

Irish Fisheries Bulletin No. **

**Survey Report: Biological Sampling Survey
22 February – 2 March 2008
North-west of Ireland**

by

Hans Gerritsen

The Marine Institute, Fisheries Science Services,
Rinville, Oranmore, Co. Galway.

Keywords: Sexual maturity; Sex ratio, Maturity, Data Collection Regulation

Table of Contents

Abstract	5
1 Introduction	5
2 Materials and Methods	5
2.1 Scientific Personnel.....	5
2.2 Survey Plan	5
2.2.1 Area of operation	5
2.2.2 Specific operations.....	5
2.3 Equipment and system details and specifications	5
2.4 Protocols used.....	6
2.5 Analysis methods	8
3 Results	8
3.1 Stations Completed.....	8
3.2 Sampling targets	8
4 Discussion and Conclusions	15
4.1 Problems encountered	15
Acknowledgements	15
Appendix 1, Cruise Narrative	15

Abstract

The Biological Sampling Survey took place from 22 February to 2 March in the area to the north-west of Ireland on the Celtic Voyager. Information on growth, maturity and sex ratio (biological data) were collected in order to address the requirements of the Data Collection Regulation 1581/2004.

1 Introduction

The purpose of the survey is to address the requirements of Module I of the Data Collection Regulation 1581/2004. Information on growth, maturity and sex ratio (biological data) were collected for a range of commercially important species. Up-to-date information on these parameters is essential for a good understanding of the state of the stock and its reproductive potential.

Ovary samples were collected to validate visual maturity staging. Genetic samples of cod were collected for Genome/Atlantic in Halifax, Canada. Samples of plaice were collected for an analysis of fin ray counts at GMIT.

2 Materials and Methods

2.1 Scientific Personnel

Name	Service area/Affiliation	Role
Hans Gerritsen	MI-FSS	Scientist in Charge
John Boyd	MI-IMEP	Scientist
Rob Bunn	MI-FSS	Scientist
Cathy Dignam	MI-FSS	Scientist
Clare Murray	MI-FSS	Scientist
Oli Wragg	MI-FSS	Scientist

2.2 Survey Plan

2.2.1 Area of operation

North-west of Ireland, Ices Divisions VIIb and VIaS

2.2.2 Specific operations

Potential towing positions were selected from previous groundfish surveys and new positions were selected using available multibeam data. The aim was to achieve a good spatial and depth coverage, representative of the survey area. Tows were selected based on these considerations in combination with practical aspects like weather, steaming time etc. Tows were ½ hour in duration and approximately 1.5nm long.

2.3 Equipment and system details and specifications

The fishing gear consisted of a GOV net (V2) with the footrope tied down to one chainlink, no tickler chain. Sweeps were made up by combining two sets of 25m sweeps. One spare net was carried.

Headline height and door spread were monitored using Scanmar sensors and a towed hydrophone

Station, catch, sample, length and otolith information was collected using the Electronic Data Capture system. New tablet PCs replaced the old workstations.

2.4 Protocols used

2.4.1.1 Sorting

Sort catch by species mentioned in Table 1, other species can be discarded without weighing. Flatfish and rays are sorted by sex. If necessary, the fish will be sorted into size categories. All sorted samples are weighed, entered into the deckmaster database and labelled.

2.4.1.2 Biological sampling

Otoliths will be taken from all species in Table 1 except rays, however ray species still require an otolith box number for the database: in this case use the number of the workstation as a "virtual otolith box" number (e.g. if you are working on workstation 4, then enter otolith box number 4 for all rays, continue from the last cell number). For all fish that are flagged for otoliths, the sex and maturity stage will be determined and the round weight will be taken.

The sampling targets for the common species are set per station (not per stratum as previously). The sampling target will be one per cm per station, unless otherwise instructed. For species that are not expected in large numbers, 100% of otoliths will be taken, unless sample sizes are very large.

