

FSS Survey Series No. 2007/03

**Mackerel Egg survey, March 6th – 26th,
2007**

by

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Abstract

Every three years the International Council for the Exploration of the Sea (ICES) coordinates a series of mackerel and horse mackerel egg surveys covering the eastern Atlantic from Gibraltar to the north coast of Scotland between January and July. The aim of this survey programme is to assess the northeastern Atlantic mackerel and horse mackerel stock. The Marine Institute participates in this programme and covers stations in the Celtic Sea. Plankton samples were collected at 112 stations, and the eggs they contained were preserved in 4% buffered formaldehyde. Preliminary analysis shows that egg numbers were concentrated close to the shelf edge, around the 200m contour line. Eleven fishing hauls were made to collect mackerel and horse mackerel samples for fecundity analysis. Samples were collected to ensure maximum temporal and geographical spread. CTD's were also carried out for the Oceanography section of the Marine Institute.

1 Introduction

Every three years the International Council for the Exploration of the Sea (ICES) coordinates a series of mackerel, *Scomber scombrus*, and horse mackerel, *Trachurus trachurus*, egg surveys covering the eastern Atlantic from Gibraltar to the north coast of Scotland between January and July. The aim of this survey programme is to estimate the spawning stock biomass of the northeastern Atlantic mackerel and horse mackerel stock. The Marine Institute participates in this programme and in this survey covered stations in the Celtic Sea.

This was the first of nine surveys covering the Celtic Sea, west of Ireland and west of Scotland, in the coming months. Five further surveys will target the Bay of Biscay and the Cantabrian Sea. This reflects the spawning area of both mackerel and horse mackerel. Preliminary results from onboard sample analysis of egg numbers are presented, but full laboratory analysis will be carried out in the coming months. The data will be submitted to the Working Group on Mackerel and Horse Mackerel Egg Surveys, WGMEGS, in March 2008. Preliminary data will be used by the Working Group on Mackerel, Horse Mackerel, Sardine and Anchovies, WGMHMSA, in September 2007.

2 Materials and Methods

2.1 Scientific Personnel

Name	Service area/Affiliation	Role
Brendan O'Hea	MI - FSS	Scientist-in-charge
Leonie Dransfeld	MI - FSS	Scientist
Shane Shannon	MI - FSS	Scientist
Helen McCormick	MI - FSS	Scientist
Imelda Hehir	MI - FSS	Scientist
Rob Bunn	MI - FSS	Scientist
Sean O' Connor	MI - FSS	Scientist
Orla Hannify	MI - FSS	Scientist
Selene Hoey	MI - FSS	Scientist
Mairead Sullivan	MI - FSS	Scientist
Turloch Smith	MI - FSS	Scientist
Clare Murray	GMIT	Student

2.2 Survey Plan

2.2.1 Area of operation

The survey was carried out in the Celtic Sea and Southwest of Ireland, from 48N to 52.25N, and from 5W to 16W. This covered ICES areas VIIg, VIIh, VIIj and VIIk, (Figure 1). Survey sites were at 0.5 degrees spacing, both latitudinally and longitudinally. The survey was adaptive, and while theoretical eastern and western limits were set, in practice the presence or absence of eggs dictated moving to the next transect. Two consecutive zero samples would lead to a transect change. Survey protocols called for the survey area to be sampled on alternate transects. The intervening transect could be sampled on the return leg.

2.2.2 Specific operations

Plankton Hauls

At each station the GULF VII plankton sampler was towed at four knots on a V-shaped profile. The GULF was deployed over the stern, using a winch with 11mm co-axial cable in an armoured sheath. The water column was sampled to within five metres of the bottom, or a maximum depth of 200m. Each sample lasted 40 minutes. Attached to the sampler was a real-time CTD and flowmeter system, (Pronet), which collected tem-

perature and salinity data, and measured the volume of water filtered during the tow. Once back aboard the cod-end was removed, a second cod-end was attached and the plankton net was washed down. The cod-ends were then brought to the lab, and the plankton sample was washed out. The sample was preserved in 4% buffered formalin. It was examined under a microscope after an hour and any eggs and fish larvae were removed. A second examination took place after 36 hours. A count was kept of mackerel and horse mackerel stage 1 eggs, mackerel and horse mackerel eggs of later stages, and other fish eggs. Note was also taken of the volume of water sampled by the GULF during each haul, as well as the salinity at 20m, and the water temperature at 5m, 20m, 50m, 100m, and deepest temperature. We were also asked to collect samples of Greater Pipefish, *Entelurus aequoreus*, from the plankton hauls.

Fishing Hauls

As part of the survey samples of mature mackerel and horse mackerel were collected at various latitudes. Fishing sites were selected close to the 200m contour line (Figure 2). Hauls were made using a herring pelagic net. Sampling targets were 80 mackerel gonads of stage 3 or greater, and 30 horse mackerel samples, over four weight categories. Four 25µl replicate samples were collected from one gonad of each fish, and stored in pre-weighed tubes containing 1.2ml of 3.6% buffered formalin. The sampling protocols for both species are attached in the appendix.

CTD transects

One CTD transect was carried out west of the Aran Islands, along 53N, using the Sea-bird 911 CTD. It comprised of eight stations, at 0.5 degree intervals, ranging in depth from 50m to 350m, (Figure 2).

