Centre for Environment Fisheries & Aquaculture Science

Cefas

RESEARCH VESSEL SURVEY REPORT

RV CEFAS ENDEAVOUR
Survey: CEND 12/23

STAFF:

1st Half (~15 days)	2nd Half (~15 days)
Staff	**Staff**
Richard Humphreys SIC	Richard Humphreys SIC
Nicola Hampton 2IC	Nicola Hampton 2IC
Georgia Robson	Georgia Robson
Louise Straker Cox	Ben Hatton
Sam Roslyn	Gary Burt
Ramon Benedet	Zach Radford
Charlie Hobbs	Pedro Warner
Hayden Close	Charlie Hobbs
Victoria Campón-Linares	Emily Roebuck
	Aaron Brazier
	Cerys Condran (Student)

DURATION: 7 August – 3 September 2023 (28 days at sea)

LOCATION: North Sea (ICES divisions 27.4a, b and c)

PRIMARY AIMS:

1. To carry out a groundfish survey of the North Sea as part of the ICES coordinated IBTS, using a hybrid 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 and anthropogenic debris.
   e) Surface and bottom temperature and salinity data using ESM2 profiler/mini-CTD logger and Niskin Bottle.
   f) Length weight & maturity information using individual fish measurements, in support of the EU Data Regulation.

SECONDARY AIMS:

2. Tag and release specimens of starry smooth-hound *Mustelus asterias*, spurdog *Squalus acanthias*, tope *Galeorhinus galeus*, common skate *Dipturus batis* species-complex, blonde ray *Raja brachyura* and cuckoo ray *Leucoraja naevus,* in support of the ICES Working Group for Elasmobranch Fishes work to inform on stock units for demersal elasmobranchs.

3. To freeze any unusual fish species for subsequent identification / verification in the laboratory, including specimens of eelpout (*Zoarces, Lycodes* and *Lycenchelys*), sea scorpions (Cottidae, sub-area IVa only), and any unusual fish species, which may also be used in otolith research (G Burt – Cefas, Lowestoft).

4. To retain any dead specimens of tope (*Galeorhinus galeus*) and common skate (*Dipturus batis* species-complex) for biological studies (J Ellis – Cefas, Lowestoft).

5. Retain any dead specimens of shad and lamprey for biological studies (T Basic – Cefas, Lowestoft).

6. Collect fisheries acoustic continuously data at five operating frequencies (38, 70, 120, 200 and 333kHz), using the Simrad EK80 split beam sounder. The data will contribute to the existing time series of acoustic data in the North Sea and will be used as part of a study monitoring changes in mackerel distribution and abundance (J Van Der Kooij – Cefas, Lowestoft).

7. Cetacean observations will be recorded where possible and sent to the Sea Watch Foundation.

8. Identification, count, measure and weigh all jellyfish caught in GOV trawl will allow the continuation of the North Sea August Jellyfish dataset started in 2012; As the dataset grows from year to year, this should allow the evaluation of changes in jellyfish community and biomass with time (S Pitois – Cefas, Lowestoft).

9. Collect squid egg samples to map spawning grounds. This could be highly relevant in studying squid stock's structure. Retain any specimens of *Loligo* vulgaris (not *L. forbesi* – keep all if in doubt) and all *ommastrephidae* squids (*Illex, Todaropsis, Todarodes*) for maturity and age analysis, respectively. 25 *Alloteuthis* are to be retained for maturity and age analysis (V Laptikhovsky – Cefas, Lowestoft).

10. Collect, retain and filter surface water samples from Ferrybox underway water supply every 12 hours (or once a day) for subsequent chlorophyll sampling in support of SLA25 (N Greenwood – Cefas, Lowestoft).

11. Zooplankton plankton sampling using ring net to collect sample from the Gabbard smart buoy site (S Pitois – Cefas, Lowestoft).

12. Collect queen scallops (queenies) *Aequipecten opercularis* to allow for experimental work on ageing, for L/W relationship analysis, development of length to height parameters and, to provide specimens to Bangor University for further work which will be made available to ICES WGScallop (J Harvey – Cefas, Lowestoft)

13. To collect specimens of *Alloteuthis* sp. with associated photography for identification studies into the potential increase of *A. media* in UK waters. (P White - Cefas, Weymouth).

14. Collect additional data from dead skates and rays (males: testes weight and outer clasper length; females: ovary weight and shell gland width) and collect a section of vertebral column comprising ca. 6-8 vertebrae from that part overlying the body cavity; samples to be kept frozen - as part of Defra project C8503. (J Ellis – Cefas, Lowestoft).

15. Genomic sampling of particular fish species to improve the methodology to assess finfish, pelagic, data-limited-stocks as part of Defra project C8503. (D Murray – Cefas, Lowestoft).

NARRATIVE

All times stated are GMT.

RV Cefas Endeavour, henceforth referred to as CEND 12/23, was due to sail on the late-evening tide 4 August, but due to technical issues before departure, it was necessary to delay departure of the survey until the issues could be resolved. The vessel sailed from Lowestoft at 1400hr on Wednesday 7 August. There were nine Cefas scientific staff on board.

A standard day consisted of collecting surface and bottom water samples at the start and end of the day to provide salinity samples and chlorophyll samples as part of the primary aim, along with deployment of an ESM2 profiler to measure environmental parameters through the water column (temperature, salinity, fluorescence, light, turbidity, and dissolved oxygen). Between these deployments, up to four 30-minute tows with the standard IBTS rigged GOV (Grand Overture Verticalé) trawl were planned. Since 2014, the net used during this survey has been a polyethylene net with nylon sleeve and cod-end. Throughout the survey, fisheries acoustic data were collected continuously at five operating frequencies (38, 70, 120, 200 and 333kHz), using the Simrad EK80 split beam sounder.

On 7 August CEND 12/23 departed the port of Lowestoft and transited to prime station 1 to begin this year's survey. Due to the loss of time, the vessel did not divert to the West Gabbard smart buoy site to collect a plankton sample. Once at prime station 1 an ESM2 profiler and Niskin water sampler were deployed successfully, before completing a GOV trawl. The catch was relatively small (113 kg) but similar in size and composition to previous years (124 kg in 2022), with Starry smooth-hound (43 kg) and whiting *Merlangius merlangus* (38 kg) making up most of the catch. Due to the distance to the next prime station and daylight hours running out, this was the only fishing activity that could be completed. Of note, five starry smooth-hounds tagged and released.

On 8 August at first light CEND 12/23 deployed the GOV trawl at prime station 2, but after 16 minutes with erratic headline and wing sensor readings, the trawl was recovered to find significant net damage. While repairs were completed, a new trawl site was located due west of the original location and after 5 hours of repair, a successful GOV deployment was completed at prime station 2 (74 kg). CEND 12/23 continued east to prime station 3, just off the coast of the Netherlands. Because of the delay due to gear damage, prime station 3 was the final trawl of the day and yielded the largest catch (194 kg). This consisted mainly of starry smooth-hounds (88 kg) and whiting (69 kg). Of note "0-group" plaice *Pleuronectes platessa*, dab *Limanda limanda,* and a long-snouted seahorse *Hippocampus guttulatus* were sampled at prime station 2, along with three starry smooth-hounds being tagged and released.

Overnight, CEND 12/23 headed north to prime station 6 and resumed fishing activity at first light. A successful GOV trawl was completed (413 kg) and contained mainly mackerel *Scomber scombrus* (275 kg) and "0-group" horse mackerel *Trachurus trachurus* (107 kg). CEND 12/23 continued west, completing prime stations 5 (86 kg) and 4 (70 kg). Both catches had reduced weight from that observed in 2022 (prime station 5, 1894kg and prime station 4, 1731 kg). Prime station 5 consisted mainly of pilchard *Sardinia pilchardus* (46 kg) and mackerel (30 kg), this is the furthest north that pilchard have been recorded in these numbers on the survey. The catch at prime station 4 was made up of whiting (16 kg) and starry smooth-hound (12 kg). In previous years on prime stations 6 and 5 large amounts of hornwrack *Securiflustra securifrons* have been

observed, but none was recorded this year at either station. Of note, a second long snout sea horse was caught at prime station 6.

On August 10 CEND 12/23 began the day at prime station 9, successfully completing a GOV trawl. The trawl was the largest catch of the day at 451 kg but still smaller than the 1107 kg caught in 2022 and consisted mainly of dab (141 kg) and juvenile whiting (121 kg). CEND 12/23 continued east throughout the day, successfully completing GOV trawls at prime stations 10 (130 kg), 11 (135 kg) and 12 (270 kg) before, ending the day north of the Netherlands West Frisian islands. The catches at prime stations 10, 11 and 12 were all similar weights and catch compositions to previous years. Of note "0-group" horse mackerel were recorded at prime station 12 (113 kg).

After a short steam overnight to prime station 18, CEND 12/23 successfully completed a GOV trawl (319 kg), before continuing east, successfully completing prime stations 19 (319 kg), 20 (545 kg) and 21(216 kg). Prime station 18's catch contained mainly juvenile whiting (148 kg) and plaice (61 kg), prime station 19 juvenile whiting (86 kg) and sprat (51 kg) *Sprattus sprattus,* the catch at prime station 20 consisted of juvenile herring (248 kg) *Clupea harengus* and sprat (248 kg), and prime station 21 mackerel (151) and "0-group" horse mackerel (11.8 kg).

August 12 began at first light with a GOV trawl at prime station 30 (85 kg). During the trawl static gear was spotted and the gear was retrieved early (15 minutes), the catch was consistent in composition to previous years, so the decision was made to move on to the next station. The haul consisted mainly of dab (44 kg) and mackerel (15 kg). The survey completed successful GOV trawls at prime stations 29 (474 kg), 39 (290 kg) and 38 (470 kg) with all catches consistent with previous years catches. Prime station 29 contained mainly sprat (235 kg) and dab (131 kg), prime station 39 saw herring (100 kg) and haddock (45 kg) recorded and prime station 38's catch consisted of haddock *Melanogrammus aeglefinus* (245 kg) and dab (72 kg). Of note, "0-group" herring and juvenile herring were caught at prime station 29.

CEND 12/23 began the day at prime station 28, with a successful GOV trawl (1571 kg). This was to be the largest catch of the day and predominantly contained haddock (1138 kg), dab (190 kg) and whiting (148 kg). The vessel then continued west, completing prime stations 27 (233 kg), 26 (1098 kg) and 25 (235 kg). Prime station 27 contained mainly mackerel (121 kg) and haddock (43 kg), prime station 26 recorded sprat (456 kg) and juvenile herring (356 kg) and prime station 25's catch was mainly haddock (137 kg), whiting (34 kg) and dab (32 kg). With just over 3 tonnes caught and all four stations yielding higher catch weights than in 2022, this was the busiest day so far of the survey. Of note, ten snake blennies *Lumpenus lampretaeformis* were caught at prime station 28 (Figure 1) and "0-group" herring at prime station 26.

Figure 1. Snake blennies at prime station 28

Overnight, CEND 12/23 headed south to prime station 17 and at first light successfully deployed the first GOV trawl (269 kg). Once completed, the survey travelled west throughout the day, with catch weights increasing as the day progressed. Successful trawls were completed at prime stations 16 (321 kg), 8 (524 kg) and 7 (573 kg). All four catches contained species compositions similar to previous years, with dab and whiting at all stations. Prime station 17 contained mainly dab (63 kg), whiting (50 kg) and sprat (46 kg), prime station 16's catch was mackerel (205 kg) and dab (60 kg), prime station 8 yielded sprat (269 kg) and whiting (201 kg), and prime station 7 saw whiting (500 kg) and dab (38 kg) recorded. Of note, one 140cm tope *Galeorhinus galeus* (19.56 kg) was tagged and released at prime station 16.

August 15 started with a successful GOV trawl at prime station 15 (409 kg). The catch was made up mainly of whiting (160kg), haddock (88 kg) and dab (67kg) and was a larger catch than in 2022 (86 kg). Once completed CEND 12/23 travelled west, completing trawls at prime stations 14 (280 kg) and 13 (3435 kg). Prime station 14 was made up of haddock (155 kg) and whiting (80 kg) and prime station 13 was not only the largest catch so far this year, but also the largest single species weight caught on the entire survey, as the catch contained mostly spawning herring (3319 kg of the 3435 kg). The catch at prime station 13 also contained haddock (75 kg) and whiting (23 kg) (Figure 2).

Figure 2 Spawning herring at prime station 13.

Overnight, CEND 12_23 transited to prime station 77 (296 kg) and began the day with a successful GOV trawl then proceeded east completing prime stations 22 (985 kg), 23 (1726 kg) and 24 (591 kg). All four catch compositions and catch weights were consistent with the 2022 survey and mainly contained whiting and haddock at every station. Prime station 77's catch mostly contained mackerel (186 kg), whiting (28kg) and haddock (21 kg), prime station 22 yielded haddock (358 kg), whiting (289 kg) and herring (200 kg), prime station 23 saw whiting (813 kg), haddock (502 kg) and herring (237 kg) recorded, and the catch at prime station 24 consisted of herring (248 kg), haddock (170 kg) and sprat (119 kg).

