Evolution of Profitability and Fisher Attitudes 1990 – 2000 in the Irish Sea, - an Overfished Fishery

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The Irish Sea, being an area fairly discrete and partially isolated from adjoining fishing grounds, lends itself well to research studies. The area is fished by Ireland and the United Kingdom, with limited effort by France and Belgium, and has been known to be overfished for quite a long time. Interview surveys of Irish fishers in 1991 and 2000 sought data on costs, earnings and fisher attitudes, with special attention to the fishers' MRTP (Marginal Rates of Time Preference) discount rates. Profitability was reported highly variable in both 1991 and 2000, with fisher attitudes in 1991 pessimistic and sceptical of possibility of improvement through regulation, though slightly less so in 2000, and with discount rates high, and higher for uncaught but catchable fish than for money. The two surveys are compared and reasons for differences postulated. The Irish fleet grew considerably smaller during the inter-survey period, and this and the discovery of markets for two previously unexploited shellfish stocks was accompanied by some improvement in results. Of ten boats common to both surveys, eight showed improved profit as a percentage of costs (two reduced losses, one loss changed to profit and five increased profits) as opposed to four reductions in profit. Comparison of the findings of these surveys with a rather similar one carried out in 1977 shows how much overfishing had increased from 1977 to 1991.

Keywords :- Surveys, Attitudes, MRTP discount rates, Comparison, Irish Sea.

INTRODUCTION

The Irish Sea has been known to be susceptible to overfishing for a considreable length of time, at least since its pelagic fisheries had been irreversibly reduced during the 1970's. It was therefore considered worthwhile to examine its state of health following the increase in economics research personnel in the Irish Department of the Marine in 1987, and the increase in the programme of assiatance for research projects by the European Community (now Union) in the late 1980's.

A joint project was accordingly undertaken by the Republic of Ireland and the United Kingdom and supported by the European Union to examine the economic health of the formerly and potentially productive but now severely overfished fishery in the Irish Sea from the North Channel south to latitude 53°N, and to demonstrate its capacity for recovery if properly managed, an interview survey was undertaken by workers under the direction of the Economic and Social Research Institute of the Republic of Ireland in 1991 (Hillis *et al*.,1994), and the process was repeated as part of a similar project additionally involving France in 2000.

METHOD

The 1991 and 2000 surveys were initiated using the Register of Fishing Boats lists from the Department of the Marine and extracting entries with owners' addresses indicating fishing ports in the study area as home bases for the boats. In the numerous cases of doubt as to boats' exact whereabouts, information from the fisheries officers was used to complete the list of boats for interview. Numbers of boats located were well below numbers originally seen on registers. Some boats owners or skippers (captains) declined to respond to interviewers and some simply could not be located, reducing numbers considerably. Regarding financial data, some interviewees declined to respond, whilst responding to other parts of the questionnaire. Also omitted were one statisitcal 'outlier' in 1991 and two in 2000,

having values for the key ratio of gross income : catch revenue differing from th mean by more than two standard deviations. As well as for the whole fleet, data were presented for boats common to both surveys, and for the fleet divided by size categories, target species and home port. To comply with confidentiality constraints of the survey, no data were presented for categories numbering less than five.

As the Irish Sea was known to be seriously overfished by 1991, the question became pertinent as to what the fishery would have been like without such overfishing, so use was made of a pre-existing survey of the whole east coast of the Irish Republic from the border with Northern Ireland to the south-east corner, Carnsore Point, (Latitude 52°10'N), (O'Connor *et al*. 1977), for comparative purposes. While latitude 53° 00' N formed a much more suitable southern limit to the study area than that of the south-eastern corner of Ireland, due to the presence of a relatively barren area roughly centred on 53° 00' N, to the south of which the stock composition resembled that off the eastern south coast more than the study area, in order to use the 1977 data, the 1991 and 2000 survey data were raised by multiplier based on boat numbers to give estimates for the whole east coast. (It may be noted that the soughern boundary of ICES Sub-area VIIa, (Irish Sea), is an even less suitable southern boundaryan it traverses the productive fishery off the eastern part of the south coast of Ireland.

RESULTS

Characteristics of the fleet and its financial performance in 1991 and in 2000 are given in Table 1, including real values, (basis : year 2000 = 1.000), to provide inflation-free comparison between the two years. The factor used to deflate 1991 financial data was 1.2435, obtained from the Consumer Price Index, Food Section. Most non-fiinancial data only appear once, - except for share data to make for easier reading of the table, - and irrelevant data (e.g. estimated sum total of ages) are omitted.   The fleet, - excluding less than five extremely large vessels beam-trawling for flatfish, of which the size gave them a recognisability incompatible with the surveys' confidentiality requirements, - decreased in estimated number from 83 to 52. Mean gross tonnage rose but mean engine power (kW) fell slightly. In the nine-year interval between surveys, mean age increased by about six years, while estimated remaining life decreased by three. The most spectacular change was that of estimated current replacement value, which increased by 177% (123% in real terms), due to scarcity value arising the imposition of restrictions in the numbers of boats allowed to fish in the area, which had not been in force in 1991.

