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

2011 RESEARCH VESSEL PROGRAMME

REPORT: RV CEFAS ENDEAVOUR: SURVEY 14

STAFF:

Part A	**Part B**
Fishing:	
S McCully (SIC)	S McCully (SIC)
B Harley (2IC)	B Harley (2IC)
R Humphreys	R Humphreys
B Hatton	B Hatton
M Eade	M Eade
J Silva	M O'Brien
J Hunt	
Plus:	
R Rodgers	L Fernand
B Queste	B Queste
A Hind	A Hind
K Mackenzie	K Mackenzie
T Sykes (JNCC observer)	J Ford (JNCC observer)
	C Wong

DURATION: 8 August – 8 September

LOCATION: North Sea

AIMS:

1. To carry out a groundfish survey of the North Sea as part of the ICES coordinated IBTS, using a standard GOV trawl in order to obtain information on:
   a) Distribution, size composition and abundance of all fish species caught.
   b) Age – length distribution of selected species.
   c) Distribution of fish in relation to their environment.
   d) Distribution of macrobenthos 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 selected stations with 'Poly GOV' in Northern area of the sampling grid.

3. Collect samples of sea water from offshore sites for calibration for nutrient analysis at Cefas.

4. Tag and release specimens of cuckoo ray (*Leucoraja naevus*), spurdog (*Squalus acanthias*) and tope (*Galeorhinus galeus*), in support of Defra projects.

5. To freeze and retain specimens of eelpout (*Zoarces, Lycodes* and *Lycenchelys*), sea scorpions (Cottidae, sub-area IVa only), *Sebastes* spp., and any unusual fish species.

6. Retain by freezing whole samples or otoliths of the more unusual species to the North Sea for otolith research.

7. Maturity photos (using protocol) of lemon sole, brill and turbot.

8. Record litter caught in the trawl in support of Defra projects.

9. Record sightings of sea birds and cetaceans for JNCC and Sea Watch Foundation.

10. A Seaglider will be deployed in a region just north of Dogger Bank (56.7N 3E approximately). This autonomous underwater vehicle (AUV) will monitor temperature, dissolved oxygen, chlorophyll fluorescence, turbidity and current direction and speed. This Seaglider will be remotely piloted to investigate regions of interest for 3 weeks during the cruise.

11. Tissue samples, scales and otoliths will be taken from herring across the North Sea for genetic studies conducted at the University of Southampton.

12. Take ring net dips at 6 sites across the North Sea and fix any *Calanus* spp. in ethanol for ongoing plankton genetic studies at the Sir Alister Hardy Foundation for Ocean Science (SAHFOS).

13. Retain all dead species of shad and lamprey for study by Cefas scientists.

14. Retain any specimens of *Chimaera monstrosa* for the Natural History Museum.

15. Collect weight and freeze 7 queen scallops from 30 designated stations, with shell heights of 50-60mm, for scientists at Bangor University to conduct research in support of 3 European funded sea trout projects.

16. Collect and fertilise herring eggs onto plates, and incubate in continuous seawater tanks for Cefas aquarium at Lowestoft.

17. Collect plankton samples from all stations for pigment analysis at Cefas.

18. Particulate in/organic carbon analysis of seawater by filtration at every station.

19. Collect 20 herring per station for stomach content analysis for litter at Cefas.

20. Collect and retain live specimens of *Scyliorhinus canicula* and incubate in continuous seawater tanks for fecundity studies at Cefas aquarium, Lowestoft.

21. Deploy a guard buoy for identifying the location of a waverider at position 52°45'.786N 002°57'.90E

NARRATIVE:
(All times GMT)

RV Cefas ENDEAVOUR sailed from Lowestoft at 05:30h on Tuesday 9 August, after a 24 hour delay, due to a crane maintenance issue, and then high winds hampering departure from the dock. Onboard were 7 Cefas fisheries staff, two environmental students from the University of East Anglia (UEA), a post-doc researcher from the University of Southampton and a JNCC 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 with the Rosette containing up to ten 10-litre Niskin bottles and the EMS2 logger, followed by a 30-minute tow with the standard IBTS rigged GOV. 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 male starry smooth-hounds, whiting 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 stations 2 and 3 before the end of the first day, with relatively large catches (>1 t) of horse mackerel, mackerel and whiting. The following day (10 August) we moved up the Dutch coast, and fished westwards completing prime stations 6, 5 and 4, catching mainly dab and mackerel, completing them in good time. Between stations 5 and 4, the guard buoy was deployed as stated in aim 21.

We then moved up the north-east English coast and fished prime stations (8, 7, 13 and 14), with fantastic weather and calm seas. The catches were very varied moving from truly bottom dwelling species such as dab and plaice on the first station to more gadoid and pelagic dominated catches on the remaining stations, with the bulk of the catches consisting of whiting, haddock, cod, mackerel and sprat. The first tow at station 7 was invalid as the codend liner came undone. We then continued eastwards fishing stations 15, 16 and 17 on 12 August. The catches were made up of dab, grey gurnards and sprat (>800 kg at station 17), along with a school of mackerel on the second station of the day. On the second station we also completed a plankton ring net dip for SAHFOS. The fine weather continued and we maximised the time fishing prime stations 9, 10, 11 and 12 successfully the following day. Catches were quite large from ~100 to ~900 kg of mixed fish, mainly consisting of dab and sprat, along with smaller amounts of plaice and small whiting. Of note, was a large mature male tope (155 cm), weighing 16.5 kg. This was tagged with a Petersen disc and returned in a very lively condition. Another good day on 14 August, with calm seas allowed us to fish the stations in the German sector (primes 18, 19, 20 and 21). It was another day of primarily sprat and dab catches. The first attempt of the third tow (prime 20) was invalid, as the liner blew due to the very large weight of the catch (sprat). This station was repeated and we hauled after just 15 minutes as the scanmar readings and sonar marks indicated another large catch, it produced over 1 t of sprat, with some herring. The following day we moved into the Danish sector and fished the coastal stations (30, 29 and 39). Dab and sprat still remained the dominant species in the catches of ~400 kg to ~1 t, along with some mackerel and plaice. Moving westwards from the Danish waters to the deeper English coastal waters, for the following two days, 7 stations were fished successfully (prime stations 28 to 22) and two more plankton dips were completed.

The catches on 16 August were mixed, consisting of mainly dab, grey gurnards and mackerel, but the following day (17 August) larger catches were seen at prime stations 23 and 22. The tow at Swallows Hole (prime 23, 80-150 m) yielded ~500 kg of large herring, haddock, whiting and sprat, and one very large boulder, which luckily did not cause much damage, whilst prime 22 produced 0.5 t of herring, 250 kg of whiting and some haddock. Four prime stations (31, 32, 33 and 34) moving from the Scottish coast eastwards were completed on 18 August. The catches consisted of mackerel, herring (>1 t at final station), haddock and whiting. There were also quite a lot of cuckoo rays and spurdog caught, and most of these were tagged with Petersen discs. The Norwegian border waters were then fished (primes 42, 43 and 35) yielding mainly herring, haddock and whiting. On the second and third tows, plankton dips were also completed. At the site of prime station 35, we also released the seaglider AUV. This took some time to get it programmed to dive and talk back to computers at the UEA and onboard, but it eventually dived and successfully made repeated dives throughout the night, transmitting environmental data. On 20 August we moved into Norwegian waters where the weather deteriorated slightly with 2 m seas and 20 mph winds, but we managed to fish 4 stations (primes 44, 36, 37 and 38). All catches were dominated by dab and grey gurnards. The second tow was invalid on the first attempt as the liner became detached. A plankton dip was also completed at prime station 38.

