CRUISE REPORT CEND-03-08

CENTRE FOR ENVIRONMENT, FISHERIES AND AQUACULTURE SCIENCE

LOWESTOFT LABORATORY, LOWESTOFT, SUFFOLK NR33 OHT

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DURATION: 8-21st February.
LOCATION: Irish Sea (Liverpool Bay, off Dundalk/Dundrum Bay)

AIMS:

1. Cary out simultaneous acoustic and trawl surveys of known cod, haddock and plaice spawning areas to examine whether the different techniques yield a different perception of fish distribution and behavior in the water column.

2. Cary out comparative trawl tows during daylight and darkness to examine whether the different techniques yield a different perception of fish distribution and behavior in the water column.

3. Collect information on the body condition (including weight, and hepatosomatic index), and reproductive status (sex, age, maturity, gonad weight) of cod, haddock and plaice on spawning grounds in the Irish Sea.

4. Collect biopsy samples from the ovaries of female cod and plaice, to determine the reproductive status, egg size and maturity etc. (for MEMFISH and ISEPS projects).

5. Determine whether plaice, haddock and cod in spawning aggregations are consuming food, and if so – what, by examining stomach contents and stomach fullness.

6. Tag and release adult cod, haddock and plaice on spawning grounds using ‘conventional’ (non DST) tagging techniques, to determine possible movement patterns in the east and west Irish Sea.

7. Determine the habitat characteristics (depth, bottom profile, temperature, salinity) associated with cod, haddock and plaice spawning aggregations, using acoustics, CTD data (attached to the trawl net) and monitoring of the ships continuous seawater intake system.

8. Record any sightings of the jellyfish *Rhizostoma octopus*, marine mammals and sea turtles.

Daily account of cruise Cend-03-08:

- Endeavour set sail from Belfast (Richardson's Wharf) at 08:00 on the morning of the 8th February and crossed the Irish Sea to Liverpool Bay. Heavy weather slowed progress during the crossing, with the result that it was not possible to start trawling at 18:00 as originally planned. Endeavour passed the Calf of Man at ~18:00 and took shelter off the North Wales coast, rather than proceeding to station A1 as originally planned.

- Trawling began at 08:00 on the morning of 9th February using the 4m beam trawl. The weather had improved substantially and it was possible to cover the first 4 stations (A18, A15, A14, A13), during this initial 6 hour shift. The 9 scientists onboard familiarized themselves with the EDC (Electronic Data Capture) system, unpacked equipment from calicoes (including items from the calicoes of the groundfish survey team) and carried out histological analyses of plaice.

- Trawling re-commenced at 18:00 (after dark) following evening meal, covering the same 4 stations as the day shift before. This pattern of 'day' and 'night' shifts continued until the evening of 13th February (12 shifts) and until the grid of 18 stations has been covered (by day and night).

- On the 10th February, stations A1, A2, A3 and A10 were covered. Haul and shoot positions of station A10 were moved slightly owing to the position of a telephone cable on the seafloor).

- On the 11th February, stations A16, A12 and A11 were covered by the day shift, whereas stations A20, A11 and A12 were covered during the night shift. The net was ripped and partially lost at position A11 during the night shift.

- On the 12th February, stations A19, A5, A6 and A17 were covered. Station A4 was abandoned as this was now occupied by a gas rig and its exclusion zone. It was felt that the area was sufficiently covered by positions A5 and A19 for this to have been of little concern.

- On the 13th February, stations A9, A8 and A7 were covered. In the afternoon Endeavour steamed inshore to a position off Llandudno to allow an engineer to be brought aboard in order to re-balance power to the three engines. Trawling recommenced at 18:00 following the evening meal. Tagged fish were released at position 53° 32.966'N 5° 41.254'W.

- On the evening of the 13th February (a day early) *Cefas Endeavour* crossed the Irish Sea and headed northwards to Northern Ireland, during which time the gear was changed to PHHT (Portuguese High-Headline Trawl) in time for the morning shift.

- 2 trawl tows with the PHHT were carried out (for 30 minutes each) at positions B7 and B4 (re-positioned slightly). The trawl was badly damaged (ripped along the sides)

at station B7 and required a lengthy period of repair. Trawling recommenced at 18:00 following the evening meal. Stations at positions B4, B5 and B6 were covered during the night shift.

- On the 15th February, the northernmost positions B1, B2 and B3 were covered. A non-valid haul was included (the sides of the gear became twisted) at position B3. The engineer who had boarded in Llandudno was offloaded at Ardglass during the afternoon.

- On the 16th February, the southernmost positions B18, B15, B17 and B16 were covered. Three of these tows had to be shifted slightly to avoid undersea cables.

- On the 17th February, positions B13, B14 and an additional tow ('B21') were covered. This area was thought to be the main spawning ground for cod and haddock. B21 was included as this is regularly surveyed as part of the Autumn groundfish survey.

- On the 18th February, positions B9, B12 and B11 were surveyed. Station B9 was moved slightly to avoid a cable and the first station of the night shift followed an aborted tow where the gear became twisted.

- The last day of trawling (19th February) involved tows at positions B5, B6, B8 and B10 during the day, but only B10 and B8 during the night (as the other tows had been covered previously). Following the last station (number 74), Endeavour made her way northwards to Belfast Loch.

- During the morning of the 20th February the scientific team thoroughly cleaned all lab space and returned items to the calicoes of the groundfish survey team. The ship docked (at Pollack Quay) in Belfast at 12:30 – a full day early.

- The scientific team flew home from Belfast City Airport on the afternoon of 21st February.

Preliminary Results:

(1) Plaice and dab in the eastern Irish Sea

Sampling using the 4m beam trawl in the eastern Irish Sea revealed marked spatial variability in the distribution of plaice and dab. Plaice were most abundant in the centre of Liverpool Bay (stations A17, A9, A8, A7, A6) and there was surprisingly little difference in abundance patterns between day and night – suggesting that 'catchability' of the 4m beam trawl was not greatly influenced by the time of day (figure 1).

It was possible to separate male and female plaice and dab by visual inspection. Female plaice were relatively evenly distributed across the whole sampling grid (figure 2), whereas males were only found in large numbers at a particular geographic location (stations A17, A9, A8). This may reflect favorable environmental conditions (temperature, salinity etc.) off the Mersey and Dee estuaries, and might be an indication of spawning aggregations for this species.

Dab exhibited broadly similar distribution patterns in comparison with plaice (figure 2), with a concentration in the centre of Liverpool Bay, however there were much fewer dab at offshore stations, and hence a greater concentration near the coast (including Red Wharf Bay, off Anglesey). Male and female dab showed similar distribution patterns overall, but there was a notable concentration of male individuals at stations A9, A17, A6, i.e in the same general location that male plaice were found. A 'hot spot' for female dab was observed off the Ribble Estuary (station A5).

