		4	1	2	1				42
35				1	4	5	14	9	4	2	1	1					41
36					3	5	18	6	3	2	1	1	1				40
37					2	8	5	6	5	2	2	2	1				33
38					1	1	5	14	5		4	4	1		1		36
39					2	4	7	4	3	2	1		1				24
40						3	6	3	1			5	2		1		21
41						1	5	4	2	1	1	1	1				16
42							3	1	1			1	1				7
43							1		1	2		1					5
44							2			2	1						5
45										1	2		1				4
46							1			1			2	1			5
47									1			2	1	1			5
48									1	1				1			3
49										1							1
50											1		1				2
51											1			1			2
TOTALS	4	67	113	160	148	172	158	112	61	35	34	24	15	7	1		1111
AV LT	10	18.3	23.4	25.6	28.0	30.0	33.1	33.4	33.2	36.1	36.2	37.4	38.7	42.4		38	

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

AGE GROUPS

LENGTH	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTALS
10	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20
11																	
12																	
13																	
14																	
15																	
16	0	18	2	0	0	0	0	0	0	0	0	0	0	0	0	0	20
17	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20
18	0	18	2	0	0	0	0	0	0	0	0	0	0	0	0	0	20
19	0	14	5	1	0	1	0	0	0	0	0	0	0	0	0	0	20
20	0	8	8	3	1	1	0	0	0	0	0	0	0	0	0	0	20
21	0	2	7	8	3	1	0	0	0	0	0	0	0	0	0	0	20
22	0	0	8	6	3	1	1	1	1	0	0	0	0	0	0	0	20
23	0	0	7	6	4	3	0	0	0	0	0	0	0	0	0	0	20
24	0	0	7	7	2	2	1	1	0	0	0	0	0	0	0	0	20
25	0	0	4	7	5	3	1	0	1	0	0	0	0	0	0	0	20
26	0	0	3	5	5	4	2	1	1	0	1	0	0	0	0	0	20
27	0	0	2	5	3	4	3	1	1	0	0	0	0	0	0	0	20
28	0	0	1	5	4	5	3	1	1	0	1	0	0	0	0	0	20
29	0	0	0	3	5	5	3	2	0	1	0	0	0	0	0	0	20
30	0	0	1	3	3	4	3	3	1	0	0	0	0	0	0	0	20
31	0	0	0	1	4	6	3	2	3	1	0	0	0	0	0	0	20
32	0	0	0	1	2	6	4	2	2	1	1	0	0	0	0	0	20
33	0	0	0	1	2	3	4	5	1	0	0	1	1	0	0	0	20
34	0	0	0	0	1	4	6	5	0	2	0	1	0	0	0	0	20
35	0	0	0	0	2	2	7	4	2	1	0	0	0	0	0	0	20
36	0	0	0	0	2	3	9	3	2	1	1	1	1	0	0	0	20
37	0	0	0	0	1	5	3	4	3	1	1	1	1	0	0	0	20
38	0	0	0	0	1	1	3	8	3	0	2	2	1	0	1	0	20
39	0	0	0	0	2	3	6	3	3	2	1	0	1	0	0	0	20
40	0	0	0	0	0	3	6	3	1	0	5	2	0	1	0	0	20
41	0	0	0	0	0	1	6	5	3	1	1	1	1	0	0	0	20
42	0	0	0	0	0	0	9	3	3	0	0	3	3	0	0	0	20
43	0	0	0	0	0	0	4	0	4	8	0	4	0	0	0	0	20
44	0	0	0	0	0	0	8	0	0	8	4	0	0	0	0	0	20
45	0	0	0	0	0	0	0	0	5	10	0	5	0	0	0	0	20
46	0	0	0	0	0	0	0	0	4	0	4	0	8	4	0	0	20
47	0	0	0	0	0	0	0	0	0	4	0	8	4	4	0	0	20
48	0	0	0	0	0	0	0	0	0	7	7	0	0	7	0	0	20
49	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	20
50	0	0	0	0	0	0	0	0	0	0	10	0	10	0	0	0	20
51	0	0	0	0	0	0	0	0	0	0	10	0	0	10	0	0	20
TOTALS	20	80.5	54.1	60.8	54.6	68.9	93.1	57.3	42.8	69.0	50.7	30.6	30.6	26.4	.556	0	740
AV LT	10	17.8	22.2	24.8	28.2	31.0	36.2	35.1	37.9	44.3	44.8	42.0	45.3	47.9		38	

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Table 7. Provisional landings of Megrim to Ireland in 1991.