Table 1. Changes in Financial Performance of the Irish Fishery in the Irish Sea,
1991 – 2000 (Monetary Values: IR£/1,000)

YEAR	Means			% Change		Estimated Totals			% Change	
	A	B	C	(C-A)	(C-B)	A	B	C	(C-A)	(C-B)
	1991 Nominal	1991, Real (2000 = 1.0000	2000 Nominal	A	B	1991 Nominal	1991, Real (2000 = 1.0000	2000 Nominal	A	B
N (Total/Sample)	45	45	32			83	83	52		
Current Value	130.5	162.2	581.0	345.4	258.2	10,827	13,464	30,027	177.3	123.0
Reg. Length (m)		18.22	18.54		1.7					
Gross Tons		57.92	76.92		32.8		4,808	3,975		-17.3
Kilowatts (kW)		246.97	239.96		-2.8		20,499	12,401		-39.5
Age		26.5	32.8		23.5					
Est. Remaining Life		20.2	17.1		-15.4					
N Crew (incl. Skipper)		4.44	4.69		5.5		373.33	242.25		-35.1
Owner/Boat Share		0.483	0.499		3.4		0.483	0.499		3.4
Skipper Share		0.162	0.159		-1.6		0.162	0.159		-1.6
Other Crew Share		0.356	0.342		-3.9		0.356	0.342		-3.9
Catch Revenue	92.0	114.4	162.2	76.3	41.7	7,639	9,499	8,383	9.7	-11.7
Running Costs	*36.2*	*45.0*	*41.9*	*15.8*	*-6.9*	*3,002*	*3,733*	*2,164*	*-27.9*	*-42.0*
Voyage Surplus	55.9	69.5	120.3	115.4	73.2	4,637	5,766	6,219	34.1	7.9

Overhead Costs	*28.5*	*35.5*	*53.3*	*86.8*	*50.2*	*2,369*	*2,946*	*2,756*	*16.3*	*-6.5*
Gross Income	27.3	34.0	67.0	145.3	97.3	2,268	2,820	3,464	52.7	22.8
Depreciation	*7.7*	*9.5*	*37.9*	*394.9*	*298.0*	*636*	*791*	*1,961*	*208.1*	*147.8*
Net Income	19.7	24.4	29.1	47.9	19.0	1,631	2,029	1,502	-7.9	-25.9
Gross Profit	-0.8	-1.0	7.8	(->+)	(->+)	-67	-83	401	(->+)	(->+)
Net Profit	-8.5	-10.5	-30.2	[256.3]	[186.5]	-703	-875	-1,560	[121.9]	[78.4]
Total Crew Pay	28.1	35.0	59.3	110.7	69.4	2,335	2,903	3,063	31.2	5.5
Mean Crew Pay	6.1	7.6	12.1	97.1	58.5	508	631	623	22.7	-1.3
Skipper Pay Amount	8.2	10.2	18.1	120.0	76.9	682	848	934	37.0	10.1
Total Other Crew Pay	20.4	25.3	41.2	102.3	62.7	1,653	2,055	2,129	28.8	3.6
Mean Other CrewPay	5.7	7.0	10.8	90.1	52.9	460	572	557	21.1	-2.6

(->+) = Change of sign, i.e. from loss to profit (percentage measurement not applicable).

[ ] Indicates negative values, i.e. change in magnitude of loss.

Mean catch revenue increased substantially (nominal 76%, 42% in real terms), while running costs (costs deducted prior to distribution of revenue into shares for boat/owner, and crew including skipper) changed very little, (nominal 15.8% up, real 6.9% down), giving mean gross income increases of 145% nominal, 97% real. Income is defined as owners profit plus crew share pay. As depreciation was calculated as current value divided by number of years remaining life, and replacement values rose by 345% nominal, 258% real, depreciation values underwent strong upward pressure, so net income showed much more modest increases. Gross profit was negative in 1991, comprising a small loss, and this changed to profit by 2000. Skipper (captain) pay rose by 120% nominal, 77% real, while other crew pay did so by 90% nominal, 53% real. Estimated total data reflect the mean data, but with the substantial reduction in numbers of the estimated fleet size, from 83 to 52, a reduction of 37% in nine years.

Table 2. Comparison of mean monetary Ratios in Fleet, 1991 and 2000, and

Percentage of Boats in surplus at each Stage of Financial Process.

