CENTRE FOR ENVIRONMENT, FISHERIES AND AQUACULTURE SCIENCE
LOWESTOFT LABORATORY, LOWESTOFT, SUFFOLK NR33 0HT

2006 RESEARCH VESSEL PROGRAMME

PROGRAMME: RV CEFAS ENDEAVOUR: SURVEY 15

STAFF:

Part A	Part B
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DURATION: Part A: 12 August – 28 August
Part B: 29 August – 12 September

LOCATION: North Sea

AIMS:

1. To carry out a groundfish survey of the North Sea as part of the ICES coordinated IBTS, using a standard GOV trawl in order to obtain information on:
   a) Distribution, size composition and abundance of all fish species caught.
   b) Age – length distribution of selected species.
   c) Distribution of fish in relation to their environment.
   d) Distribution of macrobenthos.
   e) Surface and bottom temperature and salinity data using CTD.
   f) Length weight & maturity information using individual fish measurements, in support of the EU Data Regulation.

2. To collect acoustic data at two operating frequencies (38 kHz and 120 kHz) continuously throughout the cruise. Data recorded from the 38 kHz transducer will be combined with GOV trawl data and an estimate of total abundance made for roundfish species. This work will form part of a three year project (CATEFA) aimed at examining the relationships between trawl catches and acoustic data.

3. To calibrate the echo sounders at a convenient place during the survey.

4. To trial new equipment, EM3002, collecting acoustic data for 3D presentation of fish in the water column.

5. To collect fish white muscle tissue for stable isotope analysis, as part of an ongoing study on the effects of fishing in the North Sea (S Jennings, CEFAS Lowestoft).

6. To carry out 6 hard ground tows of the NE coast using the modified rock-hopper GOV.

NARRATIVE:
(all times GMT)

RV Cefas ENDEAVOUR sailed from Lowestoft at 0845h 12 August. Before work on the primary stations commenced, a 'shakedown' tow was carried out to allow for the deployment of the gear, to check that all sensors were working correctly and to allow scientists and crew to familiarise themselves with their particular work areas. A standard station consisted of a cast with a MiniCTD and a 10-litre Niskin bottle, followed by a 30-minute tow with the standard IBTS rigged GOV, also with a MiniCTD attached. On every station fisheries acoustic data were continuously collected at two operating frequencies (38kHz and 120kHz), using the Simrad EK60 split beam sounder. On Sunday 13 August the first of the primary survey stations was towed (using net number 10) and 3 stations were fished that day. Over the next 8 days a further 26 stations were fished, all successfully and without incident, along with 26 successful MiniCTD casts. On Tuesday 22 August, after the first tow of the day, the main hydraulic pump failed (see Chief Engineers report). After approximately 3 hours, this problem was fixed and fishing resumed with a total of 3 stations fished, followed by a further 4 stations, the following day. However, on Thursday 24 August, just before the deployment of the second haul of the day, the hydraulic system failed again. After 3½ hours, and even though the engineers were unable to repair the second pump, fishing continued. Unfortunately, with only one hydraulic pump remaining, the drop keel had to be recovered and it was decided not to use the side A-frame for any further MiniCTD casts, as a precaution against a further hydraulic failure. With these limitations, fishing continued successfully and another 10 valid fishing stations were completed before Cefas ENDEAVOUR docked for a staff change and hydraulic pump repair in Aberdeen on Monday 28 August at 0830h.

Departure from Aberdeen on 30 August was delayed slightly whilst a second hydraulic pump was repaired. Cefas ENDEAVOUR sailed at 1500h and one tow was completed by 1812h, without incident. The following morning on the first tow of the day, major damage occurred at around 20 minutes into the tow. The tow was deemed valid, however, the gear was unable to be repaired at sea and a new net (number 11), was rigged. A further 2 stations were fished that day. On the last station a hole was made in the belly of the net on hauling, as it snagged on the stern roller. A further six stations were fished before heading to Dales Voe, in the Shetland Isles, in order to carry out a calibration exercise (See Aim 3). With this completed successfully, fishing recommenced at 0541h on 4 September and the final 17 sets of CTD casts and GOV trawl stations were fished without incident with the final tow of the standard survey

being hauled at 1739h on 8 September. SCANMAR readings during the standard survey appeared to be at the lower end of the acceptable limits as defined in the IBTS manual this was partly attributable to the use of 20m sweeps.

