CRUISE REPORT: CRUISE LF4098 DEMERSAL FISH SURVEY

VESSEL: R.V. *Lough Foyle* (DANI) DATES: 28 September - 13 October 1998

AREA OF OPERATION: Irish Sea (North); ICES Division VIIa

TYPE OF SURVEY: Otter trawl

OBJECTIVES

1. To obtain information on spatial patterns of abundance of different size- and age-classes of demersal fish in the northern Irish Sea.
2. To obtain abundance indices for the ICES assessments of whiting, haddock, cod and herring.
3. To monitor external parasite loads in whiting and cod, by area.
4. To collect data and samples of sprat and juvenile herring for population / feeding study
5. To collect samples of flatfish for a feeding study at Port Erin Marine Laboratory.
6. To estimate the biomass of the spawning aggregation of herring on the Douglas Bank using acoustics during one evening.
7. To collect additional data on distribution and abundance of herring and sprat in the eastern Irish Sea, by means of acoustics, to supplement data collected during acoustic survey LF3798.

PERSONNEL

M.Armstrong	DANI	(SIC)
M. Dickey-Collas	DANI	(28 Sept - 3 Oct.)
C. Burns	DANI	(3 - 13 Oct.)
M. McAliskey	DANI	
J.Peel	DANI	
R. Snÿder	QUB	(28 Sept. - 8 Oct.)
F. Amezcua	PEML	(28 Sept. - 8 Oct.)

METHODS

A commercial Rockhopper trawl fitted with a 20 mm liner in the cod-end was towed over three nautical miles where possible at the stations shown in Figure 1a. Gear and towing procedures were those employed on all previous DANI groundfish surveys. A stratified survey design with fixed station positions was employed. The survey area was divided into seven strata defined by depth and substratum, as indicated in Fig. 1a. The species composition of the catch at each station was determined, and length-frequencies were recorded for each species. Sub-samples of cod, whiting, haddock and hake were taken for recording length, mass, sex and maturity stage, and for removal of otoliths for ageing. The level of infestation of whiting and cod by external parasites was estimated from the biological samples collected at each station. Samples of flatfish were collected for a feeding study at Port Erin Marine Laboratory. Sprats and juvenile herring were frozen for a feeding / population study at Queen's University.

During one evening, a series of transects over the Douglas Bank spawning grounds for herring was surveyed using the Simrad EK-500 echosounder, to estimate the biomass of spawning herring as part of a series of estimates over the spawning season. Echo-integration data were also collected in the eastern Irish Sea between trawl stations, to supplement data collected during cruise LF3798. Data were archived using Simrad EP-500 software and backed up to digital tape. No trawls were carried out on acoustic targets. The acoustic system was calibrated at the end of the cruise.

CRUISE NARRATIVE

R.V. *Lough Foyle* departed Belfast Harbour during late evening on Sunday 28 September and proceeded overnight to station 83 (Fig. 1a). Stations were fished as indicated in Table 1. Trawling took place in daylight only, the vessel either lying at anchor during darkness or drifting/dodging near the first station to be fished the following day. The net was badly damaged at station 88 on 30 September. Lost netting, together with the temperature transducer, were recovered the next day. The remainder of the survey was carried out using the spare rockhopper trawl. The mid-cruise break took place in Dublin from Friday 2 to Sunday 4 October. The survey re-commenced at station 94 on Sunday morning and [illegible]ned at station 35 on 8 October. An acoustic survey of the Douglas Bank spawning grounds for herring was carried out during darkness on 5-6 October. The vessel returned to Belfast during Thursday evening, 8 October, berthing at 21h.15. Calibration of the acoustic system was carried out off Island Magee on Monday evening, 12 October, the vessel leaving Belfast at 18h.00 on Monday and returning again during early morning on Tuesday.

WORK COMPLETED

Forty six hauls were completed. (Fig. 1a; Table 1). The width of seabed swept by the trawl doors increased from around 35m in shallow water (30m sounding) to around 45m in deeper water (80m sounding), with variations due to tidal flow. The average headline height was 2.5 - 3.0 m. These trawl parameters were consistent with previous surveys. Dense concentrations of the large jellyfish *Rhizostoma pulmo* were encountered off Cumbria, where catches of up to 6 tonnes were made. These clogged the net, reducing its efficiency. Trawl duration was reduced to 30 minutes at two stations to reduce the problem. Length measures were carried out on all fish species at each station. Catch weights [illegible]e recorded for most invertebrates. In addition, a total of 164 cod, 1047 whiting, 292 haddock and 87 hake were analyzed for length, mass and maturity and age. Cod and whiting taken for biological analysis were screened for external parasites. Samples of flatfish were frozen for a feeding study at Port Erin Marine Laboratory. Samples of sprats and juvenile herring were taken for analysis of diet and population structure. Trawl data and length frequencies were archived using the groundfish survey data-base.

Transects surveyed acoustically for herring on the Douglas Bank are shown in Fig. 1b. Other portions of cruise track where the EK-500 echo-sounder was deployed are shown on Fig. 1a.

PRELIMINARY RESULTS

A total of 65 species of fish were recorded in the catches (Table 2). The three species whiting, sprat and haddock made up 75% of the total catch. The majority of whiting caught were 0-group fish less than 20 cm long (Figs 2 and 3). Very poor catches of whiting at or above the minimum landing size (MLS) for the commercial fishery were taken off the Irish Coast in strata 2 and 3 (Table 3). The mean catch rate of whiting above MLS in the western Irish Sea was the lowest in the time series (Table 4a). In the eastern Irish Sea, catch rates of whiting above MLS have fluctuated without trend and have consistently been

much higher than in the western region where most commercial fishing takes place (Table 4a,b). Catch-rates off Cumbria may have been reduced during cruise LF4098 because of clogging of the net with jellyfish. Haddock above MLS continued to be abundant compared with earlier years (Table 4a,b). The distribution of haddock tends to be very patchy (Table 3), with highest catch-rates of juveniles occurring inshore in Belfast Lough, off Dundrum Bay, south of Dundalk Bay and off the Manx west coast. Larger haddock were most abundant south of Dundalk Bay and south and south-west of the Isle of Man.

Preliminary indices of abundance for 0-group and 1-group cod, whiting and haddock were obtained from the length distributions (Table 5). More accurate indices will be available once the otoliths collected during the cruise have been aged. Results are summarized below:

- Catch-rates of 0-group cod (1998 year-class) were the lowest in the series. The catch-rate of 1-group cod was also below average, confirming indications from the September 1997 and March 1998 surveys that the 1997 year-class of cod is also weak. These year classes will enter the commercial fishery as codling in autumn 1998 (1997 year-class) and 1999 (1998 year-class), and will have their greatest impact on the spawning stock as 3 – 4-year olds in 2001.