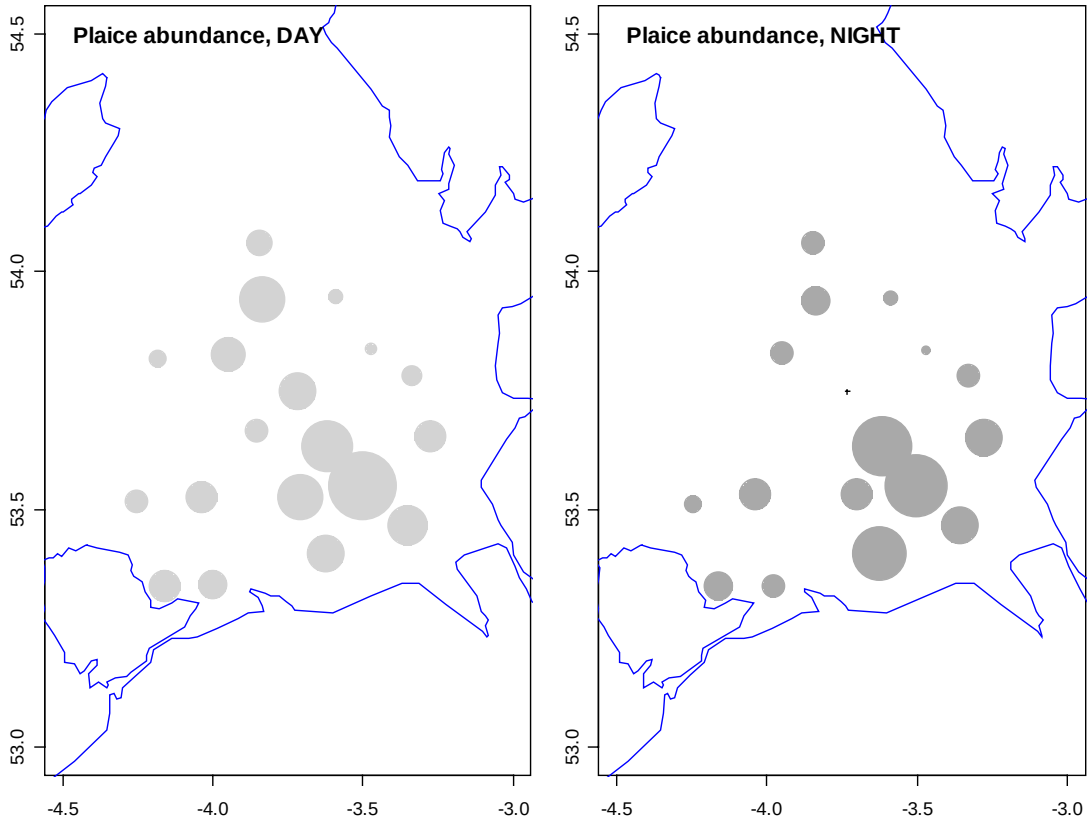


Figure 1. Abundance of plaice in the eastern study grid, compared between day and night. Note that the distribution and abundance patterns are remarkably consistent irrespective of the time of day.

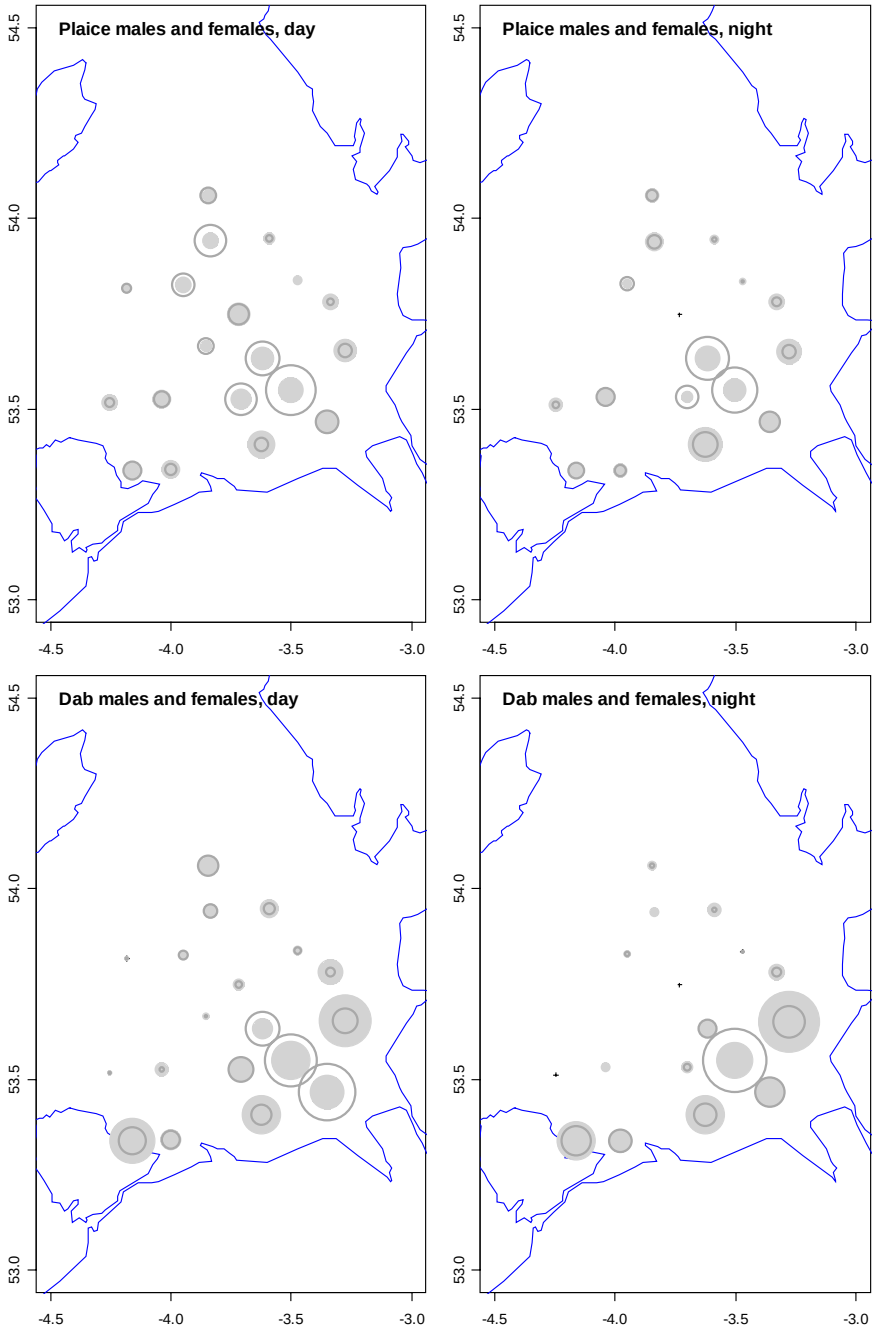


Figure 2. Abundance of male and female plaice (top figures) and dab (bottom figures) compared between day (left) and night (right). Open symbols represent males; grey filled symbols represent females.

A total of 52 fish species were observed in the beam trawl catches of the eastern Irish Sea ('Grid A', table 1). In terms of biomass, catches were dominated by plaice (303kg) and dab (225kg), but also whiting (124kg), dogfish (84kg), thornback ray (67kg), dragonet (64kg), flounder (61kg) and sole (58kg). In terms of numbers, catches were dominated by dab (4477), plaice (2918), solenette (2447) and whiting (1899).

Several large(ish) cod were observed, including 5 individuals measuring 41.3cm (station A18), 43.7cm (station A16), 50.5cm (station A9), 43.8cm (station A19), 41.2cm (station A9), of which two were tagged and released (table 5).

Table 1: Combined 4m beam trawl catches in the eastern Irish Sea ("Grid A") giving the total number of individuals of each species caught and the total weight (in kg).

Species	Latin name	Number	Total weight (kg)
BBY	*Blennius ocellaris*	27	0.844
BIB	*Trisopterus luscus*	58	4.843
BLL	*Scophthalmus rhombus*	11	6.81
BLR	*Raja brachyura*	7	0.82
BNW	*Labrus bergylta*	2	0.259
BRT	*Myoxocephalus scorpius*	30	2.185
BTF	*Pholis gunnellus*	1	0.015
CDT	*Callionymus lyra*	1114	63.732
CLG	*Crystallogobius linearis*	1	0.001
COD	*Gadus morhua*	19	14.53
CUR	*Leucoraja naevus*	6	2.09
DAB	*Limanda limanda*	4477	224.924
DGN	*Scyliorinus stellaris*	3	3
EKT	*Zeugopterus regius*	7	0.318
FLE	*Platichthys flesus*	193	60.685
FVR	*Ciliata mustela*	30	1.342
GDY	*Ctenolabrus rupestris*	2	0.045
GPF	*Syngnathus acus*	4	0.052
GSE	*Hyperoplus lanceolatus*	15	0.341
GUG	*Eutrigla gurnardus*	379	6.096
GUR	*Aspitrigla cuculus*	62	5.909
HAD	*Melanogrammus aeglefinus*	10	2.23
HER	*Clupea harengus*	12	0.62
LEM	*Microstomus kitt*	35	5.04
LSD	*Scyliorhinus caniculus*	130	83.86
MAC	*Scomber scombrus*	0	0
MON	*Lophius piscatorius*	7	8.67
MSE	*Ammodytes marinus*	3	0.037
NKT	*Phrynorhombus norvegicus*	21	0.247
NOP	*Trisopterus esmarki*	0	0
PLE	*Pleuronectes platessa*	2918	303.446
POD	*Trisopterus minutus*	497	8.85
POG	*Agonus cataphractus*	146	1.803
POM	*Pomatoschistus minutus*	33	0.073
SAN	*Ammodytes spp.*	1	0.002
SDF	*Arnoglossus laterna*	1321	16.231
SDR	*Raja montagui*	11	2.314
SDS	*Mustelus asterias*	1	1.39
SDT	*Callionymus maculatus*	1	0.002
SKP	*Entelurus aequoreus*	2	0.049
SMH	*Mustelus mustelus*	2	0.32
SOL	*Solea solea*	463	58.576
SOT	*Buglossidium luteum*	2447	35.694
SPR	*Sprattus sprattus*	22	0.163
SSL	*Liparis liparia*	31	0.171
SSN	*Taurulus bubalis*	8	0.405
SYR	*Raja radiata*	1	0.01
TBR	*Gaidropsarus vulgaris*	1	0.001
TBS	*Microchirus variegatus*	172	7.239
THR	*Raja clavata*	136	67.69
TSC	*Diplecogaster bimaculata*	3	0.001
TUR	*Scophthalmus maximus*	1	0.525
WEL	*Echiichthys vipera*	332	6.866
WHG	*Merlangius merlangus*	1898	123.636

Recordings from a calibrated EK60 scientific echosounder were used to describe the spatial distribution and relative density of fish across the whole of 'Grid A'. However analyses were not conducted during the cruise, rather – data were archived and used by personnel on cruise 04/08.

