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Spring plankton surveys of the eastern Irish Sea in 2001, 2002 and 2003: hydrography and the distribution of fish eggs and larvae

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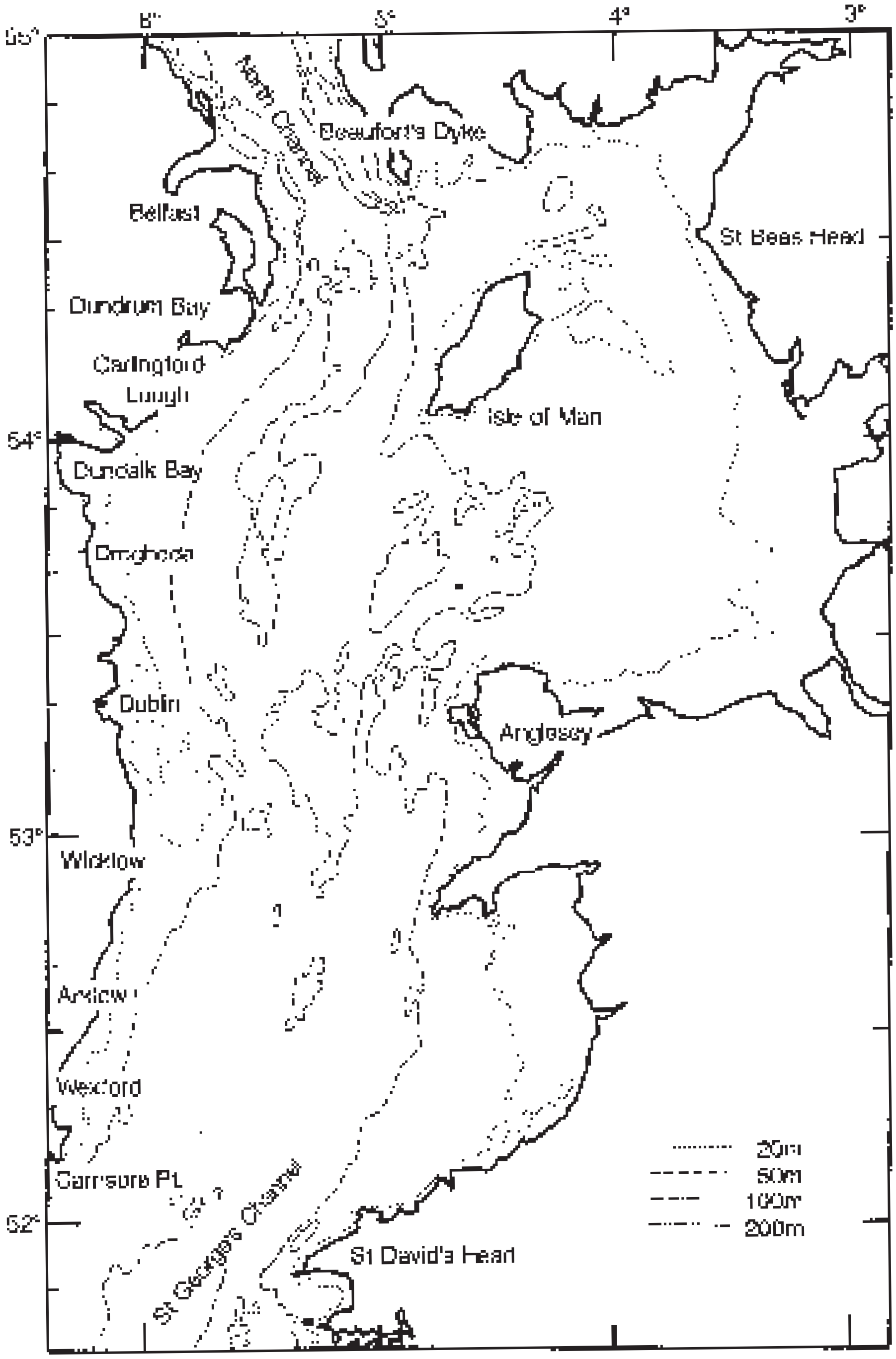


Bathymetry of the Irish Sea (adapted from Dickson and Boelens, 1988)

1. INTRODUCTION

From January to May for the years 2001 to 2003 a series of plankton surveys was carried out in the eastern Irish Sea to estimate the location, magnitude and timing of plaice spawning. The surveys were funded by Defra project MO423. Two research institutes took part in the surveys: The Centre for Environment, Fisheries and Aquaculture Science (CEFAS) and the University of Liverpool, Port Erin Marine Laboratory (PEML). Eggs and larvae from the target species were sorted and identified as part of the Defra contract programme. In addition, the eggs and larvae of all remaining fish species were analysed.

2. SURVEY COVERAGE

Table 1 summarises the timing of the surveys during the three-year period. A grid covering the eastern Irish Sea between 53˚ to 55˚ North and 3˚ to 4˚ 30′ West was surveyed at approximately three-weekly intervals. The sampling grid consisted of a total of 49 stations that aimed to include, both temporally and spatially, the major part of the spawning of plaice in this area (NB. For some surveys, unsuitable weather conditions prevented completion of the full 49 stations). This design was based on the patterns of abundance and distribution of the eggs of plaice and cod in the Irish Sea in previous years (Nichols *et al*., 1993; Armstrong *et al*., 1997; Fox *et al*., 1997; Fox *et al*., 2000).

For a brief overview of the geography and major hydrographic features of the study region see Nichols *et al*. (1993) and OSPAR (2000).

3. SAMPLING METHODS AND EQUIPMENT

3.1 Shipboard plankton sampling

A Gulf VII high-speed plankton sampler was used as standard on these surveys (Nash *et al*., 1998). The specification used has a 53 cm diameter unencased body fitted with a conical nosecone of 20 cm diameter aperture. The body of the net was made of 270 µm mesh as standard. The cod-end consisted of a bag constructed from an impermeable nylon material and incorporating a window of 270 µm mesh net that allowed the water to escape. This configuration was designed to minimise damage to the eggs and larvae by providing maximum protection during collection.

The sampler was fitted with a self-logging micro-conductivity-temperature-depth (CTD) sensor unit (Falmouth Scientific, Inc., Cataumet, Massachusetts, USA). A ‘Valeport’ (Valeport Ltd., Totnes, Devon, U.K.) flowmeter, with a blade diameter of 12.5 cm, was centrally mounted inside the nosecone. A similar flowmeter was mounted externally on the frame to provide a measure of distance travelled through the water. Flowmeter readings (count of blade revolutions) were provided by a Valeport self-logging readout unit. The ratio between internal and external flowmeter revolutions provided an index of clogging of the net, and enabled the volume of water filtered on each deployment to be calculated.

The Gulf VII design has been extensively calibrated over a range of speeds and simulated clogging

Table 1. Details of icthyoplankton surveys carried out in the eastern Irish Sea in 2001, 2002 and 2003

Year	Date	Vessel	Number of stations sampled
2001	29 Jan - 1 Feb	RV Prince Madog	49
	26 Feb - 2 Mar	RV Prince Madog	47
	19 - 23 Mar	RV Prince Madog	46
	2 -5 Apr	FV Resolute	37
	23 - 26 Apr	FV Resolute	48
2002	19 - 21 Feb	RV Prince Madog	11
	13 - 16 Mar	RV Prince Madog	49
	8 - 10 Apr	RV Prince Madog	49
	30 Apr - 2 May	RV Prince Madog	49
2003	13 - 17 Jan	RV Prince Madog	27
	3 - 6 Feb	RV Prince Madog	30
	19 - 24 Feb	RV Corystes	48
	26 Feb - 1 Mar	RV Corystes	47
	17 - 19 Mar	RV Prince Madog	49
	12 - 15 Apr	RV Prince Madog	49
	28 - 30 Apr	RV Prince Madog	41

conditions, either in a large circulating water channel or a towing tank (Harding and Arnold, 1971; Arnold *et al*., 1990; Brander *et al*., 1993). From these experiments, coefficients were obtained for the regression:

$$y = a*x + b$$

where, y = volume filtered (litres per internal flowmeter count),
x = ratio of internal to external flowmeter counts,
a = -101.44
and b = 225.52.

These data were used to calculate the volume filtered during each sampler deployment.

The sampler was deployed in an oblique tow, at 4-5 knots, from the surface to within 2 metres of the bottom (or as near as bottom topography would allow) and returned to the surface. The requirement was for an even 'V'-shaped dive profile, filtering the same volume of water per unit of depth. The aim was to shoot and haul at the same rate with the sampler spending approximately 10 seconds in each 1-metre depth band. At shallow stations, more than one dive was necessary to enable a sufficient volume of water to be filtered. It was recommended that the sampler remained in the water for a minimum period of 15 minutes.

Temperature, salinity and depth profiles were obtained at each sampling position from the CTD sensor mounted on the frame of the plankton sampler. Additional salinity bottle samples were taken at regular intervals from the near surface in order to validate the quality of the salinity data taken from the CTD.

3.2 Preservation of samples

After the sampler had been recovered the net was gently washed down from the outside with seawater. The end-bag was removed and the plankton washed into a jar and fixed using buffered formaldehyde solution (4% formaldehyde in distilled water buffered with 2.5% sodium trihydrate (w/v), (Tucker and Chester, 1984). The samples were transported to the CEFAS laboratory, Lowestoft, for plankton sorting and identification.

3.3 Identification of fish eggs and larvae

Fish eggs and larvae were picked out of the preserved samples using low power microscopes, and, whenever practicable, the whole sample was sorted. Sub-sampling, however, was at times necessary and this was carried out using a Folsom splitter. Using this method a fraction of the sample (for example ⅛, ¼ or ½) was worked up as appropriate.

Ichthyoplankton from these surveys was identified according to Russell (1976). This was supplemented by various identification guides and keys produced by the International Council for the Exploration of the Sea (Saville, 1964; Macer, 1967; Nichols, 1971; Demir, 1976; Nichols, 1976). Fish eggs were initially split into groups on the basis of presence or absence of oil globules. Those containing either a single or many oil globules could usually be identified to the species level. Eggs with no oil globules are more difficult to separate, particularly in the early stages before embryonic pigmentation develops, and as a result it is not possible to identify a proportion of these. However, egg size was recorded, and the numbers of eggs without oil globules that were measured (i.e. not total numbers) for each survey are shown in Figures 1 to 3. Overall, the patterns of size frequency reveal a bi-modal distribution in egg diameter with highest numbers occurring at around 0.8 mm and 1.2 mm. The first peak is likely to consist of eggs mainly from species such as dab (*Limanda limanda*) and to a lesser extent flounder (*Platichthys flesus*). Eggs measuring from about 1.0 to 1.25 mm in diameter cover a larger range of species including whiting (*Merlangius merlangus*), witch (*Glyptocephalus cynoglossus*), *Trisopterus* spp. (Norway pout, poor cod, bib) and others. Eggs of cod (*Gadus morhua*) and haddock (*Melanogrammus aeglefinus*) also overlap with the upper end of this range. Fish larvae were generally easy to identify unless they had been badly damaged during collection. For some groups, such as the sandeels (Ammodytidae) and the rocklings (Gadidae), individuals were not identified to the species level.

3.4 Data Analysis and data storage

Plankton data were expressed as number of organisms m^{-3} by dividing the numbers per sample by the volume filtered. The plankton distributions in this report are plotted as numbers m^{-2} of sea surface, obtained by multiplying the number m^{-3} by the sampled depth during deployment. Numbers m^{-2} of sea surface were plotted as bubbles on the same linear scale for a species for all surveys in any given year. Bubble diameter is linearly related to numbers m^{-2} above a non-zero baseline of 0.1 m^{-2} (Surfer version 8, Golden Software Inc., Colorado, U.S.A.). Hydrographical data was plotted as contour maps using the same software. Values were obtained from the CTD data recorded during each sampler deployment. The full dataset is stored on ACCESS (Microsoft Inc.) databases held at CEFAS.

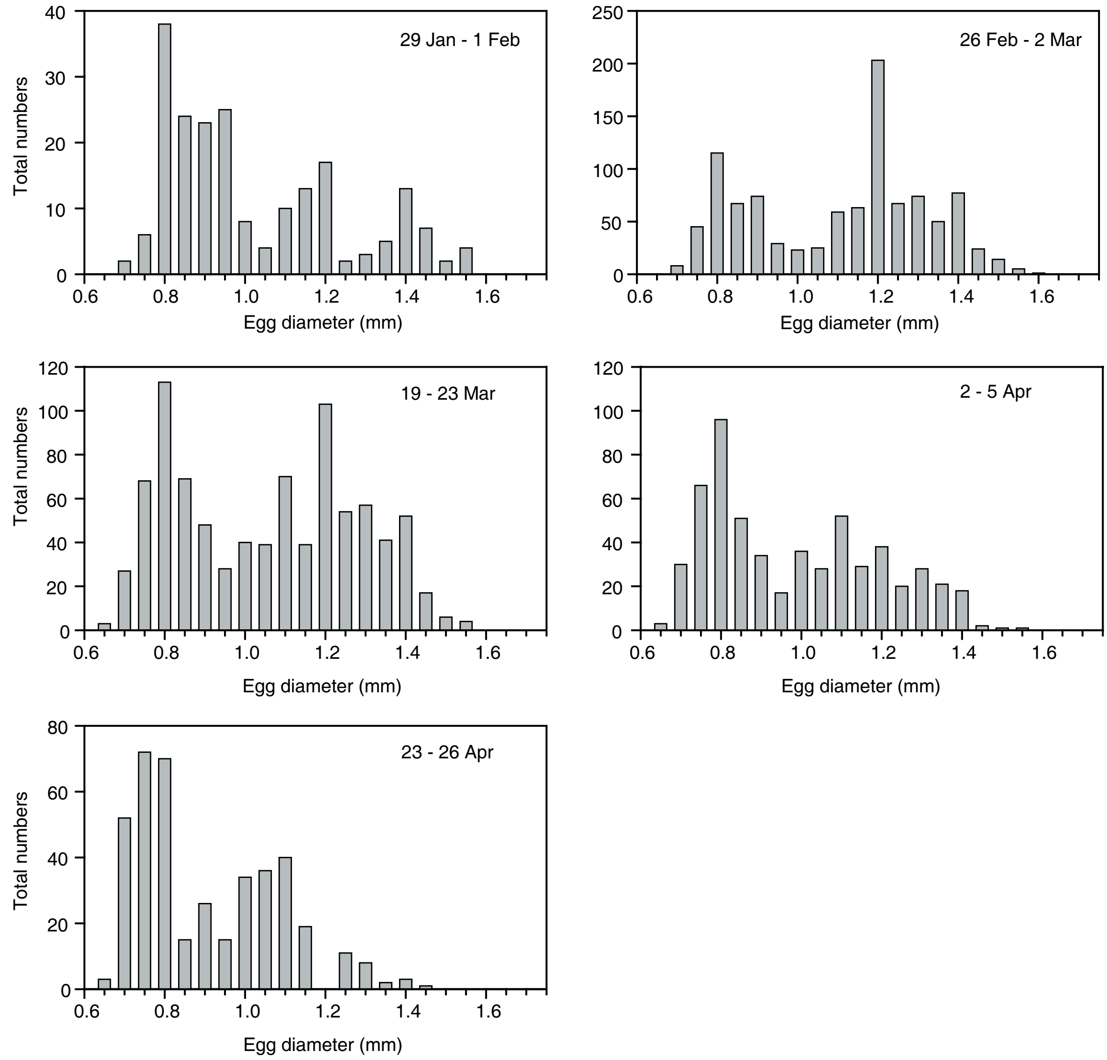


Figure 1. Size-frequencies of measured unidentified eggs by cruise in 2001

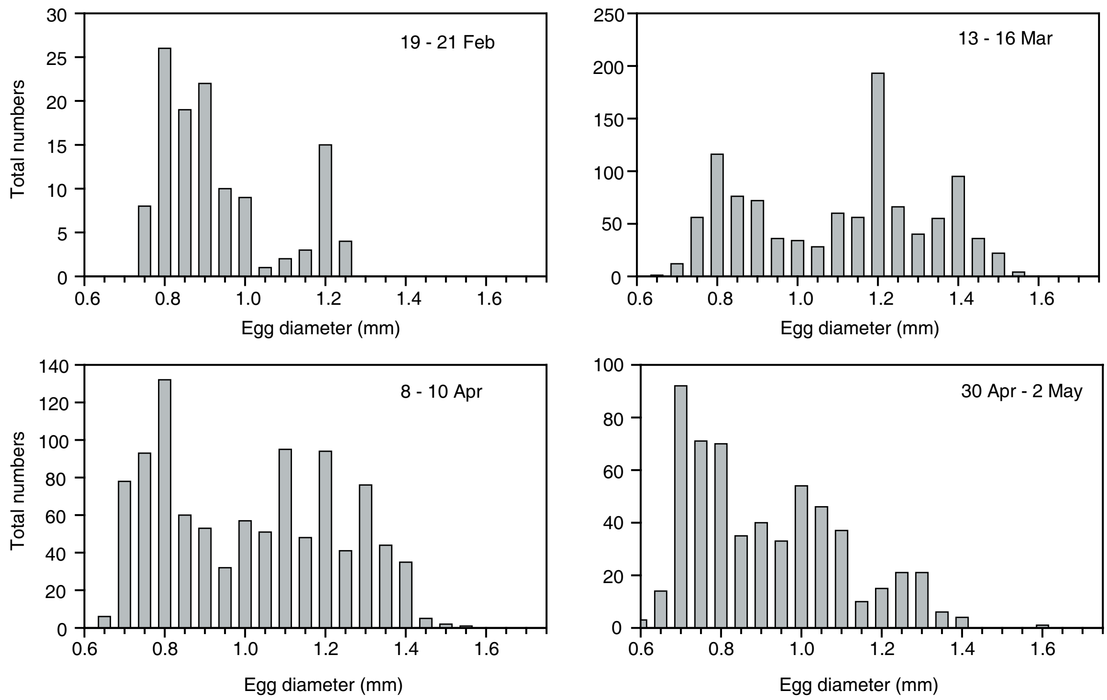


Figure 2. Size-frequencies of measured unidentified eggs by cruise in 2002

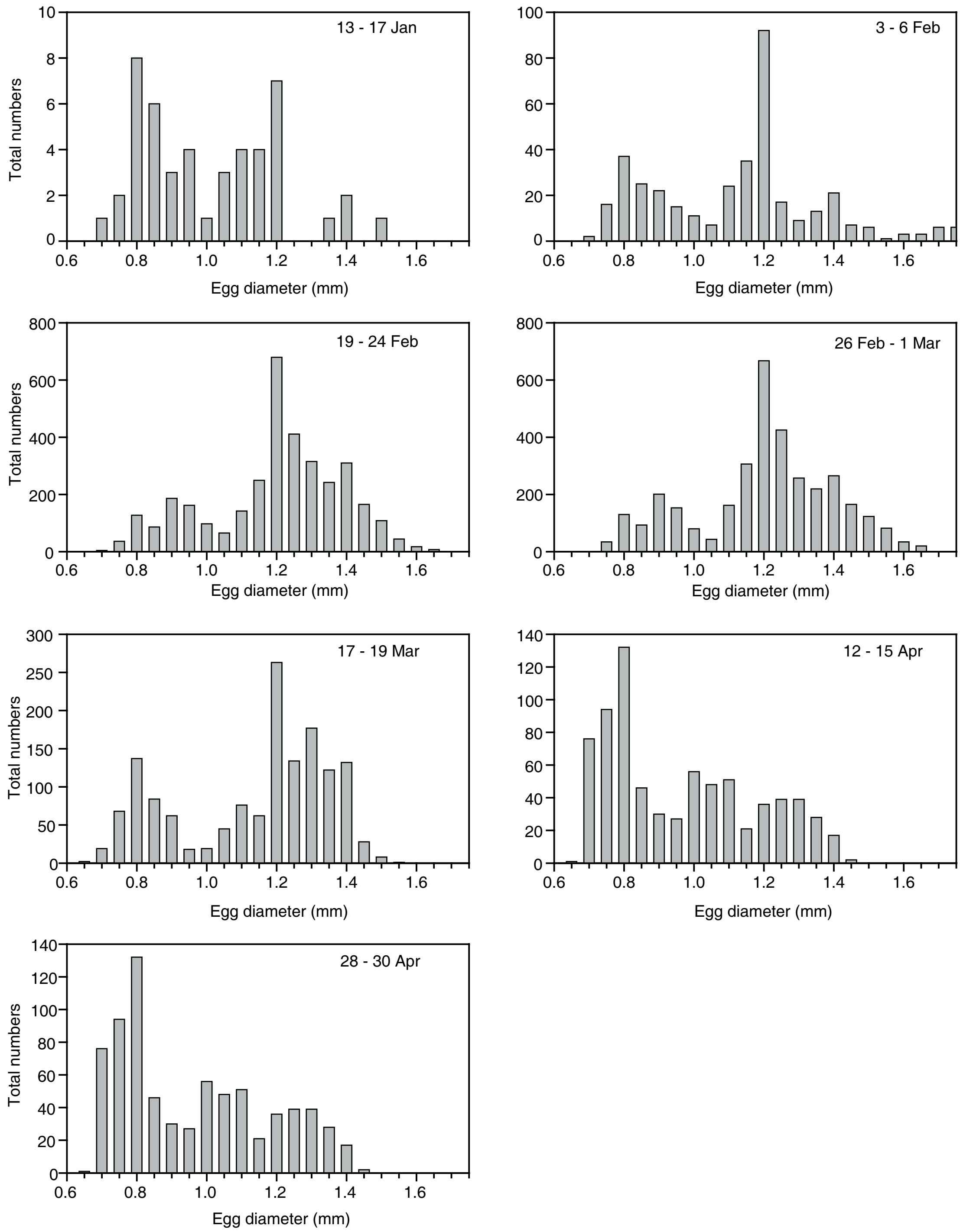


Figure 3. Size-frequencies of measured unidentified eggs by cruise in 2003

4. RESULTS

4.1 The physical environment

The bathymetry and oceanography of the Irish Sea have been extensively described (Robinson, 1979; Bowden, 1980; Proctor, 1981; Dickson and Boelens, 1988; OSPAR, 2000). However, because the physical environment plays such an important role in determining the biological processes, a brief account is included here. The Irish Sea is characterised by a deep water trough (>80 m) running centrally between the Irish coast and following a line from the southern tip of the Isle of Man to the west of Anglesey. The trough continues northwards through the North Channel reaching a depth of 315 m at Beauforts Dyke. In the central area the trough shallows rapidly to the west whilst to the east it slopes more gently to create a relatively shallow bay (<50 m deep) bordered by the North Wales, English and Scottish coasts (eastern Irish Sea).

Details of the circulation and tidal movements within the Irish Sea can be found in Ramster and Hill (1969), Simpson and Hunter (1974), Slinn (1974), Heaps and Jones (1977), Bowden (1980), Davies and Jones (1992), Hill *et al*. (1994), OSPAR (2000), Young *et al*. (2001). In most of the region, tidal mixing is sufficiently strong to maintain a vertically homogeneous water column throughout the year. An exception to this is the area to the southwest of the Isle of Man where the water is deep and the tidal flows weak. Seasonal stratification is established in this area between April and October leading to a density driven gyre. In the eastern Irish Sea, haline stratification is marked in winter and spring, especially near the main river inputs, but thermal stratification may develop in the summer.

Figures 4 to 6 show the sea surface temperature distributions from January to May for 2001-2003 in the eastern Irish Sea. For all years a similar general pattern is evident (NB. survey coverage in early 2002 and 2003 was comparatively poor due to unsuitable weather conditions). In January and February minimum temperatures (down to 5ºC in February 2001) were recorded along the length of the English coast. At the same time surface temperatures gradually increased with increasing distance from the coast. This east to west gradient in temperature was maintained during March but at an average of 0.5-1ºC higher. By April, surface temperatures had continued to rise but were now relatively uniform across the whole of the survey area. Highest temperatures of 9.5ºC were recorded at the end of April in 2002 and 2003. Patterns in bottom temperature (Figures 7-9) showed very similar patterns to surface values indicating that the water column was well mixed across the region. Overall, temperatures appeared lower in 2001 than in the other years. Integrated temperatures (temperature averaged over the whole water column) are plotted in Figures 10 to 12.

The patterns of surface salinity distribution (Figures 13-15) show a similar trend to those of temperature, incrementing in value from sites off the English coast towards the western Irish Sea. Minimum and maximum values were 31 (March 2002) and 34 (most surveys). Little difference in salinity occurred between years. However, compared to previous surveys carried out over the same time period in 2000 (Bunn and Fox, 2003), salinities are generally higher. Bottom and integrated salinity patterns follow similar contours to the surface. This implies that there was little vertical structure in salinity (Figures 16-21).

4.2 The ichthyoplankton

Over the 3-year period surveyed, fish eggs from 19 species and larvae from 30 species were identified. A further 4 groups of eggs and 9 groups of larvae were, for practical reasons, identified to the family or genus level only (e.g. Rocklings, *Trigla* spp., Ammodytidae, Gobiidae). All species and taxonomic groups are listed in Tables 2a-d. These tables also record the maximum density of eggs and larvae found on each survey and their occurrence as a percentage of the stations where a positive record was obtained. Figures 28 to 147 map the egg and larval distributions for most of the identifiable species by survey. A '+' symbol denotes a station where a plankton tow was carried out, but no eggs or larvae of the species indicated were caught.

4.2.1 The distributions of total eggs and total larvae (Figures 22 and 27)

In all years and surveys fish eggs were found at nearly every position sampled. Peak numbers generally occurred off the north Wales coast in early to mid-March. The highest number recorded during any one survey was 8085 m^{-2} in March 2003. High abundances could also be found in the waters between the Isle of Man and the coast of Cumbria. In the later surveys fish eggs were more evenly distributed across the region in lower densities.

Larvae were recorded in relatively low concentrations in all years during January and February. By mid-March increased numbers were found, especially in the areas off the north Wales coast (2002) and between the Isle of Man and Cumbria (2001 and 2003). Peak abundances occurred over a wide area towards the end of April. Maximum larval density was 2387 m^{-2} in the last survey of 2001.

4.2.2. Clupea harengus (Herring) (Figures 28-30)

Herring are demersal spawners that deposit their eggs to form a mat on the bottom substrate. Thus, no eggs of herring were caught during these surveys. Herring larvae are difficult to distinguish from another Clupeid, sprat (*Sprattus sprattus*), but separation is made possible by differences in the number of muscle blocks running the length of the larvae. The Irish Sea herring stock spawns in the autumn so most of the Clupeid larvae caught in these spring surveys were those of *S. sprattus*. However, some herring larvae were found in small numbers across the eastern Irish Sea over the period sampled. Highest densities (up to 31 m^{-2}) and widest distribution, both temporal and spatial, occurred in the 2003 surveys. Peak abundances were recorded in January and February in each year but a few larvae were still present in April at discrete positions in 2003. Herring spawn as late as November in the Irish Sea so it is thought that the larvae identified in this survey series were the product of late spawning from the previous year. It is also possible that larvae from the Celtic Sea spawning area may have drifted into the region, but this has yet to be tested (Mike Armstrong, CEFAS, *pers. com.*)

4.2.3 *Sprattus sprattus (Sprat)* (Figures 31-36)

Sprat eggs were identified from early February onwards and overall were the most abundant in both number and distribution throughout the series (Tables 2a and c). During the March and April surveys eggs were caught at an average of 91% of the stations sampled. The maximum densities recorded were 826 m^{-2} in April 2001, 534 m^{-2} in March 2002 and 484 m^{-2} in April 2003. Between years patches of higher abundance occurred in two main areas: Liverpool Bay and the North Wales coast, and between the Isle of Man and the English coast. Sprat larvae were also widespread, especially from late-March onwards, and followed a similar pattern to the eggs with peak concentrations occurring predominantly in shallower coastal waters. Highest numbers (up to 848 m^{-2}) were recorded in the final survey of 2001.

4.2.4 *Gadus morhua (Cod)* (Figures 37-42)

Cod and haddock (*Melanogrammus aeglefinus*) produce eggs that are identical in appearance during their early stages of development and also overlap in size range. Therefore, they cannot be positively distinguished. For this survey series, using sizes determined by Russell (1976) early-stage eggs measuring 1.24-1.7 mm diameter and lacking an oil globule were classified as 'cod-like'. These have not been mapped separately, but measured eggs in this range are included in Figures 1 to 3 that show the size-frequencies of unidentifiable eggs. From these figures it may be assumed that a proportion of these eggs were cod, but their concentration and distribution in terms of abundance is unknown. Recent studies of 'cod-like' eggs caught in the Irish Sea have applied molecular techniques to provide a firm identification of species (Fox *et al*., in prep.). Initial results have shown that cod and haddock eggs also overlap significantly in size with those of whiting (*Merlangius merlangus*) whose upper size limit was determined by Russell (1976) to be 1.32 mm diameter. Moreover, the 'TaqMan' analyses used showed that the majority of 'cod-like' eggs in the size range 1.2-1.75 mm (and therefore previously assumed to be cod or haddock) were in fact from whiting.

Late-stage (stages IV and V) cod eggs are more easily identifiable by the development of embryonic pigmentation. However, these too are subject to mis-identification and so the results plotted here must be taken as an indication only of their true abundance. Late-stage cod eggs were recorded from early February until middle or late-April. Peak abundances occurred in mid-March in all years. Overall numbers were lowest in 2003. In this year eggs were predominantly confined to the northern part of the area, whereas in 2001 and 2002 they were more widespread. By the end of April in all years egg numbers were low or absent. Cod larvae were found at the beginning of February in 2003, but highest numbers generally occurred in all years in early to mid-April. The maximum larval abundance recorded was 22 m^{-2} off the Cumbria coast in 2003.

4.2.5 *Melanogrammus aeglefinus (Haddock)* (Figures 43-48)

Because of the problems encountered with identification, haddock eggs were handled and recorded in the same way as those of *G. morhua*. Late-stage haddock eggs were caught at isolated positions on only 4 of the 16 surveys over the 3-year period. These were in fact single individuals and nearly all of them were caught in a similar area near the Isle of Man in March. Higher numbers of larvae were found but their distribution was also restricted to small areas. Peak densities were 3 m^{-2} in March 2001, 5 m^{-2} in April 2002 and 4.8 m^{-2} in late April 2003.

4.2.6 *Merlangius merlangus (Whiting)* (Figures 49-51)

The eggs of this species are not separately identified but are included in a group of measured eggs with no oil globules (Figures 1-3). Russell (1976) established that whiting eggs range in diameter from 0.97 to 1.32 mm. However, recent evidence using 'TaqMan' molecular probes to identify egg species has shown that the range for whiting may extend up to 1.7 mm in the Irish Sea (Fox *et al*., in prep).

Whiting larvae were found to be widespread in the eastern Irish Sea from mid-March and overall this species was the nth most abundant in the survey series. Highest densities occurred in mid or late April. The maximum number recorded was 128 m^{-2} in 2003.

4.2.7 *Gadidae (Norway Pout and Poor Cod)* (Figures 52-54)

The eggs of these two species are similar to those of *M. merlangus* and others and so are not identified in plankton samples (see Figures 1-3). Similarly the larvae of *Trisopterus minutus* (Norway pout) and *T. esmarkii* (poor cod) are difficult to distinguish between, and for the purposes of plotting, positively identified larvae have been grouped together with unidentifiable individuals. Larvae were caught as early as February in 2001 and 2003, but in 2002 were not identified from samples until the first survey in April. Numbers were generally low and patchy in distribution in 2001-02. The greatest numbers (up to 28 m^{-2}) were recorded during one survey in April 2003.

4.2.8 *Trisopterus luscus (Bib, Pout)* (Figures 55-57)

The eggs of this species lack an oil globule and range in diameter from 0.9-1.23 mm. They cannot readily be separated from those of a similar size (Figures 1-3).

Over the survey series bib larvae were more common in number and distribution than those of its close relatives *Trisopterus minutus* and *T. esmarkii*. Maximum larval densities reached 25 m^{-2}, 8 m^{-2} and 38 m^{-2} in 2001, 2002 and 2003 respectively.

4.2.9 *Pollachius pollachius* (Pollack) (Figures 58-60)

Pollack is another species to produce eggs of a similar size range and appearance to others that lack an oil globule. Pollack eggs range in diameter from 1.1-1.22 mm and because this overlaps with *Merlangius merlangus* and *Trisopterus luscus* they are not separately identified (Figures 1-3). Larvae were caught in relatively low numbers in all years. Maximum abundance was 5 m^{-2} in 2003. No distinct pattern in distribution was evident.

4.2.10 Gadidae (Rocklings) (Figures 61-66)

Four species of rockling are found in the Irish Sea, *Gaidropsarus mediterraneus* (shore rockling), *Gaidropsarus vulgaris* (three-bearded rockling), *Enchelyopus cimbrius* (four-bearded rockling) and *Ciliata mustela* (five-bearded rockling). Rockling eggs are small in diameter (0.5-0.99 mm) with a single oil globule. However, they are not identified to the species level in plankton samples. *G. mediterraneus* spawns inshore in June and July and *E. cimbrius* spawns in deeper water (>50 m) from May to August (Wheeler, 1978). Therefore it is unlikely that either species features in these surveys. *G. vulgaris* spawns in shallow water in January and February, and *C. mustela* spawns offshore in winter and spring, so both of these species may be present. Rockling eggs occurred in coastal areas in January and February. By March numbers had increased and distribution was widespread. Highest densities (<121 m^{-2}) were found during the last survey in 2002. Rockling larvae were caught throughout the eastern Irish Sea, predominantly in late-April. Peak abundances occurred in an area southeast of the Isle of Man and to a lesser extent offshore from the north Wales coast in 2001 and 2002.

4.2.11 *Molva molva* (Ling) (Figures 67-72)

Ling is described as an inhabitant of deep water (300-400 m) or shallower water on suitable open ocean coasts (Wheeler, 1978). The females spawn between March and July on grounds that are found mostly to the north of the British Isles. Ling is therefore uncommon in the Irish Sea. However, the eggs were caught sporadically during this survey series at a small number of stations (Tables 2a and b). Most occurred from late-March, but in 2003, one individual was identified at the beginning of February. Maximum egg concentrations were <4 m^{-2} in all years. Few larvae were found.

4.2.12 Triglidae (Gurnards) (Figures 73-75)

Neither the eggs nor larvae of this group are routinely identified to genus or species. However, four species occur in the Irish Sea, the most common being *Eutrigla gurnardus* (grey gurnard) which spawns from January to June. The three other species are *Aspitrigla cuculus* (red gurnard) which spawns from April to August in the eastern Irish Sea, *Trigla lucerna* (tub gurnard) which spawns from May to July and the less common *Trigloporus lastoviza* (streaked gurnard) which spawns from June to August. Gurnard eggs were relatively scarce from January to March. Maximum abundances occurred in April, but eggs were still only found at <50% of the positions sampled. Comparison between years showed that higher numbers were caught over a wider area in both 2002 and 2003 than in 2001. The larvae occurred at such low incidences (Tables 2b and d) that they have not been mapped. Triglidae predominantly feed on bottom-dwelling animals such as crustaceans and small fish. The larvae rarely feature strongly in plankton samples suggesting that they have already dropped out of the water column to feed and are situated close to the seabed.

4.2.13 Cottidae (Bullheads and Sculpins) (Figures 76-78)

Bullheads and sculpins are a shallow water family that deposit benthic eggs on rocky or weedy substrate. The younger larval stages are not easily identified to species and have therefore been grouped together as Cottidae for analysis. However, based on larger individuals, two species were identified in these surveys *Myoxocephalus scorpius* (Bull-rout) and *Taurulus bubalis* (Sea scorpion). For presentation their numbers have been combined with unidentified specimens, but details for each species can be found in Tables 2b and d. Cottidae larvae were found in small numbers at coastal sites in February and March. In April their distribution was more widespread and peak numbers (4-9 m^{-2}) were recorded on the last survey in all years.

4.2.14 *Agonus cataphractus* (Pogge) (Figures 79-81)

The eggs of this species are benthic. Pogge larvae occurred from March onwards in low concentrations. They were distributed at mainly coastal positions and the maximum density recorded was 3 m^{-2} in 2003, although overall occurrence was lowest in this year.