August 17 at first light saw a successful GOV trawl completed at prime station 33 (609 kg) and then continued west to prime stations 32 (597 kg) and 31 (212 kg) with all three completed prime stations having similar catch weights and catch compositions to that seen in 2022. Prime station 33 contained mainly mackerel (238 kg), haddock (222 kg) and whiting (96 kg), prime station 32 saw haddock (260 kg), mackerel (136 kg) and whiting (64 kg) recorded, and prime station 31's catch was haddock (63 kg), herring (63 kg) and plaice (26 kg). Once all prime stations were completed, CEND 12/23 transited to Peterhead for a scheduled crew change.

On 19 August, CEND 12/23 left the port of Peterhead at 1300hr and travelled to prime station 40. Despite poor weather conditions, a successful GOV trawl was completed (646 kg). The catch contained mainly

haddock (366 kg), herring (48 kg) and whiting (28 kg). Due to the geographical location, no other station was possible within daylight hours on this day.

After an overnight transit to prime station 41, the day began with a GOV trawl. This was to be the smallest catch of the day (253 kg) and contained mainly haddock (139 kg) and whiting (33 kg). The second GOV trawl of the day at prime station 76 needed to be moved due to commercial vessel activity at the site, so a new trawl location was found to the north of the original station and a successful trawl was deployed and recovered (552 kg). The catch contained mainly epi-benthos (278 kg), the majority of this was purple heart urchins *Spatangus purpureus*, which was also the case in 2022 and 2021. The next trawl at prime station 46 was the largest of the day (1453 kg) and mainly consisted of herring (686 kg), haddock (525 kg) and whiting (187 kg).

On 21 August, work began at first light with a GOV trawl at prime station 34 (830 kg). Throughout the day, CEND 12/23 completed prime stations 42 (830 kg), 43 (859 kg) and 35 (320 kg). All catch compositions were similar to previous years at these prime stations and comprised mainly of haddock and herring. Prime station 34 saw herring (454 kg), haddock (186 kg) caught, prime station 42 yielded haddock (355 kg) and herring (238 kg), prime station 43's catch consisted of haddock (573 kg), herring (67kg), while prime station 35 was abundant in haddock (194 kg).

CEND 12/23 started the following day with a GOV trawl at prime station 37 (483 kg). This yielded a catch very similar in size and composition to previous years, with dab (285 kg) being the most abundant species. Once completed RV Cefas Endeavour moved west, completing prime stations 36 and 44. Prime station 36 was the smallest catch of the day (187 kg) and contained mainly haddock (51 kg) and dab (51kg). Prime station 44 (929kg) was a problematic station, with extremely low headline readings on the first attempt and extremely high readings on the second attempt, both down to issues with the kite. A successful trawl was completed on the third attempt but unfortunately, the delays cost us the time we needed to reach prime station 48 to deploy in daylight so this was postponed until the next day.

After transiting overnight, a GOV trawl was completed at prime station 48 (601 kg) at first light. Once completed CEND 12/23 went on to complete prime station 49, recording the largest catch here in recent history (623 kg), as well as prime station 50 (397 kg) and prime station 58 (281kg). The first trawl of the day started off with a water depth of 68 m and became deeper throughout the day; 85 m at prime station 49, 106m at prime station 50 and the deepest of the survey so far this year, 165m at prime station 58. The catch compositions were similar to previous years with prime station 48 yielding mainly haddock (438 kg) and cod *Gadus morhua* (61 kg Figure 3), prime station 49 saw haddock (326 kg) and mackerel (99 kg), prime station 50 yielded haddock (179 kg) and mackerel (52 kg), while prime station 58 saw haddock (82 kg) and whiting (75 kg) recorded. Of note, all prime stations today had adult and juvenile cod in the catches with 61 kg, 48 kg, 37 kg and 17 kg, respectively.One curled octopus *Eledone cirrhosa* was caught at prime station 48 and a wolf fish *Anarhichas lupus* was caught at prime station 50.

Figure 3. cod caught at prime station 58

August 24 started at first light with a GOV trawl at prime station 57 (622 kg) before moving west and completing prime stations 56 (325 kg), 55 (456 kg) and 47 (543 kg). Due to the geographical locations of the stations, completing 4 prime stations was always going to be difficult, with 110 nm to travel excluding trawling time. The day could not have gone any better and all four GOV trawls were completed successfully with no issues. Prime station 57 contained mainly blue whiting *Micromesistius poutassou* (220 kg) and whiting (137 kg), prime station 56 yielded haddock (265 kg), prime station 55 saw haddock (218 kg) and whiting (88 kg) recorded, and prime station 47's catch was abundant in haddock (313 kg) and mackerel (89 kg).

After a short transit overnight, CEND 12/23 started the day at prime station 54 with a successful GOV trawl (225 kg), with the catch considerably smaller than in 2022 (2243 kg). This was mainly due to the absence of herring caught in the previous year (1877 kg). This year's catch was made up primarily of gadoids; cod (50 kg), haddock (44 kg) and whiting (46 kg). The second GOV trawl of the day at prime station 45 (4851 kg) was the largest catch of the survey so far this year and the largest single species weight in one catch, with herring (4185 kg) being the dominant species in the catch. The survey went on to complete prime station 53 (897 kg) and 52 (846 kg). As similar fish abundance was observed on the EK80 at prime station 53, to mitigate for potential safety issues, the trawl duration was reduced to 20 minutes. Of note over 6.8 tonnes were caught over all stations today.

On 26 August, work began at first light with a successful GOV trawl at prime station 51 (862 kg). Once completed the RV Cefas Endeavour continued to prime stations 59 (1244 kg), 60 (664 kg) and 61 (358 kg). The top caught species in the first three stations was haddock and these three catches all contained similar catch compositions to 2022. During the day, an invalid station at prime 59 occurred due to a headline sensor failure. This led to a delay which resulted in only being able to complete a 15-minute tow at prime station 61, due to failing light. The catch at prime station 61 was smallest of the day for this reason and contained mainly saithe *Pollachius virens* (111 kg) and whiting (73 kg). Of note, two flapper skate *Dipturus intermedius* were caught and released, with one tagged at prime station 59 (Figure 4).

Figure 4. flapper skate being tagged prime station 59.

CEND 12/23 began the following day with a GOV trawl at prime station 66 (690 kg) which was the smallest catch of the day, before completing prime stations 67 (1671 kg) and 68 (1112 kg). Herring and haddock dominated all catches throughout the day, as was the case in previous years at these prime stations. Catch weights for all three prime stations combined (4765 kg) was down on 2022 (5585 kg) at the same locations.

August 28 began at first light with a successful GOV trawl at prime station 62 (350 kg) before moving on and completing prime stations 63 (903 kg), 64 (871 kg) and 65. All four catches were primarily gadoids, with haddock the most abundant species as was observed in 2022. Prime station 62's catch contained mainly haddock (128 kg) and saithe (85 kg), prime station 63 yielded haddock (512 kg) and cod (185 kg), prime station 64 saw haddock (850 kg) and whiting (59 kg) recorded, while prime station 65's catch was abundant in horse mackerel (83 kg) and Norway pout *Trisopterus esmarkii* (55 kg). Of note, cod were caught at prime station 63 (185 kg, ranging from 29 cm – 106 cm.

On 29 August, CEND 12/23 began the day at prime station 70 with a successful GOV trawl (704 kg), before continuing and completing prime stations 69 (347 kg) and 75 (513 kg). All three catches were similar in composition and size to previous years. The catch at prime station 70 was made up of primarily of horse mackerel (253 kg) and mackerel (148 kg), prime station 69's catch was abundant in haddock (178 kg) and horse mackerel (54 kg), and prime station 75 saw blue whiting (390 kg) and epibenthos (28 kg) recorded. Erratic headline readings led to the trawl at prime 75 being retrieved after 20 minutes, but with no gear damage and the catch consistent with previous years, the trawl was considered valid.. Of note, juvenile and adult blue whiting were caught at prime station 75 which was also the deepest station of the survey at 229 meters.

August 30 began in the morning with a successful trawl at prime station 74 (377 kg). The vessel then continued west throughout the day completing prime station 73 (200 kg), 72 (127 kg) and 71 (267 kg). The trawls at these locations were not possible last year due to time constraints, but catches were significantly lower than observed in 2021(most noticeably the 3t+ mackerel caught in 2021), but catches weights and compositions were similar to 2021 at all four stations.

The next day began in rectangle 50E9 to do a GOV trawl on behalf of Marine Science Scotland. The catch weighed 322kg in total and consisted primarily of mackerel (100 kg), Norway pout (40 kg) and haddock (39

kg). CEND 12/23 then went on to complete prime station 66 (322 kg) for the second time. The catch at this prime station was half the weight of the first time we sampled at this location four days prior (690 kg), but the catch composition was similar. Of note, two wolf fish were tagged and released here. After completing this station , CEND 12/23 began the final journey south to Lowestoft and docked at 1200 hr on 3 September, concluding this year's survey.

Special thanks are given to the scientists and ship's crew of the RV Cefas Endeavour (CEND 12/23) for their enthusiasm and hard work throughout the survey.

RESULTS:

PRIMARY AIMS:

1. To carry out a groundfish survey of the North Sea as part of the ICES coordinated IBTS…

Due to technical issues prior to the survey and gear damage at prime station 2, around four days of survey time was lost this year. Despite the early setbacks CEND 12/23 managed to catch up lost time and complete all survey stations and two additional stations. A valid haul with the GOV trawl was completed at 79 prime stations (Table 1, Figure 5). Surface and bottom salinity samples were collected at 45 sites by ESM2 and Niskin water sampler.

Gear: The survey was fished using a hybrid GOV trawl (polyethylene trawl with a nylon sleeve and cod-end). GOV working trawl #1 was used for the entire survey. Net geometric sensors were used to monitor headline height, wing spread, and door spread (Figure 6).

Catches: At each station, the catch of each species was weighed and all fish, or representative sub-samples, were measured. Table 2 ranks the top 15 fish species by weight, compared to that seen over the previous four years, whilst Table 3 lists the species that were weighed and measured/counted across the survey's prime stations. Table 4 shows the number of fish sampled for age determination and other biological information. All data were recorded to computer database using Cefas' Electronic Data Capture system and uploaded to the Fishing Survey System (FSS). Figure 7 shows the length distribution of cod, haddock, whiting, saithe, Norway pout, herring, mackerel, sprat, plaice and hake (*Merluccius merluccius*), with the distribution and relative abundance (raised numbers per hour) of these species given in Figures 8–17.

Table 1: Gear deployments on the English IBTS Q3 2022 survey.

Gear	Valid	Additional	Invalid	Total
GOV (IBTS standard gear)	79	0	2	81
ESM2+Niskin	45	0	0	45

Table 2: Top 15 fish species (by total catch weight) in 2023 and corresponding catch weights in preceding years. Note: Species that were ranked in the top 15 species in earlier years, but were outside the top 15 in 2023, are not shown.

Common English Name	Scientific Name	2023 weight (kg)	2022 weight (kg)	2021 weight (kg)	2020 weight (kg)	2019 weight (kg)
Herring	*Clupea harengus*	14221	13572	7836	16338	5553
Haddock	*Melanogrammus aeglefinus*	13168	13678	6393	8375	2828
Whiting	*Merlangius merlangus*	5209	6945	5355	4961	3756
Mackerel	*Scomber scombrus*	3524	6297	4819	3862	2273
Dab	*Limanda limanda*	1921	2834	3023	3226	3665
Sprat	*Sprattus sprattus*	1764	1855	3232	2730	5984
Horse mackerel	*Trachurus trachurus*	1552	1979	956	1986	3838
Norway pout	*Trisopterus esmarkii*	872	1265	2321	3513	1224
Blue whiting	*Micromesistius poutassou*	795	88	759	370	240
Cod	*Gadus morhua*	775	453	516	355	324
Saithe	*Pollachius virens*	524	231	319	271	972
Plaice	*Pleuronectes platessa*	498	411	374	285	386
Grey gurnard	*Eutrigla gurnardus*	392	614	545	795	850
Long-rough dab	*Hippoglossoides platessoides*	272	278	260	376	323
Lesser-spotted dogfish	*Scyliorhinus canicula*	222	183	216	140	247

Table 3: Fish, cephalopods and commercial shellfish caught and number of prime stations where they were recorded.