(2) Plaice maturity, feeding and condition

491 plaice from 'Grid A' were dissected for histological examination. Weight and length were recorded (figure 3), and otoliths were removed for the purposes of age determination. The sex of each individual was determined and the maturity status of the gonad was recorded in accordance with standard maturity keys (including photographs). 210 males were examined, compared to 281 females (table 2). Only 16% of females were classified as 'immature', wheras 84% were maturing, hydrated, running or spent. Examination of the gonads confirmed that the cruise had successfully identified the peak spawning period. The vast majority of the male plaice (74%) were also classified as maturing, running or spent.

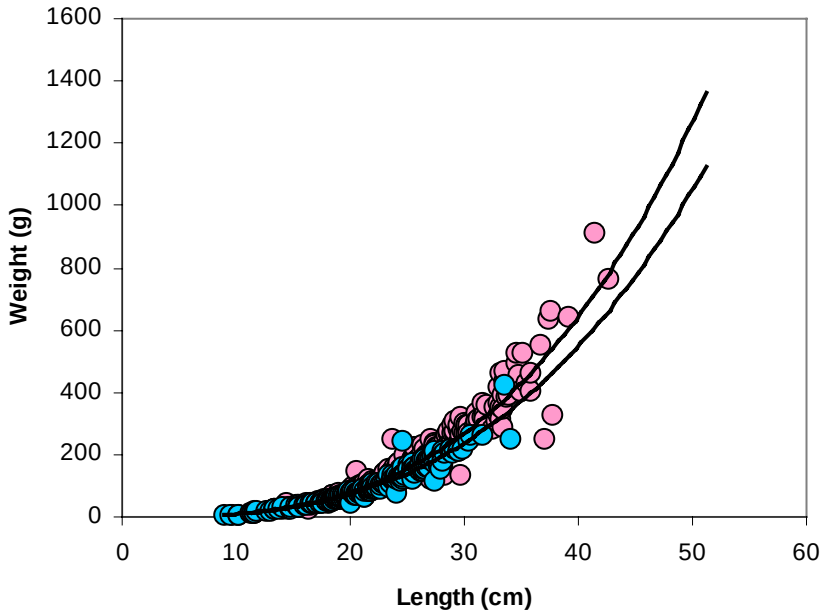


Figure 3. Weight length relationship for male (blue) and female (pink) plaice in the eastern Irish Sea (Liverpool Bay). Note that females are typically heavier than males of the same length.

Table 2: Maturity status of 491 plaice examined from 4m beam trawl catches in the eastern Irish Sea ("Grid A).

	Male		**Female**	
Stage	**Number**	**%**	**Number**	**%**
Immature	54	25.7	46	16.4
Maturing	136	64.8	114	40.6
Hydrated	-	-	52	18.5
Running	15	7.1	17	6.0
Spent	5	2.4	52	18.5
Total	210	100	281	100

Gonads were dissected from each individual and weighed (both ovaries or testes together). In addition the liver was removed and weighed as this gives a good indication of 'condition' and fat reserves immediately prior to spawning. Note that females typically possessed much heavier livers in comparison with males of the same length (figure 4). This is because female fish use the liver to store lipid prior to oogenesis.

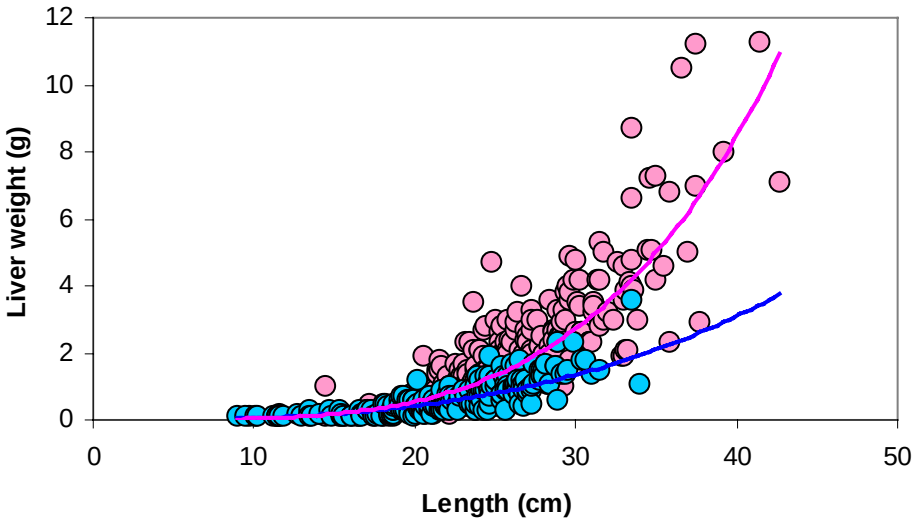


Figure 4. Relationship between liver weight and body length for male (blue) and female (pink) plaice in the eastern Irish Sea (Liverpool Bay).

Gonads were heavier in females in comparison with those in males, and of the 281 sets of female gonads examined, 'hydrated' and 'maturing' gonads were much heavier than 'spent' gonads, within fish of similar size (figure 5). Triplicate samples were taken from 50 female plaice gonads using a micro-pipette, according to predefined protocols. These were transferred to vials of formaldehyde and later examined to establish the size, number and maturity of ripening eggs as part of the ISEPS project.

The vast majority of plaice examined from Grid A possessed empty stomachs (table 3). The percentage of stomachs containing food was slightly higher in immature/non-spawning individuals and notably female fish appeared to begin feeding again after they had shed their eggs (i.e. 'spent' individuals). These observations concur with earlier studies that indicate that adult plaice cease feeding during the spawning period.

Histological analysis was also conducted on 15 cod (9 males, 6 females) and 9 haddock (7 males, 2 females) at 'Grid A'. Most cod individuals were small (20-22cm) and immature, whereas the haddock spanned 20-33cm. Unlike plaice, both cod and haddock appeared to continue feeding throughout February, the most common prey types for cod being crabs and shrimp, whereas the 9 haddock contained gammarid amphipods and bivalves. One gonad biopsy sample was taken from a 41cm female cod at station A6.

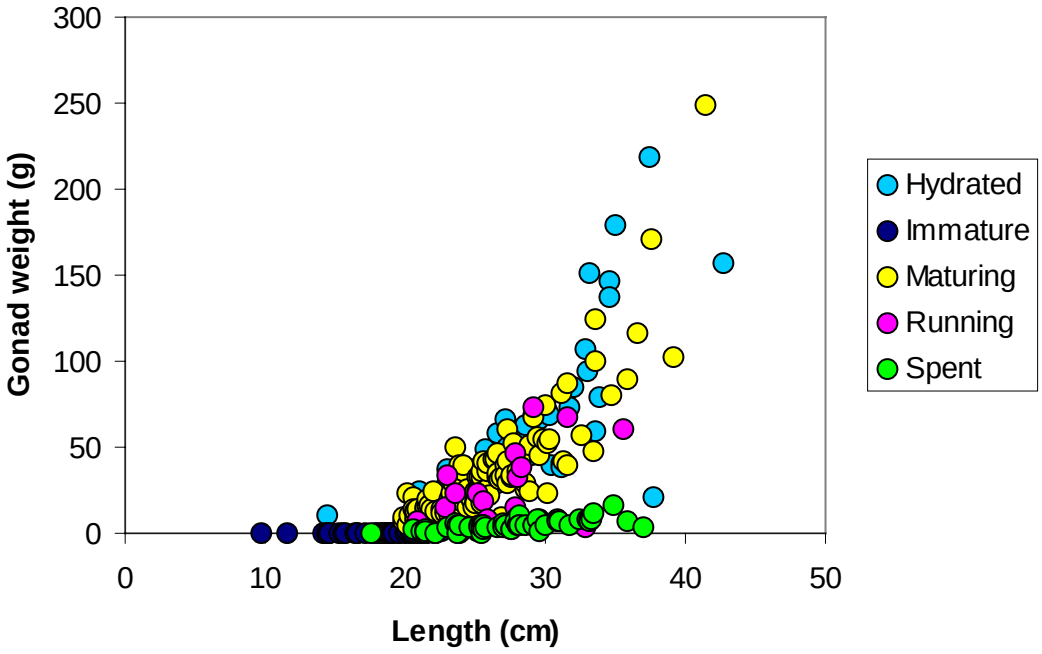


Figure 5. Relationship between gonad weight and body length for female plaice in the eastern Irish Sea (Liverpool Bay) at different maturity stages. Note that 'maturing' and 'hydrated' gonads are typically heavier than those encountered in 'running' or 'spent' individuals.