Acoustic sampling

The Simrad ER-60 split-beam transducer was run throughout the survey. This provided depth information for the plankton hauls.

2.3 Equipment and system details and specifications

GULF VII plankton sampler

11mm armoured co-axial cable

Pro-net CTD and flow sensor

Pro-monitor CTD and flow sensor

Pelagic Herring net

Seabird 911 CTD

Simrad ER-60

2.4 Protocols used

The protocols for the gonad sampling of the mackerel and horse mackerel are listed in the 2006 WGMEGS report and in the appendix. The gonads were staged using the Walsh scale.

3 Results

Plankton Hauls

A total of 112 hauls were carried out, over eight transects, Table 1. Problems were encountered with the remote control system for the winch which rendered the first two tows invalid. The problem was rectified by operating the winch manually. Mackerel and horse mackerel stage 1 eggs were recorded at 75% of the stations, and were found in large numbers at the stations close to the 200m contour line, (Figure 3). The largest numbers of stage 1 eggs were found on transects 5 and 6, on the return leg, at 983 and 2915 respectively. Total numbers of eggs sorted are also shown (Figure 4). Large numbers of eggs, thought to be Greater Pipefish, *Entelurus aequoroides*, were recorded on the western edges of transects 3 and 4. Analysis and identification of the eggs is currently taking place in the laboratory.

Fish Hauls

A total of 11 hauls were carried out. All the hauls successfully caught mackerel or horse mackerel, bar hauls 7 and 8, which produced only Boarfish, *Capros aper*. It was possible only to fill three of the mackerel weight categories, and only the two smallest horse mackerel classes. However the required geographical spread was completed. In total 80 mackerel and 30 horse mackerel samples were collected. As well as the samples required for maturity, flesh samples were collected from the mackerel for genetic analysis by IMR in Norway, and flesh samples were collected from the horse mackerel for stable isotope analysis by scientists in the Marine Institute. Samples of Greater Pipefish, *Entelurus aequoroides*, were also collected.

CTD transects

All the casts were successful. The data has been transferred to the Oceanographic section of the Marine Institute for analysis.

4 Discussion and Conclusions

The survey was extremely successful. Due to favourable weather conditions it was possible to carry out two extra transects that were not originally on the work programme. This allowed the AZTI survey to start further south, and the German survey to begin further north, than their original plans.

Acknowledgements

Much appreciation is expressed to the skipper and crew of the *Celtic Explorer*. Their many skills kept the survey functioning. Thanks are also expressed to the scientists and students who worked on the survey.

References\Bibliography

ICES, 2006. Report of the working group on mackerel and horse mackerel egg surveys. ICES CM 2006/LRC:09

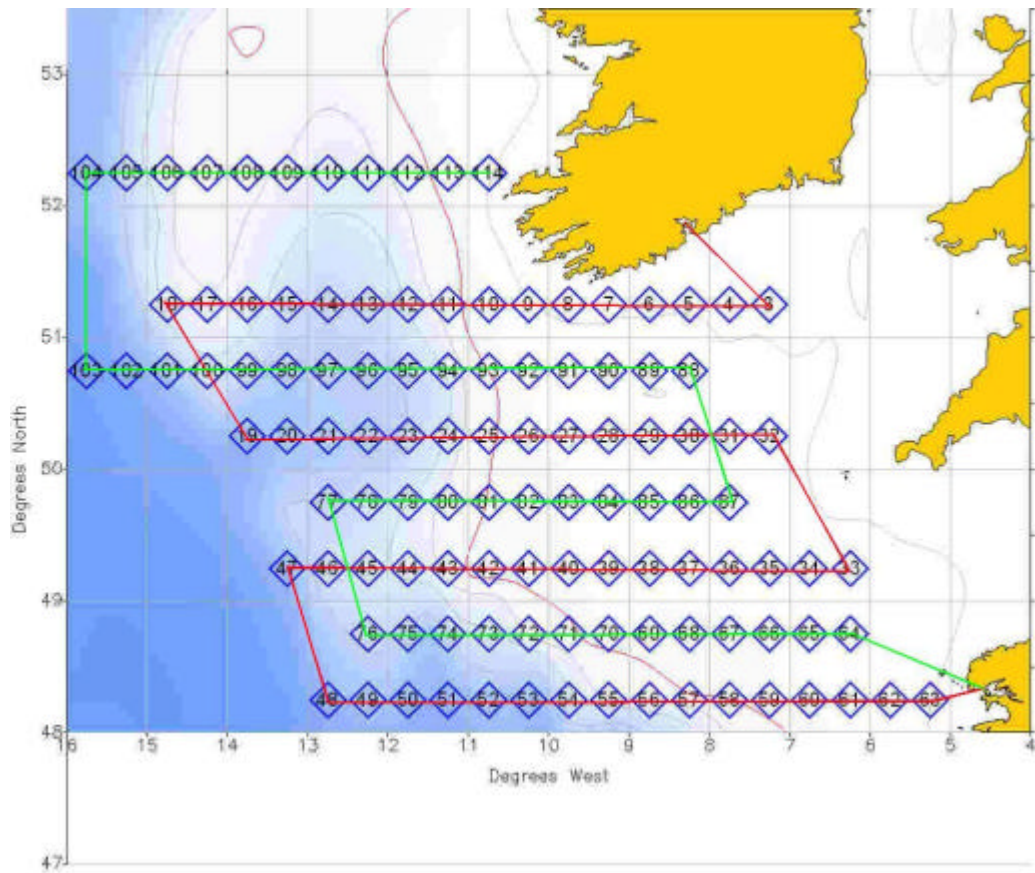


Figure 1 Survey plankton stations. The red track is the outward leg, the green homeward.