- The 1998 year-class of whiting appears to be comparatively strong, giving the highest index for 0-group fish in the series. Whiting of the 1998 year class will be represented in fishery discards from 1998 - 2000 and in landings from autumn 2000 onwards. (A preliminary index for 1-group whiting cannot be obtained directly from the length frequency because of the overlapping length distributions of 1- and 2-year-olds.)

- The index for 0-group haddock of the 1998 year class was the third highest in the series. Haddock of the 1998 year-class will be represented in fishery discards from 1998 to 1999 and in commercial landings from autumn 1999.

Data collected during cruise LF4098 will be incorporated in the stock assessments of Irish Sea cod, whiting and haddock at the ICES Northern Shelf Working Group in June 1999, and in the ICES assessment of herring in March 1999. EK-500 instrument settings used during the cruise are given in Table 6 together with the results of the calibration exercise on 12 October. A possible fault in the 120 kHz transducer, following a temporary connection of a spare plug, precluded accurate calibration at this frequency.

ACKNOWLEDGMENTS

The Master and personnel of the *Lough Foyle* are thanked for their cooperation throughout the cruise and for ensuring efficient and consistent trawling operations. The scientific personnel are thanked for the very thorough work completed.

Signed:

Scientist - in charge: M.J. Armstrong date 23-10-98

Ships master: [signature] date 23 x 1998

Head, AESD Aquatic Systems: J.D. Hemingway date 6/11/98

Table 1 Details of trawls during cruise LF4098 (Time in G.M.T.)

Date	Station	Time shot	Shooting position		Hauling position		Mean Depth (m)	Distance towed (nm)
			Latitude	Longitude	Latitude	Longitude		
28-Sep	83	06h.19	54 23.10	5 17.90	54 20.20	5 16.80	86.0	3.00
	97	08h.53	54 20.34	4 55.79	54 17.68	4 53.92	76.0	3.00
	46	10h.38	54 12.96	4 56.34	54 10.37	4 59.08	82.0	3.00
	99	12h.23	54 7.70	5 1.25	54 5.21	5 3.81	74.0	3.00
	48	14h.06	54 0.86	4 59.90	53 58.05	4 58.14	55.0	3.00
	51	15h.46	53 54.16	4 59.44	53 51.28	4 58.15	73.0	3.00
29-Sep	103	06h.19	53 33.10	5 26.03	53 35.74	5 23.44	84.0	3.00
	105	08h.44	53 40.75	5 6.14	53 42.77	5 2.44	71.0	3.00
	50	11h.18	53 44.10	5 22.13	53 46.86	5 19.95	79.0	3.02
	96	13h.32	53 49.66	5 5.34	53 52.66	5 6.23	68.0	3.09
	216	15h.27	53 54.07	5 14.63	53 56.56	5 11.84	78.0	3.00
30-Sep	100	06h.31	54 11.08	5 40.87	54 8.05	5 41.08	26.0	3.00
	17	08h.38	54 6.44	5 33.52	54 8.45	5 29.88	52.0	3.00
	81	10h.43	54 10.20	5 27.04	54 7.18	5 27.52	57.0	3.00
	101	13h.29	54 7.65	5 18.82	54 4.62	5 18.61	97.0	3.01
	88	— Net torn —						
01-Oct	70	08h.15	54 1.68	5 45.04	53 58.58	5 45.11	43.0	3.00
	88	09h.58	53 58.98	5 40.58	53 56.12	5 42.43	60.0	3.00
	208	13h.07	53 50.29	5 45.73	53 47.29	5 46.67	57.0	3.00
	71	15h.11	53 53.87	5 53.22	53 53.34	5 58.06	38.0	3.00
	73	17h.02	53 51.56	6 5.32	53 48.92	6 1.9	29.0	3.20
02-Oct	79	06h.28	53 43.6	6 0.42	53 40.86	5 58.4	33.0	3.00
	75	08h.13	53 42.2	5 51.20	53 39.26	5 50.1	56.0	3.08
	92	09h.58	53 36.9	5 55.35	53 34.0	5 53.7	42.0	3.00
	93	11h.32	53 31.5	5 50.1	53 28.5	5 49.4	56.0	3.00
04-Oct	94	09h.50	53 21.6	5 45.6	53 24.3	5 46.8	76.0	3.00
	56	12h.07	53 30.0	5 42.1	53 29.6	5 37.4	72.0	3.00
	90	14h.47	53 39.2	5 40.4	53 36.3	5 41.8	80.0	3.05
05-Oct	76	06h.22	54 0.8	4 24.1	53 59.4	4 28.7	43.0	3.00
	243	09h.10	53 49.2	4 10.5	53 46.9	4 7.0	51.0	3.02
	249	12h.28	53 46.1	3 41.8	53 48.0	3 46.1	38.0	3.20
	242	15h.32	54 4.4	4 1.9	54 7.2	4 3.6	31.0	3.00
06-Oct	77	06h.23	53 50.2	4 41.3	53 48.3	4 45.2	84.0	3.00
	102	08h.21	53 47.0	4 40.8	53 44.1	4 38.9	59.0	3.00
	245	11h.42	53 31.5	4 16.8	53 30.4	4 13.2	50.0	2.45
	246	15h.39	53 29.2	3 44.1	53 28.6	3 49.3	30.0	3.00
07-Oct	250	06h.17	54 3.2	3 37.2	54 5.9	3 39.7	24.0	3.00
	259	09h.15	54 14.6	3 41.9	54 17.5	3 43.3	36.0	3.00
	258	11h.5[illegible]	54 19.0	3 55.5	54 20.4	3 56.5	40.0	1.50
	257	13h.54	54 23.1	3 43.9	54 24.5	3 45.4	30.0	1.63
	64	15h.48	54 34.6	3 46.2	54 37.1	3 43.2	18.0	3.00
08-Oct	256	06h.17	54 38.0	3 55.1	54 37.3	3 57.5	29.0	1.52
	63	08h.12	54 38.3	4 10.9	54 36.5	4 14.9	55.0	3.00
	61	11h.13	54 33.3	4 32.1	54 33.3	4 34.2	46.0	1.27
	86	15h.00	54 35.1	5 25.7	54 38.1	5 27.2	39.0	3.00
	35	17h.04	54 43.0	5 41.4	54 43.6	5 36.4	18.0	3.00

Table 2 Species compositions of catches (in kg) by station and survey stratum in cruise LF4098 (0.0 = < 0.05 kg)