Scientific Name	Common English Name	Stns	Scientific Name	Common English Name	Stns
Engraulis encrasicolus	European anchovy	3	*Loligo forbesi*	northern squid	35
Argentinidae	argentines	33	*Octopodidae*		13
Alloteuthis subulata	European common squid	20	*Todaropsis eblanae*	lesser flying squid	5
Trisopterus luscus	bib pouting	8	*Sardinia pilchardus*	pilchards	6
Scophthalmus rhombus	brill	5	*Hippoglossoides platessoides*	American plaice (long rough dab)	55
Raja brachyura	blonde ray	2	*Pleuronectes platessa*	plaice	62
Capros aper	boarfish	7	*Maurolicus muelleri*	pearlside	1
Myoxocephalus scorpius	bullrout	6	*Trisopterus minutus*	poor cod	33
Pholis gunnellus	butterfish	1	*Agonus cataphractus*	pogge (Armed bullhead)	13
Anarhichas lupus	wolf-fish	5	*Pollachius virens*	saithe	24
Callionymus lyra	common dragonette	35	*Gobius spp.*	gobies	4
Gadus morhua	cod	50	*Aequipecten opercularis*	queen scallop	18
Cancer pagurus	edible crab	12	*Rossia macrostoma*	stout bobtail	8
Sepia officinalis	cuttlefish	1	*Lumpenus lampretaeformis*	snake blenny	6
Leucoraja naevus	cuckoo ray	11	*Pecten maximus*	scallop	4
Limanda limanda	dab	64	*Arnoglossus laterna*	scaldfish	19
Galeus melastomus	black-mouth dogfish	1	*Raja montagui*	spotted ray	4
Squalus acanthias	spurdog	6	*Mustelus asterius*	starry smooth-hound	10
Dicentarus labrax	European sea bass	1	*Callionymus maculatus*	spotted dragonette	21
Platichthys flesus	flounder	4	*Dipturus intermedia*	flapper skate	1
Enchelyopus cimbrius	four-bearded rockling	18	*Solea solea*	Dover sole	4
Galeorhinus galeus	tope	1	*Buglossidium luteum*	solenette	17
Phycis blennoides	greater fork beard	1	*Sprattus sprattus*	sprat	28
Syngnathus acus	greater pipefish	3	*Sepiolidae*	cuttlefish (without cuttlebone)	10
Hyperoplus lanceolatus	greater sandeel	6	*Illex (loligo) illecebrosus*	northern shortfin squid	31
Eutrigla gurnardus	grey gurnard	70	*Gadiculus argenteus*	silvery pout	15
Aspitrigla cuculus	red gurnard	5	*Amblyraja radiata*	starry ray	25
Melanogrammus aeglefinus	haddock	65	*Microchirus variegates*	thickback sole	2
Hippoglossus hippoglossus	halibut	1	*Raja clavata*	thornback ray	5
Clupea harengus	herring	70	*Trigla lucerna*	tub gurnard	8
Myxine glutinosa	hagfish	5	*Scophthalmus maximus*	turbot	5

Merluccius merluccius	hake	30	*Lophius budegassa*	white anglerfish (black bellied)	3
Trachurus trachurus	horse mackerel	71	*Trachinus draco*	Greater weever fish	2
Zeus faber	John dory	1	*Trachinus vipera*	lesser weever	12
Homarus gammarus	lobster	1	*Micromesistius poutassou*	blue whiting	15
Lithodes maja	stone crab	18	*Merlangius merlangus*	whiting	78
Microstomus kitt	lemon sole	59	*Glyptocephalus cynoglossus*	witch	21
Molva molva	common ling	8	*Helicolenus dactylopterus*	blue mouth redfish	19
Loligo vulgaris	European squid	1			2
Scyliorhinus canicula	lesser spotted dogfish	27			
Scomber scombrus	European mackerel	68	*Todarodes saggittatus*	flying squid	1
Lepidorhombus whiffiagonis	megrim	10	*Ammodytes tobianus*	small sandeel	1
Necora puber	velvet swimming crab	3	*Spondyliosoma cantharus*	black seabream	1
Lophius piscatorius	anglerfish (monkfish)	33	*Hyperoplus immaculatus*	immaculate sandeel	2
Mullus surmuletus	red mullet	10	*Callionymus reticulatus*	reticulated dragonet	2
Nephrops norvegicus	Norway lobster	15	*Sepia elegans*	elegant cuttlefish	2
Phrynorhombus norvegicus	Norwegian topknot	1	*Dasyatis pastinaca*	common stingray	1
Trisopterus esmarki	Norway pout	41	*Hippocampus guttulatus*	long-snouted sea horse	3

Table 4: Number of biological samples taken for ageing by species.

Common English Name	Number of samples taken
Haddock	1921
Whiting	1876
Plaice	1554
Herring	1284
Norway pout	434
Cod	414
Mackerel	386
Saithe	259
Dab	213
Lemon sole	212
Grey gurnard	199
Hake	112
Anglerfish (monkfish)	65
Blue-mouth redfish	60
Striped red mullet	42
Witch	35
Ling	23
Tub gurnard	20
Sole	13
Red Gurnard	12
Brill	6
Turbot	5
Black-bellied anglerfish	5
Black sea bream	3
John dory	1
Starry smooth-hound	139
Starry ray	71
Cuckoo ray	37
Black-mouth dogfish	25
Spurdog	23
Spotted ray	21
Thornback ray	14
Wolf fish	9
Blonde ray	5
Tope	1
Common stingray	1
Flapper skate	1
Total	9501

Gadiformes

Total cod catches during the 2023 survey (775kg; Table 2) were higher compared to 2022 (453 kg) and at a five year high. This was also true of their distribution (Table 3), seen at 8 more prime stations than last year (50, compared to 42 in 2022). The number of individuals caught across the survey was also higher than in the previous year (n = 427, compared to n = 383 in 2022). The numbers of <15 cm cod was also up slightly in comparison to previous years (n= 12 individuals compared to n = 9 individuals in 2022) but was still reduced compared to catches in earlier years (n = 76 in 2021 and n = 263 in 2020). The numbers of juvenile fish observed in 2022 may account for the increase in 2023 catch weights as the 2022 year class grows and matures and this can be seen in the length distributions. Individuals >35cm made up 65.8 % of the total catch weight this year (45.4% in 2022), but individuals between 15cm-35cm made up only 31.3 % of this year's total weight compared to 49.2% in 2022 (Figure 7a). The increased catch numbers this year has resulted in higher catch weights compared to 2022. However, the lack of sampling of six prime stations and the relocation of five prime stations into shallower water in 2022 may have resulted in the lower catch numbers last year. The increased catch numbers this year has resulted in a higher number of biological samples being collected, with 414 taken, compared to 361 in 2022 (Table 4). Cod <12 cm are not sampled for age (assigned as 0-groups).

Haddock catches were slightly down with 13.16t caught compared to 13.678 t in 2022 but was still over double the catch of 6.161 t in 2021. Despite the haddock catch weight being lower than in 2022, the overall distribution was higher this year, with haddock caught at 65 prime stations (6 more than in 2022). The increase in spatial distribution resulted in 1921 haddock otoliths being collected, compared to 1553 in 2022. There was also an increase in the number of individuals being measured this year (n=8125 compared to n=7499 in 2022). Catches containing 0-group and juvenile haddock from the last year has continued and is evident in the length distribution observed on this year's survey (Figure 7b) but there is a significant decrease in individuals <15cm with only 2.6 % compared to 23.3% in 2022).

The trend of increasing whiting catch weights over the last few years ended this year, with a decrease (5290 t, compared to 6.945 t in 2022). Despite catch weights being down, whiting was caught on more prime stations than in 2022 (78 compared to 70 in 2022), but as in 2022 it remained the most spatially abundant fish species on the survey, caught at 78 of the 79 stations sampled. Despite the decrease in catch weights, the increase in catch distribution meant the numbers of biological samples collected increased (1876 in 2023 compared to 1502 in 2022). The numbers of individuals measured this year also increased (n=10186, compared to n=7623 in 2022). The increase in both biological samples, lengths, and spatial distribution, could be attributed to completing eight more stations than in 2022. As in 2022, two distinct length classes can be seen in the length distribution plot between 0-23 cm and 23-36+ cm (figure 7c). In total, 12.5 % of all whiting caught this year were under 14 cm compared to 15.6 % in 2022. Whiting <12 cm were caught at 53 of the 79 prime stations this year, compared to 44 of the 71 prime stations in 2022.

The total saithe catch weight was up to a four-year high of 524 kg, compared to the 231 kg recorded in 2022. This is the largest total catch weight recorded for saithe since the 972 kg caught in 2019. The spatial distribution increased from 2022 (24 prime stations, compared to 15 last year) but with no large catches of saithe being recorded at any single station, as had been seen in recent years. The increased spatial distribution and catch weight this year resulted in an increase in biological samples with 259 otoliths collected, compared to 103 the previous year. This increase in numbers and weights could be partially

attributed to achieving all the primary fishing stations this year, as last year some of the deeper prime stations where this species is regularly caught were not achieved.

Norway pout catches (872 kg) were lower than in 2022 (1.265 t) and were at a five-year low for this species. Despite the decrease in catch, the spatial distribution has increased, with Norway pout caught at 41 stations compared to 36 last year. Norway pout have a limited length range and so otolith sample numbers are normally consistent year on year, but with the increased spatial distribution this year, more otoliths were taken (434 compared to 268 in 2022). As with whiting, Norway pout had two distinct length cohorts (5–10 cm and 11–20 cm; Figure 7e) as in previous years. Norway pout under <10 cm are not sampled for age (assigned as 0-groups) and this year n=108 individuals were categorised as such, compared with n= 128 in 2022. The numbers of individuals measured this year is comparable to 2022 despite the decrease in catch and increase in abundance (n=4604 compared to n=4267 in 2022) but only 33.3% of the total Norway pout caught this year were <10 cm compared to 63.2 % last year. Despite the increased spatial distribution and larger individuals caught (66.3% >10 cm individuals caught compared to 37.3% in 2022), the deceased catch weights means smaller catches were caught at individual stations compared to previous years.

Hake caught this year were higher in catch weight than in previous years (104 kg compared to 38 kg in 2022) but for the fourth year in a row, was not in the top 15 fish species by total catch weight (ranked 20, compared to the rank of 25 in 2022). This is a slight upturn in a declining trend since 2016 (where 1.084 t were caught). The spatial distribution of hake has increased, being seen at 30 stations compared to 23 last year. The numbers of individuals caught (n = 113) and biologically sampled (n = 112) this year were both higher than in 2022 (n = 40 and 40, respectively). The increase in numbers and weights could partly be attributed to not achieving some of the deeper prime stations last year where historically the survey has caught this species.

Pleuronectiformes

Plaice catches were up for the third year in a row, with catch weights up to 498 kg compared to 411 kg last year. The spatial distribution was up to a five year high, with plaice present at 62 stations this year (61 stations in 2022). Maturity stages for plaice remained mixed, as observed in previous years, with stages at this time of year normally being seen as spent, however both mature and spawning individuals were all recorded this year. The number of individuals measured increased from the previous year (n = 3494 compared to n = 2807 in 2022). Length distributions this year were similar to last year, apart from the “0-group” plaice continuing to rise (n= 309 individuals <15 cm, compared to n= 235 in 2022 n=53 individuals in 2021). With larger catch weights and an increased spatial distribution, the numbers of otoliths taken increased to 1554 (1475 in 2022).

Total lemon sole catch weight this year of 183 kg was a slight upturn on the previous five years, with a low of 170 kg caught in 2022. This increase was also seen in the spatial distribution, with lemon sole being recorded at 59 stations this year, compared to 56 stations last year which was lowest distribution in recent history. Despite the increase catch weight, numbers measured was almost identical to numbers recorded in the previous year (n= 1557 in 2022, n = 1555 this year), with very similar length distributions. Consequently, similar numbers of otolith samples were collected this year (n = 212) compared 2021 (n = 228).

Dab catch weights were down to a five-year low (1.921 t compared to 2.834 t kg in 2022), despite an increased spatial distribution across 64 stations this year, compared to 62 in 2022. With a decrease in weight caught, fewer numbers were measured (n = 6442 compared to n =7430) and as a result, a decrease in otoliths collected this year. Length distributions remained similar to the previous years, but with a slight decrease in <10 cm individuals this year (n= 216 compared to n=231 in 2022 but still higher than the n=16 in 2021).

Pelagic fish

Herring was the number one species for catch weight on this year's survey after being second to haddock in 2022. The total catch weight of herring followed a three-year increasing trend, 14.221 t; 649 kg more than seen in 2022. The spatial distribution increased to 70 prime stations compared to 59 in 2022, the highest recorded distribution in recent history on the survey. The higher distribution could be in part due to the completion of six prime stations missed from the survey last year and especially our five most northern prime stations 71, - 75 where historically herring would be caught. Increased catch weights resulted in numbers measured increasing this year (n = 8550 compared to n = 7539 in 2022) but despite increased weights and numbers measured at length, slightly reduced numbers of biological samples were collected (n= 1284 compared to n= 1307 last year). It is worth noting that two large herring catches made up 52.7% of all the herring caught on this year's survey (prime stations 13 and 45). Four distinct cohorts can be seen in the length distributions (figure 7f, 0-12, 12-19, 19-24 and 24+ cm).