2.4.1.3 Ovary sampling

Ovary samples will be taken for cod, haddock, whiting, hake, plaice and megrim. The sampling targets are five per stage for maturity stages 1, 4, 5 and 6 and ten per stage for maturity stages 2, 3 and 7. Try to spread out the sampling spatially, so don't take more than 2 ovary samples per maturity stage at each station.

A photo will be taken of each ovary that is sampled. Remove the ovary from the fish, blot dry with some tissue paper, place on the camera stand with a ruler in the picture frame. Also place a label with the ovary sample number within the picture frame. Do not change the settings on the camera (white balance fluorescent; shutter speed 1/60; macro setting; flash off). Record the weight of the ovary on the data sheet.

Ovary samples should be taken from the middle of the ovary with capacity solid displacement pipette as shown in Figure 1 below. These samples will be analysed using whole-mount techniques. A duplicate sample of 100 µl should be taken in all cases by sucking up tissue to the first blue line on the tube using the plunger provided. Removal of samples with the pipette in near spent fish can be difficult and in these cases remove a small sample from the ovary lumen with scalpel and place in the tube noting the exception.

In addition to the pipette samples, a thin slice (<5mm) of the ovary will also be preserved in a histology cassette. These cassettes are pre-printed with labels that match the sample numbers on the data sheet. The following one-letter species codes are used: Cod (C); Haddock (H); Whiting (G); Hake (K); Plaice (P); Megrim (M).

2.4.1.4 Other sampling

- Nephrops samples will be recorded using NEMESIS using standard protocol
- Finclips will be taken from cod for genetic analysis fat Genome/Atlantic in Halifa.
- Samples of plaice will be taken for fin ray count analysis at GMIT

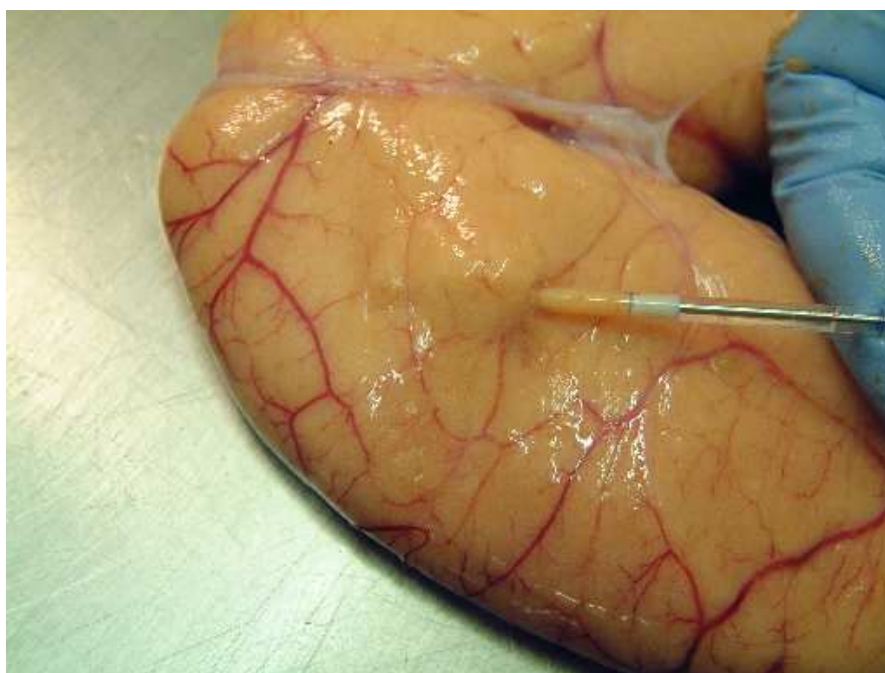


Figure 1. Sampling a cod ovary using a solid displacement pipette. The first and second blue lines on the pipette equate to 100 and 200 μ l of tissue respectively