The vessel steamed overnight in a southerly direction on 9 September, during which time the SMIT crew dismantled the standard gear and rigged the Rock-hopper gear ready for the 6 hard ground tows off the Northeast coast of England. One of the hard ground tows (HG1) was fished in the early evening on 9 September and over the next two days the remaining 5 tows were fished without incident.

On completion of the hard ground tows the vessel steamed for Lowestoft and docked at 1130h on Tuesday 12 September.

RESULTS

Aim 1. A valid GOV trawl haul was successfully completed at all of the 75 primary station positions (Table 1). 74 of these were 30 minutes in duration, and one 20 minutes (prime 51) due to net damage during the tow.. A SAIV micro CTD was used, attached to the starboard wing of the trawl to obtain temperature and salinity data. The survey started with trawl number 10 but at prime station 51, this gear was damaged beyond repair at sea, and trawl number 11 was used for the rest of the standard survey. A chart indicating the position of each trawl station is attached (Figure 1). SCANMAR equipment was used to monitor headline height, wing width and door spread. At each station, the catch of each species was weighed and all fish, or representative samples, were measured. Tables 2 lists the species caught and Table 3 ranks the species by weight compared with last year's survey. Samples of otoliths for age determination were taken as specified in standard instructions. Benthos and crustacea were identified to the species wherever possible and recorded as present. The resultant data were input to computer database using the Cefas Electronic Data Capture System. These data will be analysed at Cefas Lowestoft and will provide a major input to the ICES assessment of North Sea gadoids and pelagic species.

Surface and bottom salinity samples and a water column CTD profile were taken at each of the primary stations fished except between stations 79 and 88 (inclusive), due to problems with the ships hydraulics. These samples will be forwarded to EI in order that the CTD profile can be calibrated.

Table 1.

Gear	Valid	Additional	Invalid	Total
GOV (IBTS Standard gear)	75	1	0	76
GOV (IBTS Rock-hopper gear)	6	0	0	6
Niskin Bottle + MiniCTD	65	2	0	67

Table 2. List of species caught during the survey and number of stations at which they were recorded.

Species	Stns	Species	Stns
Agonus cataphractus	17	*Merlangius merlangus*	73
Alosa fallax	1	*Merluccius merluccius*	28
Anguilla anguilla	1	*Microchirus variegatus*	2
Aphia minuta	1	*Micromesistius poutassou*	8
Argentina silus	1	*Microstomus kitt*	60
Argentina sphyraena	1	*Molva molva*	7
Argentinidae	29	*Mullus surmuletus*	9
Arnoglossus laterna	20	*Mustelus asterias*	1
Aspitrigla cuculus	2	*Myoxocephalus scorpius*	8
Belone belone	4	*Myxine glutinosa*	4
Buglossidium luteum	20	*Nephrops norvegicus*	22
Callionymus lyra	36	*Pholis gunnellus*	2
Callionymus maculatus	31	*Platichthys flesus*	2
Callionymus reticulatus	3	*Pleuronectes platessa*	60
Cancer pagurus	20	*Pollachius pollachius*	2
Capros aper	1	*Pollachius virens*	25
Clupea harengus	56	*Raja clavata*	2
Conger conger	1	*Raja montagui*	1
Cyclopterus lumpus	1	*Raja naevus*	11
Dicentrarchus labrax	1	*Raja radiata*	40
Enchelyopus cimbrius	11	*Sardina pilchardus*	1
Entelurus aequoreus	47	*Scaphander lignarius*	12
Eutrigla gurnardus	65	*Scomber scombrus*	60
Gadiculus argenteus	9	*Scophthalmus maximus*	7
Gadus morhua	57	*Scophthalmus rhombus*	4
Glyptocephalus cynoglossus	16	*Scyliorhinus canicula*	17
Hippoglossoides platessoides	56	*Sebastes viviparus*	3
Hippoglossus hippoglossus	3	*Solea solea*	2
Homarus gammarus	1	*Sprattus sprattus*	23
Hyperoplus immaculatus	2	*Squalus acanthias*	2
Hyperoplus lanceeolatus	7	*Trachinus vipera*	13
Lepidorhombus whiffiagonis	17	*Trachurus trachurus*	31
Limanda limanda	64	*Trigla lucerna*	9
Liza aurata	2	*Trisopterus esmarki*	37
Lophius piscatorius	26	*Trisopterus luscus*	1
Lumpenus lampretaeformis	2	*Trisopterus minutus*	20
Melanogrammus aeglefinus	56	*Zeus faber*	1
		Zoarces viviparus	1