		Stratum 1				Stratum 2						
		35	86	85		81	100	78	71	73	79	92
		2.4	28.0	0.9			0.0	2.6		0.1	0.1	0.2
COD	Cod	1125.0	274.2	107.1		164.8	250.9	368.4	100.7	97.5	262.2	330.5
WHG	Whiting	221.2	14.1	0.3		4.6	96.1	224.0	1.3	0.5	6.5	388.0
HAD	Haddock			0.0		0.8		2.3	0.6	0.3	0.8	0.3
HKE	Hake		0.0	0.2		0.2						0.7
NOP	Norway pout	19.4	8.3	18.4		16.7	0.2	1.2	0.3		0.1	5.1
POK	Poor cod	5.4	0.2			0.2						
BIB	Bib			1.9								
POL	Pollack											
COE	Coalfish											
LIN	Ling			0.1								
WHB	Blue whiting											
HER	Herring	413.0		0.3		3.3	0.6	0.1	4.9	21.0		2.6
SPR	Sprat	228.1	0.1	0.1		69.0	45.2	3.5	1205.0	715.0	121.8	117.0
ANE	Anchovy											
SAN	Pearlside						2.7	8.4		2.8	0.4	1.1
MAC	Mackerel	3.1										
HOM	Horse mackerel	1.4		0.0		0.0	0.1	0.1	0.0	0.1	0.0	0.2
PLE	Plaice	2.0	1.7			0.2	28.2	0.4	0.2	1.0	9.7	10.2
DAB	Dab	0.1	1.4	0.0		0.6	11.8	0.2		4.5	5.3	7.1
FLE	Flounder						0.5					
LEM	Lemon sole		4.4	0.2		0.4		0.2				1.6
DOL	Dover sole						0.2	0.4				
TBS	Thickback sole		0.0									0.1
SOT	Solenette						0.1				0.0	
LAA	Long rough dab			0.3		3.3	0.1	0.1	0.0	0.2	0.4	1.7
MEG	Megrim											
WIT	Witch											
DAF	Scaldfish		0.0									
TKT/NKT	Topknots					0.0						
TUR	Turbot										0.3	
BLL	Brill					1.8		0.3				0.8
MON	Anglerfish	1.0	0.8	1.1		1.8	0.3		0.6			
ARG	Argentine					0.0		0.9				
BBY	Butterfly blenny											0.8
COE	Conger eel		13.4			0.3					1.5	1.5
DDT	Dragonette (common)	1.2	0.0			0.1	2.1	0.6			0.1	
SDT	Dragonette (spotted)					0.0	0.0			0.0		
GSG	Goby (Fries's)					0.8						
GPA	Goby (other)		0.0	0.0								
GUG	Gurnard (grey)	2.3	0.9	0.2		0.3	1.0	0.2		0.1	0.6	2.3
GUR	Gurnard (red)		0.5									
TUB	Gurnard (tub)						0.2					
JOD	John Dory	0.3	0.3						0.5			0.3
LUM	Lumpsucker								0.1			
PFX	Pipefish											
POG	Pogge		0.1									
RPF	Red band fish (Cepola)					0.3		0.3	1.3			
FRR	Rockling (4-bearded)					0.0						
GSE	Sandeel (greater)											
MSE	Sandeel (lesser)											
LPS	Sea snail											
SBY	Snake blenny			0.0		0.1		0.0				
WEL	Weever (lesser)											
LSD	Lesser spotted dogfish	11.3	24.5	11.5		1.5	2.6	1.7	5.7	2.8	10.3	8.2
DGN	Greater spotted dogfish										0.5	
SMH	Smooth-hound (common)											
SDS	Smooth-hound (starry)											
DGS	Spurdog											
GAG	Tope											
THR	Thornback ray											
SDR	Homelyn ray											
BLR	Blonde ray											
CUR	Cuckoo ray		1.6									
NEP	Nephrops			14.4		16.9	0.4	0.1	1.1	0.9	7.5	0.1
PSV	Pasiphaea			0.1								
PDB	Pandalids			0.6								
CSX	Crangonids			0.0								
LMD	Swimming crabs	3.3		0.1				0.1			0.0	
MUX	Spider crabs			0.0			0.0					
CRE	Brown crab											
ATS	Alloteuthis	0.4				5.0	0.5	2.4	0.9	0.1	0.5	0.4
LLV	Loligo		0.4	0.1		12.9	1.8	12.0	0.5	0.0	0.2	0.7
SPY	Sepiola		0.0	0.9		0.1						
EDC	Eledone		0.3			0.2		0.3			0.6	0.4
OSC	Queen scallop		0.4									
	Large jellyfish											
AAC	Aphrodite											

1. Numbers rather than weight

Table 2 contd.

	Stratum 3								
	(101)	(17)	(88)	(208)	(75)	(90)	(56)	(93)	(94)
Cod	5.9			0.4		2.8	3.9		
Whiting	41.8	106.4	234.8	197.1	595.7	111.8	212.0	525.2	209.6
Haddock	0.0	5.9	13.9	4.4	20.5	0.0	145.1	95.7	460.0
Hake	0.6	1.2	0.4	1.5	2.8	7.1			
Norway pout	5.0	0.0	14.0	6.0	8.6	6.6	25.0	22.0	8.2
Poor cod	4.1	8.8	8.5	9.3	2.2	1.9	6.2	11.6	27.5
Bib									
Pollack									
Coalfish									
Ling									
Blue whiting	1.4		0.5						
Herring	0.9	10.0	123.4	31.5	85.3	0.8	2.1	25.2	11.0
Sprat	0.1	17.5	508.3	221.7	156.1	0.1	0.2	23.4	9.7
Anchovy						0.3	0.1		1.7
Pearlside									
Mackerel		0.2	7.2	1.6				0.6	
Horse mackerel		0.6	0.1	2.4	3.7		0.1	0.1	0.5
Plaice		2.1	0.4				2.1	16.3	59.2
Dab		1.2	0.3	0.3		0.0	1.0	17.0	21.9
Flounder									
Lemon sole	0.1	0.2	0.7					0.2	
Dover sole							1.1		
Thick[illegible] sole			0.0	0.0	0.5		0.0	0.8	
Sole		0.0							
Long rough dab	0.5	1.3	0.3	0.2	0.5		0.2	2.6	1.0
Megrim									
Witch	0.0	0.0							
Scaldfish									
Topknots		0.0						0.1	
Turbot								0.7	
Brill									
Anglerfish	1.4	11.5			1.1		2.3	0.9	
Argentine	0.0	0.0	0.2						
Butterfly blenny									
Conger eel	1.1	1.2				0.3			
Dragonette (common)		0.4			0.1			1.3	
Dragonette (spotted)		0.0							
Goby (Fries's)		0.2							
Goby (other)	0.1					0.0			
Gurnard (grey)	0.9	0.7	0.1		0.2	0.2	3.1	7.8	6.4
Gurnard (red)							0.4		2.6
Gurnard (tub)							0.2	3.2	
John Dory	0.2	0.2	0.5						
Lemon sole									
Pipefish							0.0	0.1	
Pogge									
Red band fish (Cepola)		1.3							
Rock[illegible]-bearded)	0.0	0.0				0.1	0.0		
Sa[illegible]reater)									
Sandeel (lesser)									
Sea snail									
Snake blenny	0.0	0.0	0.2	0.2	0.2				
Weever (lesser)									
Lesser spotted dogfish	1.7	7.1	3.5		41.2		19.1	9.5	8.9
Greater spotted dogfish							8.5		
Smooth-hound (common)									
Smooth-hound (starry)									5.4
Spurdog			2.0						
Tope								0.5	
Thornback ray									
Homelyn ray									
Blonde ray									
Cuckoo ray									
Nephrops	9.2	25.1	3.0	8.6	11.9	1.5	0.1	0.8	
Pasiphaea	4.4					1.5	0.1		
Pandalids	1.7					0.3	0.3		
Crangonids	0.1					1.5	0.1		
Swimming crabs	0.0					0.2	0.4	0.3	
Spider crabs									
Brown crab								0.7	
Alloteuthis	0.0		8.0	3.2	1.7			1.6	0.3
Loligo	0.1		24.2	4.1	3.1		0.2	2.7	1.2
Sepiola	0.4			0.2	0.5	0.1	0.0		
Eledone	0.2	0.4	0.1	1.0	1.0			0.1	
Queen scallop									
Large jellyfish[1]									
Aphrodite									