Table 1. Species to be sorted from the catch

Code	Species	Sex	Otolith numbers	Ovary samples
COD	Cod	U	100-149	Y
HAD	Haddock	U	150-199	Y
WHG	Whiting	U	200-249	Y
POK	Saithe (coalfish)	U	250-299	N
MON	Monkfish (white)	U	300-349	N
WAF	Black bellied monk	U	350-399	N
MEG	Megrim	M	400-449	Y
		F	450-499	N
PLE	Plaice	M	500-549	Y
		F	550-599	N
SOL	Sole	M	600-649	N
		F	650-699	N
HER	Herring	U	700-749	N
WHB	Blue Whiting	U	750-749	N
MAC	Mackerel	U	800-849	N
LEM	Lemon sole	M	850-875	N
		F	876-899	N
HKE	Hake	U	900-949	Y
HOM	Horse Mackerel	U	950-999	N
CUR	Cuckoo Ray	M	stations	N
		F		N
SDR	Spotted Ray	M	See	N
		F	work	N
THR	Thornback Ray	M	stations	N
		F		N

2.5 Analysis methods

All data extraction and plotting was performed in the R environment

3 Results

3.1 Stations Completed

A total of 18 valid tows were completed. Due to the bad weather, the spatial coverage was incomplete and some stations were repeated due to lack of alternatives. Figure 2 shows the station positions