4.2.15 *Liparis* spp. (Sea-snails) (Figures 82-84)

Sea-snails are another shallow water group with a benthic egg. They most commonly occur close to the coast, a pattern supported by the larval distribution in the eastern Irish Sea, with highest concentrations being caught off the north Wales coast. Larvae were identified from mid-March but numbers were greatest during April.

4.2.16 *Chirolophis ascanii (Yarrell's blenny)* (Figures 85-87)

The eggs of this species are benthic. In 2001 and 2002 larvae were caught from mid-March at no more than one station per survey. A few more individuals were found in 2003, but overall concentrations did not exceed 1.5 m^{-2}.

4.2.17 *Pholis gunnellus (Butterfish)* (Figures 88-90)

Butterfish are common on rocky substrates, particularly inshore, and produce benthic eggs. They may also be found offshore on sand or mud where they deposit their eggs in the shells of bivalve molluscs (Wheeler, 1978). The spawning period in the Irish Sea is from January to March (Qasim, 1956). In the eastern Irish Sea in 2001-02, butterfish larvae were relatively abundant from mid-March onwards. The maximum concentration recorded was 18 m^{-2}. In 2003, however, comparatively few larvae were caught until the final survey at the end of April.

4.2.18 *Ammodytidae (Sandeels)* (Figures 91-93)

Four out of the five species of Ammodytidae occur in the Irish Sea although one of these, *Ammodytes tobianus*, spawns in the autumn and is therefore unlikely to feature as larvae in spring surveys. Of the other three species, *Ammodytes marinus* (Raitt's sandeel) is common offshore and spawns from January to March, *Gymnammodytes semisquamatus* (smooth sandeel) spawns from April to July and *Hyperoplus lanceolatus* (greater sandeel), which is very common and widely distributed, spawns in April and May. The eggs of the whole of this group are benthic and are therefore not caught in the plankton. For these surveys, the larvae have not been identified to species, although this is possible using descriptions by Macer (1967) and Russell (1976). In all years, larvae were uncommon until the surveys in mid-March when numbers increased significantly over the whole region. Peak abundances (up to 239 m^{-2} in 2001) occurred close to the Scottish and north Welsh coasts.

4.2.19 *Callionymidae (Dragonets)* (Figures 94-99)

The eggs of Callionymidae have a sculpted case and are therefore very distinct. Eggs and larvae of the two species commonly occurring in this area have not been separately identified from these surveys. *Callionymus lyra* (common dragonet) is reported to spawn from late January through to August (Russell, 1976) in water <50 m. *Callionymus maculatus* (spotted dragonet) spawns from April to August and shows a preference for deeper water. There is no information on the spawning in the Irish Sea of a third species, *Callionymus reticulatus* (reticulated dragonet). This species is uncommon but reputed to frequent shallow water. In the English Channel it may spawn from April to September (Demir, 1976). The distributions of eggs and larvae from these surveys are therefore likely to be mainly a mixture of *C. lyra* and *C. maculatus*. The eggs were caught on every survey throughout the 3-year study period, increasing in number and distribution before reaching a peak around the middle of April. Concentrations of between 180-225 m^{-2} were recorded for a number of stations, particularly in an area of water stretching between the Isle of Man and the north Wales coast. In 2002-03, numbers were found to have declined slightly by the end of the survey series. Dragonet larvae occurred in a similar geographical pattern to the eggs. The highest concentrations were recorded at the end of April; these were 129 m^{-2} in 2001, 98 m^{-2} in 2002 and 78 m^{-2} in 2003.

4.2.20 *Gobiidae (Gobies)* (Figures 100-102)

Gobiidae are a large group of fish common in inshore waters and producing benthic eggs. Up to 11 species are found in the Irish Sea. Their larvae are not well described, and although easy to identify as a group because of their prominent swim bladder and characteristic pigmentation, they are not routinely identified to species level. Larvae were found in low numbers at predominantly coastal sites until the last survey in each year. By the end of April distribution was widespread, particularly in 2002 and 2003. Abundances were in the main part less than 12 m^{-2}, however, a much higher density of 96 m^{-2} was recorded in May 2002 north of Liverpool Bay. Interestingly, a similar phenomenon was observed at the same site in a previous study in 2000 (Bunn and Fox, 2004).

4.2.21 *Phrynorhombus norvegicus (Norwegian top-knot)* (Figures 103-108)

Norwegian topknot spawn in late spring and summer, so the peak of spawning is likely to occur later than the period covered by these surveys. Hence, eggs of this species were found mainly in April, but were first identified at the start of February in 2003. Distribution was generally greater in 2002-03 than in 2001. Norwegian topknot larvae were caught rarely. Highest concentrations (up to 13 m^{-2}) were recorded in late-April 2003.

4.2.22 *Zeugopterus punctatus (Topknot)* (Figures 109-114)

Spawning of this species is reported to occur around the Irish Sea in April at predominantly coastal sites (Bunn and Fox, 2004). The distributions presented for the eastern Irish Sea were consistent with this. The eggs of this species were less abundant than the Norwegian topknot and reached a maximum of 8 m^{-2}. Larval concentrations were relatively low and patchy, with little difference evident between years.

4.2.23 *Pleuronectes platessa (Plaice)* (Figures 115-120)

Plaice spawn from late-December to May and therefore egg production was well underway by the start of each year's sampling period. Three main areas of spawning are reported for the Irish Sea; off the Irish coast, between the Isle of Man and the Cumbria coast, and off the North Wales coast (Nichols *et al*., 1993; Fox *et al*., 1997; Fox *et al*., 2000). The data presented here supports this pattern for the eastern Irish Sea and it is particularly evident in 2003 when extensive spawning was observed from mid-February to mid-March. Peak concentrations were similar between years (between 185 and 212 m^{-2}). However, highest abundances occurred over a wider area in 2003 compared with the other two years when numbers were generally moderate (<60 m^{-2}). By the last survey of each year, plaice eggs had decreased significantly and few were caught except in the waters near Anglesey. Plaice larvae were recorded on every survey but were most abundant numerically in March and April. Larval distributions were more widespread in 2001-02 than 2003 (Tables 2b and d) even though the egg data might have predicted otherwise. Maximum larval abundance was 71 m^{-2} in May 2002.

4.2.24 *Platichthys flesus (Flounder)* (Figures 121-123)

The eggs of this species have no oil globule and range in diameter from 0.8-1.13 mm (Figures 1-3). They are indistinguishable from eggs of a similar size such as *Limanda limanda* (dab) and *Trisopterus luscus* (bib). The adults inhabit coastal, estuarine and brackish waters but spawning is known to occur offshore. In this survey series, flounder larvae were common throughout the region, but were most abundant in the waters between the Isle of Man and the north Wales coast. Numbers and distribution steadily increased during March and into April and concentrations were on average less than 100 m^{-2}. However, at one site close to the Isle of Man in April 2001, abundance reached a high of 502 m^{-2}.

4.2.25 *Limanda limanda (Dab)* (Figures 124-126)

Dab are another species that produce small eggs with no oil globule, making them indistinguishable from similar sized eggs produced by other fish (Figures 1 to 3). Dab larvae were recorded from January (2003) but were not widespread until mid to late February. Although the larvae were found throughout the eastern Irish Sea, highest concentrations occurred off the north Wales coast and in a band spreading northwards from this area. Average numbers (max. 1222 m^{-2}) were much higher in 2001 and 2003 than in 2002. Overall dab were the most abundant larvae found during the survey series (Tables 2b and d).

4.2.26 *Microstomus kitt (Lemon sole)* (Figures 127-132)

Lemon sole is reported to spawn in spring and summer in depths of about 100 m, i.e. deeper than found in the eastern Irish Sea (Wheeler, 1978). Eggs of this species can only be positively identified at a late stage of development when characteristic pigmentation of the embryo is visible. Very few late stage eggs were recorded on these surveys and maximum concentration did not exceed 1 m^{-2}. The larvae were also relatively low in concentration and occurred irregularly in March and April.

4.2.27 *Glyptocephalus cynoglossus (Witch)* (Figures 133-135)

Like those of *Microstomus kitt*, witch eggs can only be identified in the late embryonic stages. No late-stage witch eggs were recorded in the eastern Irish Sea in this study. However, low numbers occurred in the western Irish Sea in 2000 (Bunn and Fox, 2004), so it may be assumed that the majority of spawning occurs here in the deeper water that is preferred by this species. Larvae were found in relatively low densities. Distributions peaked in the latter half of April in all years and maximum concentrations were comparable between years.

4.2.28 *Solea solea (Sole)* (Figures 136-141)

Sole live at relatively shallow depths (<100 m) and spawn in spring and early summer in coastal waters. In the Irish Sea as a whole, the majority of spawning occurs in the eastern part, with very little being observed west of 04º 30´W (Fox *et al*., 1997; Bunn and Fox, 2004). In 2001-03 peak spawning was observed off the north Wales coast in April. Sole larvae were uncommon from February to the end of April. Highest abundances (up to 23 m^{-2}) were also found in the waters close to the north Welsh coast.

4.2.29 *Buglossidium luteum (Solenette)* (Figures 142-147)

Solenettes are another shallow-water species. In the eastern Irish Sea in 2001-03 they were found to spawn slightly later than sole and were more common in the inshore waters along the English coast. Peak concentrations were 26, 172 and 193 m^{-2} for the three respective years. Few larvae were caught in 2001 but this was consistent with what might be expected from the numbers of eggs observed and the timing of the last survey. However, larval densities were higher in the two following years and distribution was mainly concentrated off the north Wales coast.

