Centre for Environment Fisheries & Aquaculture Science

Cefas

RESEARCH VESSEL SURVEY REPORT

RV CEFAS ENDEAVOUR
Survey: C END 14 - 2022

STAFF:

1st Half	Job Role	2nd Half	Job Role
Richard Humphreys	SIC	Richard Humphreys	SIC
Ben Hatton	2IC	Ian Holmes	2IC
Georgia Robson	Deck master	Georgia Robson	Deck master
Maria Gamaza		Gary Burt	
Nicola Hampton		Jo Smith	
Rob Forster		Matt Eade	
Zachary Radford		Nicola Hampton	
		Wendy Edwards	

DURATION: 3 August – 30 August 2022 (27 days)

LOCATION: North Sea (ICES Divisions 4.a–c)

PRIMARY AIMS:

1. To carry out a groundfish survey of the North Sea (Figure 1) 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.

2. Collect surface sea water samples for Caesium/Tritium testing to be performed post-survey.

SECONDARY AIMS:

3. 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.

4. 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.

5. To retain any dead specimens of tope *Galeorhinus galeus* and common skate *Dipturus batis* species-complex for biological studies.

6. Retain any dead specimens of shad *Alosa spp.* and lamprey *Petromyzontiformes* for biological studies.

7. Collect fisheries acoustic continuously data at four operating frequencies (38 kHz, 120 kHz, 200 kHz and 333kHz), using the Simrad EK60 split beam sounder. The data will contribute to the existing 17 year time series of acoustic data in the North Sea and will be used as part of the Defra funded project Poseidon (MF1112) to monitor changes in mackerel *Scomber scombrus* distribution and abundance.

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

9. Identify to species, count, measure and weight all jellyfish caught in GOV trawl to 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.

10. Collect squid egg samples to map spawning grounds. This could be highly relevant in studying squid stock's structure. Retain any specimens of *Loligo* (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.

11. 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.

12. Zooplankton plankton sampling using ringnets to collect samples from the Gabbard smart buoy site.

13. Collect queen scallops (queenies) *Aequipecten opercularis* to allow for experimental work on ageing, for Length/Weight 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

14. Visual examination of livers for liver worm conducted on all cod *Gadus morhua* selected for individual fish measurements over 25 cm, work completed for IBTS.

NARRATIVE
All times stated are GMT.

RV Cefas Endeavour, henceforth referred to as CEND 14/22, sailed from Lowestoft at 1300hr on Wednesday 3 August. There were seven Cefas scientific staff on board.

A standard day consisted of collecting surface and bottom water at the start and end of the day to provide salinity samples and water samples for additional aims, 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 (Grande Overture Verticale) 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 three operating frequencies (38 kHz, 120 kHz and 200 kHz), using the Simrad EK60 split beam sounder.

After departure on 3 August, CEND 14/22 travelled to prime station 1. The aim to complete a ring-net sample at the Outer Gabbard en-route (secondary aim 12) had to be abandoned as the equipment required was unavailable. Once at prime station 1, an ESM2 profiler and Niskin water sampler were deployed successfully, but unfortunately the GOV was not ready to deploy as the rigging of the net was still underway, so no trawl could be completed this day. By mid-afternoon the next day this work had been completed to specification and a shakedown trawl was attempted, but due to net sensor issues, the trawl was abandoned while technical repairs were made. Once the repairs were completed, fading light led to fishing being abandoned for the day.

At first light on 5 August, following a “toolbox talk,” CEND 14/22 completed a successful GOV trawl at prime station 1. The catch was relatively small (124 kg) but similar in size and composition to previous years, with starry smooth hound (43 kg) and epi-benthos (32 kg) making up most of the catch. Once complete, CEND 14/22 headed east to prime station 2 and after one invalid tow due to erratic net sensor readings, a second successful trawl was completed. The catch was larger than in previous years (171 kg) and mainly consisted of pilchard *Sardinia pilchardus* (90 kg) and horse mackerel *Trachurus trachurus* (46 kg). Once completed, CEND 14/22 continued east to prime station 3, just off the Dutch coast. The final successful trawl of the day yielded the smallest catch (95 kg) and was mainly made up of mackerel (41kg), epi-benthos (29 kg) plus “0” group and juvenile whiting *Merlangius merlangus* (18 kg). Of note, 13 Starry smooth hounds were tagged and released at prime station 1 as per survey aim 3.

Overnight, CEND 14/22 headed north to prime station 6 and resumed fishing activity at first light. A successful GOV trawl was completed (353 kg) consisting mainly of horse mackerel (137kg), sprat *Sprattus sprattus* (140 kg), plus juvenile and ”0” group herring *Clupea harengus* (55 kg). In the previous year (2021) a large amount of epi-benthos was observed at this prime station, but very little was caught this year. CEND 14/22 then continued west to prime station 5 (1894 kg) with a successful trawl, yielding a very similar catch composition to the 2021 prime station 6 catch. A large amount of Horn wrack *Securiflustra* (1634 kg), never seen in such abundance at this prime station, was caught plus juvenile and “0” group Sprat, Herring *Clupea harengus*, and Horse mackerel. The final GOV trawl of the day was at prime 4 (1731 kg) and comprised mainly of whiting (1063 kg) and horse mackerel (535 kg).

CEND 14/22 began the day at prime station 9, successfully completing a GOV trawl. The trawl yielded the largest haul ever recorded for this prime station at 1107 kg and was the largest catch of the day (Figure 1). The catch mainly consisted of sprat (834 kg) and juvenile herring (116 kg). CEND 14/22 continued east throughout the day, successfully completing GOV trawls and ending the day north of the Dutch West Frisian Islands. Primes 10 (116 kg), 11 (357 kg) and 12 (71 kg) were all relatively small catches compared to the first catch of the day but consistent with previous years species compositions and catch size for the area.

Figure 1. Catch from prime station 1

On 8 August, work began at prime station 18 with a successful GOV trawl (237 kg). Once completed CEND 14/22 travelled east, completing trawls at primes 19 (157 kg) and 20 (965 kg). Dab *Limanda limanda* and sprat were the dominant species in all three catches, consistent with previous years at these locations. Of note, the first "0" group haddock *Melanogrammus aeglefinus* of the survey at prime station 19. The tow planned at prime station 21 had to be abandoned due to the presence of static gear. A secondary clear tow location was acquired, but due to fading light the decision was made to abandon fishing until the morning and multi beam the new tow location overnight for safety.

CEND 14/22 began at first light at our new prime station 21 location and a GOV trawl was attempted but had to be retrieved due to no headline readings. A second attempted GOV trawl with a new headline sensor was successfully completed, yielding a very small catch (65 kg) consisting mainly of epi-benthos (22kg), mackerel (24 kg) and dab (14 kg). Once completed, CEND 14/22 headed due north to prime station 30 (393 kg) and then west to prime 29 (647 kg) with both catches comprising mainly of dab and mackerel, and consistent with previous years catches in this area. Of note, juvenile plaice *Pleuronectes platessa* and "0" group haddock and whiting at prime station 29.

After a short transit overnight to prime station 39, the first trawl of 10 August was successful and turned out to provide the largest catch of the day (718 kg), consisting of mackerel (596 kg), grey gurnard *Eutrigla gurnardus* (49 kg) and dab (20 kg). CEND 14/22 then travelled west throughout the day completing successful trawls at prime stations 38 and 37 and station S3. Station S3 was one of three stations traded with the Scotland IBTSQ3 survey this year, as agreed before sailing. This rectangle had not been fished on this survey before but a clear trawl position to fish was provided. Prime stations 38 and 37 yielded catches very similar in size and composition to previous years, with dab being the most abundant species in both prime station 38 (191 kg) and prime station 37 (243 kg). The catch (234 kg) at S3 contained the same catch components as the previous two stations, with dab again being the most abundant species. Of note, the first adult herring (39 kg) was caught at prime station 38, while the first cod *Gadus morhua* of the survey caught at prime station 39. Also, "0" group haddock were caught at each station during the day.

On 11 August, work started with a GOV trawl at prime station 28. This trawl provided the largest catch of the day (879 kg) and comprised mainly of herring (607 kg), dab (118 kg) and haddock (83 kg). The herring comprised of three obvious year classes (figure 2 and 3) and was the largest catch of herring on the survey so far. Once completed, CEND 14/22 travelled west to prime station 27 and completed a second GOV trawl (102 kg) which yielded a relatively small catch but consistent with previous years in weight and composition. Of note, one snake blenny *Lumpenus lampretaeformis* caught on prime station 27. With two stations successfully completed and fast approaching prime station 26, a technical issue regarding the vessel was raised resulting in a pause for safety while the issue was investigated. On completion of the investigation, it was deemed necessary to proceed to port to rectify the issue before it would be possible to continue the survey. CEND 14/22 docked in Aberdeen early afternoon on 13 August.

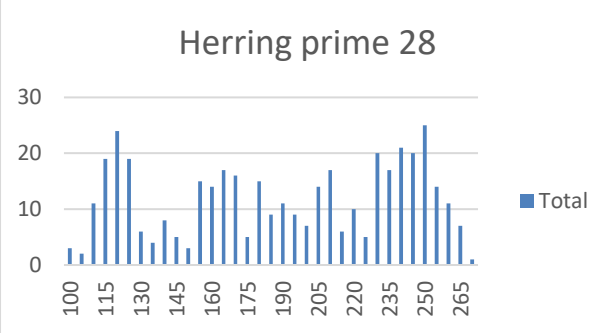

Figure 2. Length distribution prime station 28

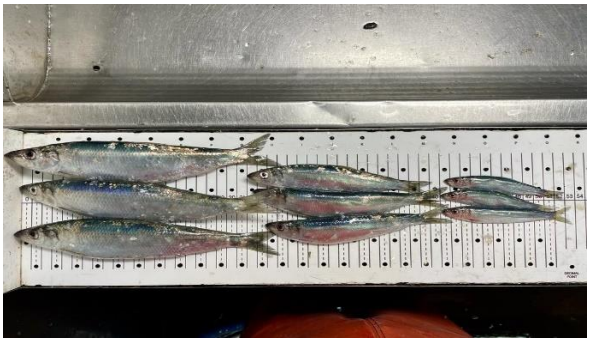

figure 3. Herring year classes prime station 28

On 15 August after repairs and a scheduled scientific staff change had been conducted, CEND 14/22 sailed from Aberdeen at 2000hr and transited over night to prime station 31. Due to the lost survey time, it had become clear the survey would be unable to complete all planned stations in the time left available. Decisions were made in communication with the IBTS international co-ordinator to remove some rectangles from the English survey programme and take on some that would save time logistically (primes S4-S7).

At first light, after some small technical issues with the headline sensor, a successful GOV trawl was completed at prime station 31. The catch was the smallest of the day (433 kg) and comprised mainly of haddock (266 kg). CEND 14/22 continued north, completing prime station 40 (1055 kg) and station S4 (588 kg). Both prime stations yielded large amounts of haddock (651 kg at prime station 40, and 444 kg at station S4). All three catches were consistent with trawls completed in previous years, with gadoids dominating the catches. Of note, blue-mouth redfish *Helicolenus dactylopterus* and "0" group haddock, whiting and cod at prime station 40 plus juvenile and adult cod caught on all prime stations throughout the day.

CEND 14/22 began the day at prime station 52 with a successful GOV trawl. This was the largest catch of the day (1848 kg) and contained primarily haddock (1043 kg) and whiting (603 kg). Once completed, CEND 14/22 travelled east to prime station 45 (1188 kg), before heading northwest to prime station 53 (407 kg). Both prime stations contained mainly haddock, herring, and whiting. The last station of the day, S7 (417kg) was one of the new stations for the English survey this year. Due to time constraints, only a 15-minute tow could be achieved at this new location. Of note, "0" group Norway pout *Trisopterus esmarkii*, whiting, cod, and poor cod *Trisopterus minutus* were all caught on prime station 45, making this a difficult and time-consuming station to sort. "0" group Norway pout were recorded on all prime stations today in large numbers.

After travelling overnight, CEND 14/22 started the day attempting a GOV trawl at station S6. Unfortunately, due to issues with headline readings, the trawl had to be recovered and re-deployed, however on the second attempt, a successful trawl was completed. This catch was the largest of the day at 1127 kg and was a good mix of haddock (341 kg), horse mackerel (283 kg), mackerel (282 kg) and whiting (131 kg). The day progressed with successful trawls at prime stations 51 (736 kg) and 59 (740 kg), as well as S5 (283 kg), with the day ending east of the Orkney Islands. All catches were dominated by haddock which is consistent with catches caught in this area in previous years. Of note, 15kg of cod caught at station S6, 28kg of cod caught at prime station 59, two small flapper skate *Dipturus intermedius* caught at station S6 (Figure 4), and one large flapper skate caught at prime station 59 (160 cm in length, weighing 30.92 kg- Figure 5). These skate were all tagged and released alive (as per aim 3).