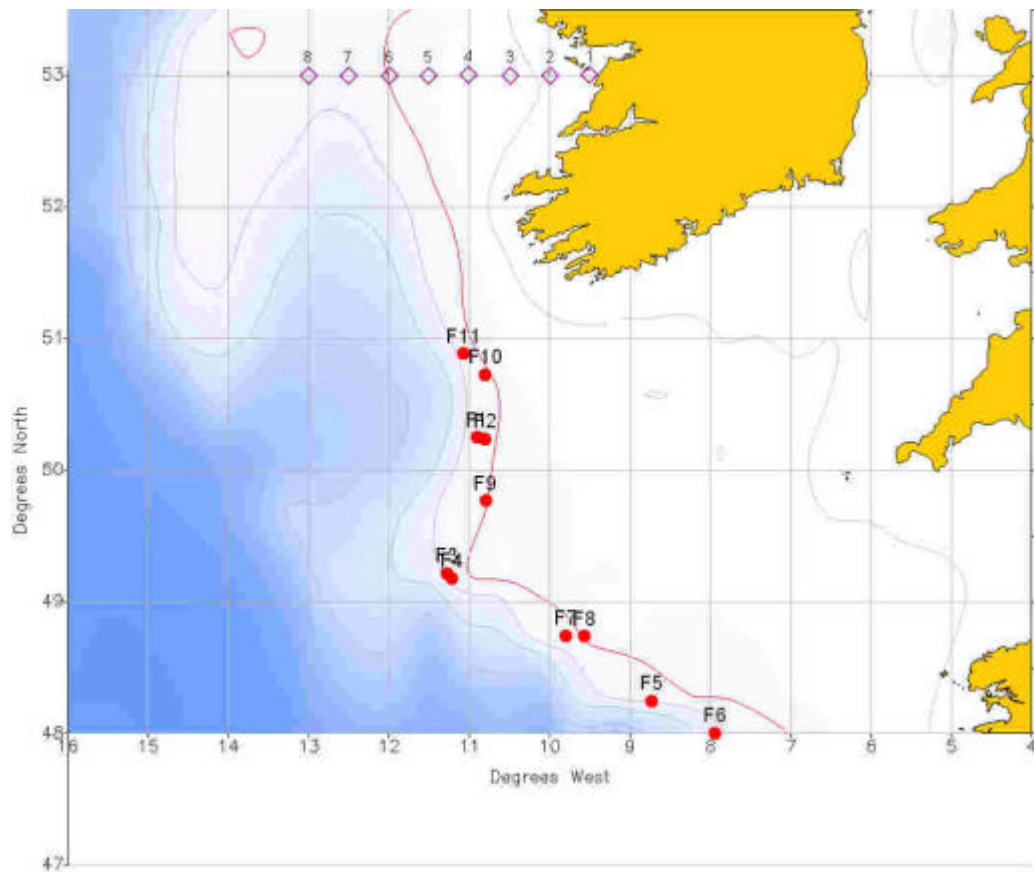


Figure 2 Fishing sites, red dots, and CTD stations, maroon diamonds.