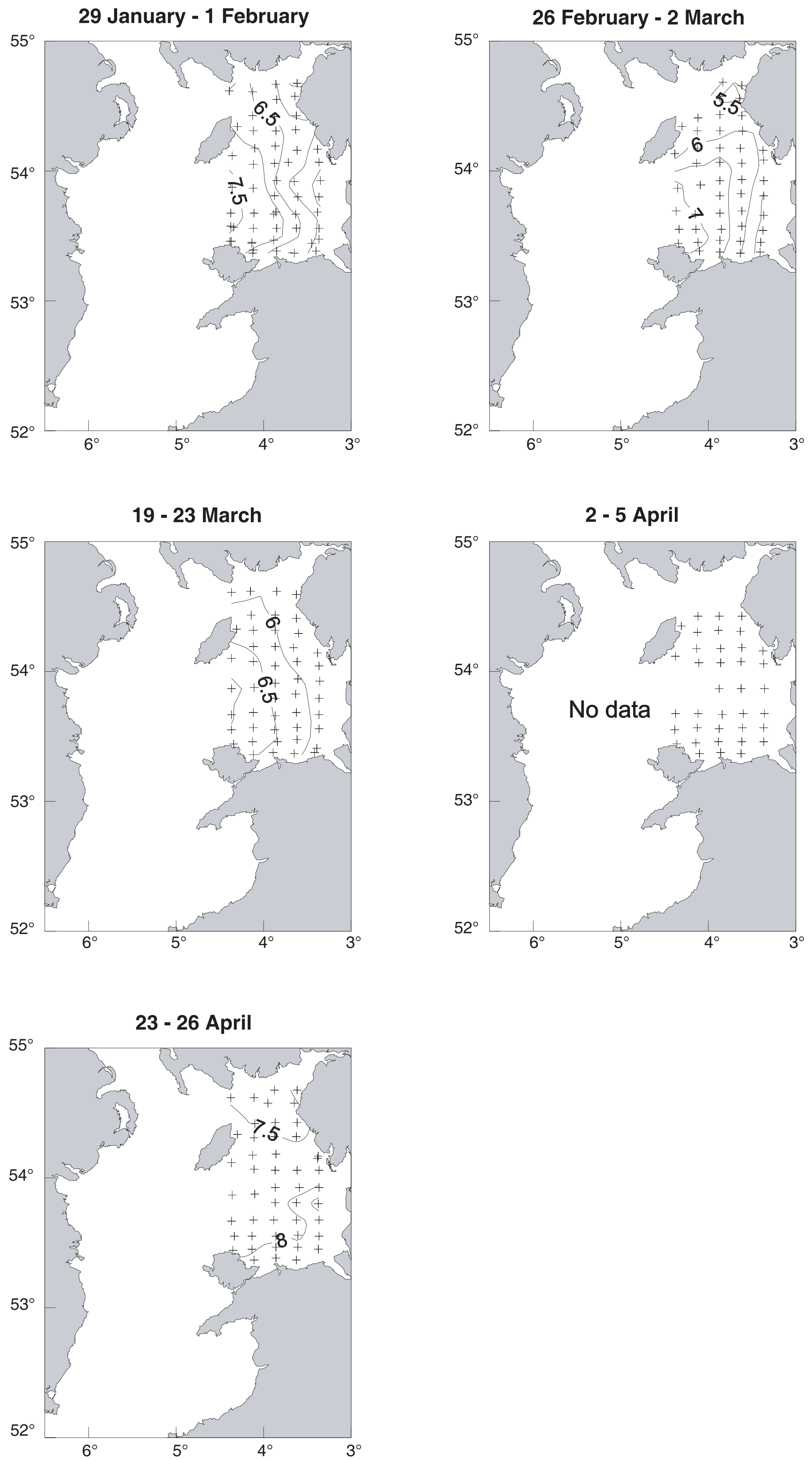


Figure 4. Surface temperatures (°C) in 2001

Figure 5. Surface temperatures (°C) in 2002

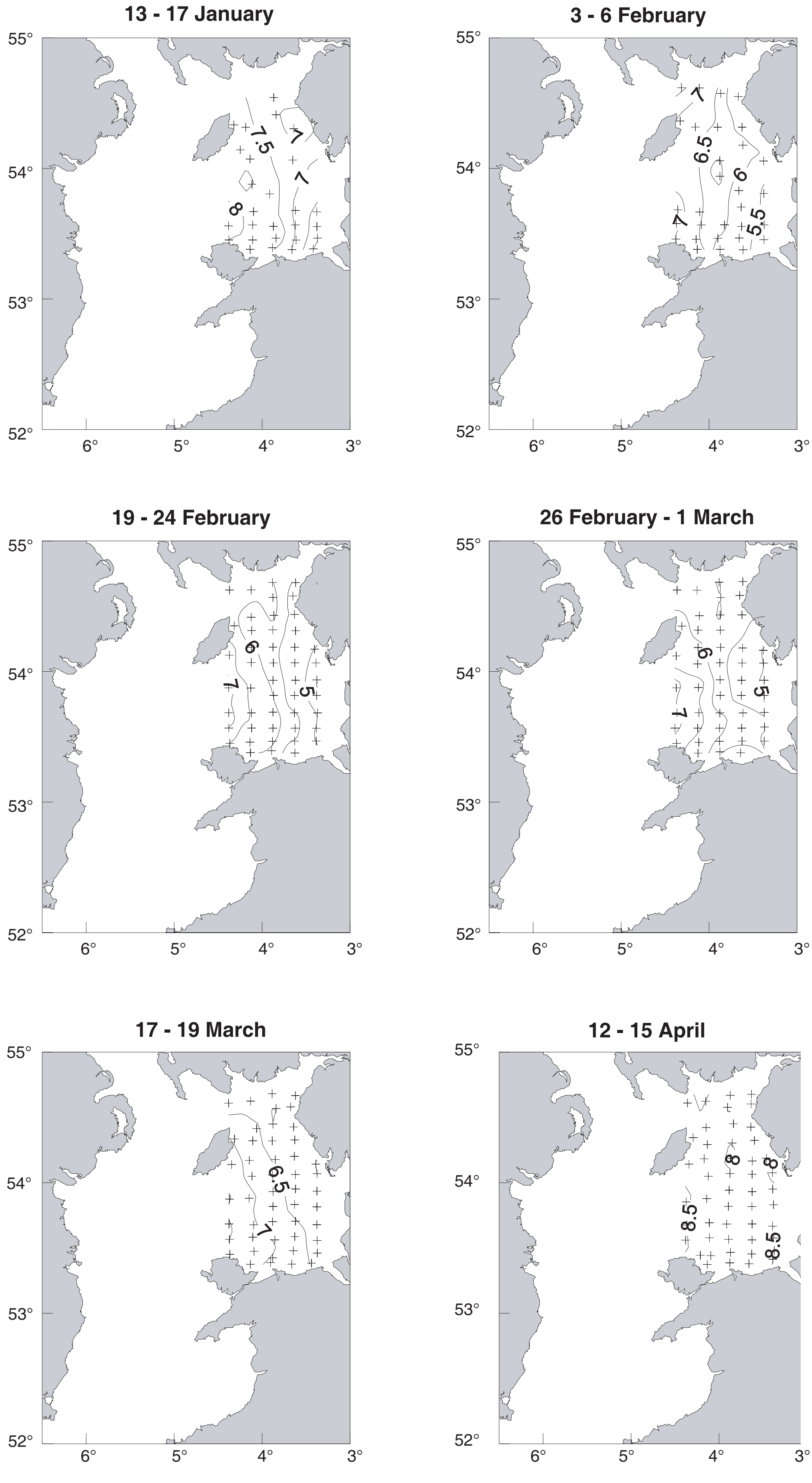


Figure 6. ***Surface temperatures (°C) in 2003***

28 - 30 April

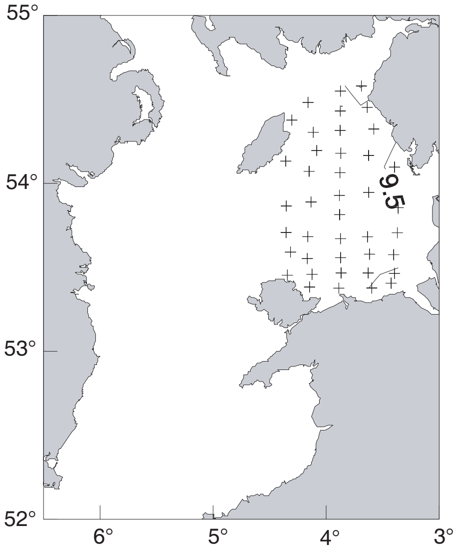


Figure 6. continued

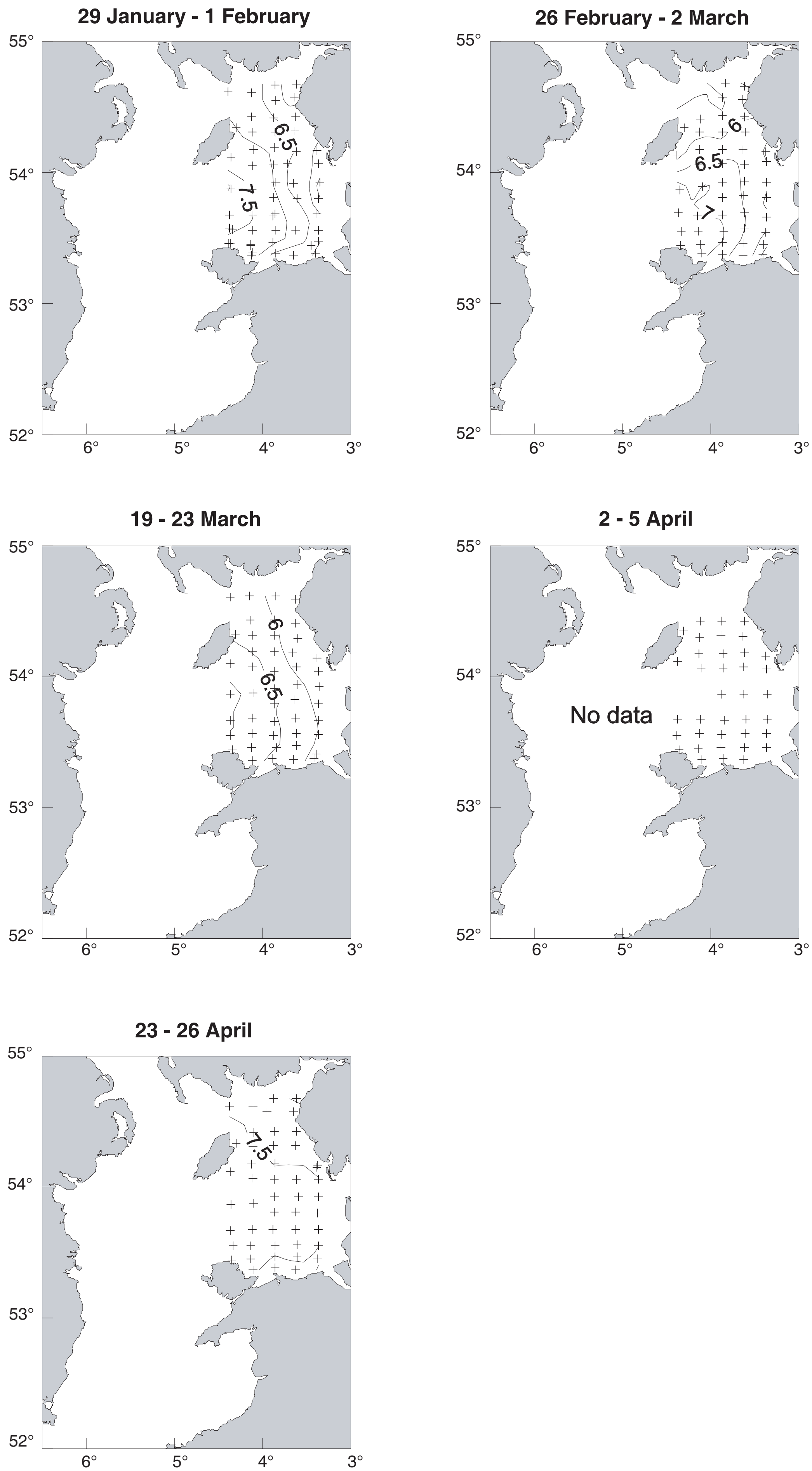


Figure 7. Bottom temperatures (°C) in 2001

Figure 8. Bottom temperatures (°C) in 2002

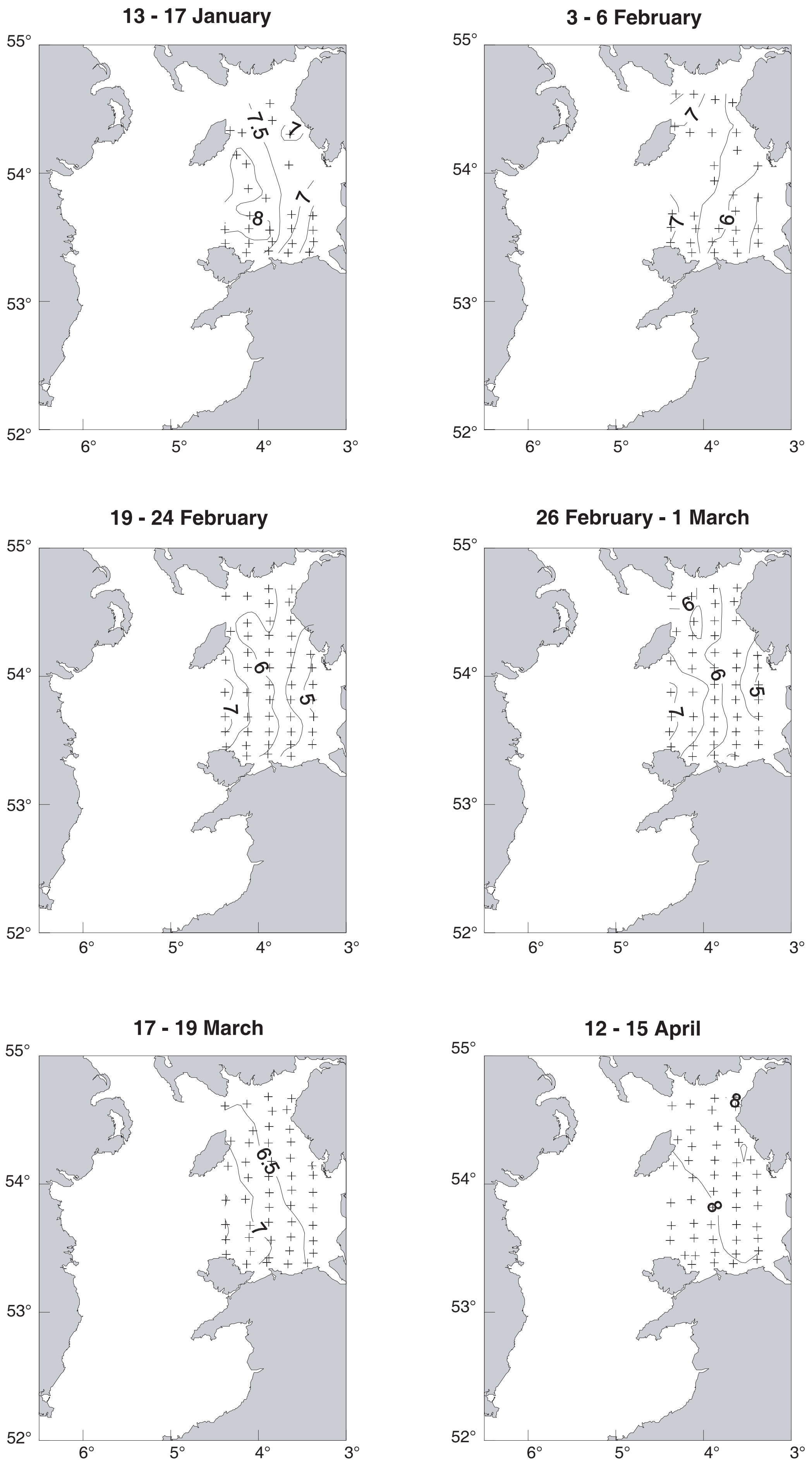


Figure 9. Bottom temperatures (°C) in 2003

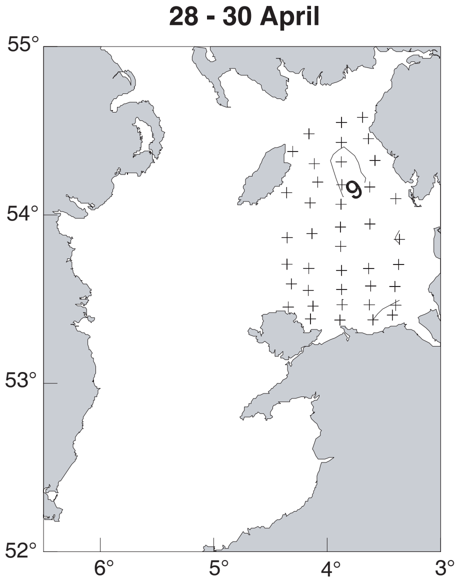


Figure 9. continued

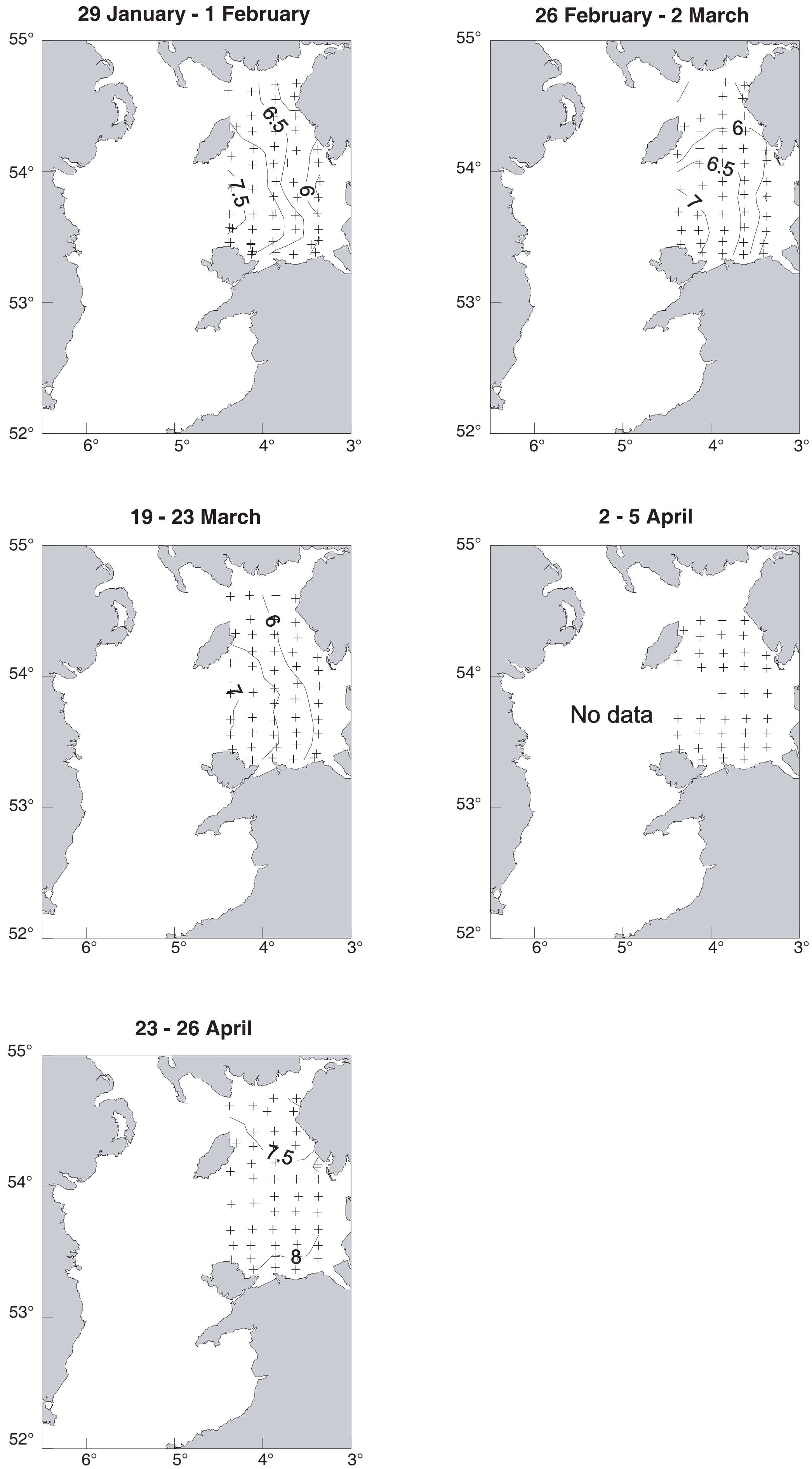


Figure 10. Integrated temperatures (°C) in 2001

Figure 11. Integrated temperatures (°C) in 2002

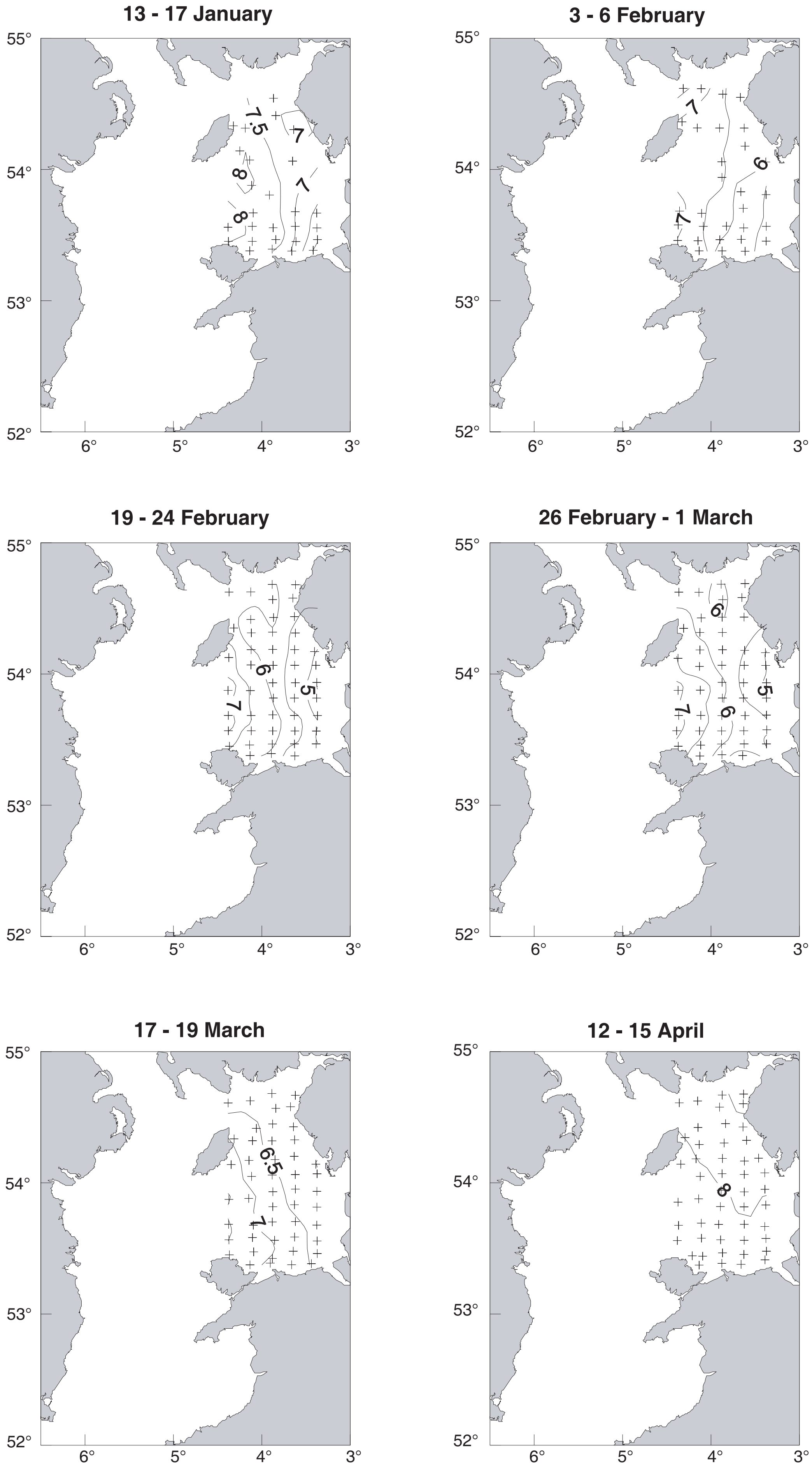


Figure 12. Integrated temperatures (°C) in 2003

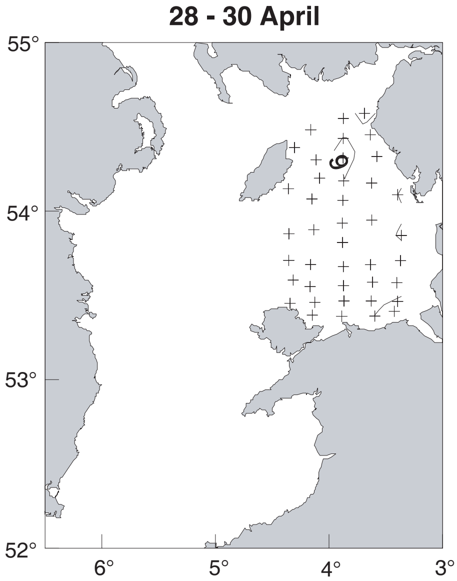


Figure 12. continued

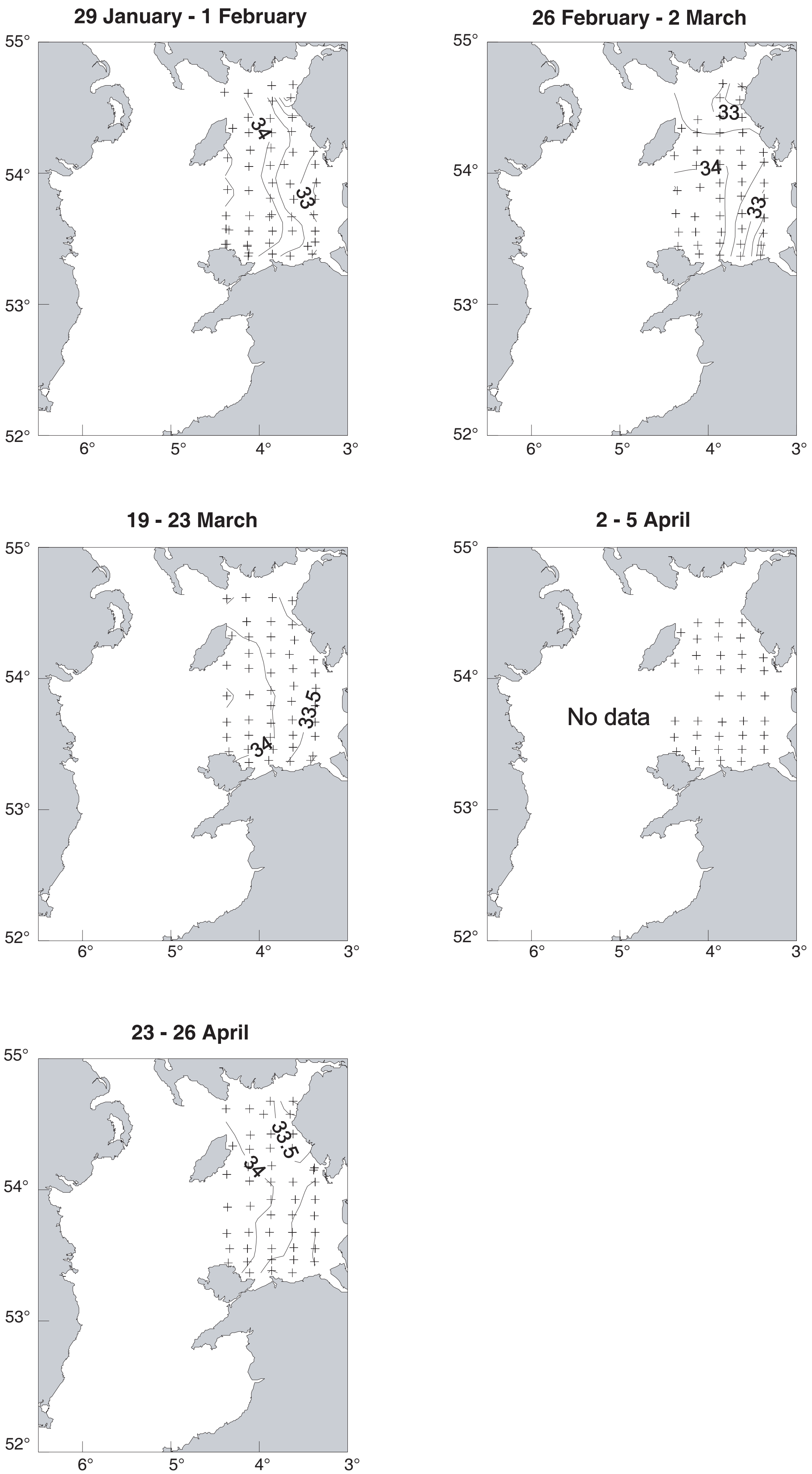


Figure 13. Surface salinities (psu) in 2001

Figure 14. Surface salinities (psu) in 2002

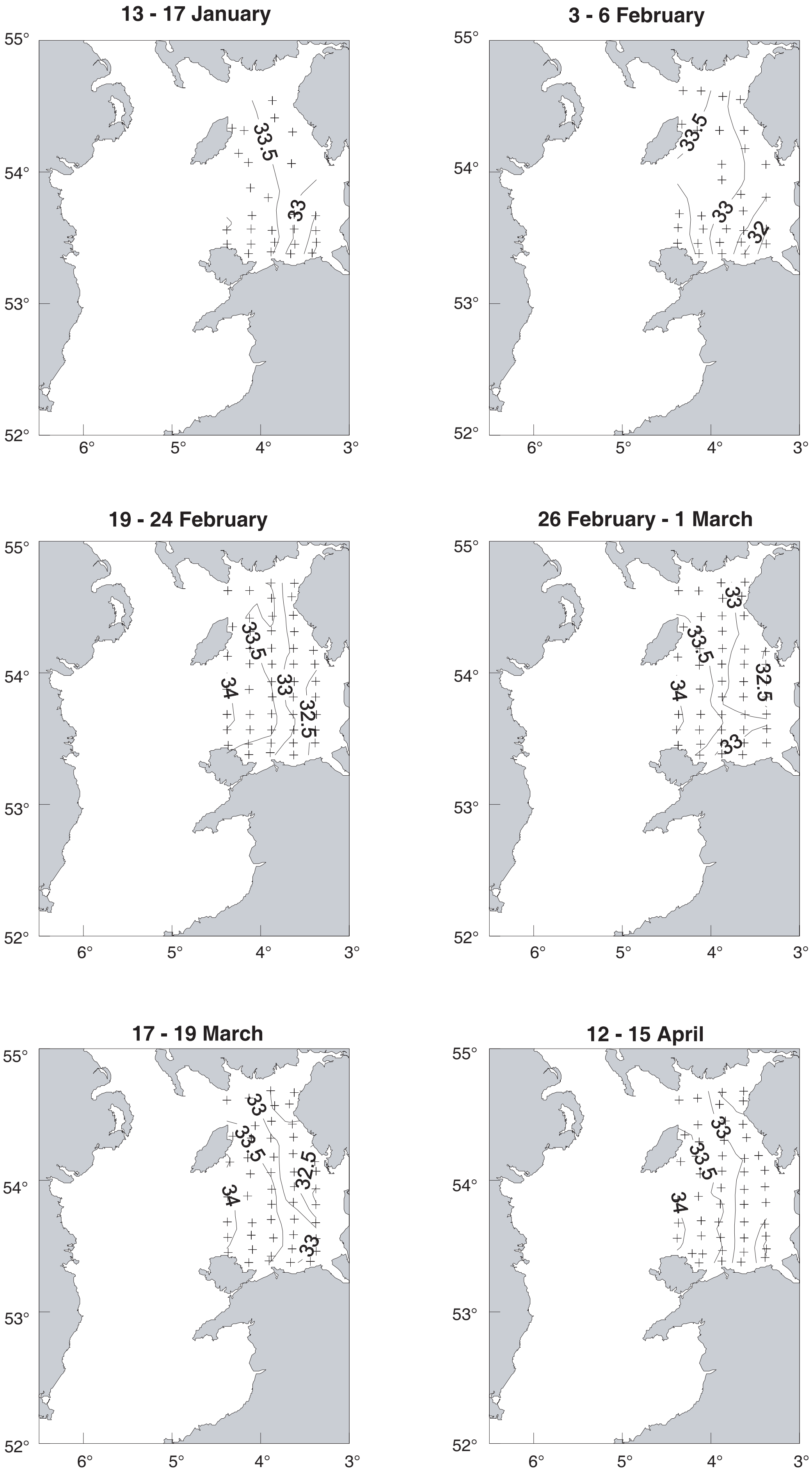


Figure 15. Surface salinities (psu) in 2003

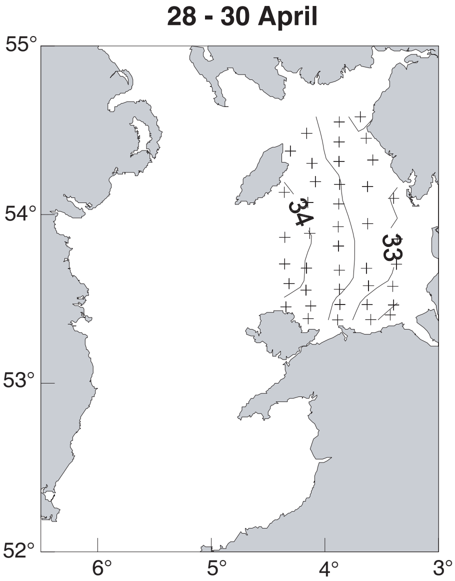


Figure 15. continued

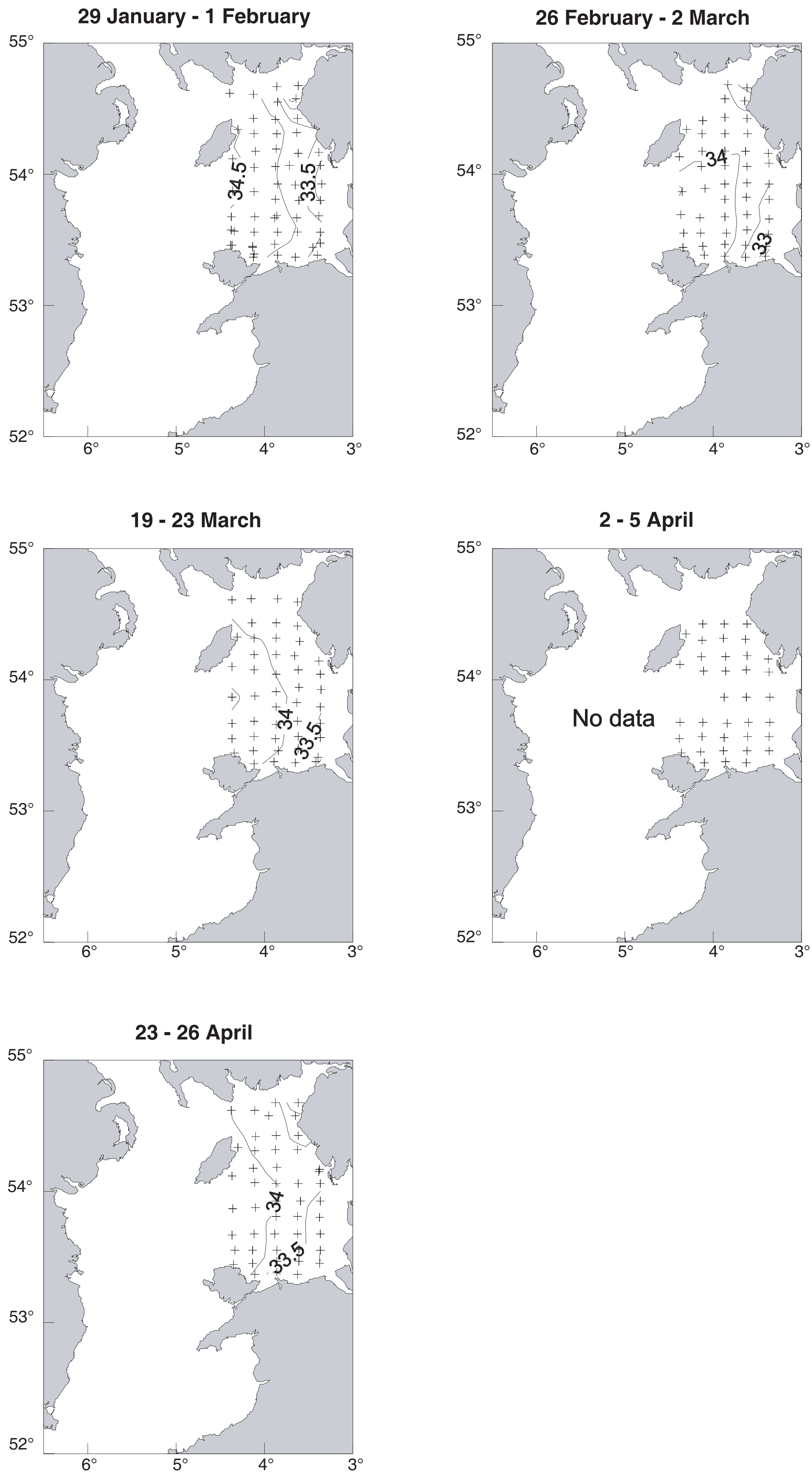


Figure 16. Bottom salinities (psu) in 2001

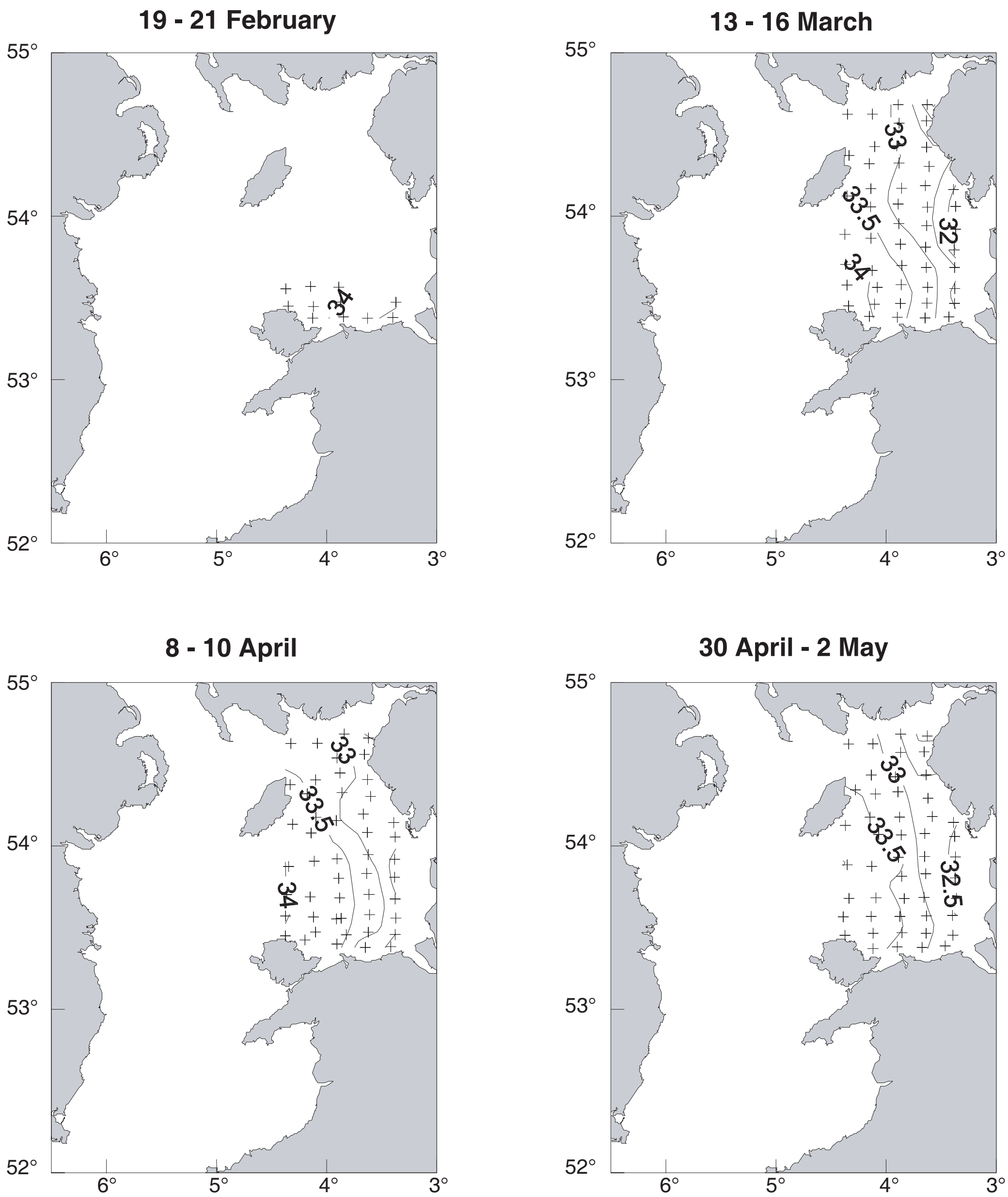


Figure 17. Bottom salinities (psu) in 2002

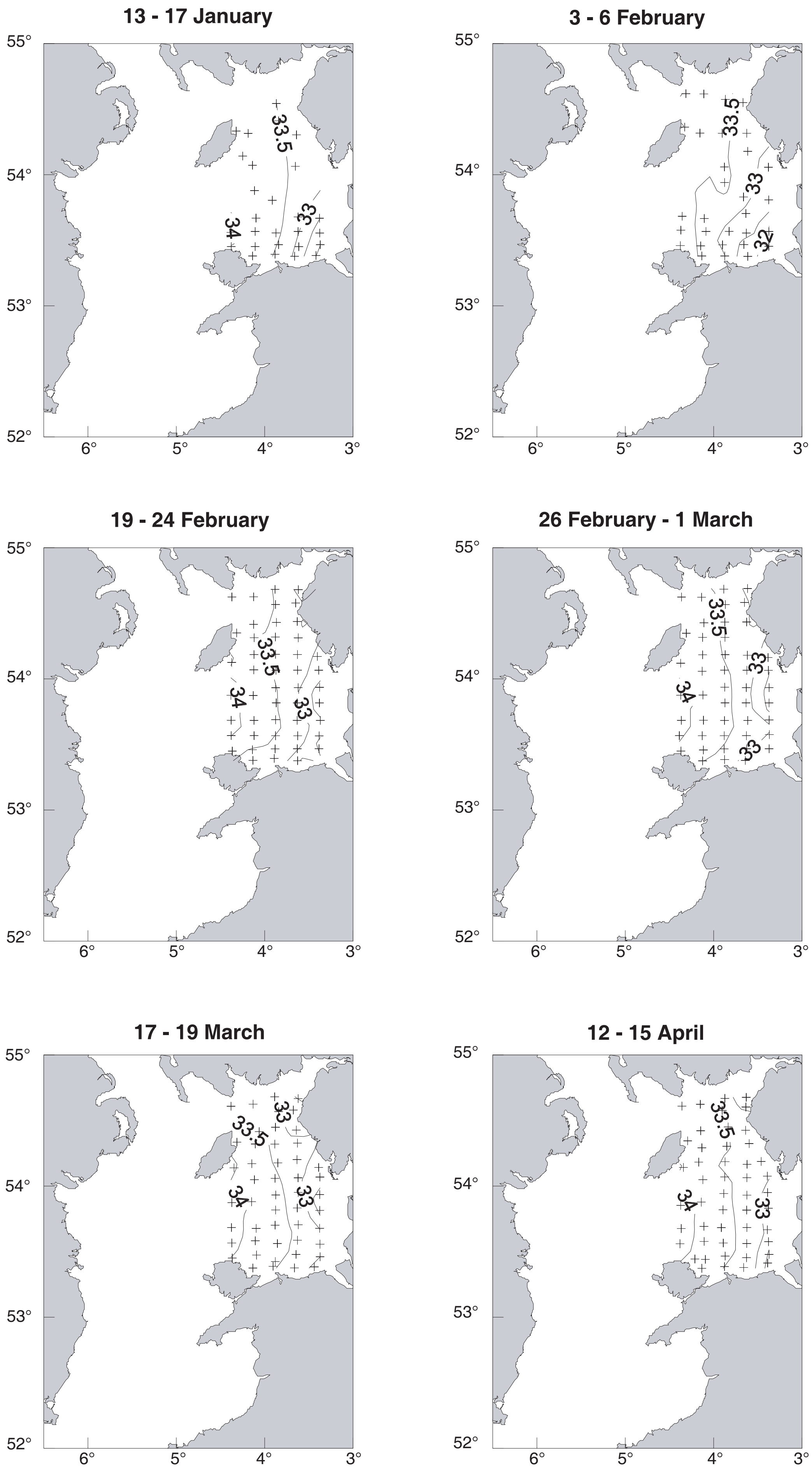


Figure 18. Bottom salinities (psu) in 2003

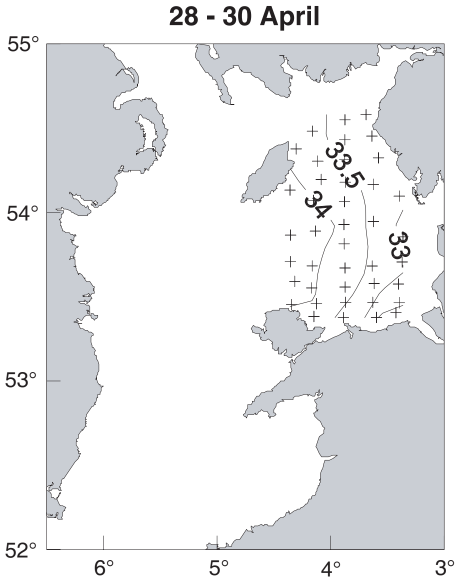


Figure 18. continued

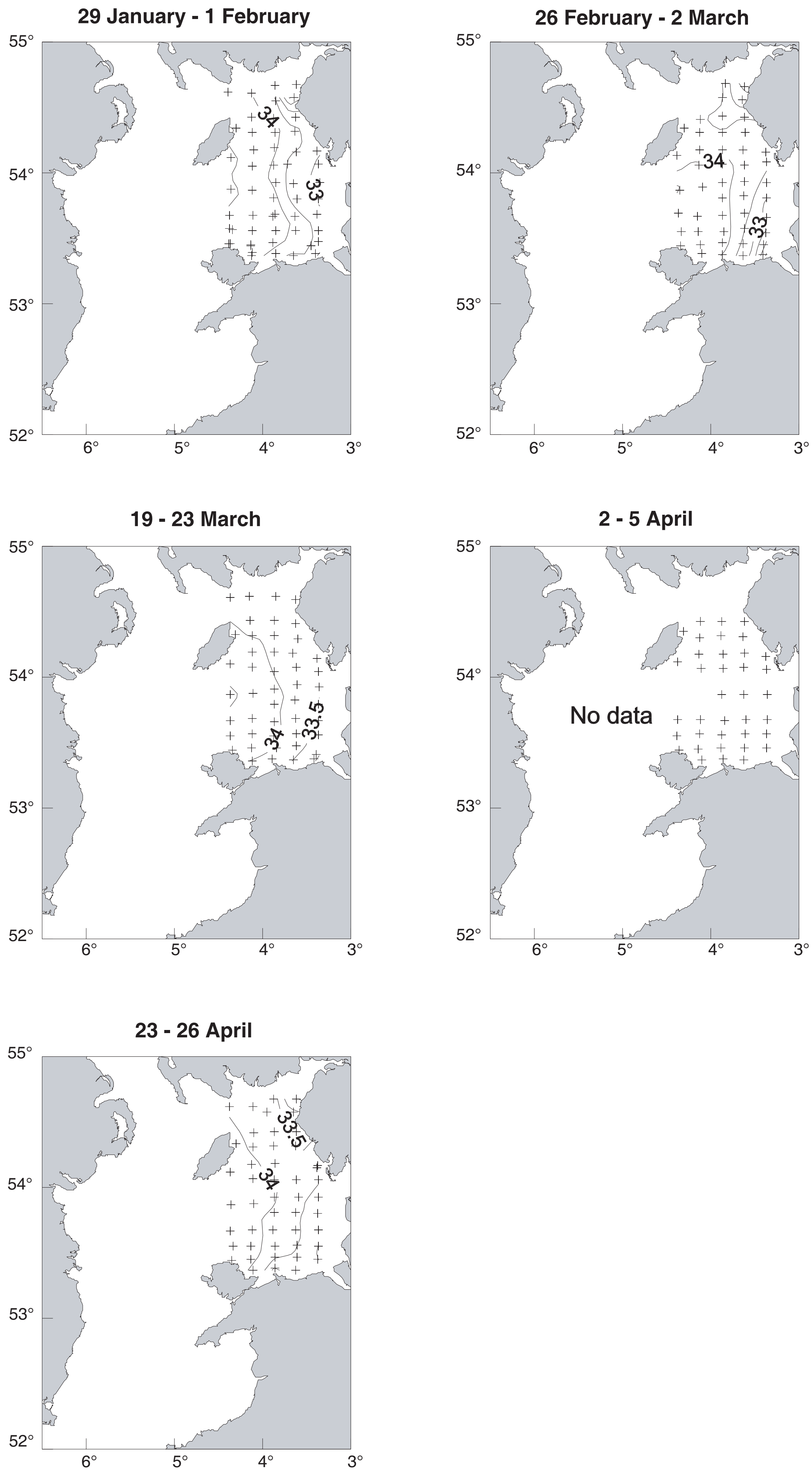


Figure 19. Integrated salinities (psu) in 2001

Figure 20. Integrated salinities (psu) in 2002

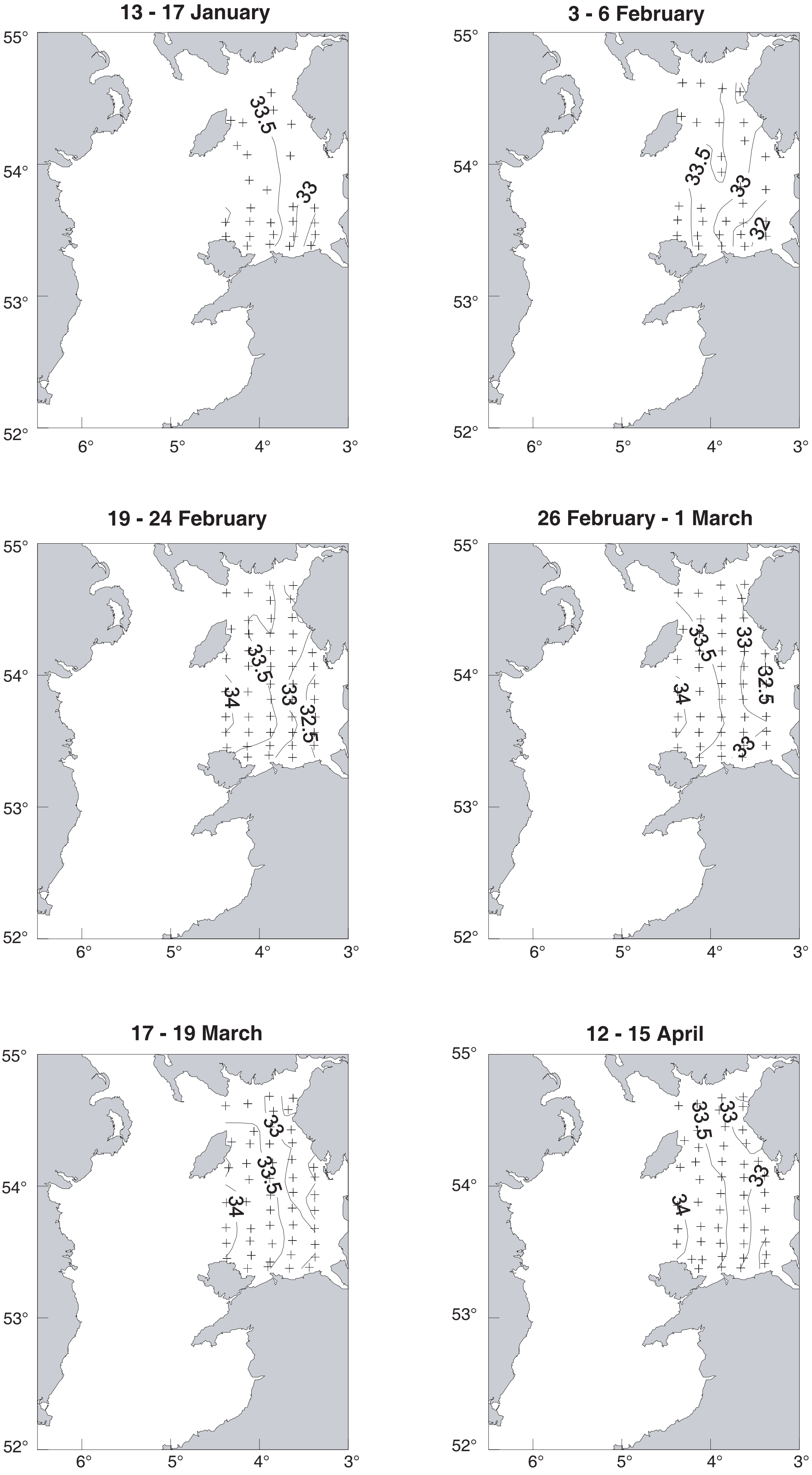
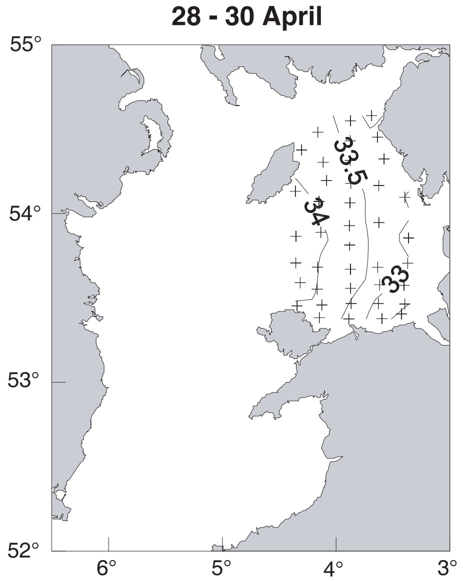


Figure 21. Integrated salinities (psu) in 2003



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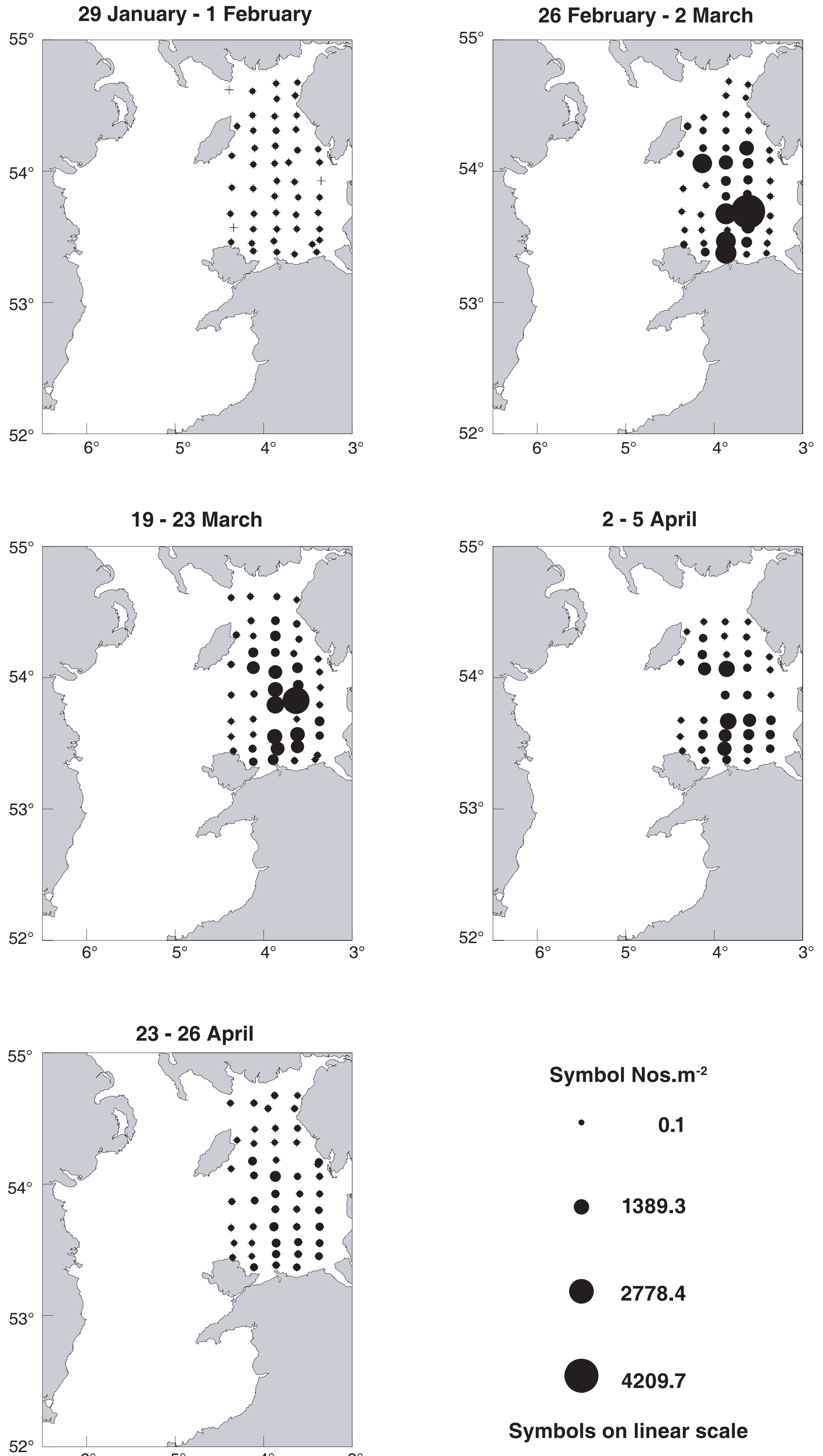