Figure 4: Flapper skate prime S6

Figure 5: Flapper skate prime 59

On 19 August at first light, CEND 14/22 deployed the first GOV trawl of the day at prime station 60 (1291 kg). Once completed, the survey travelled east and then north, completing successful trawls at prime stations 61 (1014 kg), 66 (1678 kg) and 67 (1503 kg). Prime station 62 was the only station to have catch weights consistent with the previous year, with all three other catches much larger than in 2021. Prime stations 60 and 61 had a varied catch and haddock was the main species caught with 589 kg recorded on prime station 60 and 300 kg on prime station 61. Prime station 66 and 67 comprised mostly of pelagic species with 641 kg of herring and 404 kg of mackerel on prime station 66 and 514 kg herring and 481 kg mackerel on prime station 67.

After a short steam overnight, a successful GOV trawl at prime station 68 was completed in the morning. This was to be the largest catch of the day and of this year's survey so far (2404 kg) and consisted mainly of herring (1382 kg), haddock (370 kg) and mackerel (302 kg). CEND 14/22 then moved east to station S1 and on arrival, two seismic vessels were surveying the area with one directly at our trawl location. With no secondary tow location available without multi beaming a new trawl area, and with limited time, this station had to be abandoned. CEND 14/22 continued east and completed successful trawls at prime station 69 (441 kg) and 70 (1076 kg) with haddock being the top species at prime station 69 (229 kg) and mackerel (726 kg) at prime station 70. Of note, large cod were caught at all prime stations with the largest total catch caught at prime station 68 (75 kg)

The next day began at daybreak with a successful GOV trawl at prime station 68, this was to be the smallest catch of the day (204 kg). At 175m in depth this is one of the deepest stations of the survey and, as in previous

years, yielded a small catch containing mainly Norway pout (72 kg) and blue whiting *Micromesistius poutassou* (75 kg). After finishing the trawl, CEND 14/22 continued west throughout the day completing trawls at prime stations 64 (901 kg), 63 (721 kg) and 62 (1047kg). Catches at prime stations 64 and 63 were dominated by haddock (343 kg and 229 kg, respectively) and mackerel (138 kg at prime 64, 76 kg at prime 63). The last trawl of the day at prime station 62 also contained haddock (178 kg) but the catch was predominantly herring (553 kg). Of note, cod was caught on all prime stations but the largest haul of cod was at prime station 62 with 90 kg. Also, one wolf fish *Anarhichas lupus* was tagged and released at prime station 65 (as per secondary aim 3) and two black-mouthed dogfish *Galeus melastomus* were caught at prime station 65.

After an overnight transit to prime station 54, CEND 14/22 deployed the first GOV trawl of the day. The catch was one of the largest of the survey (2243 kg) and the largest single catch of herring this year (1877 kg). CEND 14/22 continued throughout the day, completing successful trawls at prime station 55 (2460 kg), 47 (480 kg) and 46 (417 kg). The second GOV trawl of the day at prime station 55 was to be the largest catch of the survey (2460 kg) to date and consisted mainly of whiting (1157 kg) and haddock (1027 kg). Both prime stations 47 and 46 were small in comparison, with prime station 47 containing mainly haddock (368 kg) and prime station 46 containing mainly herring (140 kg) and haddock (115 kg).

23 August began at first light with a GOV trawl at prime station 41 (402 kg). The catch was smaller than seen year in the previous year's survey (641 kg), but haddock (213 kg) was the most abundant species this year, in comparison with 2021 when mackerel had been the most abundant species (321 kg). CEND 14/22 then travelled south to prime station 32 and completed a trawl which was similar in catch size and composition to previous years, with haddock being the most abundant species as in 2021, although the catch weight was less than half this year (164 kg, compared to 334 kg in 2021). CEND 14/22 then headed southwest to prime station 77 where the trawl was the smallest of the day (200 kg) and comprised of herring (68 kg), dab (22 kg) and mackerel (22 kg). Of note, many juvenile spurdog *Squalus acanthias* were caught at prime station 32, with 59 females (7.74 kg) ranging from 26cm - 36cm and 43 males (14.6 kg) 26cm – 39 cm.

The next day began with the first GOV trawl of the day at prime station 76. This was the largest catch of the day (1386 kg) and contained haddock (340 kg), mackerel (472 kg), whiting (216 kg) and epibenthos (284 kg). The majority of the epibenthos were purple heart urchins *Spatangus purpureus* which was also the case in 2021. CEND 14/22 continued the day, completing successful GOV trawls at prime stations 33 (664 kg), 34 (359 kg) and 42 (235 kg). Haddock was the most abundant species at all three stations with 412 kg at prime station 33, 138 kg at prime station 34 and 92 kg at prime station 42. The catch compositions were similar to previous years but catch weights were higher this year compared to catches in 2021 at all prime stations. Of note, one halibut *Hippoglossus hippoglossus* was caught at prime station 34 (95 cm, 10 kg).

After a short steam overnight CEND 14/22 completed a successful GOV trawl at prime station 56. This was to be the smallest catch of the day (395 kg), but similar in size to 2021 (476 kg). The catch contained mainly haddock (190 kg) and mackerel (112 kg). On nearing prime station 48 it was noticed our counterparts from the Netherlands were conducting fishing activities very close to our trawl position so a new fishing location within the rectangle was required. A location was found to the east and a successful GOV trawl was conducted. The catch (909 kg) contained mainly haddock (596 kg) and whiting (169 kg), which was consistent with the catch composition from 2021 but the catch weight was nearly three times larger (331 kg was caught

in 2021). The final trawl of the day was the largest (1847 kg) and contained mainly haddock (1043 kg) and whiting (585 kg). This catch was over four times larger than in 2021 (406 kg).

26 August began at first light with a GOV trawl at prime station 35. This was to be the smallest (196 kg) of three relatively small catches during the day, all of which were consistent with previous years catch weights and compositions. Dab was the most abundant species at all three primes with 69 kg at prime station 35, 110 kg at prime station 44 and 104 kg at prime station 36. Of note, 73% of all the haddock caught at prime station 35 had *Laenaeocera branchialis* "cod worm" (Figure 6) and were present on a large percentage of haddock on all prime stations today. This had been noticed on previous northerly stations however, only a couple of fish were affected.

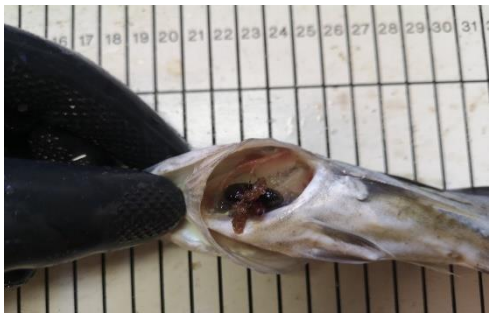

Figure 6. Cod worm in a juvenile haddock

CEND 14/22 started the following day with a successful trawl at prime station 25. The catch was relatively small (307 kg), primarily made up of mackerel (85 kg), whiting (74 kg) and dab (66 kg). The second trawl of the day at prime station 24, yielded the largest catch (2030 kg) with herring being the largest component (1843 kg). This is the largest catch of Herring caught at this prime station in recent history with only the catch in 2015 (1019 kg) being of a comparable size. The last trawl of the day was at prime station 23 (1300 kg), "Swallow Hole" which is a station that has a depth variation of 89 m to 147 m. The catch comprised mainly of haddock (473 kg) and whiting (788 kg) and the catch composition was similar to previous years, but the catch weight was substantially higher than in 2021 (120 kg).

On 28 August at first light, the first GOV trawl of the day at prime station 22 (1275 kg) was completed before continuing south throughout the day, completing prime stations 13 (3445 kg), 14 (825 kg) and 15 (72 kg). The first three catch of the day consisted mainly of herring (3184 kg), making it not only the largest catch of the survey this year, but also the largest single species weight from any catch this year. Prime station 15 (72 kg) was the smallest catch of the day and contained mainly dab (34 kg and epibenthos (12 kg).

On 29 August, CEND 14/22 started the day at prime station 7 (207 kg) with a successful GOV trawl before traveling east to prime station 8 (215 kg) and finishing on prime station 16 (154 kg). All three catches were down on previous years, with the biggest differences coming from prime stations 7 and 8 where in 2021 prime station 7 yielded 1366 kg and prime station 8 yielded 720 kg. Catch weight at prime station 16 was down on the previous year (338 kg in 2021) but this was mainly due to 241 kg of mackerel being caught in 2021 which was not present this year. After completing prime station 16, CEND 14/22 began the final journey south-west to Lowestoft and docked at 10:00hr on 30 August, concluding this year's survey.

Special thanks are given to the scientists and ship's crew of the RV Cefas Endeavour (CEND 14/22) for their enthusiasm and hard work throughout the survey. I would also thank to thank our international counterparts who assisted in helping collect data from ICES rectangles we were unable to complete this year.

RESULTS:

PRIMARY AIMS:

1) (a-c) To carry out a groundfish survey of the North Sea as part of the ICES coordinated IBTS.

Due to technical issues prior to and during the survey, five days of survey time was lost this year. The loss of these days resulted in having to abandon 11 prime stations from the usual survey plan (17, 26, 49, 50, 57, 58, 71, 72, 73, 74, and 75). In consultation with the international coordinator, it was agreed to swap tows in the most northerly ICES rectangles (51E8, 51E9, 51F0, 51F1, 51F2) and complete tows in five rectangles (44E8, 46E8, 46E7, 46E9, 43F4), which would be easier to achieve to maximise what survey time was available. A valid haul with the GOV trawl was completed at 71 prime stations (Table 1; Figure 7). This is six less valid prime stations than were completed in 2021 and includes the five substitute tows. These catches will be reflected in the results presented here. Surface and bottom salinity samples were collected at 41 sites by Niskin sampler with accompanying oceanographic profiles using the ESM2.

Gear: The survey was fished using a 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 8).

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 (EDC) system and uploaded to the Fishing Survey System (FSS). Figure 9 shows the length distribution of cod, haddock, whiting, saithe *Pollachius virens*, 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 10–19.

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

Gear	Valid	Additional	Invalid	Total
GOV (IBTS standard gear)	71	0	2	73
ESM2+Niskin	41	0	0	41

Table 2: Top 15 fish species (by total catch weight) in 2022 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 2022, are not shown.

Common English Name	Scientific Name	2022 weight (kg)	2021 weight (kg)	2020 weight (kg)	2019 weight (kg)	2018 weight (kg)
Haddock	*Melanogrammus aeglefinus*	13678	6161	8252	2746	2267
Herring	*Clupea harengus*	13572	7821	16338	4545	10380
Whiting	*Merlangius merlangus*	6945	5464	4940	3652	3944
Mackerel	*Scomber scombrus*	6297	4776	3861	2237	2336
Dab	*Limanda limanda*	2834	3038	3218	3532	3365
Horse mackerel	*Trachurus trachurus*	1979	955	1986	3542	1635
Sprat	*Sprattus sprattus*	1855	3431	2730	5859	1983
Norway pout	*Trisopterus esmarkii*	1265	2188	3513	1198	1087
Grey gurnard	*Eutrigla gurnardus*	614	552	782	768	1359
Cod	*Gadus morhua*	453	519	340	312	372
Plaice	*Pleuronectes platessa*	411	377	283	374	561
Long-rough dab	*Hippoglossoides platessoides*	278	259	370	315	395
Saithe	*Pollachius virens*	231	319	271	955	1908
Lesser-spotted dogfish	*Scyliorhinus canicula*	183	216	140	230	288
Lemon sole	*Microstomus kitt*	170	197	199	278	250

