

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

2012 RESEARCH VESSEL REPORT

REPORT: RV CEFAS ENDEAVOUR: SURVEY 13

STAFF:

Part A

Fishing:

S McCully (SIC)

B Harley (2IC)

R Humphreys

B Hatton

M Eade

R Bush

C Crisp

Part B

S McCully (SIC)

B Harley (2IC)

R Humphreys

B Hatton

M Eade

F Armstrong

Plus:

A Pliru

S Chaichana

T Barnfield

C Cronin

A Pliru

D Rawson

C Turley

C Cronin

Y Verin

DURATION: 8 August – 8 September

LOCATION: North Sea

PRIMARY AIMS:

1. To carry out a groundfish survey of the North Sea (Figure 1) as part of the ICES coordinated IBTS, using a standard GOV trawl in order to obtain information on:
 - a) Distribution, size composition and abundance of all fish species caught.
 - b) Age – length distribution of selected species.
 - c) Distribution of fish in relation to their environment.
 - d) Distribution of macrobenthos and anthropogenic debris.
 - e) Surface and bottom temperature and salinity data using CTD rosette and Niskin Bottle.
 - f) Length weight & maturity information using individual fish measurements, in support of the EU Data Regulation.
2. Fish a minimum of 10 selected stations with ‘Poly GOV’ in Northern area of the sampling grid.
3. Carry out water sampling for Caesium/Tritium for an internal Cefas contract (SLA21) at every water station.
4. Particulate in/organic carbon analysis of seawater by filtration at every station.

SECONDARY AIMS:

5. As part of a project looking at the improvement methods for jellyfish monitoring (ACOJEL), we aim to:
 - Collect acoustic data in order to identify jellyfish distribution and relative density in the North Sea.
 - Deploy a MIK net as frequently as possible to a) collect jellyfish (and other organisms) for species identification; and b) validate acoustic data;
 - Collect *Mnemiopsis leidyi* in ethanol 96% for genetic analysis
6. To collect seawater from the southern North Sea to determine dissolved and particulate organic carbon and nitrogen contents, conduct incubation experiment on board to determine rate of dissolved organic matter degradation by natural microbial community
7. Tag and release specimens of cuckoo ray (*Leucoraja naevus*), spurdog (*Squalus acanthias*), tope (*Galeorhinus galeus*) and smooth hounds (*Mustelus* spp.), in support of Defra projects.
8. To freeze and retain specimens of eelpout (*Zoarces*, *Lycodes* and *Lycenchelys*), sea scorpions (Cottidae, sub-area IVa only), *Sebastes* spp., *Mustelus* spp. (if dead), and any unusual fish species.
9. Retain by freezing whole samples or otoliths of the more unusual species to the North Sea for otolith research.
10. Record litter caught in the trawl in support of Defra projects.
11. Record sightings of sea birds and cetaceans for JNCC and Sea Watch Foundation.
12. Retain all dead species of shad and lamprey for study by Cefas scientists.
13. Retain any specimens of *Chimaera monstrosa* for the Natural History Museum.
14. Collect and retain various benthic invertebrates for Great Yarmouth Sea Life Centre.
15. Collect and cryopreserve tissue and muscle samples from several species for the University of Bedford 'Frozen Arc' project.
16. Day grabs for particle size analysis (PSA) samples from selected stations throughout the survey grid.
17. Collect plankton biodiversity samples from selected prime stations for pigment and analytical flow cytometry analysis at Cefas.
18. Maturity photos (using protocol) of lemon sole, brill and turbot
19. Deploy a baited underwater camera system at selected stations across the survey grid.

NARRATIVE:

(All times BST)

RV Cefas Endeavour sailed from Lowestoft at 00:01h on Wednesday 8 August. Onboard were 8 Cefas fisheries staff, one environmental PhD student from the University of East Anglia (UEA), a masters student from the University of Exeter, and a JNCC seabird and marine mammal observer. Before work on the primary stations commenced, a 'shakedown' tow was carried out to allow for the deployment of the gear, to check that all sensors were working correctly and to allow scientists and crew to familiarise themselves with their particular work areas. A standard station consisted of a cast to collect surface and bottom water samples, with either the Rosette carousel (containing up to ten 10-litre Niskin bottles) or a single 30-litre Niskin bottle along with an ESM2 logger, measuring additional parameters throughout the water column. On the first and last stations of the day we also completed a day grab to collect sediment from the seabed for particulate sediment analysis (PSA) back at the lab. These deployments were then followed by a 30-minute tow with the standard IBTS rigged GOV (Grand Overture Verticale) trawl. From the start of the survey, whilst steaming between and on every station, fisheries acoustic data were continuously collected at three operating frequencies (38 kHz, 120 kHz and 200 kHz), using the Simrad EK60 split beam sounder. The shakedown tow was carried out at prime station 1. The net was shot away successfully, with all rigging in correct order, thus good readings were obtained from all Scanmar units. The accurate fishing of this tow and a good catch of sprat and thornback ray allowed us to count this as a valid tow, and thus was our first prime station completed.

We then steamed to the southern North Sea and fished eastwards to complete prime station 2 before the end of the first day, catching mainly mackerel. The following day (9 August) we started at prime station 3, and then moved up the Dutch coast, and fished westwards completing prime stations 6, 5 and 4, catching mainly pelagic species, with herring and sprat dominating at prime station 3, and mackerel at primes 6 and 5. During this evening, the baited underwater camera was also deployed for the first time, but failed to record valid data. Over the next two days a further eight prime stations (9 -12 and 18-21) were fished reaching the Dutch coast going northwards to Danish waters. The catches were relatively small (100-200 kg) mixtures of dab and pelagic species (mainly sprat), apart from prime station 21, where 1.1 t of mackerel were caught. During the day of the 11 August, two very extensive patches of algal blooms (possibly *Noctiluca* spp.) were sighted between 14:00 and 15:25, whilst steaming between stations. The following day (12 August), prime stations 30, 29 and 39 were fished along the German coastline. The catches were larger in volume than the previous day, with dab, herring and mackerel dominating. The catches remained of a similar species composition fishing westwards through the central North Sea (prime stations 15-17 and 25-28), with 0.5 t of mackerel also caught at prime station 16. Despite deteriorating weather conditions, fishing continued along the north-east English coastline (prime stations 7, 8 and 13), with catches consisting of mainly horse mackerel, whiting and mackerel. On 16 August, prime stations 22-24 were fished eastwards. Traditionally these stations yield large quantities of roundfish (especially at prime station 23 at Swallow's Hole), with whiting dominating. However this year, the catches were somewhat disappointing, with <200 kg of roundfish at each station. Over the next two days, eight prime stations (34-38 and 42-44) from the central North Sea to the Danish sector were fished, with a couple of herring catches in the west to dab dominated catches in the east. Three large mature male spurdog were also tagged and released in the east. Despite the relatively unremarkable catches, the most interesting sights came courtesy of our onboard observer, who saw a minke whale, a budgie

resting onboard, a willow warbler and also a grey seal eating a ling – which was particularly interesting as we did not catch any ling in that area. On 19 August four prime stations were fished (50, 49, 58 and 48) off the south-west tip of Norway. The catch composition finally evolved beyond the dab, gurnard and pelagic mixes seen in the southern North Sea to cleaner roundfish catches, with cod, haddock, whiting, saithe and Norway pout dominating. The following day we fished westwards completing four prime stations (57, 56, 55 and 47) across the northern central North Sea. Larger catches of mackerel and herring were seen, along with some saithe, haddock, hake and Norway pout. Interestingly, communications with a demersal trawler gave us some anecdotal information that the previous week seven French and Norwegian trawlers working in the area had all moved further North due to disappointing catches. They believe this was due to the bottom temperature being around 1°C warmer than normal for the time of the year. On 21 August we fished three prime stations (54, 46 and 41) moving towards the Scottish coast, with large herring catches totalling >2 t in the last two stations. The next day we fished three stations (prime 33, 32 and 31) in the area around Devil's Hole - again a notorious area for good roundfish catches. There was a large pelagic factory trawler working in the area, yet despite this, the catches were disappointing with at most 400 kg of herring. However, the trawler was working along the deep water gulleys, while our tow was slightly outside these areas. An early start on 23 August allowed us to complete prime station 40 at first light, before cleaning down, and coming in for the scheduled mid-survey staff change. We steamed into Aberdeen and onto Blaikies Quay arriving just after midday. Over the course of the first part of the survey 36 MIK net tows were completed in the evenings.