Figure 22. Total egg concentrations (nos.m^{-2}) in 2001

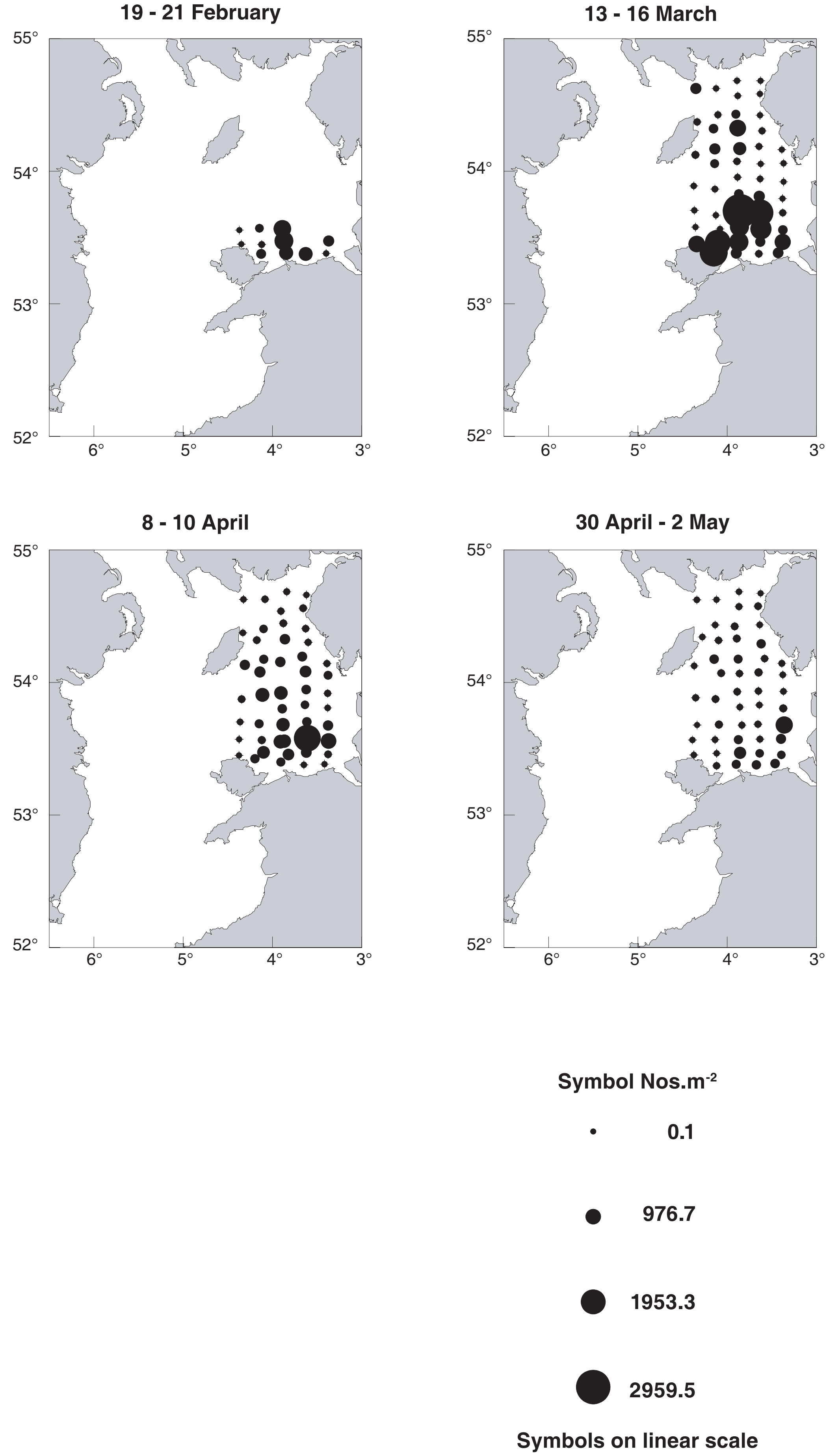


Figure 23. Total egg concentrations (nos.m^{-2}) in 2002

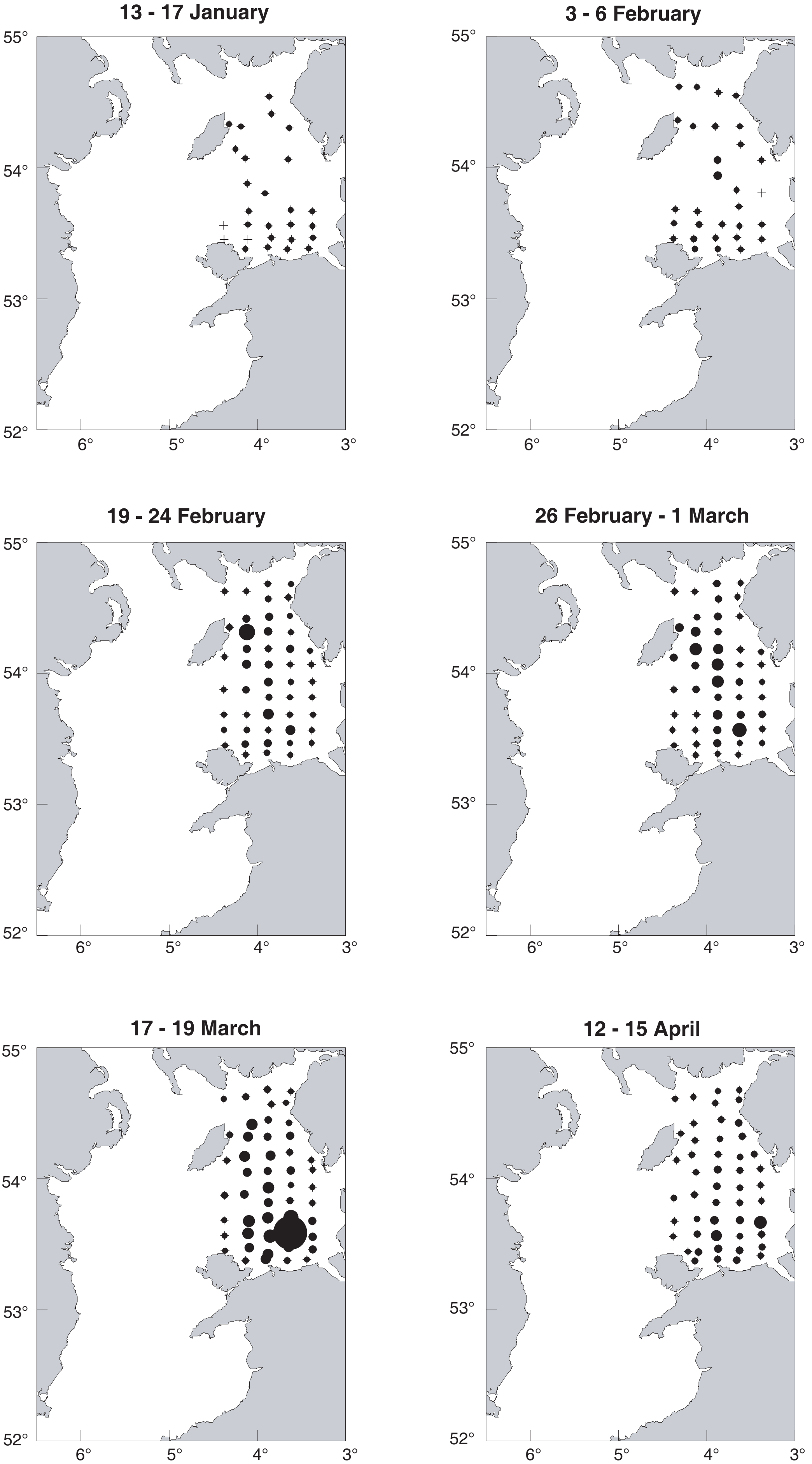
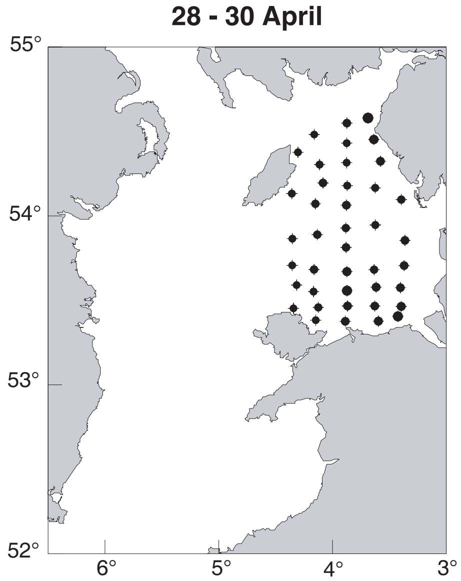
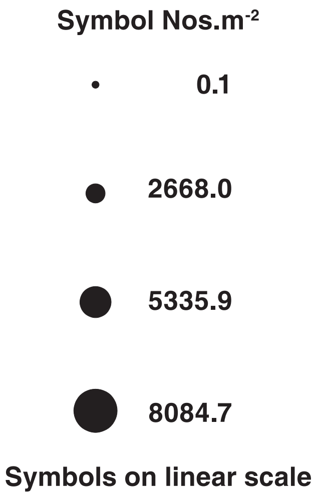


Figure 24. Total egg concentrations (nos.m^{-2}) in 2003





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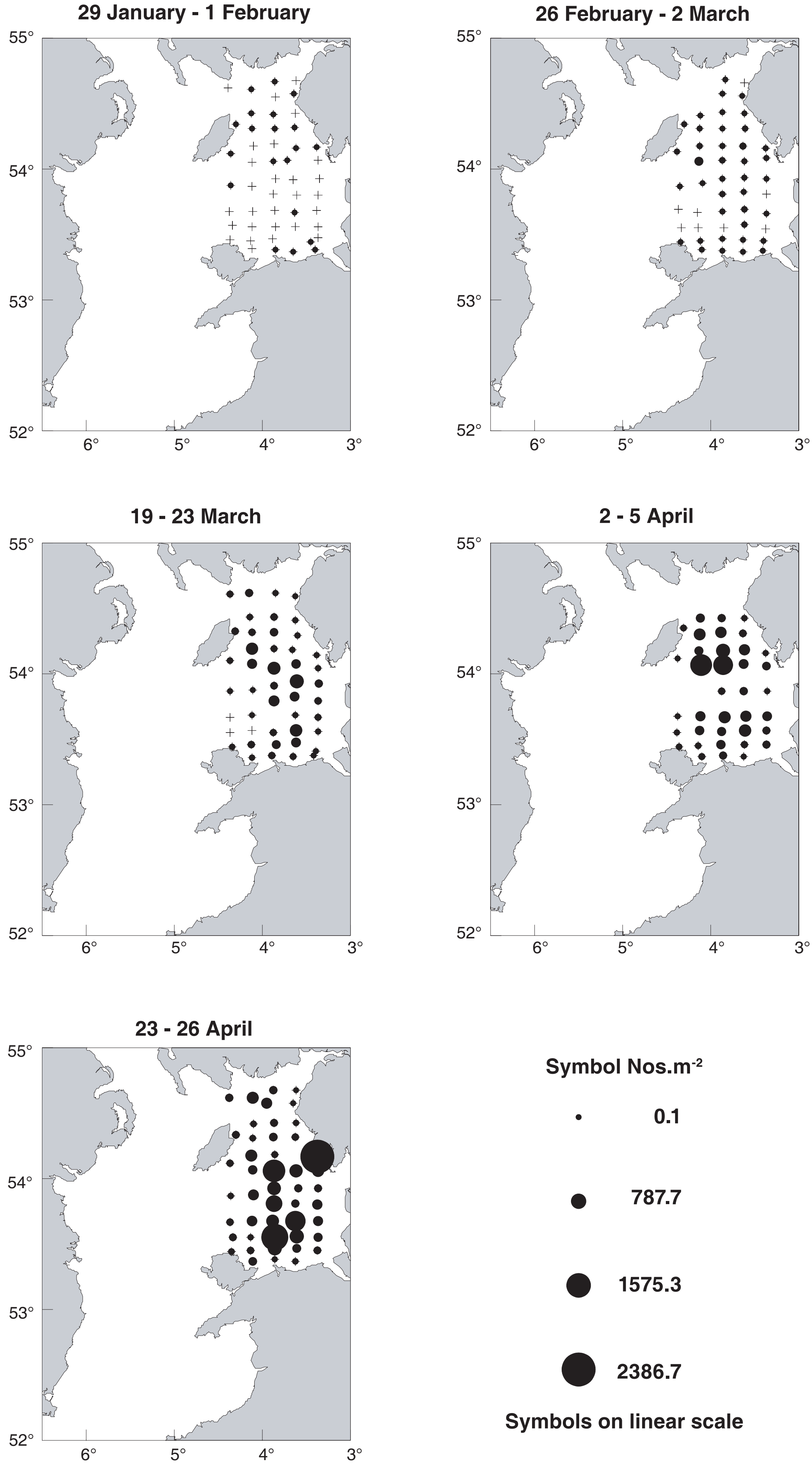


Figure 25. Total larval concentrations (nos.m^{-2}) in 2001

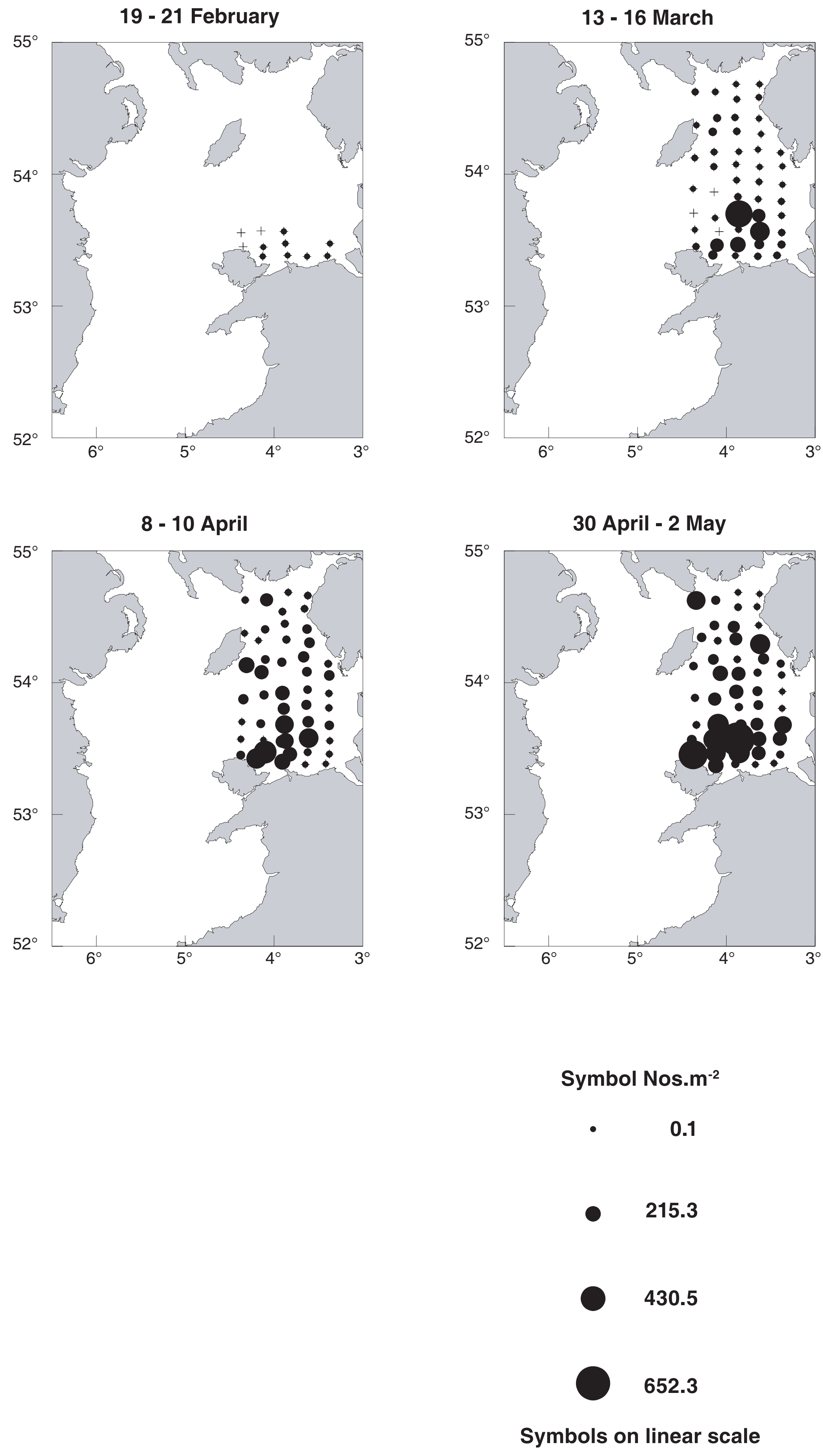


Figure 26. Total larval concentrations (nos.m^{-2}) in 2002

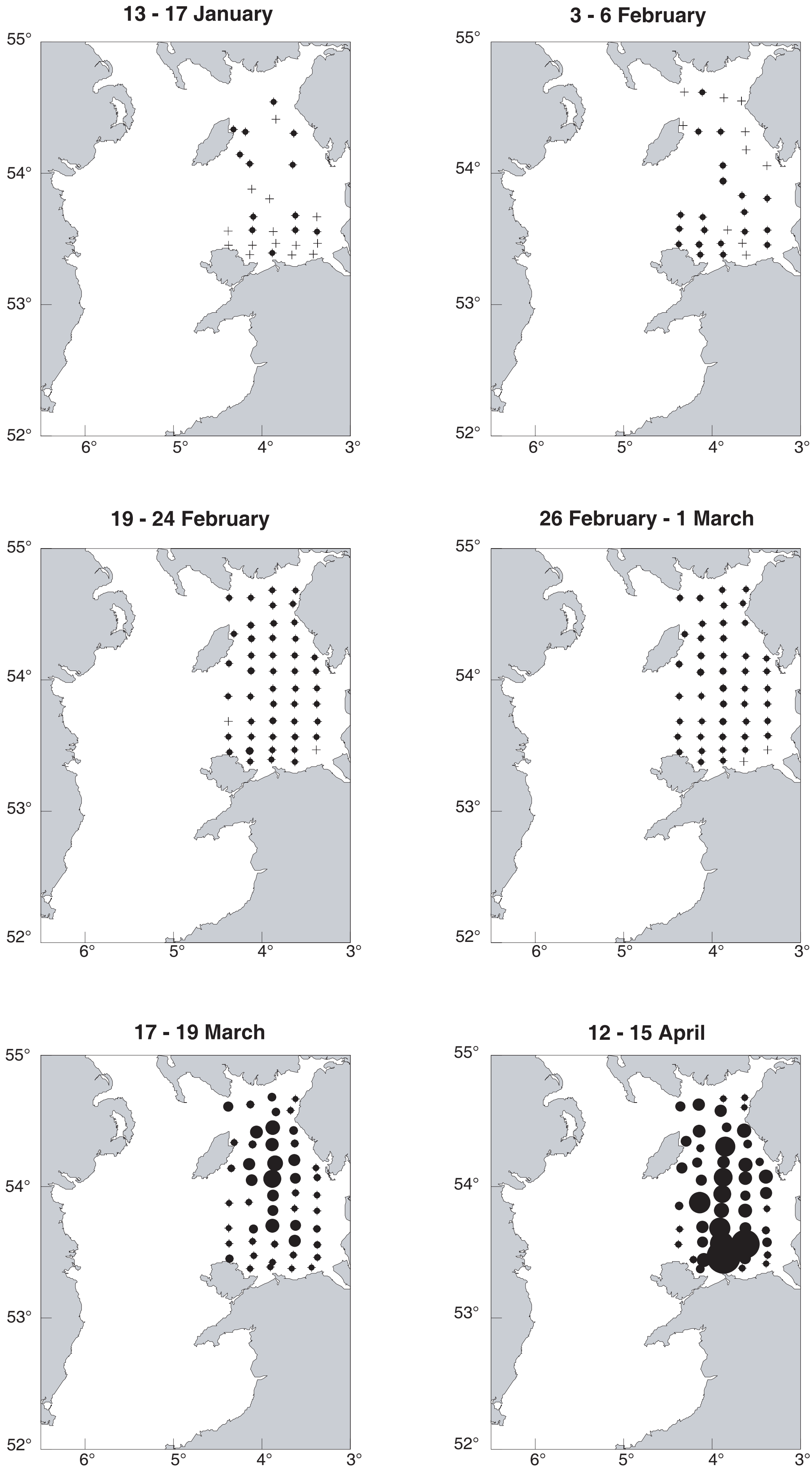
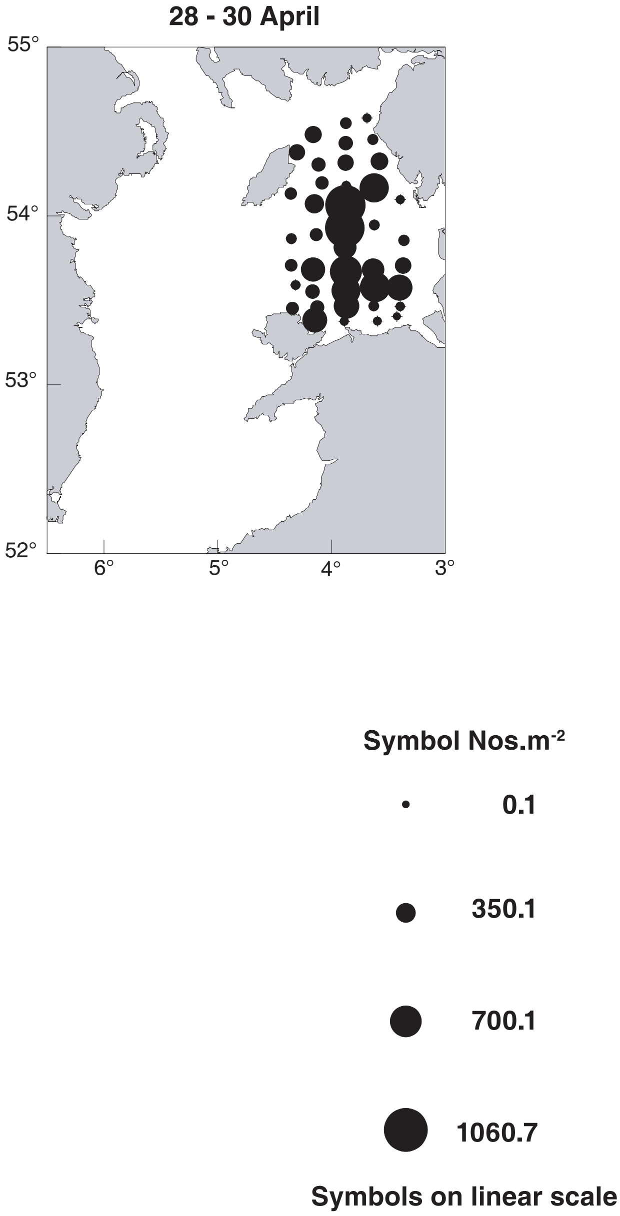


Figure 27. Total larval concentrations (nos.m^{-2}) in 2003



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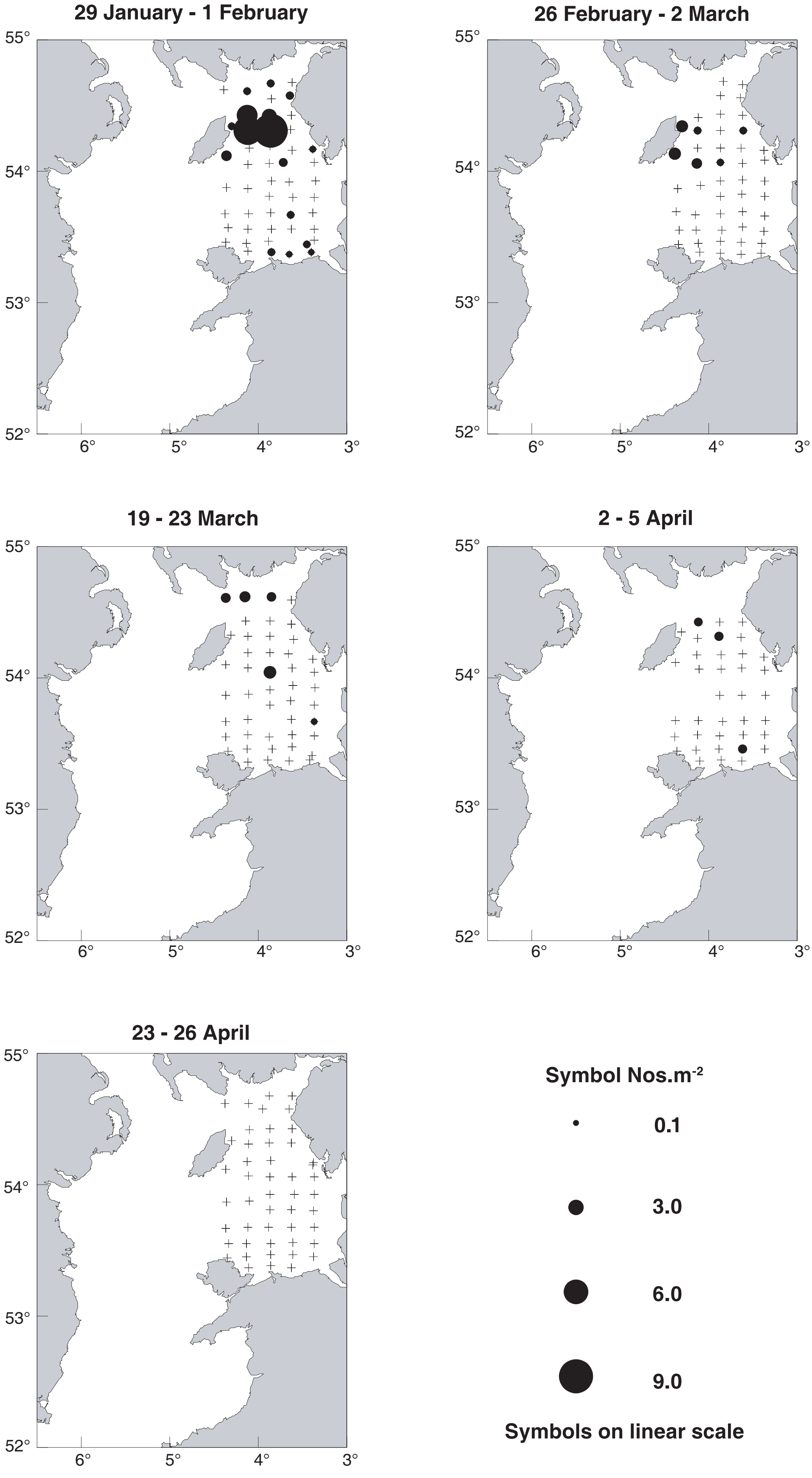


Figure 28. Concentration of herring (Clupea harengus) larvae (nos.m⁻²) in 2001

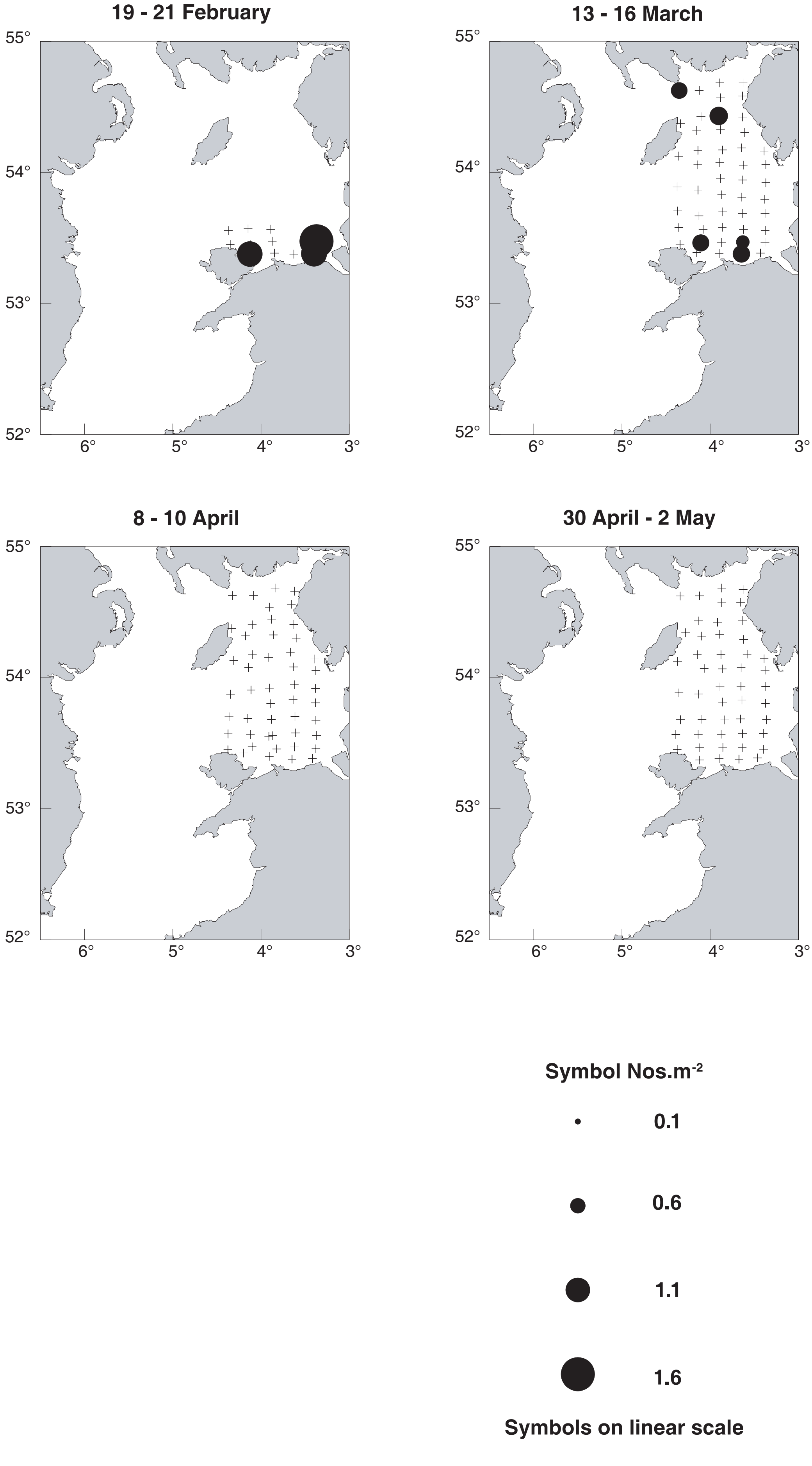


Figure 29. Concentration of herring (Clupea harengus) larvae (nos.m^{-2}) in 2002

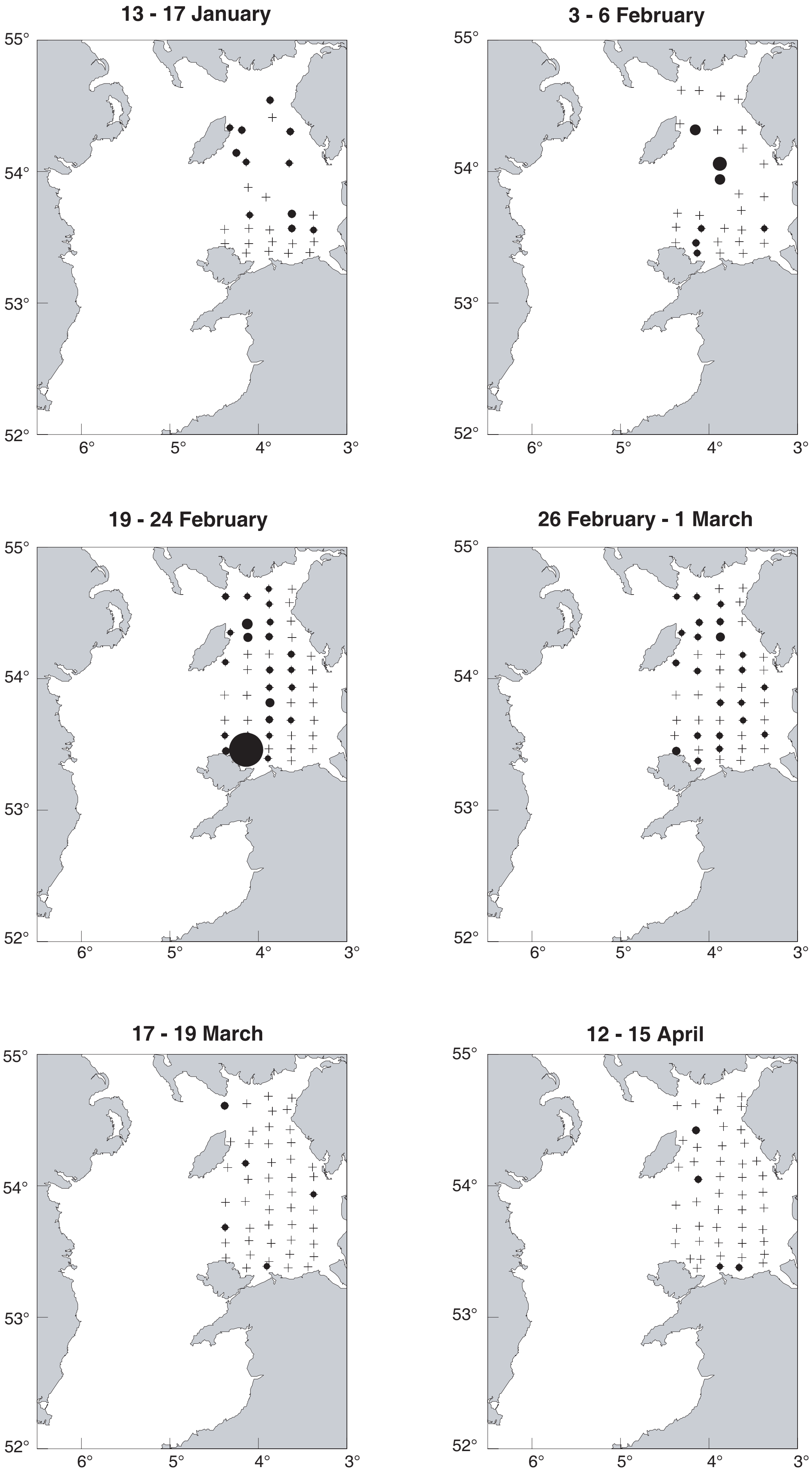
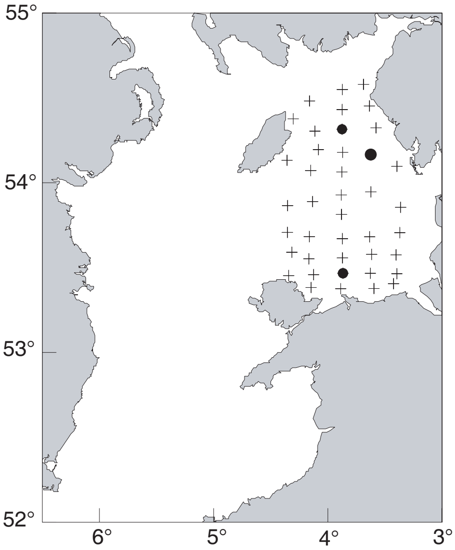


Figure 30. Concentration of herring (Clupea harengus) larvae (nos.m^{-2}) in 2003