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

Scientific Name	Common English Name	Stns	Scientific Name	Common English Name	Stns
Engraulis encrasicolus	European anchovy	3	*Phrynorhombus norvegicus*	Norwegian topknot	1
Argentinidae	Argentines	25	*Trisopterus esmarki*	Norway pout	36
Alloteuthis subulata	European common squid	20	*Loligo forbesi*	Northern squid	30
Trisopterus luscus	Bib pouting	2	*Ocopodidae*	Octopus	14
Scophthalmus rhombus	Brill	2	*Sardinia pilchardus*	Pilchards	4
Raja brachyura	Blonde ray	1	*Hippoglossoides platessoides*	American plaice (long rough dab)	48
Myoxocephalus scorpius	Bullrout	4	*Pleuronectes platessa*	Plaice	61
Anarhichas lupus	Wolf-fish	4	*Trisopterus minutus*	Poor cod	17
Callionymus lyra	Common dragonette	35	*Agonus cataphractus*	Pogge (Armed bullhead)	17
Arctica islandica	Ocean quahog	1	*Pollachius virens*	Saithe	15
Gadus morhua	Cod	42	*Pollachius pollachius*	Pollock	1
Cancer pagurus	Edible crab	15	*Gobius spp.*	Gobies	3
Leucoraja naevus	Cuckoo ray	8	*Aequipecten*	Queen scallop	16
Limanda limanda	Dab	62	*Helicolenus dactylopterus*	Blue mouth redfish	10
Galeus melastomus	Black-mouthed dogfish	1	*Rossia macrostoma*	Stout bobtail	2
Squalus acanthias	Spurdog	8	*Lumpenus lampretaeformis*	Snake blenny	5
Dicentarus labrax	European sea bass	2	*Pecten maximus*	Scallop	4
Platichthys flesus	Flounder	2	*Maja squinado*	European spider crab	1
Enchelyopus cimbrius	Four-bearded rockling	10	*Arnoglossus laterna*	Scaldfish	19
Syngnathus acus	Greater pipefish	1	*Raja montagui*	Spotted ray	5
Hyperoplus lanceolatus	Greater sandeel	12	*Mustelus asterius*	Starry smooth-hound	5
Eutrigula gurnardus	Grey gurnard	64	*Callionymus maculatus*	Spotted dragonette	12
Aspitrigula cuclus	Red gurnard	3	*Dipturus intermedia*	Flapper skate	2
Melanogrammus aegelfinus	Haddock	59	*Entelurus aequoreus*	Snake pipefish	1
Hippoglossus hippoglossus	Halibut	1	*Solea solea*	Dover sole	6
Clupea harengus	Herring	59	*Buglossidium luteum*	Solonette	19
Myxine glutinosa	Hagfish	6	*Sprattus sprattus*	Sprat	23
Merluccius merluccius	Hake	23	*Sepiolidae*	Cuttlefish	5
Trachurus trachurus	Horse mackerel	46	*Illex (loligo) illecebrosus*	Northern shortfin squid	38
Zeus faber	John dory	1	*Gadiculus argenteus*	Silvery pout	7
Lithodes maja	Stone crab	17	*Amblyraja radiata*	Starry ray	20
Microstomus kitt	Lemon sole	56	*Microchirus variegates*	Thickback sole	2
Molva molva	Common ling	4	*Raja clavata*	Thornback ray	2
Scyliorhinus canicula	Lesser spotted dogfish	21	*Ammodytes tobianus*	Small sandeel	1

Cyclopterus lumpus	Lumpsucker	1	*Trigla lucerna*	Tub gurnard	7
Scomber scombrus	European mackerel	68	*Scophthalmus maximus*	Turbot	8
Lepidorhombus whiffiagonius	Megrim	6	*Lophius budegassa*	White anglerfish (black bellied)	3
Necora puber	Velvet swimming crab	3	*Trachinus vipera*	Lesser weever	10
Lophius piscatorius	Anglerfish (monkfish)	28	*Micromesistius poutassou*	Blue whiting	8
Mullus surmuletus	Red mullet	10	*Merlangius merlangus*	Whiting	70
Nephrops norvegicus	Norway lobster	17	*Glyptocephalus cynoglossus*	Witch	15

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

Common English Name	Number of samples taken
Haddock	1553
Whiting	1502
Plaice	1475
Herring	1307
Mackerel	410
Cod	361
Norway pout	268
Dab	244
Lemon sole	195
Grey gurnard	183
Saithe	103
Sole	58
Anglerfish (monkfish)	55
Hake	40
Striped red mullet	29
Witch	26
Blue-mouth red fish	23
Tub gurnard	20
Ling	12
Turbot	9
Red gurnard	7
Black-bellied anglerfish	6
Brill	5
John dory	1
Spur dog	116

Starry ray	61
Starry smooth hound	55
Cuckoo ray	42
Spotted ray	32
Thornback ray	9
Wolf fish	5
Flapper skate	3
Black-mouthed dogfish	2
Blonde ray	1
Total	8218

Gadiformes

Total cod catches during the 2022 survey (453 kg; Table 2) were lower compared to 2021 (519 kg) though still higher than the preceding three years (2018-2020). This was also true of their distribution (Table 3), seen on 6 less stations than last year (42, compared to 48 in 2021). The number of individuals caught across the survey were also lower than in the previous year (n = 383, compared to n = 513 in 2021). The numbers of <15 cm cod were also lower in comparison to previous years (n = 9 individuals compared to n = 76 in 2021 and n = 263 in 2020), with these juvenile cod only making up 5.4% of the total catch across the survey, compared with 14.8% in 2021. Despite the decrease in catch weight from 2021, the length distribution remained similar to the previous year with individuals >35cm making up 45.4% of the total catch numbers (49.9% in 2021), but individuals between 15cm>35cm made up 49.2% of this year's total numbers compared to 35.2% in 2021 (Figure 9a). The reduced catch weight has likely resulted in the lower numbers caught this year, and this could be attributed to the loss of six prime stations and the relocation of five other stations into shallower waters. The lower catch numbers this year has resulted in lower numbers of biological samples collected, with 361 taken, compared to 437 in 2020 (Table 4). Cod <12 cm are not sampled for age (assigned as 0-groups).

Haddock catches were up to 13.678 t which is over double the catch of 6.161 t in 2021 and is the largest catch observed in the time series (1992-2022) with the largest previous catch being 8.654 t in the year 2000 and ., makes it the top caught species on this survey for the first time. Despite haddock catch weight being vastly up from 2021, the overall spatial distribution was less this year, with haddock caught at 59 prime stations (eight less than in 2021). The decrease in spatial distribution resulted in only 1553 haddock otoliths being collected, compared to 1940 in 2021. The less spatial distribution also resulted in less individuals being measured this year (n=7499 compared to n=8463 in 2021). The abundance of 0-group and juvenile haddock last year has continued and is evident in the length distribution observed from this year's survey (Figure 9b) but there were more individuals than in 2021 with 23% of the catch being <15cm (compared to 10.5% in 2021).

The trend of rising whiting catch weights over the last three years continued, with another increase this year (6.945 t, compared to 5.463 t in 2021). It remained the most spatially abundant fish species on the survey,

caught at 70 of the 71 prime stations fished whereas last year it was seen on 76 out of 80 prime stations. Despite the increase in catch weights and larger spatial distribution, biological samples collected has decreased (1502 in 2021 compared to 1706 in 2021). The individuals being measured this year has also decreased (n=7623, compared to n=9719 in 2021). The decrease in both biological samples and lengths could be attributed to completing six less prime stations than in 2021. As in 2021, two distinct length classes were seen in the length distribution plot (4–14 cm (0-group) and 15–35> cm; Figure 9c). in total, 15.6 % of all whiting caught this year were under <14 cm compared to 6.3% in 2021. Whiting <12 cm were caught at 44 of the 71 prime stations this year, compared to 48 of the 80 prime stations in 2021.

After a slight upturn in 2021, the total saithe catch weight was down to 231 kg, compared to the 319 kg recorded in 2021. This is the lowest total catch weight recorded for saithe on this survey (1992-2022). Spatial distribution had decreased from 2021 (15 prime stations, compared to 24 last year) and no large catches of saithe were recorded at any single station, as had been seen in recent years with higher catch weights. The decreased distribution and catch weight this year resulted in a decrease in biological samples with 103 otoliths collected, compared to 168 the previous year. This decline in numbers and weights could partly be attributed to not achieving some of the deeper prime stations this year where historically we have caught this species in greater numbers.

Norway pout catches (1.265 t) were lower than in 2021 (2.187 t) and lower than the peak of 3.513 t caught in 2020. Catch weights this year were similar to catches in 2019 and 2018 (1.199 t and 1.087 t, respectively). The lower catch weights can be attributed in part to the decrease in distribution, with Norway pout caught at 36 prime stations compared to 43 last year. Norway pout have a limited length range and so otolith numbers are normally consistent year on year, but with decreased distribution and catch weights this year, less otoliths were taken (268 compared to 429 in 2021). As with whiting, Norway pout had two distinct cohorts (4–10 cm and 11–20 cm; Figure 9e) as in previous years. Norway pout under <10 cm are not sampled for age (assigned as 0-groups) and this year n=128 individuals were assigned (compared with n=95 in 2021). The numbers of individuals measured this year is similar to 2021 (n=4267 compared to n=4674 in 2021) but 63% of the total Norway pout caught this year were <10 cm compared to 28% last year, contributing to the decrease in catch weights, with only 37% adult individuals caught compared to 72% in 2021.

Hake caught this year has continued a declining trend in previous years, producing the lowest total weight in seven years (38 kg compared to 138 kg in 2021) and for the third year in a row, was no longer in the top 15 fish species by total catch weight (ranked 25, compared to the rank of 18 in 2020 and 2021). This follows a declining trend since 2016 (where 1.084 t were caught). The distribution of hake has dropped, being seen at 23 prime stations compared to 30 last year. The numbers of individuals caught (n = 40) and biologically sampled (n = 40) this year were both lower than in 2021 (n = 171 and 132, respectively). The decline in numbers and weights could partly be attributed to not achieving some of the deeper prime stations this year where historically we have caught this species.

Pleuronectiformes

Plaice catches were up for the second year in a row, with catch weights up to 411 kg compared to 377kg last year and the low of 283 kg in 2020. Distribution was up to a five year high, despite completing six less prime stations than normal. Plaice were present at 61 stations this year (57 stations in 2021, 59 stations in 2020 and 60 in both 2018/17). Maturity stages observed for plaice remained mixed, as also observed in 2020 and

2019, with stages at this time of year normally spent, however mature and running individuals were all recorded. The number of individuals measured increased from the previous year (n=2807 compared to n=2541 in 2021). Length distributions this year were similar to last year, apart from the "0" group plaice (<15 cm) with n=235 individuals, compared to n=53 individuals in 2021. With larger catch weights and an increased spatial distribution, the numbers of otoliths taken increased to 1475 (1305 in 2021).

Total lemon sole *Microstomus kitt* catch weight this year followed a downward trend as seen in the previous five years, with a low of 170 kg, compared to the 199 kg caught in 2021. This decrease was also seen in the spatial distribution, with lemon sole only being recorded at 56 prime stations this year, compared to 64 stations last year (the lowest distribution in recent history). A decrease in numbers measured at length was also recorded this year n=1557 (cf. n=1741 in 2021), with very similar length distributions to 2021. Consequently, fewer otoliths were collected this year (n=228) compared 2021 (n=235).

Dab catch weights were down for a fourth year (2.834 t compared to 3.038 t kg in 2021), with a decreased spatial distribution (62 stations this year, compared to 64 in 2021) and fewer numbers measured (n = 7430 compared to n =7577). Despite catch weights, distribution and individuals measured all being down compared to 2021, the numbers of otoliths collected was up (244, compared to 211 last year). This increase in otoliths is the result this year's length distributions, and the increase in <10 cm individuals this year (n=231 compared to only n=16 in 2021).

Pelagic fish

The most marked change in catch weight in this year's survey compared to previous years was with herring. The total catch weight of herring was 13.572 t, ~75% more than seen in 2021, however herring was not the highest species by catch weight on the survey and came in second behind haddock (13.678 t). Spatial distribution was slightly up, to 59 prime stations compared to 57 in 2021, but still down on the 69 stations in 2020. The lower spatial distribution could be in part due to the six prime stations missed from the survey this year and especially the five most northernly prime stations 71, 72, 73, 75 and 75 where historically herring would be caught. Increased catch weights resulted in numbers measured increasing this year (n=7539 compared to n=4845 in 2021) which then resulted in increased numbers of biological samples being collected (1307 compared to 907 last year). It is worth noting that four large herring catches made up 61% of all the herring caught on this year's survey (prime stations 24, 52, 54 and 68). Three distinct year class can be seen in the length distributions (figure 9f, 0-12 cm, 12-23 cm and 23+ cm) the same as in 2021.