Table 3: Feeding status (number of stomachs containing food) of 491 plaice examined from 4m beam trawl catches in the eastern Irish Sea ("Grid A). The majority of prey items were brittlestars, polychaetes and bivalve siphons.

	Male			Female		
Stage	**Containing food**	**Empty**	**% with food**	**Containing food**	**Empty**	**% with food**
Immature	6	48	11.1	4	42	8.7
Maturing	0	136	0	2	112	1.8
Hydrated	-	-	-	1	51	1.9
Running	1	14	6.7	0	17	0.0
Spent	0	5	0	15	37	28.8
Total	7	203	3.3	22	259	7.8

(3) Cod, haddock and other species in the western Irish Sea

38 trawl stations were visited in the western Irish Sea and sampled using a 'Portuguese high-headline' trawl (PHHT) by day and night. A total of 48 fish species were observed (table 4) and in terms of biomass, catches were dominated by herring (2709kg), haddock (494kg), sprat (415kg) and whiting (376kg). In terms of numbers, catches were dominated by herring (93,379), sprat (71,342), whiting (8671) and dab (5725).

Table 4: Combined 'Portuguese High-Headline' trawl catches in the western Irish Sea ("Grid B") giving the total number of individuals of each species caught and the total weight (in kg).

Species	Latin name	Number	Total weight (kg)
ANE	*Engraulus encrasicholus*	75	1.107
ARG	*Argentina sphyraena*	9	0.03
CDT	*Callionymus lyra*	9	0.18
CLG	*Crystallogobius linearis*	2	0.002
COD	*Gadus morhua*	11	19.865
CUR	*Leucoraja naevus*	1	0.4
DAB	*Limanda limanda*	5725	127.813
DGN	*Scyliorinus stellaris*	2	7.87
DGS	*Squalus acanthias*	5	0.297
FLE	*Platichthys flesus*	3	0.47
FSG	*Lesueurigobius friesii*	21	0.095
GDY	*Ctenolabrus rupestris*	2	0.055
GUG	*Eutrigla gurnardus*	1122	66.33
GUR	*Aspitrigla cuculus*	4	1.065
HAD	*Melanogrammus aeglefinus*	2991	494.357
HER	*Clupea harengus*	93379	2708.825
HKE	*Merluccius merluccius*	22	1.031
HOM	*Trachurus trachurus*	52	1.043
JOD	*Zeus faber*	1	0.32
LEM	*Microstomus kitt*	10	1.094
LSD	*Scyliorhinus caniculus*	97	54.6
MAC	*Scomber scombrus*	25	1.7
MON	*Lophius piscatorius*	1	1.31
MSE	*Ammodytes marinus*	6	0.008
NOP	*Trisopterus esmarki*	904	11.137
PLA	*Hippoglossoides platessoides*	127	1.548
PLE	*Pleuronectes platessa*	440	58.292
PLS	*Maurolicus muelleri*	13	0.03
POD	*Trisopterus minutus*	539	6.604
POG	*Agonus cataphractus*	1	0.011
POL	*Pollachius pollachius*	2	9.04
POM	*Pomatoschistus minutus*	11	0.013
SDF	*Arnoglossus laterna*	1	0.002
SDR	*Raja montagui*	2	1.36
SDS	*Mustelus asterias*	11	7.46
SDT	*Callionymus maculatus*	2	0.009
SMH	*Mustelus mustelus*	1	0.345
SOL	*Solea solea*	1	0.09
SOT	*Buglossidium luteum*	1	0.01
SPR	*Sprattus sprattus*	71342	414.679
TBR	*Gaidropsarus vulgaris*	1	0.001
TBS	*Microchirus variegatus*	20	0.852
THR	*Raja clavata*	2	0.75
TUB	*Trigla lucerna*	28	14.63
TUR	*Scophthalmus maximus*	1	1.585
WEL	*Echiichthys vipera*	1	0.042
WHG	*Merlangius merlangus*	8671	375.81
WIT	*Glyptocephalus cynoglossus*	3	0.95

One of the main aims of this research cruise was to identify spawning aggregations of cod in the western Irish Sea and to characterize the maturity status of these individuals. Indeed, the sampling grid (Grid B) and the fishing gear used, were specifically selected given earlier information from Northern Ireland groundfish surveys as well as cod egg/larvae surveys (e.g. see cruise report for Corystes 02/06). In particular, large numbers of cod were expected at stations B11-B17. However, very few (11) cod were actually caught whilst sampling in the western Irish Sea – and even more surprisingly the beam trawl survey in the east seemed to yield more individuals (figure 6). Cod were caught at 7 stations and there appeared to be several cohorts, with 6 individuals measuring between 18 and 23cm. One animal measured 40cm (station 68/B11) and another 47cm (station 68/B11), whereas 3 larger individuals were also recovered: 70cm (station 50/B15), 88cm (station 55/B15), 77cm (station 67/ B12).

The cruise was much more successful at catching haddock (2991 individuals) and whiting (8671 individuals), with particularly high concentrations of haddock at position B14, but also B16 and B17 (figure 6). Of the stations that were visited during the day and at night, there seemed little consistency in the catches. At some stations (e.g. B14, B8, B6) more haddock were caught during daylight hours compared to night-time, whereas at other stations (e.g. B17, B16, B12) more were caught during the night compared to the day. In general, those locations exhibiting high haddock catches during the day also exhibited high catches during the night. Of those measured, 942 individuals were between 12 and 29cm, 200 were between 30 and 49cm, and two individuals exceeded 50cm (53cm – station 66/B9; 60cm – station 70/B6).

Whiting were distributed throughout the survey area (figure 6) but were particularly abundant at positions B14 and B12 (124kg and 59 kg respectively). Of the stations that were visited during the day and at night, in almost every case – catches were dramatically larger during the night (notably at stations B15, B17, B9, B6, B17 and B21) compared to those during the day. Grey gurnard were particularly abundant at position B17 and were distributed mainly towards the south of the sampling grid (figure 6).

The Portuguese High-Headline trawl is less well suited to sampling flatfishes (and dragonets) in comparison with the 4m beam-trawl (figures 7 and 8). However, some plaice were caught in the western Irish Sea, and the highest biomass was recorded at position B11 (8.6kg). Large numbers of dab were captured by the trawl with the highest biomasses recorded at stations 73/B10 (27kg), 39/B4 (20kg), 74/B8 (13.7kg), 68/B11 (12.7kg) and 37/B7 (11kg).

Enormous catches of herring and sprat were obtained using this gear and these also included a few individuals of other pelagic species such as anchovy, argentine and horse mackerel. Very large catches of herring were obtained at stations 37/B7 (1352kg) and 66/B9 (361kg) (figure 8), whereas sprat were more evenly distributed along the coast (figure 8) with the largest catches obtained from stations 72/B10 (118kg), 65/B11 (83kg) and 71/B8 (45kg).

11 individuals of the jellyfish *Rhizostoma octopus* were captured in the western Irish Sea (at positions B2, B3, B4, B5, B7, B9, B14, B15, B17, B18 and B21, figure 8). Most weighed between 2 and 10kg, but one (from station 43/B2) weighed 14.3kg and was the single heaviest animal on the whole survey.

Recordings from a calibrated EK60 scientific echosounder were used to describe the spatial distribution and relative density of fish across the whole of ‘Grid B’. However analyses were not conducted during the cruise, rather – data were archived and used by personnel on cruise 04/08.