28 - 30 April



Symbol Nos.m^{-2}

•	**0.1**
•	**10.3**
●	**20.5**
⬤	**31.0**

Symbols on linear scale

Figure 30. continued

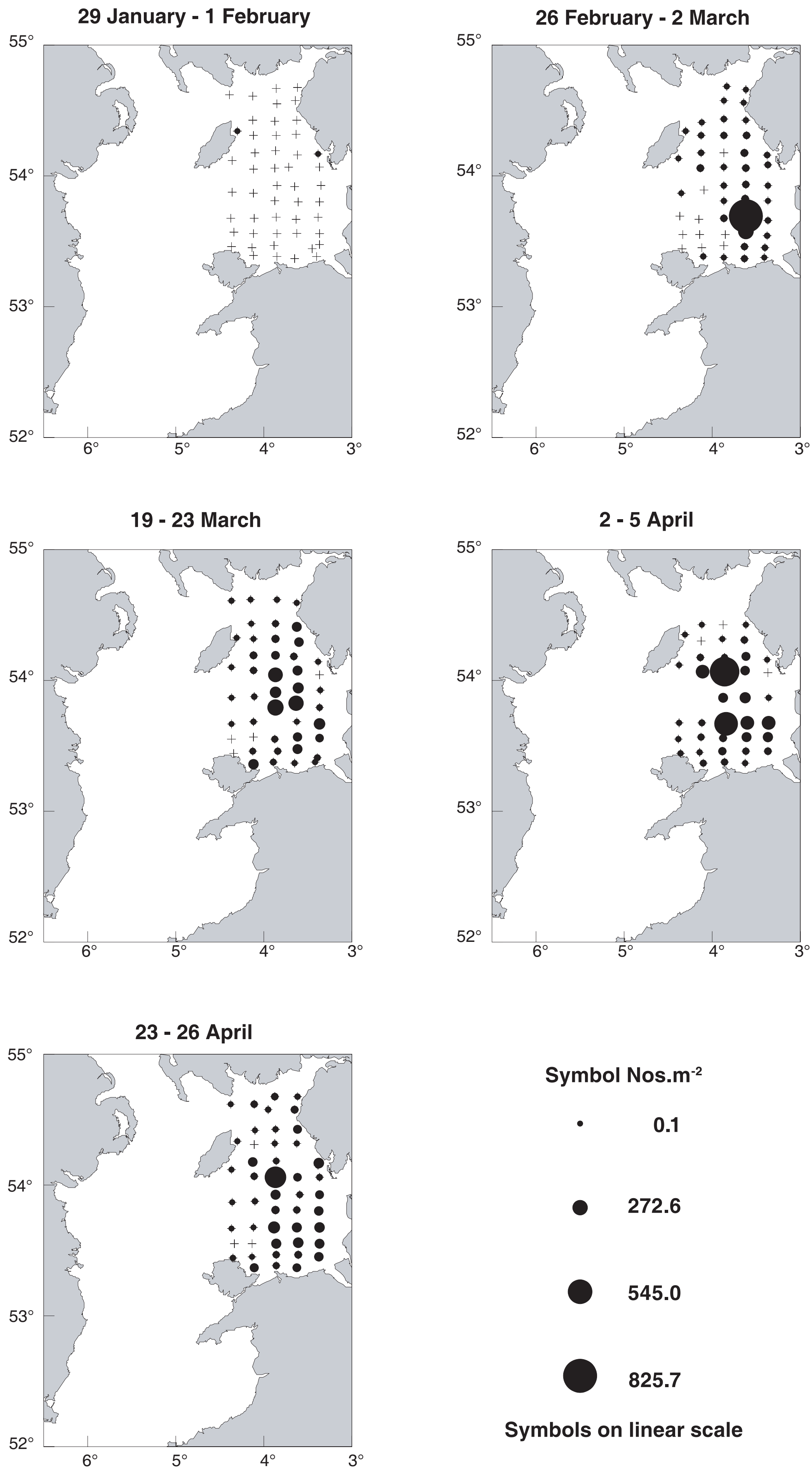


Figure 31. Concentration of sprat (Sprattus sprattus) eggs (nos.m^{-2}) in 2001

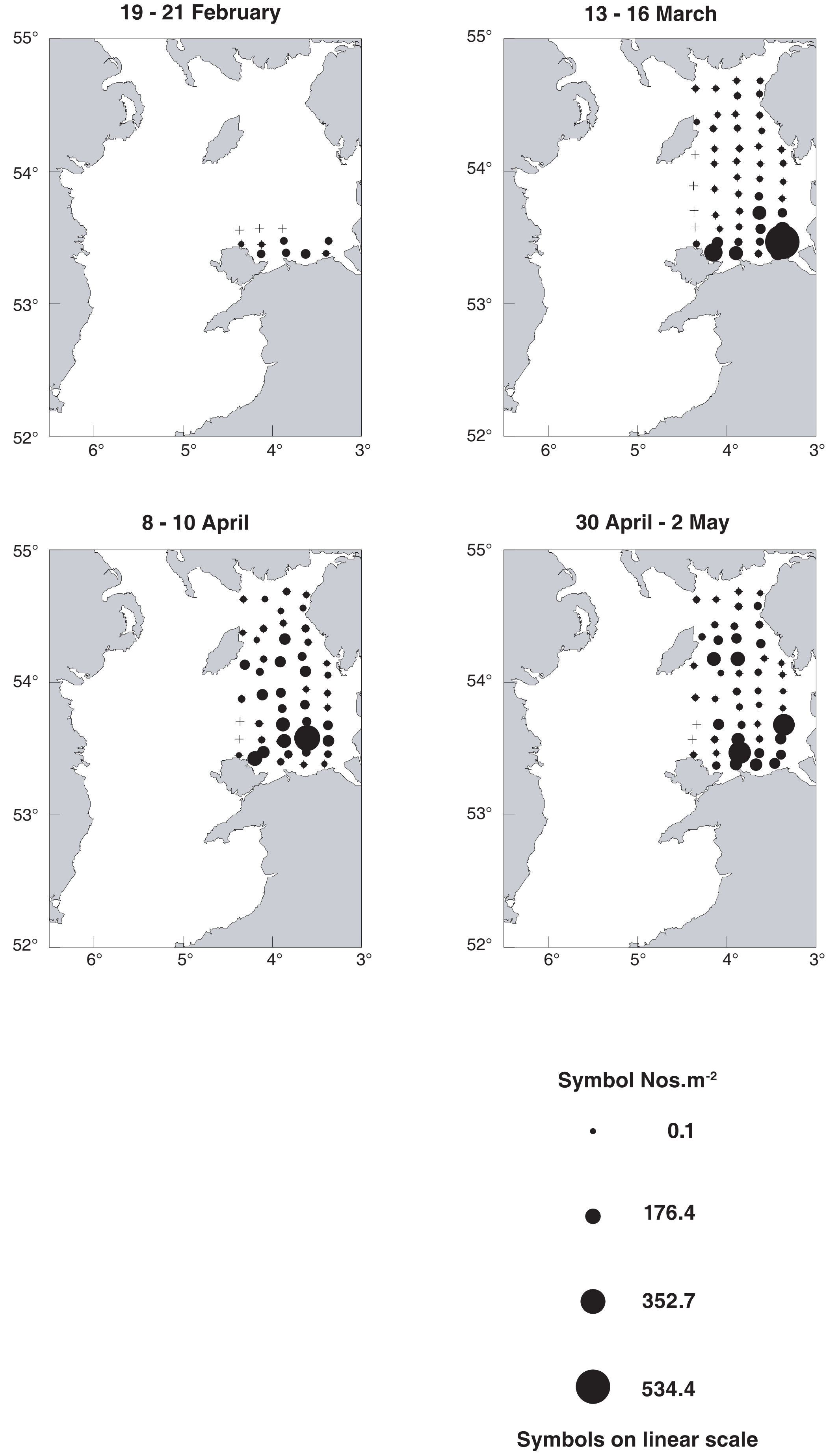


Figure 32. Concentration of sprat (Sprattus sprattus) eggs (nos.m^{-2}) in 2002

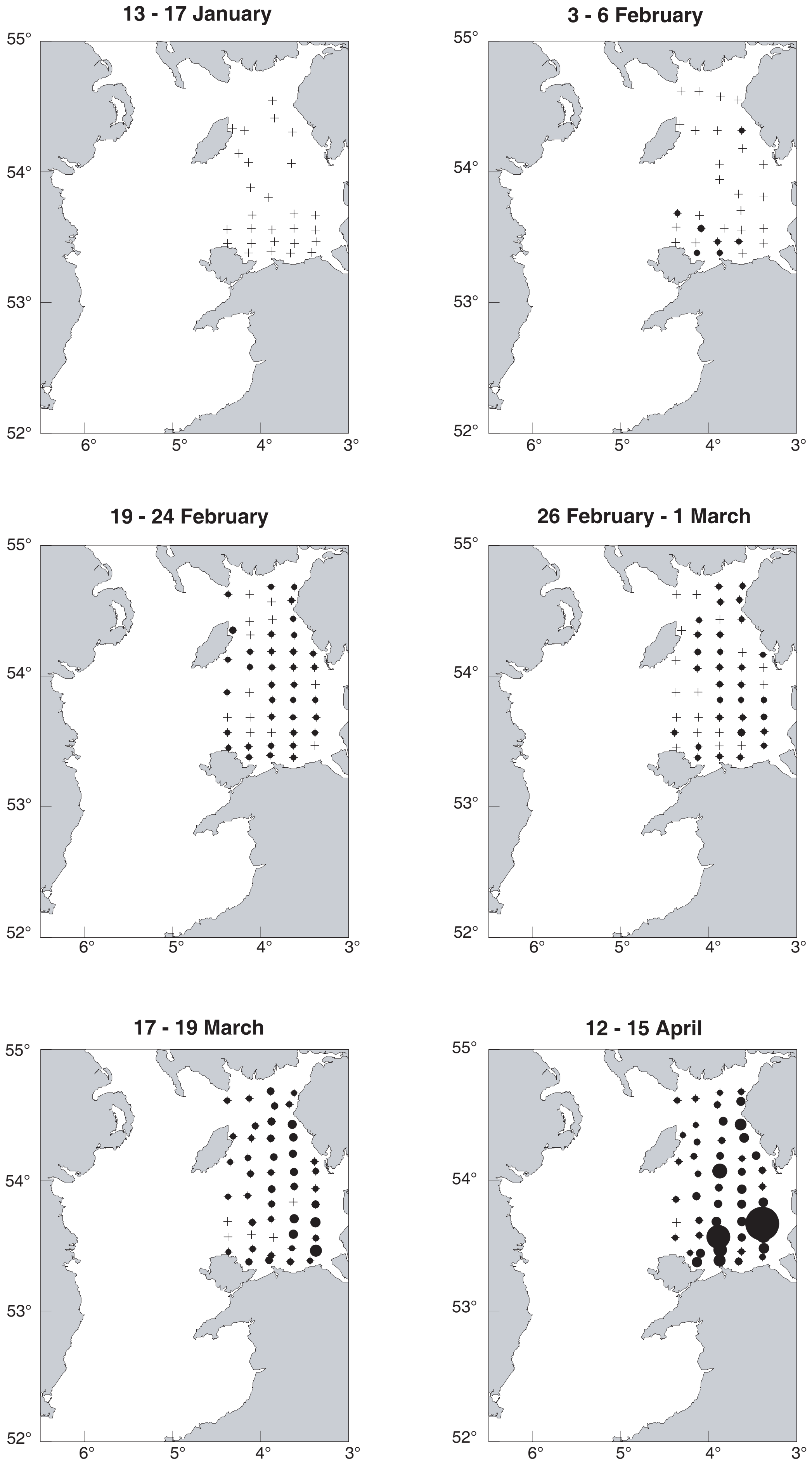
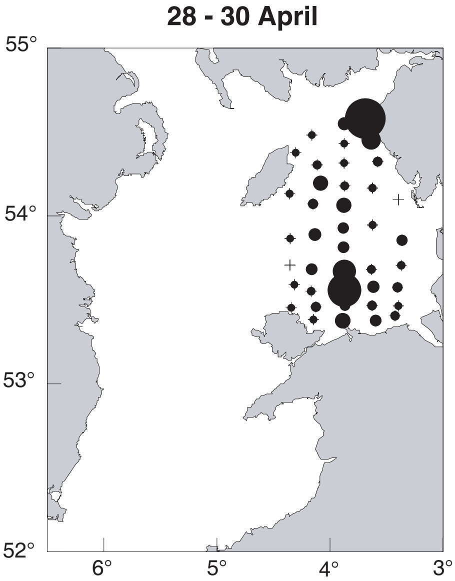


Figure 33. Concentration of sprat (Sprattus sprattus) eggs (nos.m^{-2}) in 2003



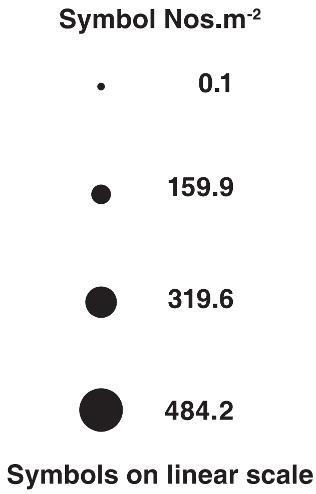


Figure 33. continued

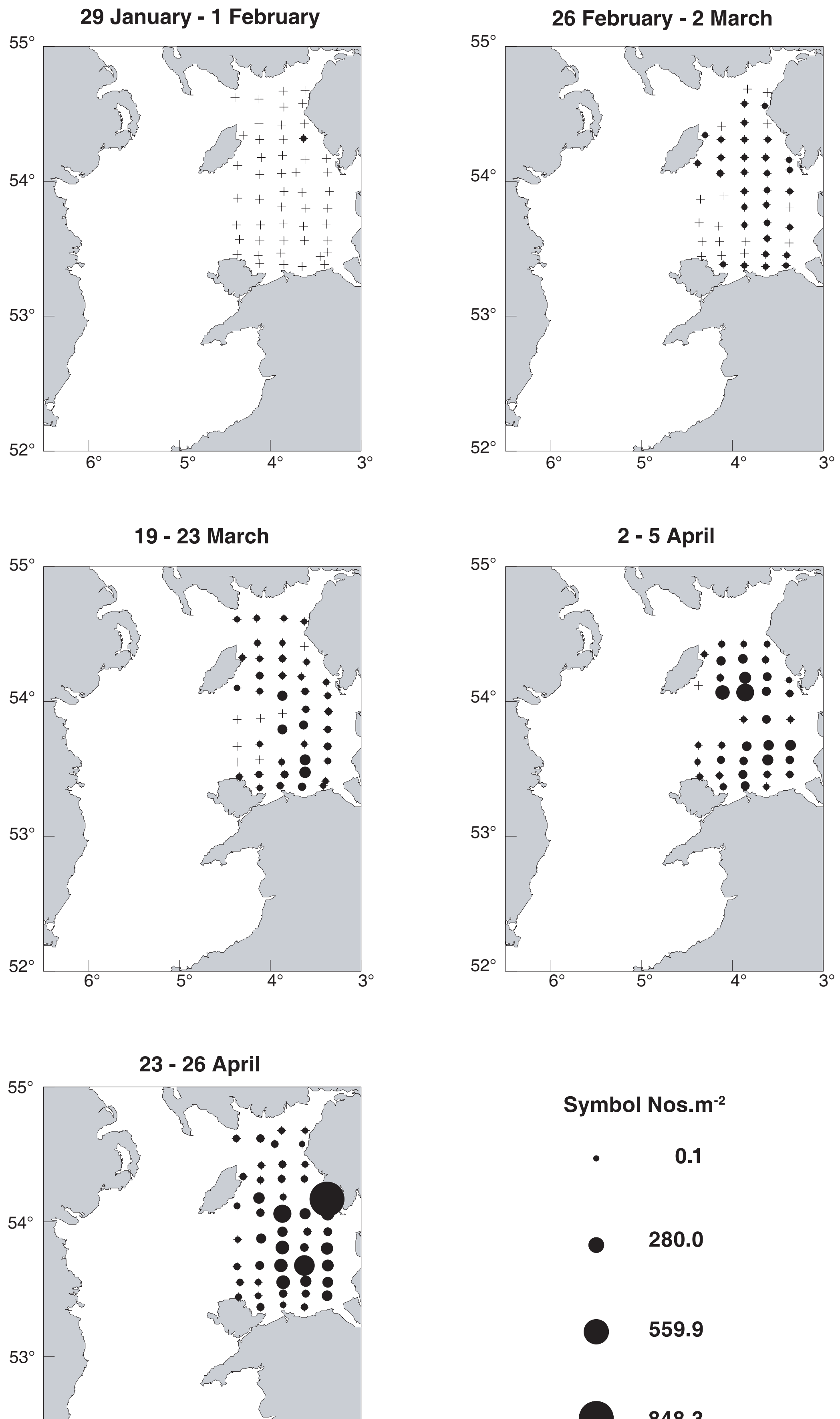


Figure 34. Concentration of sprat (Sprattus sprattus) larvae (nos.m^{-2}) in 2001

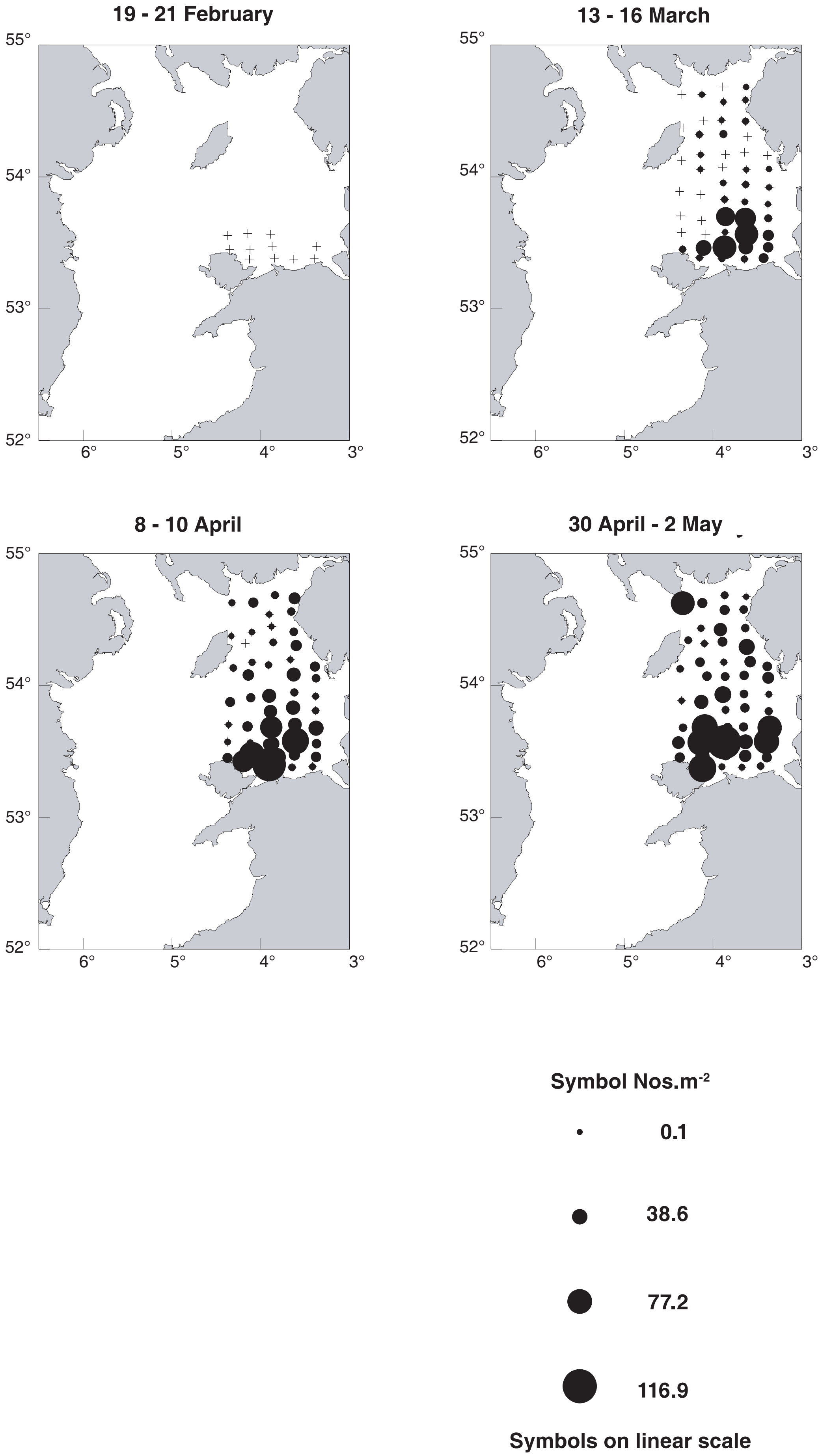


Figure 35. Concentration of sprat (Sprattus sprattus) larvae (nos.m^{-2}) in 2002

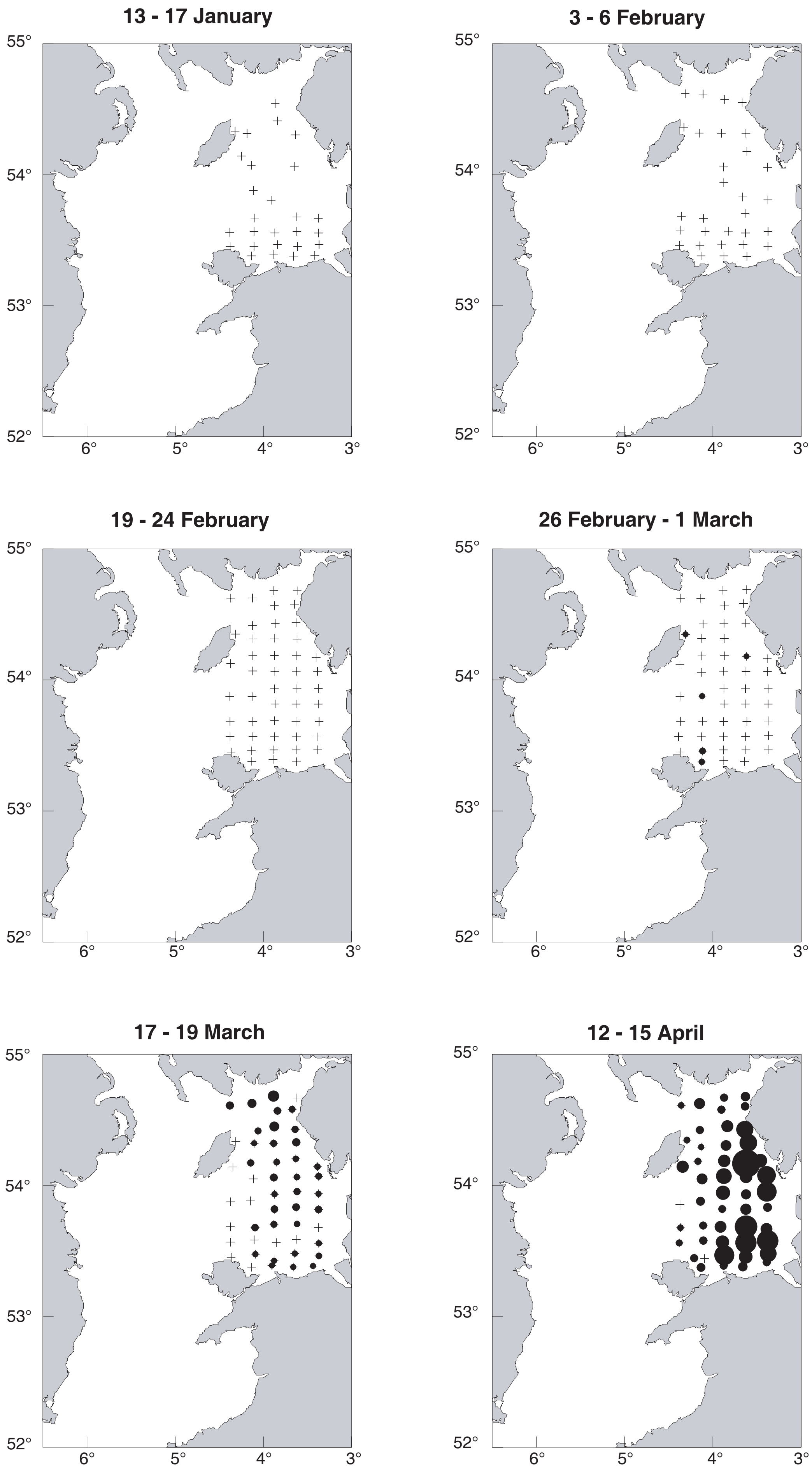
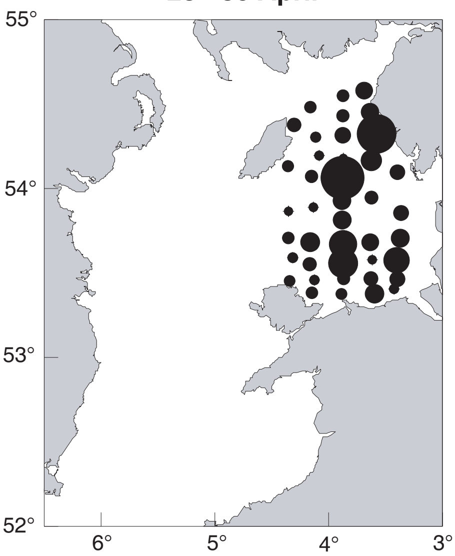
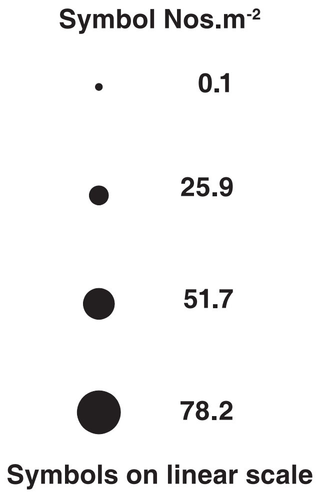


Figure 36. Concentration of sprat (Sprattus sprattus) larvae (nos.m⁻²) in 2003

28 - 30 April





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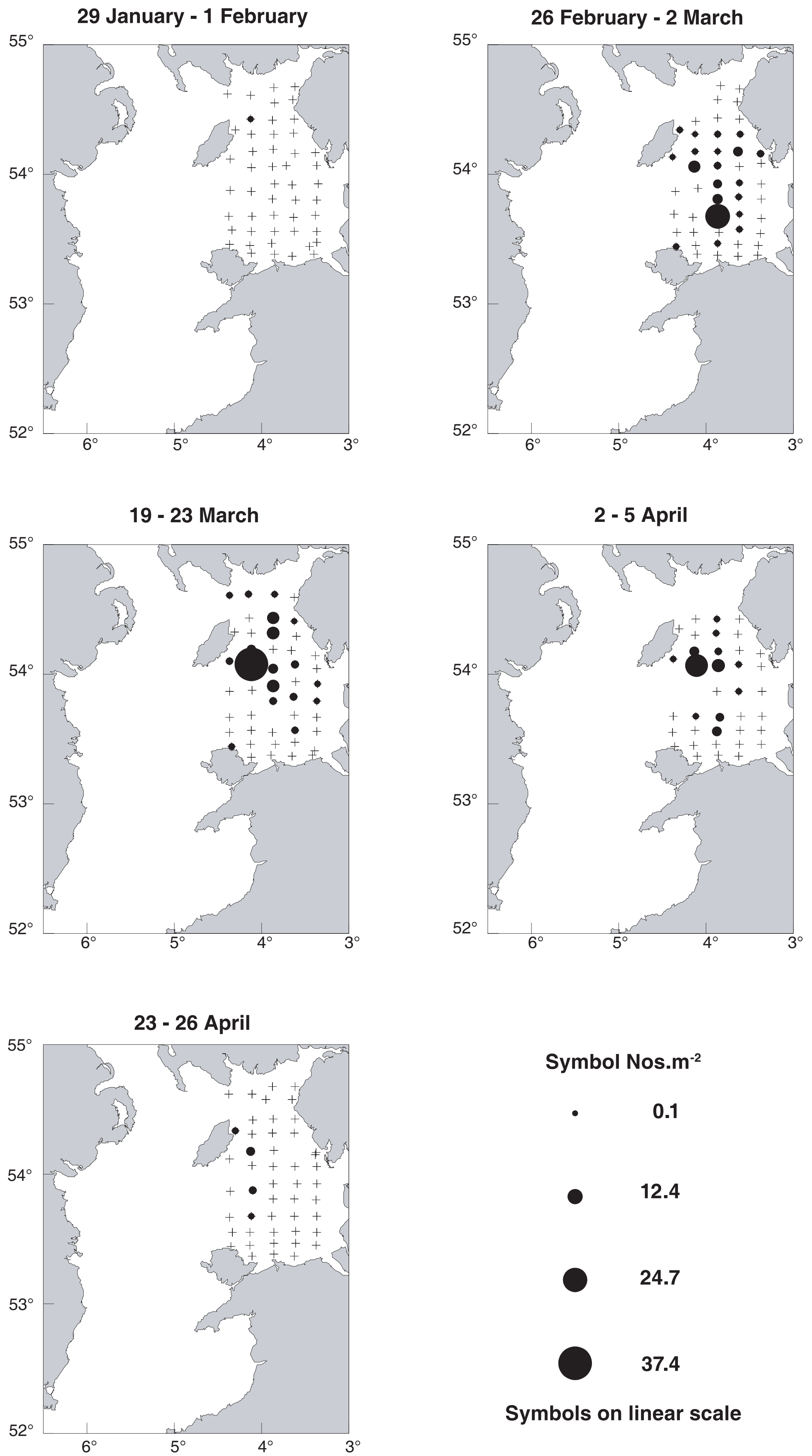


Figure 37. Concentration of late-stage cod (Gadus morhua) eggs (nos.m^{-2}) in 2001

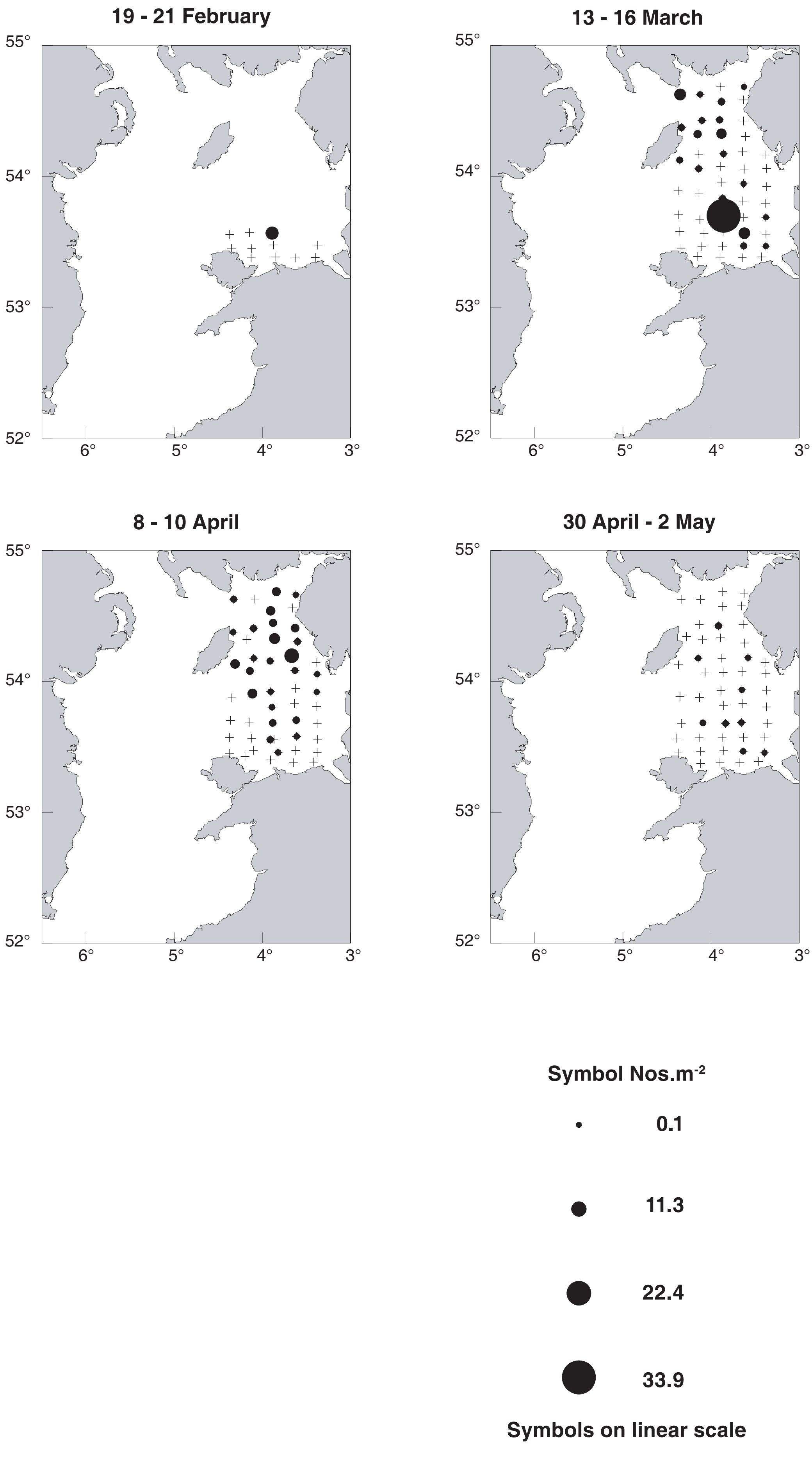


Figure 38. Concentration of late-stage cod (Gadus morhua) eggs (nos.m^{-2}) in 2002

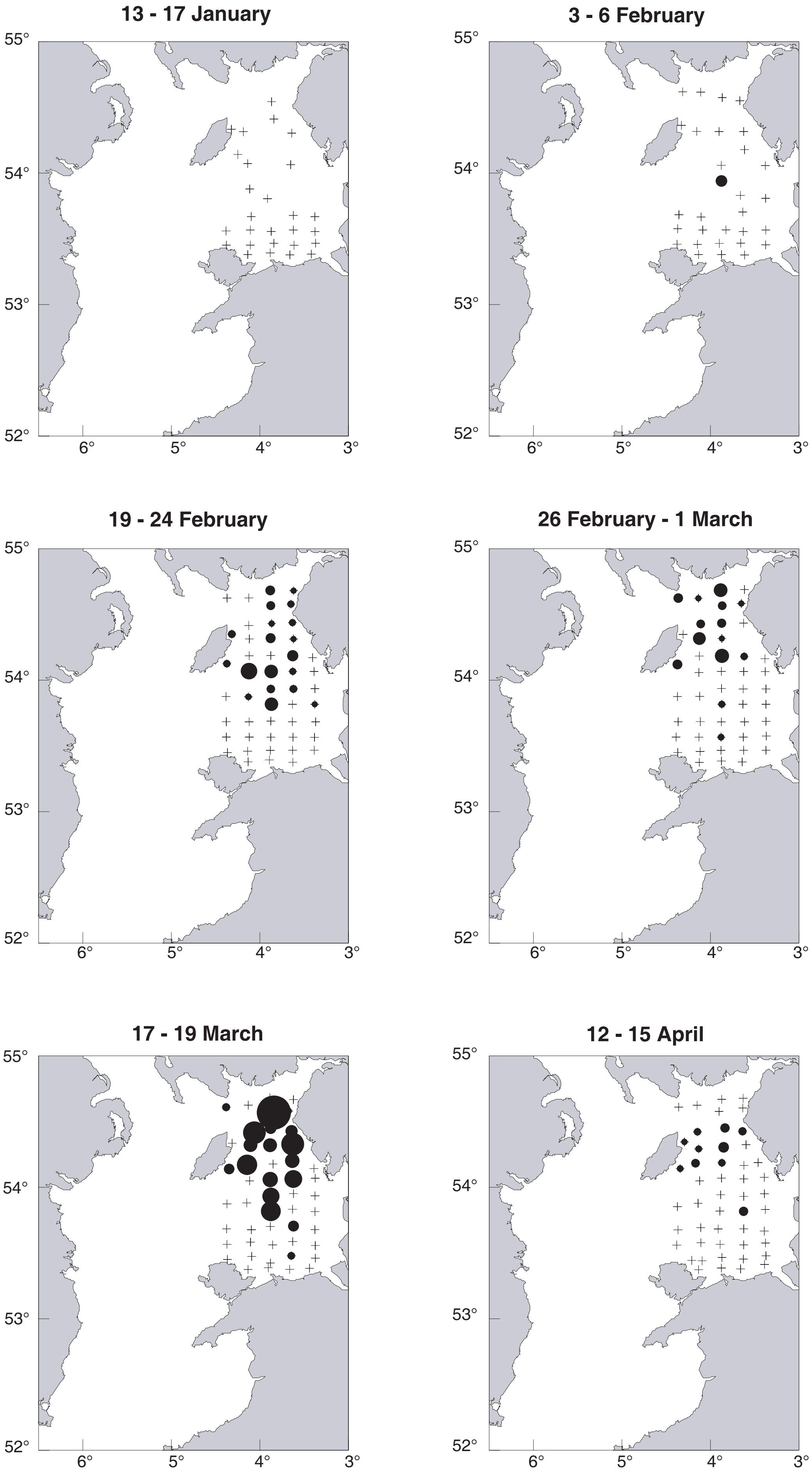


Figure 39. Concentration of late-stage cod (Gadus morhua) eggs (nos.m^{-2}) in 2003

