

**CENTRE FOR ENVIRONMENT, FISHERIES AND AQUACULTURE SCIENCE  
LOWESTOFT LABORATORY, LOWESTOFT, SUFFOLK NR33 OHT**

**2007 RESEARCH VESSEL PROGRAMME**

**REPORT: RV CEFAS ENDEAVOUR: SURVEY 20**

**STAFF:**

Parts 1 and 2  
Part 1 only

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Part 2 only

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**DURATION:** Part 1: 07–22 November. Part 2: 23 November–08 December 2007

**LOCATION:** Irish Sea, Celtic Sea, English Channel.

**AIMS:**

1. To carry out a trawl survey of the Irish Sea, Celtic Sea and western English Channel (ICES divisions VII a, e-j), using the modified GOV trawl with rockhopper ground gear on hard grounds and standard IBTS GOV trawl on fine grounds, as part of the west coast IBTS series and in support of the EU data regulations, to obtain information on:

- (a) Distribution, size composition and relative abundance of fish, cephalopods, and benthic invertebrates
- (b) Age-length distribution of commercial fish species for ICES WG input and biological studies
- (c) Biological parameters of selected species
- (d) Environmental parameters (including CTD profiles and sediment samples) at trawl stations

2. To take photographs and preserve sections of gonadal tissue for microscopic validation of macroscopic maturity staging.

3. To tag and release specimens of spurdog *Squalus acanthias*, smooth-hound *Mustelus* spp., tope *Galeorhinus galeus*, greater-spotted dogfish *Scyliorhinus stellaris* and other elasmobranchs.

4. To record details of surface sightings of any marine mammals, sea turtles and pelagic fish, and record observations on jellyfish aggregations

5. To sample the epibenthos in ICES divisions VII f-h with 2m beam trawl

6. To collect biological samples in support of research projects:

- (a) Scallop *Pecten maximus* (to be frozen) (D. Palmer, Cefas)
- (b) Berried edible crab *Cancer pagurus* (to be frozen) (D. Eaton, Cefas)

- (c) Tissue samples of smoothhounds *Mustelus* spp. and biological information on non-tagged fish (E. Farrell, University College Dublin)
- (d) Tissue samples of skates (Rajidae) for genetic analyses (M. Genner, MBA)
- (e) Alimentary tracts from a variety of fish species (C. Dawson, VLA, Weybridge)

7. To (a) explore the topography, seabed hardness on trawl stations (less than 110 m depth) using multibeam acoustics; (b) map the distribution of demersal and pelagic fish assemblages and weak scattering layers of plankton and squid in the water column using multi-frequency fisheries acoustic tools (on 38, 120 and 200 kHz); and (c) obtain continuous acoustic data on the seabed substrate using Acoustic Ground Discrimination Systems (QTC).

8. To release two batches of dummy releasable tags, so as to examine the recoverability of such tags and the validation of hydrographic models in estimating release positions (J. Metcalfe).

**NARRATIVE:**  
**(all times GMT)**

CEFAS ENDEAVOUR sailed from Lowestoft at 0845h on 07 November, and steamed southwards to a fishing station in the southern North Sea where a shakedown tow was undertaken shortly after 1800h. After completing this tow, CEFAS ENDEAVOUR steamed towards the sampling grid in the western English Channel.

The mini CTD and Niskin bottle was deployed at the first station shortly after 1530h on 8 November, and this station was then fished with the modified rockhopper GOV. During this tow, one of the doors became snagged on the sea floor, although the gear was retrieved without damage. This tow was then sampled again, and the catch processed as an 'additional tow', as it had been conducted after dark. CEFAS ENDEAVOUR steamed inshore that evening and, on 9 November, completed four stations in the western English Channel. The following day, CEFAS ENDEAVOUR headed westwards, completing three stations in the western English Channel, with an additional tow also made at the third station after dark. CEFAS ENDEAVOUR steamed to the north coast of Cornwall over night and four stations were fished successfully on 11 November, with the fourth station also fished after dark. Following the additional tow, CEFAS ENDEAVOUR steamed northwards to south-eastern Ireland, with the first batch of 25 tags released at 50° 51.2N, 06° 06.1'W at 2115h.

Sampling commenced at first light on 12 November with two stations fished without incident. The winches and net drum failed whilst hauling the trawl at the third station and, as the net had been in mid-water for 50 minutes, the station was repeated. That night CEFAS ENDEAVOUR steamed eastwards to the Pembrokeshire coast, though problems with power supplies and the winches on the morning of 13 November meant that only three stations in Cardigan Bay were fished successfully that day. The final station in Cardigan Bay was completed at first light on 14 November, and a further three stations south and west of Anglesey were also sampled. An additional tow at the final station of the day was also undertaken that evening. Three stations along the east coast of Ireland were sampled on the 15 November, and CEFAS ENDEAVOUR then steamed eastwards

to Anglesey. A final three stations were fished with the rockhopper GOV on the morning and early afternoon of the 16 November, and then the GOV trawl with ground gear A (for fine ground) was rigged.

Sampling with the fine ground GOV commenced in Liverpool Bay on the morning of 17 November, with four stations completed that day in worsening sea conditions. Three of these stations were only fished for 20 minutes, as these stations can result in large catches of either muddy sand, starfish *Asterias rubens* and brittlestars *Ophiura ophiura* (in Liverpool Bay) or queen scallops *Aequipecten opercularis*, broken shells and dead mans fingers *Alcyonium digitatum* (further offshore). With the weather deteriorating further, CEFAS ENDEAVOUR steamed west to the Isle of Man to dodge. Four Stations in the NE Irish Sea and Solway Firth were completed on 18 November, with sea conditions improving throughout the day. That night CEFAS ENDEAVOUR steamed westwards to the NW Irish Sea, though easterly gale force winds on 19 November prevented work being undertaken until the late afternoon, with only one station sampled. A further four stations in the NW Irish Sea were fished successfully on 20 November, including a tow in Dundalk Bay which yielded a large number of different fish species. A further 24 dummy tags were released in the Irish Sea (53° 45.3' N, 05° 37.0'W) at 1043h on 20 November. The following morning, the final station in the NW Irish Sea (Dundrum Bay) was completed and CEFAS ENDEAVOUR then steamed south. The following morning the first of the Celtic Sea fine ground stations was sampled before CEFAS ENDEAVOUR steamed to Cobh for a change of staff, docking at 1430h on 22 November.

CEFAS ENDEAVOUR departed from Cobh at 0900h on 24 November and three stations were fished successfully off the south coast of Ireland. A further four stations were completed on 25 November and that night CEFAS ENDEAVOUR steamed southwards to the south-western corner of the survey grid, and then worked northwards over the next three days. CEFAS ENDEAVOUR moved northwards on the night of 28 November and completed four stations on the south coast of Ireland on 29 November before steaming eastwards to the Bristol Channel that night. With the weather deteriorating, only three stations were fished on 30 November. The first of these stations resulted in gear damage (the belly was torn in panel 5), though given the size of the catch it was treated as an additional tow. Fishing at this site can catch the occasional boulder, and it is possible that something was in the belly of the net on hauling, resulting in a tear. After a new panel was inserted into the net, the next two stations were fished without incident. Weather further deteriorated on 01 December, and although CEFAS ENDEAVOUR remained on station for several hours, given that the poor weather was not easing and the swell too large to fish safely, CEFAS ENDEAVOUR steamed eastwards to Tenby, anchoring near Caldey Island.

CEFAS ENDEAVOUR remained at anchor during 02 December and left the sheltered conditions off Caldey Island at first light on 03 December, with two stations south of Milford Haven fished later that day. CEFAS ENDEAVOUR remained on station that evening and fished successfully at three stations in the Celtic Sea on 04 December. Given the worsening sea conditions, and that the forecast was for severe gales, CEFAS ENDEAVOUR steamed southwards that night and at 1400h on the 05 December, one member of scientific staff was taken ashore at Falmouth. That evening CEFAS ENDEAVOUR steamed eastwards to

Start Bay. A plan to work offshore from Start Bay on 06 December was hampered when the rescue boats needed repairs, and as weather deteriorated during the course of the morning, CEFAS ENDEAVOUR steamed eastwards towards Lowestoft, docking at 0730h on 08 December.

## **GEAR DESCRIPTIONS:**

The modified GOV with rockhopper ground gear was used on fishing grounds around the Cornish Peninsula, St George's Channel and central Irish Sea, whilst the standard ground gear was used on softer grounds in the Irish Sea, Celtic Sea and Bristol Channel.

As per 2006, the rockhopper GOV was a polyethylene net, and a 75 cm length of chain was used to join the ground gear to the fish plate, so as to ensure that the fishing line and ground gear were tight. This year, the fine ground gear GOV trawl was also constructed of polyethylene, and as per previous years, extra flotation was used instead of a kite and the toggle chains were set at 10 cm.

## **STATIONS SAMPLED:**

Overall, 70 fixed trawl stations were fished successfully out of the target 72 stations. Twenty-seven of these were fished with the modified GOV with rockhopper ground gear and 43 with the standard ground gear (Figure 1). One station resulted in major damage and was not re-sampled, though the catch and size composition was recorded at this station (it was classed as an additional tow) as the belly panel may have been damaged during hauling. Five additional tows were undertaken during the dark at stations already fished. The relationships between net geometry measurements (headline height, wing spread and door spread) in relation to water depth are illustrated for the two gears in Figure 2.

Vertical profiles with the mini CTD and Niskin bottle were collected at 39 stations, and one beam trawl sample was taken in the Celtic Sea (Figure 3). The number of stations by gear are summarised in Table 1.