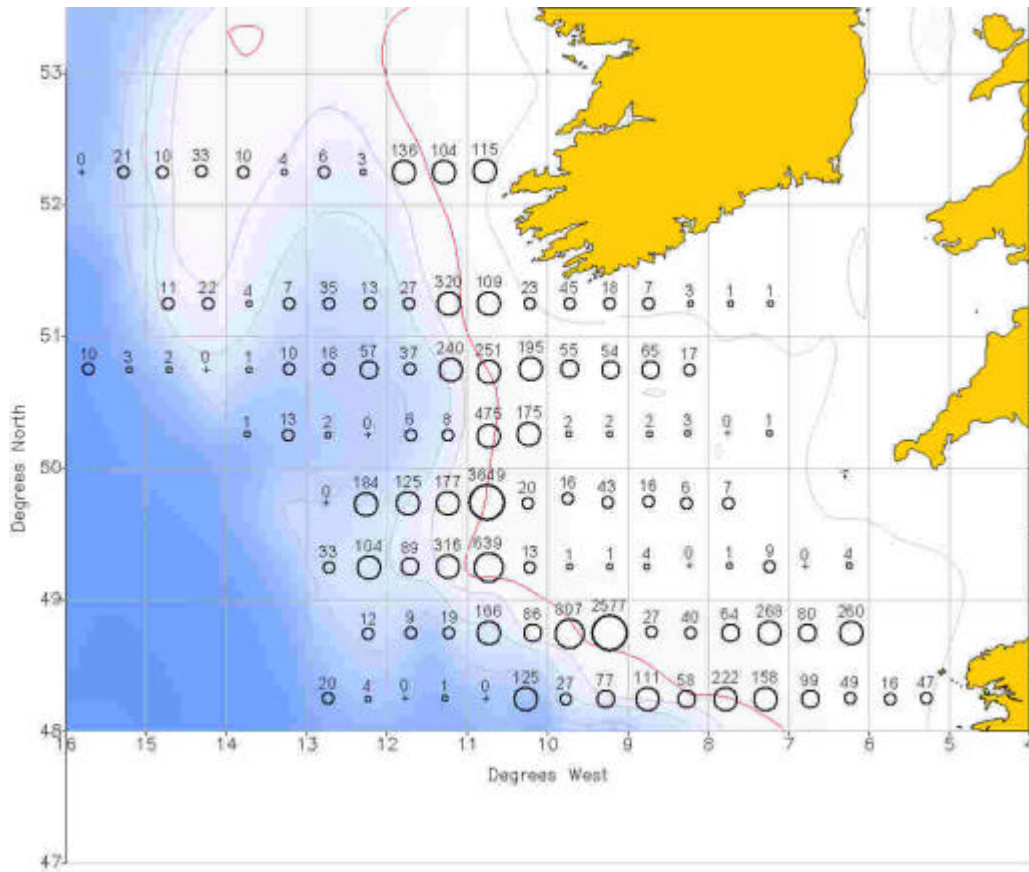


Table 1 Plankton stations and associated preliminary egg numbers.

Haul no	Date	Time Start	Lat deg	Lat Min	Latitude Dec	Long Deg	Long Min	Long Dec	Sample Depth Metres	Prelim Results			
										Stage 1		Stage 2 - 5	
										Mac&Hom		Mac&Hom	Other
0	07/03/07	07:08	51	15.08	51.25133	7	13.92	-7.23200	88	0	0	1	
1	07/03/07	09:36	51	15.01	51.25017	7	43.74	-7.72900	85	1	0	0	
2	07/03/07	11:50	51	15.05	51.25083	8	13.46	-8.22433	90	2	0	1	
3	07/03/07	14:03	51	15.11	51.25183	8	44.4	-8.74000	98	4	0	3	
4	07/03/07	16:24	51	15.02	51.25033	9	13.4	-9.22333	102	12	0	6	
5	07/03/07	19:29	51	14.94	51.24900	9	43.57	-9.72617	100	34	1	10	
6	07/03/07	22:17	51	14.98	51.24967	10	13.04	-10.21733	132	5	4	14	
7	08/03/07	01:25	51	15.14	51.25233	10	44.03	-10.73383	161	34	23	52	
8	08/03/07	04:22	51	15	51.25000	11	13.43	-11.22383	180	75	18	227	
9	08/03/07	06:54	51	15.04	51.25067	11	43.32	-11.72200	184	10	0	17	
10	08/03/07	09:19	51	15.03	51.25050	12	12.97	-12.21617	193	1	0	12	
11	08/03/07	12:01	51	15.01	51.25017	12	43.12	-12.71867	201	0	1	34	
12	08/03/07	15:01	51	15	51.25000	13	13.15	-13.21917	204	1	0	6	
13	08/03/07	21:23	51	15.05	51.25083	13	43.25	-13.72083	209	0	2	2	
14	09/03/07	00:48	51	14.99	51.24983	14	13.78	-14.22967	155	0	0	22	
15	09/03/07	04:57	51	15.11	51.25183	14	42.95	-14.71583	201	1	0	10	
16	09/03/07	12:39	50	15.41	50.25683	13	44.28	-13.73800	200	0	0	1	
17	09/03/07	15:17	50	15.04	50.25067	13	13.58	-13.22633	200	1	0	12	
18	09/03/07	18:04	50	15.13	50.25217	12	44.28	-12.73800	196	0	0	2	
19	09/03/07	20:58	50	15.04	50.25067	12	14.01	-12.23350	199	0	0	0	
20	10/03/07	00:14	50	15.23	50.25383	11	42.06	-11.70100	199	0	0	6	
21	10/03/07	03:01	50	15.2	50.25333	11	14.68	-11.24467	202	4	0	4	
22	10/03/07	08:02	50	14.92	50.24867	10	44.03	-10.73383	175	194	210	71	
23	10/03/07	13:03	50	15.38	50.25633	10	13.97	-10.23283	132	43	10	122	
24	10/03/07	15:35	50	15.4	50.25667	9	44.43	-9.74050	120	1	0	1	
25	10/03/07	18:31	50	15.56	50.25933	9	13.7	-9.22833	127	0	0	2	
26	10/03/07	20:54	50	15.59	50.25983	8	44.21	-8.73683	128	1	0	1	
27	10/03/07	23:24	50	16.13	50.26883	8	15.31	-8.25517	123	1	0	2	
28	10/03/07	02:01	50	15.83	50.26383	7	45.53	-7.75883	90	0	0	0	
29	11/03/07	04:33	50	15.93	50.26550	7	14.77	-7.24617	102	1	0	0	
30	11/03/07	13:06	49	15.54	49.25900	6	14.98	-6.24967	110	1	2	1	
31	11/03/07	15:56	49	15.05	49.25083	6	47.59	-6.79317	113	0	0	0	
32	11/03/07	18:35	49	15.09	49.25150	7	14.18	-7.23633	129	3	2	4	
33	11/03/07	21:26	49	15.72	49.26200	7	44.06	-7.73433	129	0	0	1	
34	12/03/07	00:13	49	15.61	49.26017	8	14.33	-8.23883	128	0	0	0	
35	12/03/07	02:53	49	15.4	49.25667	8	45.83	-8.76383		3	0	1	
36	12/03/07	05:14	49	15.23	49.25383	9	13.41	-9.22350	142	1	0	0	
37	12/03/07	07:53	49	15.03	49.25050	9	43.58	-9.72633	145	1	0	0	
38	12/03/07	10:15	49	14.95	49.24917	10	13.31	-10.22183	150	9	1	3	
39	12/03/07	13:02	49	14.93	49.24883	10	44.13	-10.73550	156	431	92	116	
40	12/03/07	15:49	49	15.07	49.25117	11	14.45	-11.24083	196	118	49	149	
41	12/03/07	22:29	49	15.07	49.25117	11	42.77	-11.71283	196	49	11	29	