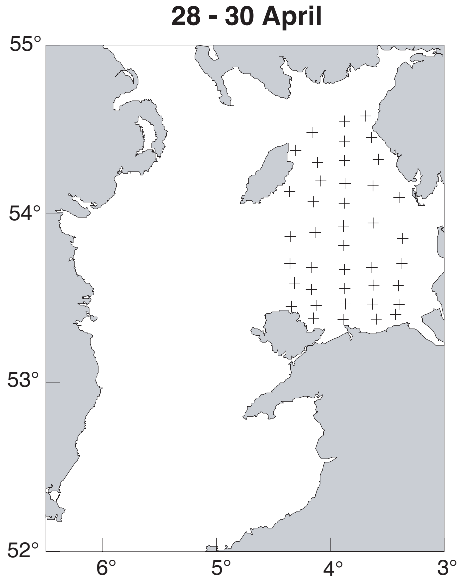


Figure 39. continued

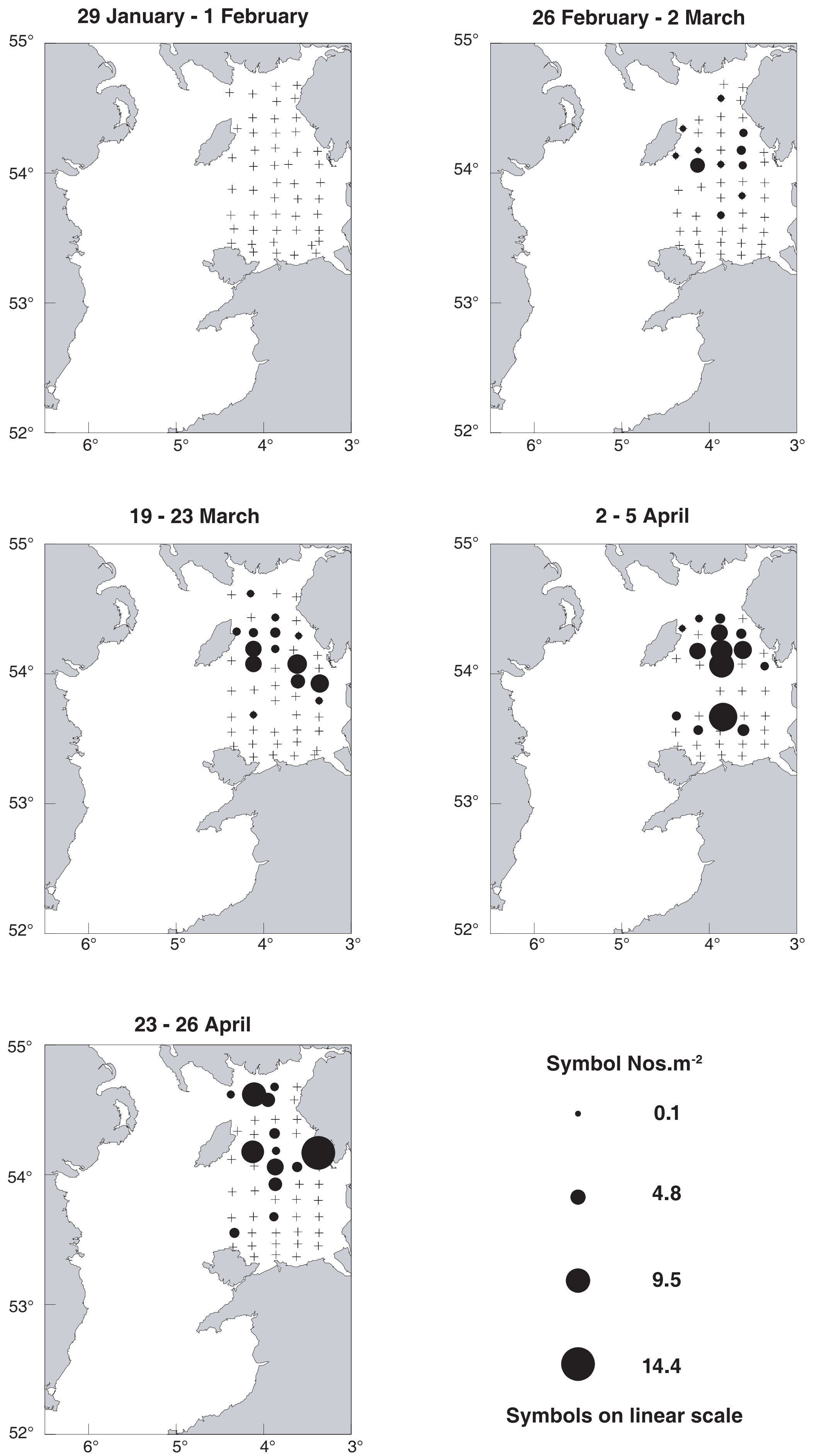


Figure 40. Concentration of cod (Gadus morhua) larvae (nos.m^{-2}) in 2001

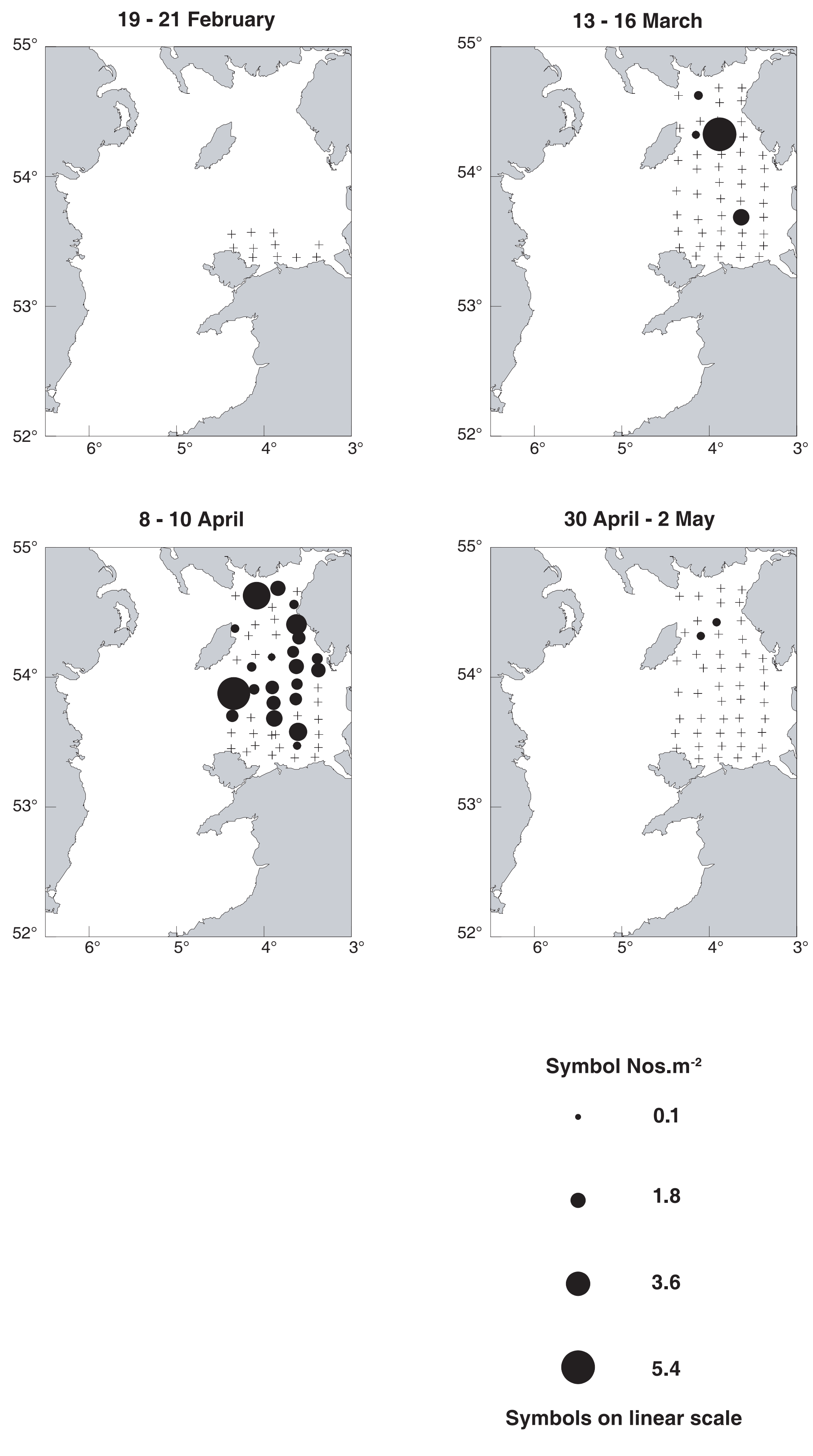


Figure 41. Concentration of cod (Gadus morhua) larvae (nos.m^{-2}) in 2002

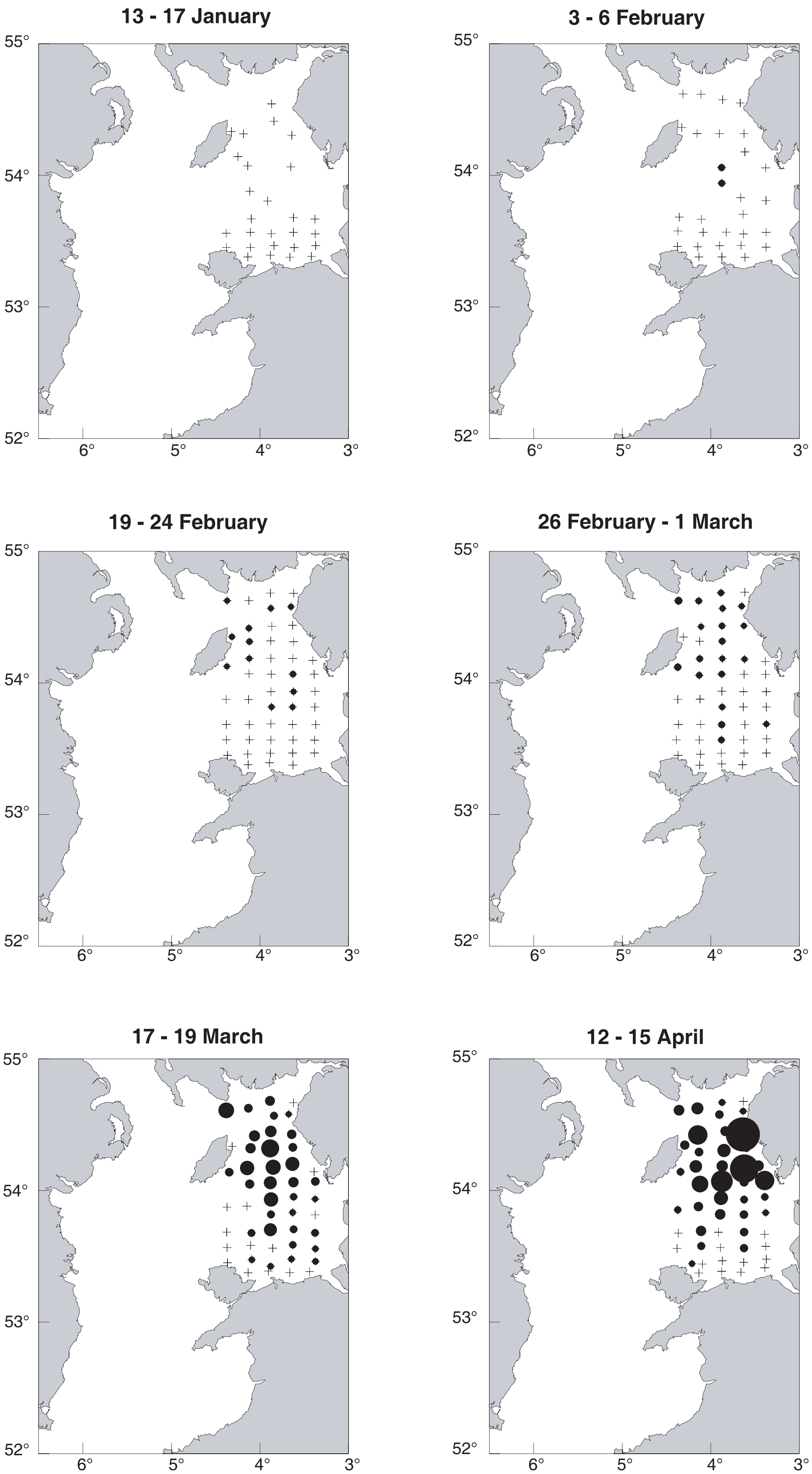


Figure 42. Concentration of cod (Gadus morhua) larvae (nos.m^{-2}) in 2003

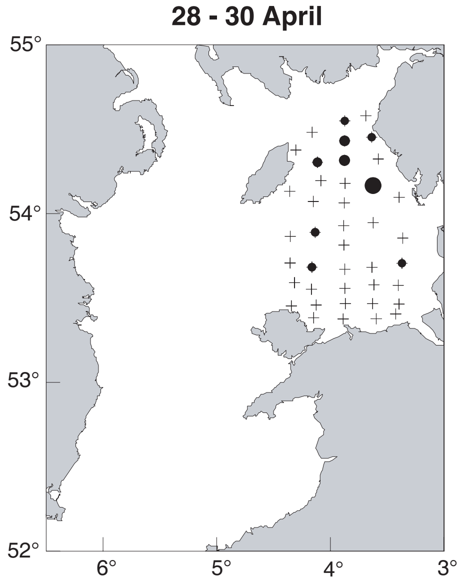


Figure 42. continued

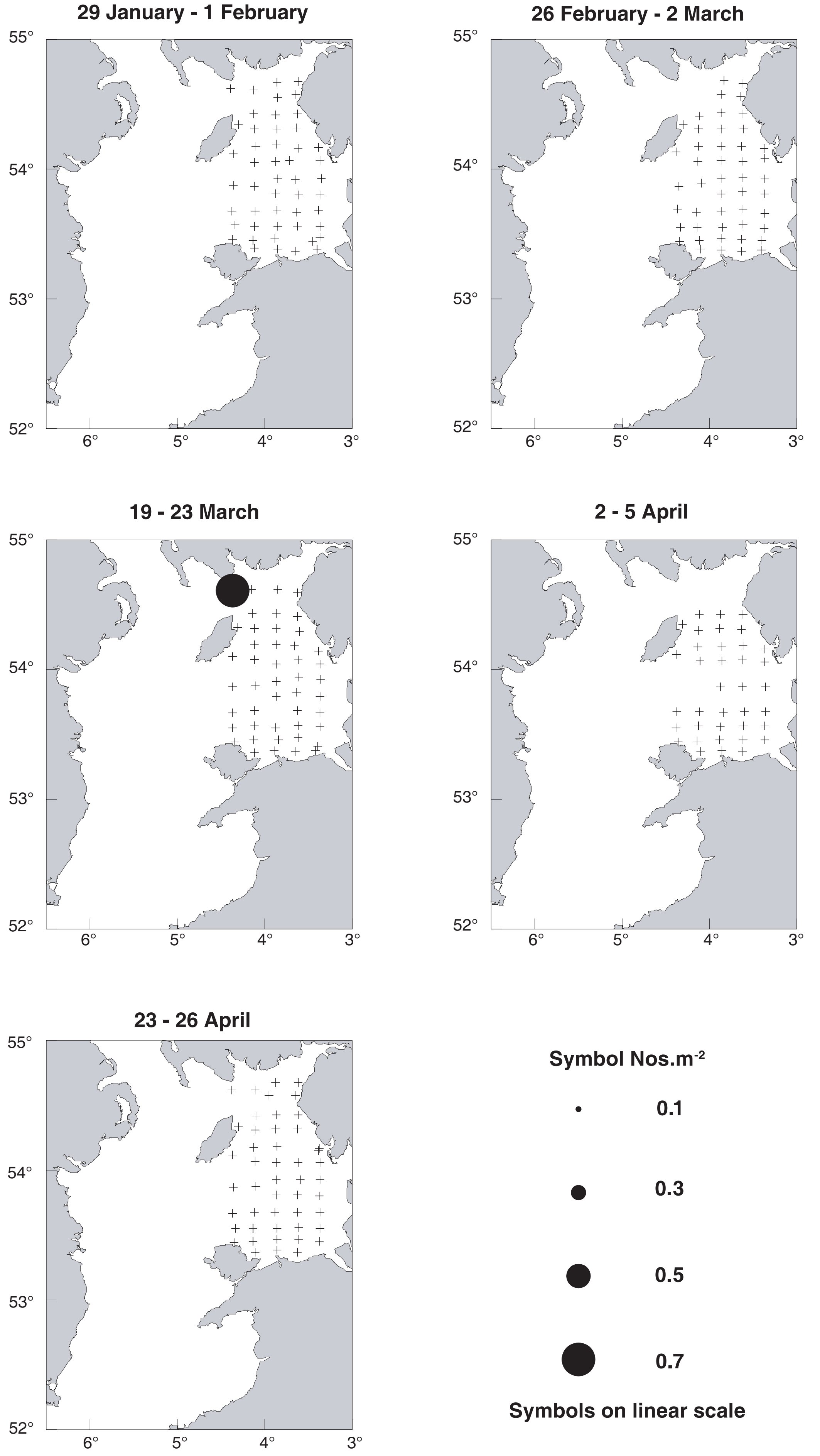


Figure 43. Concentration of late-stage haddock (Melanogrammus aeglefinus) eggs (nos.m^{-2}) in 2001

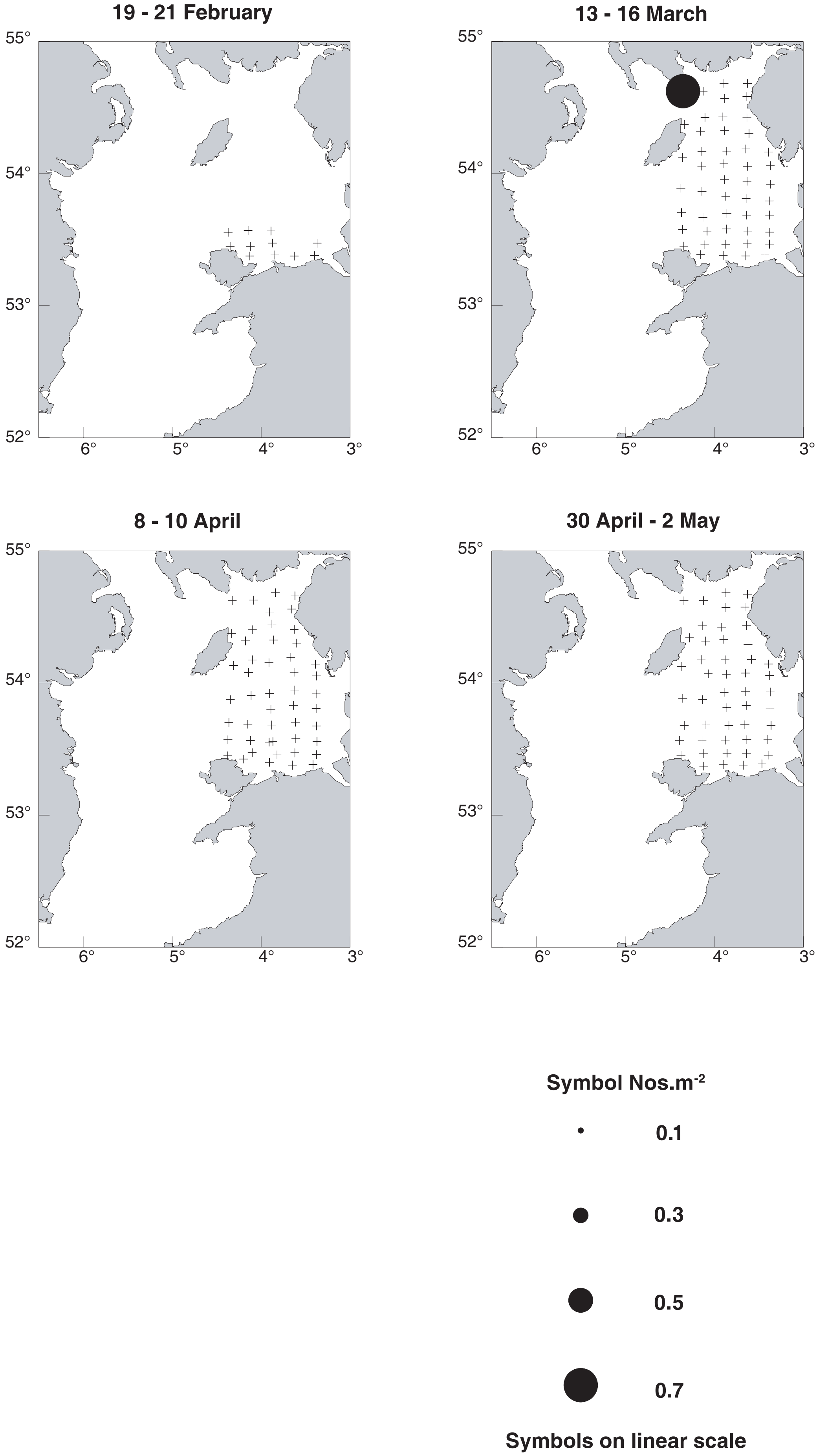


Figure 44. Concentration of late-stage haddock (Melanogrammus aeglefinus) eggs (nos.m^{-2}) in 2002

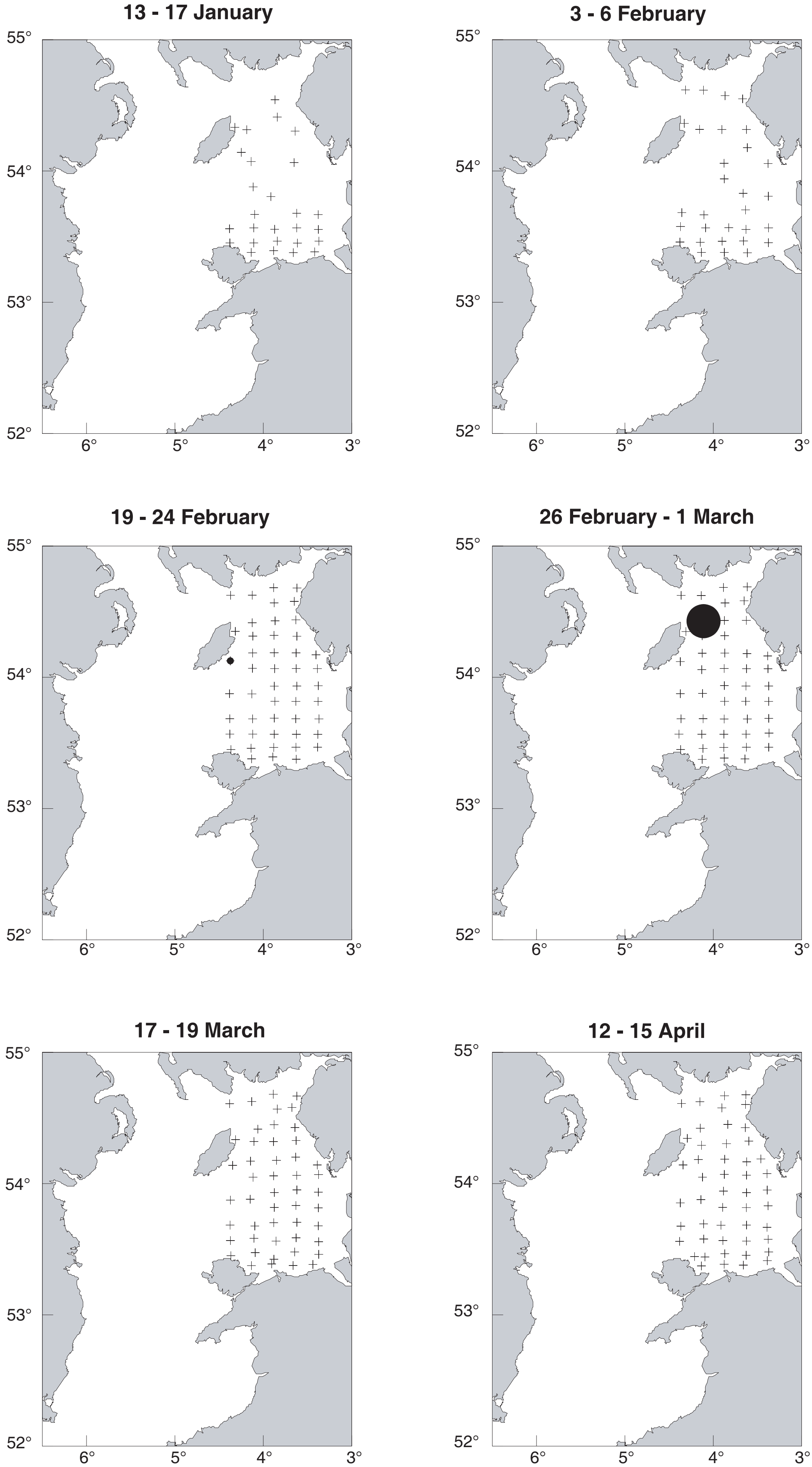
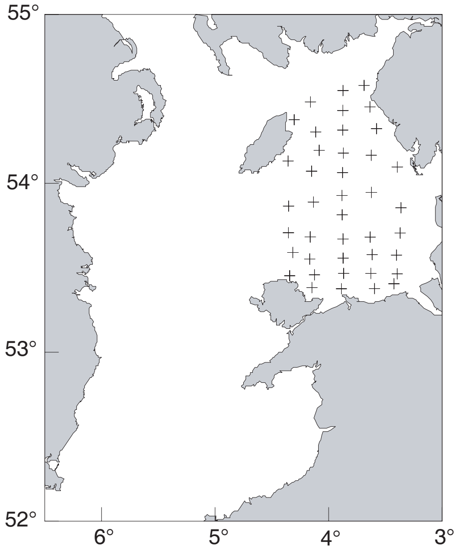


Figure 45. Concentration of late-stage haddock (Melanogrammus aeglefinus) eggs (nos.m^{-2}) in 2003

28 - 30 April



Symbol Nos.m^{-2}

0.1

0.2

0.2

0.3

Symbols on linear scale

Figure 45. continued

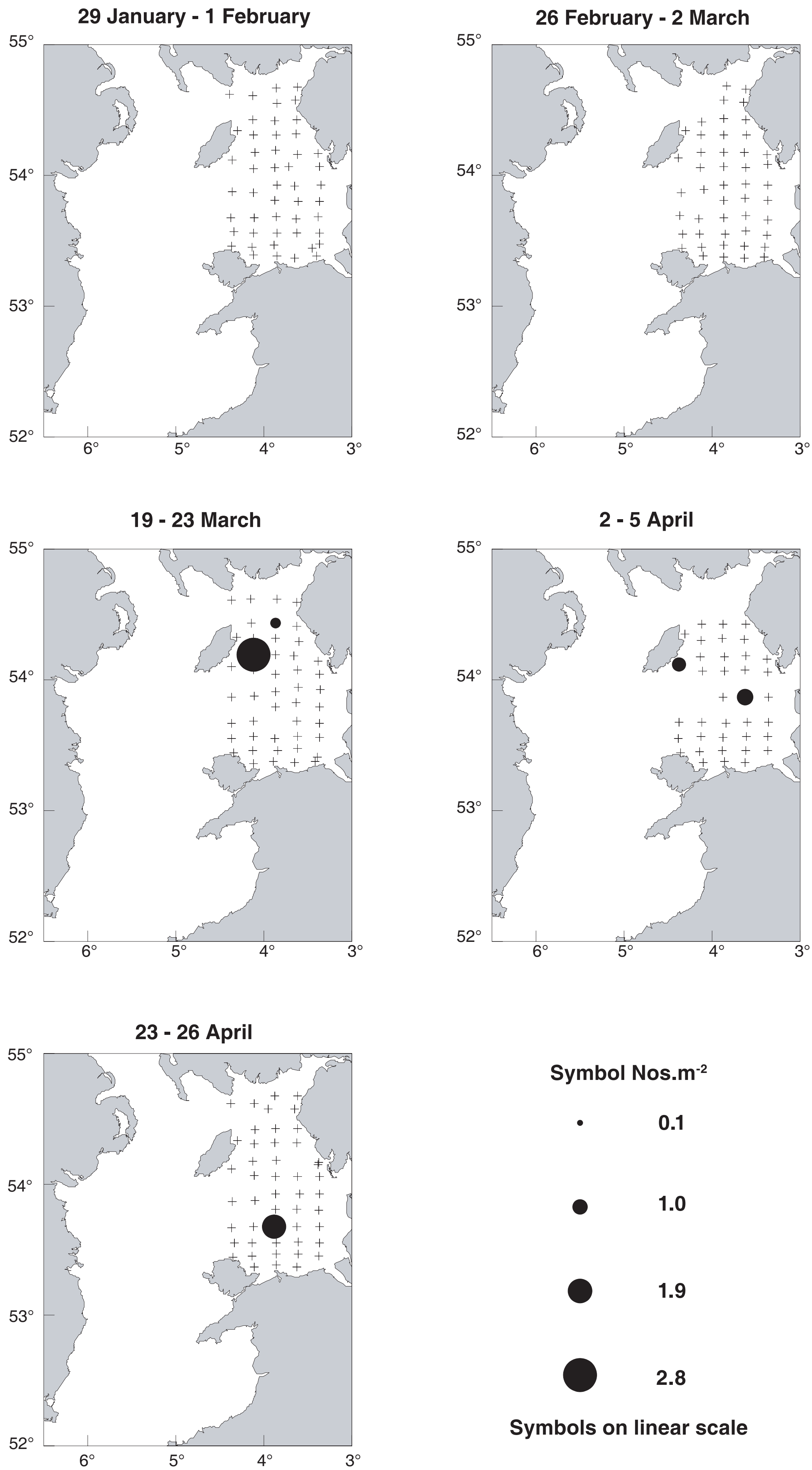


Figure 46. Concentration of haddock (Melanogrammus aeglefinus) larvae (nos.m^{-2}) in 2001

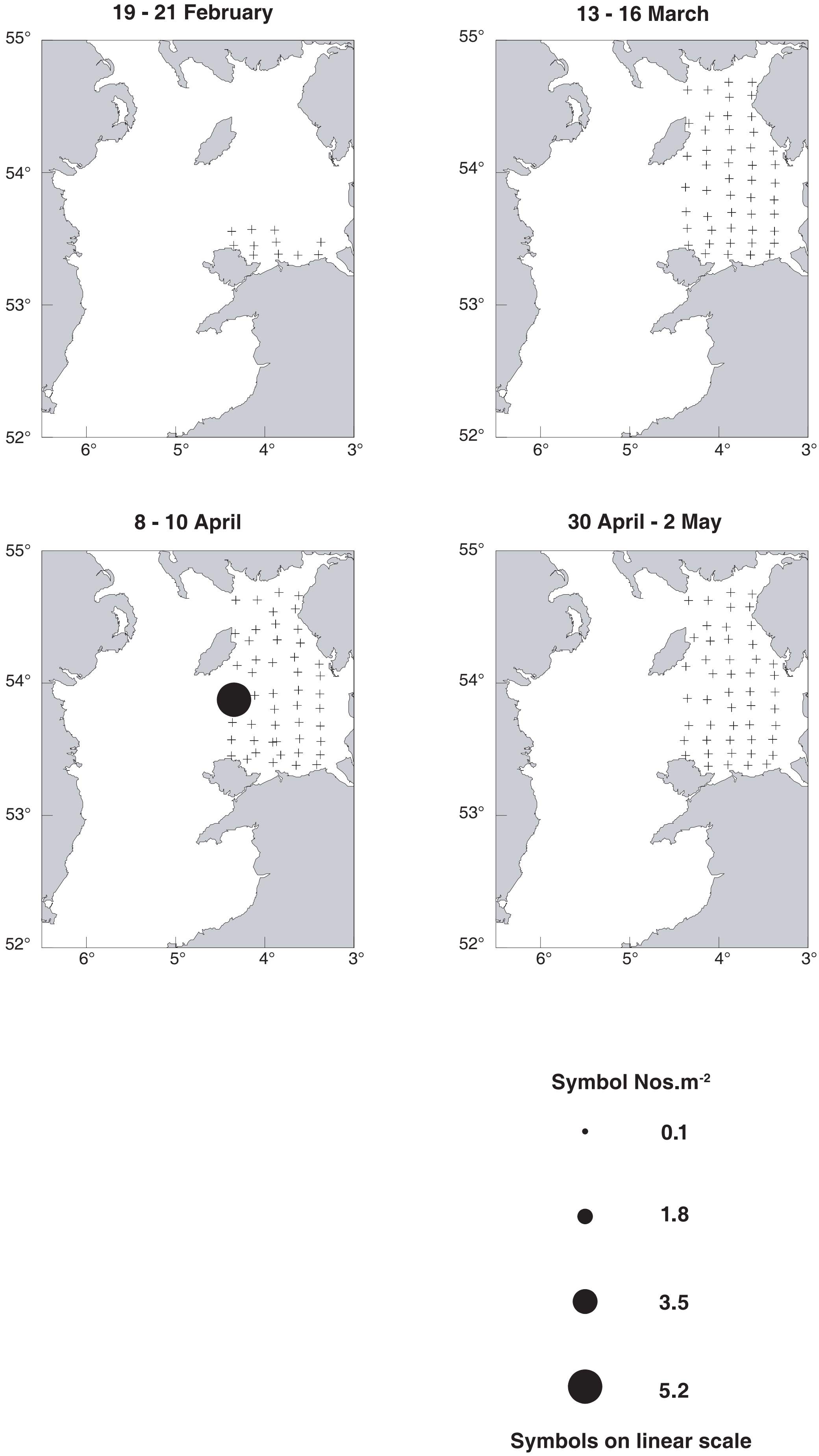


Figure 47. Concentration of haddock (Melanogrammus aeglefinus) larvae (nos.m^{-2}) in 2002

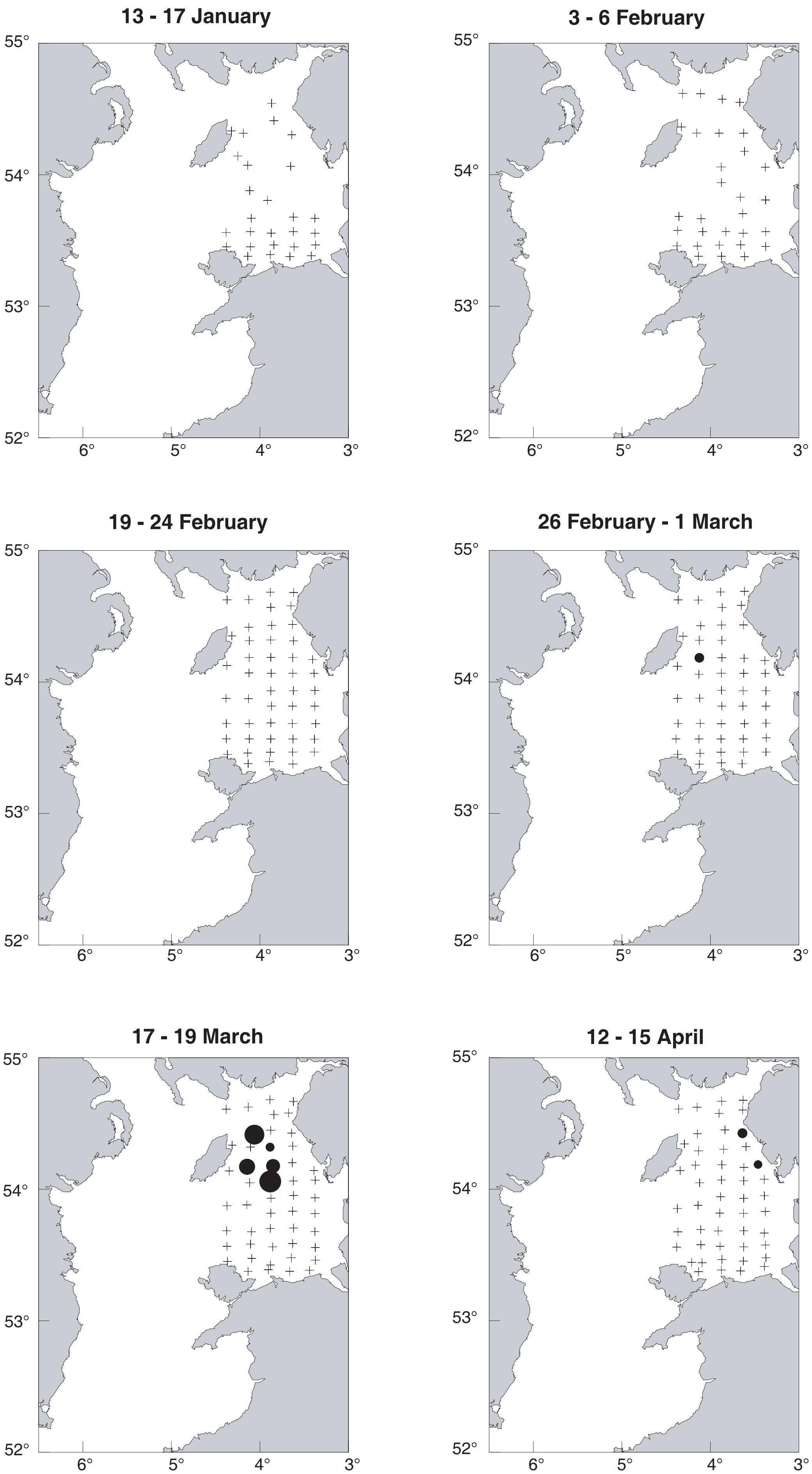
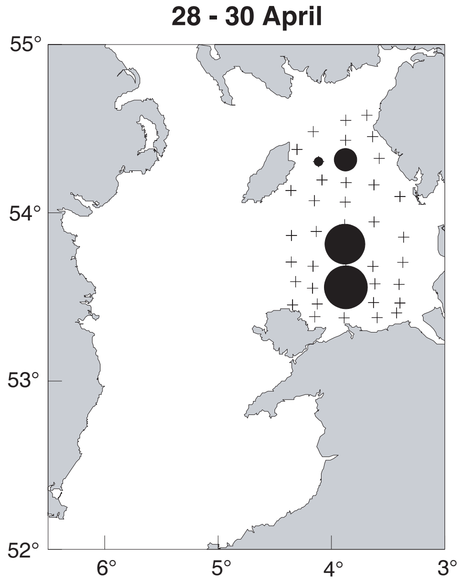


Figure 48. Concentration of haddock (Melanogrammus aeglefinus) larvae (nos.m^{-2}) in 2003