Sprat catches and distribution were down compared to catches observed during the 2021 survey, with 1.855 t caught in total over 23 stations compared to 3.431 t over 32 prime stations last year. Catches were similar to 2018, which also had low catch weights and distribution (1.983 t caught over 22 prime stations). A lower number of stations with catch weights over 100 kg was also observed this year with only three, compared to eight last year. These three prime stations (primes 6, 9 and 20) made up 83.7% of the total catch of the survey for sprat, (1.554 t) and were all located in the southeast of the North Sea. Length distributions are similar to previous years, but the reduced catch resulted in less individuals measured this year (n=1943 compared to n=3452 in 2021).

Mackerel catch weights continue a rising trend and have increased on last year's five-year high, with a total catch weight of 6.297 t recorded (4.776 t seen in 2021). This increase in catch weight was reflected with an

increased spatial distribution, the highest seen in over six years, with mackerel recorded at 68 stations (55 station in 2021). Mackerel station catches over 100 kg have increased from 6 in 2021 to 14 this year and with the increased distribution, the numbers of individuals measured at length have also increased (n=4218 compared to n=2491 in 2021) but this resulted in fewer otoliths being collected (380, compared to 410 in 2021).

Total catches of horse mackerel in 2022 (1.979 kg) increased compared to last year, which was the lowest total catch in five years. It is also worth noting that 27% of the total catch weight came from just a single tow (536 kg at prime station 4). Spatial distribution was up from the five-year low in 2020 (27 prime stations) to 46 stations this year. As a result of the increased landings and distribution, numbers of individuals measured was also up this year (n=2301 compared to n=674 in 2021).

Elasmobranchs

A total of 244 kg of elasmobranchs were caught this year, which is nearly half that seen in 2021 (562 kg). Starry smooth hound was the main elasmobranch species caught this year (total catch weight 71 kg, down from 75 kg in 2021), followed by spurdogs (39 kg, down from 43 kg) and two flapper skate (39 kg, down from 97 kg). A total of twenty-nine individuals were tagged with Petersen discs and released (25 starry smooth hounds, three flapper skate and one black-mouthed dogfish).

Cephalopods and commercial shellfish

The highest catch weight this year was northern squid *Loligo forbesii*, with increased amounts seen compared to last year (41 kg compared to 25 kg in 2021), despite spatial abundance being down (30 prime stations compared to 34 in 2021). Length distributions were similar to that of 2021 but number of individuals measured at length was down (n=559 compared to n=672 in 2021) Broadtail shortfin squid *Illex coindetii* catch weights were slightly down at 12.2 kg compared to 14.7 kg in 2021. European common squid *Alloteuthis subulata* weights were up significantly from last year (34.3 kg compared to 5.96 kg in 2021). Curled octopus *Eledone cirrhosa* numbers declined compared to last year, with only 14 individuals recorded compared to 16 in 2021.

Edible crab *Cancer pagurus* catch weight increased from 25 kg last year to 28 kg this year and velvet swimming crab *Necora puber* catches increased compared to that seen in 2021 (0.566 kg compared to 0.141 kg last year). No European lobster *Homarus gammarus* were caught on the survey this year. Stone crab *Lithodes maja* catch weights were lower than in previous years (16 kg compared to 28 kg last year). Of note this year, a European spider crab *Maja squinado* was recorded at prime station 1.

Ichthyological observations

A total of 77 fish species were recorded on the survey this year, two more than in 2021. Species of note were the moustache sculpin *Triglops murrayi*, blue-mouth redfish and a large wolf-fish tagged and released.

d*) Distribution of Macrobenthos*

A total of 135 taxa of macrobenthos were recorded on this year's survey, four more than in 2021. The sand star *Astropecten irregularis* was the most widely distributed, the same as in 2021, with presence recorded at 51 of the 71 prime stations completed.

Distribution of Marine litter

A total of 194 (compared to 231 in 2021) litter items were logged from 73 trawls, totalling 414.2182kg in weight (400kg of which was a single item – rope/cable and metal from one haul). Of those 194 items, 154 were plastic. There were 10 trawls where no litter was recorded. See figure 20.

e) 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 bottle, were collected at 41 stations.

F) Length weight & maturity information using individual fish measurements, in support of the EU Data Regulation.

As Table 5 shows, two fish were measured for additional length/weight & maturity data.

Table 5 : Number of length weights recorded.

Scientific Name	Common English Name	Number measured
Cyclopterus lumpus	Lump sucker	1
Triglops murrayi	Moustache sculpin	1
Total		2

2) Collect surface sea water samples for Caesium/Tritium testing to be performed post-survey.

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

SECONDARY AIMS:

3. ***Tag and release specimens… 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, 30 individuals were deemed appropriate to attach Petersen discs and released (Table 6).

Table 6: Species tagged and released.

Scientific Name	Common English Name	Number tagged	Minimum Length (cm)	Max Length (cm)
Mustelus asterias	Stary smooth hound	25	83	102
Dipturus intermedius (Intermedia)	Flapper skate	3	76	92
Anarhichas lupus	Wolf fish	1	72	72
Galeus melastomus	Black-mouthed dogfish	1	63	63

4. ***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)***

   43 species of unusual fish/epibenthos were retained for further analysis, including greater weever fish *Trachinus draco* and hagfish *Myxine glutinosa*.

5. ***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 2.

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

   No specimens were caught during the survey.

7. ***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)***

   No acoustics data were recorded this year.

8. ***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 and this year no observations were recorded.

9. ***Identification, count, measure and weight 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, 2788 individual jellyfish (from a total of five species) were measured on the survey (Table 6). Total catch weight (149 kg) was noticeably lower than recorded in 2021 (278 kg). Lion's mane *Cyanea capillata* was the dominant species, with a total catch weight of 93.641 kg, and had the largest size and weight range (3.5–56.0 cm; 3–3402 g). Lion's mane jellyfish, blue jellyfish *Cyanea lamarckii* and moon jellyfish *Aurelia aurita* saw decreased catch weights this year, compared to 2021, however crystal jellyfish *Aequorea* spp and 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	19704	123	3	18.5	4	301
Cyanea lamarckii	blue jellyfish	10493	335	2	18	1	142
Chrysaora hysoscella	compass jellyfish	14072	226	2.5	20.5	1	240
Aequorea spp.	crystal jellyfish	11373	53	3.5	13.5	1	105
Cyanea capillata	lion's mane jellyfish	93641	249	3.5	56	3	3402
	Total	149283	2788				

Table 7. Jellyfish species (by total catch weight) in 2021 and corresponding catch weights in preceding years.

Scientific Name	Common English Name	2022 weight g	2021 weight g	2020 weight g	2019 weigh g	2018 weight g
Aurelia aurita	moon jellyfish	19704	47345	27234	11129	81830
Cyanea lamarckii	blue jellyfish	10493	72144	27234	19796	89150
Chrysaora hysoscella	compass jellyfish	14072	5226	24698	19046	2321
Aequorea spp.	crystal jellyfish	11373	3650	15717	13125	1376
Cyanea capillata	lion's mane jellyfish	93641	150130	285090	444581	355642
	Total	149283	278495	379973	507677	530319

10. 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 ommastrephid squids (Illex, Todaropsis, Todarodes) for maturity and age analysis, respectively. (V Laptikovksy – Cefas, Lowestoft)

No squid eggs were caught during the 2022 survey. 36 samples of northern shortfin squid *Loligo forbesii*, four broadtail shortfin squid *Illex coindettii* and several European common squid were retained for further analysis.

11. 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 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.

12. Zooplankton plankton sampling using ringnets to collect samples from the Gabbard smart buoy site. (S Pitois – Cefas, Lowestoft)

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

13. Collect queen scallops (queenies) Aequipecten opercularis to allow for experimental work on ageing, for Length/Weight 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.

12 individual specimens were collected and retained from 4 prime stations.

14. Visual examination of livers for liver worm conducted on all cod Gadus morhua selected for individual fish measurements over 25 cm, work completed for IBTS.

Visual examination of 209 individual cod was conducted during the survey at 33 prime stations.

Richard Humphreys
Scientist in Charge
04/10/21

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)

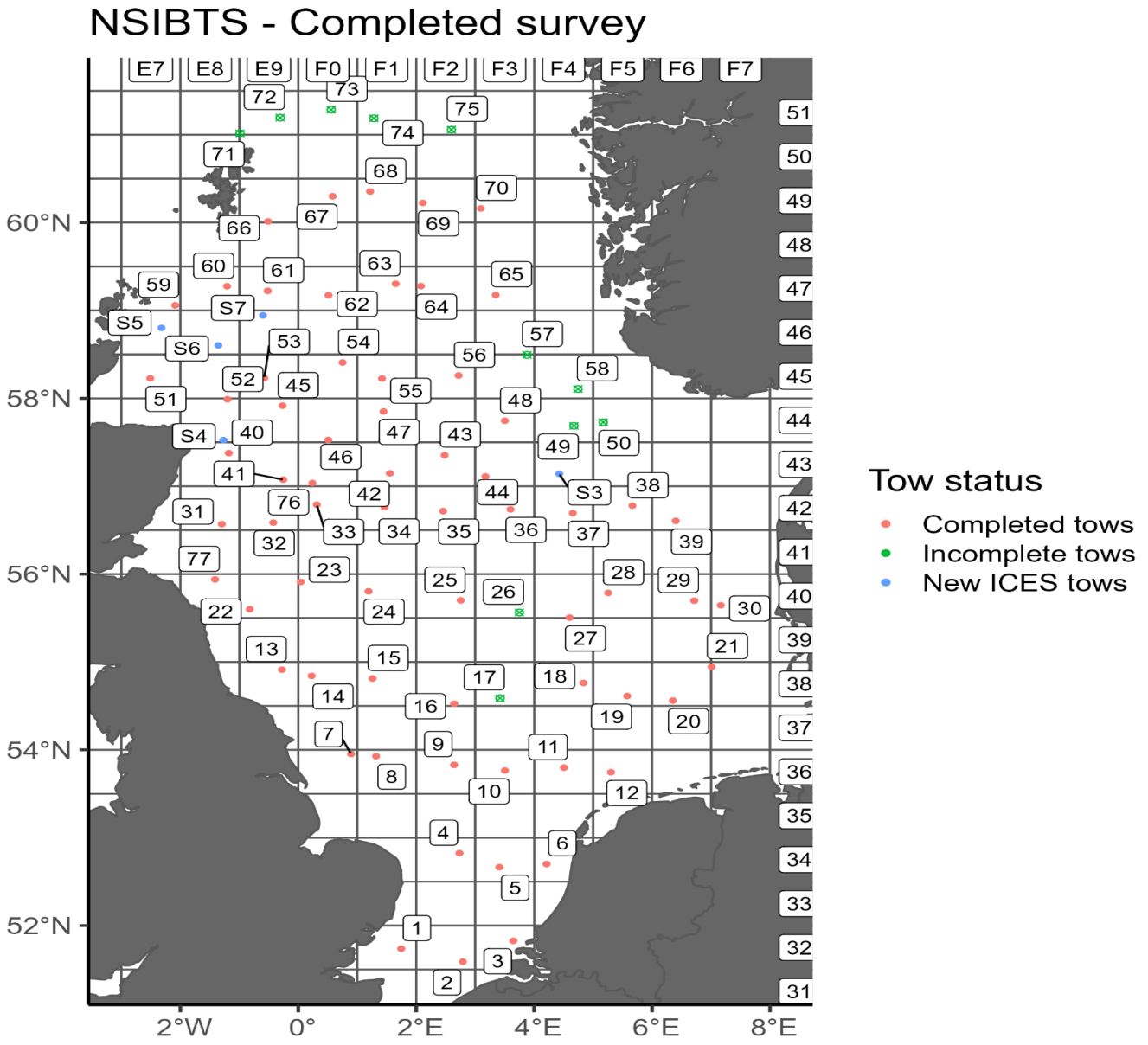

Figure 7. Deployment positions for valid and additional GOV trawl stations giving prime station numbers.