By quarters

Sub-area	1	2	3	4
VI	75	180	155	75
VII	304	481	588	583

By half year

VI	255	230
VII	785	1171

By fleet

Irish	832	1121
Joint venture (estimated)	208	280

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

Numbers in hundreds

Age	FIRST HALF Landings	Discards	SECOND HALF Landings	Discards	ALL YEAR Landings	Discards	Catches
0		901				901	901
1	141	11959	27	1106	168	13065	13233
2	641	28903	913	8523	1554	37426	38980
3	3404	16369	5193	14188	8597	30557	39154
4	5612	9006	5587	5356	11199	14362	25561
5	9007	9014	5875	5963	14882	14977	29859
6	9920	4184	6852	727	15772	4911	21683
7	5541	1051	7607	1011	13148	2062	15210
8	1937	411	6380	95	8317	506	8823
9	1196		4974		6170		6170
10	567		4566		5133		5133
11	480		3082		3562		3562
12	254		2218		2472		2472
13	220		884		1104		1104
14	115		29		144		144
15	79		44		122		122

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 121,500.
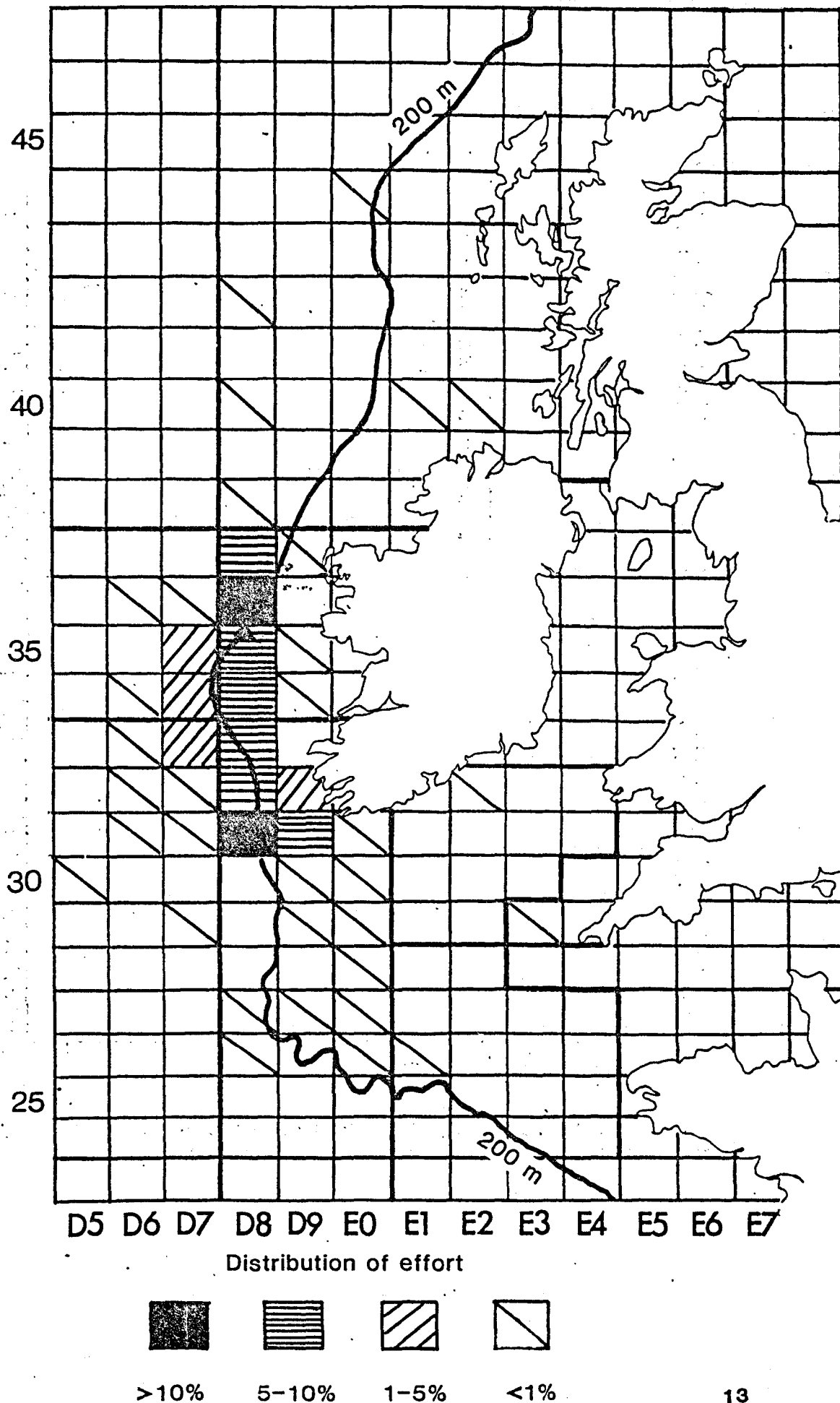
Distribution of effort