We sailed from the port of Aberdeen at 08:00 on 25 August with four new personnel onboard including a Professor from the University of Bedford carrying out cryopreservation of fish tissues for a 'Frozen Arc' project, a new student from the University of Exeter and the SIC from the French Quarter 1 IBTS survey. We steamed northeast to fish prime stations 45 and 53 before the end of the day. The first catch was our largest of the survey so far, with 3.3 t of herring, followed by a further 1.1 t at the next station, so it was in at the deep end for our new recruits! The following day we fished northwards around the Orkney Isles and completed prime stations 52, 51 and 59. The main component of all these catches was haddock (90-200 kg per tow), along with some other roundfish. Of note, on the final station was a female common skate 197 cm long, weighing in excess of 80 kg. This was tagged and released back at the same position, along with a further 25 rays (spotted and cuckoo rays) and a spurdog. On 27 August, we worked eastwards from the Orkney Isles across towards the Norwegian coast and fished prime stations 60 and 61, catching roundfish at the first and herring at the second. We had hoped to complete three stations, but with south-easterly winds in excess of 40 knots and 3 m seas, this made it unsafe to work. The following day, despite a remaining swell, the winds had dropped enough to be able to fish, so stations 62-64 were completed eastwards. The catches were a good mixture of cod, saithe, haddock and hake. The area around the Griffin oil field was extremely busy with floating platforms and support vessels, however no fishing vessels were seen. On the final station of the day, a seismic vessel was carrying out a survey across our tow path. Therefore given the obstruction and potential impacts of the pulses on fish in the area, we moved the tow position 10 nm to a clear area in the east. On 28 August we fished prime stations 65, 70 and 69 off the Norwegian coast, with saithe and Norway pout dominating the first two catches and large mackerel the last. Despite the weather deteriorating throughout the day we then steamed northwards overnight to fish prime station 75 the next day, with a small catch of saithe, blue whiting and hake. After this, the plan to steam westwards had to be curtailed, and we spent the rest of the day dodging into the weather in 40-50 knot winds and 3+ m seas. By the following morning,

the winds had dropped enough to continue westwards to complete prime stations 74, 73, 72 and 71, although the residual swell was still at 3 m. Catches were better with larger weights of prime commercial fish. Almost 100 kg of cod, 200 kg of hake, 750 kg of saithe and some good amounts of ling, blue whiting, mackerel and Norway pout were seen throughout the day. On 1 September, we fished the southeast side of the Shetlands, and completed the final prime stations of the survey (68, 67 and 66), with the nylon GOV. The catches were all similar with a good mix of cod (~150 kg), haddock, hake, saithe and Norway pout. The weather picked up throughout the day and by the final station we had 2 m seas and 30+ knot winds from the southwest. With a deteriorating forecast for the evening, we sheltered in the lee of the Shetland Isles. Whilst sheltering, the standard survey net (nylon GOV) was taken off, and the poly GOV was rigged, in order to start our comparative tows the following day. After sheltering for the night, we made a scheduled small boat transfer to put a member of staff ashore in Lerwick first thing in the morning. With remaining high winds and seas we were restricted to re-fishing the stations close to the Shetland Isles with the poly net, so we completed prime stations 66 and 67 before the end of the day. Over the next 3 days (3-5 September), we re-fished 9 prime stations (61, 60, 59, 51, 52, 53, 45, 46, and 34) with catches comprising of mainly roundfish (cod, haddock, whiting, hake, saithe and Norway pout) and slowly changing to more pelagic (herring in particular) catches – these ranged from 300-1200 kg. Late morning of the 5 September, we had to make a detour to our survey plan to take a crew member into Aberdeen for medical treatment, which meant no more stations were fished on this day. The following afternoon prime stations 13 and 14 were fished with the poly net and whiting, herring and haddock were the main species present in the catches. In the early evening, two baited camera deployments were made in waters near Scarborough, with whiting, cod and lesser-spotted dogfish being identified. On 7 September before first light, the baited camera was deployed again, and following this we fished the final station (prime 7) of the survey with the poly net and caught 0.5 t of whiting. After recovery of the camera system, we started the long steam home, and docked back into Lowestoft on 8 September at 02:00.

Results

Aim 1: A valid GOV trawl haul was successfully completed at all of the 75 primary station positions (Table 1, Figure 1). Also shown in Table 1 is the number of additional stations fished using the polyethylene GOV net. There were 2 invalid tows, which were all repeated to obtain valid samples. The survey was fished using GOV trawl number 2, and the gear trials were fished using the poly GOV net number 2. A chart indicating the position of each trawl station is attached (Figure 1). Scanmar equipment was used to monitor headline height, wing width and door spread, as well as tilt sensors monitoring the angle of the doors. At each station, the catch of each species was weighed and all fish, or representative samples, were measured. Table 2 lists the species caught that are sampled for length and Table 3 ranks the top 15 species by weight compared with the last three year's survey. Samples of otoliths for age determination were taken (Table 4) as specified in standard instructions. Benthos and crustacea were identified to the species wherever possible and recorded as present. The resultant data were input to computer database using the Cefas Electronic Data Capture System. This data will be analysed at Cefas Lowestoft and will provide a major input to the ICES assessment of North Sea gadoids and pelagic species. Once checked and validated, all data will also be input to the ICES Datas database.

Surface and bottom salinity samples and a water column CTD profile were taken on all but one of the primary stations fished. In all 74 valid CTDs were performed, with profiles obtained, of temperature, salinity, fluorescence, light, turbidity and oxygen.

Species of note caught this year during the survey are *Galeus melastomus*, *Dipturus batis* species-complex, *Sebastes viviparous* and *Gymnannodytes semisquamatus*.

Figures 2-10 show distribution and relative abundance (kg per hour) of cod (*Gadus morhua*), haddock (*Melanogrammus aeglefinus*), whiting (*Melanogobius merlangus*), saithe (*Pollachius virens*), Norway pout (*Trisopterus esmarkii*), herring (*Clupea harengus*), mackerel (*Scomber scombrus*), sprat (*Sprattus sprattus*), plaice (*Pleuronectes platessa*) and hake (*Merluccius merluccius*), respectively, over the last 4 years.

The total weight of cod caught has decreased from last year (485 kg in 2012, 626 kg in 2011), however 2011 was a particularly good year for cod. The catch seen this year is on par with that seen in 2009 (441 kg) and higher than that of 2010 (395 kg). The number of stations that cod were caught at decreased by 4 from last year, and only 1 from 2010 and 2009. The haddock catch this year was 1 t lower than last year, but as with cod, 2011 was a particularly good year. The catch this year (2264 kg) was on par with that of 2009 and 600 kg less than that in 2010. Interestingly, of particular note this year, was the presence of two different types of parasites present in many haddock. The first was only noted up as far as 59°N and was a blood-sucking parasite that attaches itself to the gills and drains the body of blood, leaving the fish emaciated. The second, noticed further north, and to a lesser extent in more southern stations was a disease that rots away the nasal area.



Whiting catches remained more or less even (+/- ~100 kg) for the past three years. Following a three-fold increase in the saithe catch in 2011, it was encouraging to see that this year the catches (1426 kg) remained around the same level as 2011. The Norway pout catches continued their downwards trend since 2009, with almost a 3 fold decrease, resulting in a catch of just 1182 kg this year - a decrease of 270 kg from 2011. Positively the catches of two pelagic species (herring and mackerel) were at the highest levels seen in the last five years. Herring were again the dominant species by weight, and catches this year (9402 kg) were up by >4 t on 2011 levels. Catches of this volume have not been seen since 2007 where a similar amount (9365 kg) was seen. Mackerel catches (3821 kg) have also increased slightly from 2011, and by >1 t since 2009. Unfortunately, another pelagic species, sprat, has not fared as well, with catches down significantly (>3 t) from 2011, and at their lowest level (456 kg) over the last five years. Hake catches have been steadily increasing from just 155 kg in 2007 to around 470 kg in 2010-2011 and this year the catches have risen again to their highest level of 588 kg. Plaice remained around the level seen last year (552 kg in 2012, 592 kg in

2011), and similarly dab, grey gurnards and lemon sole all achieved catches on par with that seen in 2011. Horse mackerel were down by ~100 kg and after a bad year in 2011, blue whiting were back into the top 15 species by weight.

In addition, continuing from the previous three years work, further length-weight measurements were taken from some non-otolithed species, in order to obtain length-weight curves specific to this survey.