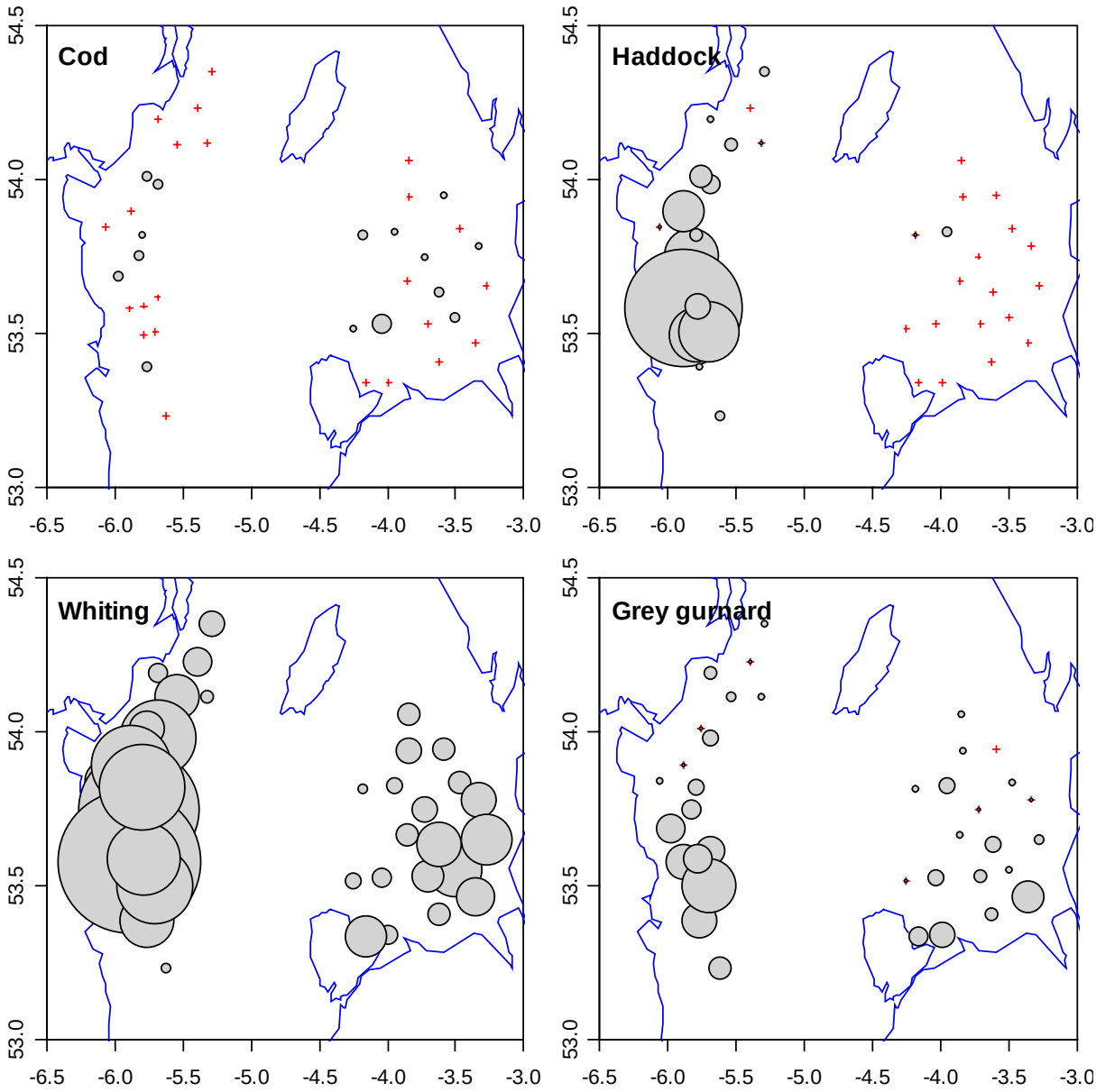


Figure 6. Abundance of 4 fish species in the Irish Sea. Surface areas of symbols proportional to number of fish caught in 30-min tows (west: by PHH trawl; east: by 4m beam trawl). Equal scale in maps on haddock, whiting and grey gurnard, scale doubled in map on cod.

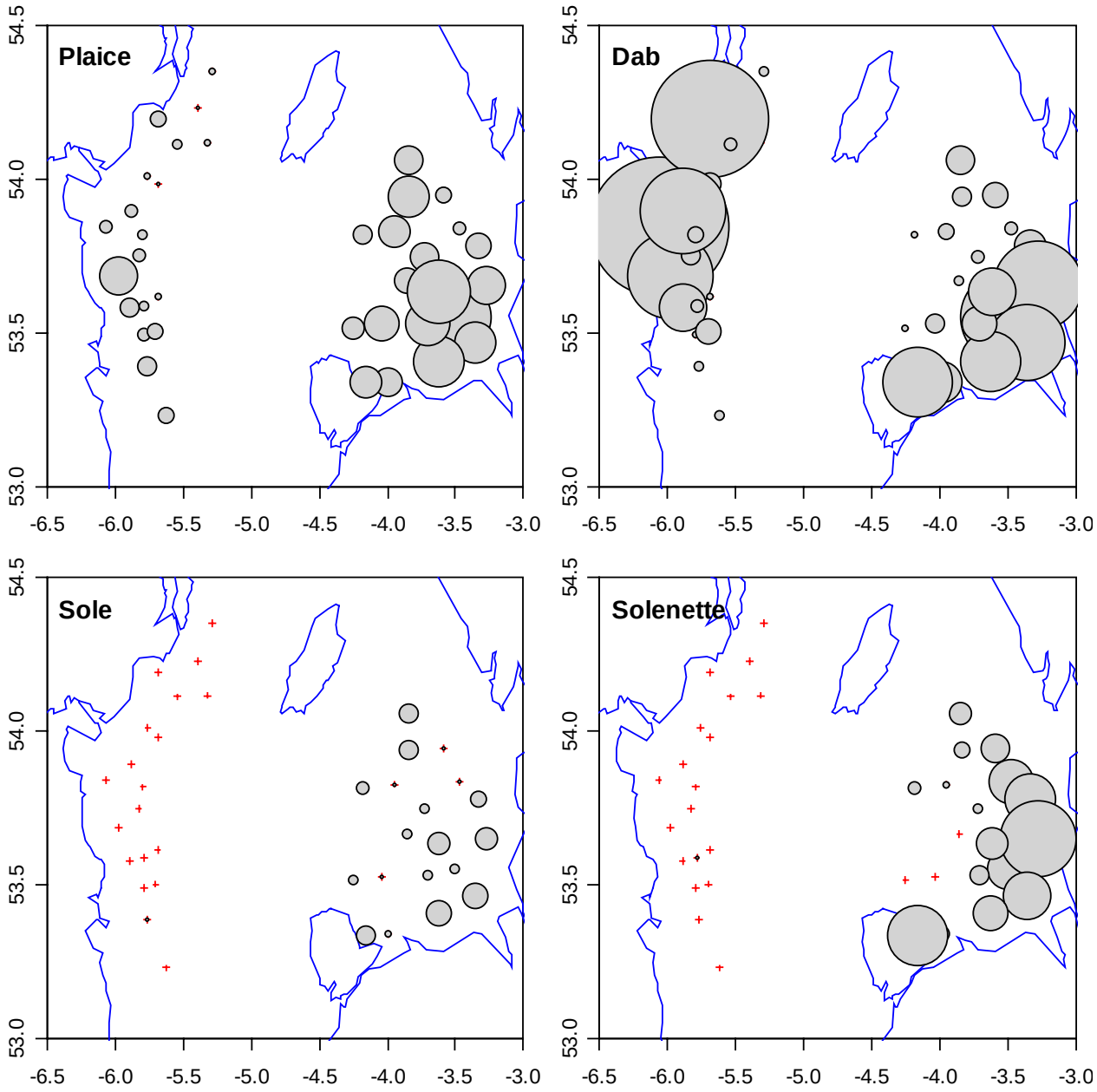


Figure 7. Abundance of 4 fish species in the Irish Sea. Surface areas of symbols proportional to number of fish caught in 30-min tows (west: by PHH trawl; east: by beam trawl). Scale in all maps equal to that in Figure 1b-c.