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5	13/03/07	01:29	49	14.99	49.24983	12	13.62	-12.22700	201	2	8	94
6	13/03/07	04:04	49	14.99	49.24983	12	43.46	-12.72433	202	0	0	33
7	13/03/07	06:46	49	15.02	49.25033	13	13.58	-13.22633	202	0	0	5
8	13/03/07	13:50	48	15.13	48.25217	12	44.1	-12.73500	201	1	1	18
9	13/03/07	17:00	48	14.77	48.24617	12	14.04	-12.23400	201	1	0	3
10	13/03/07	19:45	48	15.37	48.25617	11	46.69	-11.77817	200	0	0	0
11	13/03/07	22:30	48	15.15	48.25250	11	17.02	-11.28367	200	1	0	0
12	14/03/07	01:23	48	15.01	48.25017	10	46.08	-10.76800	200	0	0	0
13	14/03/07	04:10	48	15.06	48.25100	10	16.06	-10.26767	201	0	0	125
14	14/03/07	06:32	48	14.94	48.24900	9	46.48	-9.77467	201	0	24	3
15	14/03/07	08:57	48	14.99	48.24983	9	16.88	-9.28133	196	26	32	19
16	14/03/07	11:32	48	14.87	48.24783	8	45.62	-8.76033	183	67	26	18
17	14/03/07	16:18	48	15.06	48.25100	8	16.43	-8.27383	194	22	27	9
18	14/03/07	21:42	48	15.03	48.25050	7	46.9	-7.78167	181	145	42	35
19	15/03/07	00:13	48	14.95	48.24917	7	17.56	-7.29267	163	64	36	58
20	15/03/07	03:22	48	14.93	48.24883	6	44.08	-6.73467	156	28	11	60
21	15/03/07	06:24	48	15.23	48.25383	6	14.02	-6.23367	134	8	2	39
22	15/03/07	09:07	48	14.96	48.24933	5	44.49	-5.74150	118	10	0	6
23	15/03/07	11:22	48	15.22	48.25367	5	16.96	-5.28267	111	6	1	40
24	17/03/07	00:10	48	45.05	48.75083	6	13.42	-6.22367	128	30	134	96
25	17/03/07	02:54	48	44.98	48.74967	6	46.23	-6.77050	130	27	11	42
26	17/03/07	05:02	48	44.96	48.74933	7	14.08	-7.23467	144	105	58	105
27	17/03/07	07:24	48	44.97	48.74950	7	43.82	-7.73033	152	29	13	22
28	17/03/07	09:37	48	45.06	48.75100	8	13.24	-8.22067	152	15	2	23
29	17/03/07	11:41	48	45.27	48.75450	8	42.25	-8.70417	163	17	5	5
30	17/03/07	14:24	48	45.13	48.75217	9	14.01	-9.23350	155	983	1542	52
31	17/03/07	17:15	48	44.69	48.74483	9	43.72	-9.72867	181	453	227	127
32	18/03/07	00:01	48	45.2	48.75333	10	11.48	-10.19133	155	53	23	10
33	18/03/07	03:19	48	45.01	48.75017	10	44.09	-10.73483	200	71	93	2
34	18/03/07	06:28	48	44.95	48.74917	11	13.64	-11.22733	203	8	8	3
35	18/03/07	10:07	48	45.13	48.75217	11	42.31	-11.70517	200	1	2	6
36	18/03/07	14:15	48	44.44	48.74067	12	13.99	-12.23317	200	0	0	12
37	19/03/07	20:05	49	43.94	49.73233	12	45.11	-12.75183	200	0	0	0
38	19/03/07	23:58	49	43.78	49.72967	12	15.31	-12.25517	200	155	13	16
39	20/03/07	03:23	49	44.23	49.73717	11	44.28	-11.73800	200	47	19	59
40	20/03/07	06:40	49	44.14	49.73567	11	14.41	-11.24017	201	63	33	81
41	20/03/07	09:37	49	44.54	49.74233	10	45.27	-10.75450	151	2915	612	122
42	20/03/07	15:58	49	44.04	49.73400	10	14.88	-10.24800	142	10	0	10
43	20/03/07	18:32	49	46.23	49.77050	9	44.88	-9.74800	142	8	2	6
44	20/03/07	21:08	49	44.39	49.73983	9	15.43	-9.25717	125	19	4	20
45	21/03/07	00:03	49	44.99	49.74983	8	44.76	-8.74600	85	12	2	2
46	21/03/07	02:34	49	44.15	49.73583	8	16.43	-8.27383	128	6	0	0
47	21/03/07	05:09	49	44.16	49.73600	7	45.21	-7.75350	127	3	4	0
48	21/03/07	12:20	50	44.76	50.74600	8	14.17	-8.23617	108	6	9	2
49	21/03/07	14:31	50	45.09	50.75150	8	42.89	-8.71483	88	9	25	31
50	21/03/07	16:58	50	45.05	50.75083	9	13.1	-9.21833	124	29	20	5
51	21/03/07	19:39	50	45.25	50.75417	9	43.56	-9.72600	118	18	13	24
52	21/03/07	21:51	50	45.2	50.75333	10	12.48	-10.20800	127	49	57	89
53	22/03/07	00:56	50	43.79	50.72983	10	43.64	-10.72733	159	126	80	45
54	22/03/07	03:20	50	45.01	50.75017	11	12.5	-11.20833	203	153	77	10