Table 1. Number of trawls, Rosette and MIK net tows made during the survey

Gear	Valid	Additional	Invalid	Total
GOV (IBTS Standard gear)	75	0	2	77
Niskin Bottle + CTD	74	0	1	75
Poly GOV stations	0	14	0	0
MIK Net Tow	50	0	1	51
Baited Camera Deployments	3	0	1	4

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

Species	Common Name	Stns	Species	Common Name	Stns
<i>Agonus cataphractus</i>	Pogge (Armed bullhead)	8	<i>Microchirus variegatus</i>	Thickback sole	1
<i>Alloteuthis subulata</i>		18	<i>Micromesistius poutassou</i>	Blue whiting	15
<i>Alosa alosa</i>	Allis Shad	1	<i>Microstomus kitt</i>	Lemon sole	62
<i>Ammodytes tobianus</i>	Sandeel	2	<i>Molva molva</i>	Common ling	11
<i>Anarhichas lupus</i>	Wolffish	4	<i>Mullus surmuletus</i>	Red mullett	2
<i>Argentinidae</i>	Argentine	34	<i>Mustelus asterias</i>	Starry smooth-hound	3
<i>Arnoglossus laterna</i>	Scaldfish	14	<i>Myoxocephalus scorpius</i>	Bullrout	5
<i>Aspitrigla cuculus</i>	Red gurnard	4	<i>Myxine glutinosa</i>	Hagfish	3
<i>Blennius ocellaris</i>	Butterfly blenny	1	<i>Nephrops norvegicus</i>	Norway lobster	22
<i>Buglossidium luteum</i>	Solonette	21	<i>Ommastrephes eblanae</i>		5
<i>Callionymus lyra</i>	Common dragonet	23	<i>Ommastrephes saggittatus</i>	Flying squid	5
<i>Callionymus maculatus</i>	Spotted dragonet	25	<i>Pecten maximus</i>	Scallop	1
<i>Cancer pagurus</i>	Edible crab	19	<i>Phycis blennoides</i>	Greater forkbeard	1
<i>Clupea harengus</i>	Herring	75	<i>Platichthys flesus</i>	Flounder	2
<i>Cyclopterus lumpus</i>	Lumpsucker	5	<i>Pollachius pollachius</i>	Pollack	2
<i>Dipturus batis</i> (species complex)	Common skate	1	<i>Pleuronectes platessa</i>	European plaice	114

<i>Enchelyopus cimbrius</i>	Four-bearded rockling	9	<i>Pollachius virens</i>	Saithe	26
<i>Engraulis encrasicolus</i>	European anchovy	1	<i>Raja brachyura</i>	Blonde ray	1
<i>Eutrigla gurnardus</i>	Grey gurnard	72	<i>Raja clavata</i>	Thornback ray	3
<i>Gadiculus argenteus</i>	Silvery pout	9	<i>Raja montagui</i>	Spotted ray	6
<i>Gadus morhua</i>	Cod	43	<i>Raja radiata</i>	Starry ray	27
<i>Galeus melastomus</i>	Blackmouthed dogfish	1	<i>Sardina pilchardus</i>	Pilchard	4
<i>Glyptocephalus cynoglossus</i>	Witch	9	<i>Scomber scombrus</i>	European mackerel	74
<i>Gymnannodytes semisquamatus</i>	Smooth sandeel	1	<i>Scophthalmus maximus</i>	Turbot	8
<i>Gobius Spp.</i>	Gobies	4	<i>Scophthalmus rhombus</i>	Brill	7
<i>Hippoglossoides platessoides</i>	American plaice (Long-rough dab)	59	<i>Scyliorhinus canicula</i>	Lesser spotted dogfish	26
<i>Homarus gammarus</i>	European lobster	2	<i>Sebastes viviparus</i>	Redfish	3
<i>Hyperoplus lanceeolatus</i>	Greater sandeel	12	<i>Sepia elegans</i>	Cuttlefish	4
<i>Illex (loligo) illecebrosus</i>	Northern shortfin squid	1	<i>Sepia officinalis</i>	Common cuttlefish	1
<i>Lepidorhombus whiffiagonis</i>	Megrim	19	<i>Sepiola atlantica</i>	Little cuttle	9
<i>Leucoraja naevus</i>	Cuckoo ray	14	<i>Solea solea</i>	Sole	4
<i>Limanda limanda</i>	Dab	171	<i>Sprattus sprattus</i>	Sprat	26
<i>Lithodes maja</i>	Stone crab	18	<i>Squalus acanthias</i>	Spurdog	6
<i>Loligo forbesi</i>	Northern squid	20	<i>Trachinus vipera</i>	Lesser weever	11
<i>Lophius piscatorius</i>	Anglerfish (Monkfish)	14	<i>Trachurus trachurus</i>	Horse-mackerel	28
<i>Lumpenus lampretæformis</i>	Snake blenny	3	<i>Trigla lucerna</i>	Tub gurnard	8
<i>Mauroliticus muelleri</i>	Pearlside	2	<i>Trisopterus esmarki</i>	Norway pout	107
<i>Melanogrammus aeglefinus</i>	Haddock	79	<i>Trisopterus luscus</i>	Bib	2
<i>Merlangius merlangus</i>	Whiting	130	<i>Trisopterus minutus</i>	Poor cod	46
<i>Merluccius merluccius</i>	European hake	42	<i>Zeus faber</i>	John Dory	2

Table 3. Top 15 species by weight compared with the last three years surveys

Species common name	Scientific name	2012 weight (kg)	2011 weight (kg)	2010 weight (kg)	2009 weight (kg)
Herring	<i>Clupea harengus</i>	9402.01	5310.42	7636.15	5526.40
Mackerel	<i>Scomber scombrus</i>	3821.50	3564.11	2442.41	2800.20
Dab	<i>Limanda limanda</i>	2466.15	2403.13	1582.01	2052.98
Haddock	<i>Melanogrammus aeglefinus</i>	2264.92	3233.58	2826.90	2277.23

Whiting	<i>Merlangius merlangus</i>	2257.61	2163.29	2356.44	4507.87
Saithe	<i>Pollachius virens</i>	1426.91	1596.85	457.73	416.45
Norway Pout	<i>Trisopterus esmarkii</i>	1182.22	1453.87	2730.32	3383.58
Grey Gurnard	<i>Eutrigla gurnardus</i>	1000.37	1019.53	625.96	1002.81
Horse Mackerel	<i>Trachurus trachurus</i>	868.67	969.81	2181.85	1440.91
Hake	<i>Merluccius merluccius</i>	588.71	465.26	479.94	289.83
Plaice	<i>Pleuronectes platessa</i>	522.64	592.37	361.21	378.92
Cod	<i>Gadus morhua</i>	485.81	626.68	395.05	441.75
Sprat	<i>Sprattus sprattus</i>	456.12	3644.49	2305.76	1204.15
Lemon Sole	<i>Microstomus kitt</i>	225.36	250.32	136.67	173.90
Blue Whiting	<i>Micromesistius poutassou</i>	217.32	29.33	498.86	2.21

A total of 7301 biological samples were taken for the primary target species (Table 4). In addition, a total of 148 samples were also taken from elasmobranchs captured during the survey.

Table 4. The number of biological samples taken by species

Species	Number of samples taken
Plaice	1201
Whiting	1019
Herring	938
Haddock	810
Hake	459
Mackerel	423
Saithe	417
Dab	368
Cod	271
Lemon Sole	235
Norway Pout	229
Grey Gurnard	220
Ling	30
Monkfish	21
Witch	20
Tub Gurnard	14
Turbot	11
Brill	11
Turbot	11
Red Gurnard	8
Red Mullet	6
John Dory	4

Aim 2: 14 stations were fished using the polyethylene GOV net

Aim 3: All 38 water stations had water collected for caesium/tritium analysis.

Aim 4: Particulate in/organic carbon analysis of seawater was conducted at 75 stations.

SECONDARY AIMS:

Aim 5: Acoustic data were collected continuously throughout the survey. In total 50 MIK net tows were successfully carried out, along with sampling any jellyfish caught in the GOV net. In total, 2022 individuals were sampled, belonging to 9 species of pelagic cnidarians; 4 species of scyphozoans, compass jellyfish, blue jellyfish, lion's mane and moon jellyfish (*Chrysaora hysascella*, *Cyanea lamarckii*, *Cyanea capillata* and *Aurelia aurita*, respectively). Also, 3 different species of hydromedusae were caught, with only one species identified as being crystal jelly (*Aequorea victoria*), and 2 different species belonging to the ctenophora group, one species was positively identified as *Pleurobrachia pileus* (sea gooseberry).

Aim 6: Seawater was collected from 53 stations in the southern North Sea, and incubations conducted determine rate of dissolved organic matter degradation by the natural microbial community.

Aim 7: In total 89 elasmobranchs were tagged and released: 43 spotted rays, 31 cuckoo rays, 7 smooth-hounds, 4 spurdog, 2 blonde rays, 1 thornback ray and 1 common skate.

Aims 8 and 9: Species including, *Galeus melastomus*, *Gymnannodytes semisquamatus*, *Sebastes viviparous* and *Alosa alosa* were frozen and retained.

Aim 10: Litter was recorded throughout the survey and in total one or more pieces were recorded at 42 different fishing stations.

Aim 11: In total 190 hours of surveying by the observer were undertaken, resulting in sightings of ~13,000 seabirds (30 different species), 200 marine mammals (4 species) and 1 ocean sunfish.

Aim 12 and 13: One allis shad was caught and retained, no lamprey or *Chimaera monstrosa* were caught this year.

Aim 14: Selections of benthic invertebrates were retained for the Great Yarmouth Sea Life Centre.

Aim 15: In total, DNA tissue samples were taken from 20 different species. Of these, 14 were from live specimens, with, on average 3 viable cell cultures being taken, resulting in a total of 42 samples for subsequent culture. The remaining six species were from frozen samples, so DNA tissues and fin clips were taken.