Sprat catches were down to a five-year low, despite an increase in the spatial distribution compared to the 2022 survey, with 1.764 t caught in total over 28 stations compared to 1.855 t over 23 stations last year. Five stations with catch weights over 100 kg was also observed this year despite the decrease in total catch weight compared to three stations last year. These five prime stations (primes 20, 29, 26, 8 and 24) made up 75.2% of the total catch of the survey for sprat, (1.329 t) and were all located in the southern half of the North Sea. Length distributions look similar to previous years, but despite the reduced total catch, individuals measured this year increased (n= 3162 compared to n= 1943 in 2022, but similar to n=3452 in 2021)

Mackerel catches fell to nearly half of last year's five-year high, with a total catch weight of 3.524 t recorded (6.297 t in 2022). Despite having the same spatial distribution as in 2022, a 2.773 t decrease in catch weight occurred this year, however, 2022-2023 had the joint highest spatial distribution seen in over seven years, with mackerel recorded at 68 stations. Mackerel catches over 100 kg were similar, with 13 stations this year compared to 14 in 2022. With the high spatial distribution, the numbers of individuals measured at length has increased slightly (n = 4427 compared to n = 4218 in 2022). The lower total catch weight resulted in fewer otoliths being collected (386, compared to 410 in 2022).

Total catches of horse mackerel in 2023 (1.552 t) decreased compared to last year (1.979 t), a decrease of 427 kg. It is worth noting that 60.6% of the total catch weight came from just 5 stations. The decrease in total catch is despite having the largest spatial distribution recorded in more than 7 years (71 prime stations compared to 46 stations last year). As a result of the increased distribution, numbers of individuals measured was up this year (n=2603 compared to n=2301 in 2022). It is also clear there are three length ranges this year, the same as in 2022).

Elasmobranchs

574 kg of elasmobranchs were caught this year, which is an increase from 427 kg seen in 2022. Lesser-spotted dogfish, *Scyliorhinus canicula* were the top caught species this year (total catch up to 221 kg compared to 182 in 2022), followed by starry smooth-hound (total catch weight 196 kg, up from 71 kg in 2022), starry ray *Amblyraja radiata* (23 kg, the same as in 2022) and cuckoo ray *Leucoraja naevus* (21 kg down from 28 kg in 2022). Two flapper skate were caught during the survey, only one caught at a valid station (20.54 kg, down from 39 kg in 2022). A total of ten individuals were tagged with Petersen discs and released (eight starry smooth-hounds, one flapper skate and one tope).

Cephalopods and commercial shellfish

The highest cephalopod catch weight this year was northern squid *Loligo forbesii*, despite decreased amounts seen compared to last year (24 kg compared to 41 kg in 2022), however the spatial distribution was reduced (30 prime stations compared to 35 in 2022). Length distributions were similar to that of 2022 but the number of individuals measured at length were down (n=481 compared to n=559 in 2022). Broadtail shortfin squid *Illex coindetii* catch weights were slightly down at 11.2 kg compared to 12.2 kg in 2022. European common squid *Alloteuthis subulata* weights were noticeably down compared to last year (10.8 kg compared to 34.3 kg in 2022). Curled octopus numbers have declined to a six-year low with only 13 individuals recorded (14 recorded in 2022).

Edible crab *Cancer pagurus* catch weight remained the same as last year at 25 kg. Velvet swimming crab *Necora puber* catches slightly increased compared to that seen in 2022 (0.602 kg compared to 0.566 kg last year). One European lobster *Homarus gammarus* was caught on the survey this year , while stone crab *Lithodes maja* catch weights were the same as the previous years (16.2 kg compared to 16 kg last year).

Ichthyological observations

79 fish species were recorded on the survey this year, two more than in 2022. Species of note were the blue-mouth redfish *Helicolenus dactylopterus*, long snout sea horse and flapper skate.

Macrobenthos

138 taxa of macrobenthos were recorded on this year's survey, three more than in 2022. The sand star *Astropecten irregularis* was the most widely distributed, the same as in 2022 and 2021, with presence recorded at 59 of the 79 prime stations completed, compared to 51 in 2022.

Marine litter

203 litter items logged, totalling 18.8857kg in weight. Of those 203 items, 177 were plastic, over 87% of all litter collected. Out of the 81 stations/trawls, 17 had no litter items recorded, meaning litter was found at 79% of stations/sites visited (64 stations/trawls) and averaged 3 items per station/trawl. (Figure 18)

Surface and bottom temperature and salinity

Environmental data, including surface water samples, vertical profiles from the ESM2 profiler/mini-CTD logger and bottom water samples from Niskin water sampler, were collected at 45 stations.

SECONDARY AIMS:

2. Tag and release specimens of selected elasmobranch species, in support of the ICES Working Group for Elasmobranch Fishes work to inform on stock units for demersal elasmobranchs. (J Ellis – Cefas, Lowestoft)

Of the species targeted for tagging, 12 individuals were deemed appropriate to attach Petersen discs, tagged and release (Table 5).

Table 5: Species tagged and released.

Scientific Name	Common English Name	Cefas code	Length (cm)	Weight (g)	Sex	Maturity
Mustelus asterias	Starry smooth-hound	SDS	880	2545	F	U
Mustelus asterias	Starry smooth-hound	SDS	920	2345	M	C
Mustelus asterias	Starry smooth-hound	SDS	770	1586	M	B
Mustelus asterias	Starry smooth-hound	SDS	900	2475	M	C
Mustelus asterias	Starry smooth-hound	SDS	810	1820	M	C
Mustelus asterias	Starry smooth-hound	SDS	740	1505	F	U
Mustelus asterias	Starry smooth-hound	SDS	830	1972	M	C
Mustelus asterias	Starry smooth-hound	SDS	910	2784	F	U
Galeorhinus galeus	Tope	GAG	141	19560	M	C
Dipturus intermedius (Intermedia)	Flapper skate	SKF	166	46060	M	B
Anarhichas lupus	Wolf fish	CAA	630	2495	U	
Anarhichas lupus	Wolf fish	CAA	910	8280	U	

3. *To freeze any unusual fish species for subsequent identification / verification in the laboratory, which may also be used in otolith research. (J Ellis – Cefas, Lowestoft)*

   79 species of unusual fish/epibenthos were retained for further analysis, including greater weever fish *Trachinus draco*.

4. *To retain any dead specimens of tope and common skate for biological studies. (J Ellis – Cefas, Lowestoft)*

   Only live specimens were caught on this year's survey, all being tagged and released or released alive as per secondary aim number 2.

5. *Retain any dead specimens of diadromous fish for the DiadES Interreg project (T Basic - Cefas, Lowestoft)*

   No specimens were caught during the survey.

6. *Collect fisheries acoustic continuously data at four operating frequencies (38 kHz, 120 kHz, 200 kHz and 333kHz), using the Simrad EK60 split beam sounder. (J Van Der Kooij – Cefas, Lowestoft)*

   Acoustics data was recorded for the entire survey.

7. *Cetacean observations will be recorded where possible and sent to MARINElife and the SeaWatch Foundation.*

   With no dedicated marine mammal observer on board, observations were limited to *ad-hoc* sightings by bridge crew and SICs.

8. *Identification, count, measure and weigh all jellyfish caught in GOV trawl will allow the continuation of the North Sea August Jellyfish dataset started in 2012 (S Pitois – Cefas, Lowestoft)*

   In total, 691 individual jellyfish (from a total of five species) were measured on the survey (Table 6). Total catch weight (89 kg) was noticeably lower than recorded in 2022 (149 kg) and at a five-year low. Lion's mane *Cyanea capillata* was the most abundant species, with a total catch weight of 60.42 kg, and had the largest size and weight range (2.5–52.0 cm; 3–3558 g). Lion's mane jellyfish, blue jellyfish *Cyanea lamarckii*, moon jellyfish *Aurelia aurita* and crystal jellyfish *Aequorea spp*. saw decreased catch weights this year, compared to 2022, however compass jellyfish *Chrysaora hysoscella* showed increased catch weights compared to the previous years (Table 7).

Table 6. Details of jellyfish caught and measured during the survey.

Scientific Name	Common English Name	Total weight caught (g)	No. measured	Minimum length (cm)	Maximum length (cm)	Minimum weight (g)	Maximum weight (g)
Aurelia aurita	moon jellyfish	9204	87	2	17.5	7	263
Cyanea lamarckii	blue jellyfish	2076	97	3	19.5	1	215
Chrysaora hysoscella	compass jellyfish	14986	276	2	19.5	1	345
Aequorea spp.	crystal jellyfish	2557	76	3	14.5	3	120
Cyanea capillata	lion's mane jellyfish	60422	155	2.5	52	3	3558
	Total	89245	691				

Table 7. Jellyfish species (by total catch weight) in 2022 and corresponding catch weights in preceding years.

Scientific Name	Common English Name	2023 weight (g)	2022 weight (g)	2021 weight (g)	2020 weight (g)	2019 weigh (g)
Aurelia aurita	moon jellyfish	9204	47345	27234	11129	81830
Cyanea lamarckii	blue jellyfish	2076	72144	27234	19796	89150
Chrysaora hysoscella	compass jellyfish	14986	5226	24698	19046	2321
Aequorea spp.	crystal jellyfish	2557	3650	15717	13125	1376
Cyanea capillata	lion's mane jellyfish	60422	150130	285090	444581	355642
	Total	89245	278495	379973	507677	530319

9. *Collect squid egg samples to map spawning grounds. This could be highly relevant in studying squid stock's structure. Retain any specimens of Loligo vulgaris and all ommastrephidae squids (Illex, Todaropsis, Todarodes) for maturity and age analysis, respectively. (V Laptikhovksy – Cefas, Lowestoft)*

   No squid eggs were caught during the 2023 survey.

10. *Collect chlorophyll samples to test for nutrients from the surface water collected once a day for the ASMIAC project. (N Greenwood – Cefas, Lowestoft)*

    22 chlorophyll samples were collected from surface water at the first prime station each day throughout the survey with additional samples from sites of interest.

11. *Zooplankton plankton sampling using ring net to collect samples from the Gabbard smart buoy site. (S Pitois – Cefas, Lowestoft)*

    A ring net deployment at the West Gabbard site was not completed due to time constraints.

12. *Collect queen scallops (queenies) to allow for experimental work on ageing, for L/W relationship analysis, development of length to height parameters and, to provide specimens to Bangor University for further work which will be made available to ICES WGScallop (J Harvey – Cefas, Lowestoft) to collect specimens of Alloteuthis sp. with associated photography for identification studies into the potential increase of A. media in UK waters. (P White -Cefas, Weymouth).*

    Twenty-one queen scallop samples were retained for further studies.

13. *Collect additional data from dead skates and rays (males: testes weight and outer clasper length; females: ovary weight and shell gland width) and collect a section of vertebral column comprising ca. 6-8 vertebrae from that part overlying the body cavity; samples to be kept frozen - as part of Defra project C8503. (J Ellis – Cefas, Lowestoft).*

Twenty-five samples were collected:

Species	Samples
Cuckoo ray	2
Starry ray	15
Blonde ray	2
Thornback ray	6
total	25

14. *Genomic sampling of particular fish species to improve the methodology to assess finfish, pelagic, data-limited-stocks as part of Defra project C8503. (D Murray – Cefas, Lowestoft).*

Tissue samples and corresponding otoliths from deceased specimens of small pelagic fish were successfully collected to support ongoing population and genomic studies with 158 Horse mackerel, 198 herring, 2 sardine and 83 sprat samples purely for genetic assessment.