TYPE OF RATIO	Means of Ratios		Comparisons	
YEAR	1991	2000	2000-	(2000-1991)
SAMPLE N.	45	32	1991	1991 (%)
Income, Profit and Share Amount as % Ratios of Catch Revenue,				
Voyage Surplus **:** Catch Revenue	**57.3**	**73.1**	15.8	27.5
Gross Income **:** Catch Revenue	**23.1**	**42.8**	19.7	85.2
Net Income **:** Catch Revenue	**12.5**	**18.0**	5.6	44.7
Gross Profit**:** Catch Revenue	**-6.4**	**6.3**	12.7	(->+)
Net Profi**:** Catch Revenue	**-17.0**	**-18.5**	-1.5	[8.6]
Skippers Share**:** Catch Revenue; N (1991) = 20; N (2000) = 8	**9.4**	**11.6**	2.2	23.7
Other Crew **:** Catch Revenue; N (1991) = 40; N (2000) = 32.	**6.1**	**8.1**	2.0	32.0
Income and Profit as % Ratios of Corresponding Outlay				
Voyage Surplus **:** Running Costs	**234.9**	**320.4**	85.6	36.4
Gross Income **:** Running Costs + Overheads	**77.2**	**106.4**	29.1	37.7
Net Income **:** Running Costs + Overheads + Depreciation	**49.0**	**35.5**	-13.5	-27.5
Gross Profit**:** Running Costs + Overheads	**30.9**	**41.4**	10.5	34.1
Net Profit**:** Running Costs + Overheads + Depreciation	**2.2**	**-16.9**	-19.2	(+>-)

	Percentages		2000-	
Boats in Surplus, (N and %); N(1991) = 45, N(2000) = 32	1991	2000	1991	
Voyage Surplus	**91~98**	**100**	2~9	
Gross Income	**73**	**94**	21	
Net Income	**67**	**81**	14	
Gross Profit	**47**	**63**	16	
Net Profit	**27**	**3~13**	(-14~24)	

N.B. Percentage values based on numbers of boats under five are disclosed in the form of range only.

(->+), (+>-) = Change of sign, i.e. from loss to profit or vice versa (percentage measurement not applicable).
[…] Indicates negative values, i.e. change in magnitude of loss.

Table 2 gives the voyage surplus, gross and net income and gross and net profit data of Table 1 in the form of percentage ratios of catch revenue and of the expenses outlaid before aririval at those values. Ratios of catch revenue, as expected, rose, gross profit changing from a negative to a positive value, - with the exception of net profit, due to increased depreciation values as mentioned above, and the same applies to income and profit as ratios of corresponding outlaid costs. Elevated depreciation values made net income decline and changed a net profit of 2.% of associated costs into a net loss of 17%. Percentages in surplus at each stage of the financial process also improved, except for that of net profit, due to elevated depreciation values. (Values which would result in disclosure of the status of groups of less than five boats are only given in absolute or percentage ranges, thus :- N = 1~4).

The ten boats which participated in both surveys performed slightly better than the overall average, being representative of that sector of the fleet with above-average financial stamina. Table 3 shows key indicators of financial performance of different sectors of the fleet and how they changed from 1991 to 2000, in nominal, not real terms. overall the number of boats declined but larger boats increased in number. High levels of gross income in this sector are associated with large boats fishing for nephrops, albeit with increasing fishing outside the area of study, and at the opposite end of the scale, mean income and numbers both declined amongst boats in the under 40 ton category. The whitefish fishery performed very poorly in 1991 but had recovered considerably, assisted by a boom in the haddock stock, by 2000. Five smaller boats started new fisheries for inshore molluscs, either whelk (*Buccinum*) or razor clams (*Ensis*), but these were too few sampled to be analysed separately.

Table 3. Key Indicators of Financial Performance of Different Sectors of the Fleet

in 1991 and 2000 (Monetary Values : IR£/1,000).

Category	Monetary indicator	Est. No.		Gross Income		Gross Profit		Mean Cr ew Pay*	
	Year	1991	2000	1991	2000	1991	2000	1991	2000
O V E R A L L		83	52	27.3	67.0	-0.8	7.8	6.1	12.1
Registered Tonnage	100.0-189.9	6	12	24.4	122.7	-14.8	22.1	8.0	18.1
	70.0-99.9	11	15	47.3	62.9	1.4	-2.4	9.2	12.8
	50.0-69.9	20	10	37.8	38.0	6.3	3.0	6.7	8.9
	40.0-49.9	18	7	15.7	43.5	-3.8	16.4	4.4	7.6
	20.0-39.9	28	8	21.4	14.0	0.0	-10.6	5.1	6.6
Target Species	Nephrops, >70RT	7	15**	53.0	106.0	5.1	12.6	9.7	16.8
	Nephrops, <70RT	50	19**	25.0	37.6	0.1	11.3	5.4	7.6
	Whitefish	26	13**	18.0	51.3	-12.4	7.3	5.6	12.2
Base Port	Howth	30	16	31.5	61.1	-3.6	9.6	7.8	11.4
	Skerries/Balbriggan	31	17	29.6	37.9	9.3	14.0	4.7	6.9
	Clogherheaad	22	19	19.7	91.7	-11.7	2.0	6.3	16.1

* Including that of skipper (captain).
** Excluding five boats fishing for other species.