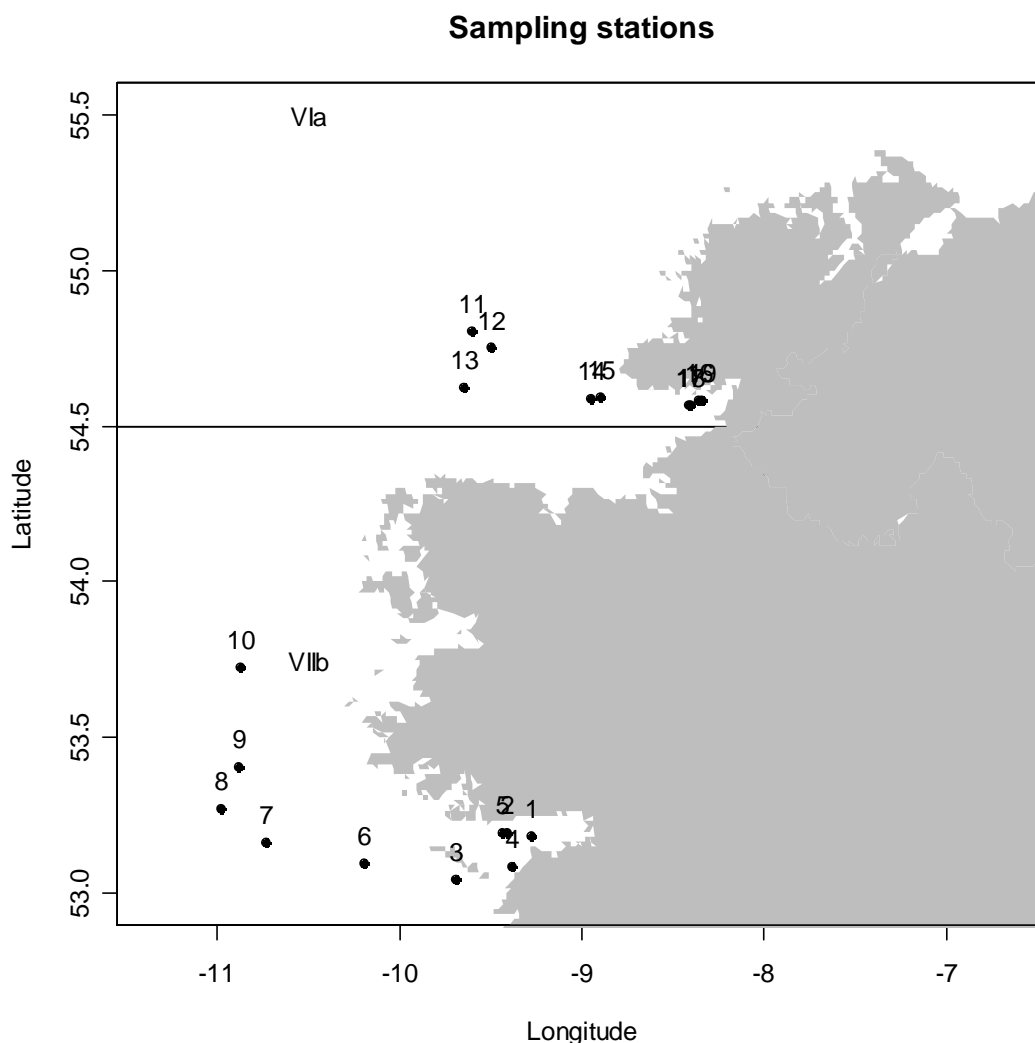


Figure 2. Station positions. The numbers refer to the haul numbers.

3.2 Sampling targets

The distribution of the catches is indicated in Figure 3. Catches to the west of Donegal bay were dominated by very large volumes of medium-sized mackerel. Hauls 11, 12 and 13 had to be reduced to 15-20 minutes to avoid catching more fish than could be brought on board. Haddock were the main target species in the catches to the west of the Aran Islands, while

whiting were most abundant in the catches in Galway Bay. Cod were caught fairly consistently in small numbers at the shallow stations.

The catch numbers, numbers measured, numbers of biological samples and the numbers of ovary samples are given in Table 2. Overall an estimated 139,384 fish of the target species were caught, however 90% of these were mackerel. A total of 5717 fish were measured and 1016 biological samples were taken (length, weight, sex, maturity, age). 231 ovaries were collected for validation of the maturity stages.

The sampling targets for biological samples were one fish per cm length class per haul, or one fish per half-centimetre for herring. Length distributions of the biological samples taken are as well as length distributions of the catches are shown in

Figure 4 and

Figure 5. Ovary samples were taken from selected species for validation of the macroscopically assigned maturity stages (using histology and image analysis techniques). The targets for these samples were five samples each for maturity stages 1, 4, 5 and 6 and ten samples each for maturity stages 2, 3 and 7 (at the latter stages confusion between immature and mature fish can potentially exist). Ovary samples were taken from cod, haddock, whiting, hake, plaice and megrim.

Table 3. shows a breakdown of the maturity stages in the biological samples. These samples were collected on a length-stratified basis and are therefore not random samples from the population; however they give a reasonable reflection of the maturity stages available at the time of sampling. Of the mature fish, cod were either ripe or spent, haddock were mostly maturing or ripe, as were whiting. Mackerel were all immature or resting-spent. Some plaice might have been spent but indistinguishable from immature fish (sampling takes place too late in the season to reliably determine the maturity state of plaice). Megrim and lemon sole were mostly ripe. This suggests that the timing of the survey was good for most of the target species; to distinguish fish that spawn during the current season from those that will not spawn, the gonads of the spawners need to be sufficiently developed to reliably distinguish them from those that will not spawn.

Table 2. Catch numbers, number of fish measured, numbers sampled for biological parameters (weight, sex, maturity and age; rays were not aged) and numbers of ovary samples taken.

SPECIES	COMMON NAME	CAUGHT	MEASURED	SAMPLED	OVARIES
COD	COD	16	16	16	7
CUR	CUCKOO RAY	7	7	7	
HAD	HADDOCK	7820	1461	166	24
HER	HERRING	406	360	95	
HKE	HAKE	200	200	67	7
HOM	HORSE MACKEREL	282	176	34	
LEM	LEMON SOLE	220	220	70	
LIN	LING	1	1	1	
MAC	MACKEREL	125634	831	63	
MEG	MEGRIM	117	117	62	18
MON	ANGLERFISH	4	4	4	
PLE	EUROPEAN PLAICE	165	165	105	25
SDR	SPOTTED RAY	9	9	9	
SOL	SOLE	5	5	5	
THR	THORNBACK RAY	33	33	33	
WAF	BLACK-BELLIED	1	1	1	
WHB	BLUE WHITING	178	178	19	
WHG	WHITING	4286	1933	259	39
TOTAL		139384	5717	1016	120



Figure 3. Catch numbers by station, represented by the size of the circles. Sex ratios are represented by pie charts for species of which the catch was sexed: the black area represents the proportion of females, white for males, unsexed samples are shown as grey. Note that the catches to the west of Donegal bay were reduced to 15-20 minutes to avoid catching more fish than could be lifted onboard.