'5	22/03/07	10:32	50	45.2	50.75333	11	42.91	-11.71517	203	1	35	1
'6	22/03/07	13:18	50	44.91	50.74850	12	13.1	-12.21833	203	0	56	1
'7	22/03/07	15:50	50	45.25	50.75417	12	43.08	-12.71800	203	0	18	0
'8	22/03/07	18:33	50	45.22	50.75367	13	13.07	-13.21783	200	7	1	2
'9	22/03/07	21:05	50	45.1	50.75167	13	43.09	-13.71817	202	1	0	0
00	22/03/07	23:33	50	45.1	50.75167	14	14.91	-14.24850	202	0	0	0
01	23/03/07	02:03	50	44.92	50.74867	14	42.59	-14.70983	201	0	1	1
02	23/03/07	04:36	50	45	50.75000	15	12.72	-15.21200	203	0	0	3
03	23/03/07	07:12	50	45.16	50.75267	15	42.67	-15.71117	203	0	0	10
04	23/03/07	16:42	52	14.97	52.24950	15	47.74	-15.79567	201	0	0	0
05	23/03/07	18:59	52	14.98	52.24967	15	17.03	-15.28383	200	0	0	21
06	23/03/07	21:18	52	14.9	52.24833	14	47.5	-14.79167	201	2	0	8
07	23/03/07	23:34	52	15.34	52.25567	14	18.46	-14.30767	203	7	10	16
08	24/03/07	02:04	52	14.93	52.24883	13	46.92	-13.78200	202	0	0	10
09	24/03/07	04:25	52	15.02	52.25033	13	16.62	-13.27700	201	1	0	3
10	24/03/07	06:44	52	14.94	52.24900	12	47.2	-12.78667	202	3	3	0
11	24/03/07	09:02	52	14.99	52.24983	12	17.69	-12.29483	203	1	2	0
12	24/03/07	12:22	52	14.88	52.24800	11	47.2	-11.78667	203	69	41	26
13	24/03/07	14:43	52	15.08	52.25133	11	17.11	-11.28517	136	34	29	41
14	24/03/07	16:56	52	15.28	52.25467	10	46.84	-10.78067	114	35	15	65

Appendices

Survey Narrative

Date	Events
Tuesday, March 6th:	Mobilisation took place in Verholme dockyards, Cobh. A delay was experienced getting spare microscope bulbs down from Dublin. At 20.00 a scientific briefing was held to run through the various methodologies to be carried out during the survey. A watch plan was drawn up. After some discussion it was decided to start the survey one rectangle to the east. We sailed at 23.00.
Wednesday, March 7th:	Arrived at first Station at 05.00. The GULF VII was deployed. After a couple of minutes the winch started shuddering. Deployment was stopped. After 30 minutes the GULF was lifted to the surface and taken aboard. After some work on the winch controls the GULF was deployed again, with similar results. Once again the sampling was stopped and the instrument taken aboard. It was found that the problem was with the remote control unit, and that the winch could be operated manually. At 07.30 the GULF was deployed for a third time, and the haul was carried out satisfactorily, to a depth of 88m. Stations 1 & 2 were invalid. Seven hauls were carried out during the day.
Thursday, March 8th:	Proceeded westwards on the 51° 15 transect. The bridge officers had been asked to watch the screens for marks of fish, particularly around the 200m contour, but none were recorded. In the afternoon the Pronet system kept cutting out, so we tested the communication through the cable and found a break in the termination. The termination was rewired but the DOS system was still crashing. Changed over to the Pronet Windows version at Station 16. Details on termination problem see separate termination report. Seven stations were carried out today.
Friday, March 9th:	Transect 1 finished with Station 18. Turned south at 05.30. We arrived at the new transect at 12.30, and recommenced with the profiles. Six stations were carried out.
Saturday, March 10th:	While steaming towards the 200m contour line officers on the bridge started marking fish. It was decided to break off the transect and commence trawling. Fishing started at 50° 15 N, 10° 54 W, using a herring pelagic trawl. The tow lasted 45 minutes and produced a small bag of mackerel and horse mackerel. These were taken into the lab for analysis. We switched back to the GULF and completed Station 25. After looking at the fish sample it was decided to carry out a second tow. This was done after Station 25, with the ship turning around and steaming westwards to 50° 14 N, 10° 48 W. The trawl was fished for 60 minutes and produced a large bag of mackerel. At 11.00 the ship turned back onto transect 2 and recommenced the survey. Eight stations were carried out.
Sunday, March 11th:	Carried out Stations 31 and 32. This finished transect 2, so we turned southeast at 05.00. We arrived and started transect 3 at 13:06. Six stations carried out.
Monday, March 12th:	Continued along transect 3. Started fishing at 49° 13 N, 11° 16W. The tow lasted 30 minutes. The haul comprised mainly of blue whiting, with a small amount of mackerel and one horse mackerel.