Table 3.

Species common name	Scientific name	2006 weight (kg)	2005 weight (kg)
Herring	*Clupea harengus*	7232.222	3377.525
Dab	*Lamanda lamanda*	4110.781	5545.580
Mackerel	*Scomber scombrus*	2887.207	1434.116
Haddock	*Melanogrammus aeglefinus*	2857.630	3572.871
Saithe	*Pollachius virens*	2806.417	1705.120
Norway Pout	*Trisopterus esmarkii*	1968.145	1074.437
Whiting	*Merlangius merlangus*	1849.026	3329.122
Horse Mackerel	*Trachurus trachurus*	1254.689	2476.885
Sprat	*Sprattus sprattus*	1032.529	1376.445
Grey Gurnard	*Eutrigla gurnardus*	670.34	1017.598
Long Rough Dab	*Hippoglossoides platessoides*	420.435	298.075
Cod	*Gadus morhua*	312.741	167.149
Plaice	*Pleuronectes platessa*	437.284	780.813
Lemon Sole	*Microstomus kitt*	188.378	239.578
Blue Whiting	*Micromesistius potassou*	145.819	717.279
Greater Sandeel	*Hyperoplus lanceolatus*	142.82	6.055
Anglerfish	*Lophius piscatorius*	105.435	64.563
Hake	*Merluccius merluccius*	80.928	68.656
Starry Ray	*Raja radiata*	129.366	122.391
Lesser Spotted Dogfish	*Scyliorhinus canicula*	76.723	115.370

Figure 2 shows distribution and relative abundance (kg per hour) of cod, haddock, whiting and saithe and Figure 3 shows distribution and relative abundance of Norway pout, herring, mackerel and sprat.

A total of 7570 biological samples were taken for the primary target species (Table 4). In addition, a total of 77 samples were also taken from elasmobranches captured during the survey.

Table 4.

Species	**Number of samples taken**
Cod	597
Dab	382
Haddock	1597
Herring	919
Lemon Sole	224
Mackerel	382
Norway pout	475
Plaice	828
Saithe	337
Sprat	235
Turbot	6
Whiting	1588
R. clavata	33
R. montagui	10
R. neavus	34

Aim 2. Fisheries acoustic data were continuously collected throughout the survey at two operating frequencies (38kHz and 120kHz), using the Simrad EK60 split beam sounder. Post processing was undertaken on the 38kHz frequency only, which is considered to be the standard operating frequency for fisheries acoustic surveys. The 120kHz echogram was scrutinised in parallel with the 38kHz data to aid identification of echo targets and bad data regions.

Echograms were scrutinised and acoustic marks that could reliably be identified based on acoustic 'signature' and the trawl catch were selected. In addition the total acoustic backscatter data of 0-6m above the bottom was integrated. The acoustic data that correspond to the area covered by the trawl on the sample stations are compared to the catch data (species composition, length and weight) and are extrapolated to the between station acoustic data (partitioned in 1 n.mi intervals) to quantify demersal fish abundance in the North Sea. This work continues on the three-year EU project (CATEFA) aimed at examining the relationships between ground fish trawl catches and acoustic data. It will contribute to the acoustic ground fish database ensuring participation in future EU projects. A new software package allowed us to use seabed acoustic data, recorded on the fisheries sounders, for acoustic ground discrimination (AGDS) applications with QTC Impact. Post processing of the AGDS data from the 38kHz sounder will be undertaken at the Lowestoft laboratory and will be used in combination with data from other surveys to map the North Sea seabed.