Irish Fisheries Investigations No. XX

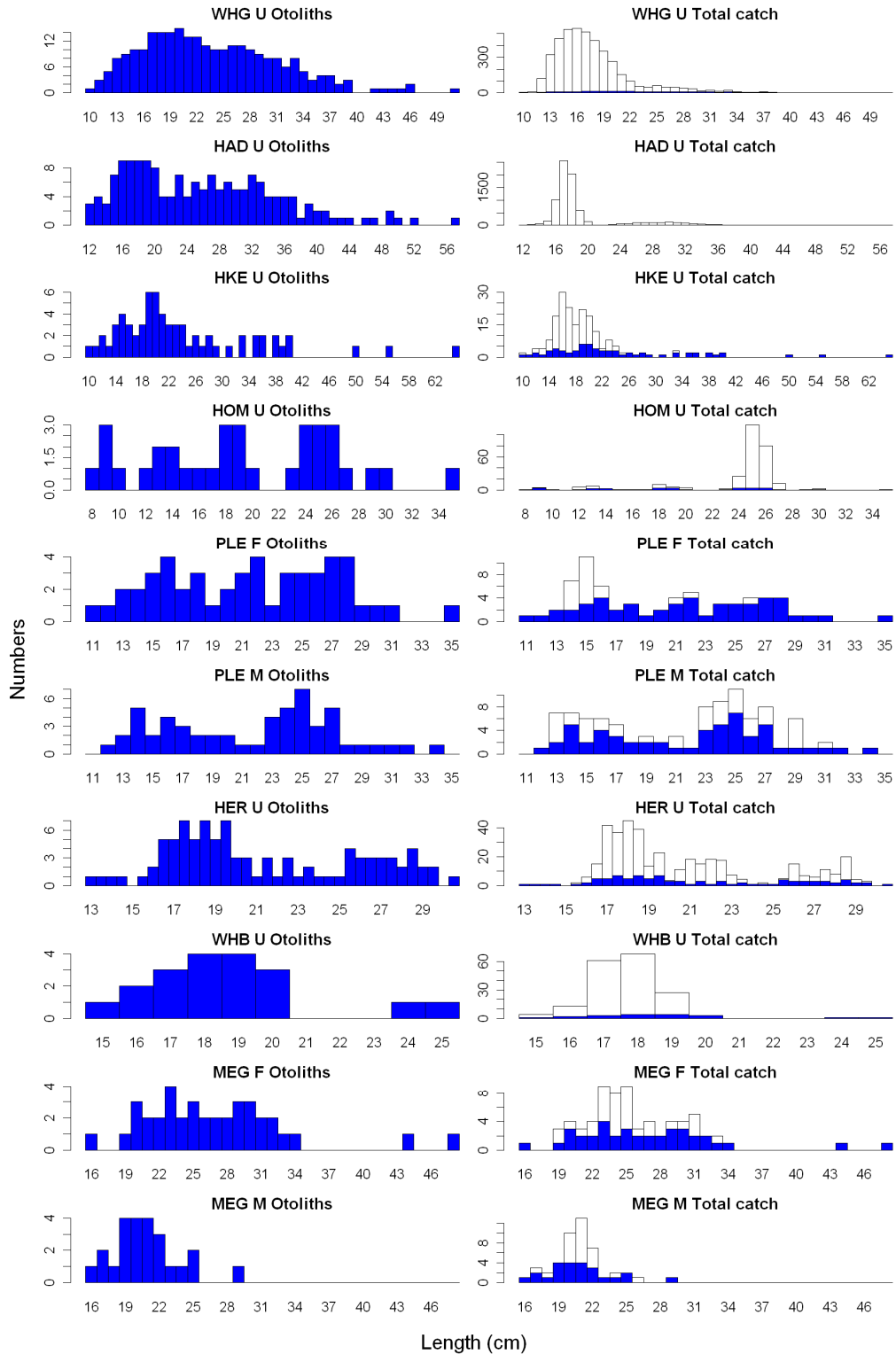


Figure 4. Size frequency of biological samples taken (blue) and total catch (white). The left-hand graphs show only the biological samples, the right-hand graphs show both the total catch and biological samples.