Remaining in Norwegian waters for the following day (prime stations 50, 49, 58 and 57), the most cod of the trip so far were caught, totalling ~150 kg (7-105 cm), along with good amounts of hake, haddock and saithe. The weather was squally on and off with 2 m seas, and increasing winds. The highlight of the day was upon hauling the final tow, when 4 killer whales were seen behind the vessel jumping clear of the water for a couple of minutes. The following day, we moved westwards crossing over from the Norwegian sector to Scottish waters, completing prime stations 48, 56 and 55. Catches were >100 kg in every tow, with haddock and whiting being the main component of the first two catches, while the dominant species were Norway pout and herring at the final station. At the final station, within an 18 nm radius, 22 twin-rig nephrops fishing boats were seen – however despite this, not one nephrop was caught in our trawl! On 23 August, back in Scottish waters, prime stations 54, 47 and 46 were fished. Catches were relatively large and made up of herring, haddock and Norway pout. During this day we were made aware that there was a problem with the seaglider that we deployed earlier in the trip. It was no longer recording data, and had slowed down significantly, and there were concerns that it would stop diving altogether, and thus become a 'sitting duck' running a large risk of being hit by a vessel. After discussions, the decision was made to deviate from our planned stations the following day in order to go and recover the glider. Therefore immediately after the final station, we started steaming to its last know position. Despite inclement weather and fog, the seaglider was successfully recovered at 06:44am, and a rosette dip was undertaken. We then steamed back to our survey track, completing prime station 41 before sundown, yielding ~0.5 t of mackerel and >100 kg of herring. An early start on 25 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 the fuel berth at 11am, and were finally transferred onto Matthew's Quay by 14:00.

We left Aberdeen dock at 05:30am on 27 August and steamed northeast to prime station 52. The weather had deteriorated significantly and upon arrival there were steady 30 knot winds, however it was fished successfully and ~0.25 t of haddock and 80 kg of whiting were caught. Of note, we also caught a large common skate of 194 cm long, and 61 kg. We then steamed to pick up prime stations 53 and 45, however, when we arrived the winds had reached a

steady 40 knots, with seas in excess of 3 m, therefore it was deemed unsafe to shoot the trawl, and by 15:00 we had to steam to shelter south of Moray Firth near station 51. We remained in the lee of the land just south of the Orkney Islands overnight. We remained there all of the following day as the winds were 40-65 knots (in the lee), gale force 9 increasing to 10 throughout the day, with very rough seas. At midday on 29 August, the decision was taken to head out and steam to prime station 51, the closest to land, as the winds were dropping away.

We arrived on station at 15:30 and fished successfully, yielding a small catch of haddock, herring and plaice. The following day, three prime stations were fished (45, 53 and 59), despite the relatively strong winds and 2 m choppy seas. At each station >100 kg of haddock were caught, with herring dominating the second catch at ~0.25 t. On the final station, another large female (131 cm) common skate was caught, tagged and released. Staying near the Orkney and Shetland Isles prime stations 60, 61 and 66 were fished on 31 August. The catches were similar in composition throughout the day, with 33-42 kg of cod in each (sizes 28-84 cm), large amounts of haddock, mackerel, herring, whiting and Norway pout. The following day we moved eastwards back into Norwegian waters completing four stations (primes 62 to 65), and two plankton dips. The catches were very similar in composition to those of the previous day, with good amounts of cod (30-40 kg each tow, 22-85 cm in length), and sizable haddock, along with some herring, mackerel, Norway pout, hake and whiting. Whilst at station 63, a pod of pilot whales, along with some white-sided dolphins were seen, and came very close to the vessel for several minutes. On the final station, the liner blew, and therefore the catch was invalid, and had to be repeated just in time for sundown. On 2 September we planned to fish four stations westwards (primes 70-67), however winds in excess of 40 knots hampered fishing for a few hours in the afternoon, and we had to abandon tow 63. The first and last catches were dominated by saithe (850 kg and 210 kg respectively), while station 69 was mainly haddock. Hake, cod and Norway pout were also represented in all catches. Low nutrient seawater was collected at station 62. We then steamed back overnight to prime 68, and fished at first light, followed by primes 75 (where we saw 7 killer whales on arrival) and 74. The first and last stations caught >40 kg and 32 kg of cod respectively (38-94 cm), and all stations also consisted of Norway pout, saithe and hake. Prime 74 yielded a large catch of 116 kg of ling (n=22, length were 77-123 cm). On 4 September, we fished primes 73, 72 and 71 thus finishing the last of the IBTS survey stations. The catches were a mixture of hake, saithe, cod, Norway pout and horse mackerel. We then immediately changed the net from the standard IBTS nylon net, to the polyethylene GOV net (used for comparative tows), and re-fished prime 72 that evening.

The following day we managed to repeat 4 stations (66, 61, 60 and 59) fishing with the poly net. The catches were of a good size all day and comparative with those seen using the nylon net (haddock, mackerel, Norway pout, cod, hake, ling, and whiting). We also caught 3 male common skate in this final tow, two of a large size (188 and 175 cm), totalling 100kg. With bad weather due, we immediately started to steam 160nm southwards to make as big a distance as possible while the weather allowed. On the 6 September we were hit with severe south-westerly winds, hampering our ability to fish to our full capacity. We were however, able to manage to fish 2 stations close to shore (primes 31 and 22). The catches were again of good quantities, and similar in composition to the catches made here with the nylon. The following day, still with strong winds, we managed to fish 3 more stations with the poly net (primes 13, 14 and 7), yielding large catches of herring, haddock and whiting. We could not fish any more stations given the weather conditions, so we slowly started making the journey back to Lowestoft, stopping at the Dowsing buoy for a final CTD dip. On the final day of the survey (8 September), we steamed home, and docked back into Lowestoft at 19:30.

Results

Aim 1: A valid GOV trawl haul was successfully completed at all of the 75 primary station positions (Table 1). Also shown in Table 1 is the number of additional stations fished using the polyethylene GOV net. There were 4 invalid tows, which were all repeated to obtain valid samples. The survey was fished using GOV trawl number 12, and the gear trials were fished using the poly GOV net number 3. 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 two 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 Datras database.

Surface and bottom salinity samples and a water column CTD profile were taken on all of the primary stations fished. In all 80 CTDs were performed, with profiles obtained, of temperature, salinity, fluorescence, light, turbidty and oxygen.

Species of note caught this year during the survey are *Galeus melastomus, Dipturus batis* species-complex, *Liza ramada, Triglops murrayi, Lycodes vahlii, Pholis gunnellus, Sebastes marinus, Sebastes viviparous* and *Brosme brosme.*

Figures 2-10 show distribution and relative abundance (kg per hour) of cod (*Gadus morhua*), haddock (*Melanogrammus aeglefinus*), whiting (*Melangius 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 increased from last year (626 kg in 2011, 395 kg in 2010), while the number of stations that cod were caught at only increased by 3, to 47 this year (44 stations in both 2010 and 2009). In excess of a three fold increase in saithe was seen this year (>1.5 t, compared with <0.5 t in 2009), and was the highest catch recorded for 5 years. Sprat also showed a marked increase, up by 1.3 t from 2010, along with mackerel which was up by >1 t on the previous year. Increases in catches were also seen in dab (almost 1 t more) haddock (up by >400 kg), grey gurnards (up by ~400 kg), plaice (up 230 kg), and also in lemon sole (83% increase to 250 kg), from the 2010 levels. The new species to enter the top 15 by weight was long-rough dab, showing a two fold increase since 2010 catches. The catch of herring has decreased by over 2 tonnes (30%) from 2010, however has returned to almost the same amount as seen in 2009. Whiting catches remained at the similar low levels seen in 2010, which were the lowest seen in 3 years, and >2 tonnes less than 2009. Hake catches remained unchanged from the previous year. Norway pout catch has declined this year again for the second year in a row, to almost half that seen in 2010 – however it is back to levels seen in 2008 (1485 kg). Likewise horse mackerel catches have also halved this year from 2010.