Figure 1 shows changes in values of landings of the fishery overall, and nephrops, the dominant species. Figure 2 shows landings for the four traditional main whitefish species, all of which are assessed annually by the Northern Shelf Seas Working Group of ICES, namely cod, whiting, plaice and sole. The severe decline of cod and whiting are very obvious. Figure 3 shows values of three previously negligible species which suddenly came into prominence and relieved the fishery of some of the worst

Table 4. Changes in Financial Performance and Size of Fishery, All of East Coast,

		1977	% change	1991	% change	2000
Number of boats	(a)	158	-14.6	135	-34.1	89
	(b)	130	-15.4	*110*	-36.4	70
Weight (Gross tons)	(a)	10,572	-22.9	8,150.1	-10.3	7,309.1
	(b)	8,674	-25.9	6,430.0	-9.0	5,853.0
Number of fishers	(a)	486	4.1	*506*	-20.9	*400*
	(b)	*400*	-3.3	*387*	-20.2	*309*
Total **Nominal** **values**	**Total revenue**	**20,375,829**	**-38.1**	**12,612,446**	**-12.0**	**11,098,991**
	Operating expenses	*6,861,601*	*35.1*	*9,268,585*	*-24.0*	*7,045,419*
	Gross income*	**13,514,227**	**-75.3**	**3,343,861**	**21.2**	**4,053,571**
	Depreciation	*2,792,265*	*-61.7*	*1,070,739*	*141.4*	*2,584,618*
	Net income*	**10,721,963**	**-78.8**	**2,273,122**	**-35.4**	**1,468,954**
Total **Year 2000** **values** **(2000 = 1.000)**	**Total revenue**	**79,072,479**	**-80.2**	**15,687,361**	**-29.2**	**11,098,991**
	Operating expenses	*26,627,817*	*-56.7*	*11,528,266*	*-38.9*	*7,045,419*
	Gross income*	**52,444,662**	**-92.1**	**4,159,094**	**-2.5**	**4,053,571**
	Depreciation	*10,835,941*	*-87.7*	*1,331,786*	*94.1*	*2,584,618*
	Net income*	**41,608,721**	**-93.2**	**2,827,309**	**-48.0**	**1,468,954**
Per boat **Nominal** **values**	**Total revenue**	**156,737**	**-26.8**	**114,659**	**38.3**	**158,557**
	Operating expenses	*52,782*	*59.6*	*84,260*	*19.5*	*100,649*
	Gross income*	**103,956**	**-70.8**	**30,399**	**90.5**	**57,908**
	Depreciation	*21,479*	*-54.7*	*9,734*	*279.3*	*36,923*
	Net income*	**82,477**	**-74.9**	**20,665**	**1.6**	**20,985**
Per boat **Year 2000** **values** **(2000 = 1.000)**	**Total revenue**	**608,250**	**-76.6**	**142,612**	**11.2**	**158,557**
	Operating expenses	*204,829*	*-48.8*	*104,802*	*-4.0*	*100,649*
	Gross income*	**403,420**	**-90.6**	**37,810**	**53.2**	**57,908**
	Depreciation	*83,353*	*-85.5*	*12,107*	*205.0*	*36,923*
	Net income*	**320,067**	**-92.0**	**25,703**	**-18.4**	**20,985**
Per fisher **Nominal** **values**	**Total revenue**	**50,940**	**-36.0**	**32,590**	**10.2**	**35,919**
	Operating expenses	*17,154*	*39.6*	*23,950*	*-4.8*	*22,801*
	Gross income*	**33,786**	**-74.4**	**8,640**	**51.8**	**13,118**
	Depreciation	*6,981*	*-60.4*	*2,767*	*202.3*	*8,364*
	Net income*	**26,805**	**-78.1**	**5,874**	**-19.1**	**4,754**
Per fisher **Year 2000** **values** **(2000 = 1.000)**	**Total revenue**	**197,681**	**-79.5**	**40,536**	**-11.4**	**35,919**
	Operating expenses	*66,570*	*-55.3*	*29,789*	*-23.5*	*22,801*
	Gross income*	**131,112**	**-91.8**	**10,747**	**22.1**	**13,118**
	Depreciation	*27,090*	*-87.3*	*3,441*	*143.1*	*8,364*
	Net income*	**104,022**	**-93.0**	**7,306**	**-34.9**	**4,754**
As **percentage** **of total** **revenue**	**Total revenue**	**100.0**		**100.0**		**100.0**
	Operating expenses	*33.7*		*73.5*		*63.5*
	Gross income*	**66.3**		**26.5**		**36.5**
	Depreciation	*13.7*		*8.5*		*23.3*
	Net income*	**52.6**		**18.0**		**13.2**

(a) = Boats on Register,   (b) = Fleet Recorded by Interviewers (See Text).
* = Sum of Crew Pay and Owners' Profit.
consequences of the decline of cod and whiting. These were haddock, a whitefish rather similar to cod and whiting previously very scarce in the area, and two previously unutilised mollusc shellfish for which markets were discovered, whelk and razor clam.

COMPARISON WITH EARLIER SURVEY, 1977.