Aim 16: A total of 38 valid samples from day grabs were taken for PSA analysis.

Aim 17: Pigment and flow cytometry analysis was conducted on water from 54 prime stations.

Aim 18: No maturity photographs were taken of lemon sole, brill or turbot, as the required stagings of maturity were not found.

Aim 19: The baited underwater camera was deployed on 4 occasions (3 valid) and species including lesser-spotted dogfish, cod and whiting were seen, with whiting in particular taking the bait in a voracious manner.

Special thanks are given to the officers and crew of Cefas Endeavour and the scientists for all of their enthusiasm and hard work in making this cruise a success and completed in good time.

S. McCully
8 September 2012

DISTRIBUTION:

Basic list +

S McCully	B Harley
R Humphreys	B Hatton
M Eade	R Bush
C Crisp	F Armstrong
A Pliru	A Pliru
S Chaichana	D Rawson
T Barnfield	C Turley
C Cronin	Y Verin
T Bailey	N Greenwood
G Burt	J Ellis
M Nicolaus	T Maes
T Dunn	M Etherton
A Walker	S Hetherington
N Lyman	

Figure 1. Station positions CEFAS Endeavour 13/12.

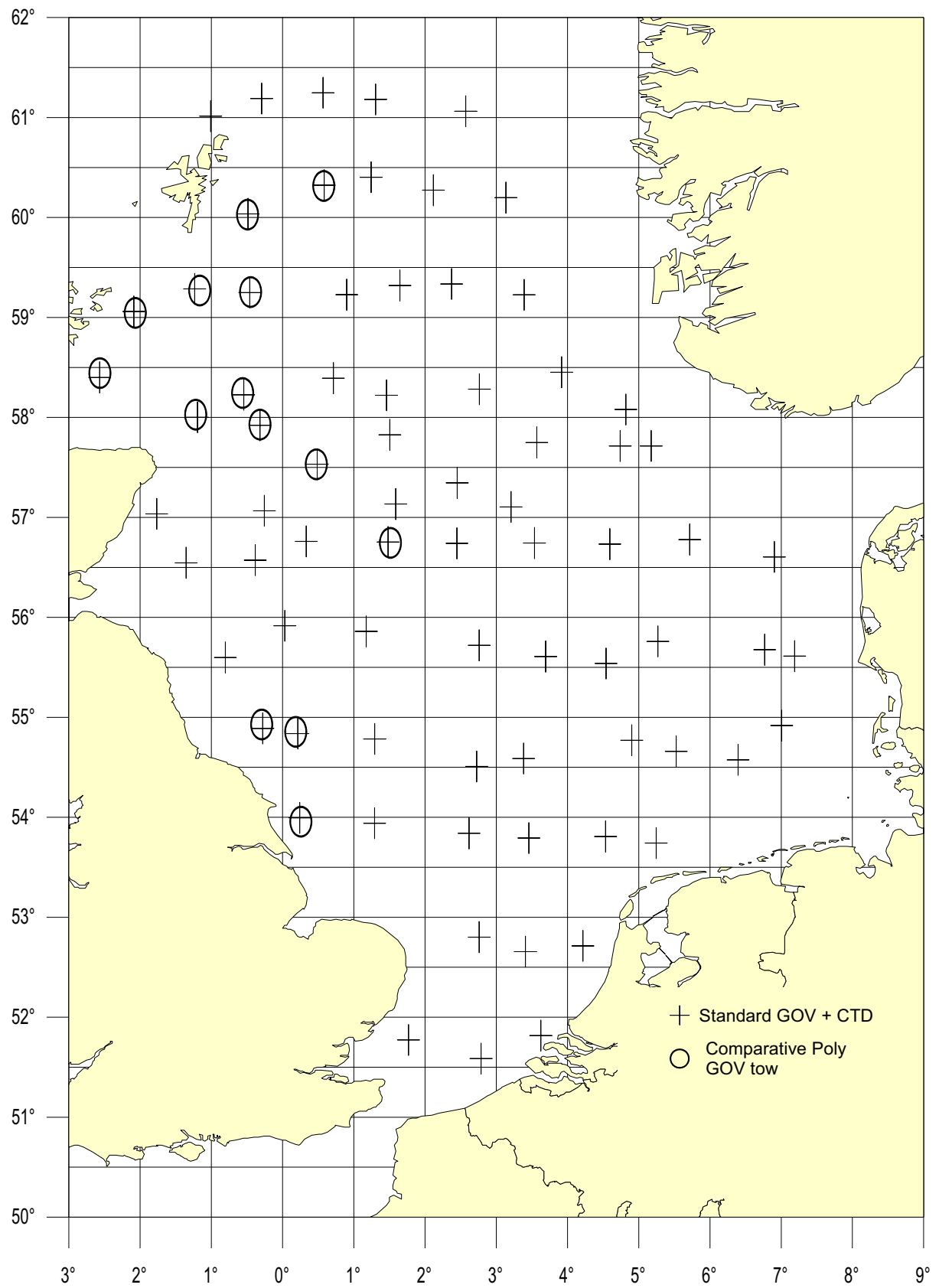


Figure 2. Positions of MIK net, day grab, and baited underwater camera deployments on CEFAS Endeavour 13/12.

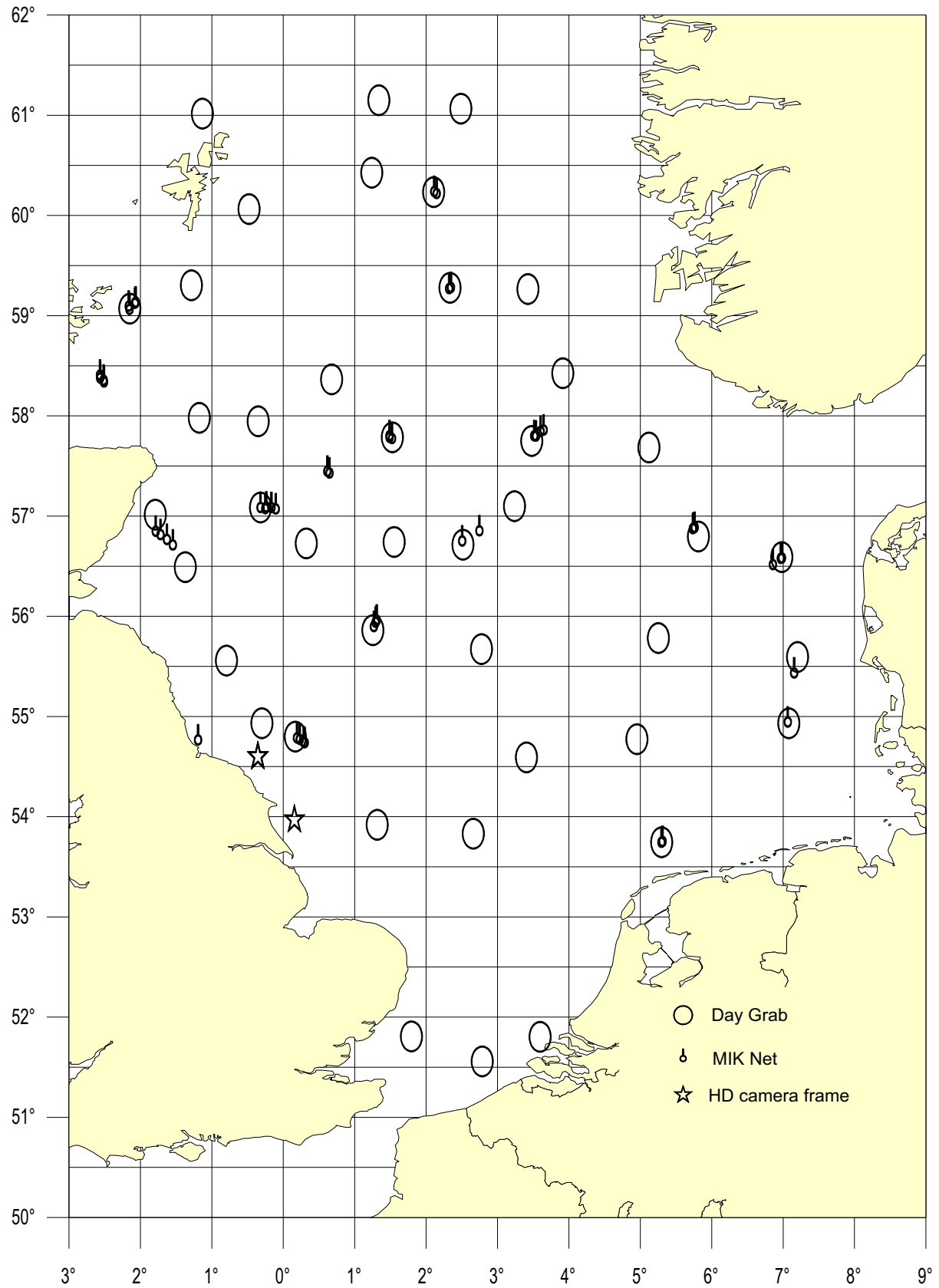


Figure 3. Distribution and relative abundance (kg) of cod for 2009 to 2012.