## **RESULTS:**

### **(1) TRAWL SURVEY**

Otoliths and biological data were collected for commercially important fish species, and the numbers of each species/stock for which otoliths were collected is summarised in Table 2. In addition to the 2,897 otoliths collected, biological parameters were also collected for 262 skates (Table 3).

**Gadiforms:** Cod *Gadus morhua* were caught at 29 of all the valid and additional stations fished (Figure 4), with the best catches in Dundalk Bay and off southern Ireland. Haddock *Melanogrammus aeglefinus* were captured at 48 stations (Figure 4), and the maximum CPUE was  $>400 \text{ kg.h}^{-1}$ . Whiting *Merlangius merlangus* were also abundant, being captured at 63 of the stations (Figure 4), and the maximum CPUE was  $500 \text{ kg.h}^{-1}$ . Hake *Merluccius merluccius* were captured at 43 stations (Figure 4), and the maximum CPUE was  $55 \text{ kg.h}^{-1}$ .

**Anglerfish:** Catches of anglerfish *Lophius piscatorius* (Figure 5) and black-bellied anglerfish *L. budegassa* were relatively low, with *L. piscatorius* caught at 25 stations, mainly in the south-western parts of the survey grid, though low numbers were taken in the Irish Sea.

**Flatfish:** Lemon sole *Microstomus kitt* were relatively common off southern Ireland and in the Bristol Channel (Figure 5), and the maximum CPUE was 6.5 kg.h<sup>-1</sup>. Megril *Lepidorhombus whiffiagonis* were caught at 27 stations (Figure 5) and the maximum CPUE was 7 kg.h<sup>-1</sup>. Plaice *Pleuronectes platessa* were recorded at 38 stations (Figure 5), with good catches in Dundrum Bay, eastern Irish Sea and off SE Ireland, with a maximum CPUE of 95 kg.h<sup>-1</sup>.

**Pelagic fish:** Herring *Clupea harengus* were caught at 48 stations, with the largest catches in the north-western Irish Sea and off southern Ireland (Figure 6). Mackerel *Scomber scombrus* were caught at 42 stations, with the largest catches off the Cornish peninsula and off southern Ireland. Catches of pilchard *Sardina pilchardus* and anchovy *Engraulis encrasicolus* were greatest in the western English Channel, though anchovy were also taken in relatively good numbers in St George's Channel and Irish Sea (Figure 6).

**Elasmobranchs:** Several tope *Galeorhinus galeus* were caught in the southern St George's Channel, although some of these specimens were taken at a station that was repeated due to winch failure, and may have been taken in mid-water. Spurdog *Squalus acanthias* were caught at 19 stations, with several specimens caught at stations in the Irish Sea and Celtic Sea. Thornback skate *Raja clavata* were taken at 17 stations and were most abundant in the eastern Irish Sea. Fewer thornback rays were observed in the Bristol Channel this year (Figure 7).

**Shellfish:** Stations in the north-western Irish Sea, off Cumbria and in the Celtic Sea yielded good samples of *Nephrops*. Catches of northern squid *Loligo forbesi* were made off the Cornish peninsula (Figure 7).

**Ichthyological observations:** Overall, 96 species of fish were recorded during the survey (Table 4), and most of the species caught were relatively common. Unusual fish species caught included single specimens of bogue *Boops boops*, electric ray *Torpedo nobiliana* and Yarrell's blenny, and three specimens of river lamprey *Lampetra fluviatilis* were caught in Liverpool Bay. Although crystal gobies have been observed in previous surveys, the 2007 survey yielded several examples of transparent goby *Aphia minuta*. Catches south of Cork yielded comparatively large numbers of red band fish *Cepola rubescens* and pearlside. Although no juvenile red band fish were caught at these sites, John dory were observed to have small (4-5 cm) red band fish in their stomachs. Single specimens of streaked gurnard were captured in Dundalk Bay and at another station in the Irish Sea,

**Benthic observations:** The benthic by-catch was quantified at the majority of stations, though the species present were only recorded as observed at two stations due to time constraints. Catches of invertebrates in the rockhopper GOV trawl were generally small, though large numbers of shrimps were captured in St George's Channel.

More benthic invertebrates were captured with the standard ground gear, and echinoderms and crustaceans (shrimps, swimming crabs, spider crabs and hermit crabs) were the major taxa caught. A list of the invertebrates caught by the main survey trawls is given in Table 5. Most of the species observed are caught routinely in this survey, with observations of special note including specimens of sponge crab *Dromia personata* captured in Cardigan Bay and north of the Lley Peninsula, and a single specimen of fan mussel *Atrina fragilis* in the Celtic Sea.

**Miscellaneous studies:** Data on the relationship between mantle length and total weight were collected for various species of squid, so as to provide additional data for condition factors (Figure 8). Data on the stomach contents of John Dory *Zeus faber* and some other fish species were also recorded, and the otoliths from a variety of teleost species taken for the otolith collection.

## **(2) MATURITY STUDIES**

Digital photographs were taken and samples of gonadal tissue were collected for six anglerfish *Lophius piscatorius* and two black-bellied anglerfish *L. budegassa*.

## **(3) FISH TAGGING**

During the course of the survey, a total of 203 elasmobranchs were tagged with Petersen discs and released, with summary details given in Table 6 and release locations shown in Figure 9. Several specimens of smalleyed skate were also tagged and released in the Bristol Channel (VIIf) this year to complement tagging programmes for these species being undertaken in Jersey.

One of the tope (total length 145 cm, 13.54 kg, female) caught at station 24 had evidence of being tagged previously, although the tag had recently been pulled out. A Central Fisheries Board of Ireland tag (no. 32357) was observed whilst sorting the catch at the next station, and so may have originated from this tope.

## **(4) OBSERVATIONS ON MARINE MAMMALS, PELAGIC FISH AND JELLYFISH**

Frequent sightings of common dolphin *Delphinus delphis* were recorded during the survey, with all sightings made in the western English Channel, outer Bristol Channel, and Celtic Sea (ICES Divisions VIIe-g). These observations are summarised in Table 7. There were no surface sightings of large pelagic fish or jellyfish aggregations, though a small number of *Rhizostoma* were caught at several stations in the Irish Sea (Stn 25/PrimeH9; Stn 53/Prime A2), 27 specimens were recorded at station 54 (Prime B4).

## **(5) EPIBENTHIC SAMPLING**

Only one site in the Celtic Sea (Jones Bank) was sampled with 2m-beam trawl (Figure 3)

## **(6) COLLECTION OF BIOLOGICAL MATERIAL**

- (a) The flat shells of 20 specimens of scallop *Pecten maximus* were retained.
- (b) Three berried edible crab *Cancer pagurus* were recorded during the survey.
- (c) Fin clips were taken for 100 smoothhounds *Mustelus* spp. for genetic studies.
- (d) Tissue samples were taken from 250 specimens of various skate species for genetic studies.
- (e) The alimentary tracts of a variety of demersal and pelagic fish were frozen for microbiological studies.

## **(7) ACOUSTIC STUDIES**

Bathymetry of a total of 64 stations were recorded and 40 stations of the 45 stations during the first half of the survey were processed. Stations deeper than 120m, mainly during the second half, were not recorded and in addition some stations were not sampled due to bad weather. Backscatter provided insight into the seabed hardness and can help justifying using both hard and soft ground gear. The data also provided insight into fish habitat of the trawl area (Figure 10).

Fisheries acoustic data were continuously collected during daylight hours of the cruise (see above) at three operating frequencies (38kHz, 120kHz and 200kHz), using the SIMRAD EK60 split beam sounder. Post processing on the data of the first half was undertaken on the 38kHz frequency, which is considered to be the standard operating frequency for fisheries acoustic surveys. The 120kHz and 200kHz echograms were scrutinised in parallel with the 38kHz data to aid identification of echo targets and bad data regions. Some stations were lost due to bad weather. Relationships between the acoustic backscatter data of 0-6m above the bottom and the catch data (species composition, length and weight) on the sample stations will be extrapolated to the between station acoustic data (partitioned in 1nmi intervals) to quantify demersal fish density distribution in the Irish and Celtic Sea (e.g. Figure 11). Acoustic pelagic species composition will be identified based on trawl stations.

AGDS: Acoustic seabed data were continuously recorded and data from the first half were cleaned. Data from the second half will be processed in the lab subject to time availability.

## **(8) Release of electronic tags**

One batch of 25 tags was released in the Celtic Sea (50° 51.2N, 06° 06.1'W) at 21:15 on 11 November. The second batch of 24 tags was released in the Irish Sea (53° 45.3' N, 05° 37.0'W) at 10:43 on 20 November.

We thank the officers and crew for all their hard work during the course of the survey, much of which was conducted in poor weather conditions.

Extra special thanks to our dear friend and colleague Mick Easey for all his help, knowledge and sense of humour on this, his final survey. After nearly 42 years of service to the Lowestoft Laboratory, you deserve a great retirement!

J Ellis

08 December 2007

SEEN IN DRAFT

A Reading (Master)

B Salter (Senior Fishing Mates)

INITIALLED:

Dr M Armstrong

DISTRIBUTION:

Basic list

Staff on Cruise

Ireland (via FCO)

Devon SFC

Isles of Scilly SFC

North Wales & NW SFC

France (via FCO)

Cornwall SFC

South Wales SFC

Cumbria SFC

Oliver Crimmen, Natural History Museum (E-mail: [o.crimmen@nhm.ac.uk](mailto:o.crimmen@nhm.ac.uk))

National Marine Aquarium (E-mail: [douglas.herdson@national-aquarium.co.uk](mailto:douglas.herdson@national-aquarium.co.uk))

Sea Watch Foundation (E-mail: [info@seawatchfoundation.org.uk](mailto:info@seawatchfoundation.org.uk))

Irish Whale and Dolphin Group (E-mail: [enquiries@iwdg.ie](mailto:enquiries@iwdg.ie))



**TABLE 1:** Summary of gear deployments.

Gear	Valid	Additional	Invalid	Total
GOV (Rockhopper)	27	6 <sup>(a)</sup>	1 <sup>(c)</sup>	34
GOV (Standard ground gear)	43	2 <sup>(b)</sup>	0	45
Niskin Bottle/Mini CTD	39	-	-	39
2m beam trawl	1	-	-	1
<b>TOTAL</b>				<b>119</b>

(a) Includes the shakedown tow, four dark tows, and one tow when the winches failed whilst hauling and the net likely caught part of the catch in midwater.