In addition, continuing from the previous two 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 plankton dips made during the survey

Gear	Valid	Additional	Invalid	Total
GOV (IBTS Standard gear)	75	0	4	79
Niskin Bottle + CTD	80	0	1	81
Poly GOV stations	0	10	0	0
Plankton Ring Net Dip	13	0	0	13

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

Species	Stns	Species	Stns
Agonus cataphractus	16	*Melanogrammus aeglefinus*	33
Alloteuthis subulata	21	*Merlangius merlangus*	54
Alosa fallax	1	*Merluccius merluccius*	36
Ammodytes marinus	4	*Microchirus variegatus*	1
Anarhichas lupus	4	*Micromesistius poutassou*	6
Argentinidae	33	*Microstomus kitt*	64
Arnoglossus laterna	16	*Molva molva*	14
Aspitrigla cuculus	4	*Mullus surmuletus*	5
Brosme brosme	2	*Mustelus asterias*	2
Buglossidium luteum	21	*Myoxocephalus scorpius*	9
Callionymus lyra	32	*Myxine glutinosa*	6
Callionymus maculatus	29	*Nephrops norvegicus*	12
Callionymus reticulatus	1	*Ommastrephes eblanae*	3
Cancer pagurus	22	*Ommastrephes saggittatus*	13
Chlamys opercularis	1	*Pecten maximus*	3
Clupea harengus	49	*Pholis gunnellus*	1
Cyclopterus lumpus	1	*Phrynorhombus norvegius*	1
Enchelyopus cimbrius	12	*Platichthys flesus*	4
Engraulis encrasicolus	3	*Pleuronectes platessa*	62
Entelurus aequoreus	1	*Pollachius virens*	24
Eutrigla gurnardus	65	*Dipturus batis Species-Complex*	2
Gadiculus argenteus	10	*Raja clavata*	3
Gadus morhua	47	*Raja montagui*	4
Galeorhinus galeus	2	*Raja radiata*	27
Glyptocephalus cynoglossus	12	*Sardina pilchardus*	1
Gobius Spp.	5	*Scomber scombrus*	49

Hippoglossoides platessoides	49	*Scophthalmus maximus*	8
Hippoglossus hippoglossus	2	*Scophthalmus rhombus*	4
Homarus gammarus	1	*Scyliorhinus canicula*	16
Hyperoplus immaculatus	3	*Sebastes marinus*	1
Hyperoplus lanceeolatus	12	*Sebastes viviparus*	1
Lepidorhombus whiffiagonis	13	*Solea solea*	4
Leucoraja naevus	10	*Sprattus sprattus*	23
Limanda limanda	50	*Squalus acanthias*	2
Liza ramada	1	*Trachinus vipera*	10
Loligo forbesi	23	*Trachurus trachurus*	31
Loligo vulgaris	1	*Trigla lucerna*	12
Lophius budegassa	3	*Triglops murrayi*	2
Lophius piscatorius	18	*Trisopterus esmarki*	14
Lumpenus lampretaeformis	4	*Trisopterus luscus*	1
Lycodes vahlii	1	*Trisopterus minutus*	12
Maia squinado	20	*Zeus faber*	2
Maurolicus muelleri	1		

Table 3. Top 15 species by weight compared with the last two year's surveys

Species common name	**Scientific name**	**2011 weight (kg)**	**2010 weight (kg)**	**2009 weight (kg)**
Herring	*Clupea harengus*	5310.415	7636.146	5526.396
Sprat	*Sprattus sprattus*	3644.491	2305.760	1204.149
Mackerel	*Scomber scombrus*	3564.105	2442.406	2800.200
Haddock	*Melanogrammus aeglefinus*	3233.584	2826.904	2277.232
Dab	*Limanda limanda*	2403.130	1582.011	2052.979
Whiting	*Merlangius merlangus*	2163.285	2356.443	4507.874
Saithe	*Pollachius virens*	1596.850	457.726	416.447
Norway Pout	*Trisopterus esmarkii*	1453.874	2730.316	3383.579
Grey Gurnard	*Eutrigla gurnardus*	1019.530	625.955	1002.812
Horse Mackerel	*Trachurus trachurus*	969.807	2181.852	1440.914
Cod	*Gadus morhua*	626.680	395.052	441.754
Plaice	*Pleuronectes platessa*	592.373	361.211	378.922
Hake	*Merluccius merluccius*	465.263	479.937	289.832
Long-rough dab	*Hippoglossoides platessoides*	253.107	116.372	148.760
Lemon Sole	*Microstomus kitt*	250.324	136.673	173.898

A total of 6592 biological samples were taken for the primary target species (Table 4). In addition, a total of 288 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	1019
Whiting	976
Herring	943
Haddock	775
Cod	448
Hake	415
Dab	404
Mackerel	403
Saithe	321
Norway Pout	262
Lemon Sole	232
Grey Gurnard	223
Ling	49
Tub Gurnard	33
Monkfish	26
Red Mullet	24
Witch	15
Turbot	9
Red Gurnard	7
Brill	5
Black-bellied Anglerfish	3

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

Aim 3: Low nutrient seawater (9 x 25L carboys) was collected from approximately 60^{o} 19.15' N 000^{o}34.72'E.

Aim 4: In total, 38 spotted rays, 22 cuckoo rays, 15 spurdog, 5 common skate, 3 starry-smooth hounds, 1 tope and 1 black-mouthed dogfish were tagged with Petersen discs.

Aim 5: One Vahl's eelpout (Lycodes Vahlii), three Redfish (*Sebastes viviparous*) and one Immaculate sandeel (*Hyperoplus immaculatus*) were retained and frozen.

Aim 6: Several species were retained for otolith training purposes.

Aim 7: Maturity photos were taken for 32 lemon sole, 6 brill and 3 turbot.

Aim 8: Litter was recorded for all trawls, and in total 272 individual pieces were recorded and photographed, from the 85 valid and additional nylon and poly trawls.

Aim 9: Seabird and cetacean sightings were made during the survey by a JNCC observer. These were reported to the Sea Watch Foundation also.

Aim 10: The seaglider was deployed at a site of potential reduced oxygen concentration in lower waters in the Central North Sea (56^{o} 41.91'N 02^{o} 26.57'E) on 19/08/11 at 16:00 to investigate low oxygen events in the North Sea. The instrument performed well, completing 160 dives until an internal technical fault, meant that recovery was desirably. It was therefore recovered at 57^{o} 10.26'N 02^{o} 23.49'E on 24/08/11 at 06:44. Preliminary findings show that large areas of the heavily stratified central areas of the North Sea have reduced oxygen concentration approx 70% of saturation. Some locations in the well mixed regions near Denmark have even lower concentrations, but these are of much lesser spatial extent.

Aim 11: Dr Kirsteen MacKenzie, from the University of Southampton, sampled muscle, scales and otoliths from 353 herring with the aim of using stable isotope analysis to determine whether separate spawning stocks are truly mixed on their feeding grounds. Along with the herring samples, she has also collected 72 jellyfish, and is intending to find out if they can be used as natural biologgers of the isotopic compositions of higher trophic level animals in specific areas. Finally, she has collected muscle, scale, otolith, stomach and gut content samples from 19 different species of fish for Dr Clive Trueman, who is investigating the production of carbonates in the guts of wild fish.

Aim 12: A total of 13 plankton ring net dips were made across the survey, and the samples fixed in ethanol.

Aim 13: Two Twaite shad (*Allosa fallax*) were retained and frozen.

Aim 14: No specimens of *Chimaera monstrosa* were caught during this survey.

Aim 15: Queen scallop samples were found and frozen from 4 stations from the 30 designated locations.

Aim 16: No herring eggs were collected and fertilised onto plates, as we missed the spawning season of the herring.

Aim 17: Spot samples for chlorophyll pigment analysis were taken from all stations where a rosette dip was completed.

Aim 18: Particulate in/organic carbon analysis of seawater was carried out at every one of the stations where a rosette dip was completed.

Aim 19: A total of 26 samples of 20+ herring were taken from stations for stomach content analysis.

Aim 20: A total of 20 female and 5 male Lesser-spotted dogfish (*Scyliorhinus canicula*) were retained onboard to be taken back for fecundity studies at the Cefas aquarium, along with 5 European lobsters.

Aim 21: The guard buoy was deployed as planned at 14:22 on 10 August at 52°45'.771N 002°57'.898E.

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, despite a number of delays.