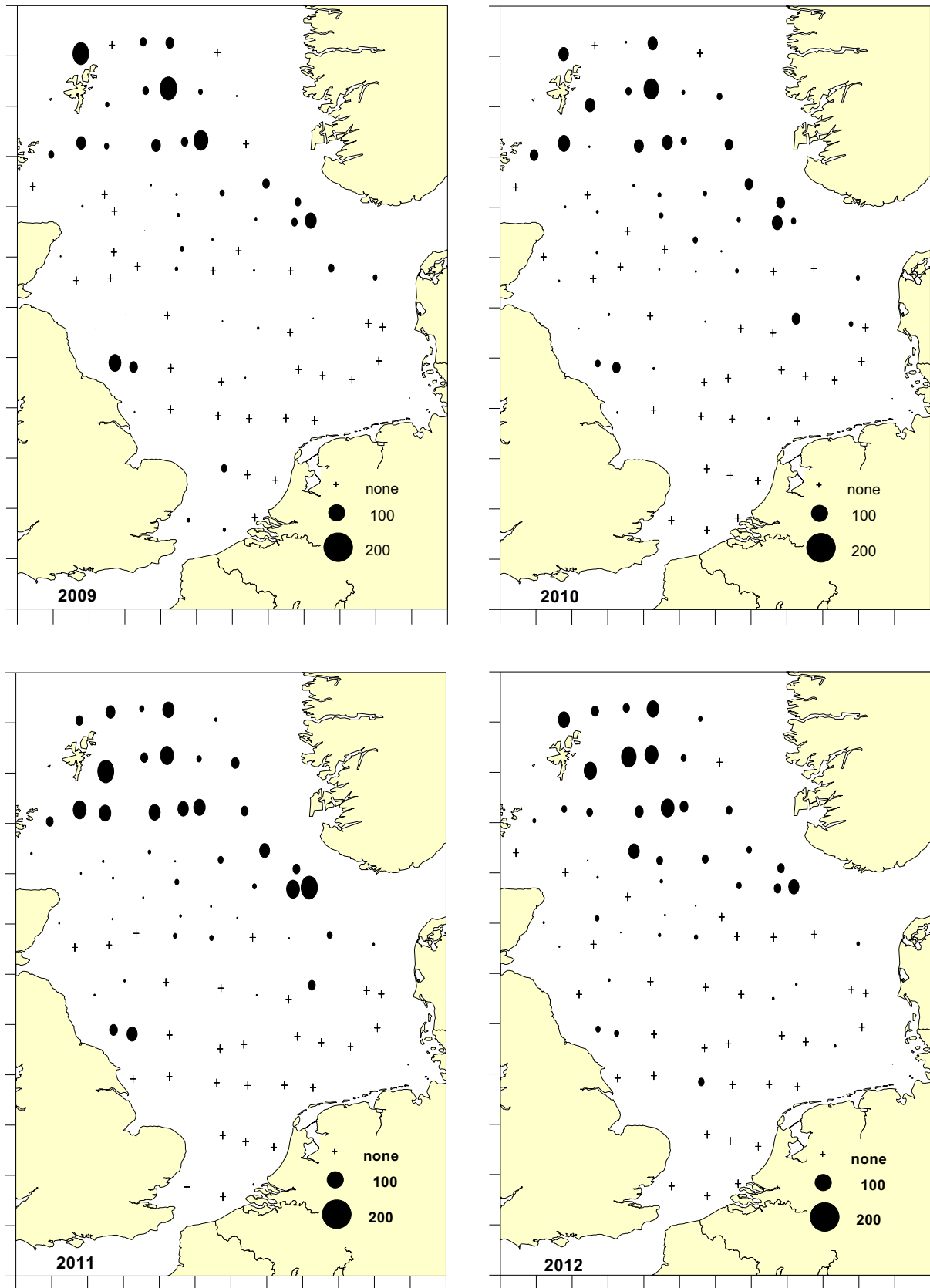


Figure 4. Distribution and relative abundance (kg) of haddock for 2009 to 2012.

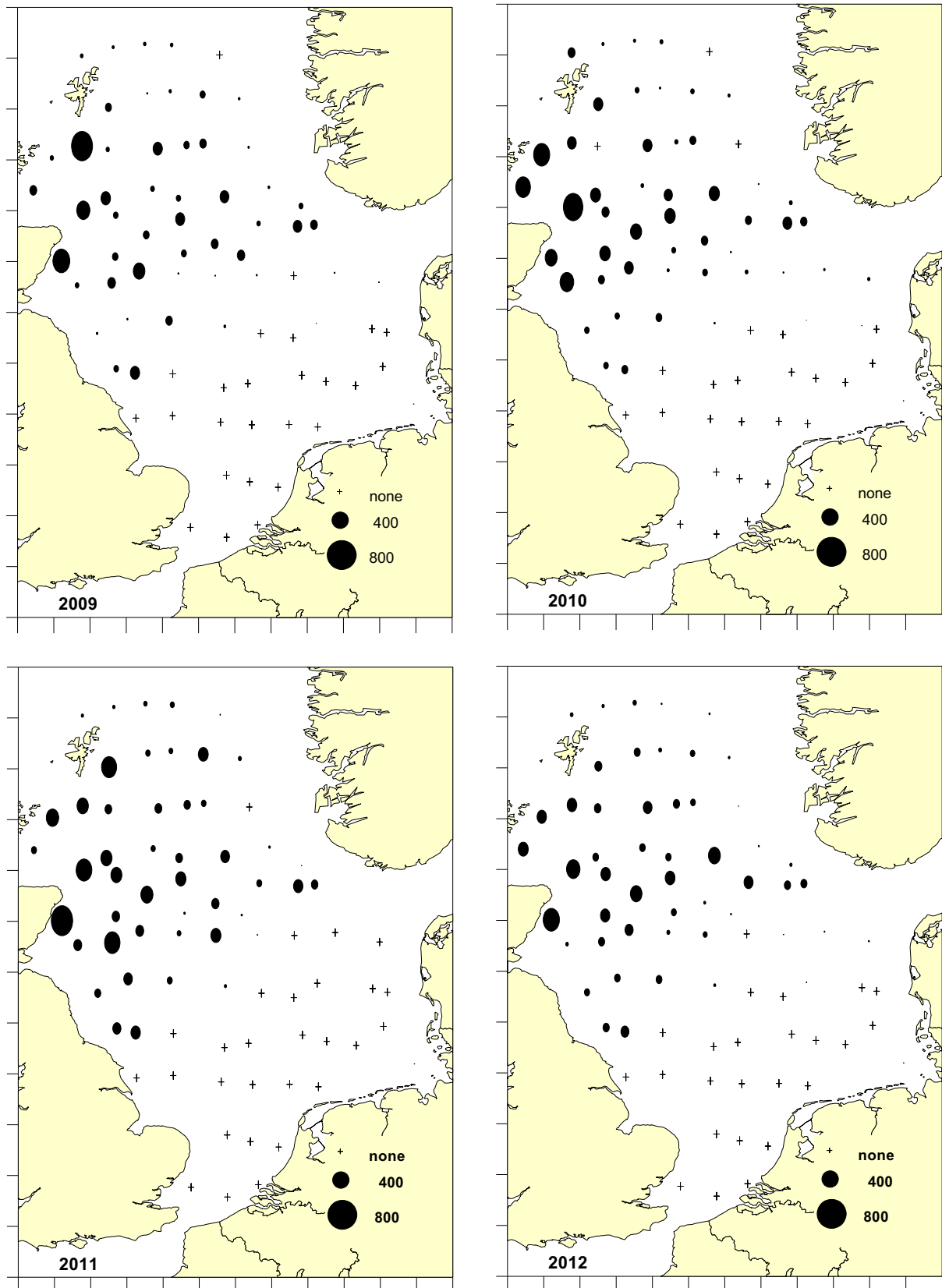


Figure 5. Distribution and relative abundance (kg) of whiting for 2009 to 2012.