Centre for Environment Fisheries & Aquaculture Science

Cefas

Richard Humphreys
Scientist in Charge
9 September 2023

DISTRIBUTION:

Participants of survey
Marine Operations
D Pettengell (PM)
I Holmes (PI)
P Falconer (PL)
Cefas Fisheries surveys SICs/2ICs
Cefas CDP (Gary Burt)
AWSM - Pinbush
Fishing Skipper/Master Cefas Endeavour
FCO (Overseas EEZ's)

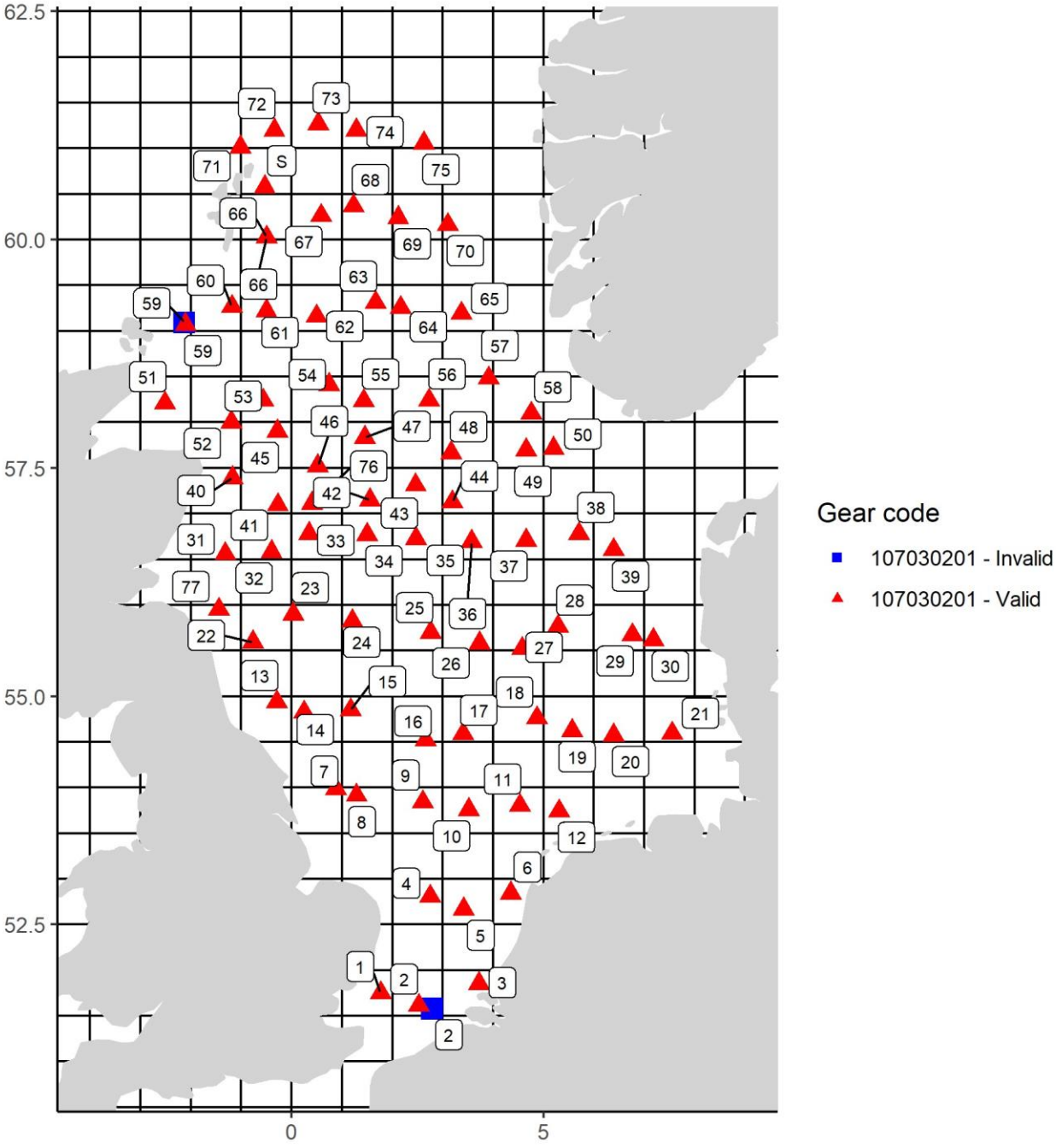
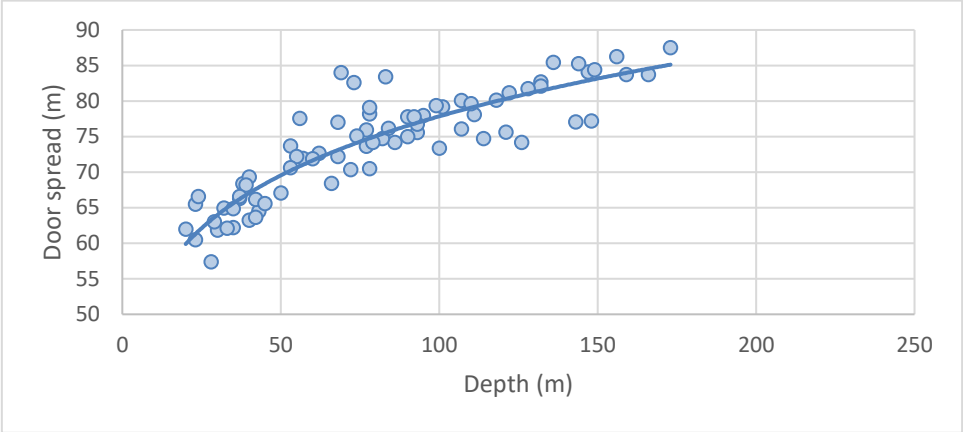
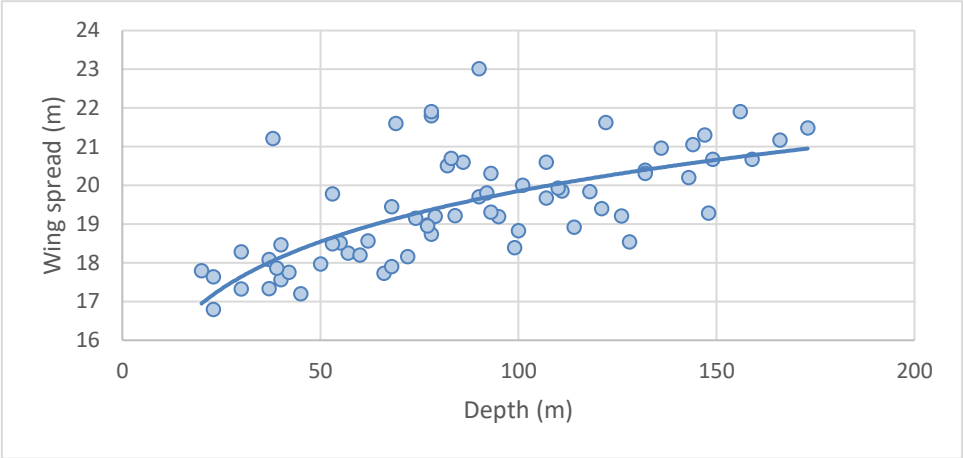


Figure 5. Deployment positions for valid and additional GOV trawl stations giving prime station numbers.





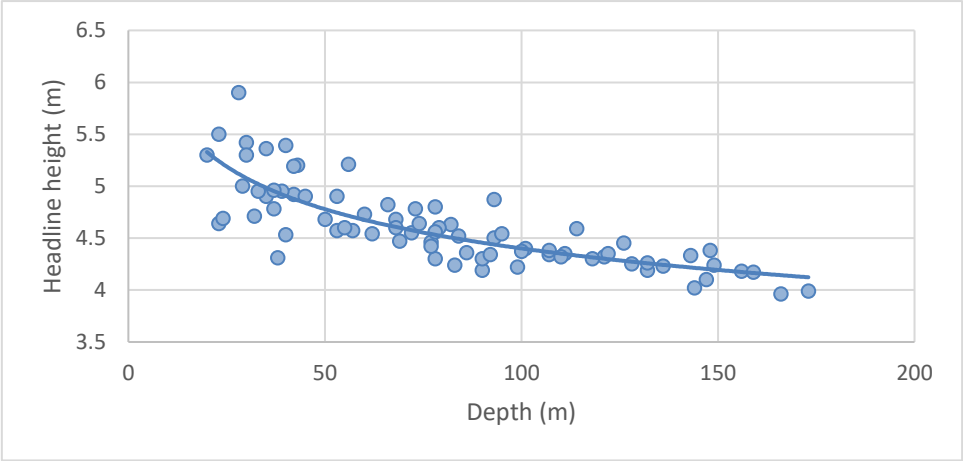


Figure 6. Relationships between door spread, wing spread and headline height with water depth (valid tows only).

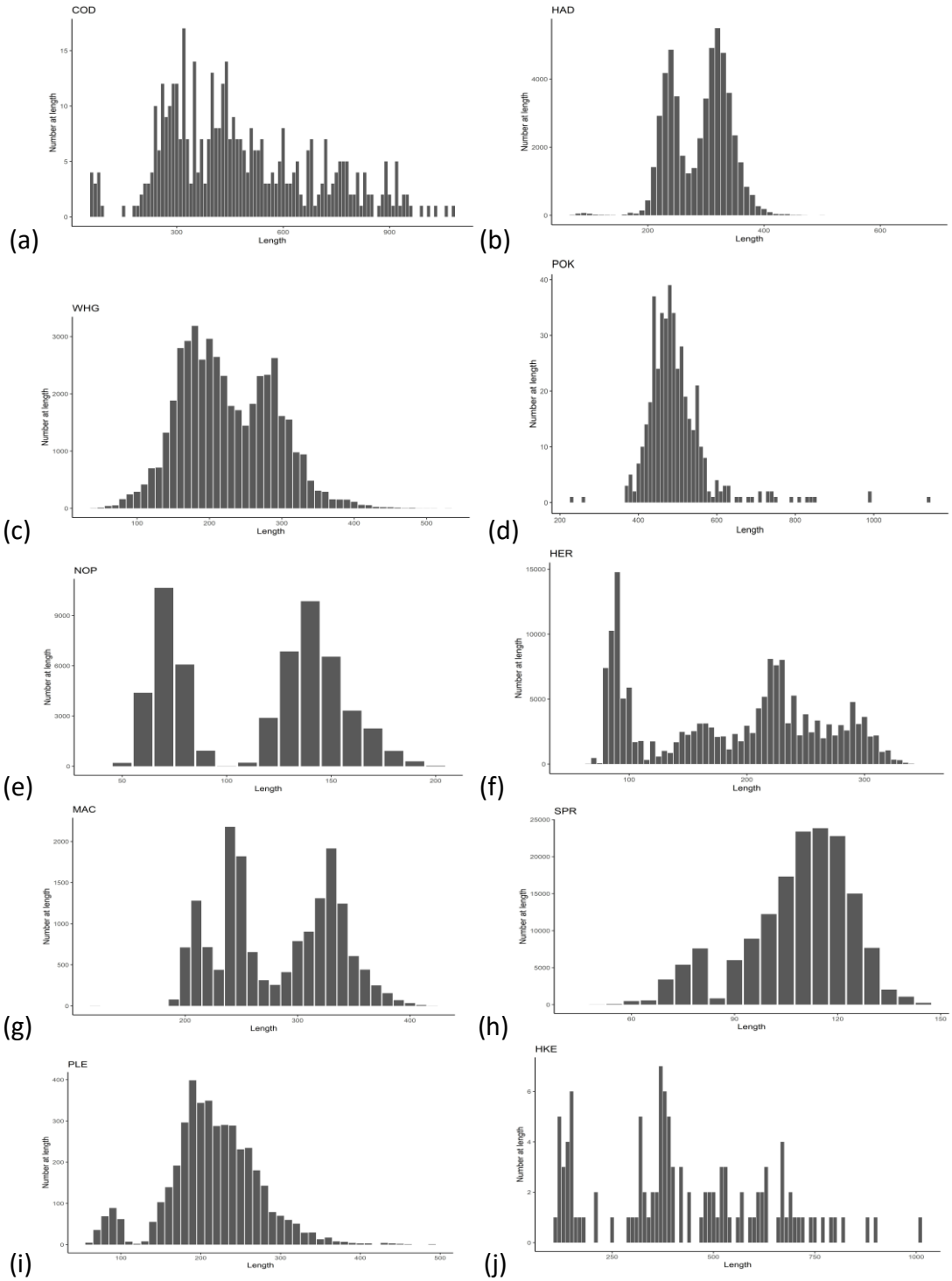


Figure 7. Length distribution plots for (a) cod, (b) haddock, (c) whiting, (d) saithe, (e) Norway pout, (f) herring, (g) mackerel, (h) sprat, (i) plaice and (j) hake.