(b) Includes one dark tow and one tow when the belly of the net was damaged, possibly on hauling

(c) Door snagged on an obstruction

**TABLE 2:** Number of commercial fishes for which biological information and otoliths were collected during the survey.

Species	ICES Stock	Number collected
Cod <i>Gadus morhua</i>	VII a	29
	VII e-k	60
Haddock <i>Melanogrammus aeglefinus</i>	VII a	225
	VII b-k	293
Whiting <i>Merlangius merlangus</i>	VII a	207
	VII e-k	220
Hake <i>Merluccius merluccius</i>	Northern	218
Megrim <i>Lepidorhombus whiffiagonis</i>	VII b,c,e-k, VIII a,b,d	174
Lemon sole <i>Microstomus kitt</i>	–	146
Plaice <i>Pleuronectes platessa</i>	VII a	414
	VII e and VII f-g	200
Sole <i>Solea solea</i>	VII a	14
	VII e and VII f-g	28
Turbot <i>Psetta maximus</i>	–	3
Brill <i>Scophthalmus rhombus</i>	–	8
<sup>1</sup> Anglerfish <i>Lophius piscatorius</i>	VII a-k	53
Anglerfish <i>Lophius budegassa</i>	VII b-k	39
<sup>2</sup> Bass <i>Dicentrarchus labrax</i>	–	32
Red mullet <i>Mullus surmuletus</i>	–	9
Herring <i>Clupea harengus</i>	VII a	160
	Celtic Sea	150
Mackerel <i>Scomber scombrus</i>	Western	215
	<b>Total</b>	<b>2 897</b>

<sup>1</sup> Includes ilicia

<sup>2</sup> Includes scales

**TABLE 3:** Number of skates for which maturity data were collected.

Species	Number examined for maturity
Common skate <i>Dipturus batis</i>	4
Shagreen skate <i>Leucoraja fullonica</i>	2
Cuckoo skate <i>Leucoraja naevus</i>	76
Blonde skate <i>Raja brachyura</i>	8
Thornback skate <i>Raja clavata</i>	71
Smalleyed skate <i>Raja microocellata</i>	36
Spotted skate <i>Raja montagui</i>	65
<b>Total</b>	<b>262</b>

**TABLE 4:** Taxonomic list of fish species caught during the survey and the number of stations at which they were recorded (includes all tows). Species indicated ‘-’ were not recorded in 2007, but have been reported in earlier surveys.

Species	Stns	Species	Stns
Lamprey <i>Lampetra fluviatilis</i>	1	Cod <i>Gadus morhua</i>	29
Spurdog <i>Squalus acanthias</i>	19	Haddock <i>Melanogrammus aeglefinus</i>	48
Black-mouth dogfish <i>Galeus melastomus</i>	1	Whiting <i>Merlangius merlangus</i>	63
Lesser-spotted dogfish <i>Scyliorhinus canicula</i>	74	Blue whiting <i>Micromesistius poutassou</i>	36
Greater-spotted dogfish <i>Scyliorhinus stellaris</i>	16	Pollock <i>Pollachius pollachius</i>	6
Tope <i>Galeorhinus galeus</i>	9	Saithe <i>Pollachius virens</i>	3
Starry smoothhound <i>Mustelus asterias</i>	18	Norway pout <i>Trisopterus esmarki</i>	48
Smoothhound <i>Mustelus mustelus</i>	4	Bib <i>Trisopterus luscus</i>	14
Common skate <i>Dipturus batis</i>	4	Poor cod <i>Trisopterus minutus</i>	75
Cuckoo skate <i>Leucoraja naevus</i>	13	Greater forkbeard <i>Phycis blennoides</i>	6
Shagreen skate <i>Leucoraja fullonica</i>	1	Ling <i>Molva molva</i>	8
Blonde skate <i>Raja brachyura</i>	6	Northern rockling <i>Ciliata septentrionalis</i>	10
Thornback skate <i>Raja clavata</i>	17	5-bearded rockling <i>Ciliata mustela</i>	-
Smalleyed skate <i>Raja microocellata</i>	5	4-bearded rockling <i>Enchelyopus cimbrius</i>	10
Spotted skate <i>Raja montagui</i>	16	3-bearded rockling <i>Gaidropsarus vulgaris</i>	2
Electric ray <i>Torpedo nobiliana</i>	1	Hake <i>Merluccius merluccius</i>	43
Stingray <i>Dasyatis pastinaca</i>	-	Garfish <i>Belone belone</i>	-
Eel <i>Anguilla anguilla</i>	-	John dory <i>Zeus faber</i>	32
Conger eel <i>Conger conger</i>	14	Boarfish <i>Capros aper</i>	25
Allis shad <i>Alosa alosa</i>	-	Snake pipefish <i>Entelurus aequoreus</i>	15
Twaite shad <i>Alosa fallax</i>	-	Greater pipefish <i>Syngnathus acus</i>	4
Herring <i>Clupea harengus</i>	48	Blue mouth redfish <i>Helicolenus dactylopterus</i>	-
Sprat <i>Sprattus sprattus</i>	42	Red gurnard <i>Aspitrigla cuculus</i>	37
Pilchard <i>Sardina pilchardus</i>	25	Grey gurnard <i>Eutrigla gurnardus</i>	51
Anchovy <i>Engraulis encrasicolus</i>	33	Tub gurnard <i>Trigla lucerna</i>	20
Salmon <i>Salmo salar</i>	-	Streaked gurnard <i>Trigloporus lastoviza</i>	2
Sea trout <i>Salmo trutta</i>	-	Bullrout <i>Myoxocephalus scorpius</i>	2
Argentine <i>Argentina</i> sp.	32	Sea scorpion <i>Taurulus bubalis</i>	1
Pearlside <i>Maurolicus muelleri</i>	31	Norwegian bullhead <i>Taurulus lilljeborgi</i>	-
Black-bellied anglerfish <i>Lophius budegassa</i>	13	Pogge <i>Agonus cataphractus</i>	11
Anglerfish <i>Lophius piscatorius</i>	25	Lumpsucker <i>Cyclopterus lumpus</i>	1
Silvery pout <i>Gadiculus argenteus</i>	9	Sea snail <i>Liparis liparis</i>	8
		Montagu's sea snail <i>Liparis montagui</i>	-

**Table 4 (continued):** Taxonomic list of fish species caught during the survey and the number of stations at which they were recorded (includes all tows). Species indicated ‘-’ were not recorded in 2007, but have been reported in earlier surveys.

Species	Stns	Species	Stns
Bass <i>Dicentrarchus labrax</i>	6	Jeffrey's goby <i>Buenia jeffreysi</i>	10
Bogue <i>Boops boops</i>	1	Crystal goby <i>Crystallogobius linearis</i>	2
Red seabream <i>Pagellus bogaraveo</i>	-	Black goby <i>Gobius niger</i>	-
Black seabream <i>Spondylisoma cantharus</i>	-	Steven's goby <i>Gobius gasteveni</i>	-
Scad <i>Trachurus trachurus</i>	70	Rock goby <i>Gobius paganellus</i>	-
Red mullet <i>Mullus surmuletus</i>	10	Fries's goby <i>Lesueurigobius friesii</i>	3
Redband fish <i>Cepola rubescens</i>	3	Sand goby <i>Pomatoschistus</i> spp.	42
Corkwing wrasse <i>Crenilabrus melops</i>	-	Mackerel <i>Scomber scombrus</i>	42
Goldsinny wrasse <i>Ctenolabrus rupestris</i>	6	Megrim <i>Lepidorhombus whiffiagonis</i>	27
Ballan wrasse <i>Labrus bergylta</i>	-	Turbot <i>Psetta maximus</i>	3
Cuckoo wrasse <i>Labrus mixtus</i>	2	Brill <i>Scophthalmus rhombus</i>	5
Lesser weever <i>Echiichthys vipera</i>	6	Norwegian topknot <i>Phrynorhombus norvegicus</i>	4
Greater weever <i>Trachinus draco</i>	1	Topknot <i>Zeugopterus punctatus</i>	1
Raitts sandeel <i>Ammodytes marinus</i>	1	Imperial scaldfish <i>Arnoglossus imperialis</i>	6
Common sandeel <i>Ammodytes tobianus</i>	1	Scaldfish <i>Arnoglossus laterna</i>	18
Immaculate sandeel <i>Hyperoplus immaculatus</i>	7	Witch <i>Glyptocephalus cynoglossus</i>	13
Greater sandeel <i>Hyperopus lanceolatus</i>	6	Long-rough dab <i>Hippoglossoides platessoides</i>	23
Sand eel <i>Ammodytidae</i> indet.	-	Dab <i>Limanda limanda</i>	38
Common dragonet <i>Callionymus lyra</i>	47	Lemon sole <i>Microstomus kitt</i>	37
Spotted dragonet <i>Callionymus maculatus</i>	27	Flounder <i>Platichthys flesus</i>	2
Reticulated dragonet <i>Callionymus reticulatus</i>	3	Plaice <i>Pleuronectes platessa</i>	38
Butterfly blenny <i>Blennius ocellaris</i>	2	Solenette <i>Buglossidium luteum</i>	15
Tompot blenny <i>Parablennius gattorugine</i>	-	Thickback sole <i>Microchirus variegatus</i>	29
Yarrell's blenny <i>Chirolophis acanii</i>	1	Sand sole <i>Pegusa lascaris</i>	4
Butterfish <i>Pholis gunnellus</i>	2	Sole <i>Solea solea</i>	14
Transparent goby <i>Aphia minuta</i>	8	Triggerfish <i>Balistes caprisus</i>	-