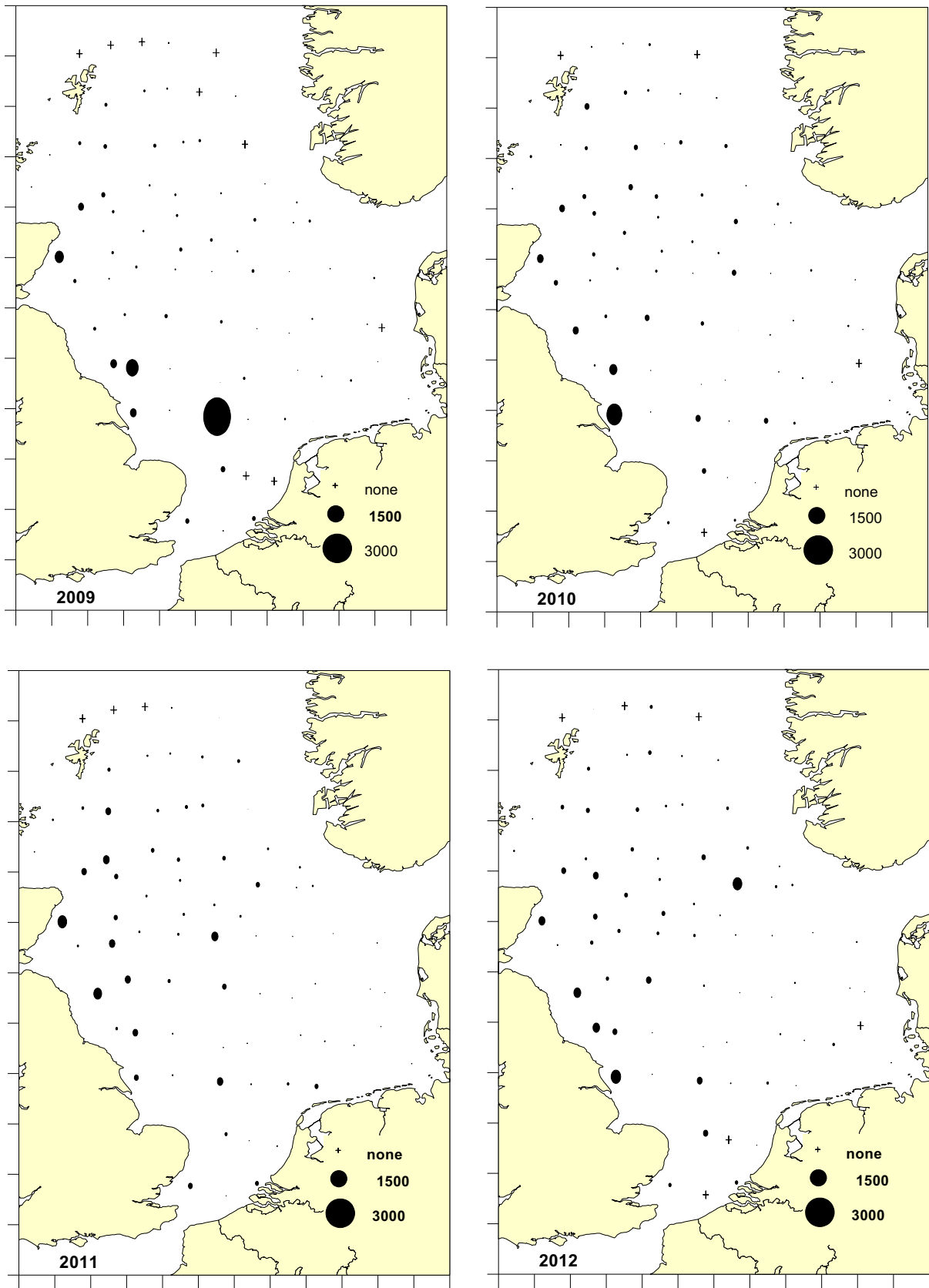


Figure 6. Distribution and relative abundance (kg) of saithe for 2009 to 2012.

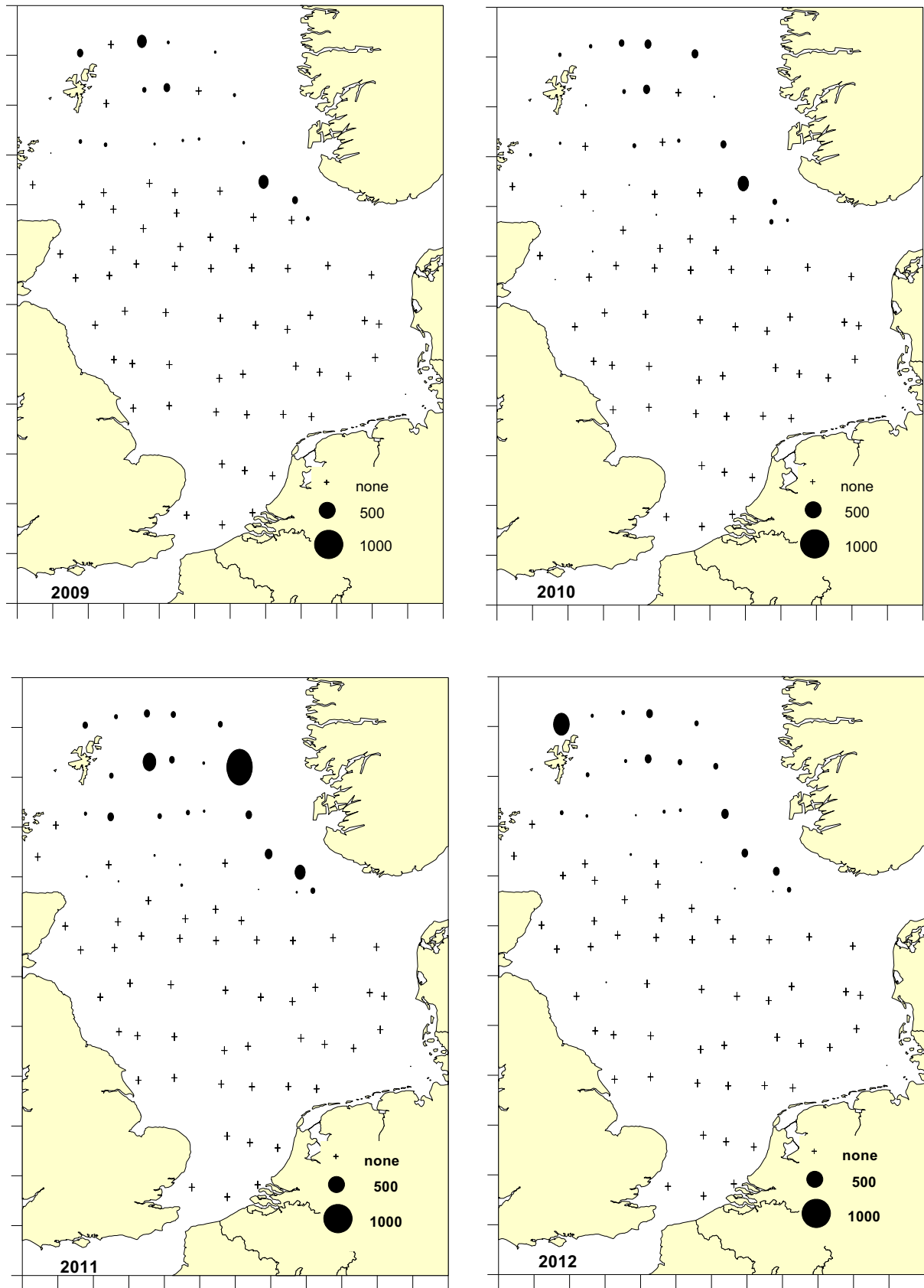


Figure 7. Distribution and relative abundance (kg) of Norway pout for 2009 to 2012.