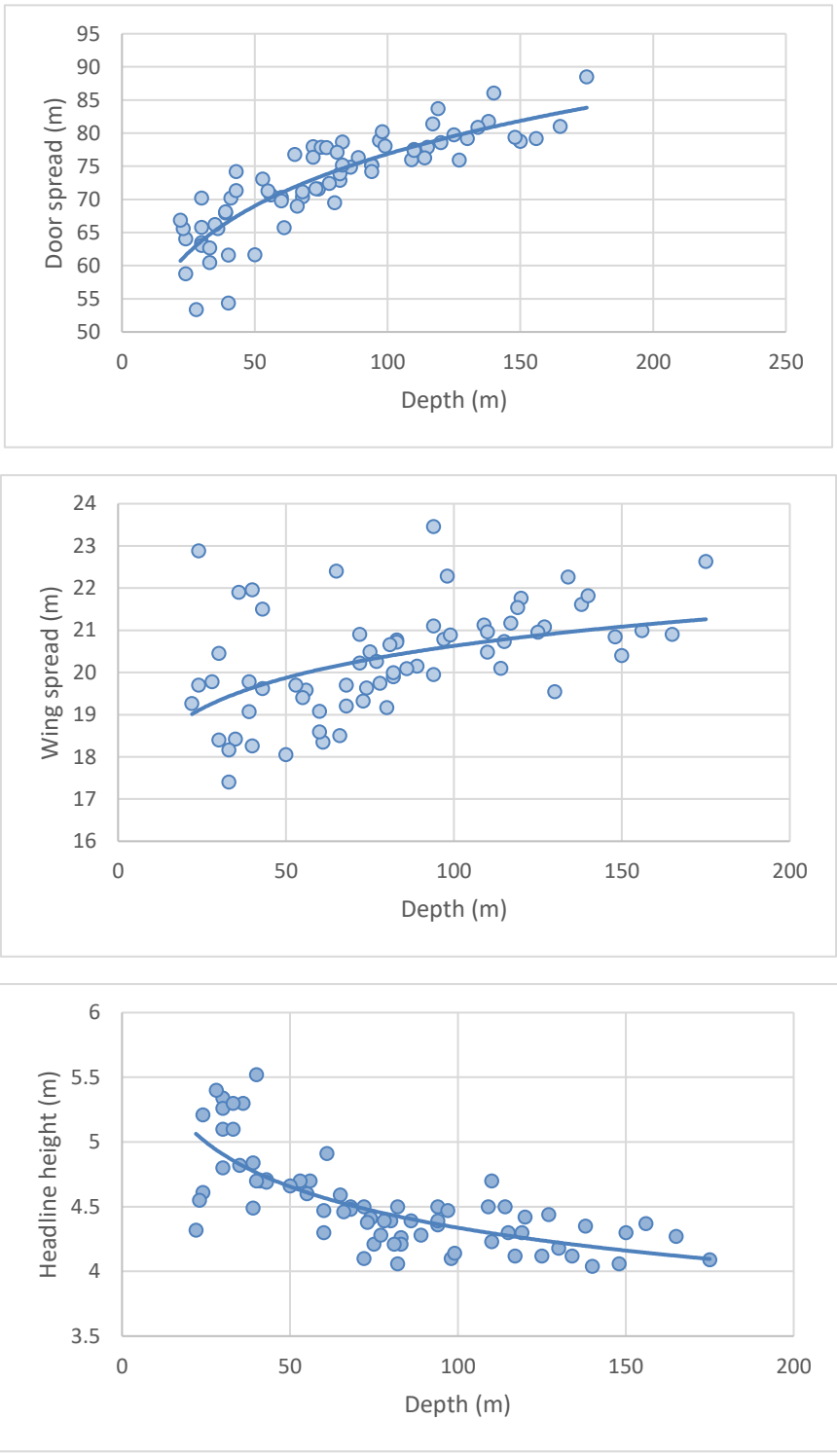

Figure 8. Relationships between door spread, wing spread and headline height with water depth (valid tows only).

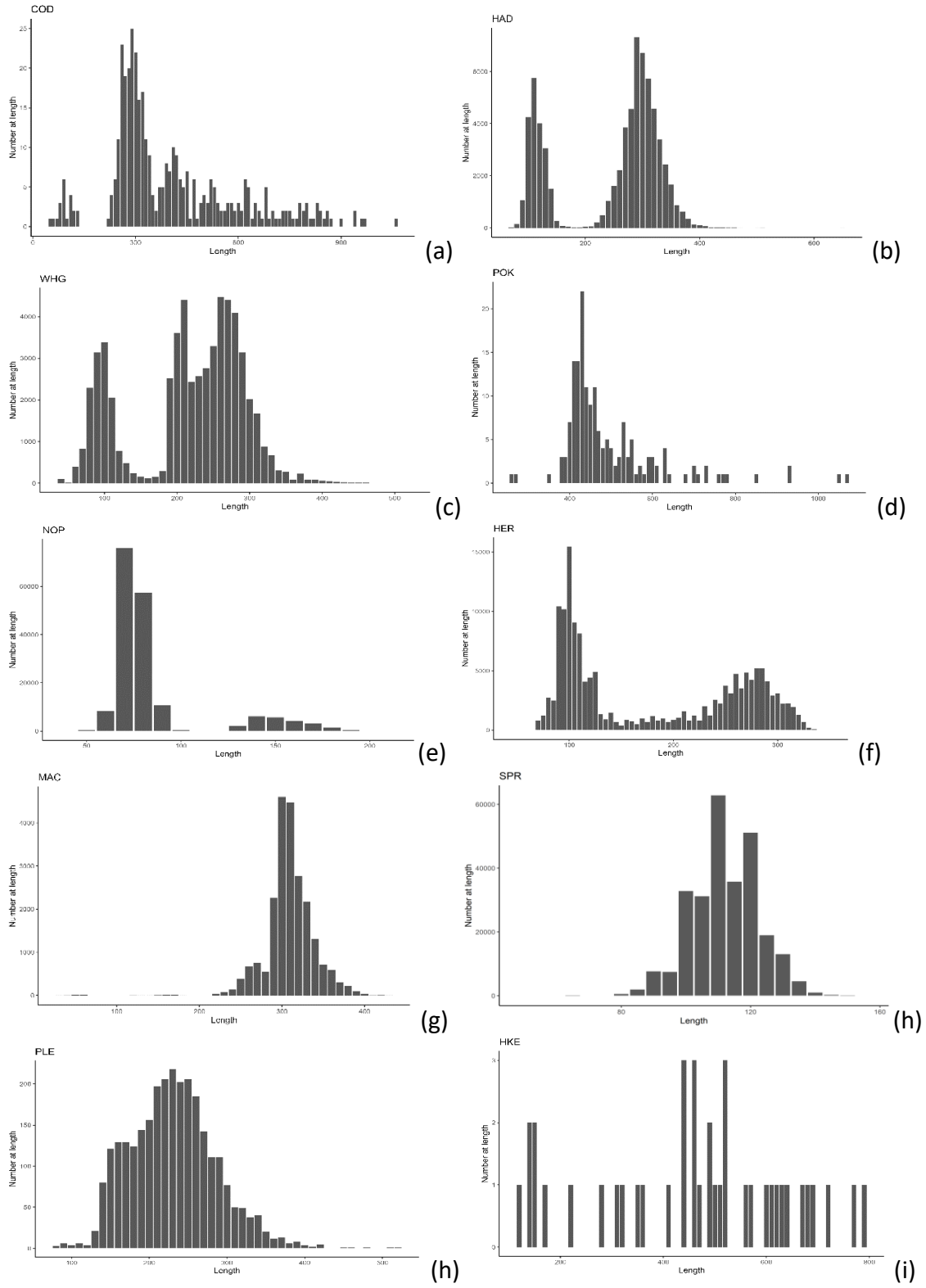

Figure 9. Length distribution plots for (a) cod, (b) haddock, (c) whiting, (d) saithe, (e) Norway pout, (f) herring, (g) mackerel, (h) sprat, (i) plaice and (j) hake.

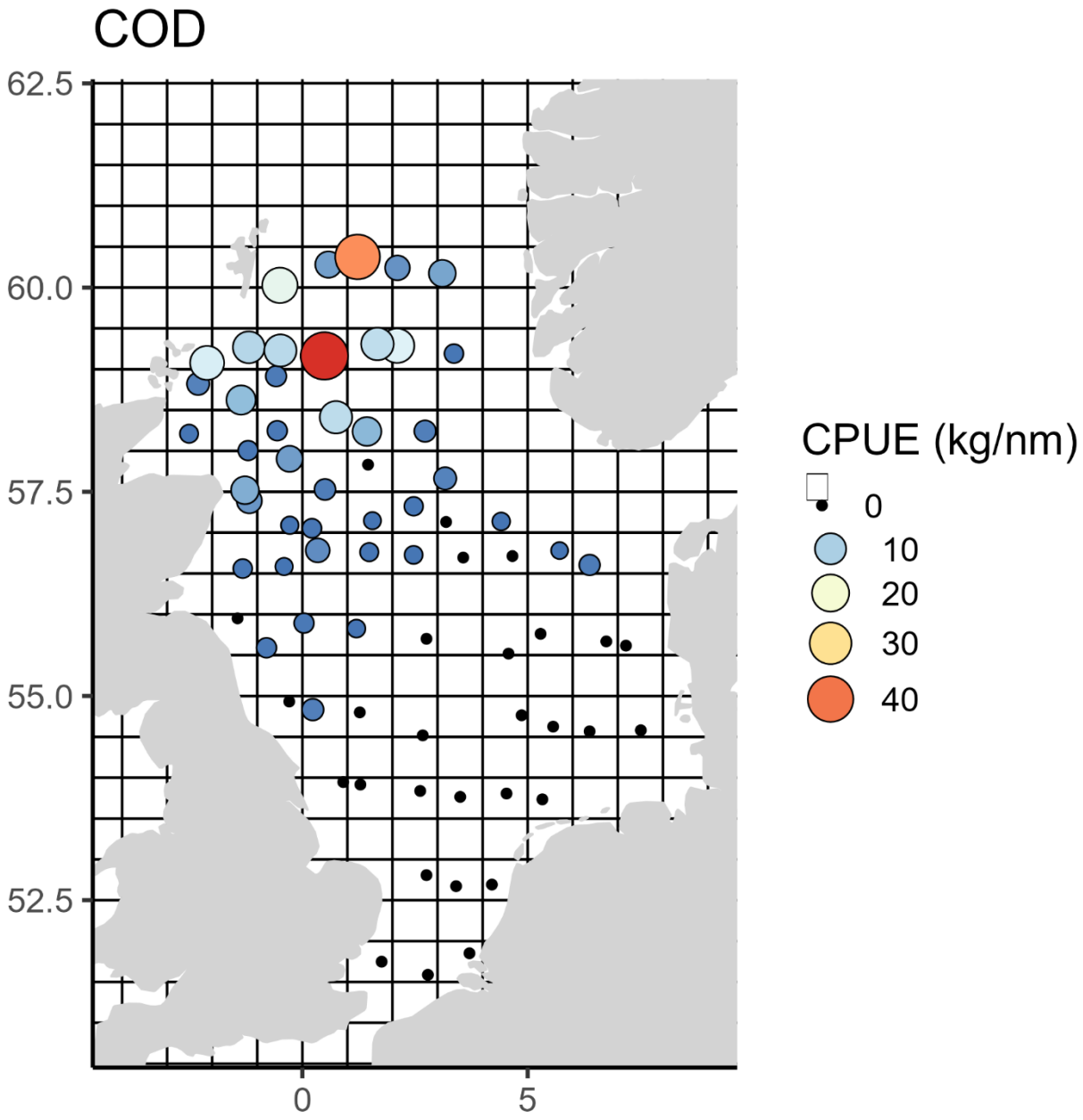

Figure 10. Distribution and relative abundance of cod (*Gadus morhua*) across the survey.