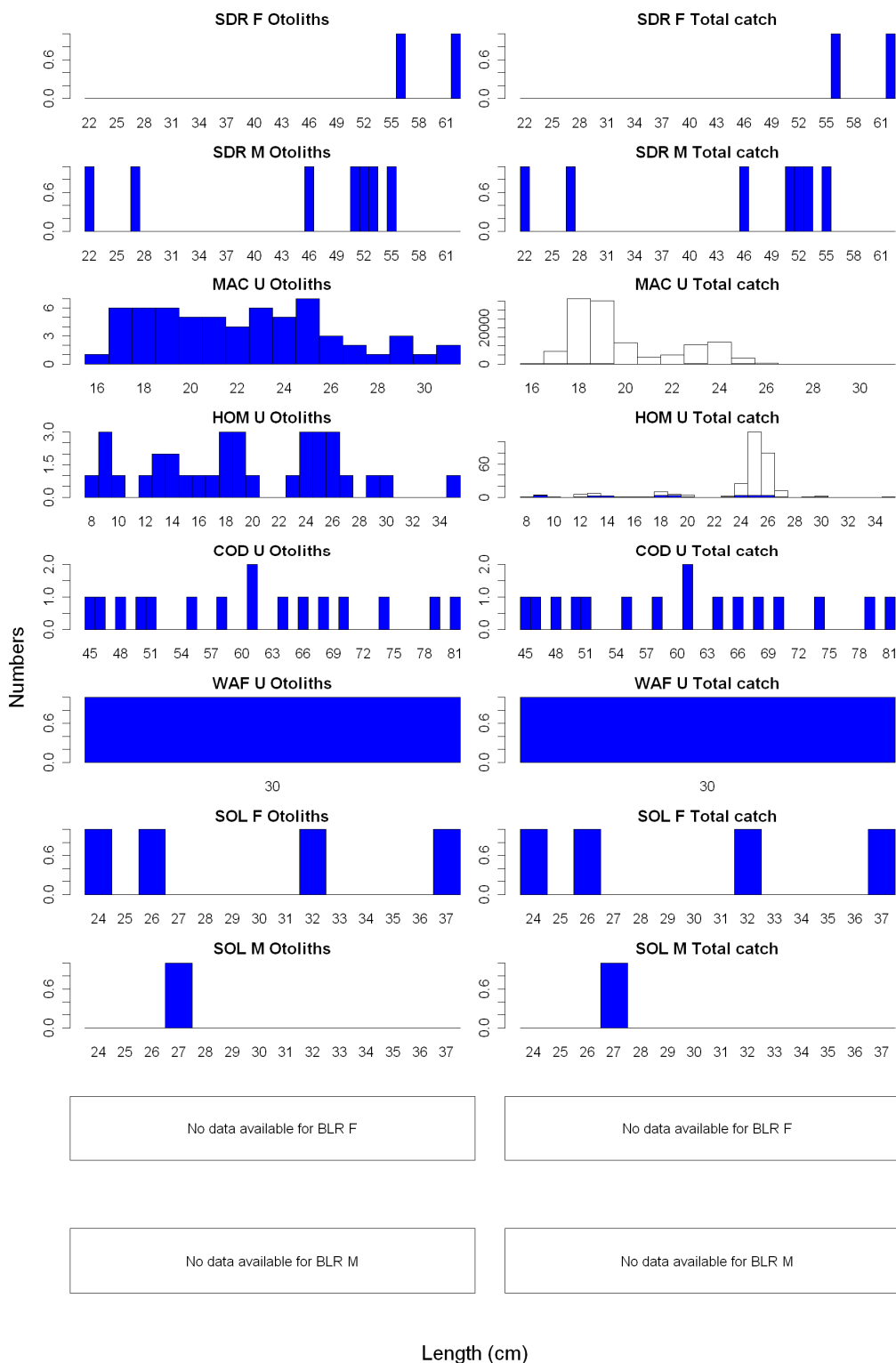


Figure 5. Size frequency of biological samples taken (blue) and total catch (white). The left-hand graphs show only the biological samples, the right-hand graphs show both the total catch and biological samples.

Table 3. Biological samples by sex (Female, Male and Unsexed) and maturity state.

Species	Sex	Immature	Maturing	Ripe	Spent	Total
MON	F	1				1
MON	M	3				3
COD	F			1	6	7
COD	M			9		9
CUR	F	3				3
CUR	M	2	2			4
HAD	F	29	20	32	4	85
HAD	M	29	16	29		74
HAD	U	7				7
HER	F	25	13			43
HER	M	19	7	1		30
HER	U	22				22
HKE	F	23	1			24
HKE	M	23	9	5		37
HKE	U	6				6
HOM	F	8	4			12
HOM	M	6	4			10
HOM	U	12				12
LEM	F	2	10	26		39
LEM	M	2	4	25		31
LIN	F			1		1
MAC	F	31				31
MAC	M	30				30
MAC	U	2				2
MEG	F	8	3	25	1	38
MEG	M	5	7	11		24
PLE	F	27	2	4	17	50
PLE	M	15	8	29	3	55
SDR	F		2			2
SDR	M	3	4			7
SOL	F	1	2		1	4
SOL	M	1				1
THR	F	20	2			22
THR	M	7	4			11
WAF	F	1				1
WHB	F	10		2		12
WHB	M	2		3		5
WHB	U	2				2
WHG	F	56	46	46		148
WHG	M	27	29	52	2	110
WHG	U					1

4 Discussion and Conclusions

4.1 Problems encountered

Five days were lost due to bad weather. Four days were spent fishing. A disproportionate number of tows were completed in inshore areas and some tow locations were fished repeatedly for lack of suitably sheltered alternatives. Three tows west of Donegal Bay contained very large catches of mackerel and had to be reduced to 15-20 minutes to avoid catching more fish than could be lifted onboard. A blow-out panel was suggested to limit the size of this type of catches.