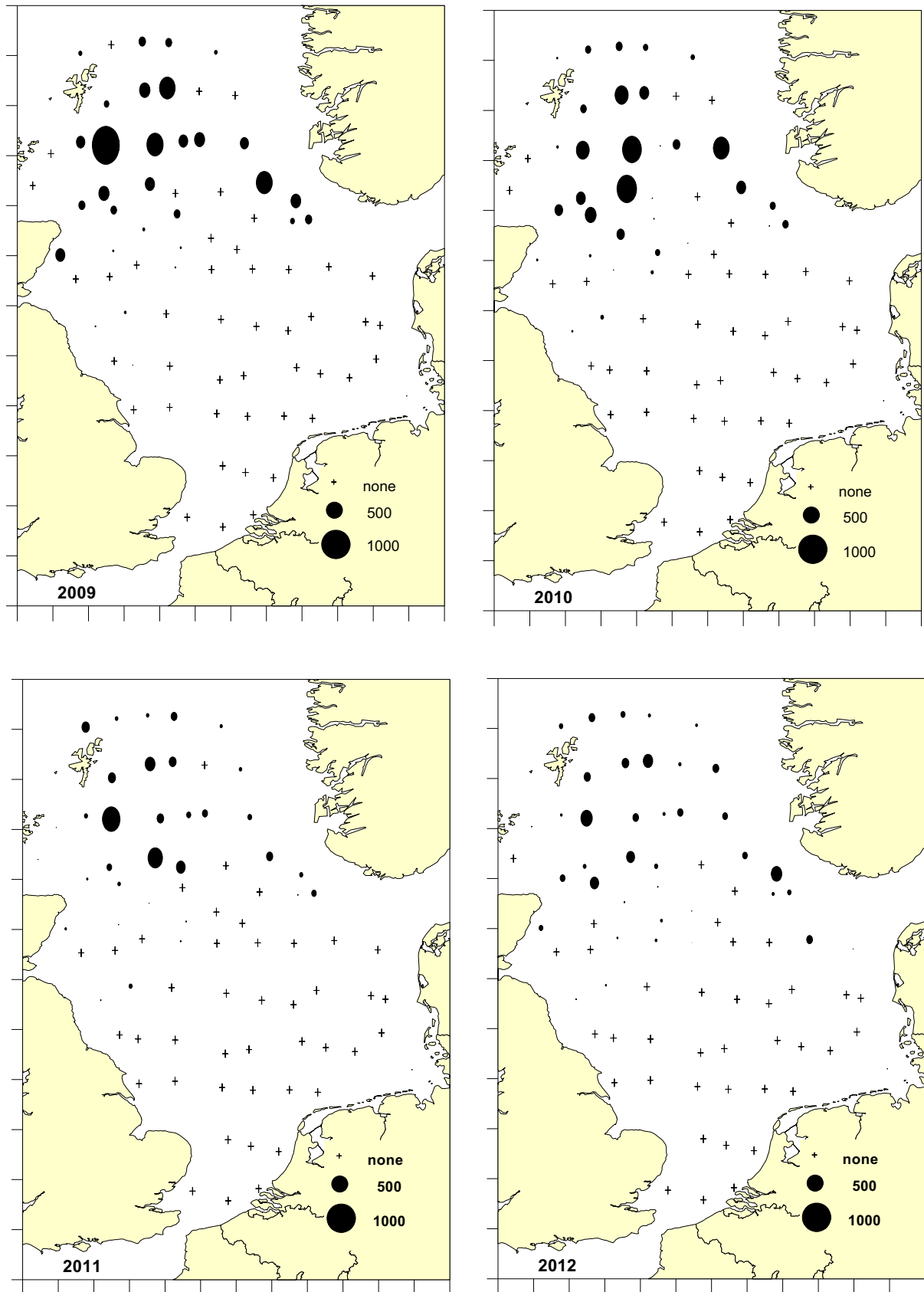


Figure 8. Distribution and relative abundance (kg) of herring for 2009 to 2012.

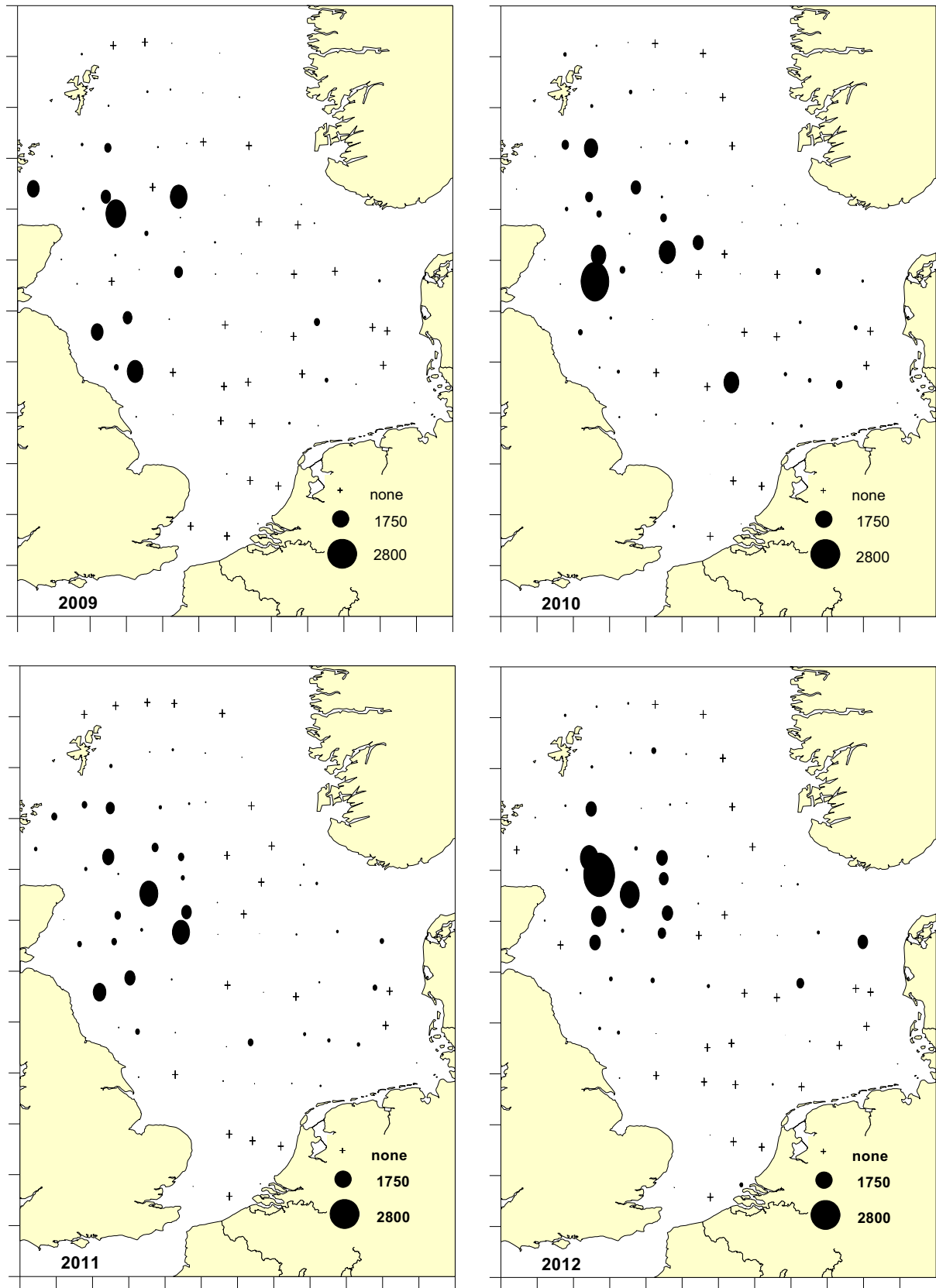


Figure 9. Distribution and relative abundance (kg) of mackerel for 2009 to 2012.

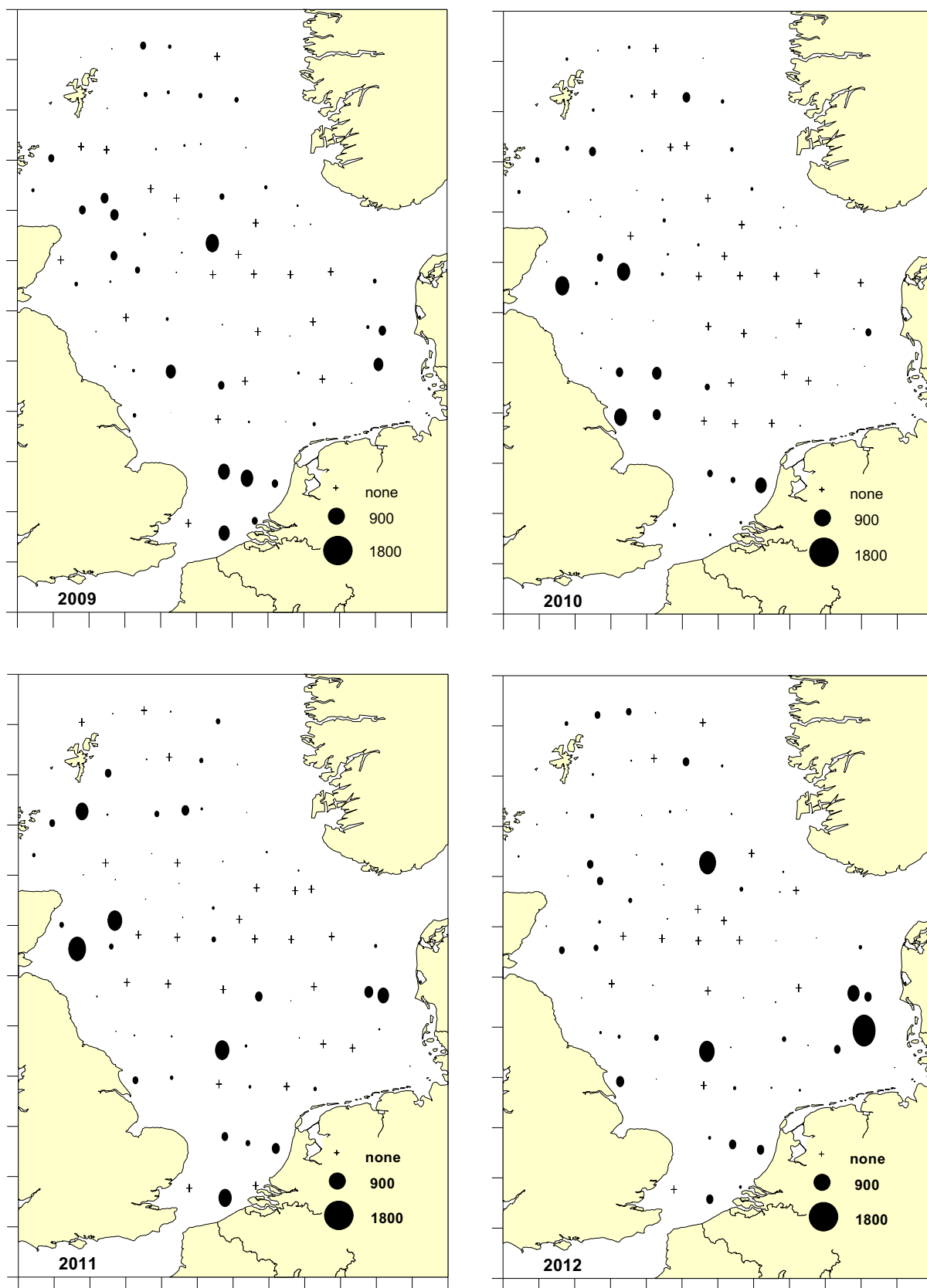


Figure 10. Distribution and relative abundance (kg) of sprat for 2009 to 2012.