	Seven of the mackerel were sampled. A second haul was carried out at 49° 11 N, 11° 13 W, for 45 minutes. This haul produced a large bag of mackerel and horse mackerel. We resumed the survey track at 20.30. Eight stations were carried out.
Tuesday, March 13th:	Completed stations 45, 46 and 47 to finish transect 3. Turned southeast and arrived at transect four at 13.50. Seven stations were carried out.
Wednesday, March 14th:	Continued along transect 4. As soon as we reached the 200m contour we started looking for fish. A haul was made at 48° 15 N, 08° 44W for 45 minutes. The haul consisted mainly of Boarfish, with a small number of mackerel. We decided to wait until dusk to fish again, so we went back on transect. A second haul was made at 48° 00N, 07° 56W, again for 45 minutes. This haul comprised mainly horse mackerel, with some mackerel mixed in. We went back onto transect at 21.42. Seven stations were carried out.
Thursday, March 15th:	The last seven stations of transect 4 were carried out, and the transect was completed at 11.55. In the afternoon calibration tests were carried out on the GULF flowmeter. We then steamed to Brest for the crew change.
Friday, March 16th:	The replacement crew arrived last night. The ship left Brest at 17.00. At 17.20 a scientific briefing was held with the new crew to discuss the rota, shifts, and lab methodologies. After discussions with the skipper at the evening briefing it was decided to drop the first two stations on transect 5, staying out of the English Channel separation zone. The remote control function for the winch was tested after fitting the new part. The GULF was towed, without the codend, and the cable was paid in and out. The winch worked properly.
Saturday, March 17th:	We arrived at the first station at 00.10. We recommenced with station 64. As we reached the 200m contour line it was decided to fish. A haul was made at 48° 45 N, 09° 47 W. The net was hauled after 60 minutes but only contained a small bag of boarfish. As the net was being hauled a number of fish marks were seen so we decided to shoot again. The second haul was carried out at 48° 45 N, 09° 34 W, for 45 minutes. Again we only caught boarfish. As the seas were quite rough it was decided to abandon fishing, and return to the transect. Eight stations were carried out for the day. The largest number of eggs encountered on the survey so far was collected in sample 70.
Sunday, March 18th:	As weather conditions continue to worsen the ship speed has slowed, and time between transects has increased. High numbers of eggs continue to be collected. The transect was completed at 14.47, and the ship steamed northwest. Five stations were carried out.
Monday, March 19th:	Due to weather conditions steaming to transect 6 took 30 hours. We arrived at station 77 at 20.05. Two stations were carried out
Tuesday, March 20th:	Continued along transect 6. We were still experiencing large swells, particularly during squalls. We fished after station 81, at 49° 46 N, 10° 48 W for 90 minutes. A large bag of mackerel was collected and sampled. We went back on transect at 15.58. Six stations were carried out for the day. Again a large number of eggs were collected close to the 200m contour.
Wednesday, March	Continued along transect 6 until station 87. At this stage we decided to turn north to transect 7. We arrived at station 88 at 12.20. A haul was made at 50° 44 N, 10° 39 W, for 45 minutes. It consisted of mackerel and boarfish. It was decided to continue along the transect for a couple of

21st:	more stations, and return to the 200m contour early in the morning to fish again. Eight stations were carried out for the day.
Thursday, March 22nd:	We returned to the 200m contour and began fishing at 50° 53 N, 11° 04 W. We fished for 90 minutes and collected a mixed bag of mackerel and horse mackerel. This haul provided the final samples we need for fecundity so we returned to the transect. Carried out eight stations for the day.
Friday, March 23rd:	Finished transect 7 with station 103. Turned north to latitude 52° 15 N. Arrived on station at 16.35. Seven stations carried out for the day.
Saturday, March 24th:	Continued along transect 8. All stations were completed at 17.40. As we were finishing the last haul the German research vessel, Walther Herwig III, came past on the way to start their survey off the west coast. Three flowmeter calibrations were carried out at 3.5, 4, and 4.5 knots. We then steamed to 53N to carry out a series of CTD's. We arrived at the first station, 53° 00 N, 10° 00W at 23.00.
Sunday, March 25th:	Continued west along 53N carrying out CTD's. Problems with CTD 5. Rerun as CTD 6.
Monday, March 26th:	Finished last CTD at 04.00, eight carried out in total. Steamed to Galway. Arrived in docks at 11.00. Gear and crew unloaded. Post-cruise meeting at 13.30.

Horse mackerel sampling procedure at sea

Before the cruise:

Fill the labelled 2,5 ml eppendorf tubes with 1,2 ml of 3,6% buffered (sodium phosphate) formaldehyde (see excel-file : Buffered formaldehyde) and measure the weight ($\pm 0,0001$ g).

During the cruise:

Measure the weight of the whole catch and select a subsample of 100 fish and measure the total weight of the subsample.

Measure total length, weight, maturity (Walsh scale) and sex of each fish in the subsample.