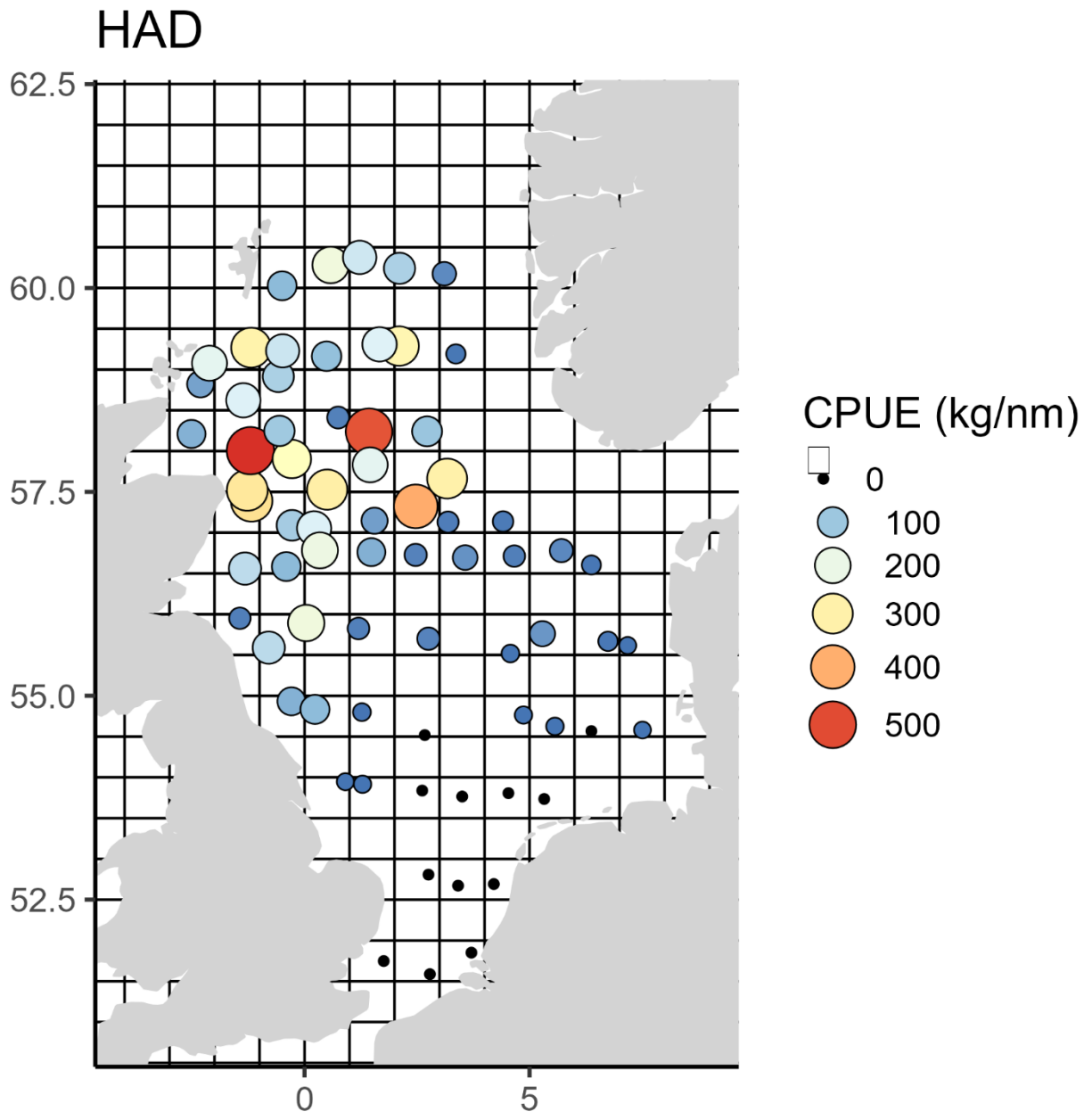

Figure 11. Distribution and relative abundance of haddock (*Melanogrammus aeglefinus*) across the survey.

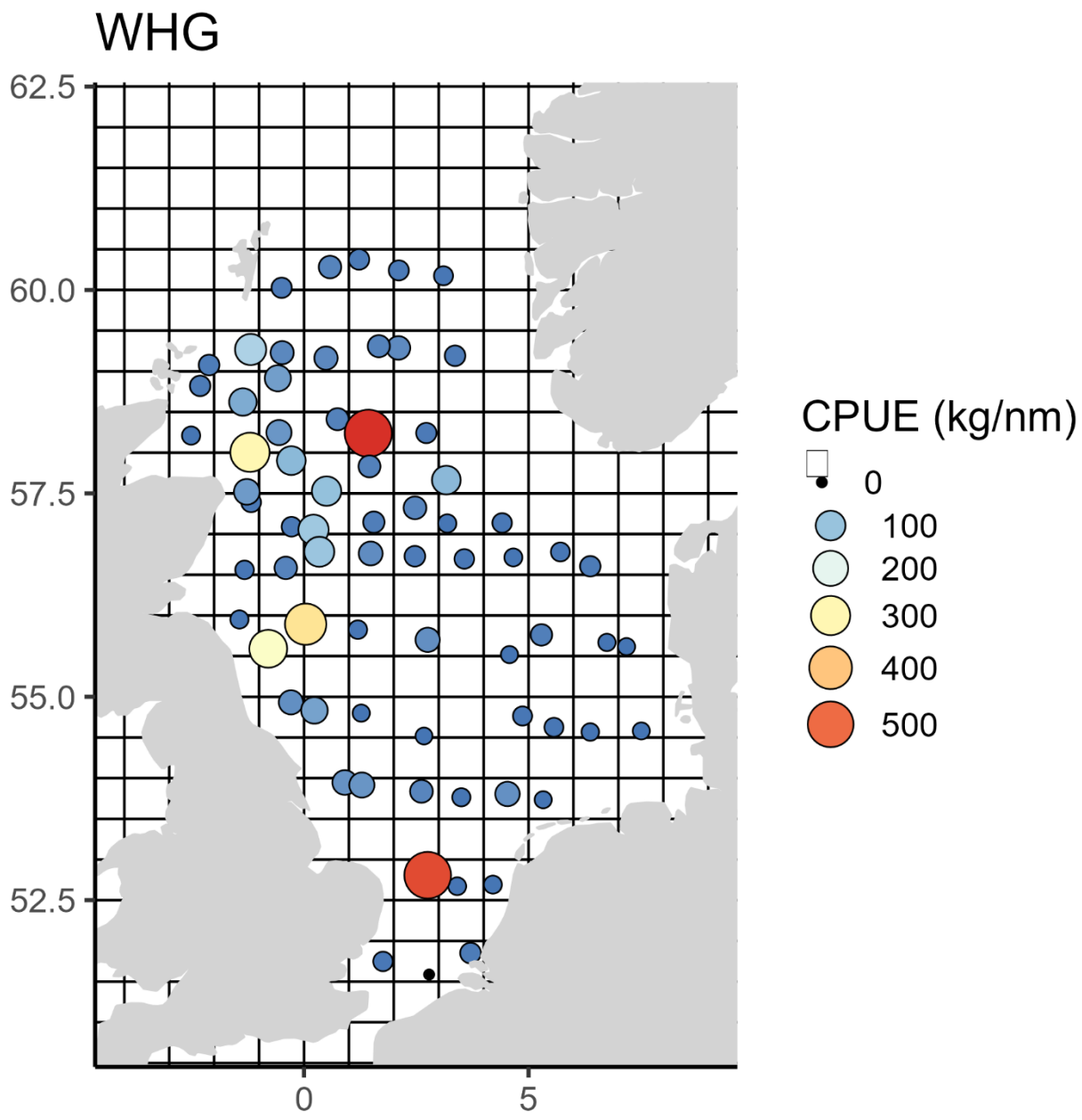

Figure 12. Distribution and relative abundance of whiting (*Merlangius merlangus*) across the survey.

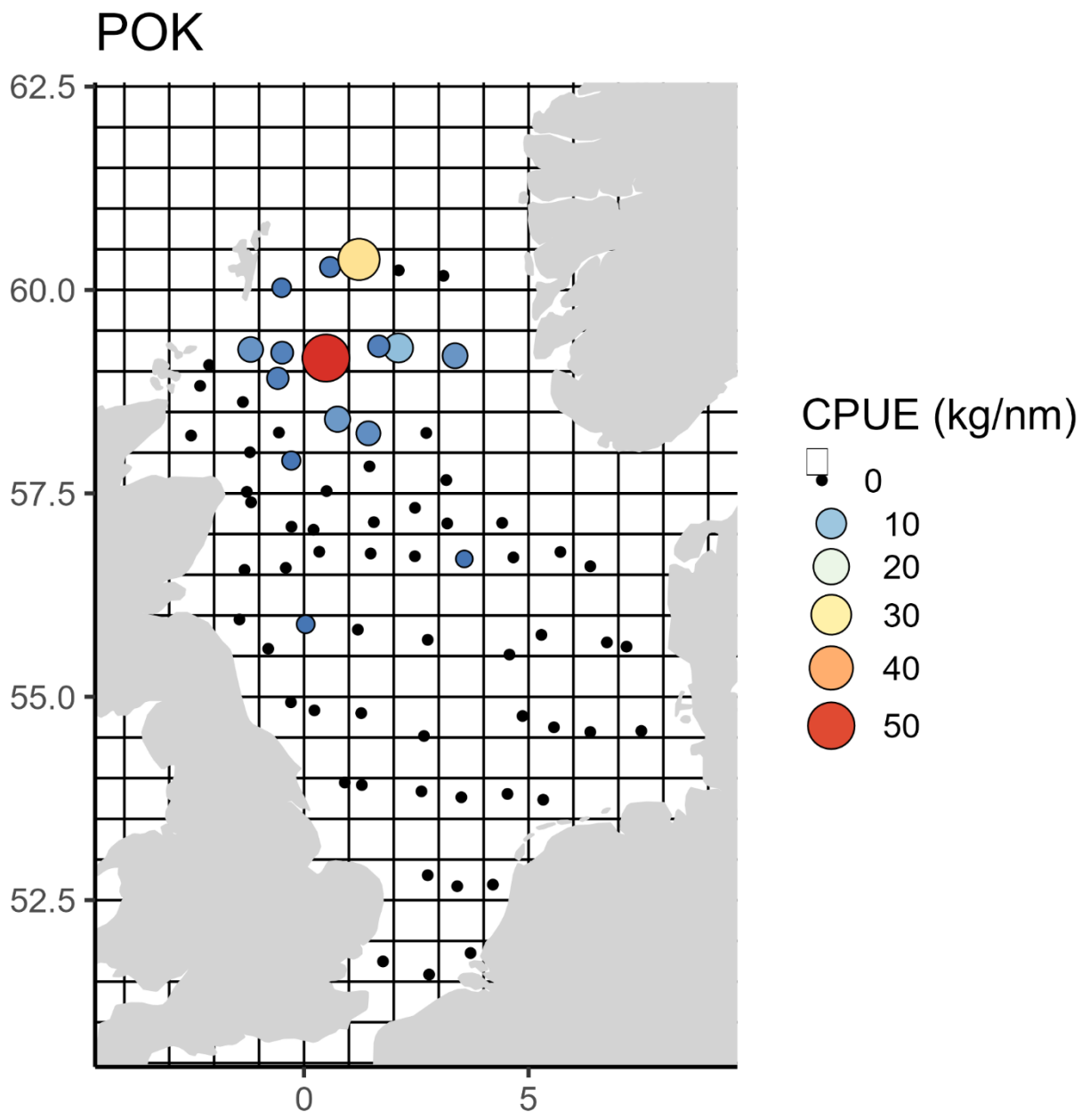

Figure 13. Distribution and relative abundance of saithe (*Pollachius virens*) across the survey.

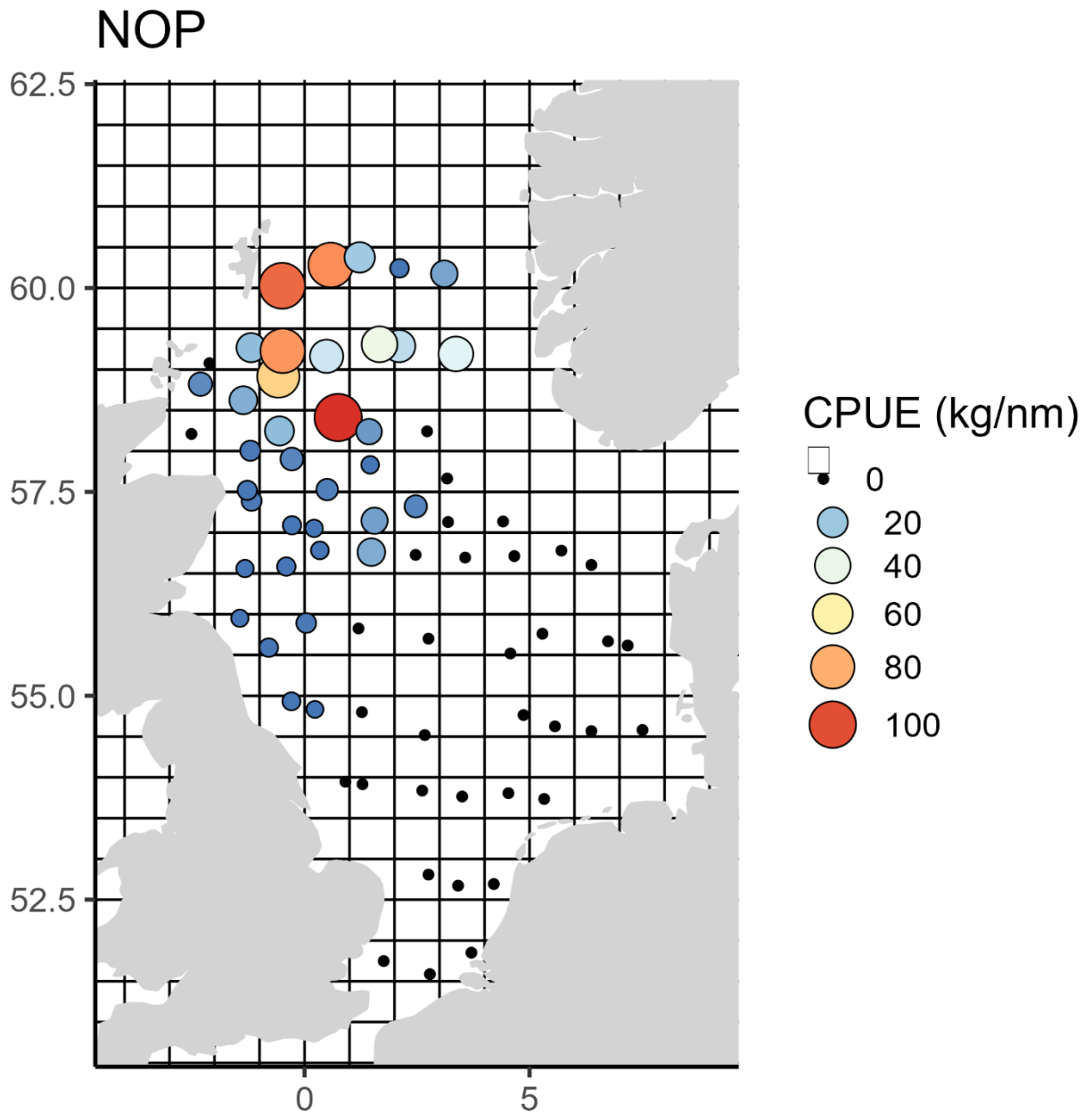

Figure 14. Distribution and relative abundance of Norway pout (*Trisopterus esmarkii*) across the survey.