**TABLE 5:** Taxonomic list of invertebrates caught during the survey.

<i>Phakellia ventilabrum</i>	<i>Hyas coarctatus</i>	<i>Illex spp.</i>
<i>Porifera (indet.)</i>	<i>Eurynome aspera</i>	<i>Todaropsis eblanae</i>
<i>Hydrallmania falcata</i>	<i>Inachus dorsettensis</i>	<i>Eledone cirrosa</i>
<i>Diphasia nigra</i>	<i>Inachus leptochirus</i>	<i>Pentapora foliacea</i>
<i>Nemertesia antennina</i>	<i>Macropodia rostrata</i>	<i>Porella compressa</i>
<i>Lytocarpia myriophyllum</i>	<i>Macropodia tenuirostris</i>	<i>Alcyonidium diaphanum</i>
<i>Hydrozoa (indet.)</i>	<i>Maia squinado</i>	<i>Alcyonidium parasiticum</i>
<i>Epizoanthus papillosus</i>	<i>Dromia personata</i>	<i>Cellaria spp.</i>
<i>Alcyonium digitatum</i>	<i>Atelecyclus rotundatus</i>	<i>Flustra foliacea</i>
<i>Alcyonium glomeratum</i>	<i>Cancer pagurus</i>	<i>Antedon petasus</i>
<i>Alcyonium palmatum</i>	<i>Bathynectes longipes</i>	<i>Astropecten irregularis</i>
<i>Caryophyllia smithi</i>	<i>Liocarcinus depurator</i>	<i>Luidia ciliaris</i>
<i>Actinauge richardi</i>	<i>Liocarcinus holsatus</i>	<i>Luidia sarsi</i>
<i>Adamsia carcinopados</i>	<i>Liocarcinus pusillus</i>	<i>Stichastrella rosea</i>
<i>Metridium senile</i>	<i>Macropipus tuberculatus</i>	<i>Henricia oculata</i>
<i>Urticina felina</i>	<i>Necora puber</i>	<i>Anseropoda placenta</i>
<i>Bolocera tuediae</i>	<i>Goneplax rhomboides</i>	<i>Porania pulvillus</i>
<i>Anemone (indet.)</i>	<i>Monodeus couchi</i>	<i>Crossaster papposus</i>
<i>Aphrodita aculeata</i>	<i>Pycnogonum littorale</i>	<i>Asterias rubens</i>
<i>Sabellaria spinulosa</i>	<i>Calliostoma papillosum</i>	<i>Marthasterias glacialis</i>
<i>Hyalinoecia tubicola</i>	<i>Calliostoma zizyphinum</i>	<i>Ophiura albida</i>
<i>Scalpellum scalpellum</i>	<i>Crepidula fornicata</i>	<i>Ophiura ophiura</i>
<i>Cirolana cranchii</i>	<i>Turritella communis</i>	<i>Ophiocomina nigra</i>
<i>Eurydice spp.</i>	<i>Euspira fusca</i>	<i>Ophiothrix lutkeni</i>
<i>Epimeria conchilega</i>	<i>Polinices catena</i>	<i>Ophiothrix fragilis</i>
<i>Solenocera membranacea</i>	<i>Aporrhais pespelecani</i>	<i>Echinus acutus</i>
<i>Alpheus glaber</i>	<i>Buccinum humphreysianum</i>	<i>Echinus esculentus</i>
<i>Pasiphaea sivado</i>	<i>Buccinum undatum</i>	<i>Psamechinus miliaris</i>
<i>Palaemon serratus</i>	<i>Colus gracilis</i>	<i>Echinocardium cordatum</i>
<i>Processa canaliculata</i>	<i>Neptunea antiqua</i>	<i>Spatangus purpureus</i>
<i>Pandalus montagui</i>	<i>Scaphander lignarius</i>	<i>Eustichopus regalis</i>
<i>Pandalus propinquus</i>	<i>Philine aperta</i>	<i>Holothouroidea (indet.)</i>
<i>Dichelopandalus bonnieri</i>	<i>Archidoris pseudargus</i>	<i>Botryllus schlosseri</i>
<i>Spirontocaris lilljeborgi</i>	<i>Dendronotus frondosus</i>	<i>Ascidia conchilega</i>
<i>Crangon allmanni</i>	<i>Nudibranchia (indet.)</i>	<i>Ascidia mentula</i>
<i>Crangon crangon</i>	<i>Atrina fragilis</i>	<i>Ascidiella aspersa</i>
<i>Philocheras echinulatus</i>	<i>Nucula sulcata</i>	<i>Ascidiella scabra</i>
<i>Pontophilus spinosus</i>	<i>Aequipecten opercularis</i>	<i>Ascidia (indet.)</i>
<i>Homarus gammarus</i>	<i>Palliolum tigerinum</i>	
<i>Nephrops norvegicus</i>	<i>Pecten maximus</i>	
<i>Anapagurus laevis</i>	<i>Mytilus edulis</i>	
<i>Pagurus bernhardus</i>	<i>Modiolus modiolus</i>	
<i>Pagurus prideaux</i>	<i>Acanthocardia sp.</i>	
<i>Pagurus variabilis</i>	<i>Abra alba</i>	
<i>Galathea spp.</i>	<i>Sepia elegans</i>	
<i>Munida rugosa</i>	<i>Sepia orbignyana</i>	
<i>Jaxea nocturna</i>	<i>Rossia macrosoma</i>	
<i>Ebalia tuberosa</i>	<i>Sepiola atlantica</i>	
<i>Ebalia cranchii</i>	<i>Alloteuthis subulata</i>	
<i>Ebalia tumefacta</i>	<i>Loligo forbesi</i>	

**TABLE 6:** Summary of elasmobranchs tagged and released.

ICES sub-area Species/Sex	VII		IV	
	Female	Male	Female	Male
Spurdog <i>Squalus acanthias</i>	50	47	-	-
Greater spotted dogfish <i>Scyliorhinus stellaris</i>	14	15	-	-
Tope <i>Galeorhinus galeus</i>	8	12	-	-
Starry smoothhound <i>Mustelus asterias</i>	9	16	-	-
Smoothhound <i>Mustelus mustelus</i>	4	-	1	1
Common skate <i>Dipturus batis</i>	2	1		
Blonde skate <i>Raja brachyura</i>	-	2	-	-
Thornback skate <i>Raja clavata</i>	-	1	3	2
Smalleyed skate <i>Raja microocellata</i>	5	9	-	-
Electric ray <i>Torpedo nobiliana</i>	1	-	-	-
<b>TOTAL</b>		<b>196</b>		<b>7</b>

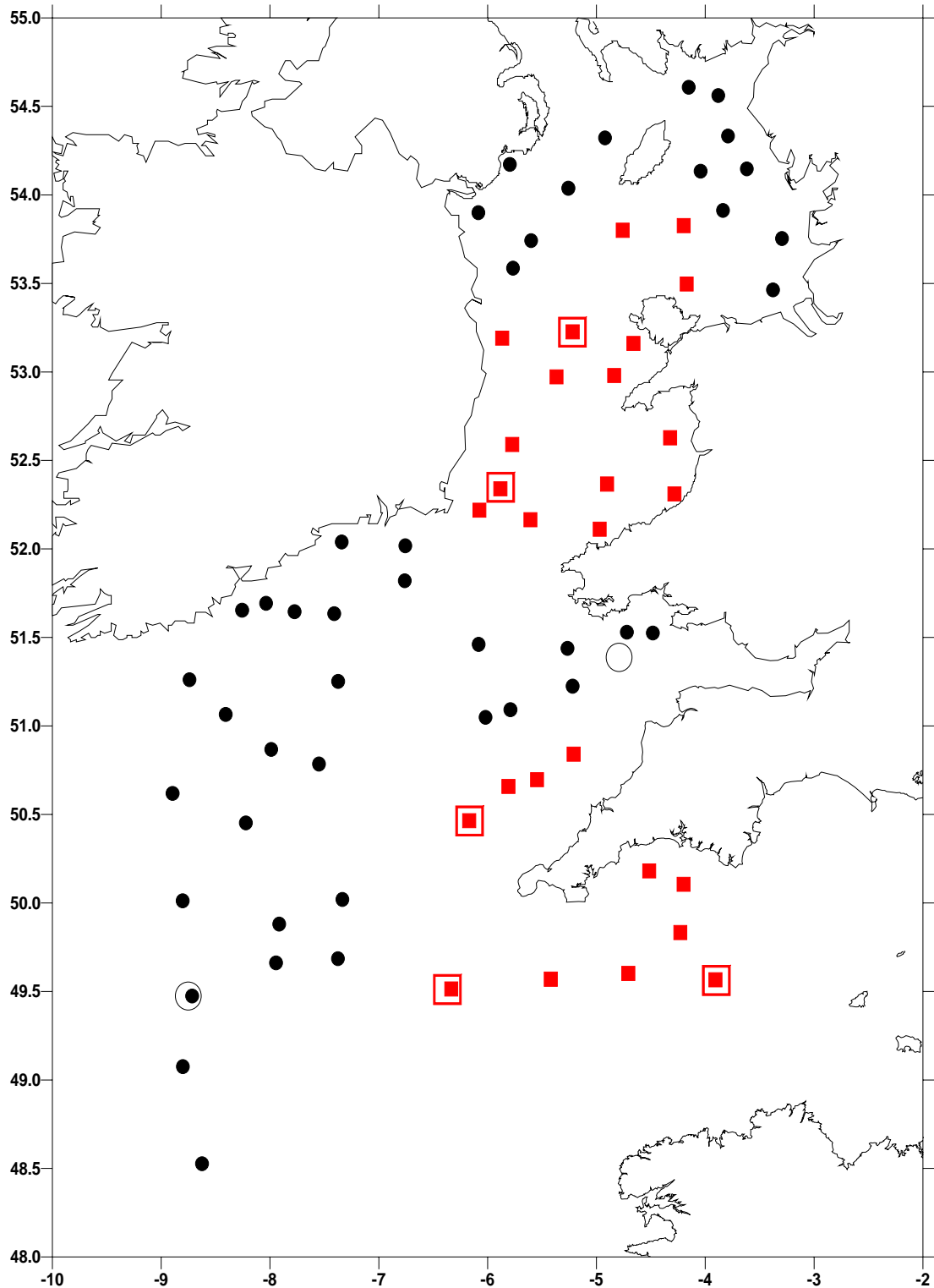
**TABLE 7:** Summary of cetacean sightings made during the cruise.