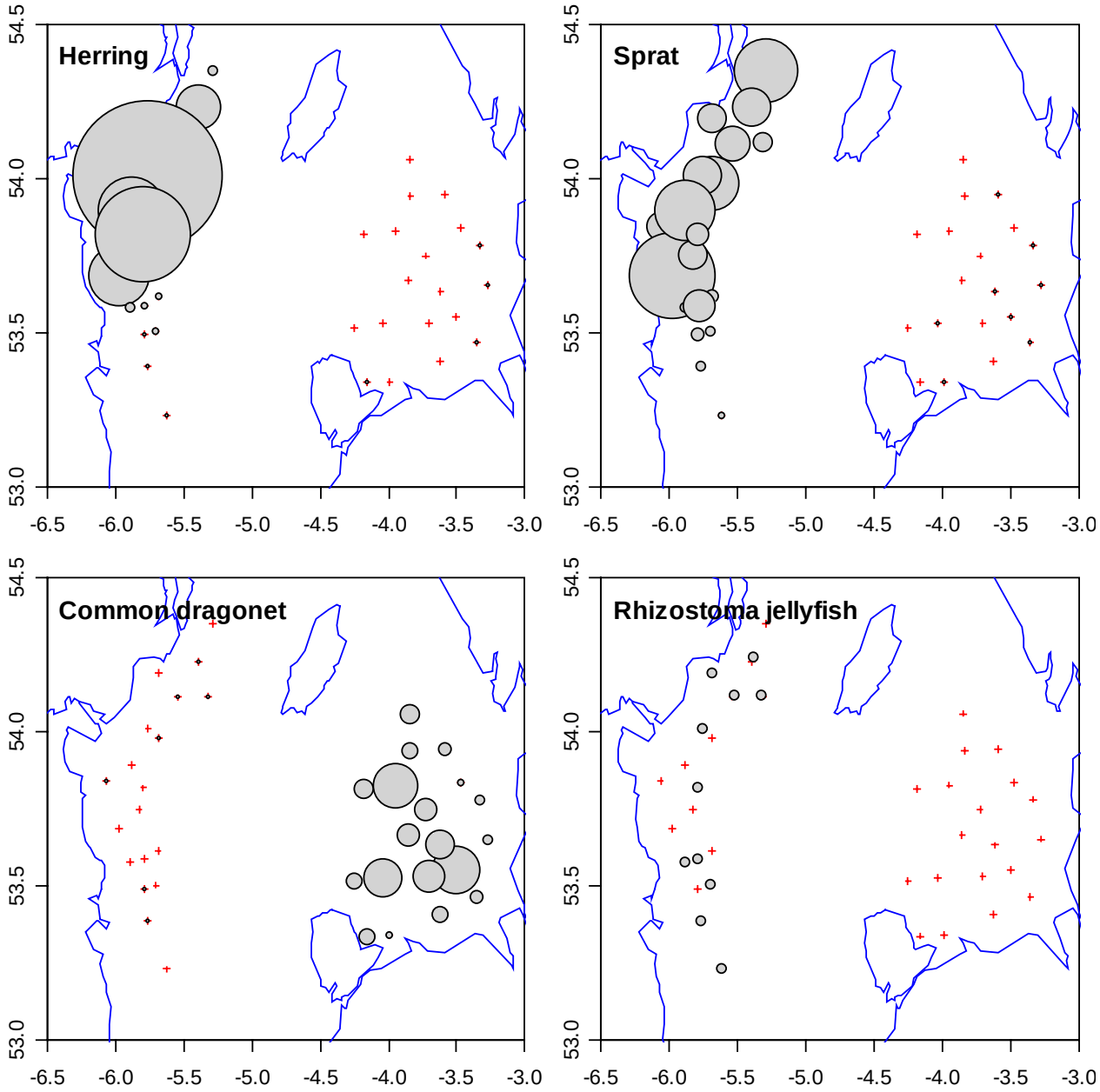


Figure 8. Abundance of 3 fish and 1 jellyfish species in the Irish Sea. Surface areas of symbols proportional to number of fish caught in 30-min tows (west: by PHH trawl; east: by beam trawl). Scale in maps on herring and sprat equal and 1/5 of that in map on common dragonet. With respect to *Rhizostoma*, single individuals were caught at 11 stations.

(4) Cod and Plaice tagging

A total of 24 fish were tagged (table 5) and released during the two week trip, including 21 plaice (all females) and 3 cod. Individuals released at station 35a were caught by 4m beam trawl in the eastern Irish Sea, whereas those released at stations 62a and 74a were caught using the PHHT and released in the western Irish Sea.

Table 5. Capture and release positions of tagged fish from cruise 03/08.

Experiment	Capture station	Release station	Release Date	Species	Tag type	Tag N°	Length	Weight	Sex	Lat Deg	Lat Min	Lon Deg	Lon Min
2510032008	30	35a	13/02/2008	COD	17	E93 9247	43.8	1905.0	U	53	32.996	3	41.254
2510032008	31	35a	13/02/2008	COD	17	E93 9248	41.2	865.5	U	53	32.996	3	41.254
2510032008	26	35a	13/02/2008	PLE	5	E62 6828	32.6	297.0	F	53	32.996	3	41.254
2510032008	26	35a	13/02/2008	PLE	5	E62 6829	37.4	558.0	F	53	32.996	3	41.254
2510032008	26	35a	13/02/2008	PLE	5	E62 6830	28.4	201.0	F	53	32.996	3	41.254
2510032008	26	35a	13/02/2008	PLE	5	E62 6831	35.0	641.0	F	53	32.996	3	41.254
2510032008	50	62a	17/02/2008	PLE	5	E62 6832	39.4	647.5	F	53	38.482	5	44.013
2510032008	50	62a	17/02/2008	PLE	5	E62 6833	32.4	361.0	F	53	38.482	5	44.013
2510032008	52	62a	17/02/2008	PLE	5	E62 6834	39.5	760.0	F	53	38.482	5	44.013
2510032008	52	62a	17/02/2008	PLE	5	E62 6835	33.2	364.0	F	53	38.482	5	44.013
2510032008	54	62a	17/02/2008	PLE	5	E62 6836	29.2	371.8	F	53	38.482	5	44.013
2510032008	54	62a	17/02/2008	PLE	5	E62 6837	39.5	676.5	F	53	38.482	5	44.013
2510032008	54	62a	17/02/2008	PLE	5	E62 6838	39.7	835.0	F	53	38.482	5	44.013
2510032008	54	62a	17/02/2008	PLE	5	E62 6839	38.6	590.6	F	53	38.482	5	44.013
2510032008	55	62a	17/02/2008	PLE	5	E62 6840	28.0	448.2	F	53	38.482	5	44.013
2510032008	55	62a	17/02/2008	PLE	5	E62 6841	38.2	658.0	F	53	38.482	5	44.013
2510032008	55	62a	17/02/2008	PLE	5	E62 6842	34.5	355.6	F	53	38.482	5	44.013
2510032008	55	62a	17/02/2008	PLE	5	E62 6843	29.9	297.4	F	53	38.482	5	44.013
2510032008	55	62a	17/02/2008	PLE	5	E62 6844	29.7	253.1	F	53	38.482	5	44.013
2510032008	62	74a	19/02/2008	PLE	5	E62 6845	31.8	354.8	F	54	3.532	5	44.181
2510032008	62	74a	19/02/2008	PLE	5	E62 6846	33.5	362.6	F	54	3.532	5	44.181
2510032008	68	74a	19/02/2008	COD	17	E93 9249	47.0	1267.0	M	54	3.532	5	44.181
2510032008	68	74a	19/02/2008	PLE	5	E62 6847	34.5	442.2	F	54	3.532	5	44.181
2510032008	67	74a	19/02/2008	PLE	5	E62 6848	36.1	505.4	F	54	3.532	5	44.181

(5) Cod and haddock maturity, feeding and condition

8 cod and 340 haddock from 'Grid B' were dissected for histological examination. Weight and length were recorded, and otoliths were removed for the purposes of age determination. The sex of each individual fish was determined and the maturity status of the gonad was recorded in accordance with standard maturity keys. Of the cod, 5 were female (3 of which were immature and 2 contained 'hydrated' eggs), 3 were male, of which only one was mature. Gonads and liver were dissected from each individual and weighed (both ovaries or testes together). Triplicate biopsy samples were taken from two female cod gonads using a micro-pipette, according to predefined protocols. These were transferred to vials of formaldehyde and later examined to establish the size, number and maturity of ripening eggs as part of the ISEPS project.

Table 6: Maturity status of 340 haddock examined from Portuguese High-Headline trawl (PHHT) catches in the western Irish Sea ("Grid B).