On one haul there was a large tear in the codend which took around 3 hours to repair. During this same haul the starboard door had fallen over. Otherwise, gear damage was minimal, although the sweeps are worn out and need replacement next year.

Acknowledgements

Many thanks to Denis Rowan and the rest of the crew of the Celtic Voyager, the scientific staff and all others involved in this survey.

Appendix 1, Cruise Narrative

The weather was particularly bad during the period of the survey. A series of deep Atlantic depressions passed to the north of Ireland, resulting in frequent gale and storm force winds in the survey area.

22 Feb	Mobilised in Galway, departure delayed due to bad weather
23 Feb	Remained in Galway
24 Feb	Departed Galway 05:30. Completed 5 valid stations in Galway bay and near the Aran Islands, returned to Galway due to deteriorating weather
25 Feb	Remained in Galway
26 Feb	Departed Galway 20:00
27 Feb	Completed 5 valid stations to the west of the Aran Islands
28 Feb	Completed 4 valid hauls and one invalid haul to the west of Donegal Bay. Large catches of mackerel, Docked in Killybegs in the evening
29 Feb	Remained in Killybegs
1 Mar	Remained in Killybegs
2 Mar	Departed Killibegs 10:00, completed 4 stations behind St John's point, returned to Killibegs in the evening
3 Mar	Demobilised