Date	Time	Station	Prime	Speceis	Numbers	Comments	Latitude		Longitude			Depth m
							Deg	Min	Deg	Min	E/W	
10/11/2007	19:04	13	G11	Common Dolphins	6	Could see six playing around the ship in the deck lights.	49	31	6	26	W	111
11/11/2007	15:40-16:40	20	G4	Common Dolphins	2+	Off the starboard bow, whilst shooting and again at the end of the tow	50	27.7	6	9.8	W	90
12/11/2007	10:40	25	H9	Common Dolphins	15 to 20	Alongside the bow whilst trawling.	52	12.3	6	4.9	W	75
24/11/2007	12:40	76	E2	Common Dolphins	3	On port side.	51	40.6	8	3.8	W	70
24/11/2007	13:33	76	E2	Common Dolphins	10+	On starboard side on hauling.	51	42.9	7	59.1	W	70
25/11/2007	17:45	Steaming	-	Common Dolphins	20+?	Playing around the boat whilst steaming South (all deck lights on).	50	36	7	38	W	108
26/11/2007	08:30	86	F20	Common Dolphins	4	On starboard side.	48	31.6	8	39.9	W	170
26/11/2007	16:30	88	F15	Common Dolphins	4	On port side.	49	28.4	8	45.4	W	142
26/11/2007	21:00	-	-	Common Dolphins	4 to 6	On starboard side.	49	33.1	8	36	W	-
27/11/2007	08:10	92	F11	Common Dolphins	10 to 20+	Swam towards ship on hauling.	50	1.24	7	16.96	W	116
27/11/2007	10:00	93	F14	Common Dolphins	20+	Ahead of the ship whilst heading West.	49	44	7	21	W	110
27/11/2007	11:08	93	F14	Common Dolphins	3	Came to the ship (starboard) and then swam off.	49	42.6	7	22.9	W	117
27/11/2007	12:15	-	-	Common Dolphins	15+	All around the ship whilst steaming to the next station.	49	42.4	7	32.3	W	119
27/11/2007	14:35	94	F13	Common Dolphins	6	Swimming along the starboard side.	49	41.4	7	55.3	W	120

**TABLE 7 (continued):** Summary of cetacean sightings made during the cruise.

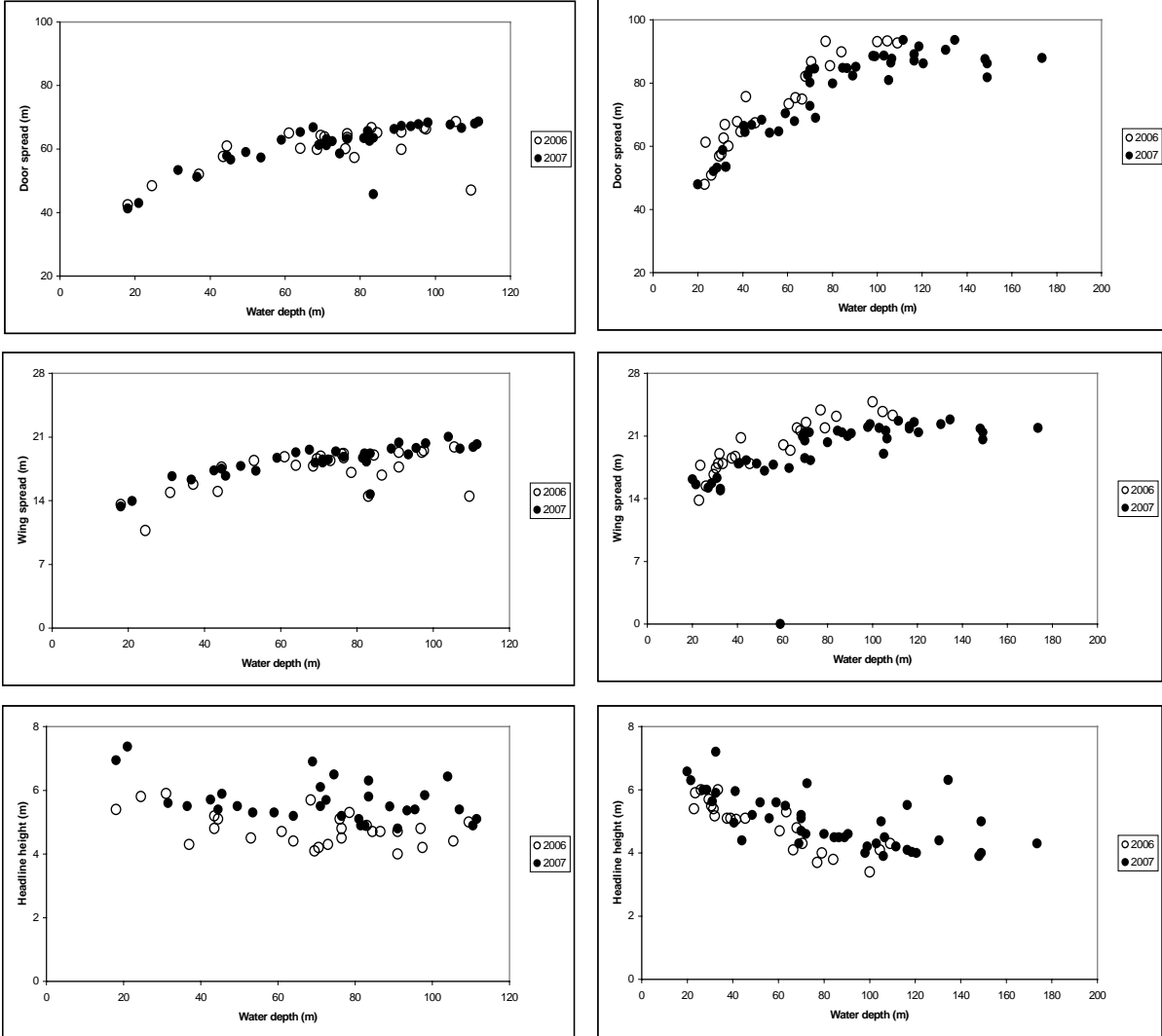
Date	Time	Station	Prime	Speceis	Numbers	Comments	Latitude		Longitude		Depth m	
27/11/2007	16:00	95	F12	Common Dolphins	3 to 4	Swimming along the starboard side.	49	52.8	7	54.87	W	85
28/11/2007	15:30	-	-	Common Dolphins	4 to 6	Along both sides of the ship.	50	30.8	8	22.4	W	114
29/11/2007	14:00	106	D2	Common Dolphins	3 to 4	Starboard side of ship	52	2.2	6	49.3	W	41
29/11/2007	15:30	-	-	Common Dolphins	6 to 12	Portside whilst steaming to next station.	51	54.9	6	46.6	W	57

**FIGURE 1:** Study area showing sites sampled with GOV trawl with rockhopper ground gear (filled squares: valid tows; open squares: additional tows) and standard ground gear (filled circles: valid tows; open circles: additional tows).