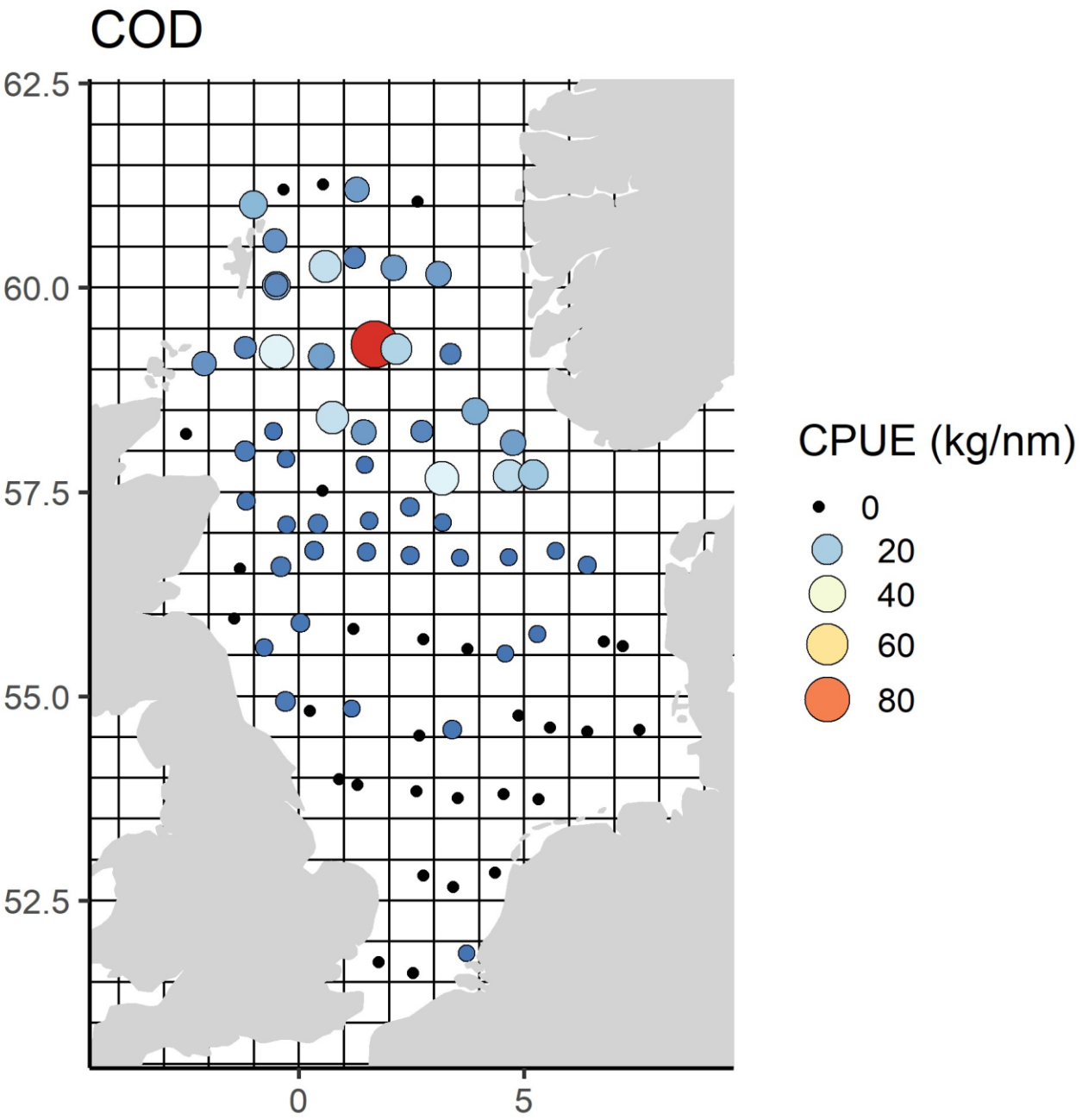


Figure 8. Distribution and relative abundance of cod *Gadus morhua* across the survey.

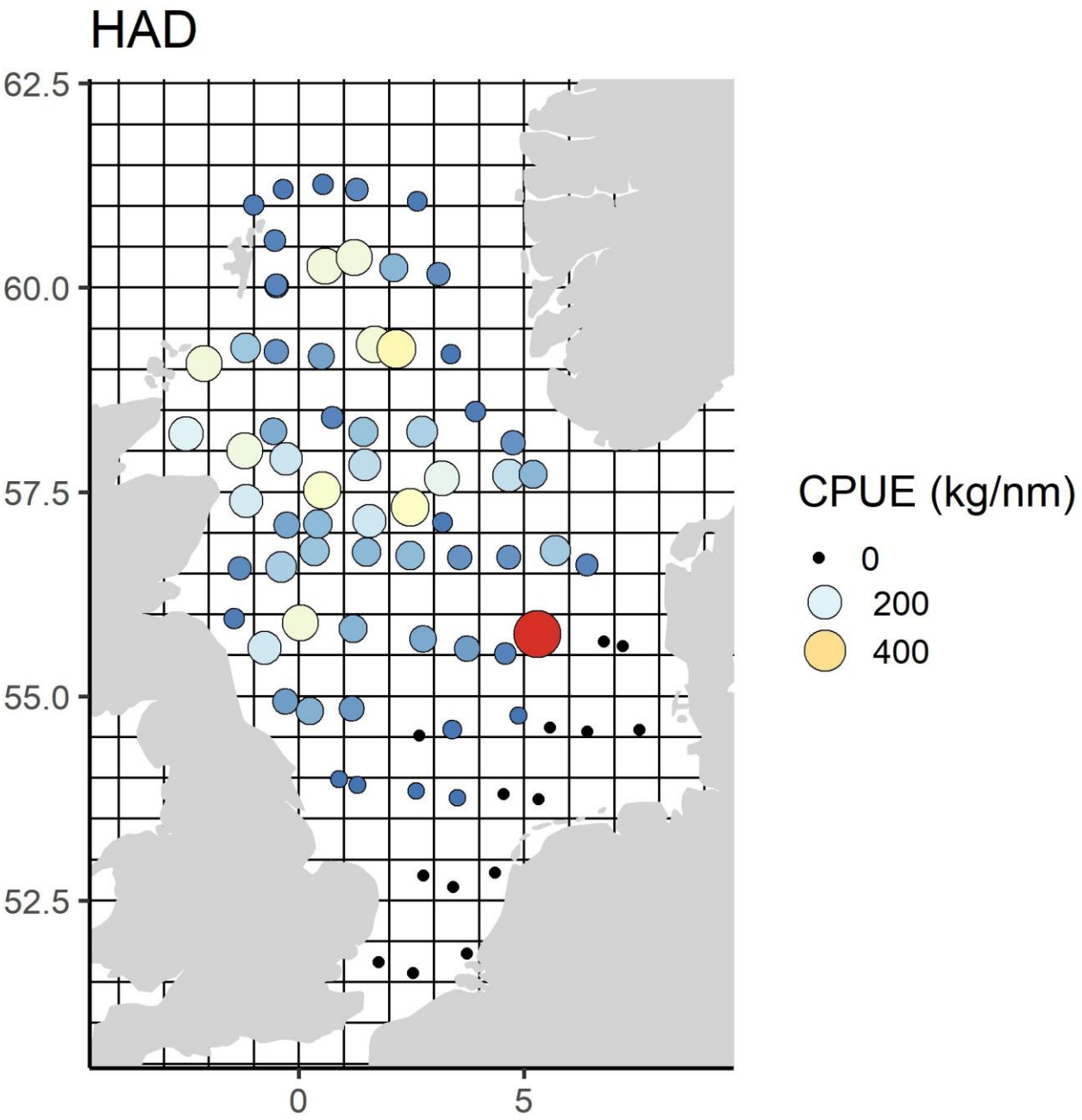


Figure 9. Distribution and relative abundance of haddock *Melanogrammus aeglefinus* across the survey.

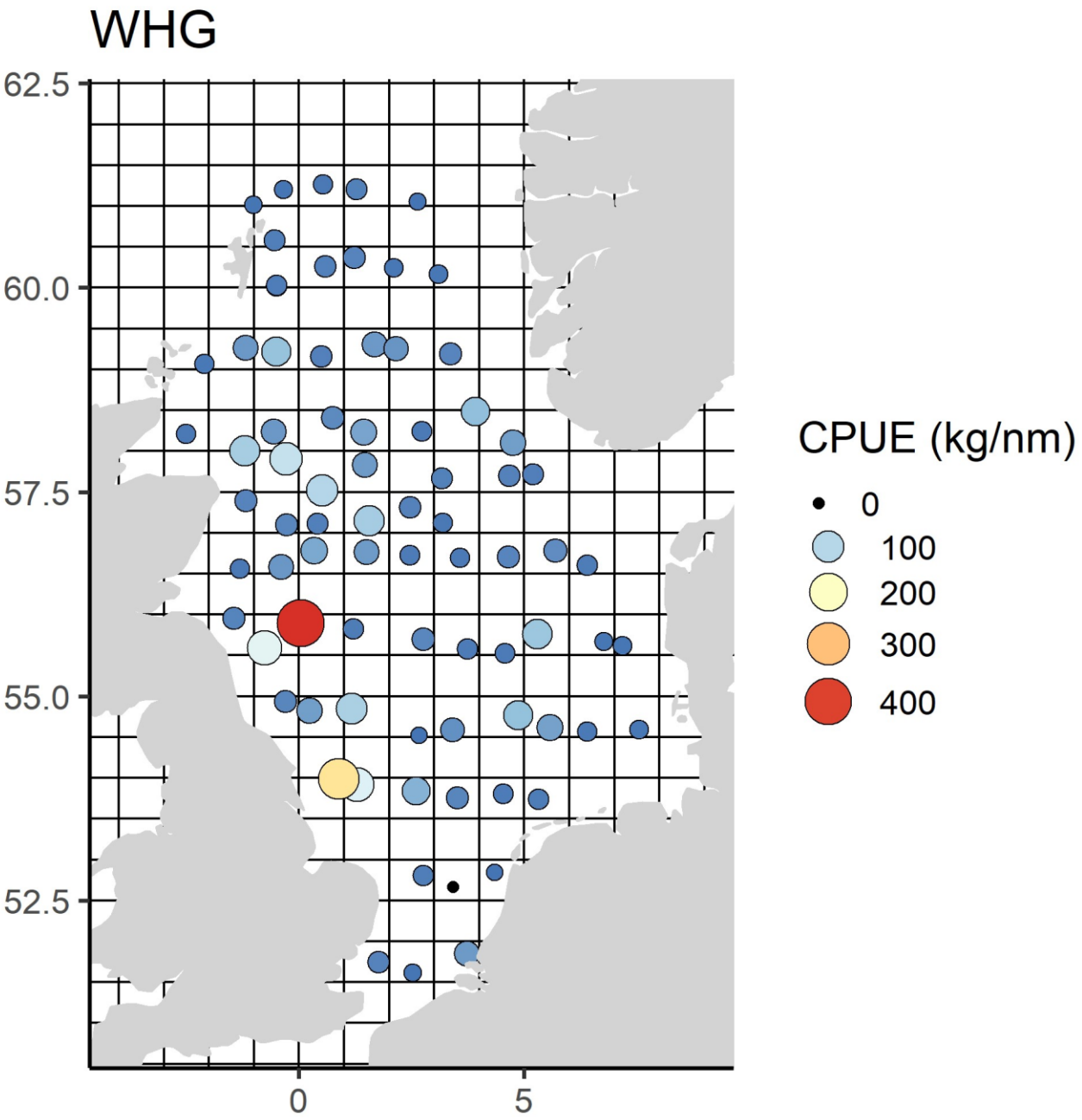


Figure 10. Distribution and relative abundance of whiting *Merlangius merlangus* across the survey.

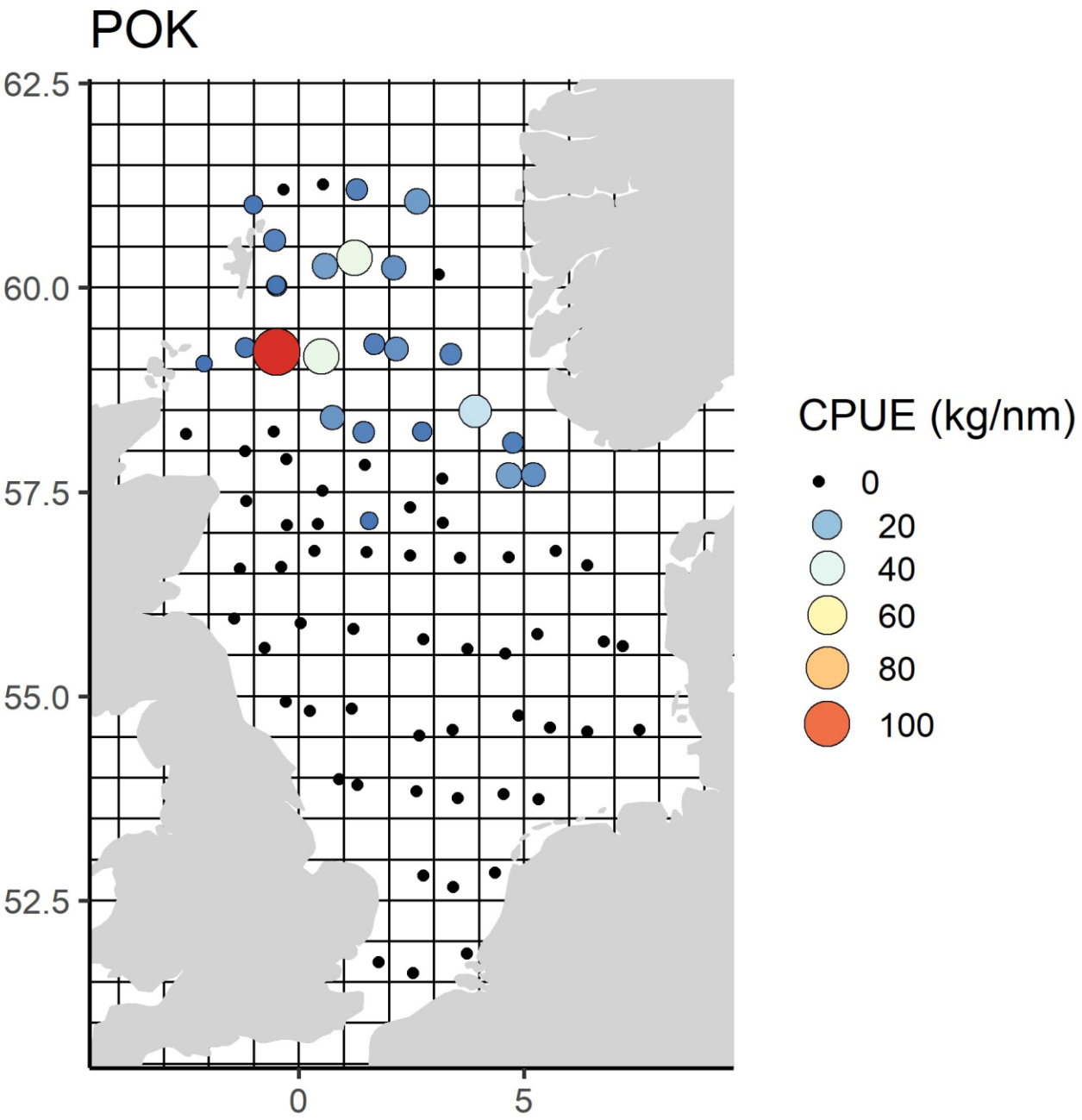


Figure 11. Distribution and relative abundance of saithe *Pollachius virens* across the survey.