	Stratum 4								
(97)	(46)	(99)	(48)	(216)	(51)	(96)	(50)	(103)	
2.1	0.0		0.4		5.3	0.0		21.0	
200.7	53.9	88.4	126.3	52.2	440.9	344.4	180.8	132.0	
2.2	0.1	27.5	117.8	2.3	202.8	41.3	1.4	35.9	
0.0	3.6	1.9	0.7	0.5	0.5	0.4	5.4	0.3	
17.6	1.9	3.9	2.6	4.5	3.6	5.1	2.4	3.0	
8.2	4.7	7.5	52.3	2.5	19.3	5.1	4.3	7.2	
	1.6								
0.1	0.1	0.1	0.2						
21.5	0.5	5.3	0.7	0.8	0.8	2.8	1.9	0.3	
2.0	0.2	0.1	0.0	0.0	0.2		0.0	0.0	
							2.0	5.9	
					0.0				
1.1	0.2	1.0	0.6		2.8	0.4		0.9	
	1.8	0.6	0.3	32.2			0.4		
					13.2	1.0		1.4	
		0.0	0.0	0.2	4.3	0.1	0.1		
	0.5	1.0	11.3		0.7	0.1			
					0.7			0.7	
0.0		0.4	1.5	0.3	12.1	1.3	0.0	0.1	
4.8	1.1	3.0	0.1	3.8	1.5	2.7	0.1	0.1	
		0.0						0.3	
1.7	0.5	0.1		0.4	0.2	0.0			
0.0			0.0						
13.0	0.9	4.3	3.3	3.0	5.6				
			1.7						
0.0						2.1		13.9	
			9.6		1.8	0.1			
		0.0	0.1		0.6				
0.0				0.0			0.1		
	0.3	0.2	1.1	2.5	6.5	4.5	12.0	11.1	
			2.8						
			2.2	0.5	22.3	2.6		2.8	
0.5			0.1			0.6		0.2	
					0.1	0.0		0.0	
	0.1	0.2		0.0		0.3			
								0.0	
0.0	0.2	0.0		0.0					
8.9	0.0	4.2	31.3		6.0	20.6	2.5	11.0	
			5.1						
			6.7						
0.8	0.9	5.8	3.2		11.4			2.6	
								2.6	
					1.3			3.0	
22.4	34.2	42.8	0.8	52.6	11.6	30.1	11.4		
0.3	0.4	0.1		0.2		0.0	0.3	0.4	
0.6	0.5	0.9		0.1		1.4	0.7		
				0.0		0.0	0.9	0.1	
			0.0	0.1	0.5	0.8	0.2	0.2	
			0.0					1.0	
	0.7							0.3	
0.6	0.4	3.0	0.6	0.6	0.8	0.2			
0.1		0.4	0.6	0.2	1.3				
0.3	1.5	1.3	0.0	1.7	0.0	0.6	0.8	0.6	
0.1	0.3	0.5	0.4	0.1		0.1		0.2	
0.0			0.1		0.0			0.0	
					0.0				