Table 4 shows the great reduction in size and profitability which took place in the fishery off the whole of the east coast of the Republic of Ireland between 1977 and 1991. To give an inflation-free comparison. real monetary values (year 2000 = 1.000) are given along with nominal values, and the decline in the fishery is striking. Total catch revenue declined in real terms by 80% 1977 – 1991 declining further by 29% by 2000. Gross income decliined by 92% 1977 – 1991 and by 2.5% during 1991 – 2000. The decline in boat numbers was accompanied by a rise in mean profitability per boat, though not to 1977 lavels, with real gross income falling by 91% in the first period and recovering by 53% in the second, while per fisher, the changes in real terms were -91% and +22%.

The cause of the decline is overfishing. Figure 4 shows changes in the characteristics of cod stocks in ICES Sub-area VIIa, the Irish Sea and its southern approaches, taken form the Report of the ICES Northern Shelf Seas Working Group (Anon., 2002), while Figure 5 shows changes in the level of exploitation. Figure 4 shows how, up to about 1989, any exceptional boom year for recruits yielded a peak in stock biomass (aggregate weight) about two years later, and a peak in spawniing stock biomass usually the following year. However, after the peak recruitment of 1986, and peak in stock biomass in 1987, the pattern broke down, with only a slight peak in spawning stock biomass in 1989 and progressive dwindling in total and spawning biomass and in recruitment numbers thereafter. The main event to have perhaps caused this rather abrupt stock reduction would appear to be the rise in the percentage landed during the year of the total biomass present on 1st January to above 55% on a more or less permanent basis in 1985. In 1989 it rose above 60% and it thereafter averaged over 60% up top about 1998 (See Figure 5). The decline in whiting stocks and catches followed a similar course, though it is not quite so well documented, while of the less important species, Plaice was only slightly affeected by such a decline whils sole was not really affected to any appreciable extent.

CONCLUSIONS AND RECOMMENDATIONS

Theoretically the irish Sea should be an easily regulated area being surrounded by land to the west and east and with few countries operating in it. However, this has proved not to be the case, and the fishery has declined staeadily since the 1970's, its improvement since 1991 only being achieved by substantial down-sizing. There is evidence of difficulties in effective regulation of the fishery. Landings statistics appear not to be trusted by the biologists whose finally adopted landings figures for cod, 1986 – 1998 ranged from 75% to 132% of the sum total of official statistics of the participating countries (Anon. *Op. cit*.). Further, Hillis and Arnason (1995) showed that quotas for Irish Sea fish landings in the ensuing year recommended by the ICES biologists to the Council of Ministers of the European Union had been raised by the Council by 34% for cod, 47% for whiting and 18% for plaice (and 3% for sole) to give the levels of quota finally adopted by the EU ministers for the ensuing year.

If the fishery recovers further, fleet size will almost certainly decrease further. Fishing has undergone a continuing predictable shift from labour to capital, with the added effect that competitive overinvestment has led to reduced returns. The inshore species of whelk and razor clam probably cannot sustain a very large fishery in the long term, and haddock stocks normally fluctuate much more violently than those of other species. In reducing fishing effort, two main approaches are possible, reduction of boat numbers and thus of crew numbers, which is favoured by most market economists. Individual transferable boat quota (ITQ in Europe, IBQ in North America) has emerged as the most effective way to do this. However, it seems to lack equity for government measures which greatly increase the revenue that an industry can generate to simultaneously concentrate the increased revenue in the hands of a much reduced number of people. (Job-creation resulting from extra prosperity and around fishing ports due to markedly increased ambient welth can be rather disappointing in fact).