The data quality was generally of high standard. Some bad weather days at the start of the survey and halfway through the second half had some negative impact on the quality, but this was not detrimental. Data from some stations had been contaminated with interference and these will be cleaned up when the appropriate tools are available.

Aim 3. Calibrated splitbeam echosounders allow recorded fisheries acoustic data to be used for absolute biomass calculations. Regular calibration (before and after each survey) of fisheries echosounders is recommended by ICES Working Group for Fisheries Acoustics Science and Technology (WGFAST). Although the new EK60 splitbeam echosounders on the CEFAS Endeavour are likely to be quite stable, they had not been calibrated since a period in dry-dock and target strength values were expected to be off significantly.

The evening of the 2 September CEFAS Endeavour anchored in Dales Voe (south) outside Lerwick, Shetland (60º 12.380N, 1º 09.845W). The following day the drop keel mounted Simrad EK60 splitbeam sounders (38 and 120kHz) were calibrated (0900h-1330h). After taking a CTD cast, two copper spheres with known reference target strengths were suspended below the transducer using three rods (2 on port and one on starboard). The larger 38kHz sphere was suspended by a 5m monofilament fishing line below the 120kHz sphere. Next, the 120 kHz sphere was moved around in the beam of the transducer to provide equal coverage in the whole beam. This was repeated for the 38kHz target. The new calibration settings were loaded in the software and were used to correct for the fisheries acoustic data recorded in the first half of the survey.

Aim 4. Multibeam Sonar - Multibeam data, recording 3D acoustic data of the seabed as well as the water column, were collected using a dual head Simrad EM3002 multibeam sonar, available on temporary loan from Simrad. Following malfunction during an earlier attempt on last year's survey, the data logging was routinely checked. In total 69 of the groundfish survey stations were sampled and a further 6 hard ground stations. Those stations with particularly good quality data (i.e. without any bad weather effects and with fish schools) were marked for primary attention. The seabed data will be worked up in the lab and will provide detailed information on the seabed bathymetry and roughness and where appropriate tools are available its application will be tested for seabed classification purposes. Recording water column data in 3D is only a very recent development and as part of a Seedcorn project we will explore and assess its potential applications.

Aim 5. White muscle tissue samples were collected from 15 different species for stable isotope analysis, 197 samples from 9 stations in area A and 218 samples from 12 stations in area B.

Aim 6. Using the IBTS rock hopper ground gear rigged GOV (variant D, see IBTS NS manual version VII for full details), six hauls were completed on harder ground. Three of these were offshore around the Dogger Bank and three inshore on the Yorkshire coast (Figure 1). HG1 and HG2 had to be moved further offshore due to the number of dans on the tows. HG4 hauled with 2.6 tonne of fish consisting of mainly whiting (1.35 tonne) and mackerel (0.85 tonne) and notably, 202kg of cod.

Additional Aims.

i. Photographs and sections were taken from numerous cod, haddock and lemon sole (total of 111 photographs and 91 gonad sections - see below) for use in creating a maturity identification database.

Table 4.

Species	Number of photographs	Number of gonad section samples taken per sex
Haddock	37	10 males, 7 females
Cod	35	1 males, 34 females
Lemon Sole	39	15 males, 24 females

ii. Sections of tentacle were taken from 3 species of squid for DNA analysis by Montserrat Espiñeira Fernández, Department of molecular biology and biotechnology ANFACO-CECOPESC, Vigo, Spain.

iii. Water samples were taken from 40 stations in the North Sea for caesium and tritium analysis back in the laboratory (Figure 4)

Special thanks are given to the officers and crew of Cefas ENDEAVOUR and the scientists for their positive and significant contribution to the successful completion of the survey.