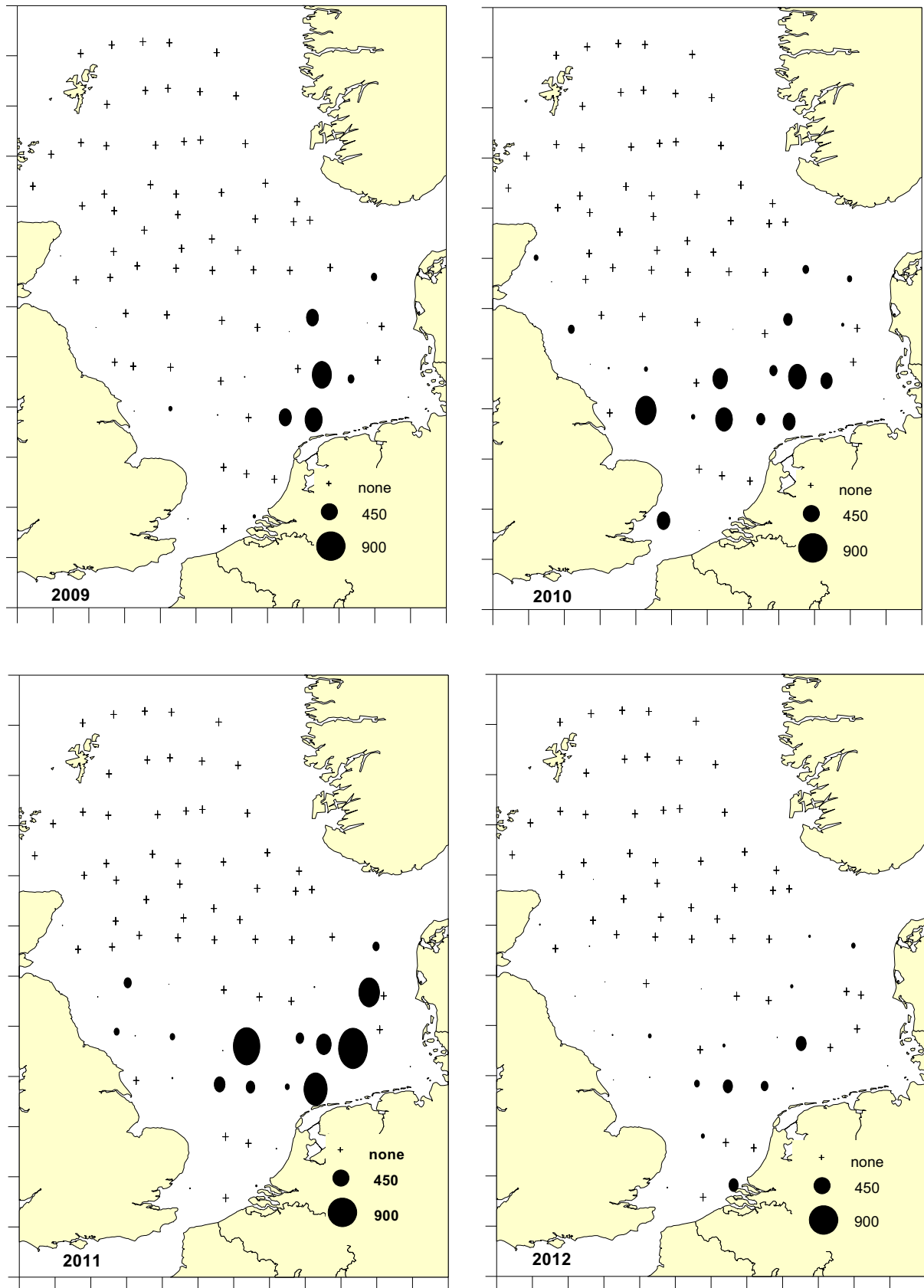


Figure 11. Distribution and relative abundance (kg) of plaice for 2009 to 2012.

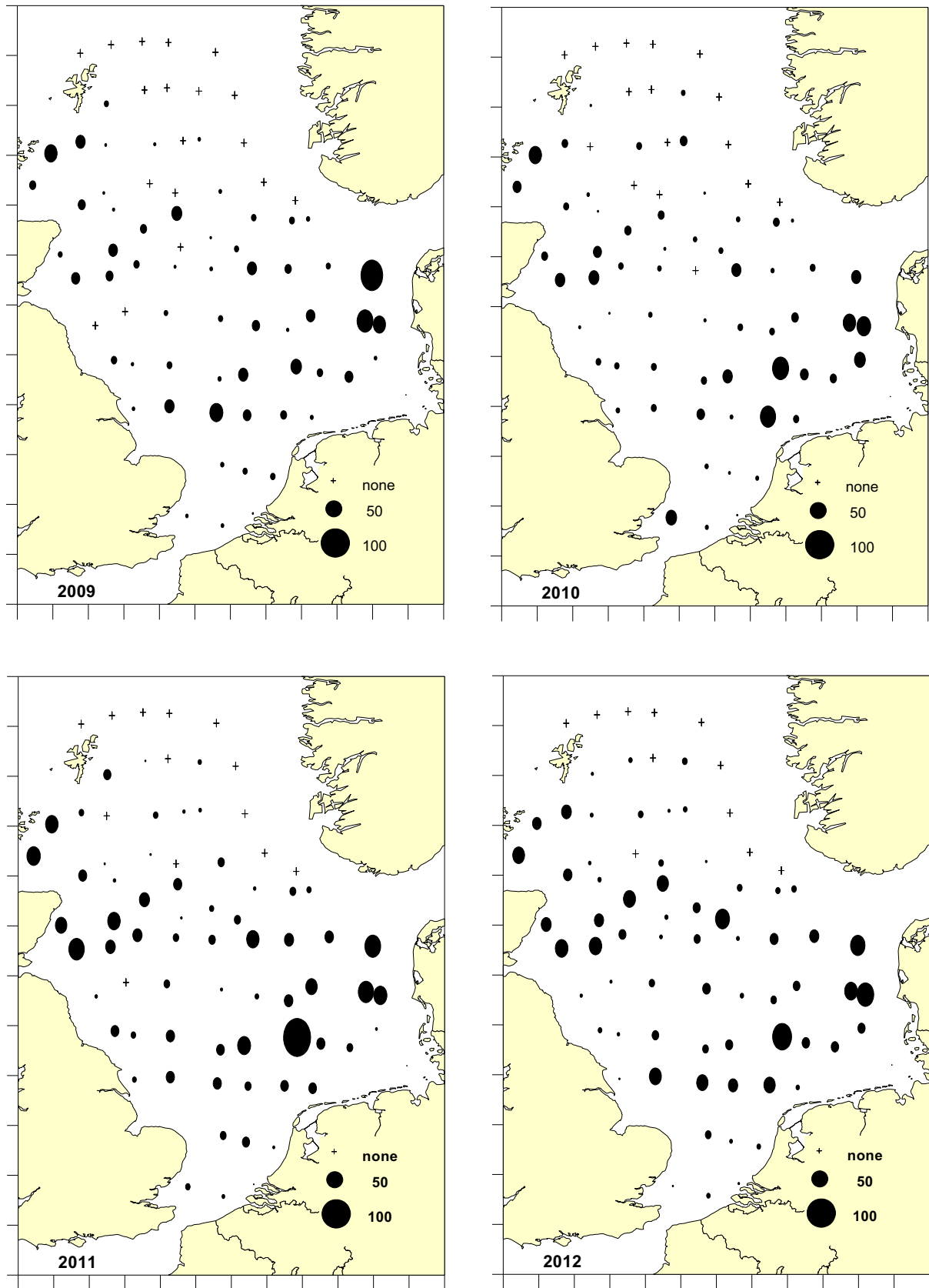


Figure 12. Distribution and relative abundance (kg) of hake for 2009 to 2012.