S. McCully
8 September 2011

DISTRIBUTION:

Basic list +

S McCully	B Harley
R Humphreys	B Hatton
M Eade	J Silva
M O'Brien	J Hunt
L Fernand	B Queste
A Hind	K Mackenzie
C Wong	A Reeves
J Ellis	M Etherton
M Nicolaus	T Maes
S Pitois	C Castellani
A Webb	A Walker
S Hetherington	I McCarthy

Figure 1.
Station positions CEFAS Endeavour 14/11.

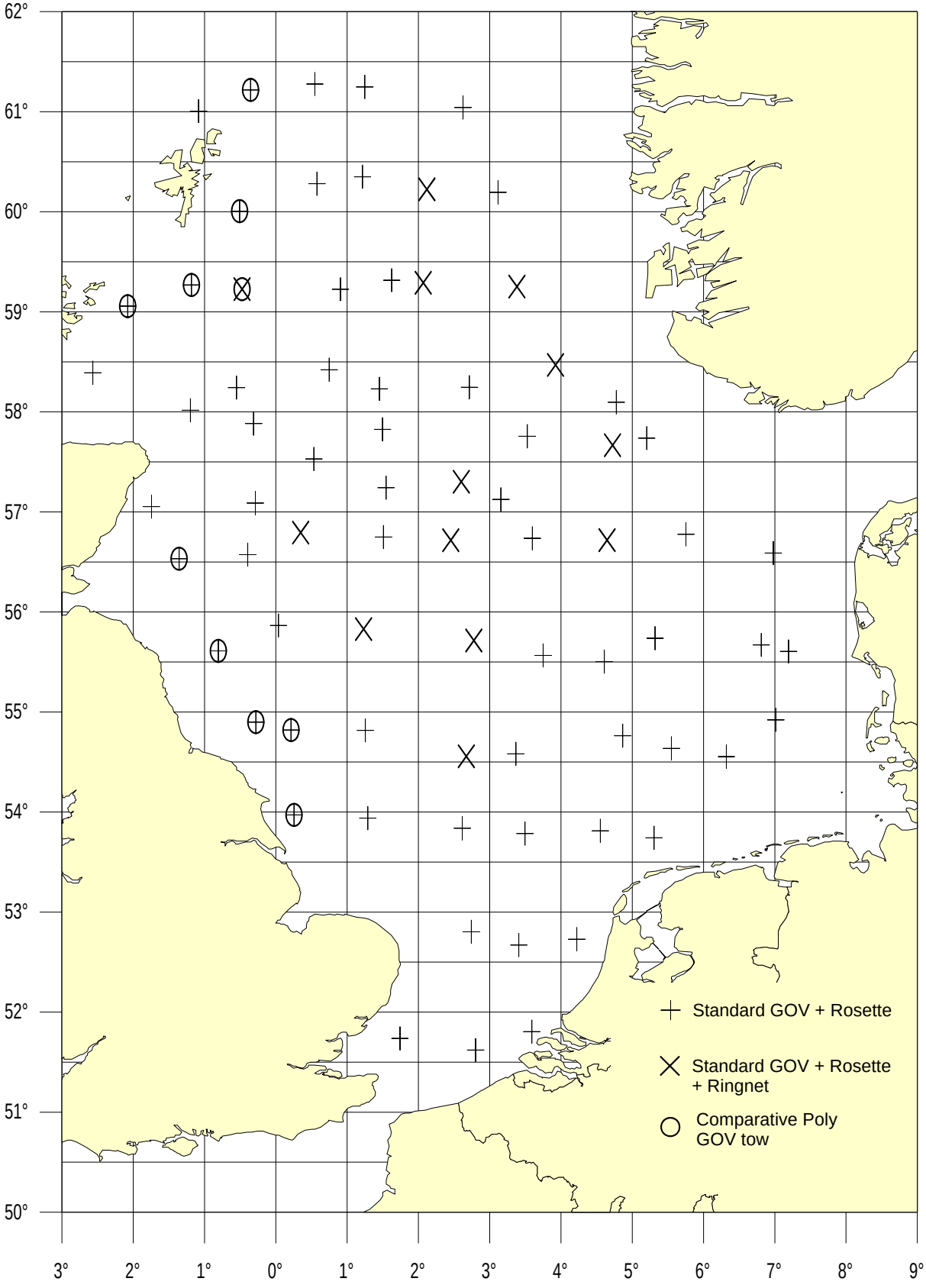

Figure 2.
Distribution and relative abundance (kg) of cod for 2008 to 2011.

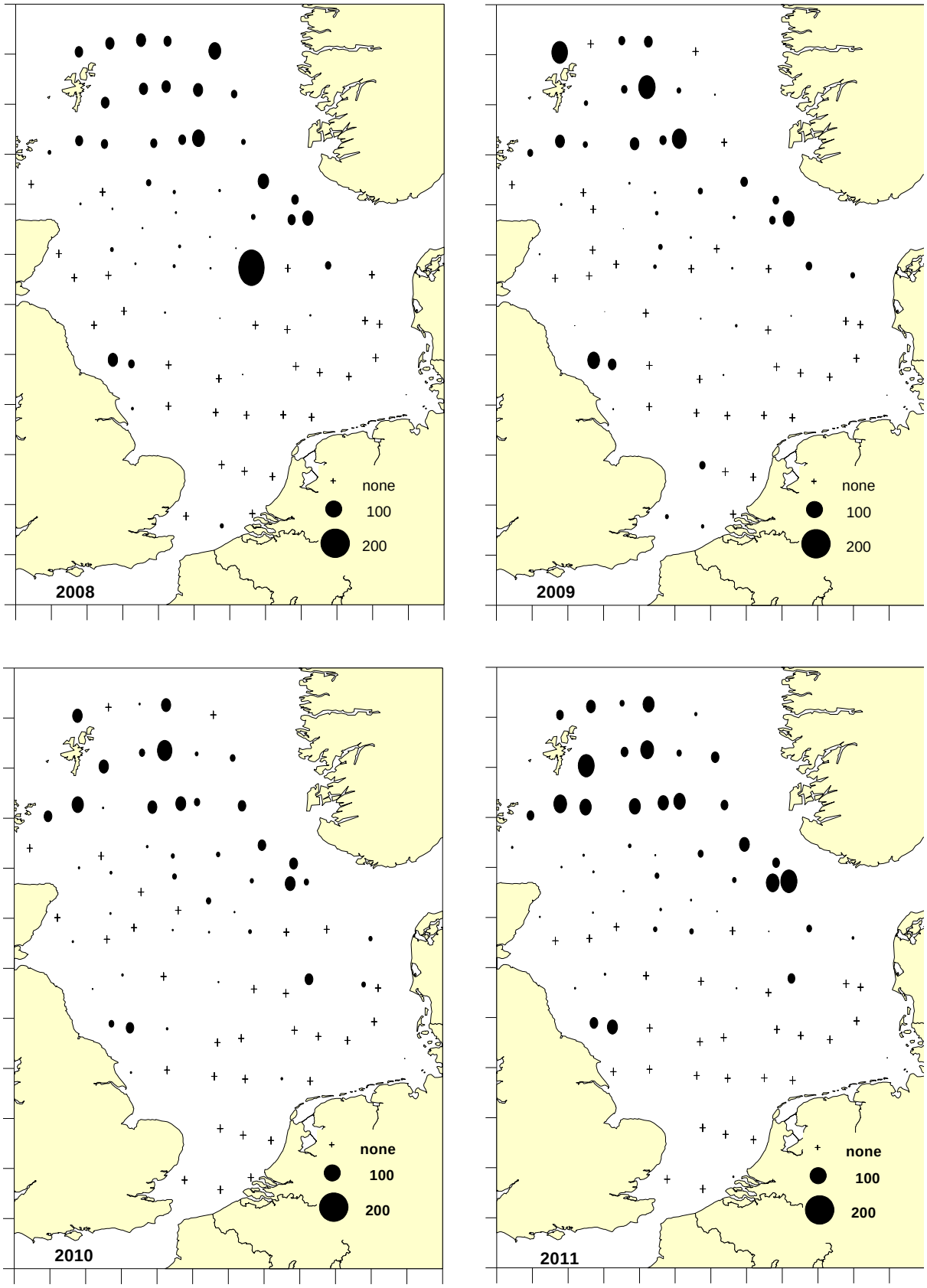

Figure 3.
Distribution and relative abundance (kg) of haddock for 2008 to 2011.