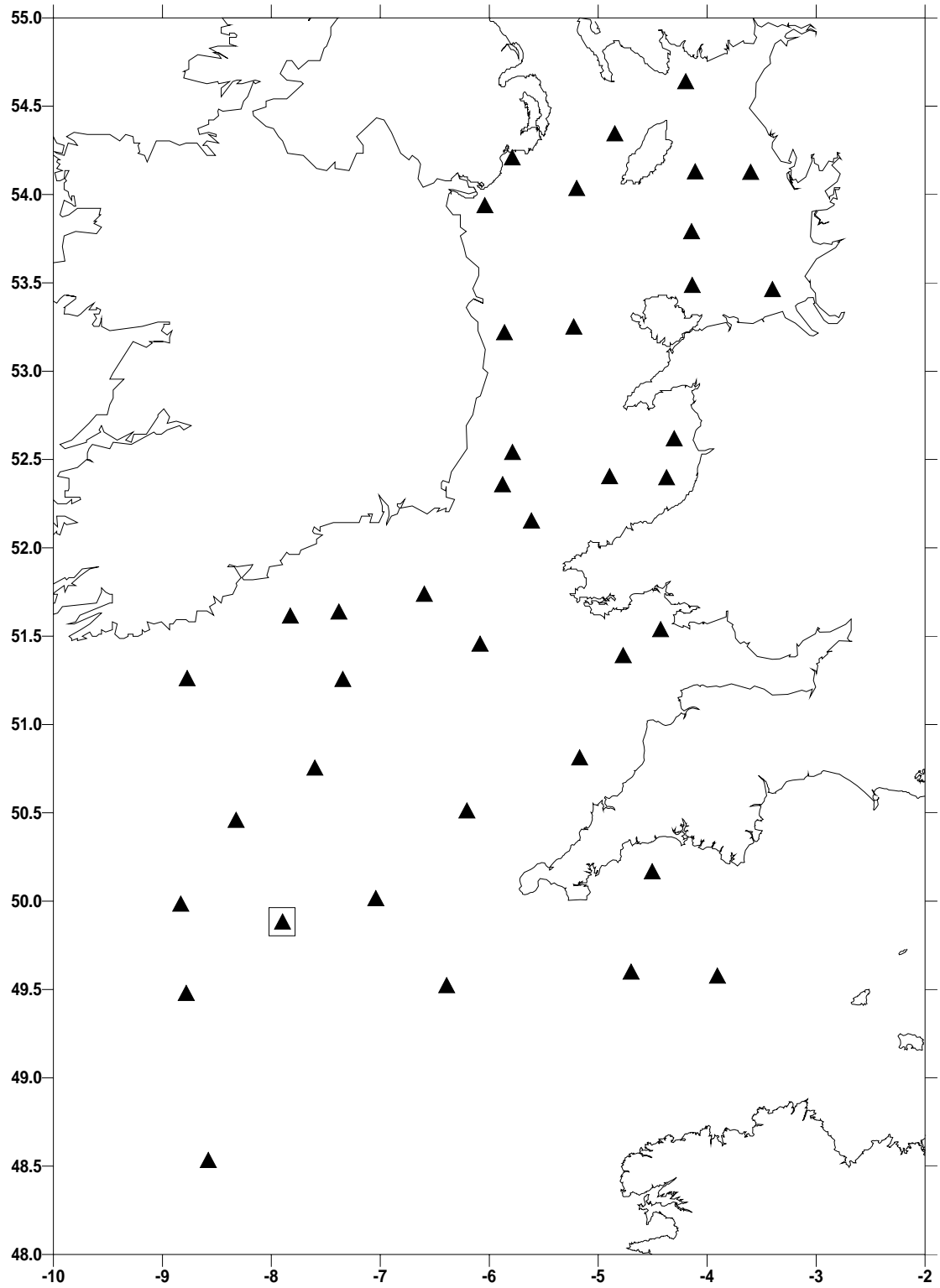




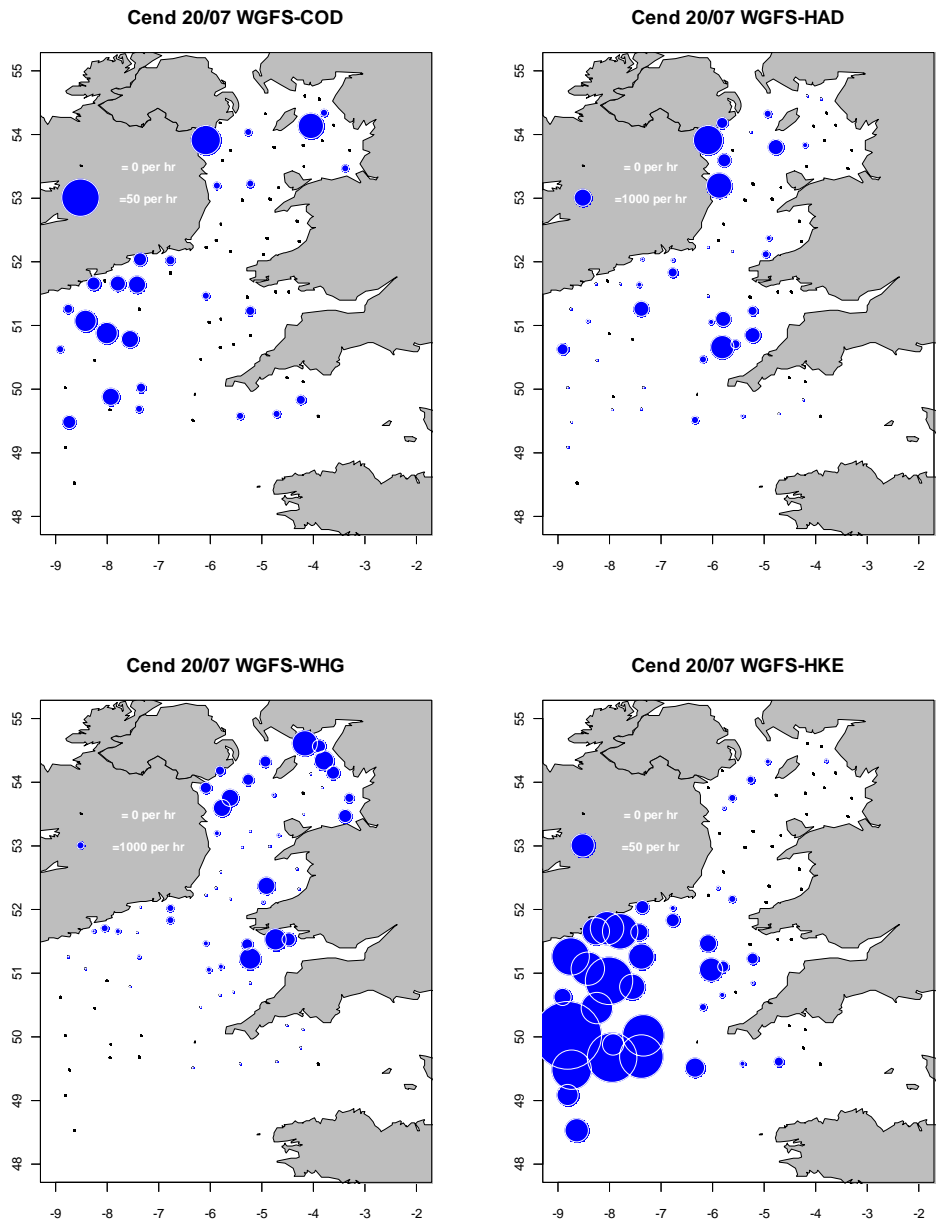
**FIGURE 2:** Graphs showing relationships between headline height, wing spread and door spread with depth for the GOV trawl with rockhopper ground gear (left hand panel) and standard ground gear (right hand panel) for 2007 (filled circles) and 2006 (open circles).



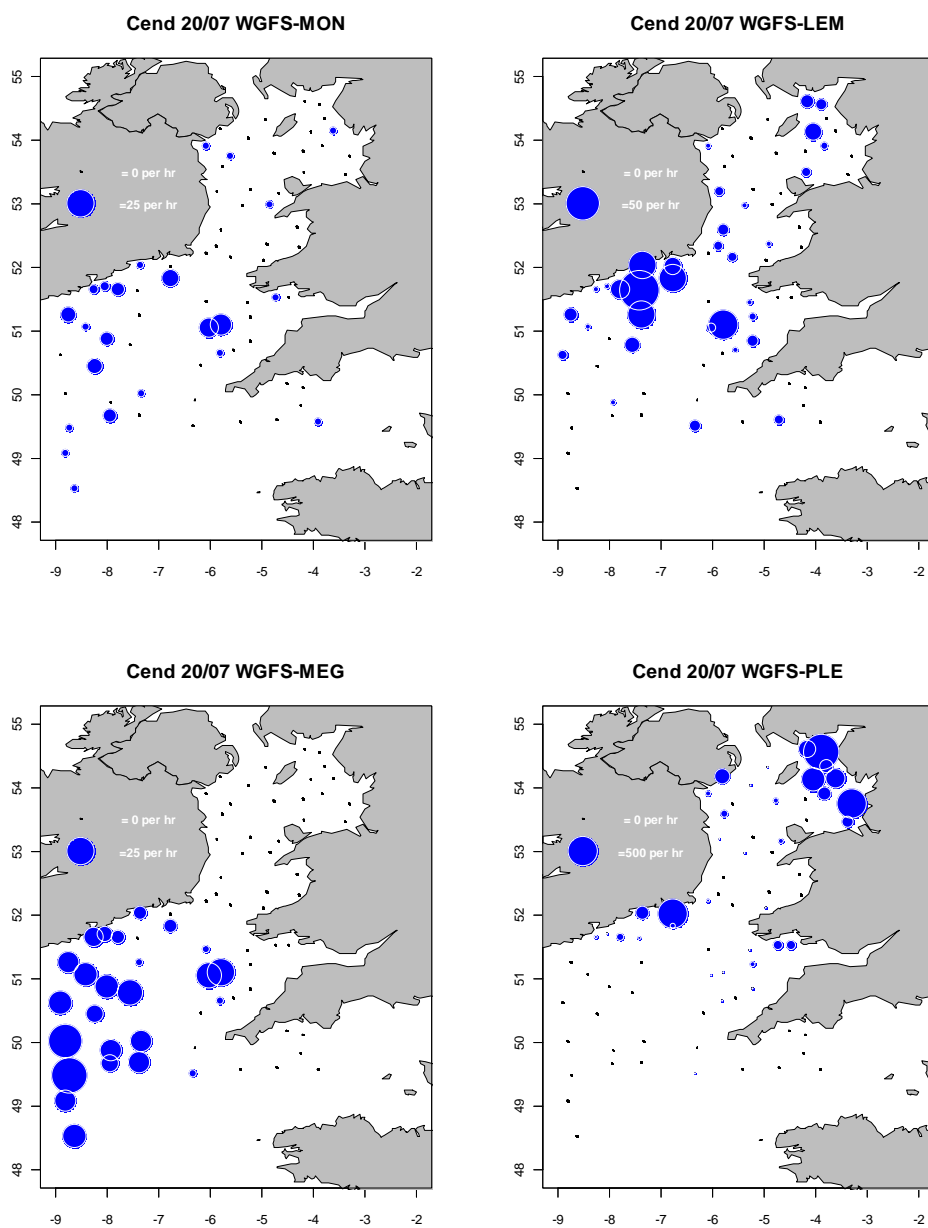
**FIGURE 3:** Study area indicating sites sampled with mini CTD and niskin bottle (triangles), and 2m-beam trawl (open square).