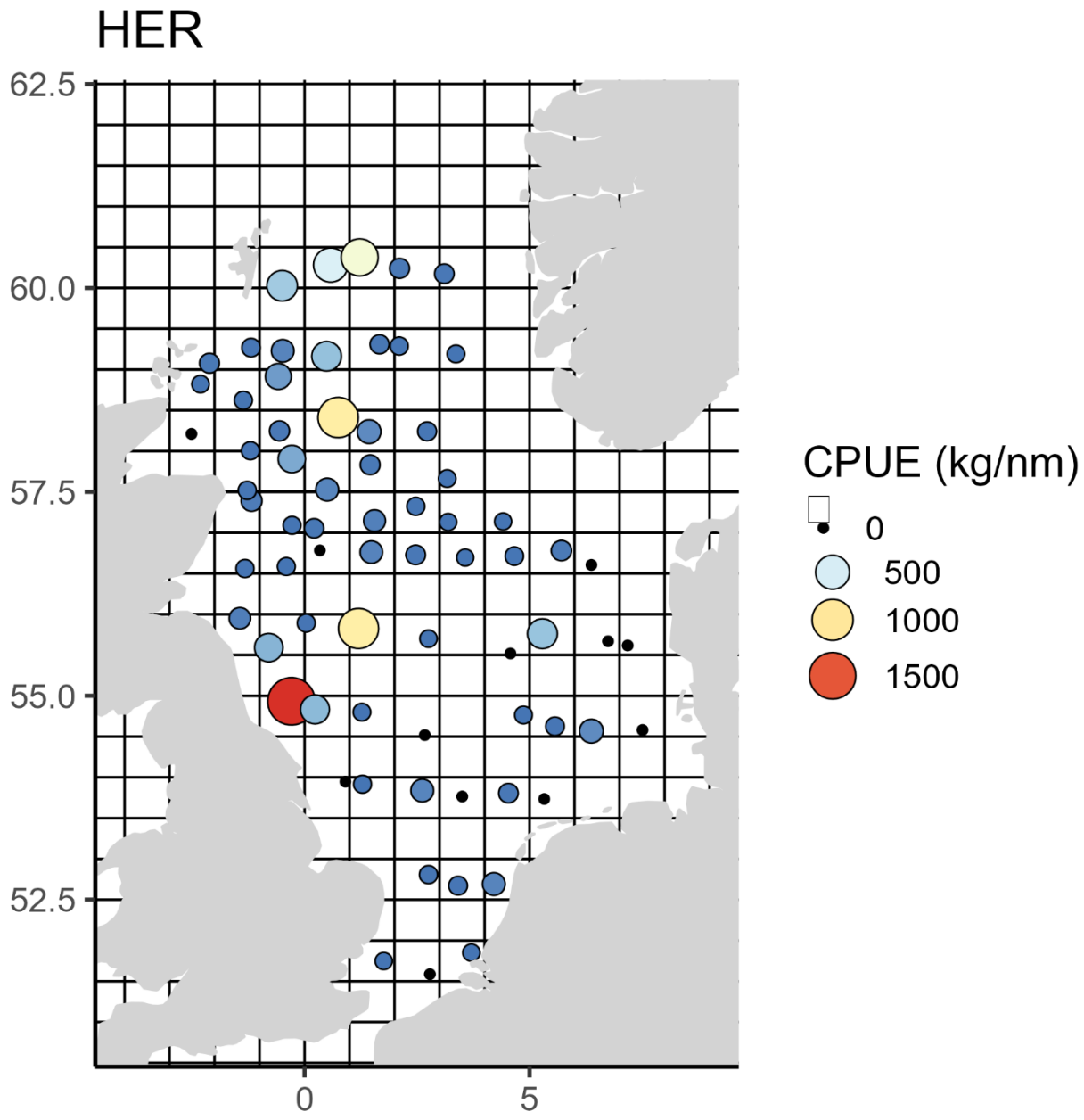

Figure 15. Distribution and relative abundance of herring (*Clupea harengus*) across the survey.

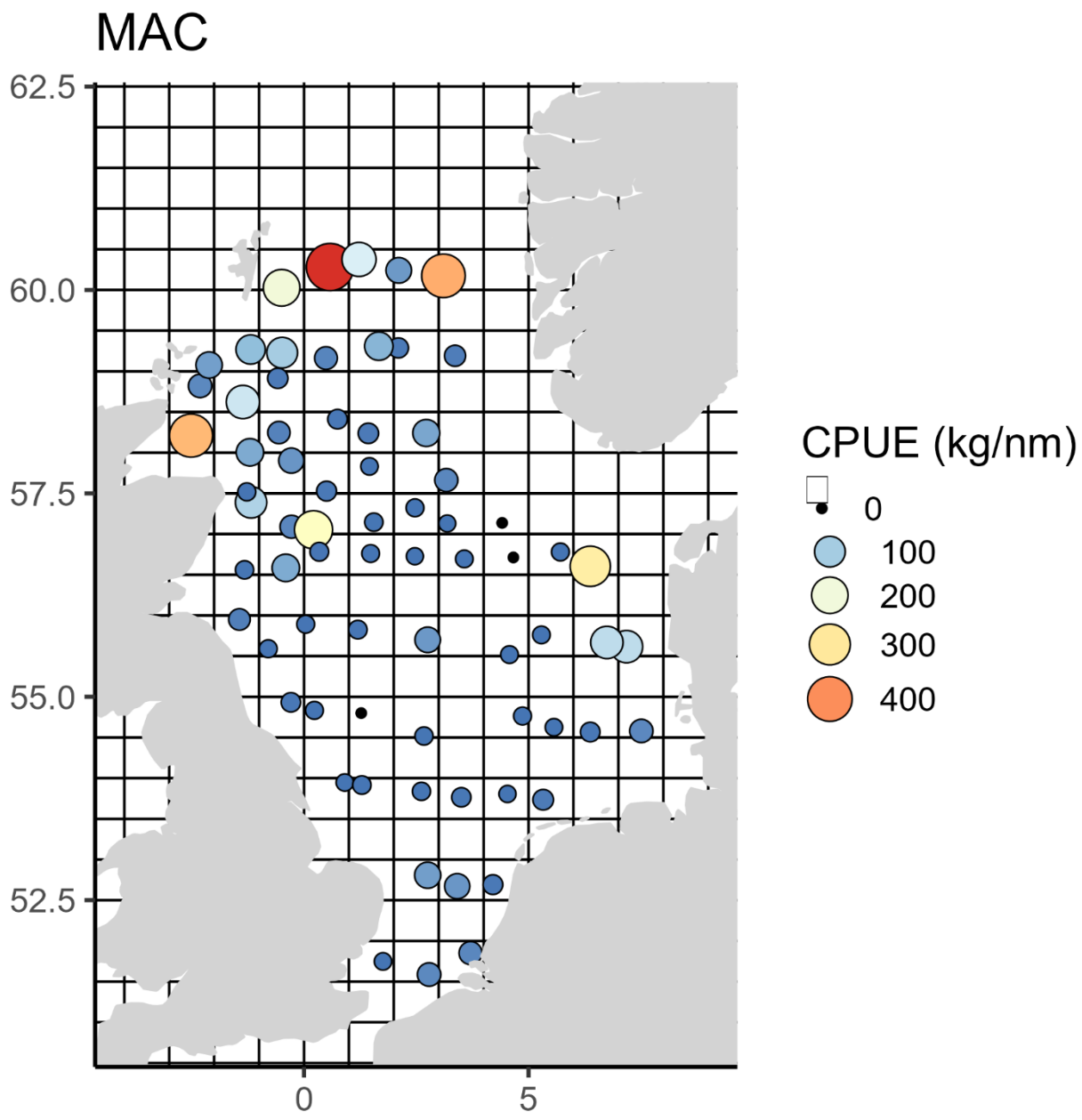

Figure 16. Distribution and relative abundance of mackerel (*Scomber scombrus*) across the survey.

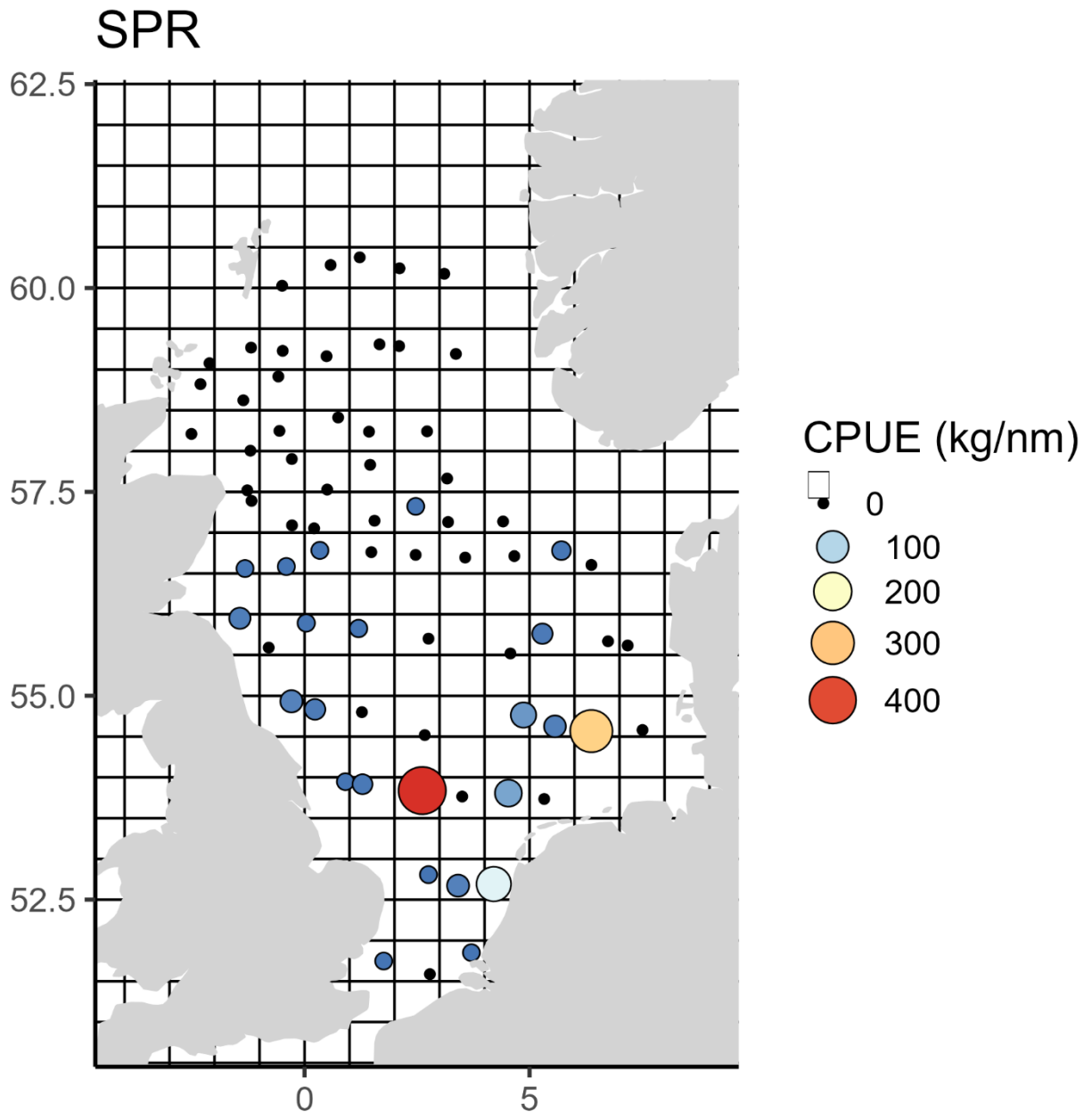

Figure 17. Distribution and relative abundance of sprat (*Sprattus sprattus*) across the survey.