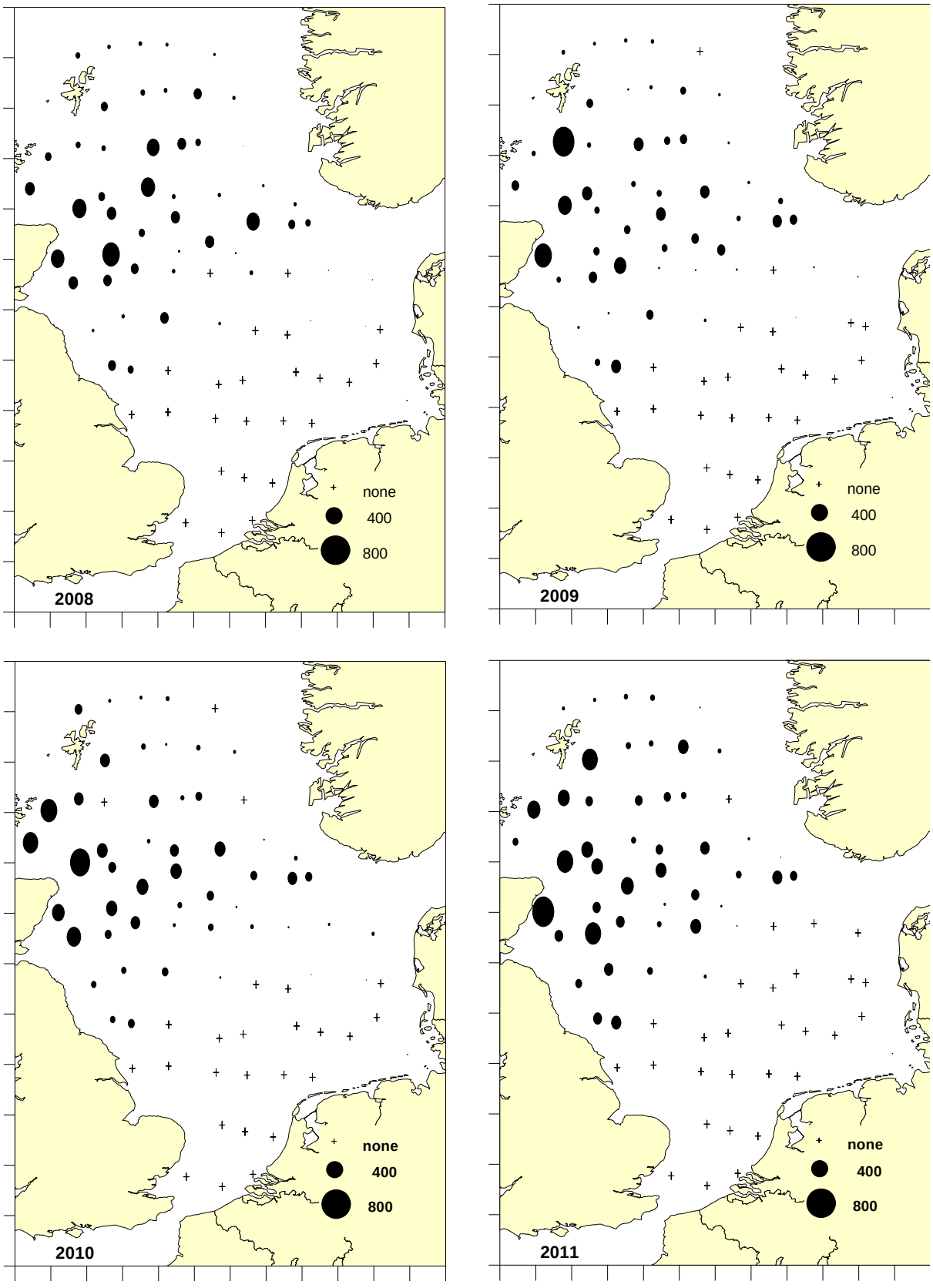

Figure 4.
Distribution and relative abundance (kg) of whiting for 2008 to 2011.

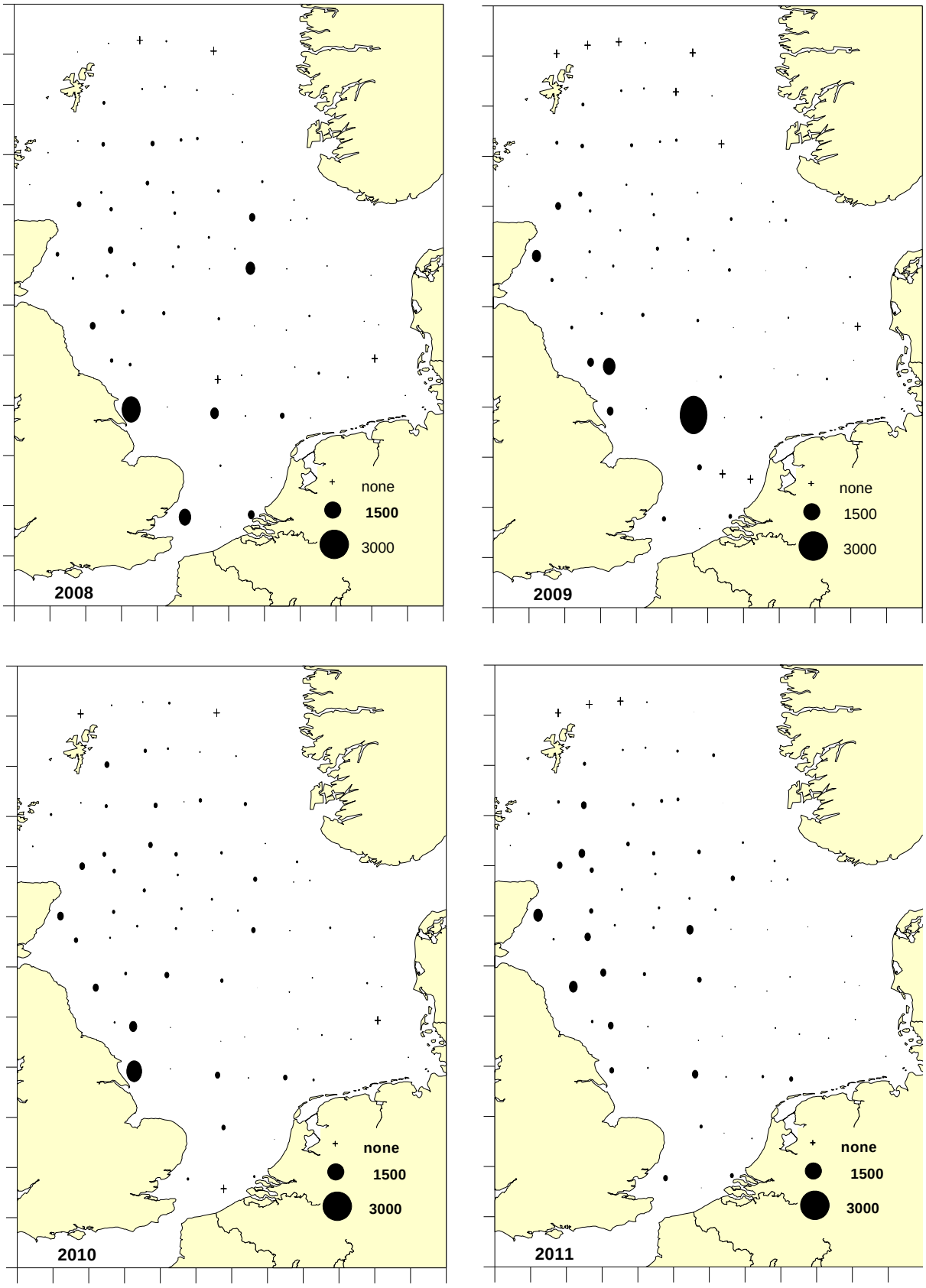

Figure 5.
Distribution and relative abundance (kg) of saithe for 2008 to 2011.