Ensuring that distribution of increased overall income will meet the Pareto criterion that while some will be better off none will be worse off can be difficult as it implies making an unnecessarily large labour force work part-time to entitle all to income from the fishery without allowing effort to subtly increase so as to destroy the conservation programme. The problem has eased locally as a rise in the Irish standard of living has resulted in less persons anxious to earn a living in the relatively harsh environment of a fishery, many crewmen now being recent immigrants to Ireland. However if the countries round the Irish Sea achieve the politically difficult feat of regulating the fishery effectively, there are very great gains to be obtained in the medium and long term as the fishery is still far from operating at its most productive (reduced) level
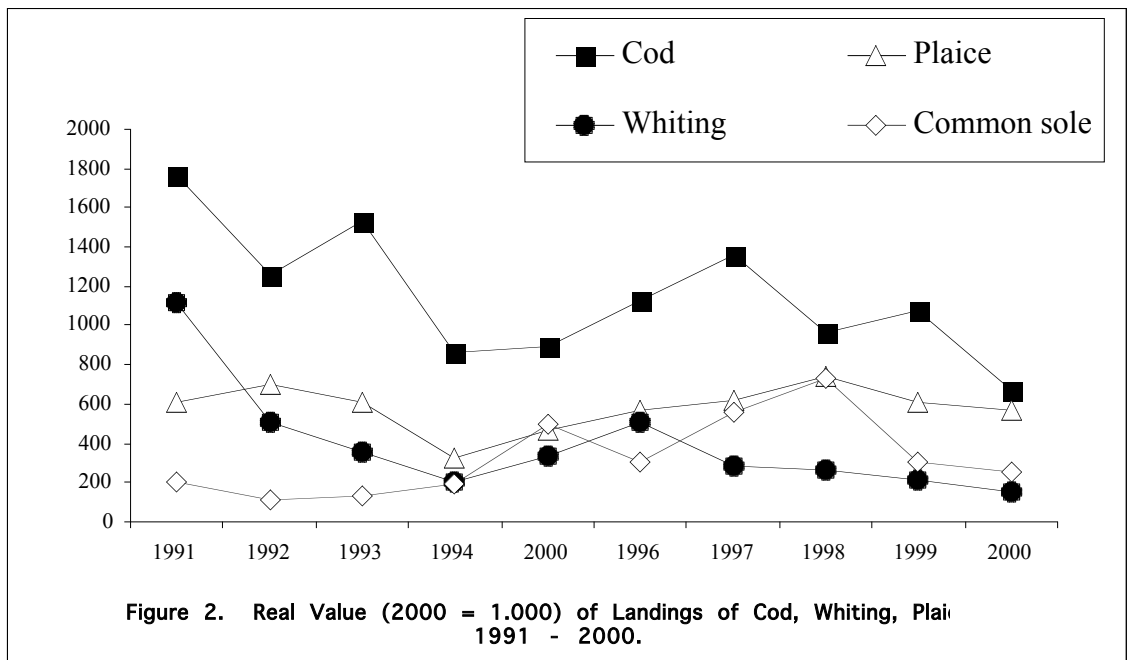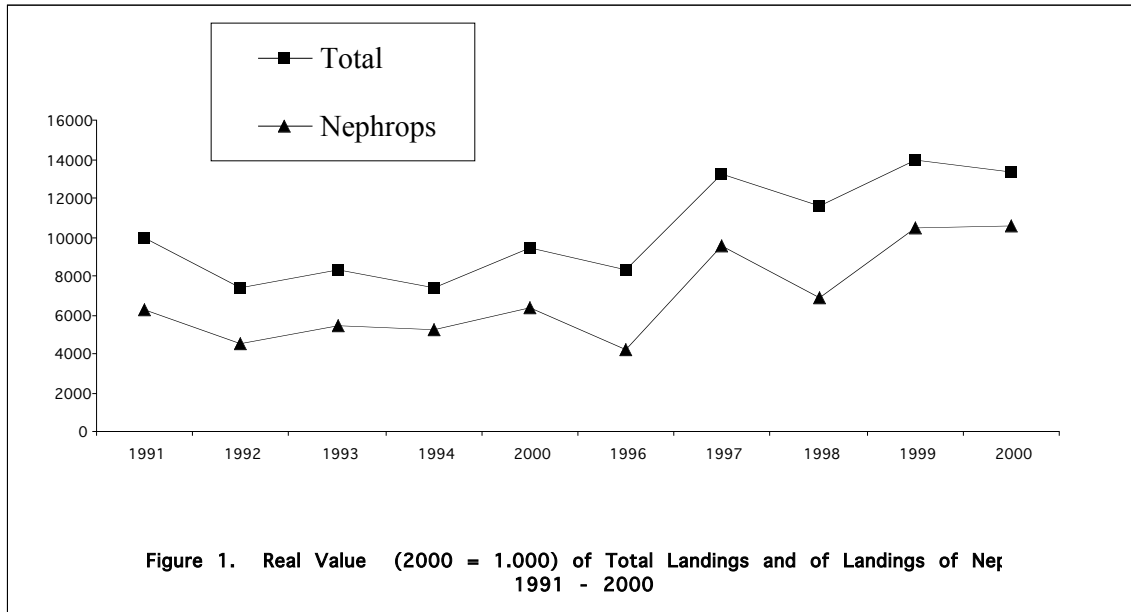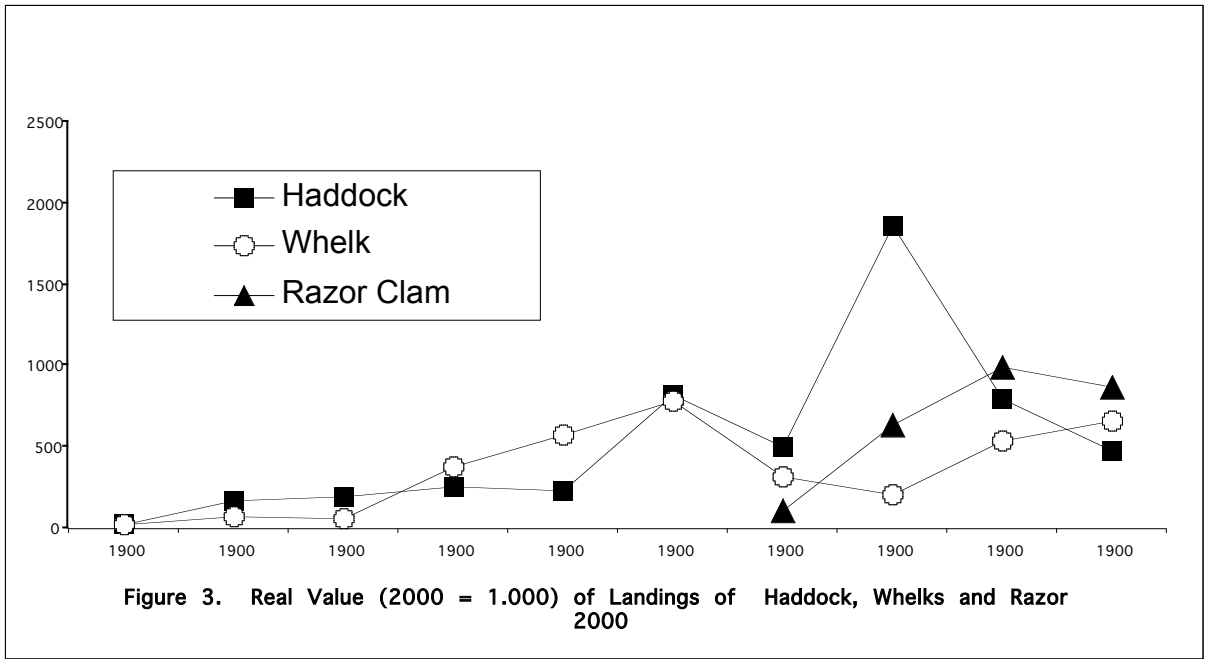
REFERENCES