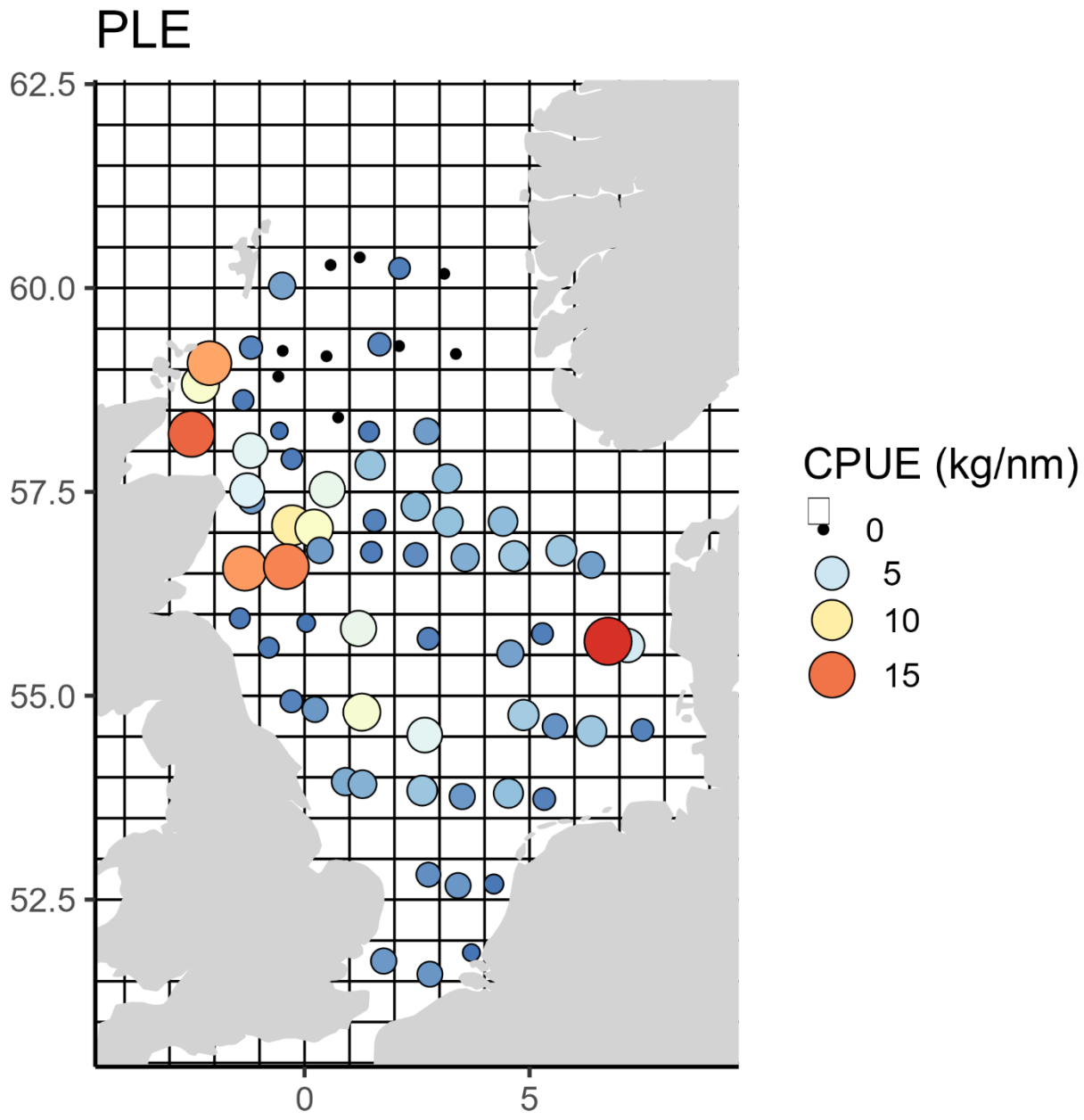

Figure 18. Distribution and relative abundance of plaice (*Pleuronectes platessa*) across the survey.

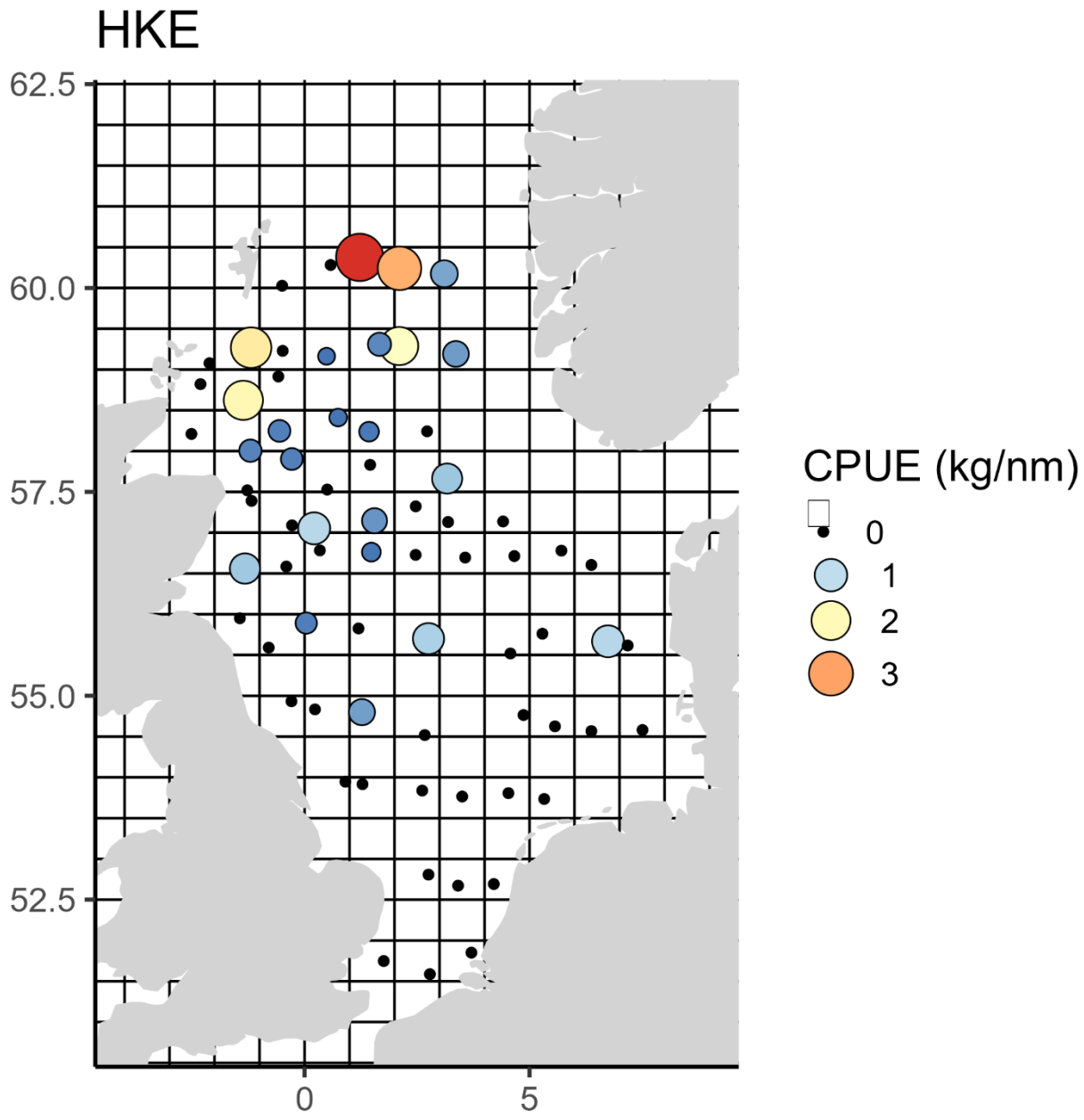

Figure 19. Distribution and relative abundance of hake (*Merluccius merluccius*) across the survey.

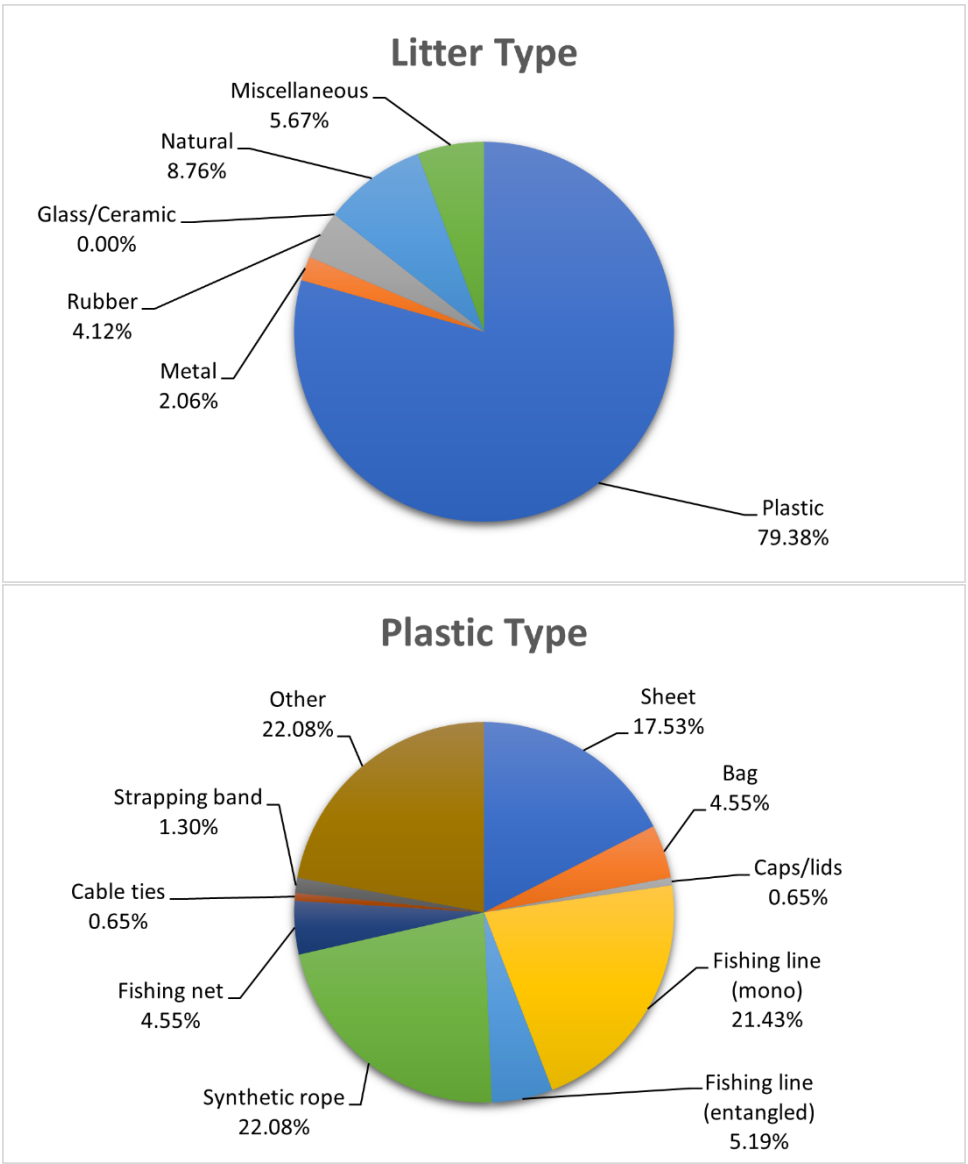

Figure 20. Marine litter collected during the English IBTS-Q3 trawl survey in 2022 (n = 194).