1. Numbers rather than weight

	Stratum 5		Stratum 6								Stratum 7					
	61	63	246	242	249	250	258	259	257	256	64	76	77	102	243	245	105
	22.9	4.0		48.2	14.5	5.0					2.3		2.0	12.0	25.0	21.5	
ng	48.1	26.1	4.6	2.6	42.3	399.1	157.4	106.1	48.0	75.3	239.7		306.5	67.8	40.0	27.5	57.6
ock	7.5	13.9	61.0	11.2	2.1								250.2	11.3	9.9		22.5
		1.7	0.7				0.5	0.3				1.2	0.3	3.3		1.3	
vay pout	0.0	0.3				0.1	0.4	0.1	0.0	0.0			1.6	0.1		0.1	0.7
ood	4.8	56.2	36.6	45.8	59.9	3.9	1.6	2.7	0.9	0.4	0.5	164.7	13.0	6.9	2.7	9.1	1.6
		5.0	48.3		13.4	2.2	7.1	3.5	6.0	0.6	11.4		0.6	1.5	0.1	1.7	
ck	2.0													2.5			
ish	2.1														1.5		
							0.1						0.1				
whiting																	
	0.5	0.5	0.1	0.6	31.2	1.0	0.8	0.2	0.1	0.6	1.5		0.0			0.2	
ring	0.5	2.0				1.3	0.3	2.8	0.5	4.8	6.9				0.0	0.0	0.0
					0.1		0.0						0.0			0.0	0.6
bovv																	
nside																	
kerel		0.6	0.8	17.8	0.6	1.1		0.8				0.2		2.7		2.3	0.0
e mackerel		0.6	1.7	1.1	1.3		0.0	0.0	0.0	0.0	0.0						
ce		6.1	4.1	3.6	7.8	5.7	2.0	0.6	14.4	19.6	41.6		2.7	9.3	1.9		2.1
		1.2	0.4	0.4	1.1	8.8	4.1	1.9	3.0	28.1	73.4		0.6	2.9		0.4	0.6
nder										0.7							
non sole		9.7	2.4	1.1	0.3							0.1	0.7	0.2	0.9	2.7	
ver sole			1.1			0.6	0.3	1.7	0.9	0.3	0.3						0.2
dback sole		0.6	0.2				0.1			0.7			0.9	0.0		0.0	0.5
sette						0.0		0.0	0.0	0.0	0.3						
g rough dab							0.1	0.1									
ram																	
ab																	
dfish							0.0										
knots																	5.1
bot						1.1				0.9				1.3			
ll											1.6						
ierfish		0.0	1.4	4.0								1.9					
ventine																	
merfly blenny													0.0				
ater eel								1.9									
nonette (common)		2.4	1.5		0.5	0.8	0.4	0.3		0.4	1.7	0.0	0.1	0.4	0.1	0.8	
nonette (spotted)																	0.2
by (Frie's)																	
by (other)	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0					0.0	
rnard (grey)		2.2	7.2	1.2	1.1	0.6	1.1	0.3	0.1	0.6	0.7		0.4	0.4	1.0		1.3
rnard (red)	0.3	0.1		14.4	4.0							4.9	1.3	2.2	2.4	10.9	
rnard (tub)		1.7		4.3	2.3	2.9	3.9	1.4	1.1	3.5	5.1	5.9	1.8	2.7	12.4	2.5	1.7
m Dory		0.4	1.3	1.7	0.4					0.3					0.3	0.3	
nnsucker																	
pefish			0.0														
ggar	0.0	0.0	0.0			0.0				0.0	0.1		0.0		0.0		0.0
ed band fish (Capola)																	
ocking (4-bearded)						0.0		0.0	0.0								
andeel (greater)				0.4	1.2									0.0			
andeel (lesser)				0.0													
n snail	0.0																
nake blenny																	0.0
weever (lesser)																	
esser spotted dogfish	7.7	12.3	99.0	129.5	59.0		10.9	15.1		6.1	6.3	30.1	7.8	8.2	27.7	41.3	41.3
reater spotted dogfish	5.0				11.1								10.6				
mooth-hound (common)												6.6					2.0
mooth-hound (starry)					3.6						5.4	14.6	2.8				7.1
Spurdog	20.9			16.7		4.1	5.1					346.4	4.0	7.6	3.8		
Tope	17.5				4.5							6.0		11.5	16.0		1.7
Thornback ray			1.3	5.7											8.9		13.4
Homelyn ray													1.7	1.5			
Blonde ray		2.9													1.4		
Cuckoo ray				1.6													
Nephrops						10.8	7.5	1.0	0.9		0.1						0.0
Pasiphaea																	
Pandalids																	
Crangonids													0.0				0.2
Swimming crabs	0.0	0.1				0.3	0.0	0.1	0.2	1.0	2.3						
Spider crabs																	
Brown crab															0.6		0.2
Alloeurthis	0.0	0.2	0.1	0.2	0.1	0.0	0.1		0.0	0.0	0.4	0.1					
Loligo		0.7	2.6	6.8	0.2	0.3						15.2	1.1	0.4	10.8	0.5	
Sepiola	0.1	0.1					0.0			0.0			0.0	0.0		0.2	0.2
Eledone	0.1	0.2	0.6	0.1	0.2			0.1					0.0		0.1		
Queen scallop	0.6	1.2	0.1	22.5	0.4					0.3		0.1	3.2	0.5		0.5	
Large jellyfish[1]	4	4	86	114	64	300	100	300	70	20							
Aphrodite		0.0															

1. Numbers rather than weight

Table 3 Catches in kg per 3 nautical miles (approx 1 hour) towed, for fish below and at or above the minimum landing size of 27 cm (whiting) and 30 cm (haddock) during cruise LF4098.

STRATUM	STATION	WHITING		HADDOCK	
		below MLS	above MLS	below MLS	above MLS
1	35	1061.6	63.7	185.9	35.3
	86	207.7	66.5	6.5	7.5
	83	80.1	0.5	0.3	0.0
2	81	164.0	0.8	3.6	1.0
	100	250.9	0.0	96.1	0.0
	70	367.7	0.7	215.1	8.9
	71	100.7	0.0	1.3	0.0
	73	90.9	0.4	0.5	0.0
	79	261.9	0.2	6.5	0.0
	92	329.5	1.0	388.0	28.9
3	101	38.1	3.6	0.0	0.0
	17	105.7	0.7	5.5	0.4
	88	233.8	1.0	12.9	1.0
	208	196.3	0.8	4.4	0.0
	75	580.2	0.0	20.0	0.0
	90	110.0	0.0	0.0	0.0
	56	212.0	0.0	27.6	117.6
	93	523.4	1.8	94.5	1.2
	94	209.6	0.0	85.2	374.8
4	97	198.9	1.7	2.2	0.0
	46	52.8	1.1	0.1	0.0
	99	84.2	4.1	17.4	10.1
	48	100.7	25.6	24.1	93.6
	216	51.7	0.4	0.6	1.7
	51	362.3	78.6	137.6	65.2
	96	319.0	15.3	36.5	4.7
	50	177.0	3.8	0.1	1.4
	103	131.8	0.2	3.7	32.2
5	63	7.5	18.6	0.6	13.3
	61	16.8	98.7	0.0	17.7
7	77	279.3	27.3	15.7	250.2
	102	54.9	12.9	2.4	8.9
	76	0.0	0.0	0.0	0.0
	243	5.6	34.2	0.0	9.8
	245	1.7	31.8	0.0	0.0
	105	56.5	1.1	1.3	21.2
6	246	7.5	53.5	0.0	0.0
	242	0.6	1.9	0.0	11.2
	249	17.4	22.1	0.1	1.9
	250	184.7	214.4	0.0	0.0
	258	237.2	77.6	0.0	0.0
	259	79.2	26.9	0.0	0.0
	257	65.0	23.4	0.0	0.0
	256	143.5	5.1	0.0	0.0
	64	217.8	21.9	0.0	0.0
Mean: Strata 2 - 4		210.1	5.7	47.3	29.7

Table 4 Time series of DANI trawl survey indices of abundance of haddock and whiting at and above the minimum landing sizes of 27cm (whiting) and 30 cm (haddock). Data are kg per 3 nautical miles towed.