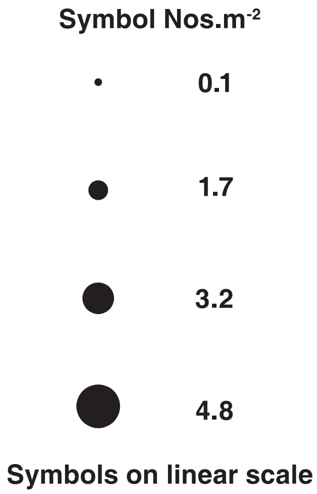


Figure 48. continued

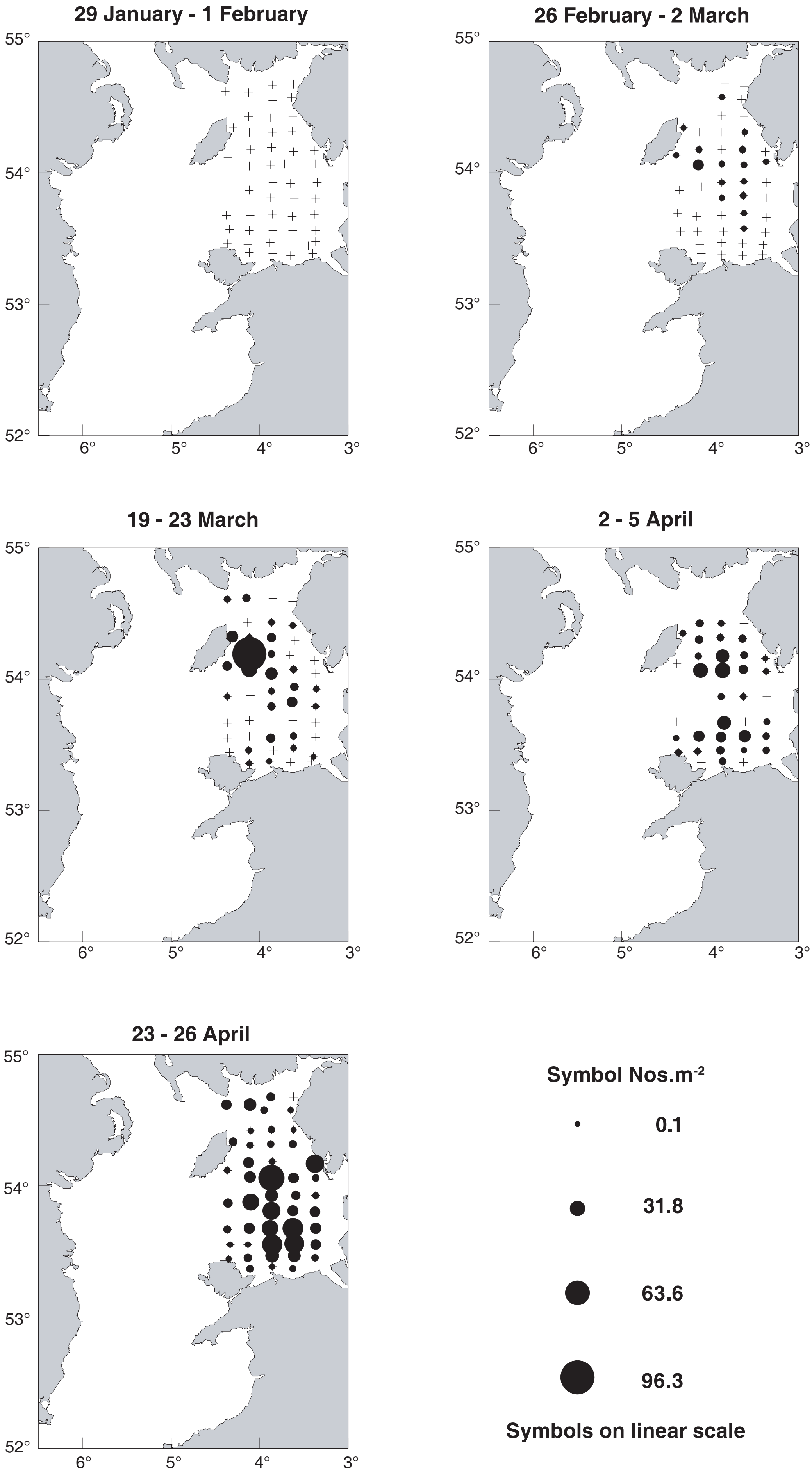


Figure 49. Concentration of whiting (Merlangius merlangus) larvae (nos.m^{-2}) in 2001

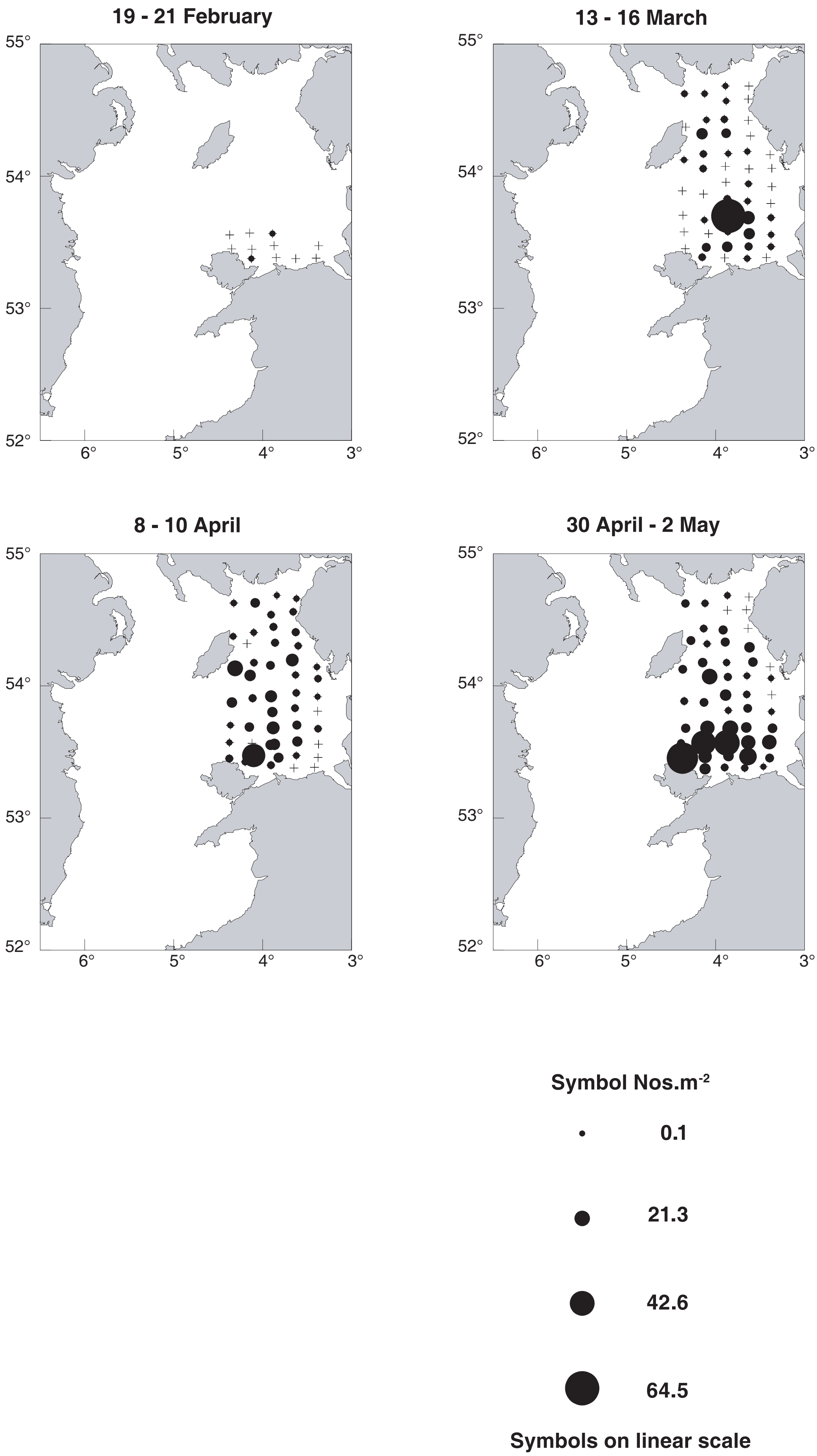


Figure 50. Concentration of whiting (Merlangius merlangus) larvae (nos.m^{-2}) in 2002

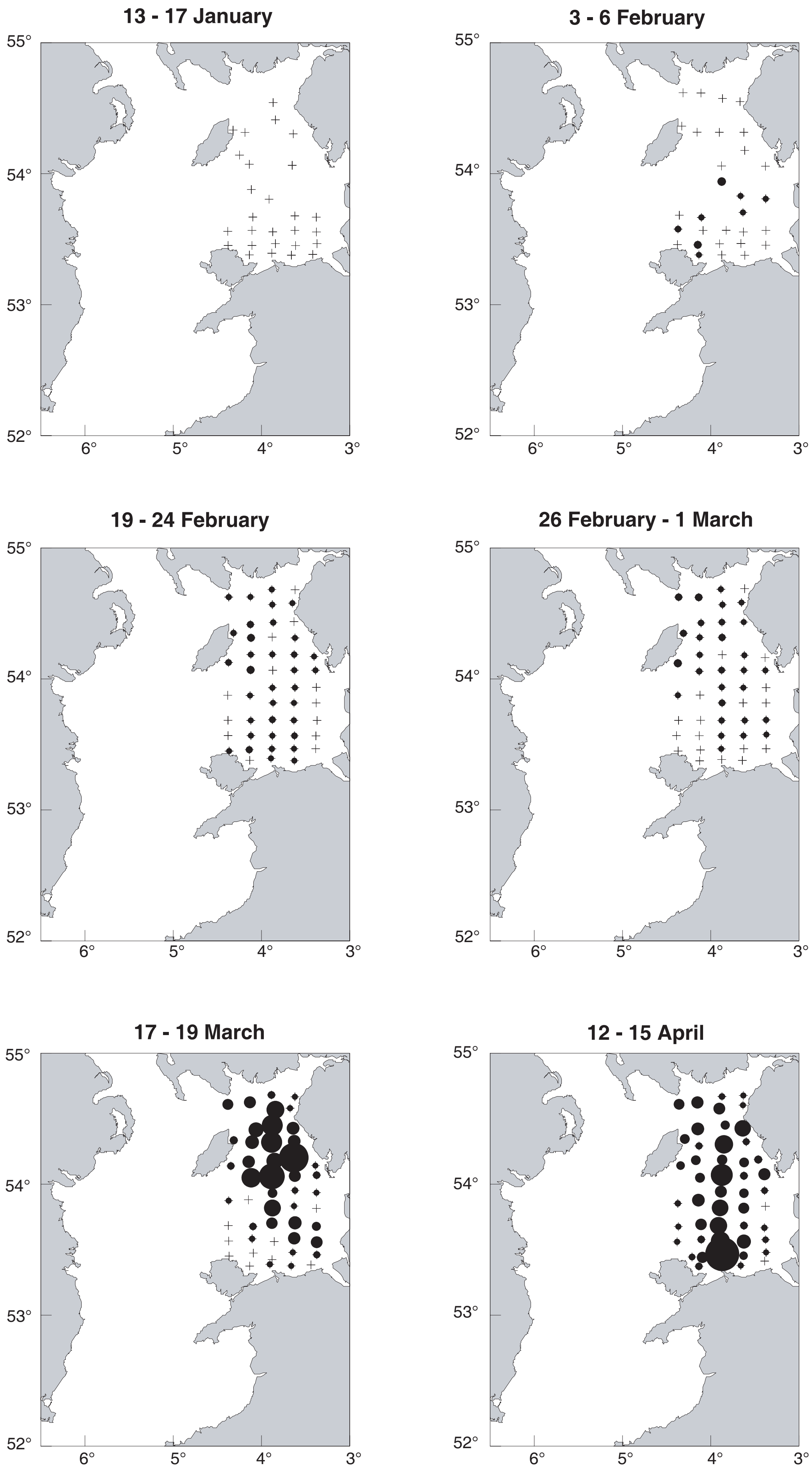
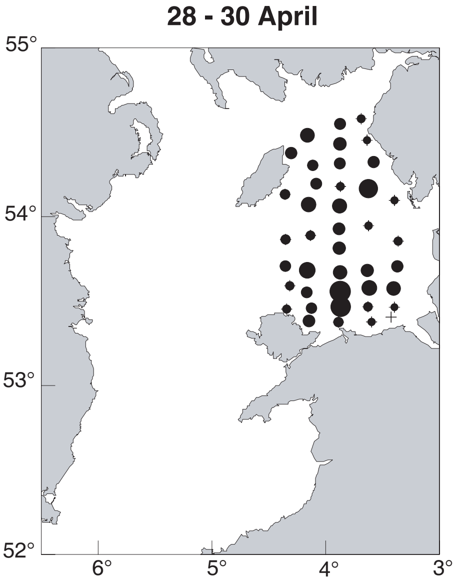


Figure 51. Concentration of whiting (Merlangius merlangus) larvae (nos.m^{-2}) in 2003



Symbol Nos.m^{-2}

•	0.1
●	42.2
●	84.3
●	127.7

Symbols on linear scale

Figure 51. continued

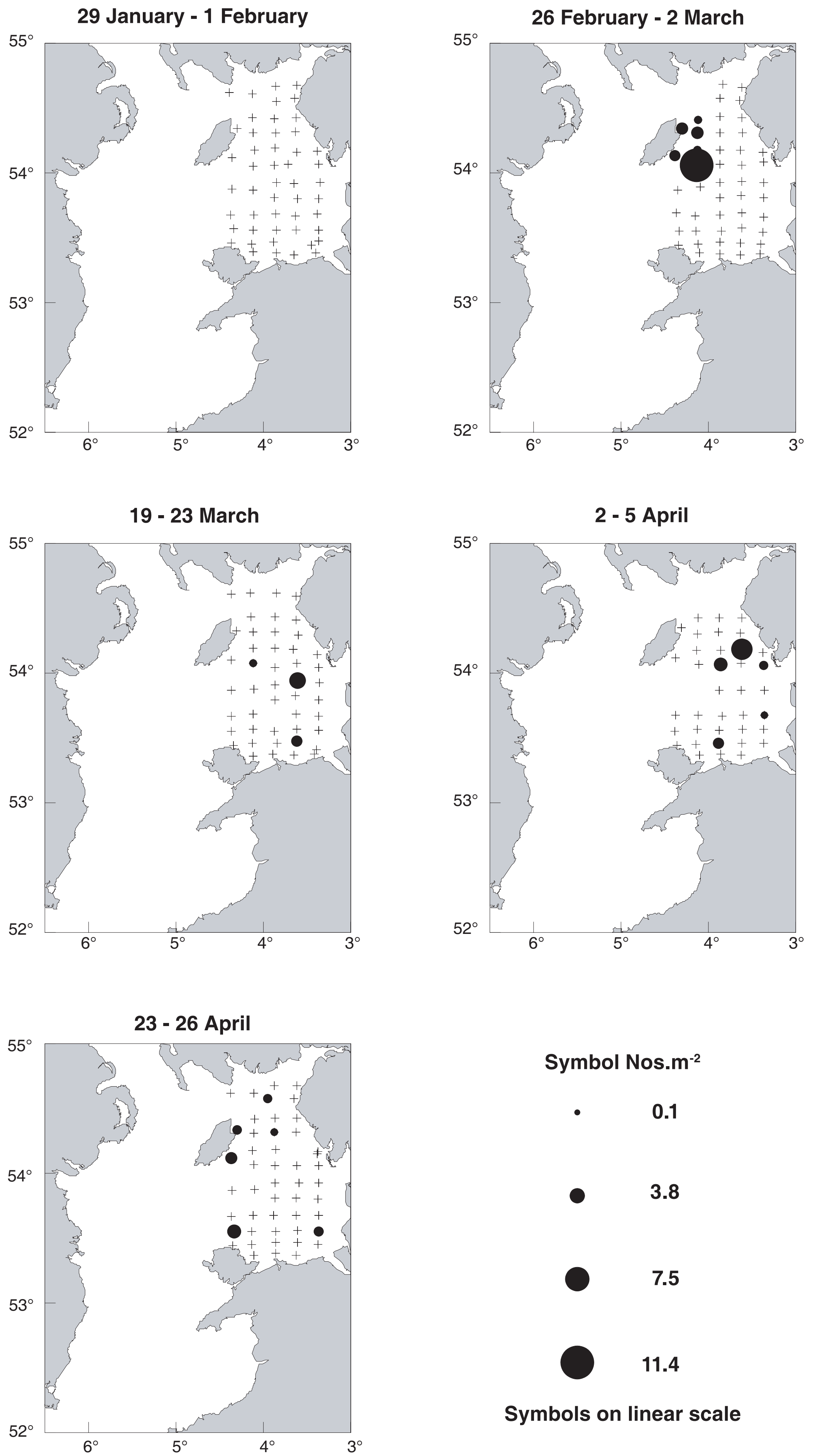


Figure 52. Concentration of Norway pout and poor cod (Gadidae) larvae (nos.m^{-2}) in 2001

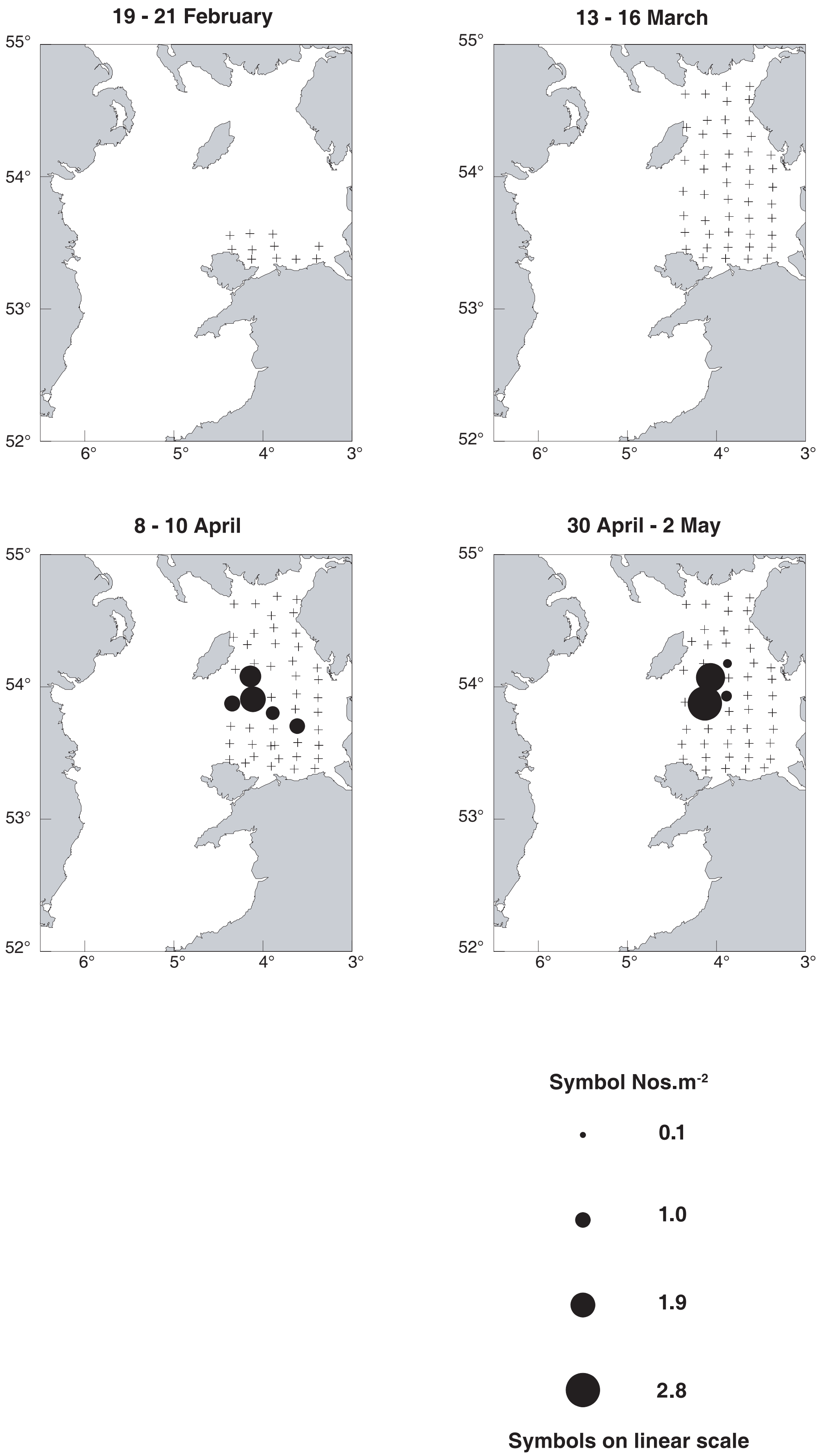


Figure 53. Concentration of Norway pout and poor cod (Gadidae) larvae (nos.m^{-2}) in 2002

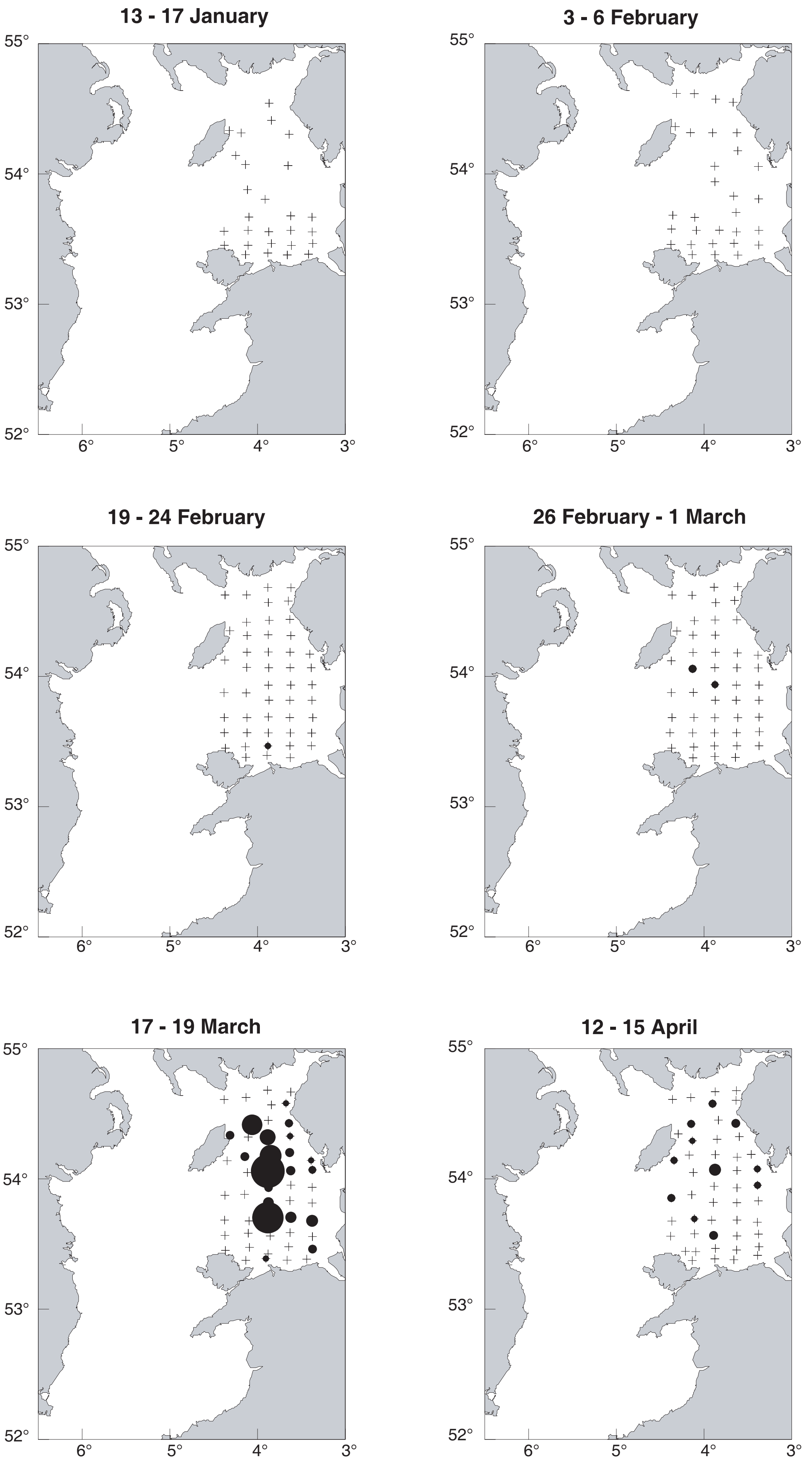
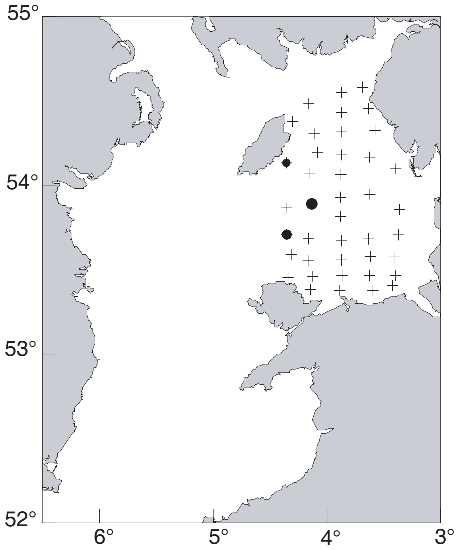


Figure 54. Concentration of Norway pout and poor cod (Gadidae) larvae (nos.m^{-2}) in 2003

28 - 30 April



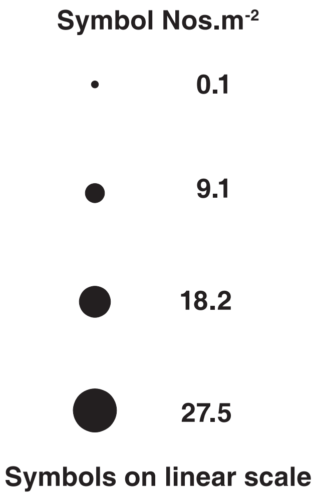


Figure 54. continued

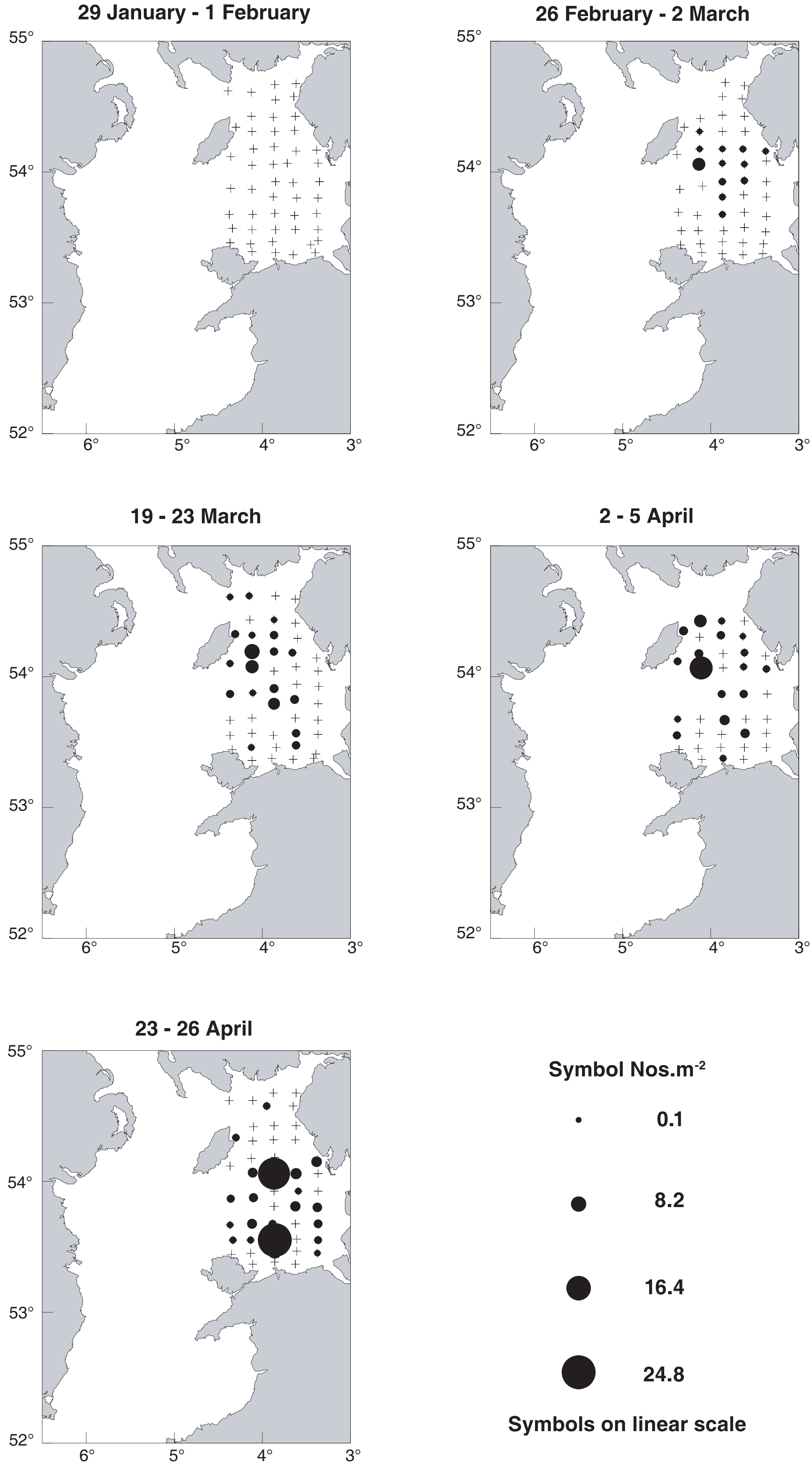


Figure 55. Concentration of bib (Trisopterus luscus) larvae (nos.m^{-2}) in 2001

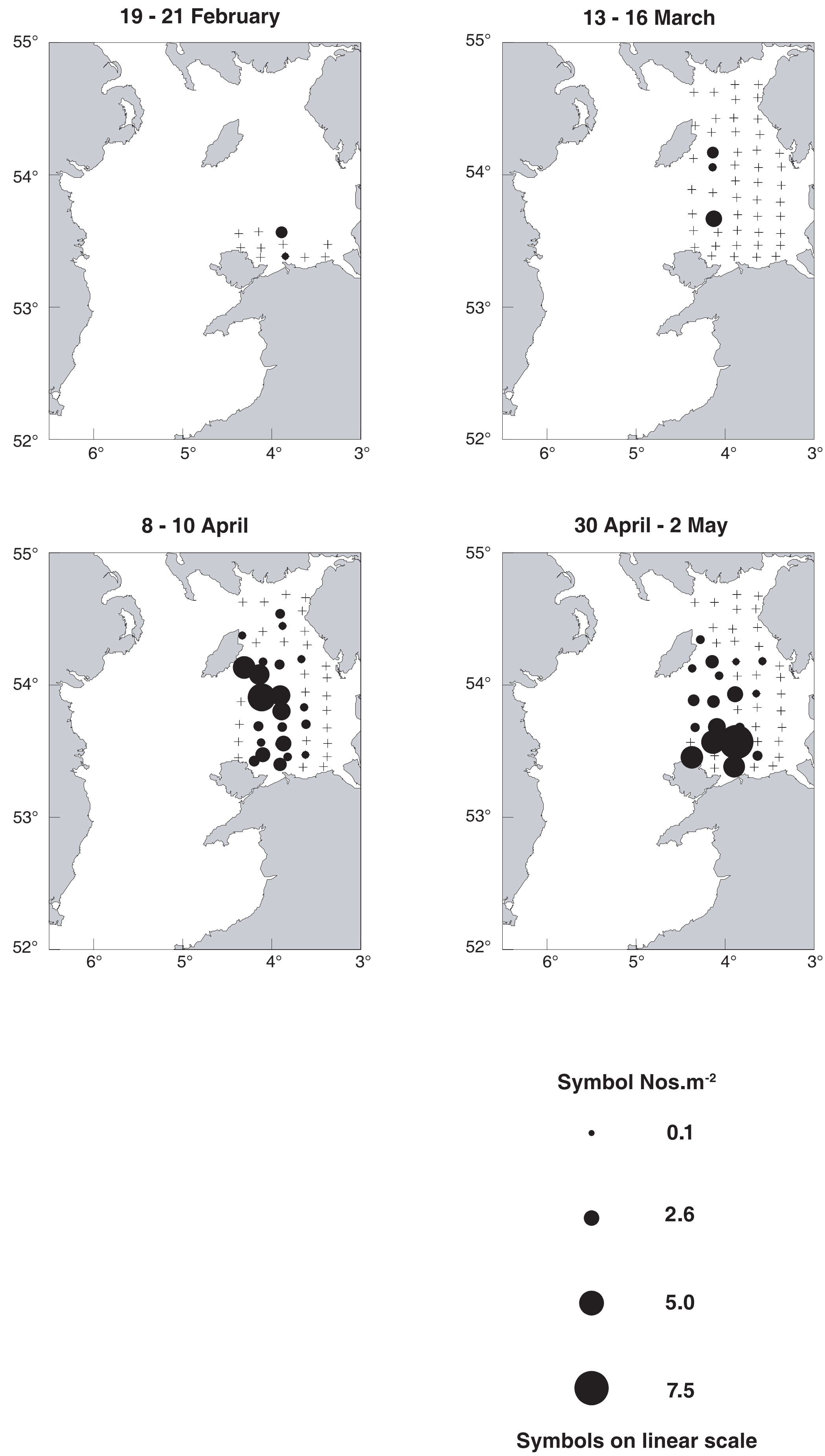


Figure 56. Concentration of bib (Trisopterus luscus) larvae (nos.m^{-2}) in 2002

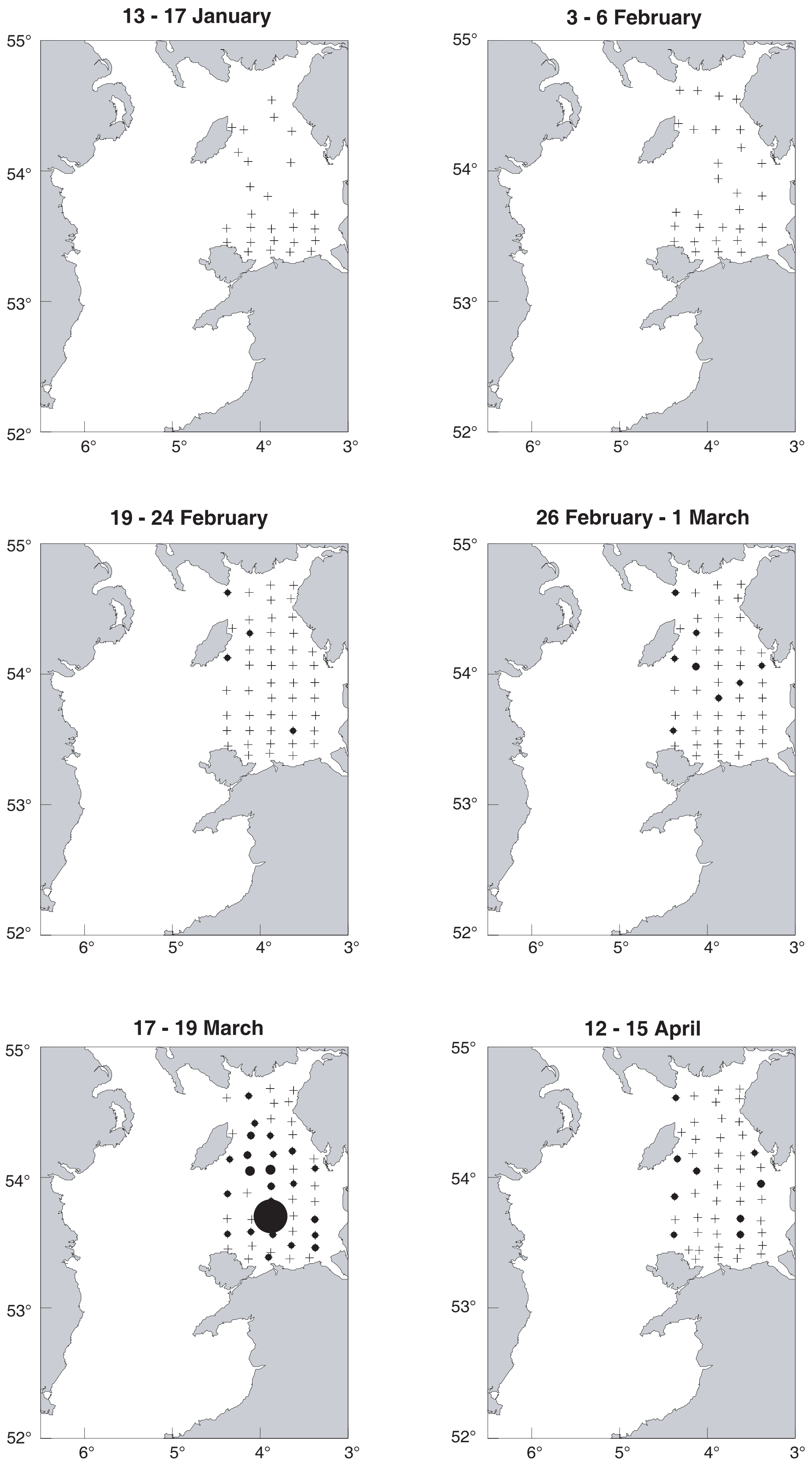
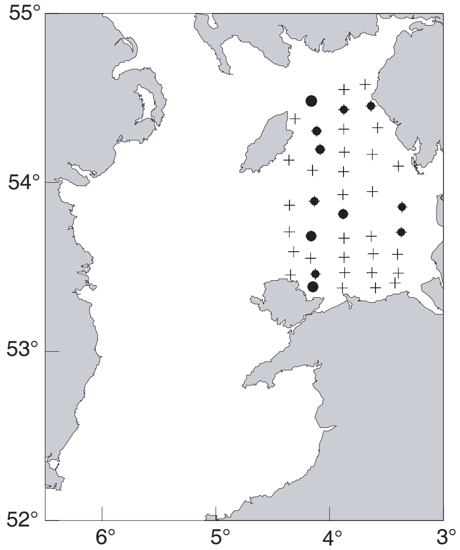