	Male		Female	
Stage	**Number**	**%**	**Number**	**%**
Immature	23	11.9	24	16.3
Maturing	161	83.4	68	46.3
Hydrated	-	-	52	35.4
Running	9	4.7	3	2.0
Spent	0	0	0	0
Total	193	100	147	100

193 male haddock were examined, compared to 147 females (table 6). 16% of females were classified as 'immature', whereas 84% were maturing, hydrated or running. No individuals were classified as possessing 'spent' gonads. The vast majority of the male haddock (88%) were also classified as maturing, or running. Unlike in plaice (figure 4) the livers of male and female haddock were of comparable weight for individuals of the same length (figure 9).

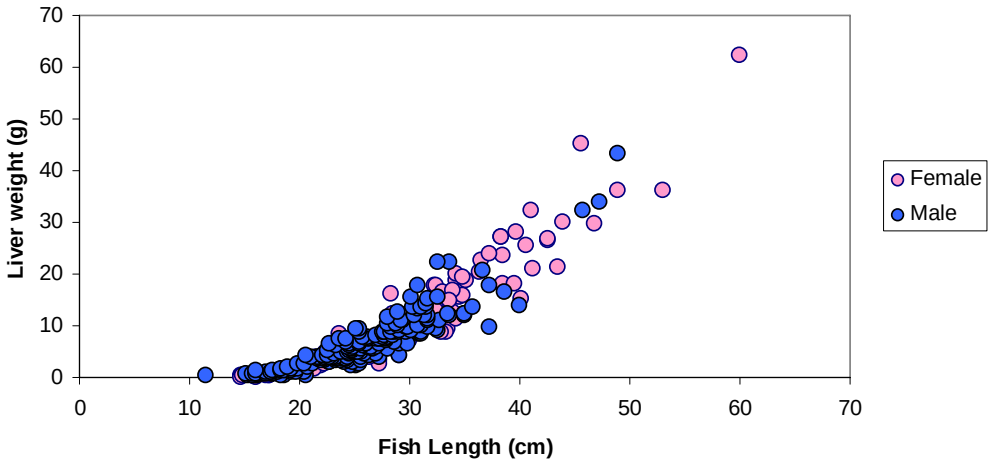


Figure 9. Relationship between liver weight and body length for male (blue) and female (pink) haddock in the western Irish Sea (Grid B).

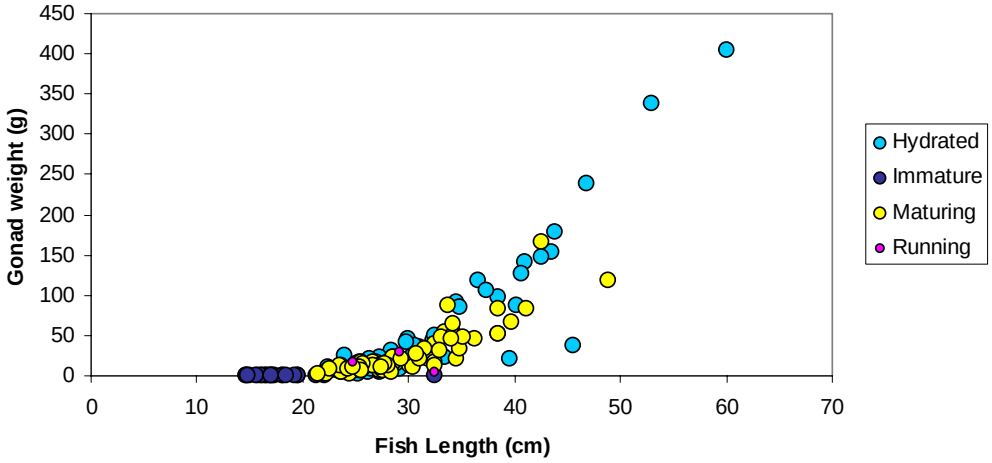


Figure 10. Relationship between gonad weight and body length for female haddock in the western Irish Sea (Grid B) at different maturity stages.

Gonads were heavier in females in comparison with those in males, and of the 147 sets of female gonads examined, 'hydrated' and 'maturing' gonads were much heavier than 'immature' gonads, within fish of similar size (figure 10).

The vast majority of haddock examined from Grid B possessed food in their stomachs (table 7), and the main prey types were ophiuroids, bivalves and polychaetes. The percentage of stomachs containing food was slightly higher in females compared to males (70.7% of females and 49.7% of all males). Of the 8 cod examined 3 possessed empty stomachs (2 males and 1 female), and the main prey types observed were small whiting, shrimps and *Nephrops*.

Table 7: Feeding status (number of stomachs containing food) of 340 haddock examined from PHHT catches in the western Irish Sea ("Grid B").

	Male			Female		
Stage	**Containing food**	**Empty**	**% with food**	**Containing food**	**Empty**	**% with food**
Immature	9	14	39.1	17	7	70.8
Maturing	84	77	52.2	48	20	70.6
Hydrated	-	-	-	36	16	69.2
Running	3	6	33.3	3	0	100
Total	96	97	49.7	104	43	70.7

Histological analysis was also conducted on 161 plaice from Grid 'B' (50 males, 111 females). 19% of females were classified as 'immature', whereas 81% were maturing, hydrated, running or spent. The vast majority of the male plaice (80%) were also classified as maturing, or running. It is interesting to note that the percentage of females exhibiting 'hydrated' eggs was slightly higher compared to table 2 (Grid A). This may reflect the slightly later sampling date (one week later).

Table 8: Maturity status of 161 plaice examined from Portuguese High-Headline trawl (PHHT) catches in the western Irish Sea ("Grid B).

	Male		Female	
Stage	**Number**	**%**	**Number**	**%**
Immature	10	20	21	19
Maturing	31	62	36	32
Hydrated	-	-	24	22
Running	9	18	7	6
Spent	0	0	23	21
Total	50	100	111	100

(6) Temperature, salinity and depth

Whilst sampling on both sides of the Irish Sea, surface temperature and salinity were continuously logged using the in-built system on *Cefas Endeavour*. In addition a mini-CTD was attached to the mesh of the trawl at each station before being deployed in order to obtain an accurate depth profile for each trawl tow (e.g. figure 11), but also a measure of bottom temperature and salinity for each station (e.g. figure 11). Depth was also recorded on the bridge, based on echosounder readings. It is important to note that the CTD malfunctioned whilst surveying "Grid B" and hence there are no CTD data for stations 50-66.