(a) Autumn surveys

	WHITING		HADDOCK
Survey	western Irish sea	eastern Irish Sea	western Irish Sea
1991	27	n/a	1
1992	12	34	1
1993	27	45	1
1994	9	58	9
1995	16	48	23
1996	19	41	27
1997	13	67	51
1998	**6**	**34**	**30**

LF4098

(a) Spring surveys

	WHITING		HADDOCK
Survey	western Irish sea	eastern Irish Sea	western Irish Sea
1992	31	104	1
1993	21	42	8
1994	21	69	8
1995	23	60	5
1996	58	59	31
1997	16	32	63
1998	20	67	27

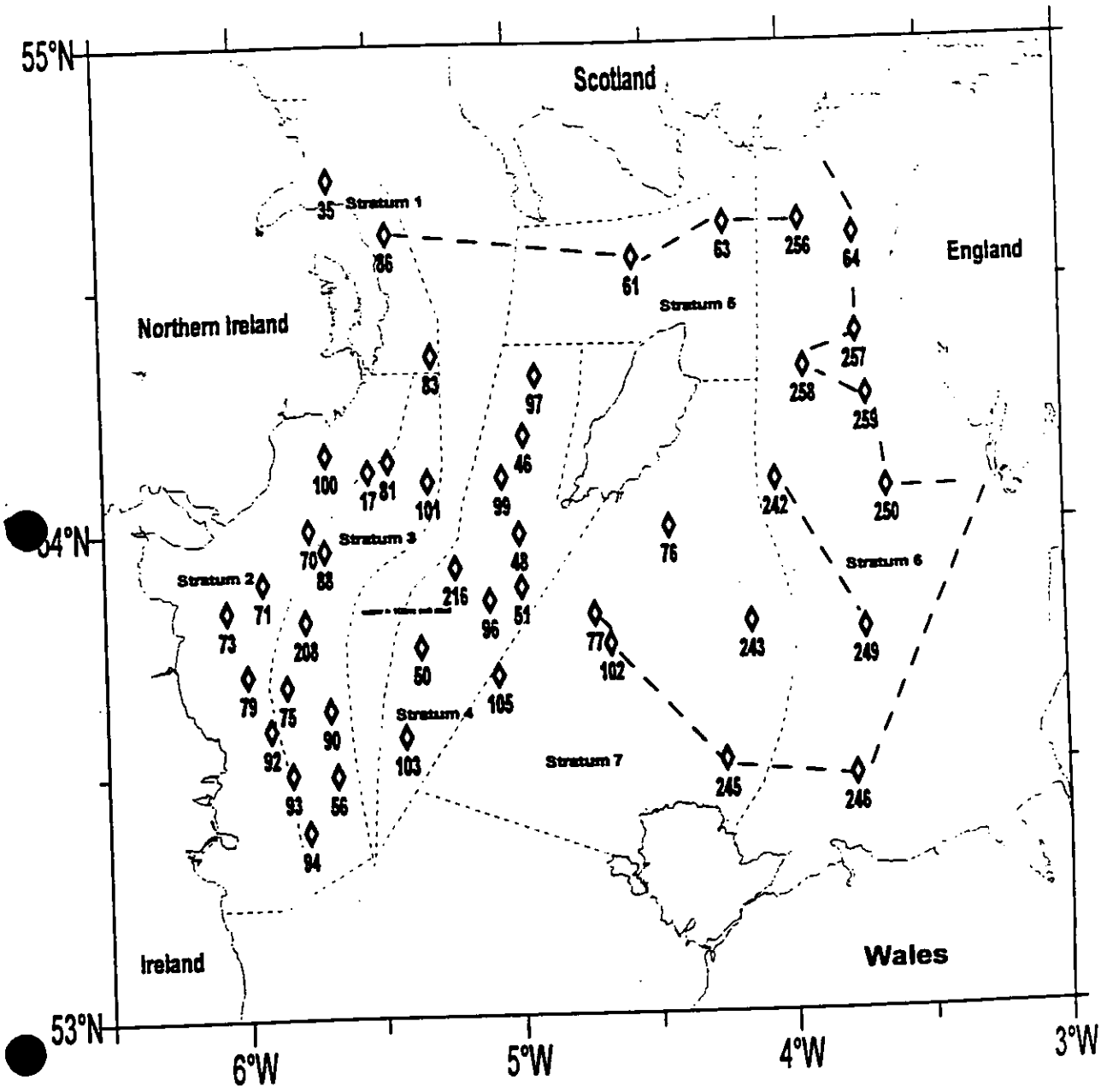

Fig. 1a. Trawl station positions for cruise LF4098. Echo-integration was carried out on transects indicated by dashed lines.