DISTRIBUTION:

Basic list +

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R Humphreys	K Warr
G Engelhard	M Godard
M Eade	L Cox
G Padda	M Shaw
J Pettigrew	
S Mackinson	J van der Kooij

NFFO Hull

Figure 1.
Station positions CEFAS Endeavour 15/06.

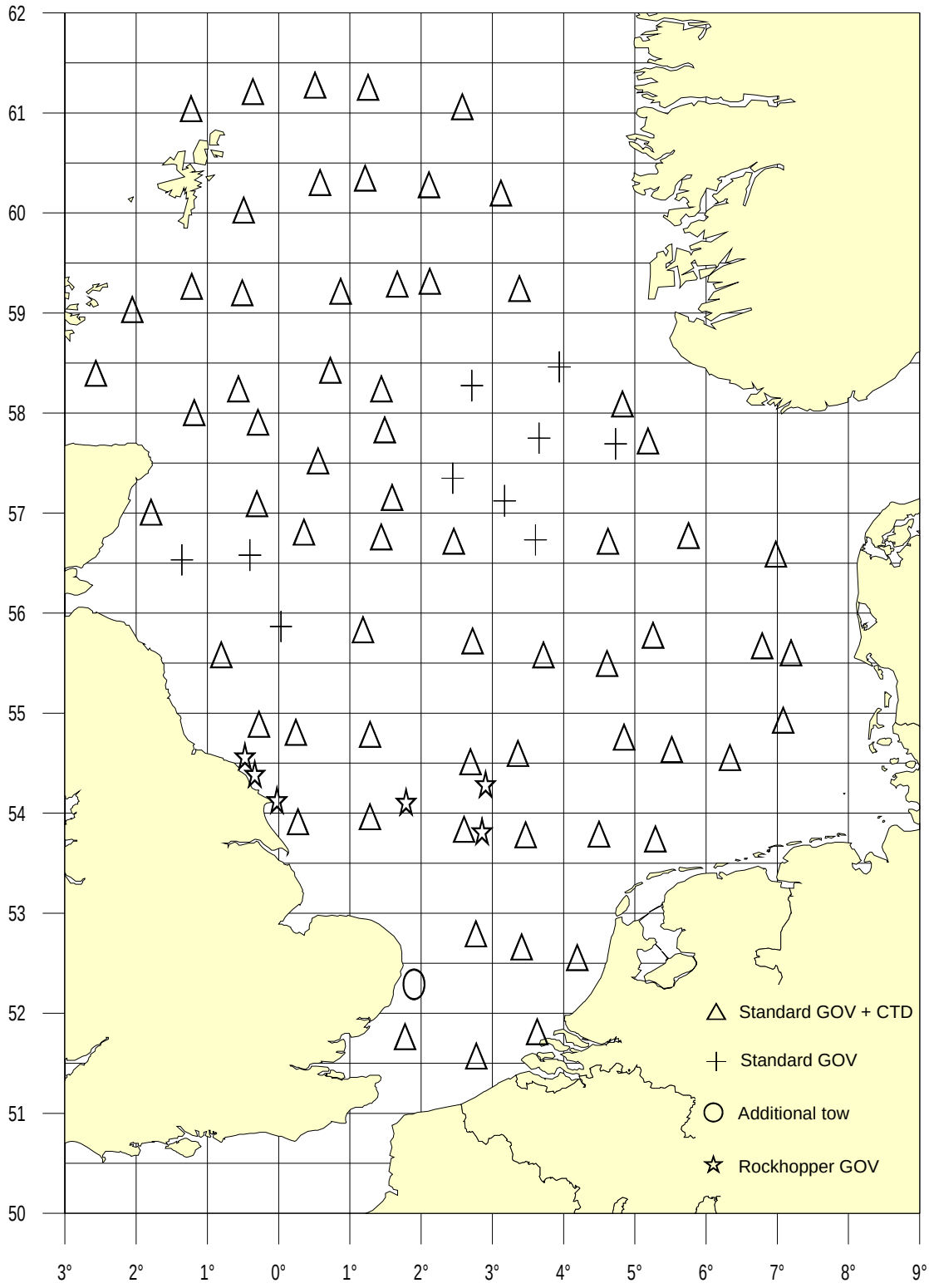

Figure 2.
Distribution and relative abundance of cod, haddock, whiting and saithe.