Anon. 2002. Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, ICES Headquarters, 14-23 August 2001. *International Council For the Exploration of the Sea.* Copenhagen. ICES CM 2002/ACFM :02. 474 pp.

Hillis, J. P. and R. Arnason, 1995. Why fisheries cannot be managed by technical measures alone : a comparison of selected fisheries insidre and outside the European Union. *International Council For the Exploration of the Sea.* ICES CM 1995/S:9 15pp.

Hillis, J. P., M. Fitzsimons, V. McEwan, P. E. Rodgers, R. O'Connoir, and B. J. Whelan, 1994. Overall Profit Optimisation in the Irish sea Fisheries : a Management, Economic, Socio-economic and Biological Study. EU FAR Programme, Contract No. MA.1.222. Dept. of the Marine, Dublin. 328pp.

O'Connor, R., J. A. Crutchfield, B. J. Whelan, and K. E. Mellon, 1980. Developoment of the Irish Sea Fishing Industry and its Regional Implications. *Economic and Social Research Institute, Dublin.* Paper No. 100. 386pp.
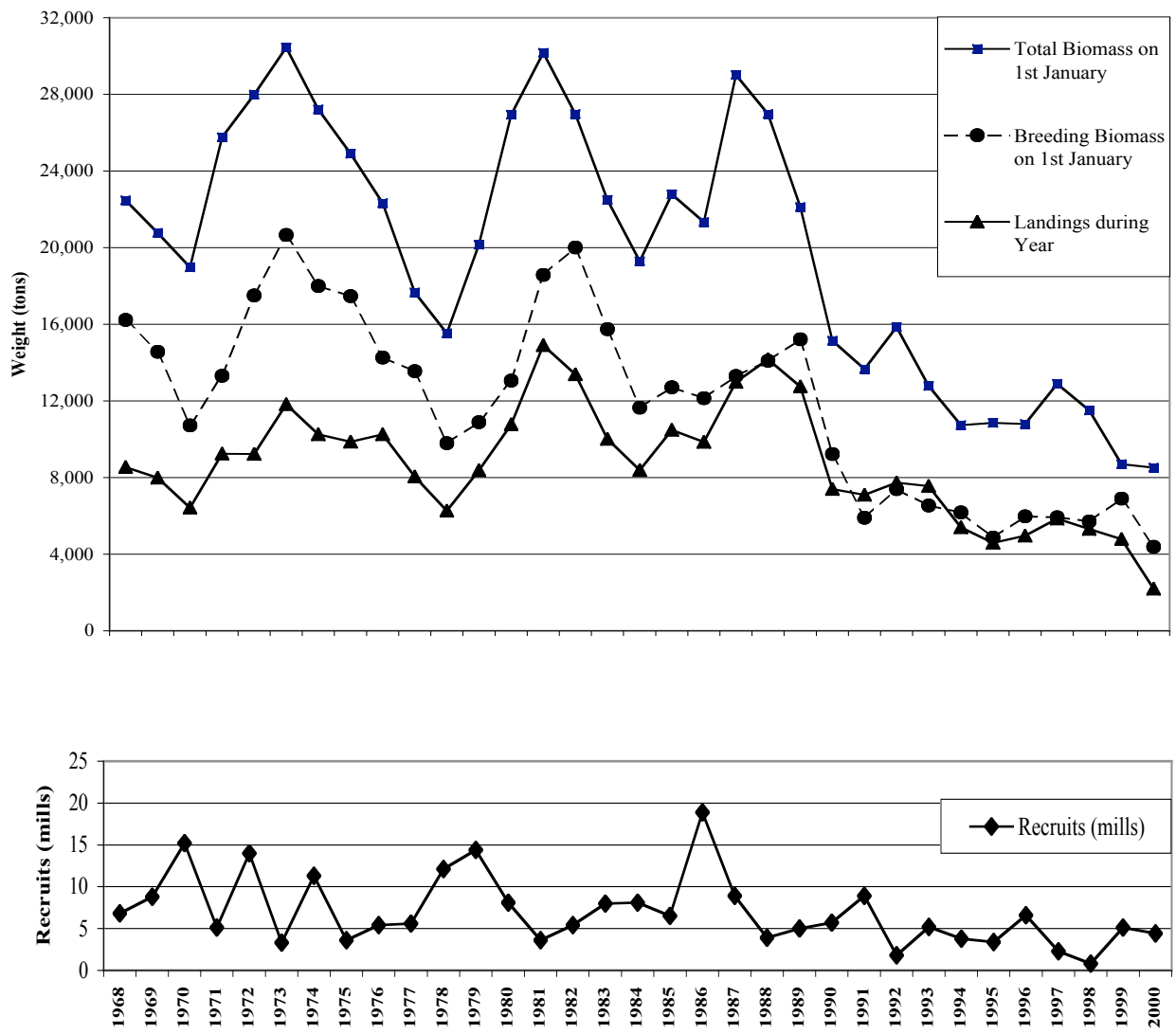
Figure 1. Real Value (2000 = 1.000) of Total Landings and of Landings of Nephrops 1991 - 2000