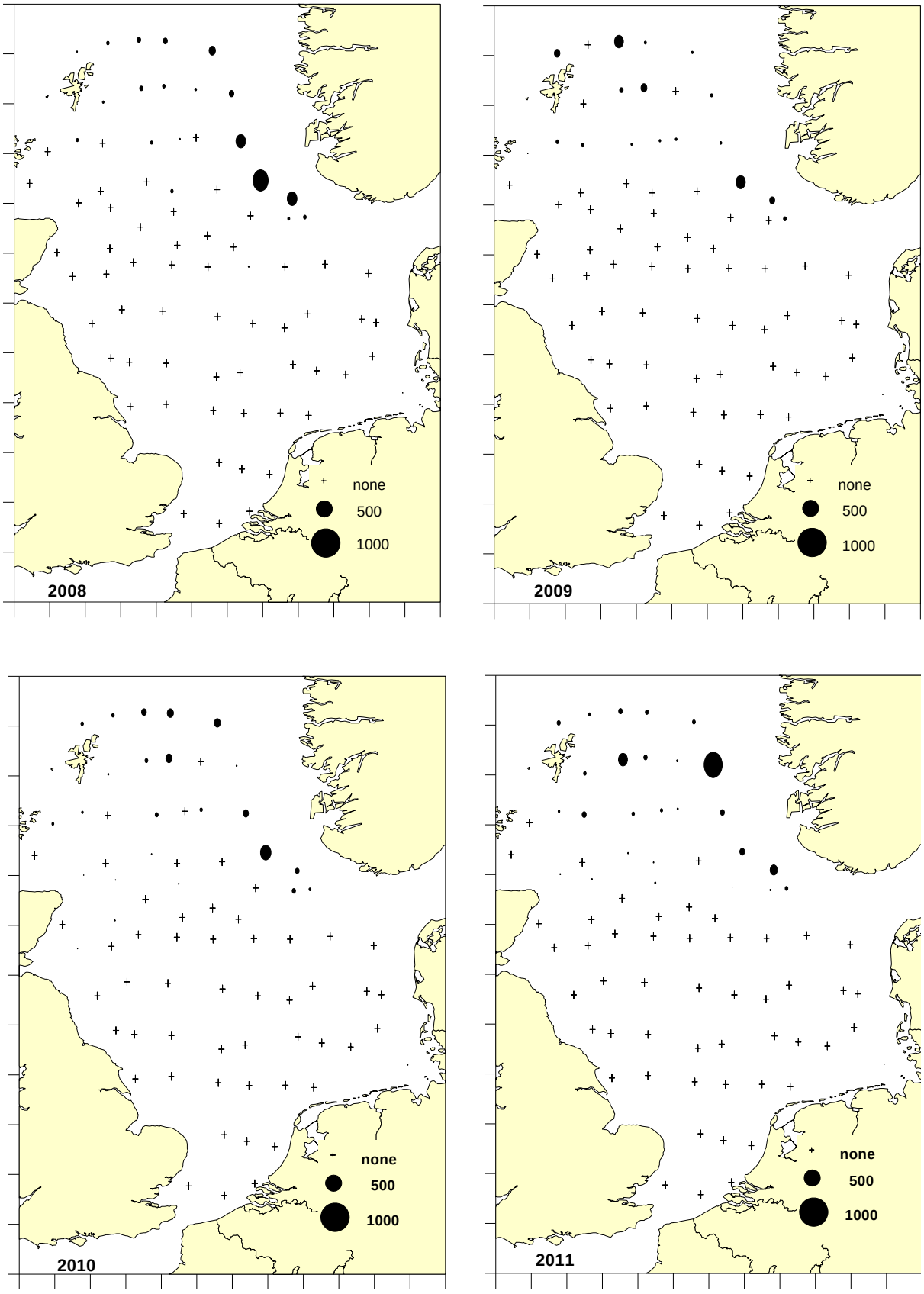

Figure 6.
Distribution and relative abundance (kg) of Norway pout for 2008 to 2011.

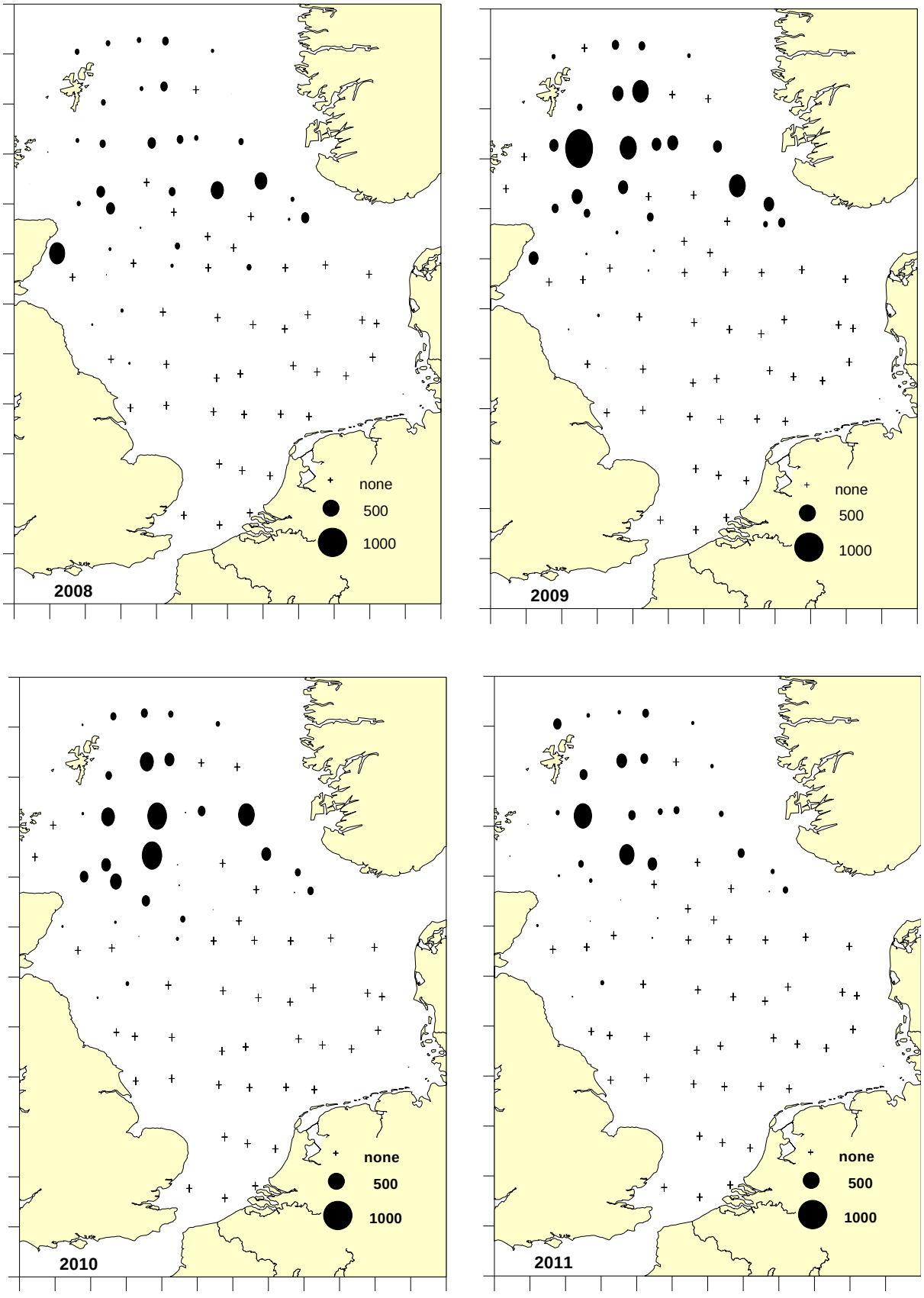

Figure 7.
Distribution and relative abundance (kg) of herring for 2008 to 2011.