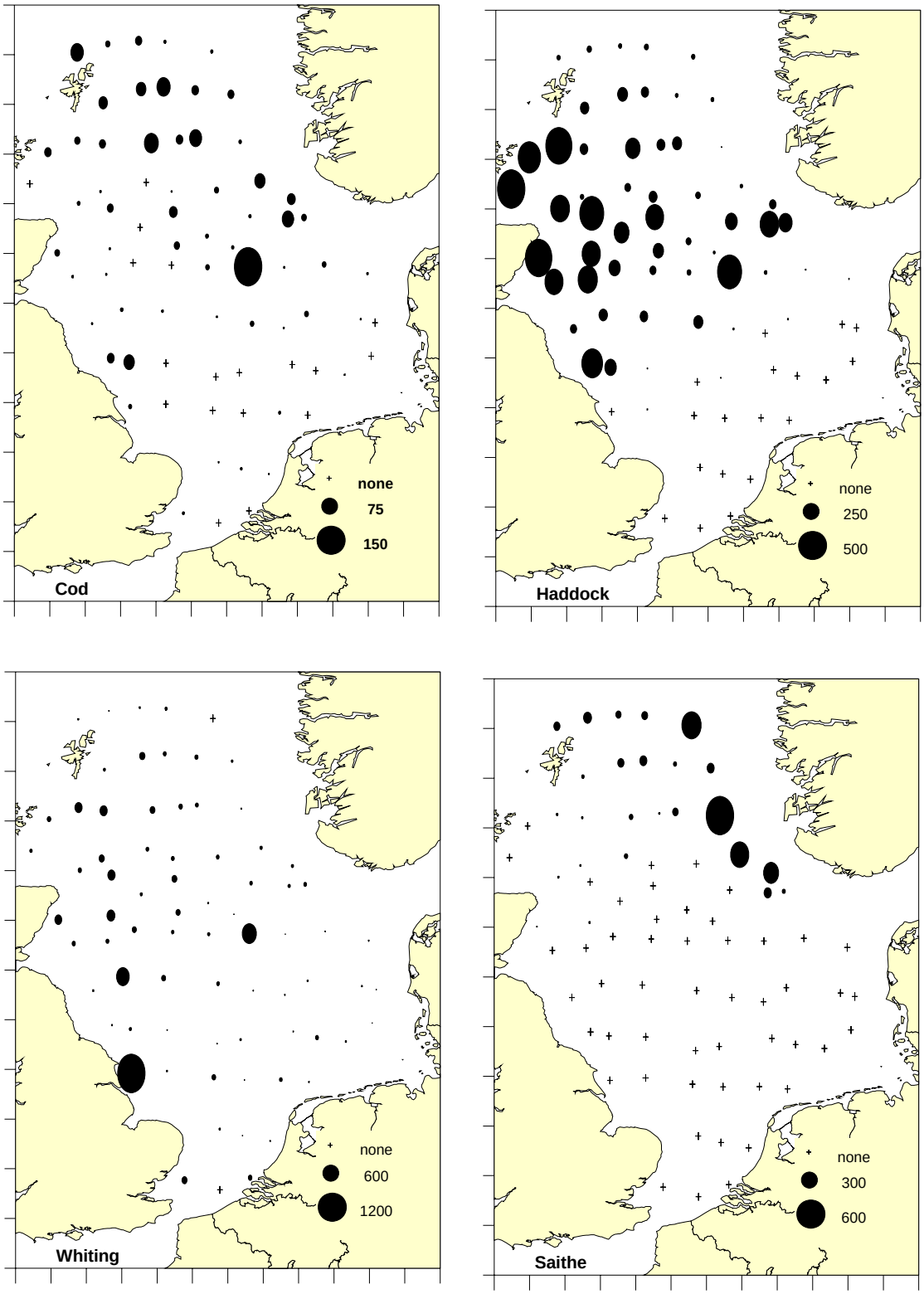

Figure 3.
Distribution and relative abundance of Norway pout, herring, mackerel and sprat.