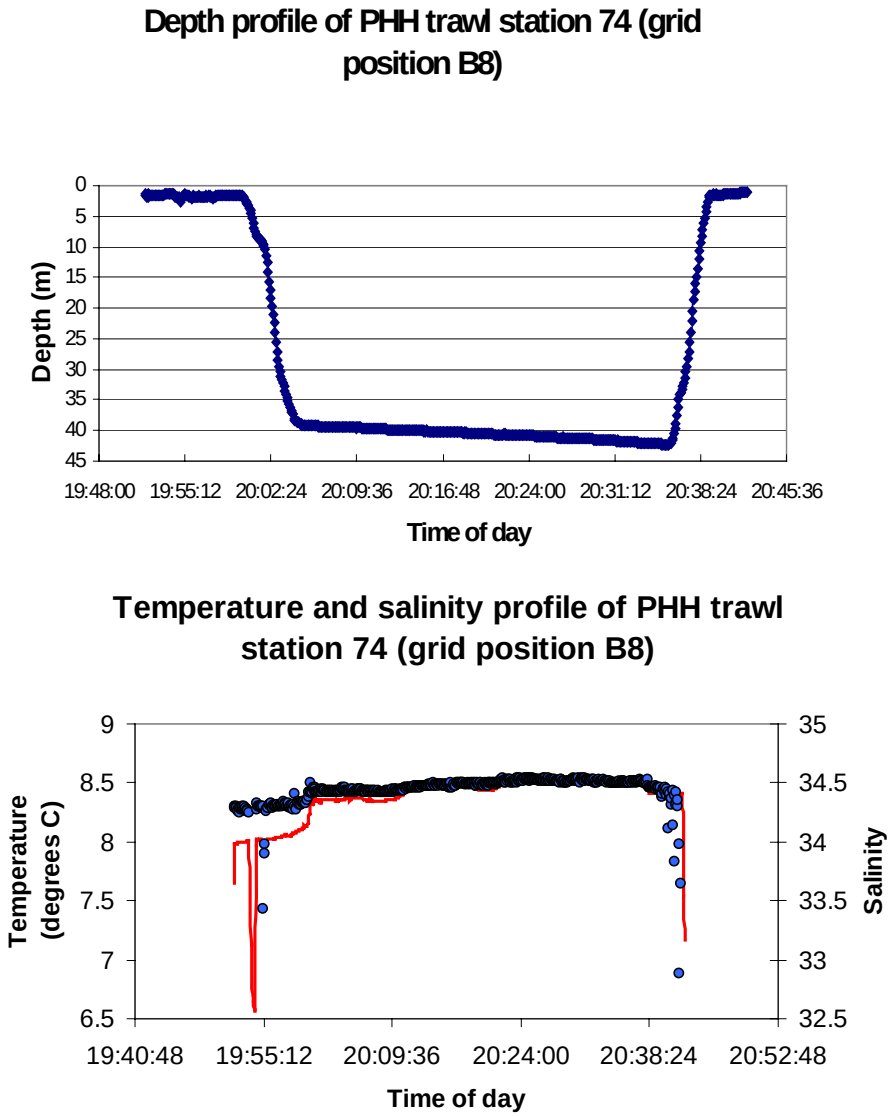
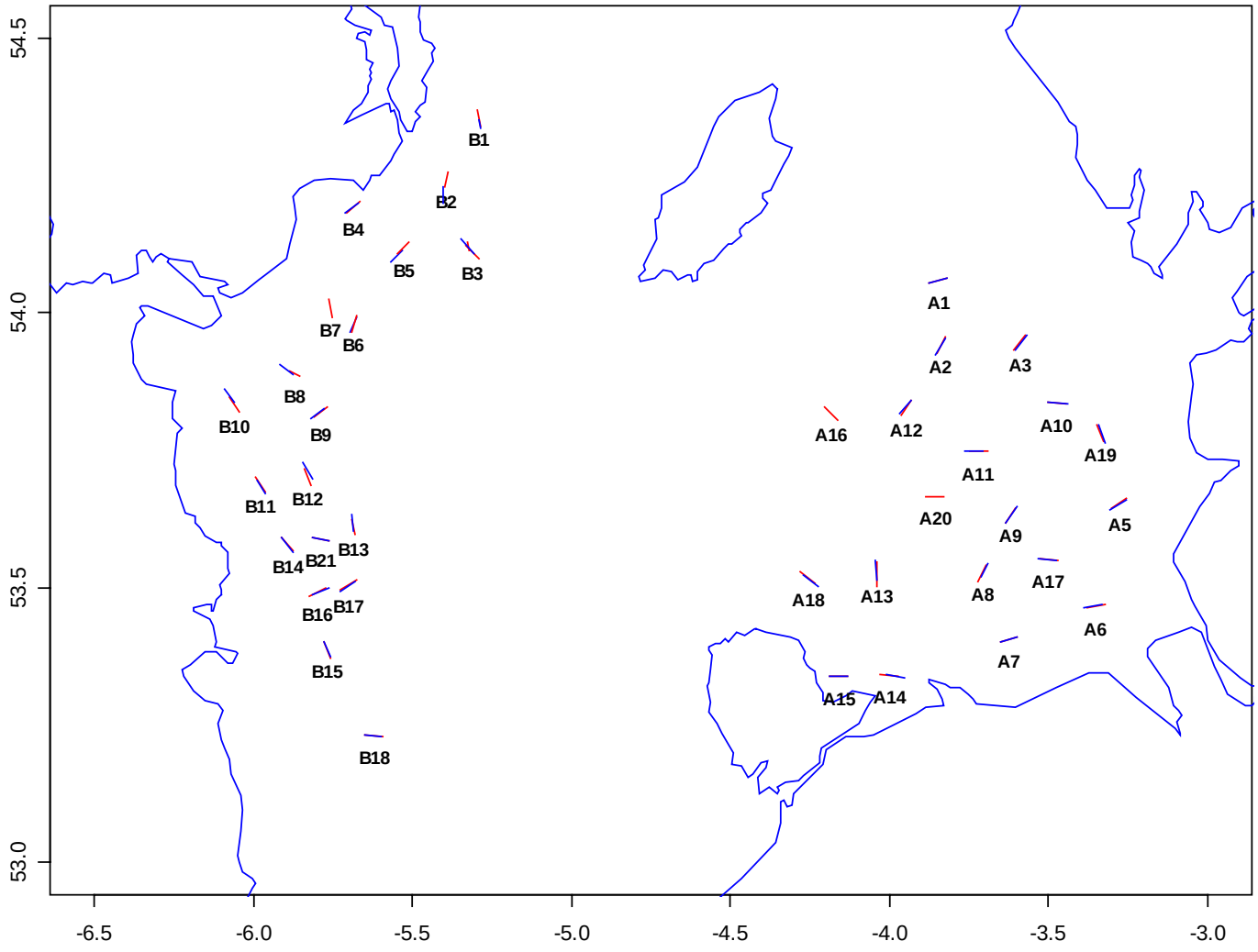


Figure 11. Depth, temperature and salinity profiles for station 74 (grid position B8) in the western Irish Sea.

(5) Station Positions

The following map shows the station positions as realised during the survey, with 19 stations each in the eastern and western grids (“A” and “B”, respectively). Of these, 17 stations in grid “A” and 18 stations in grid “B” were sampled repeatedly by day and night. Small red lines indicate daytime hauling positions, small blue lines indicate night hauling positions.

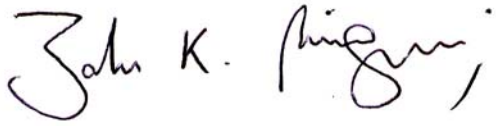


“Grid A” Tow Positions (Eastern Irish Sea)

	Shooting position				Hauling position			
Station	**Latitude**		**Longitude**		**Latitude**		**Longitude**	
A1	54	3.8	3	49.5	54	3.3	3	52.9
A2	53	55.3	3	51.5	53	57.3	3	49.5
A3	53	55.9	3	36.4	53	57.6	3	34.5
A4	53	37.3	3	10.9	53	39.3	3	11.3
A5	53	38.6	3	18.1	53	39.7	3	15.2
A6	53	27.8	3	23.1	53	28.1	3	19.6
A7	53	24.1	3	39.3	53	24.6	3	36.0
A8	53	32.5	3	41.6	53	30.7	3	43.2
A9	53	38.8	3	36.0	53	37.1	3	37.9
A10	53	50.2	3	31.6	53	50.2	3	28.4
A11	53	44.6	3	45.1	53	44.8	3	41.5
A12	53	49.3	3	57.4	53	50.9	3	55.3
A13	53	31.0	4	2.5	53	33.2	4	2.5
A14	53	20.2	3	57.3	53	20.5	4	0.8
A15	53	20.3	4	10.4	53	20.3	4	7.8
A16	53	47.2	4	8.1	53	49.4	4	11.5
A17	53	33.1	3	31.9	53	33.0	3	28.6
A18	53	31.3	4	16.5	53	29.1	4	12.1
Additional								
A19	53	43.9	3	17.9	53	45.9	3	19.3
A20	53	40.0	3	50.0	53	40.0	3	53.0

“Grid B” Tow Positions (Western Irish Sea)

	Shooting position				Hauling position			
Station	**Latitude**		**Longitude**		**Latitude**		**Longitude**	
B1	54	22.9	5	17.7	54	19.8	5	16.8
B2	54	15.1	5	23.2	54	12.2	5	24.2
B3	54	5.2	5	18.7	54	8.1	5	19.4
B4	54	11.3	5	41.3	54	8.3	5	40.7
B5	54	7.9	5	30.3	54	5.8	5	33.8
B6	53	59.7	5	40.4	53	56.9	5	42.2
B7	54	2.2	5	45.6	53	59.3	5	45.0
B8	53	54.6	5	56.0	53	53.1	5	51.5
B9	53	48.6	5	45.4	53	49.7	5	50.2
B10	53	49.2	6	2.6	53	51.8	6	5.4
B11	53	43.5	6	0.7	53	40.9	5	58.3
B12	53	40.7	5	48.6	53	43.7	5	50.7
B13	53	38.8	5	41.7	53	35.6	5	40.9
B14	53	36.5	5	55.8	53	34.0	5	52.6
B15	53	22.3	5	45.4	53	25.0	5	47.5
B16	53	29.1	5	49.6	53	32.1	5	50.3
B17	53	30.5	5	43.3	53	29.6	5	38.3
B18	53	14.9	5	33.2	53	15.9	5	33.0
Additional								
B19	53	44.6	5	21.0	53	47.5	5	19.4
B20	53	54.2	5	14.8	53	56.6	5	11.7



John K. Pinnegar
Scientist In Charge
2nd July 2008

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