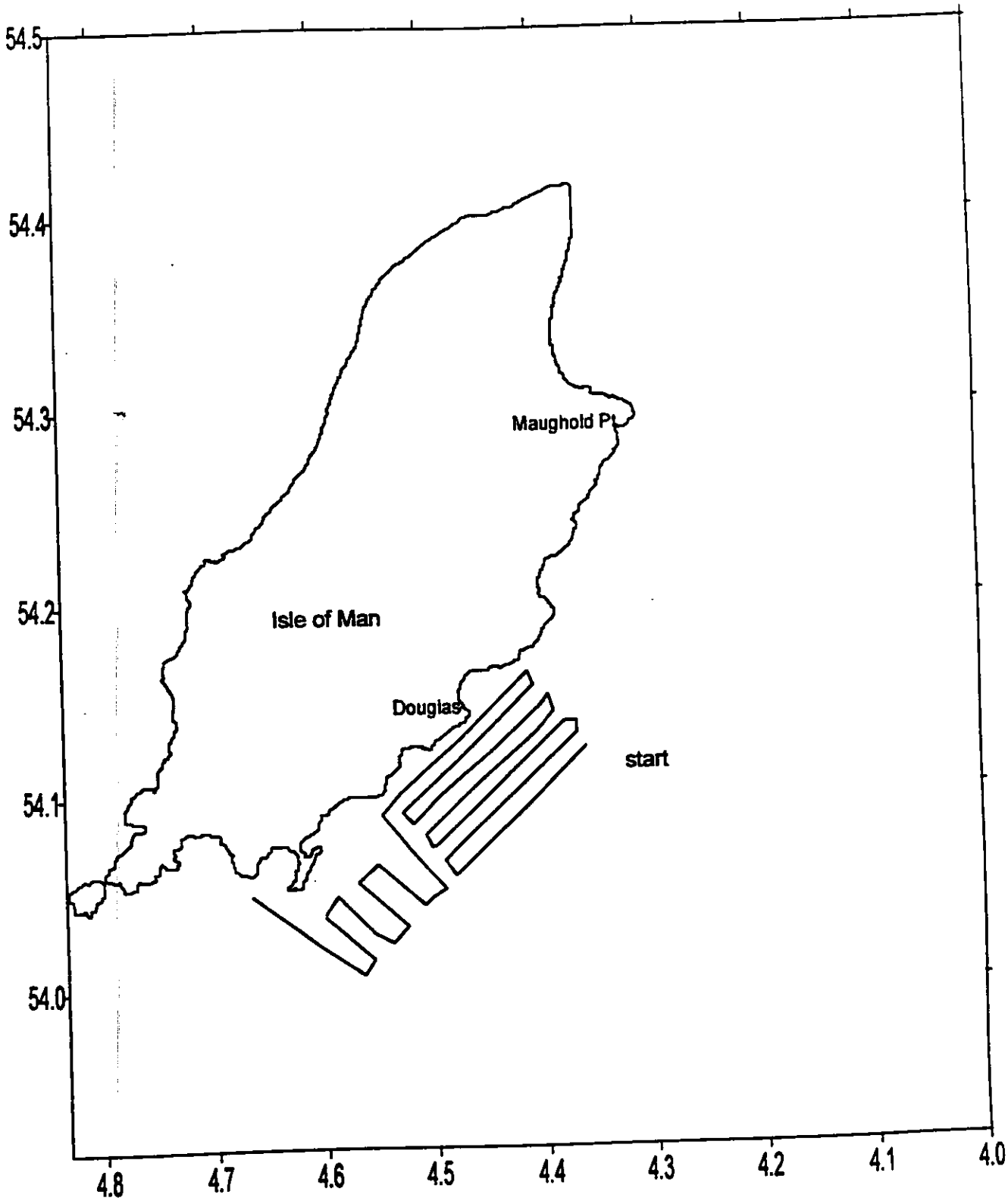

Fig. 1b. Transects surveyed acoustically on the Douglas Bank spawning grounds for herring.

Table 5 Preliminary indices of abundance of 0-group and 1-group cod, whiting and haddock from cruise LF4098, based on length frequency data only. Data are mean numbers caught per 3 nautical miles towed. Indices from previous autumn surveys covering the eastern and western Irish Sea are also given. Indices for March surveys are given in Table (b).

(a) Autumn surveys

	COD		WHITING		HADDOCK	
SURVEY	0-gp	1-gp	0-gp	1-gp	0-gp	1-gp
1991					175[1]	
1992	0.6	10.8	1454	995	1	8
1993	7.9	5.5	1554	425	45	1
1994	13.3	9.5	2450	686	567	11
1995	7.8	12.1	3199	483	17	102
1996	14.8	4.8	2628	605	1433	12
1997	4.2	13.5	3219	655	164	397
1998	**0.4**	**3.6**	**3641**	**n/a**	**417**	**39**

1. Assuming zero abundance in eastern Irish Sea

lf4098

(b) March surveys

	COD		WHITING		HADDOCK	
SURVEY		1-gp		1-gp		1-gp
1992		23.4		1477		15.3
1993		1.7		667		1.4
1994		13.8		1790		6.4
1995		7.1		1696		248.2
1996		11.3		1478		10.7
1997		5.4		1419		251.0
1998		1.7		1730		39.1

Table 6 EK-500 instrument settings used during cruise LF4098
Also given are revised 38 kHz settings after calibration on 12 October

Transducer	ES38B	ES120-7	ES38B (revised)	
Serial No.	28877	26352	28877	
Frequency	38 kHz	120 kHz	38 kHz	
(1) TRANSCEIVER MENU		(not used in survey)	On-axis calibraion	Lobe
Absorption coefficient	10 dB/km	38 dB/km	10 dB/km	
Pulse length	Medium (1.0 ms)	Medium (0.3 ms)	Medium (1.0 ms)	
Bandwidth	Wide	Wide	Wide	
Max. power	2000 W	1000 W	2000 W	
Angle sensitivity	21.9	21.0	21.9	
2-way beam angle	-20.5 dB	-20.6 dB	-20.5 dB	
Sv transducer gain	26.11 dB	25.60 dB	26.08 dB	
TS transducer gain	26.43 dB	25.80 dB	26.34 dB	26.03 dB
3 dB beamwidth Alongship	7.2 deg	7.1 deg	7.2 deg	7.1 deg
3 dB beamwidth Athwartship	7.1 deg	7.1 deg	7.1 deg	6.6 deg.
Alongship offset	-0.03 deg	0.0 deg		-0.12 deg
Athwartship offset	0.10 deg	0.0 deg		0.08 deg

(2) OTHER SETTINGS	
Operation menu:	Ping rate = 0.6 s (50m,100m, 150m range); 0.8 s (250m range) [25m range not used]
Log menu:	Mode = ping based Ping interval = 1490 (50, 100, 150); 1115 (250m range)
Layer menu:	Super-layer = 11 - 250 metres Layers: 8-11, 11-25, 25-50, 50-75, 75-100, 100-150, 150-200, 200-250 metres
Printer / EP-500 settings:	Sv colour min. = -70 dB TS colour min. = -60 dB
TS detection menu: (both frequencies)	TS min. = -60 dB Min. echo length = 0.8 Max. echo length = 1.3 Max. gain compensation = 3.0 dB Max. phase deviation = 4.0 dB
Bottom detection menu:	Minimum level = -45 dB