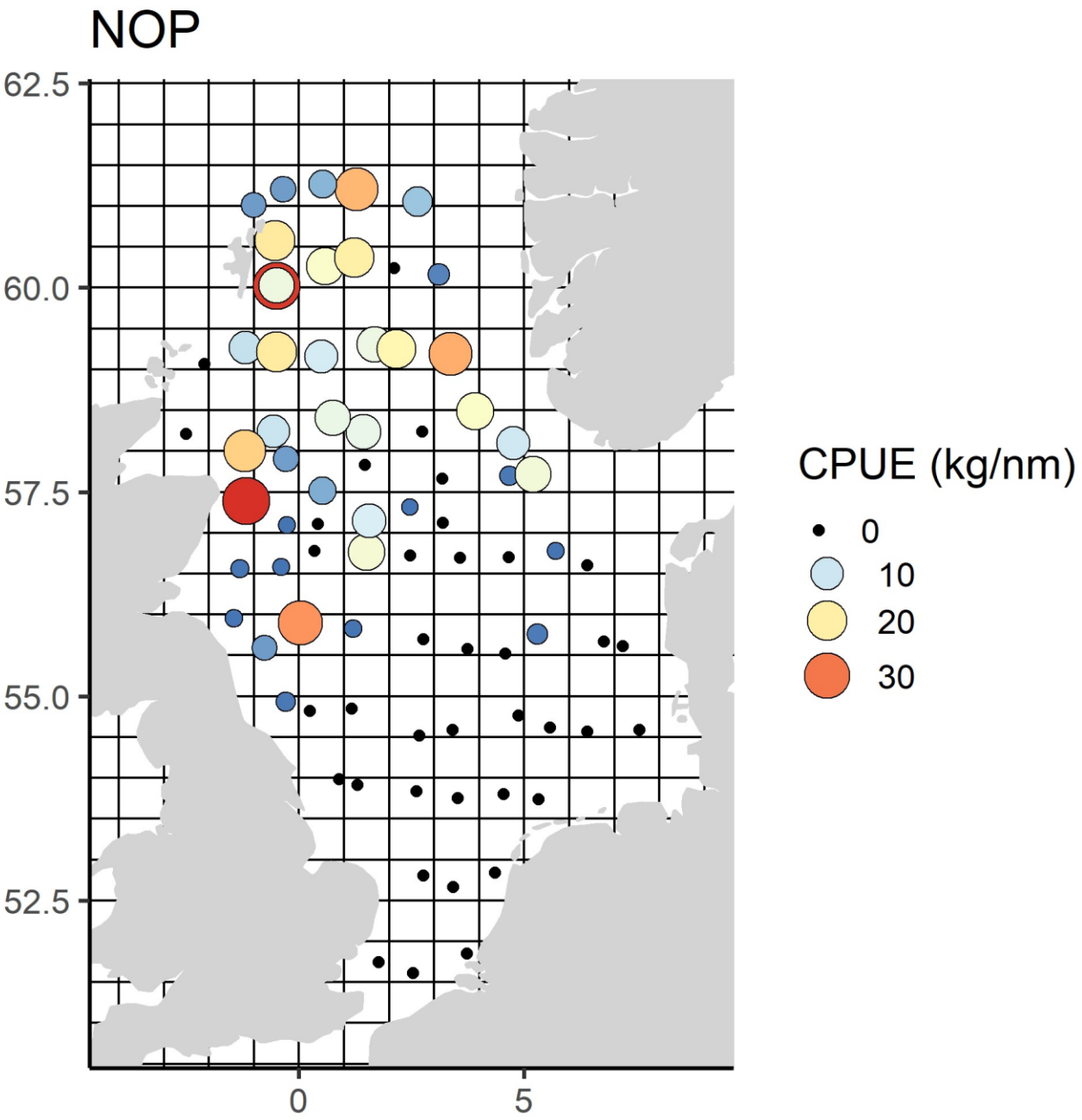


Figure 12. Distribution and relative abundance of Norway pout *Trisopterus esmarkii* across the survey.

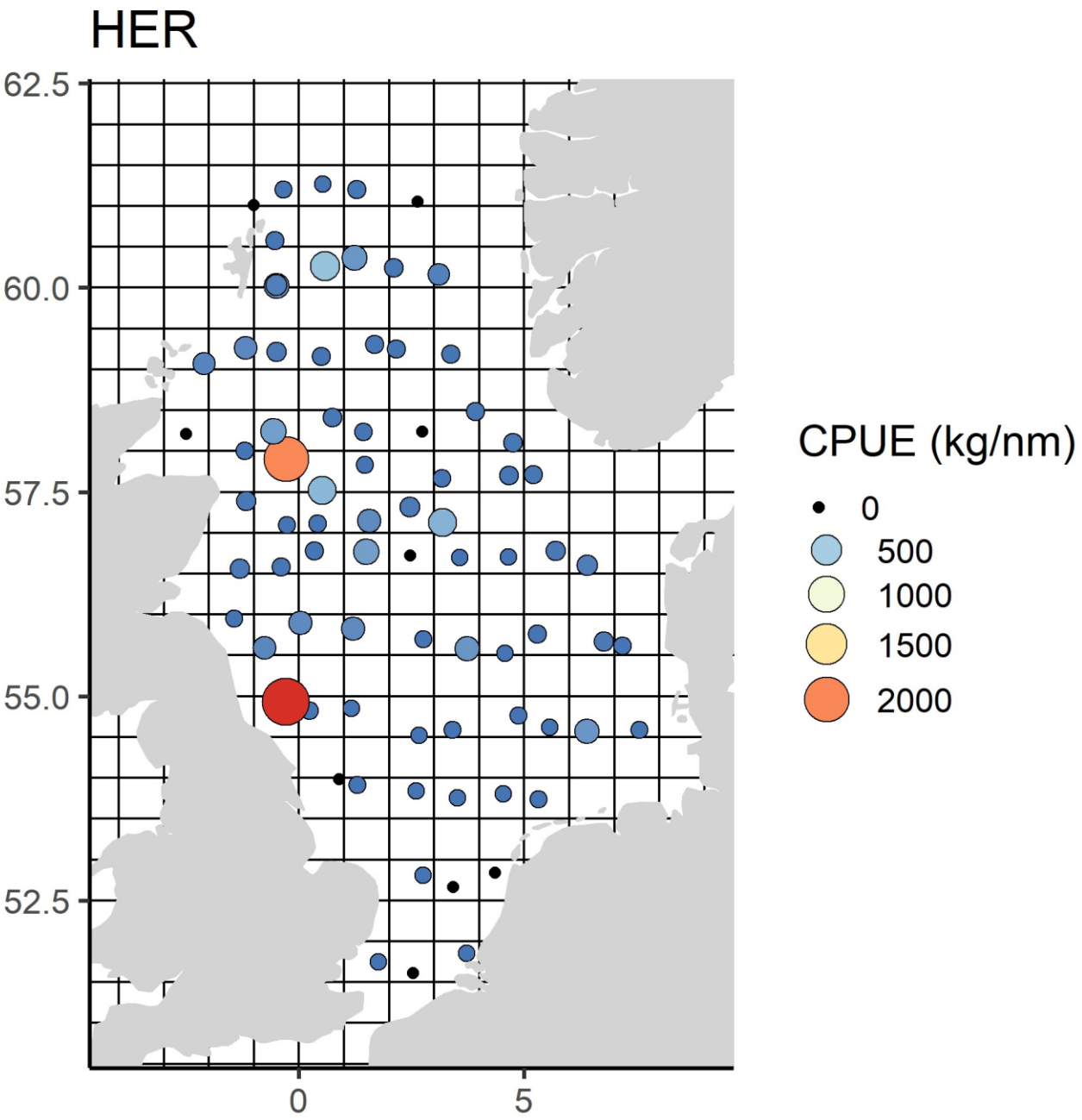


Figure 13. Distribution and relative abundance of herring *Clupea harengus* across the survey.

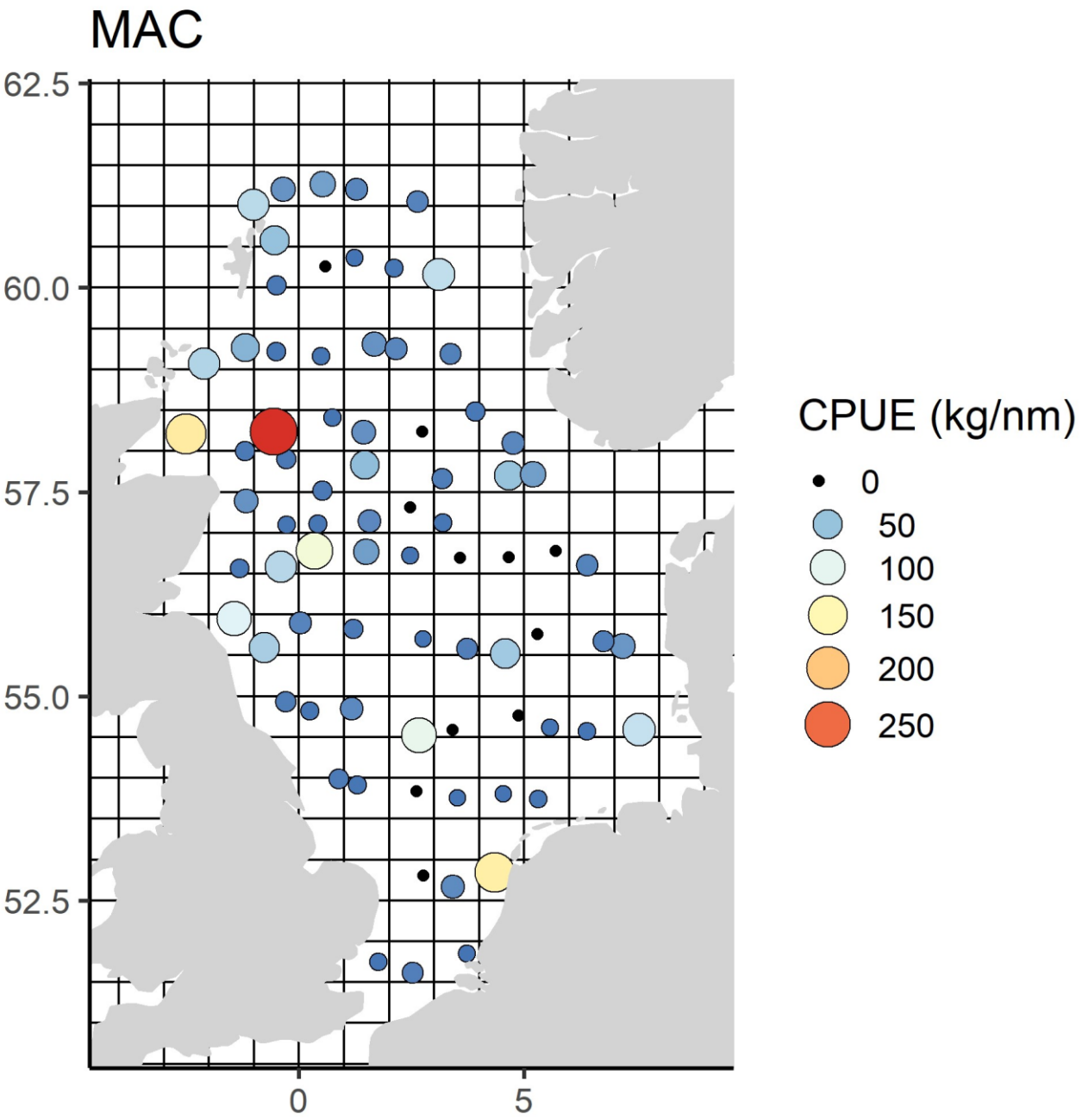


Figure 14. Distribution and relative abundance of mackerel *Scomber scombrus* across the survey.