Select females in maturity stages 3-6 (see table 3.1.2 WGMEGS 2006) from the subsample for fecundity analysis. Be sure to divide the females equally into the 4 weight categories: < 150g, 151-250g, 251-350g and >351g.

Measure or take:

- Total length
- Total weight
- Maturity
- Otoliths for age reading
- Weight of gut, ovary and liver
- Stomach fullness (1: empty, 2: filled, 3: full and 4: bursting)

Ovary sampling:

- From the ovary take 4 * 25 μ l samples with a pipette and immediately put each sample in individual coded eppendorf tubes.
- Make sure that all the ovary samples are covered with formaldehyde.
- Freeze and label the gutted fish separately in plastic bags for lipid measurements. Be sure to use the same code for the eppendorf tubes and frozen fish for each individual

After the cruise :

Measure the weight of the eppendorf tubes containing the sample.

Send all the frozen fish to IMARES, see address in table 1.

Send the eppendorf samples for analysis to the different institutes referred to in table 1.

Colour code	Country	Institute and address	Responsible person
Blue	Norway	IMR, Nordnesgaten 50,PB 1870, 5817 Bergen-Nordnes, Norway	Merete Fonn
Pink	Ireland	MI, Rinville, Oranmore, Co. Galway, Ireland	Brendan O’Hea
Green	Netherlands	IMARES, Haringkade 1, 1976 cp Ymuiden, Netherlands	Cindy van Damme
White	Spain	IEO, Cabo Estay-Canido, 36280 - VIGO (Pontevedra) Spain	Jose Ramon Perez

Fecundity whole mount analysis procedure for horse mackerel

Transfer the unstained sample to a tray and try to separate the oocytes.

Under the microscope check for spawning markers, if there are hydrated oocytes, atretic hydrated oocytes or ≥ 5 POFs, the sample should not be analysed for fecundity.

Note the present or absence of atretic oocytes.

Count all the oocytes $>175\mu\text{m}$ in the sample.

Distribute the sample randomly in the tray and measure the diameter for size distribution for all oocytes $>175\mu\text{m}$ in 1/3 of the sample.

Formula to calculate the total fecundity:

Number of oocytes / weight of the pipette sample * ovary weight

Formula to calculate the potential fecundity:

Total fecundity / total fish weight

Mackerel sampling procedure at sea

Before the cruise :

Fill the labelled 2,5 ml eppendorf tubes with 1,2 ml of 3,6% buffered (sodium phosphate) formaldehyde (see excel-file : Buffered formaldehyde) and measure the weight ($\pm 0,0001$ g).

During the cruise :

Measure the weight of the whole catch and select a subsample of 100 fish and measure the total weight of the subsample.

Measure total length, weight, maturity (Walsh scale) and sex of each fish in the subsample.

Select females in maturity stages 3-6 (see table 3.1.2 WGMEGS 2006) from the subsample of 100 for DNA, fecundity and atresia analysis. Be sure to divide the females equally into the 4 weight categories: < 250g, 251-400g, 401-550g and >551g.

Measure or take:

- Total length
- Total weight
- Maturity
- Otoliths for age reading
- Weight of gut, ovary and liver

DNA sampling:

- Cut a tissue sample, (roughly 10x5x5 mm), of the muscle from the thick muscle behind the head. Put each tissue sample in a 1.5 ml eppendorf tube in absolute alcohol.

Ovary sampling:

- From the ovary take 4 * 25 μ l samples with a pipette and immediately put each sample in individual coded eppendorf tubes.
- Make sure that all the ovary samples are covered with formaldehyde.

Atresia sampling:

- Place the other ovary in a bottle filled with 3.6% buffered, (sodium phosphate) formaldehyde.

- Make sure that all the ovary sample is covered with formaldehyde

After the cruise :

Measure the weight of the eppendorf tubes containing the sample.

From the fixed half ovary cut two 5mm thick slices and put them in a labelled cassette. If the ovary is very large you may have to use two cassettes. Separate the cassettes into 4 colour coded bottles filled with 70% ethanol.

Send the cassettes and eppendorf samples for analysis to the different institutes referred to in table 1.

Table 1

Colour code	Country	Institute and address	Responsible person
Blue	Norway	IMR, Nordnesgaten 50,PB 1870, 5817 Bergen-Nordnes, Norway	Merete Fonn
Red	Ireland	MI, Rinville, Oranmore, Co.Galway, Ireland	Brendan O’Hea
Yellow	Scotland	FRS, Marine Laboratory, Victoria Road, Torry, Aberdeen AB9 8DB, Scotland.	Findlay Burns
White Even numbers	Spain	IEO, Cabo Estay-Canido, 36280 - VIGO (Pontevedra) Spain	Jose Ramon Perez
White Uneven numbers	Spain	AZTI, Foundation Herrera Kaia, Portualde z/g 20110, Pasaia, Basque Country, Spain	Maria Santos

Parasites sampling:

Select new fish from the catch to freeze individually in plastic bags. The total number of fish should be 50 for each cruise, see table 2.

Table 2

Area	Sampled by	Period / number of fish				
		1	2	3	4	5
Southern	POR / IPI-					
	MAR	50				
	ESP / IEO	50	50			
Western	ESP / AZTI			50		
	GER / BFA Fi	50				
	IRL / MI					50
	SCO / FRS		50			
	NED / IMARES			50		
	NOR / IMR				50	