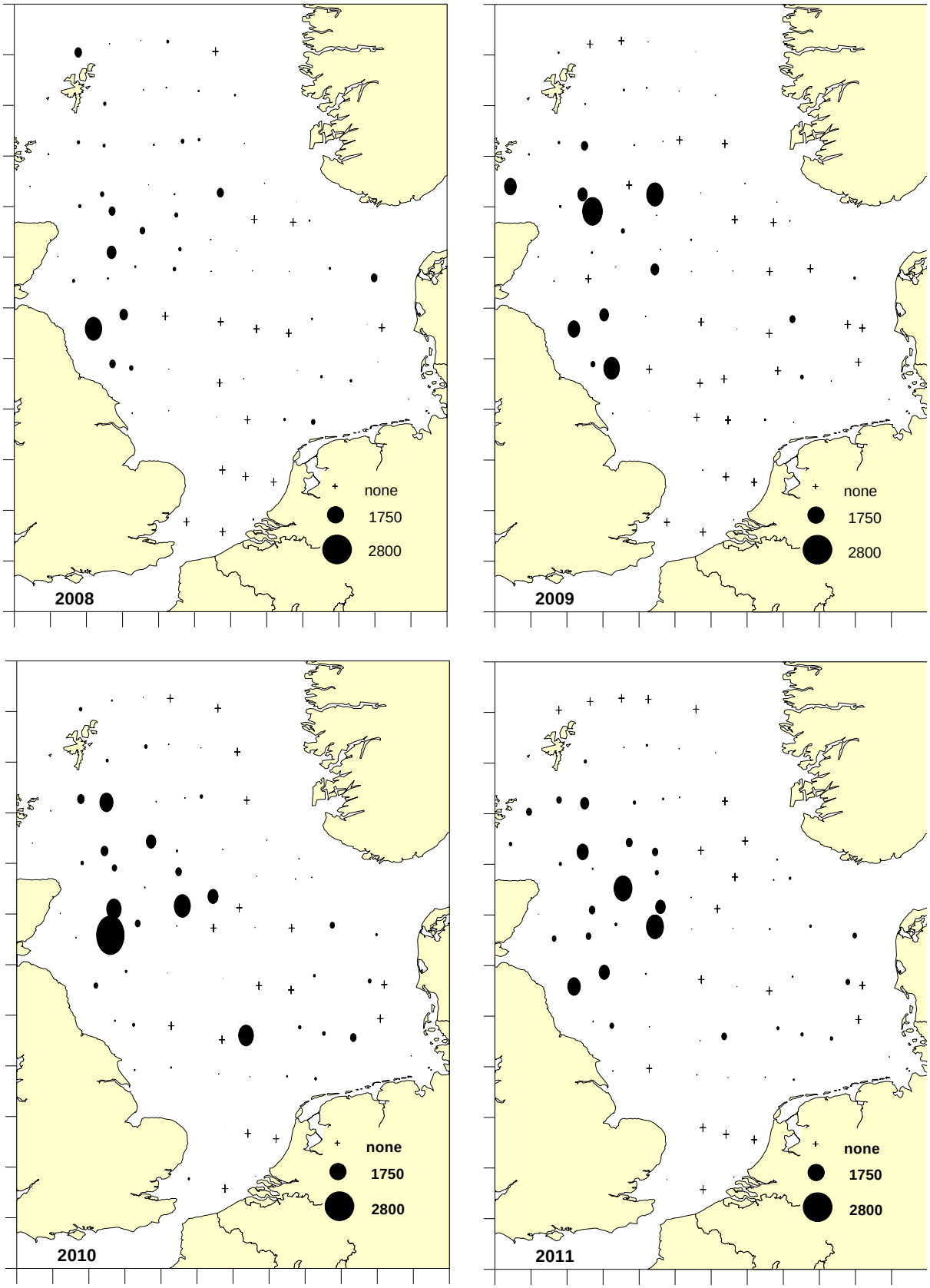

Figure 8.
Distribution and relative abundance (kg) of mackerel for 2008 to 2011.

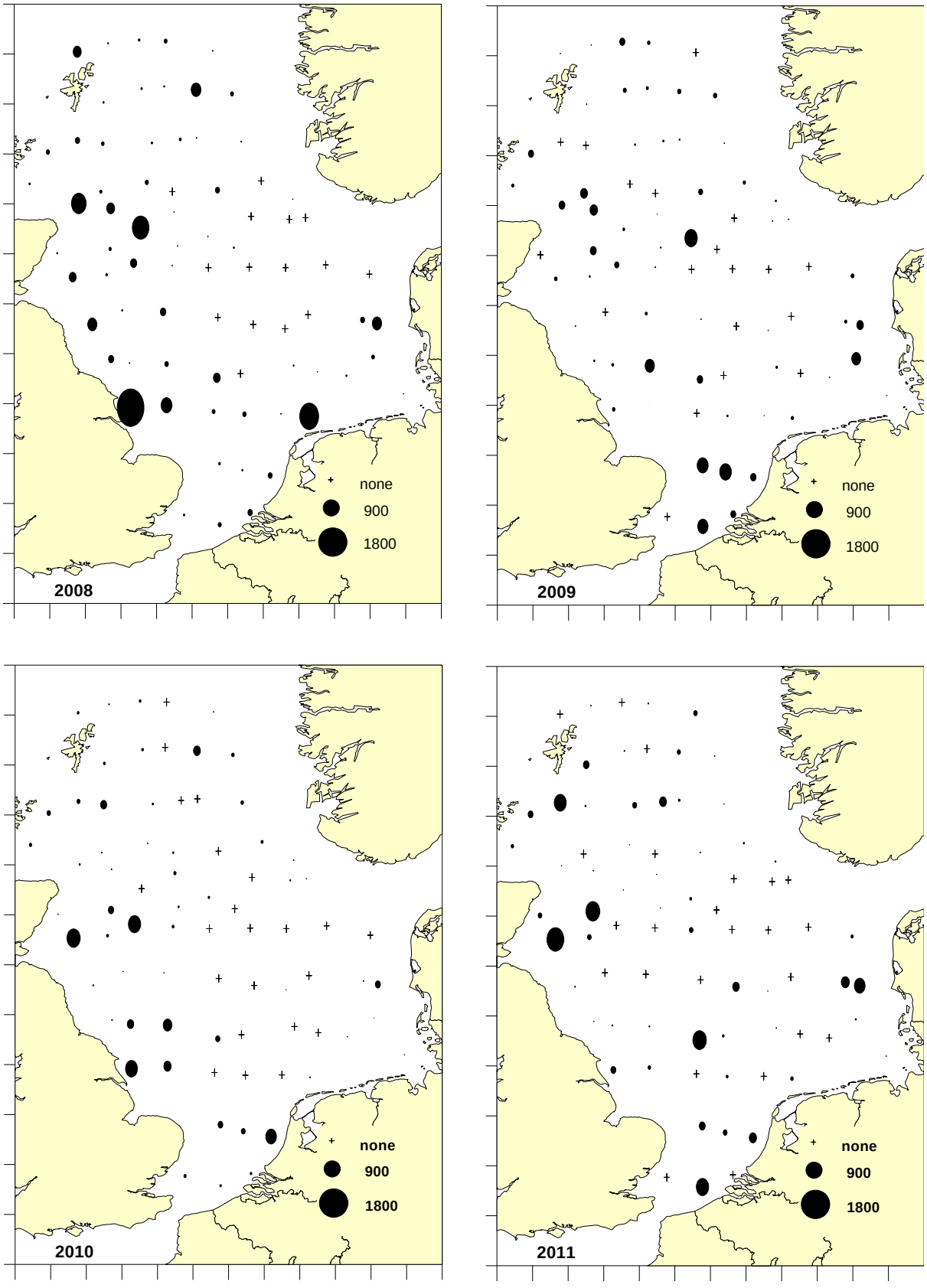

Figure 9.
Distribution and relative abundance (kg) of sprat for 2008 to 2011.