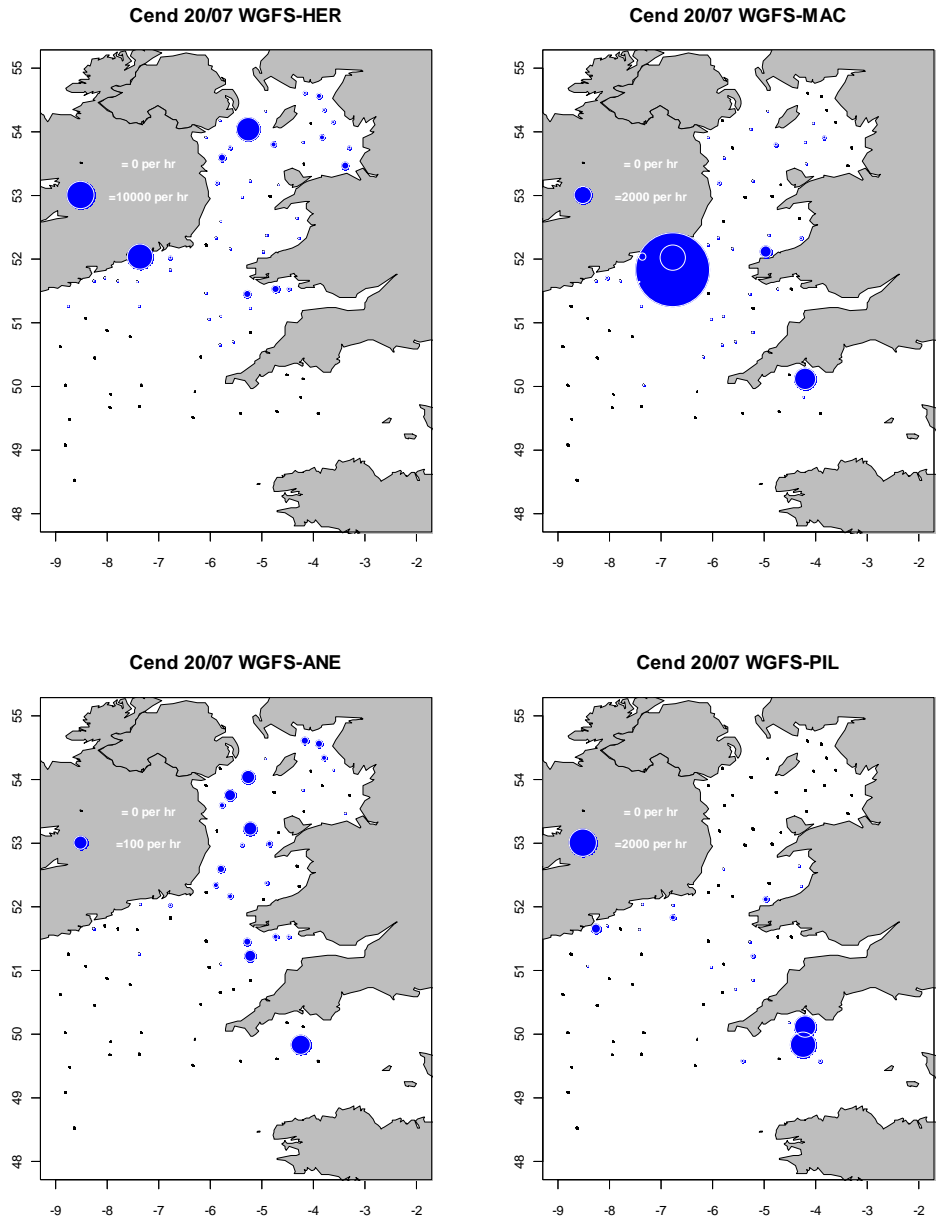
**FIGURE 4:** Distribution and relative abundance (no. per hour) of cod (COD), haddock (HAD), whiting (WHG) and hake (HKE). Refer to Figure 1 for which ground gear was used.



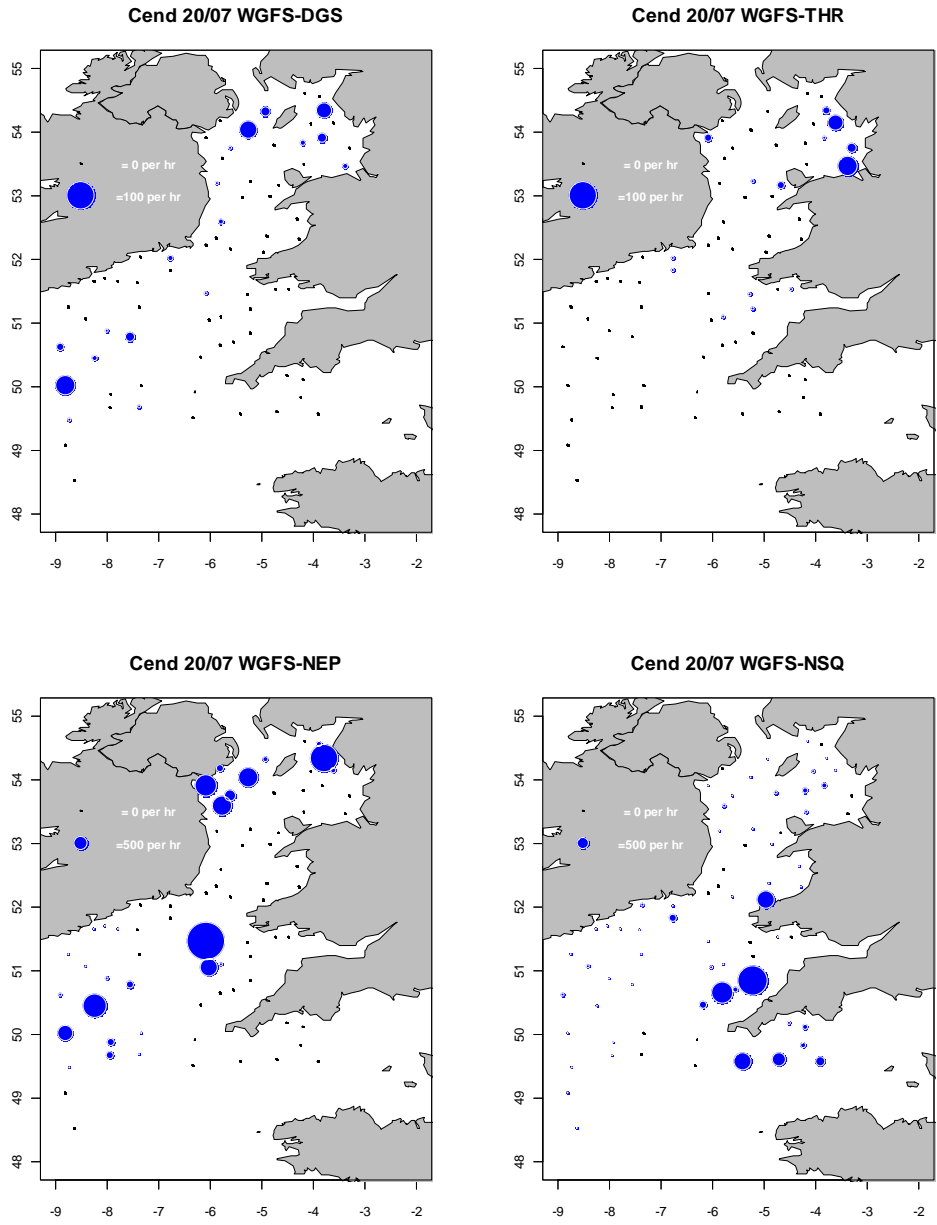
**FIGURE 5:** Distribution and relative abundance (no. per hour) of anglerfish (MON), lemon sole (LEM), megrim (MEG) and plaice (PLE). Refer to Figure 1 for which ground gear was used.