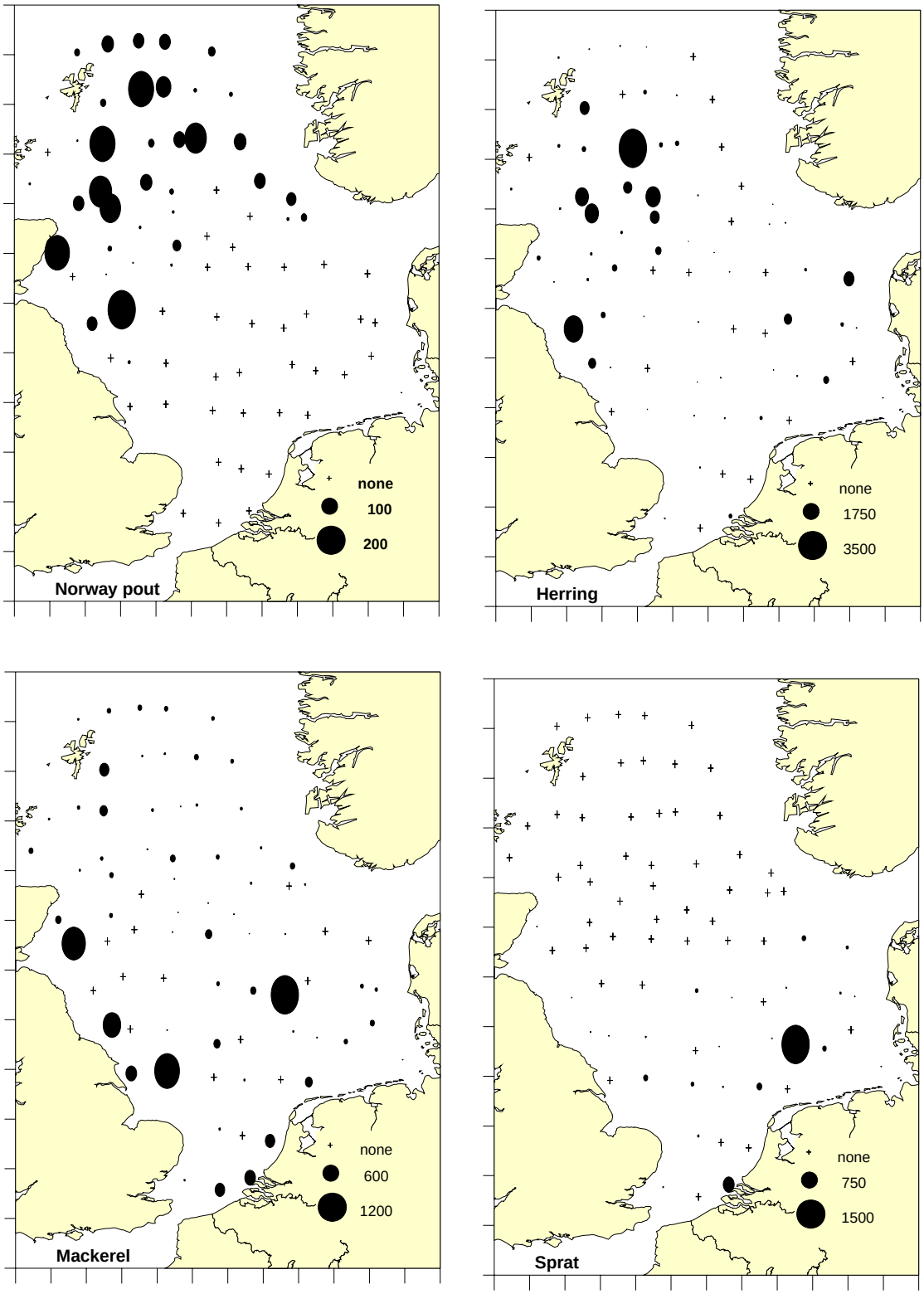

Figure 4.
Plot of positions where caesium and tritium samples were taken.