Figure 2. Real Value (2000 = 1.000) of Landings of Cod, Whiting, Plaice 1991 - 2000.

Figure 3. Real Value (2000 = 1.000) of Landings of Haddock, Whelks and Razor 2000

Figure 4. Changes in Cod Biomass, Recruitment and Landings, 1968 - 2000

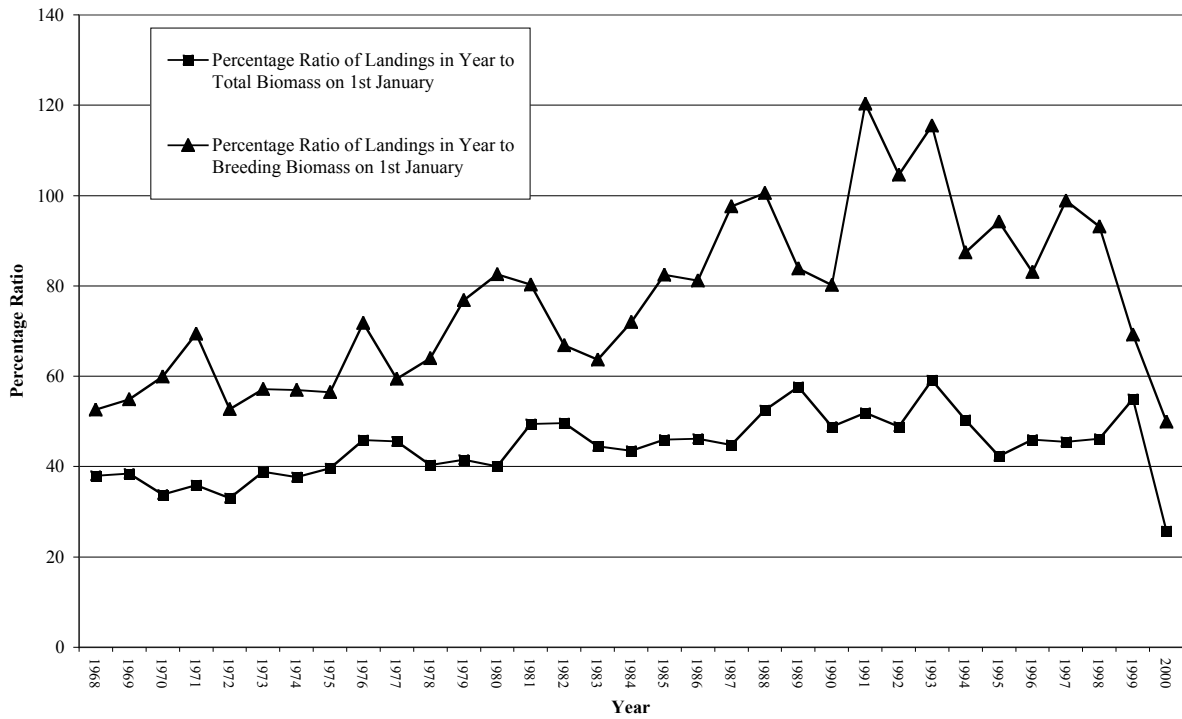**Figure 4. Changes in Cod Biomass, Recruitment and Landings, 1968 - 2000**

Figure 5. Cod Landings in Year as percentage Ratio of Biomass on 1st January.