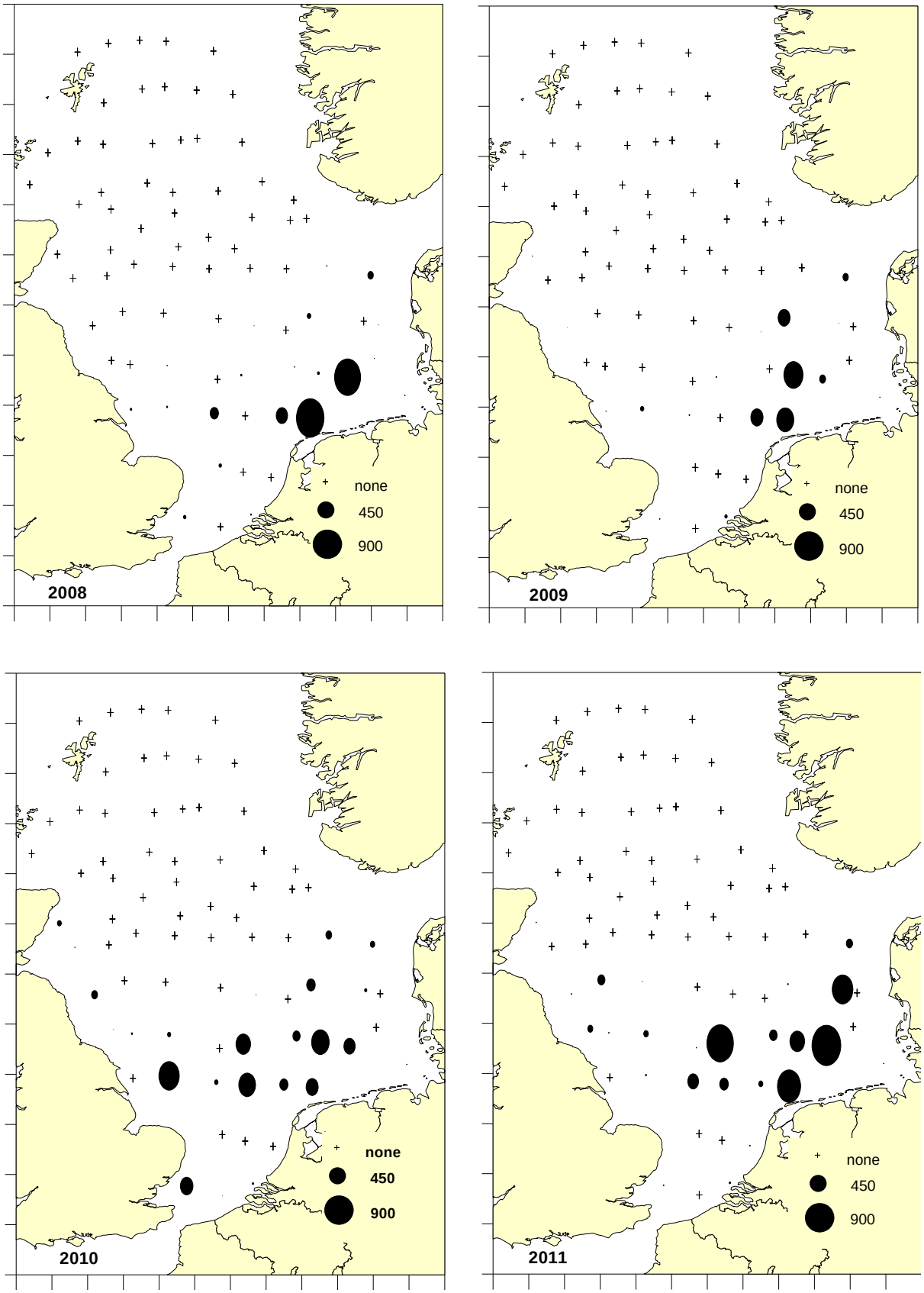

Figure 10.
Distribution and relative abundance (kg) of plaice for 2008 to 2011.

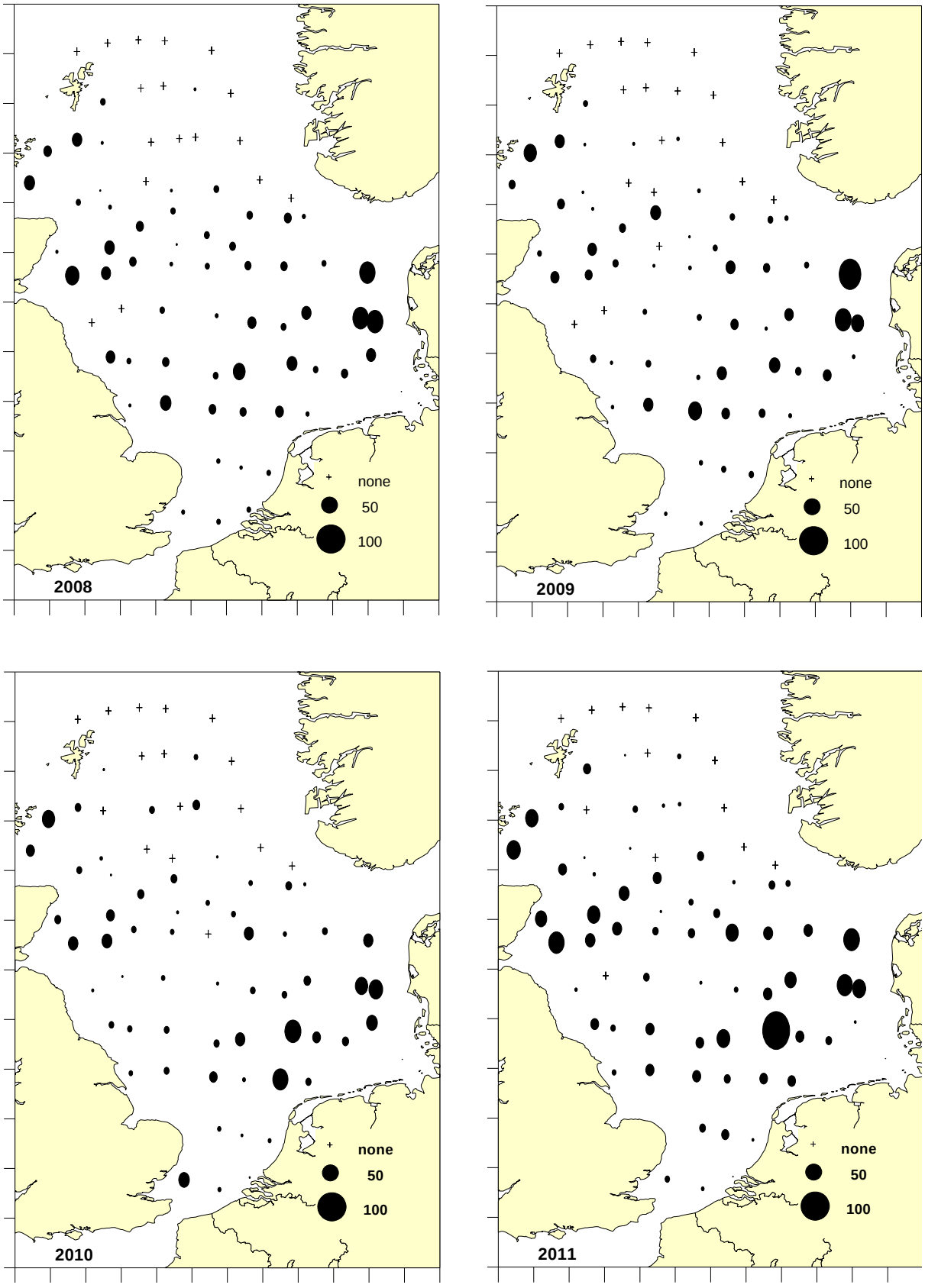

Figure 11.
Distribution and relative abundance (kg) of hake for 2008 to 2011.