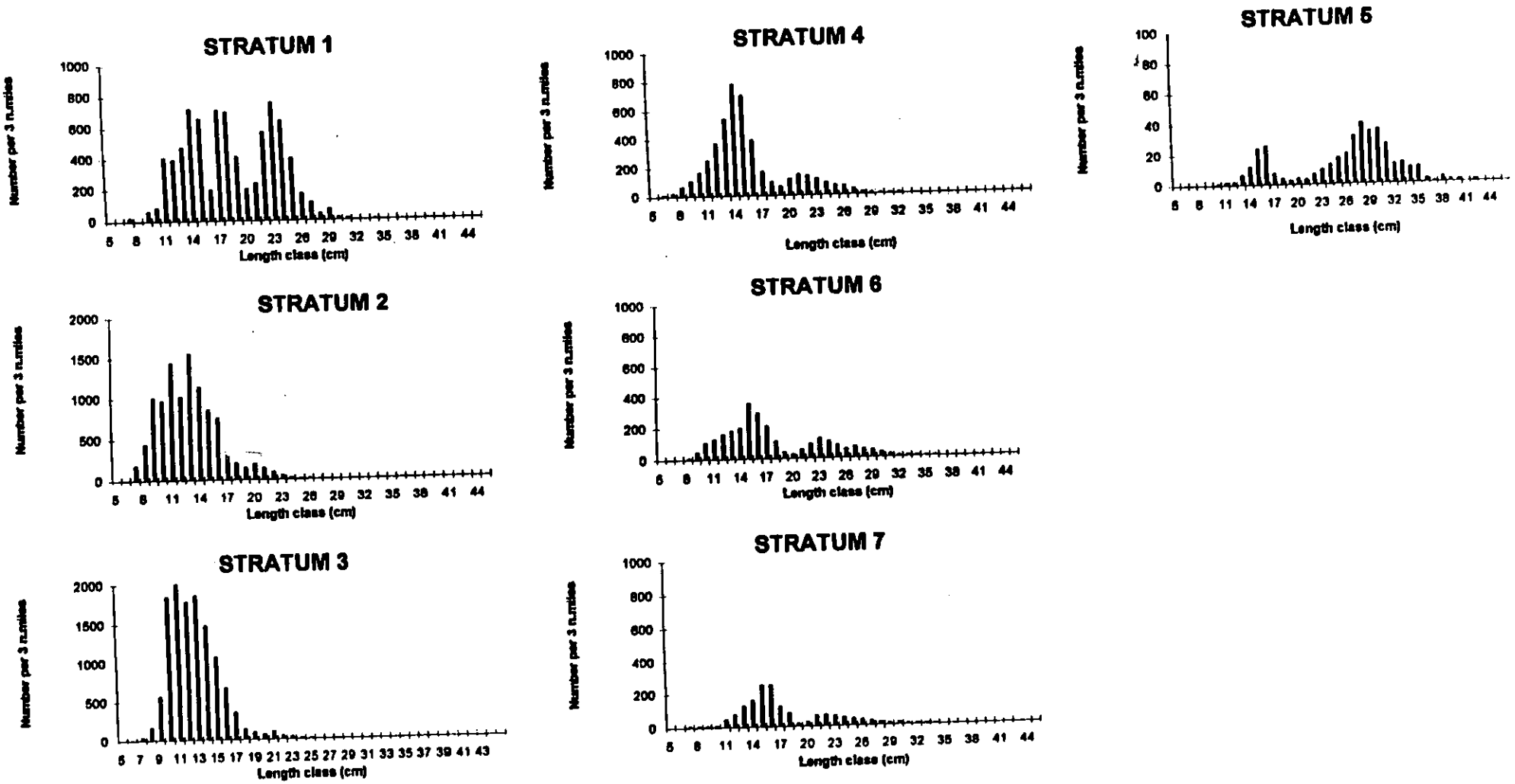

Fig. 2 Length distributions of whiting in strata 1 - 7 during LF4098.
Data are mean numbers caught per 3 nautical miles towed. (Note different scale in strata 2, 3 and 5)

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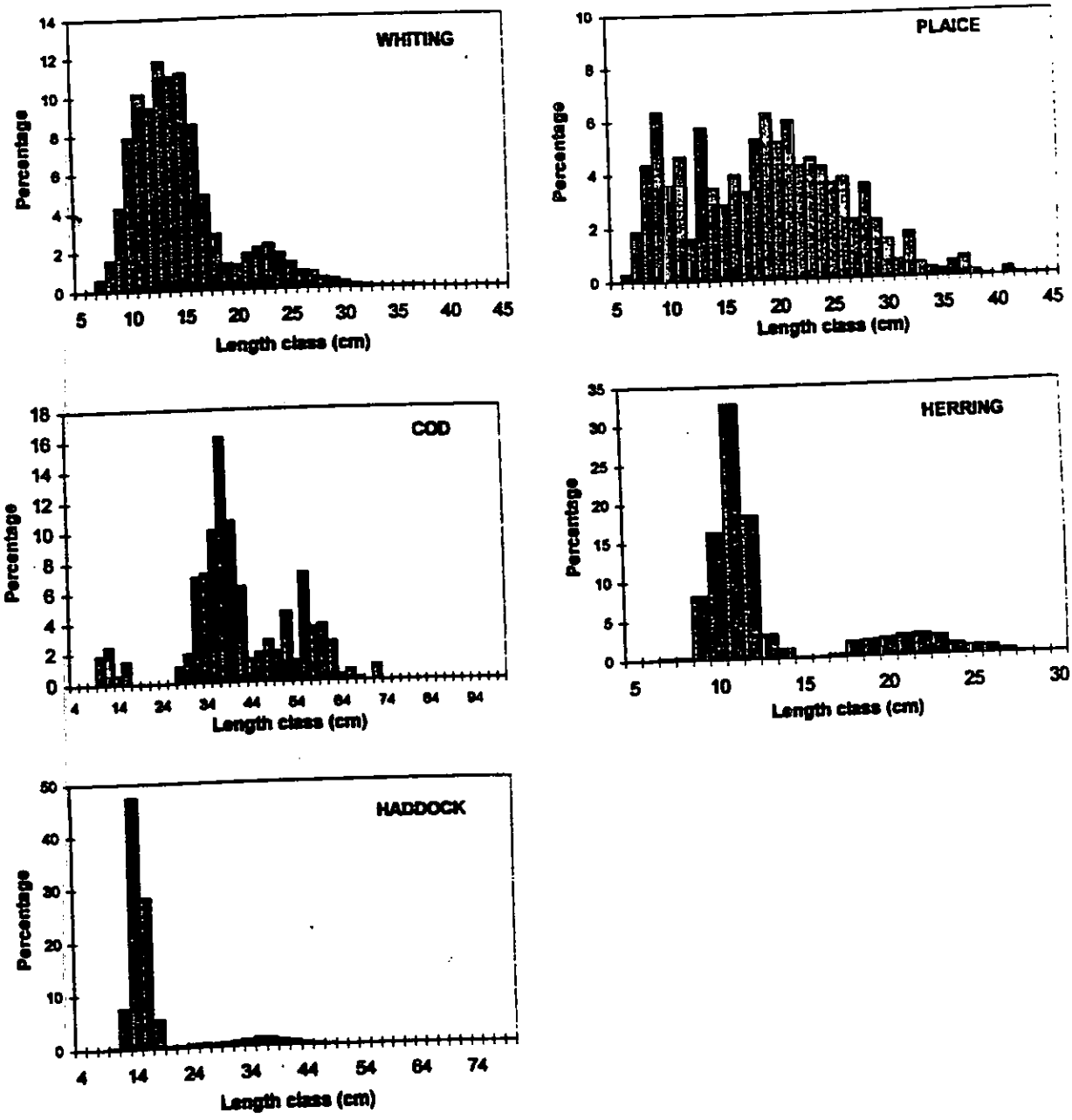

Fig. 3 Average percentage length compositions of whiting, cod, haddock, plaice and herring during cruise LF4098.