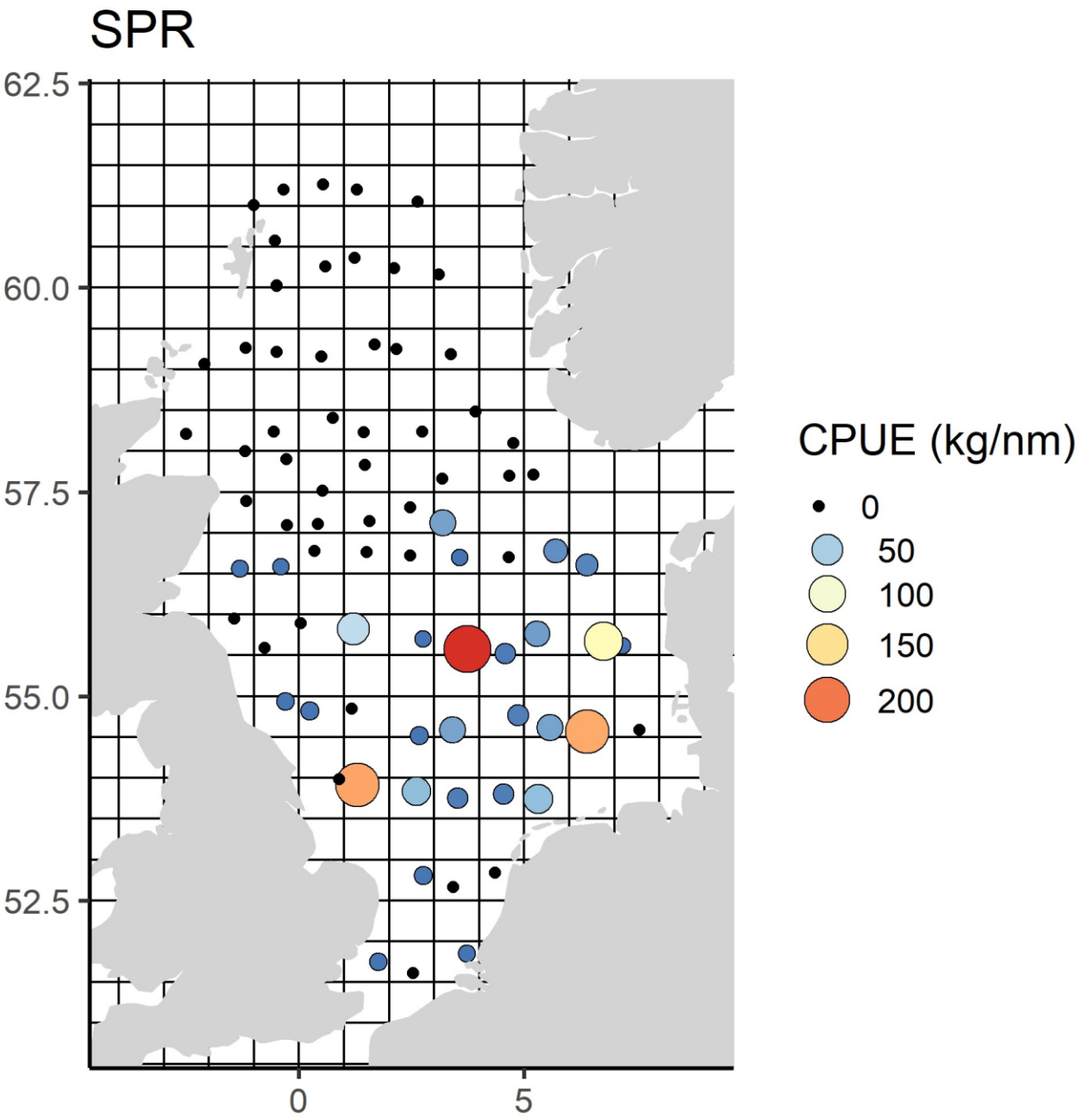


Figure 15. Distribution and relative abundance of sprat *Sprattus sprattus* across the survey.

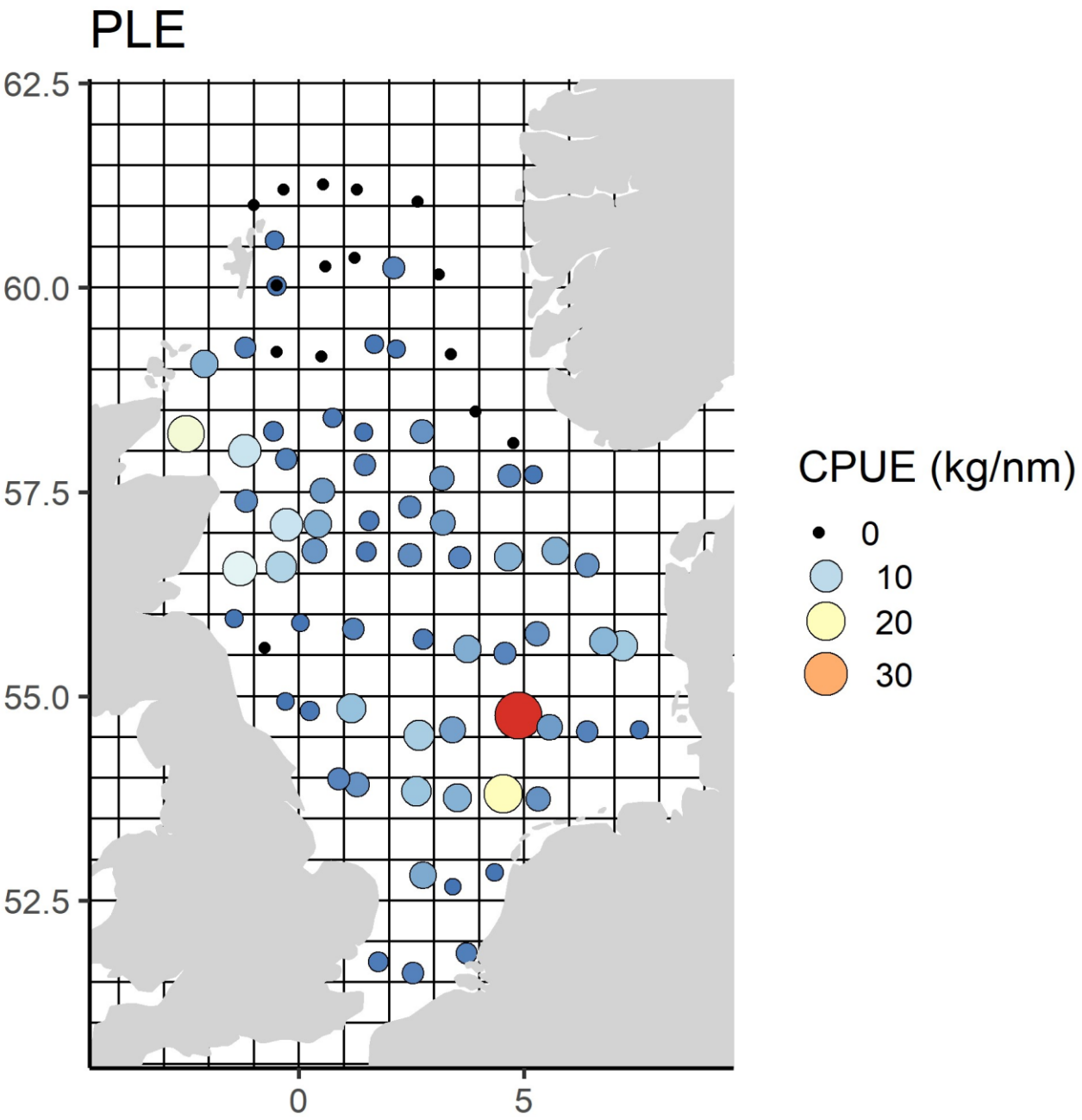


Figure 16. Distribution and relative abundance of plaice *Pleuronectes platessa* across the survey.

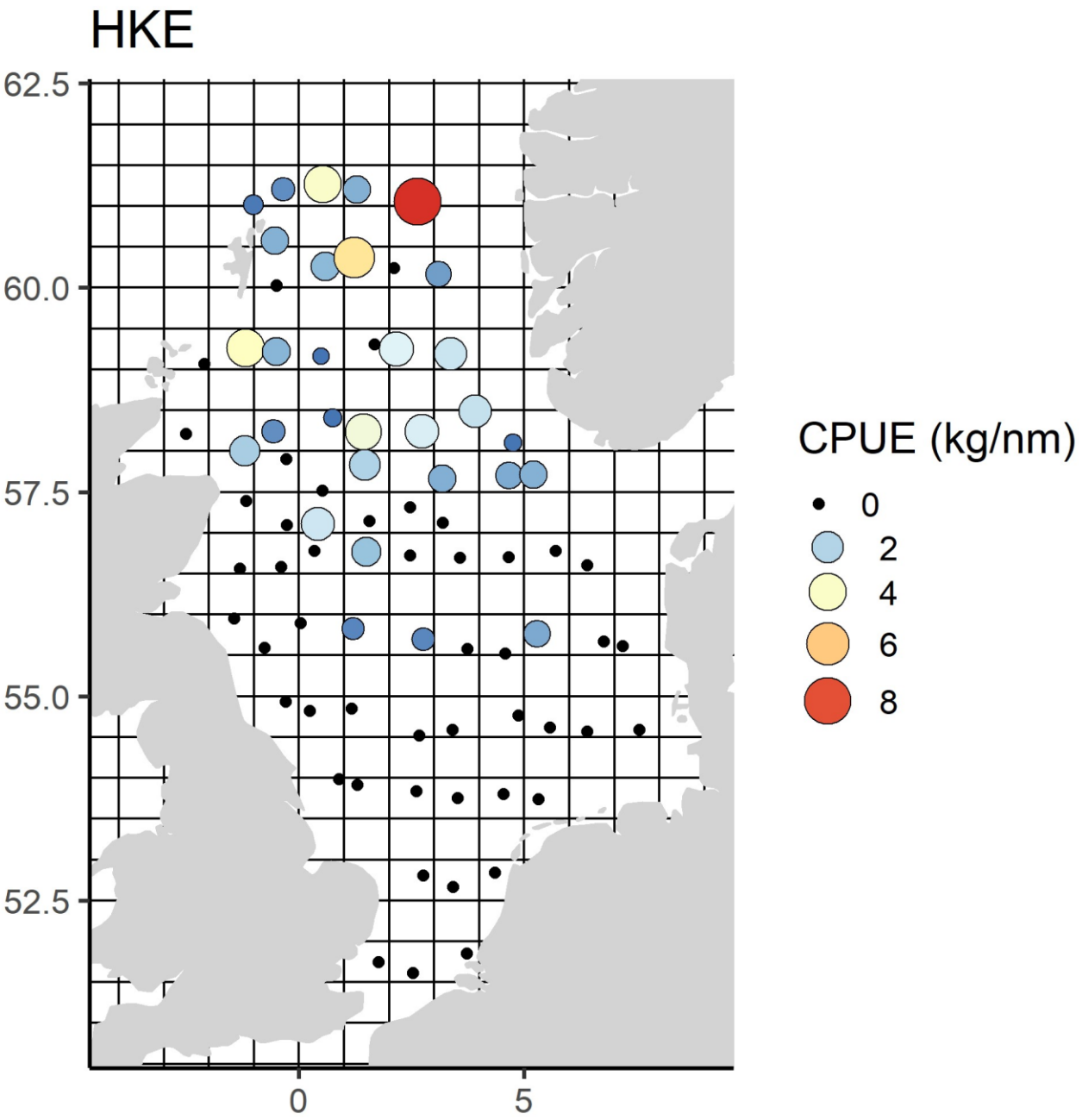


Figure 17. Distribution and relative abundance of hake *Merluccius merluccius* across the survey.

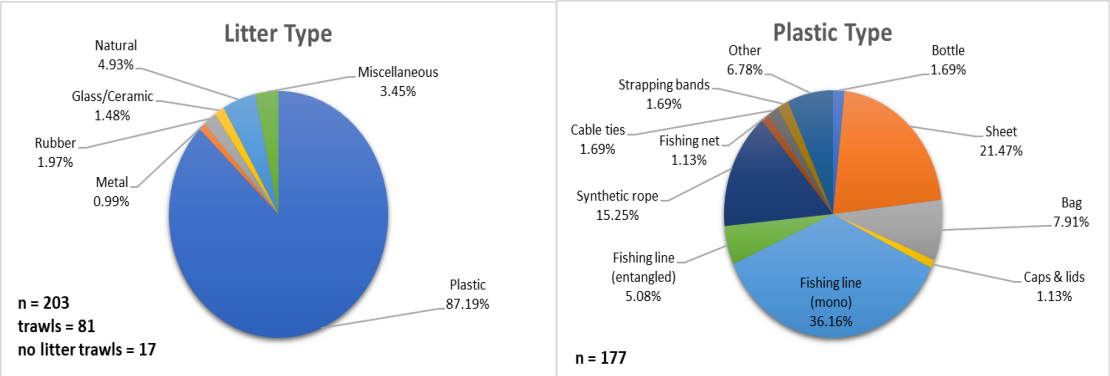


Figure 18. Marine litter collected during the English IBTS-Q3 trawl survey in 2023.