>10%   5-10%   1-5%   <1%

Fig. 2 Megrim discards as a percentage of total landings by two Irish fleets, November 1990 to April 1992 inclusive.
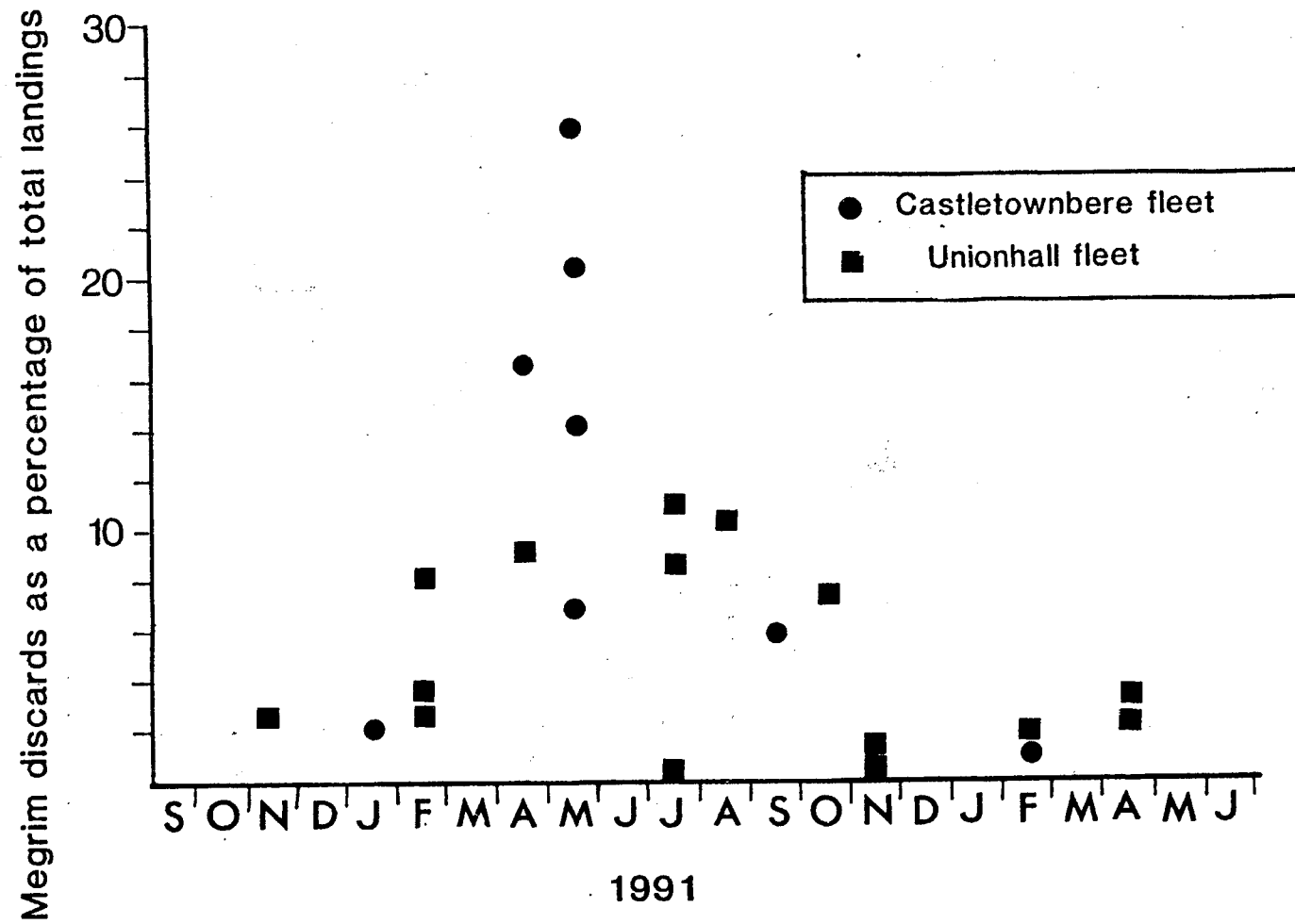
Fig. 3 Yield and biomass per recruit curves for megrim sampled in 1991. The position of F (Fishing mortality) is arrowed.