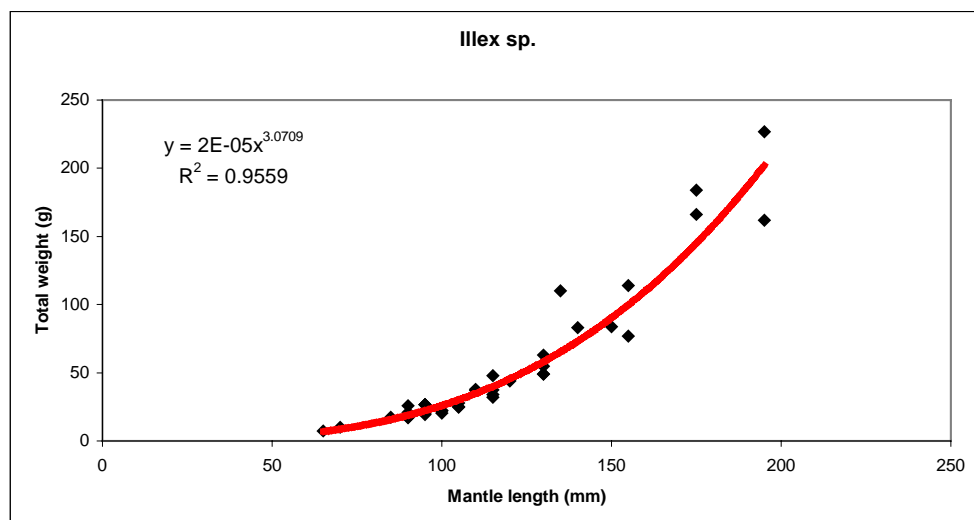
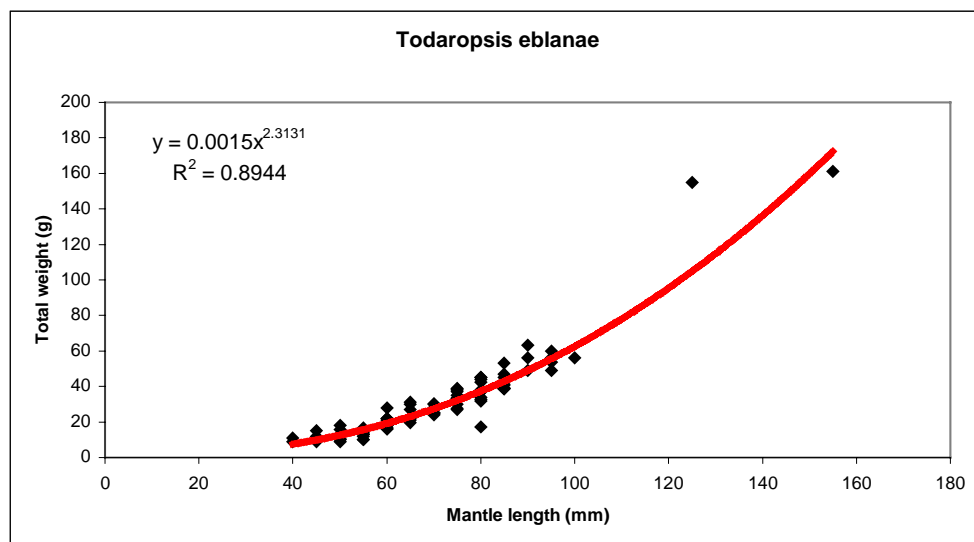
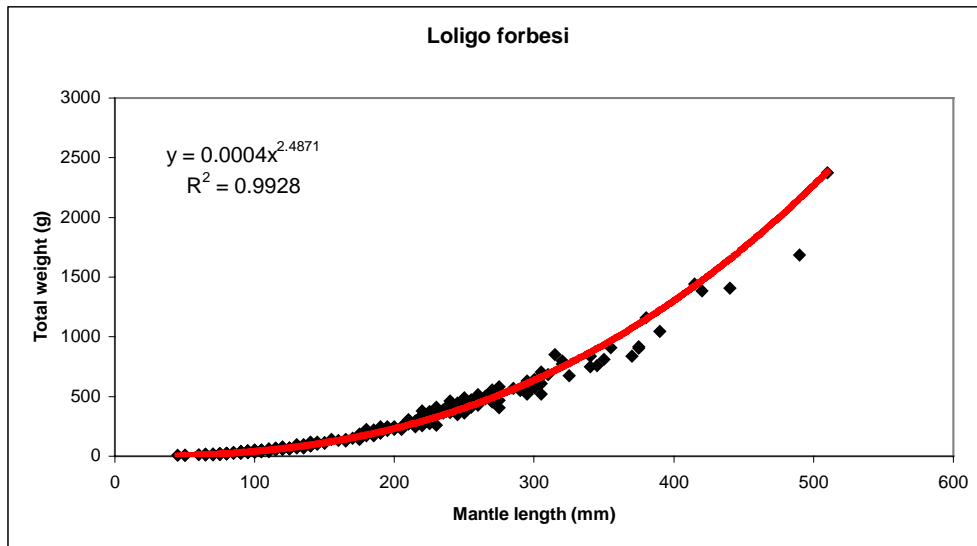
**FIGURE 6:** Distribution and relative abundance (no. per hour) of herring (HER), mackerel (MAC), anchovy (ANE) and pilchard (PIL). Refer to Figure 1 for which ground gear was used.



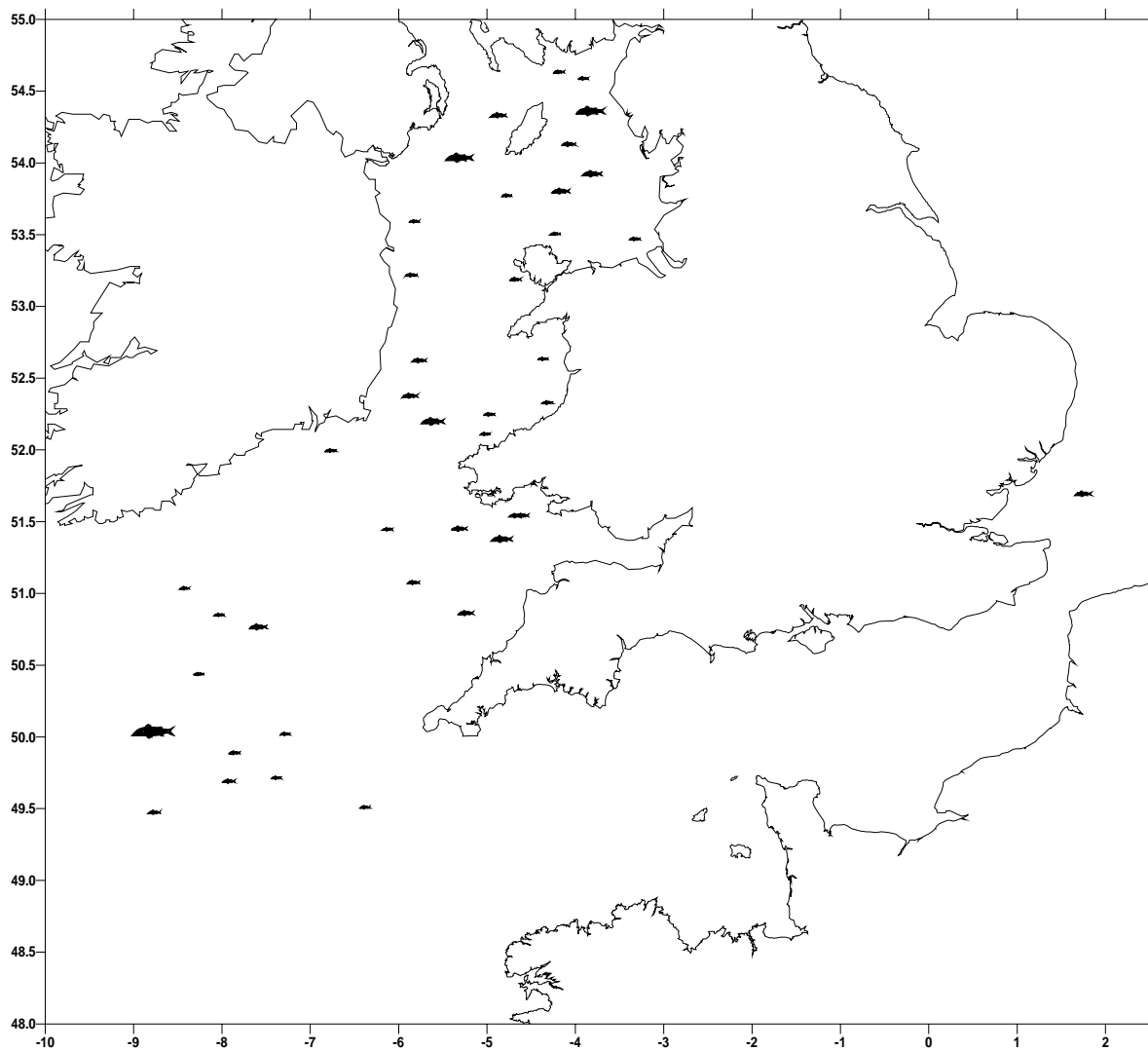
**FIGURE 7:** Distribution and relative abundance (no. per hour) of spurdog (DGS), thornback skate (THR), *Nephrops* (NEP), and northern squid (NSQ). Refer to Figure 1 for which ground gear was used.



**FIGURE 8:** Relationships between total weight and mantle length in three species of squid (*Loligo forbesi*, *Todaropsis eblanae* and *Illex* spp.) from data collected during the 2006 and 2007 cruises.

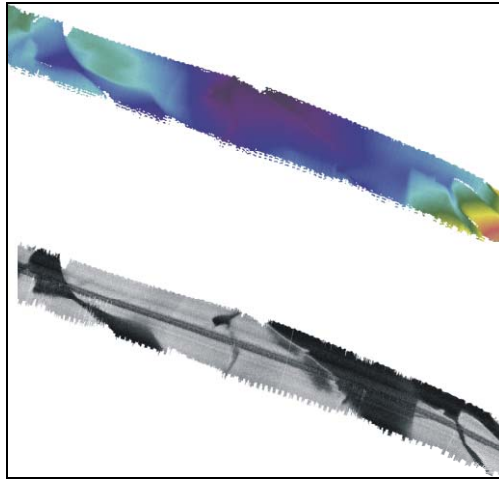


**FIGURE 9:** Study area and sites where elasmobranchs were tagged and released.





**FIGURE 10:** Close up of bathymetry (top image in upper panel) and backscatter (bottom image in upper panel) of station 35. In the backscatter image, hard substrate is represented by dark shades. Example of sea bed topography (bottom image) showing various scales of sand ripples at station 25.



**FIGURE 11:** Acoustic densities of 0-6m above the seabed integrated per 1 n.mi (left) and individual pelagic schools (corresponding to clupeids and horse mackerel) in the water column. Recorded during the first half of the survey.