Figure 57. Concentration of bib (Trisopterus luscus) larvae (nos.m^{-2}) in 2003

28 - 30 April



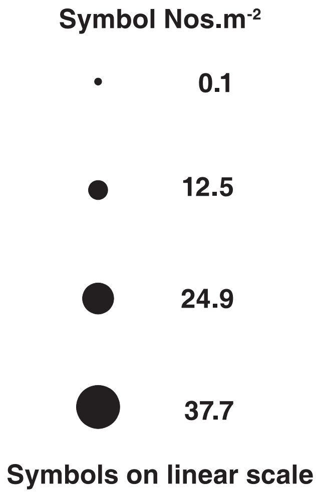


Figure 57. continued

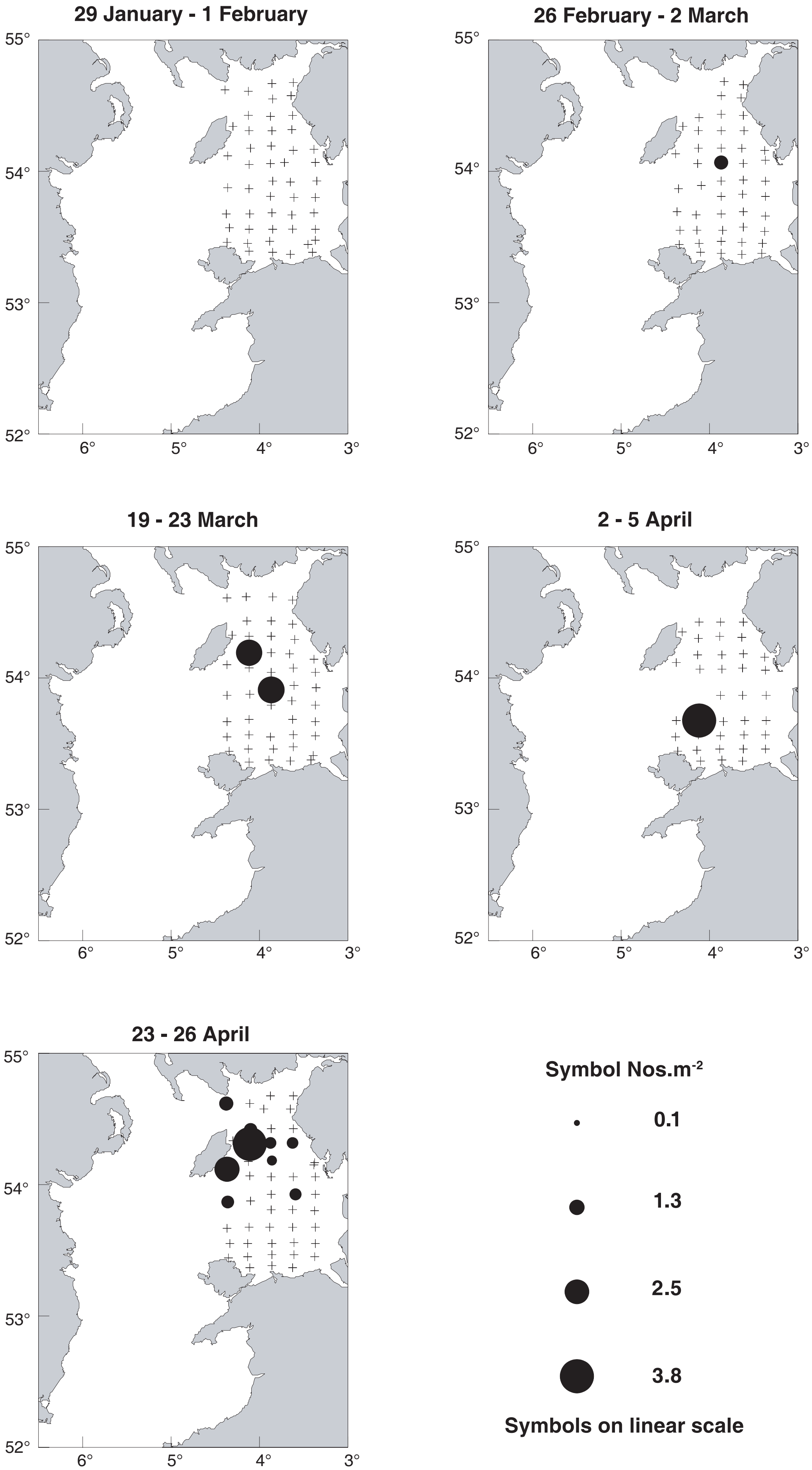


Figure 58. Concentration of pollack (Pollachius pollachius) larvae (nos.m^{-2}) in 2001

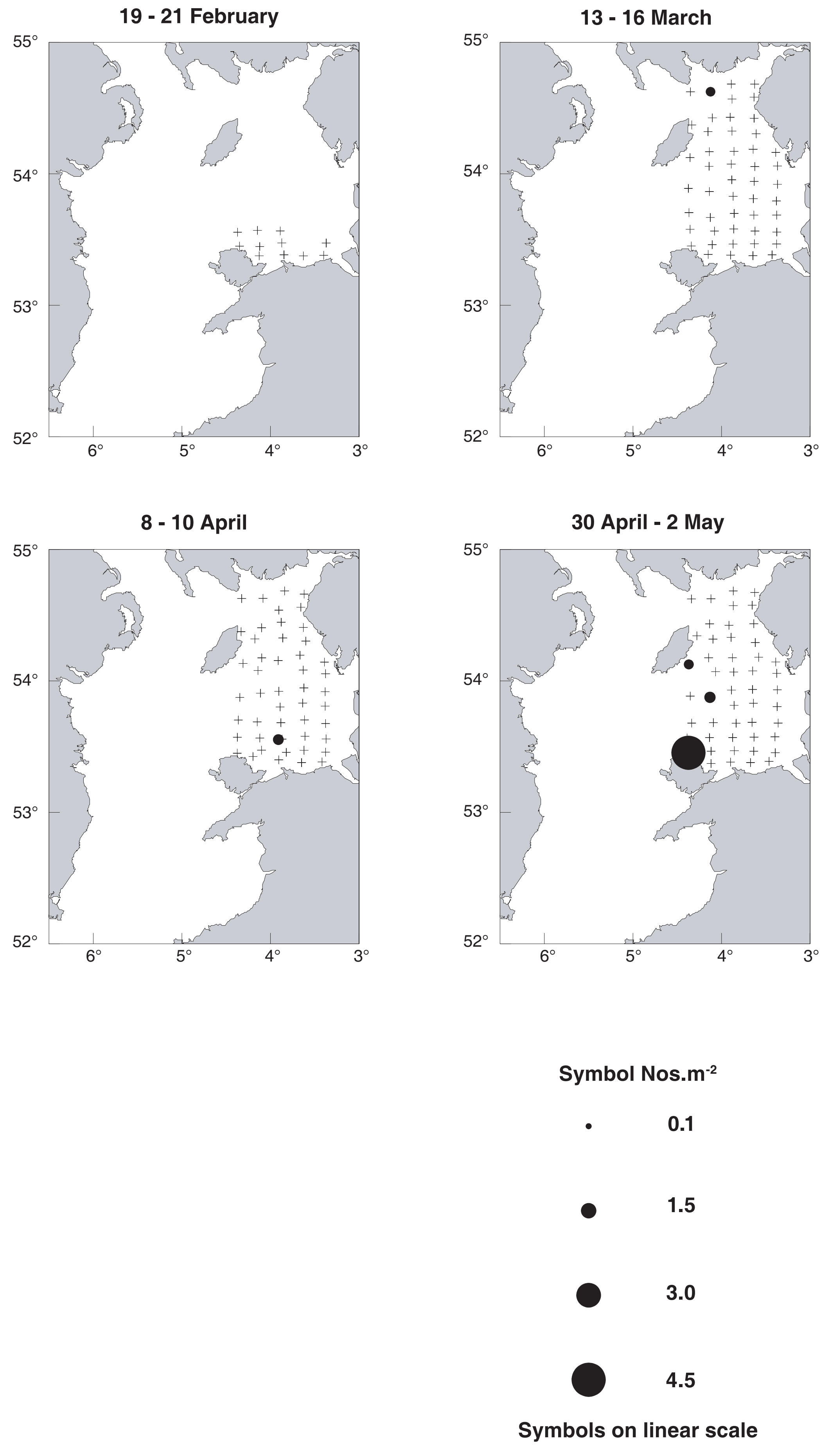


Figure 59. Concentration of pollack (Pollachius pollachius) larvae (nos.m^{-2}) in 2002

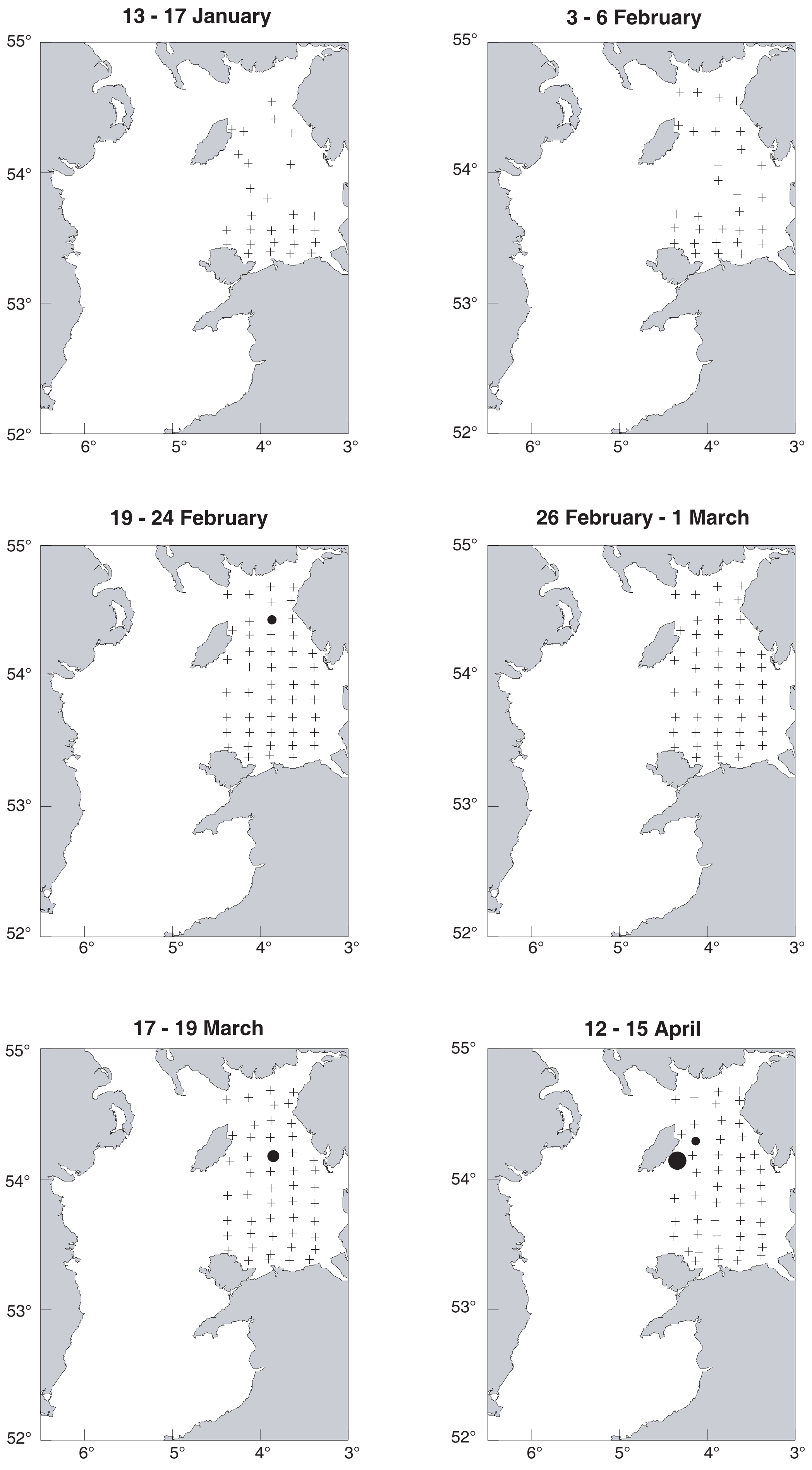


Figure 60. Concentration of pollack (Pollachius pollachius) larvae (nos.m⁻²) in 2003

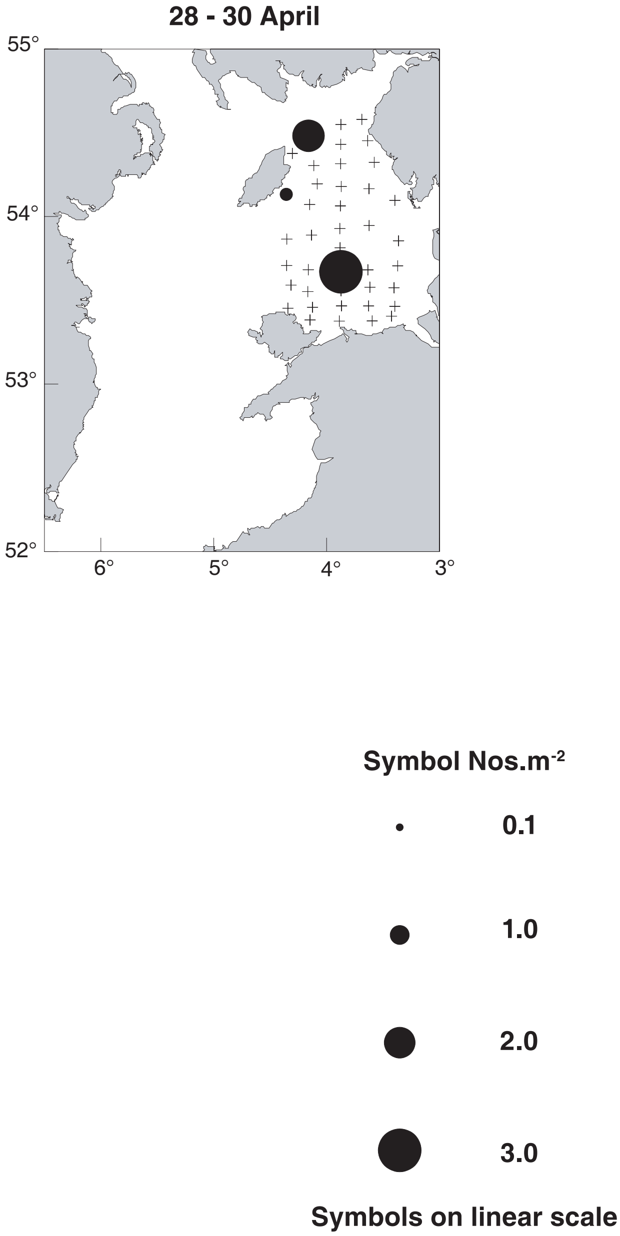


Figure 60. continued

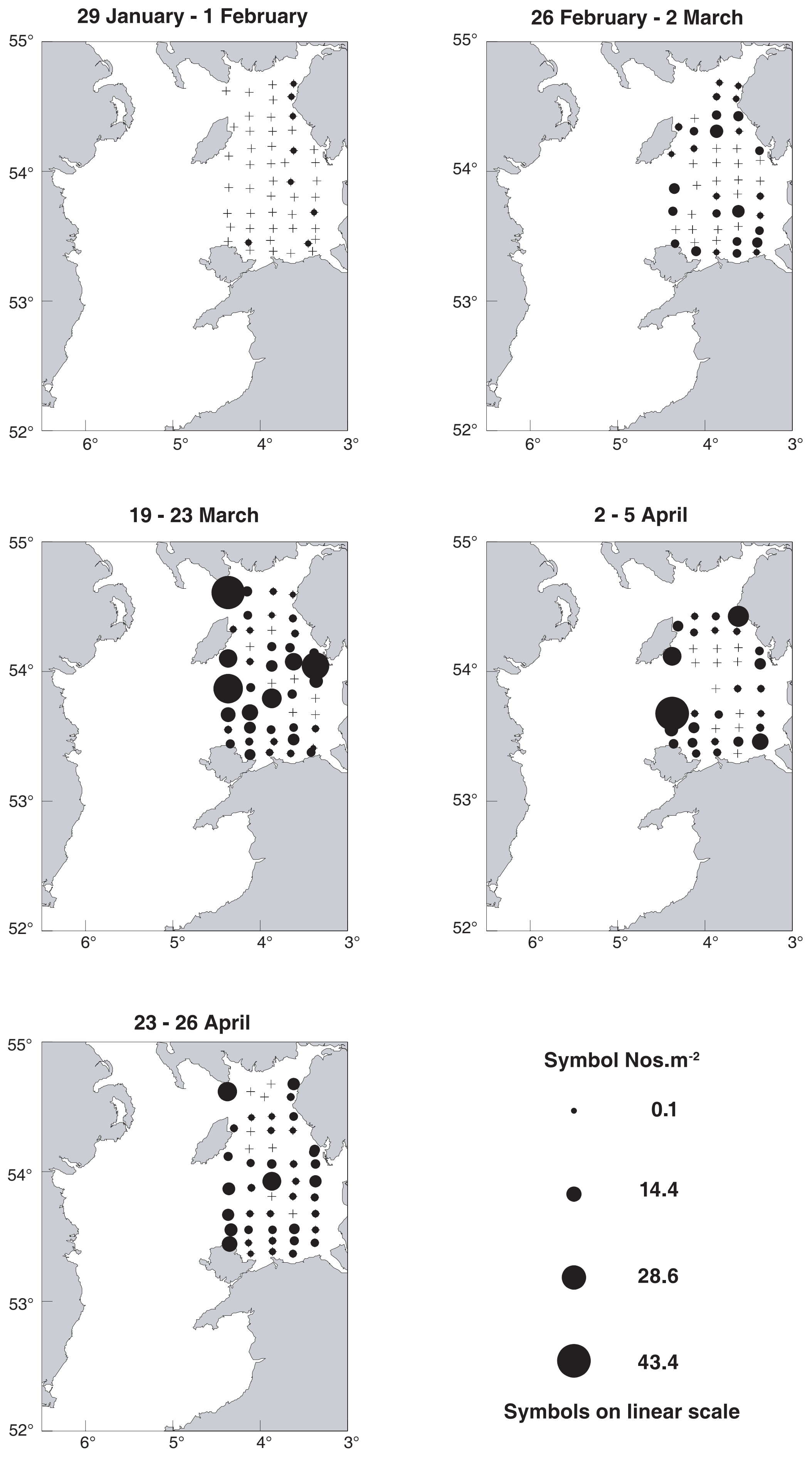


Figure 61. Concentration of rockling (Gadidae) eggs (nos.m^{-2}) in 2001

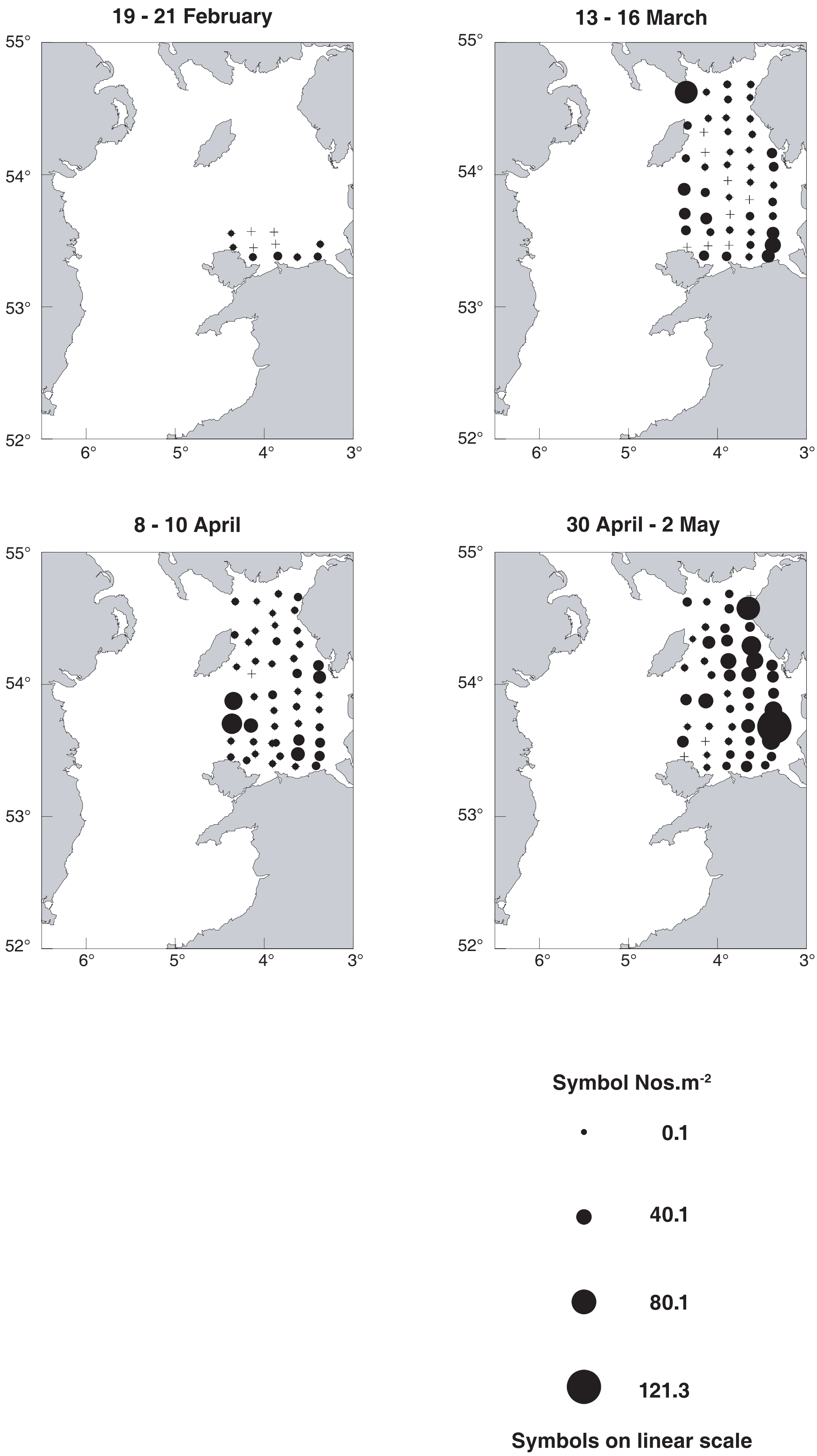


Figure 62. Concentration of rockling (Gadidae) eggs (nos.m⁻²) in 2002

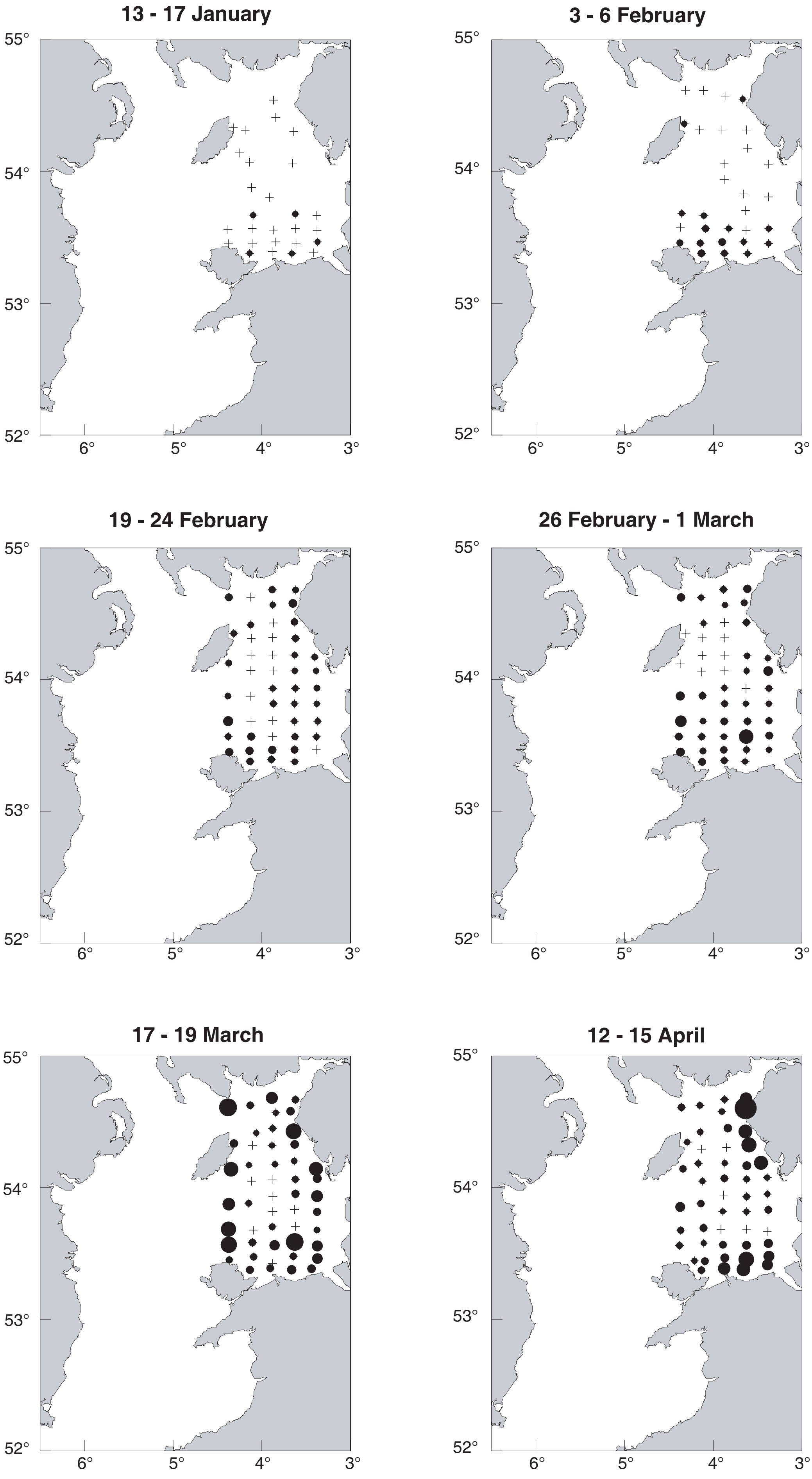
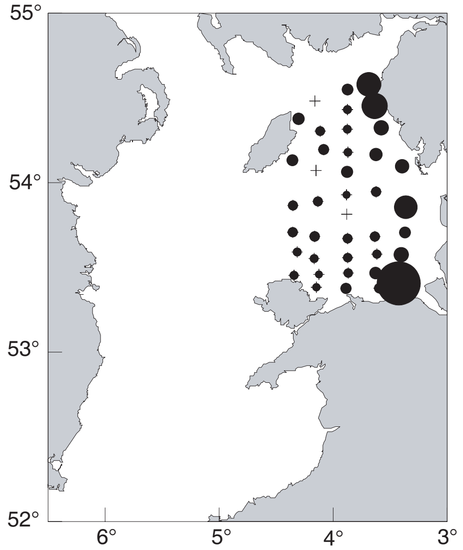


Figure 63. Concentration of rockling (Gadidae) eggs (nos.m^{-2}) in 2003

28 - 30 April



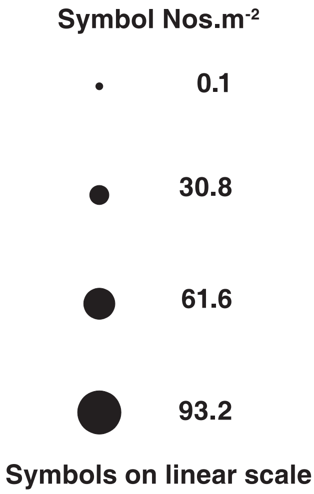


Figure 63. continued

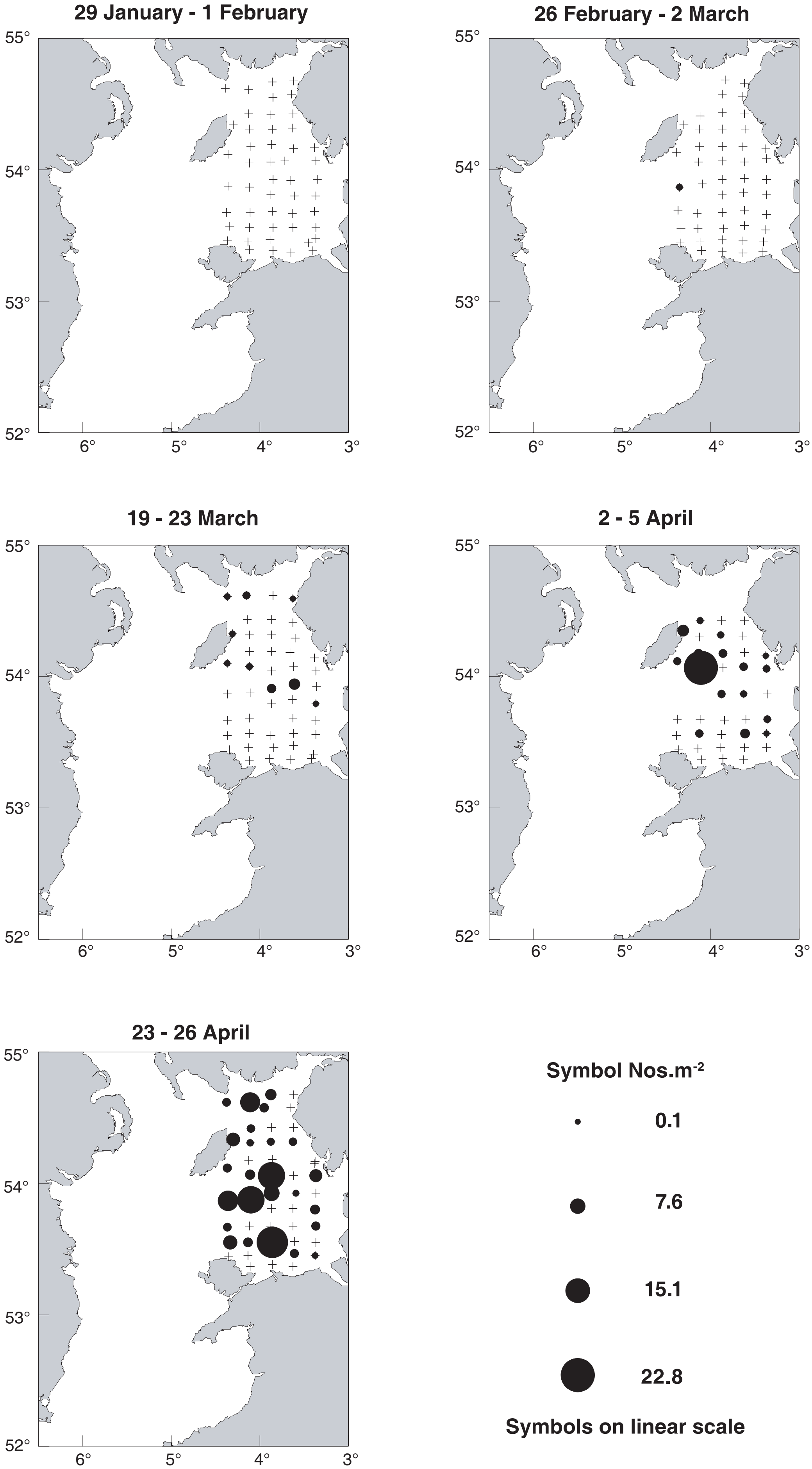


Figure 64. Concentration of rockling (Gadidae) larvae (nos.m⁻²) in 2001

Figure 65. Concentration of rockling (Gadidae) larvae (nos.m^{-2}) in 2002

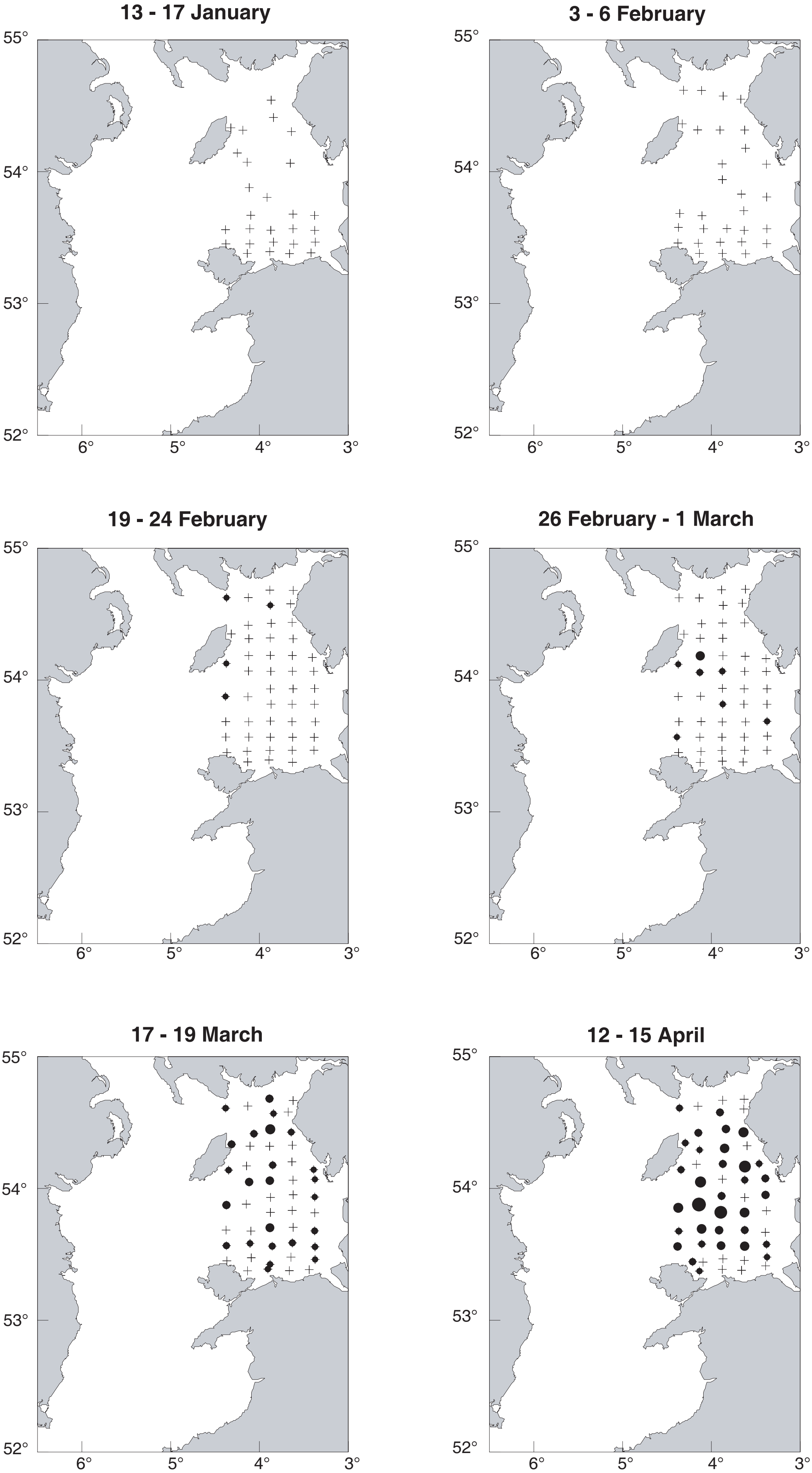


Figure 66. Concentration of rockling (Gadidae) larvae (nos.m⁻²) in 2003

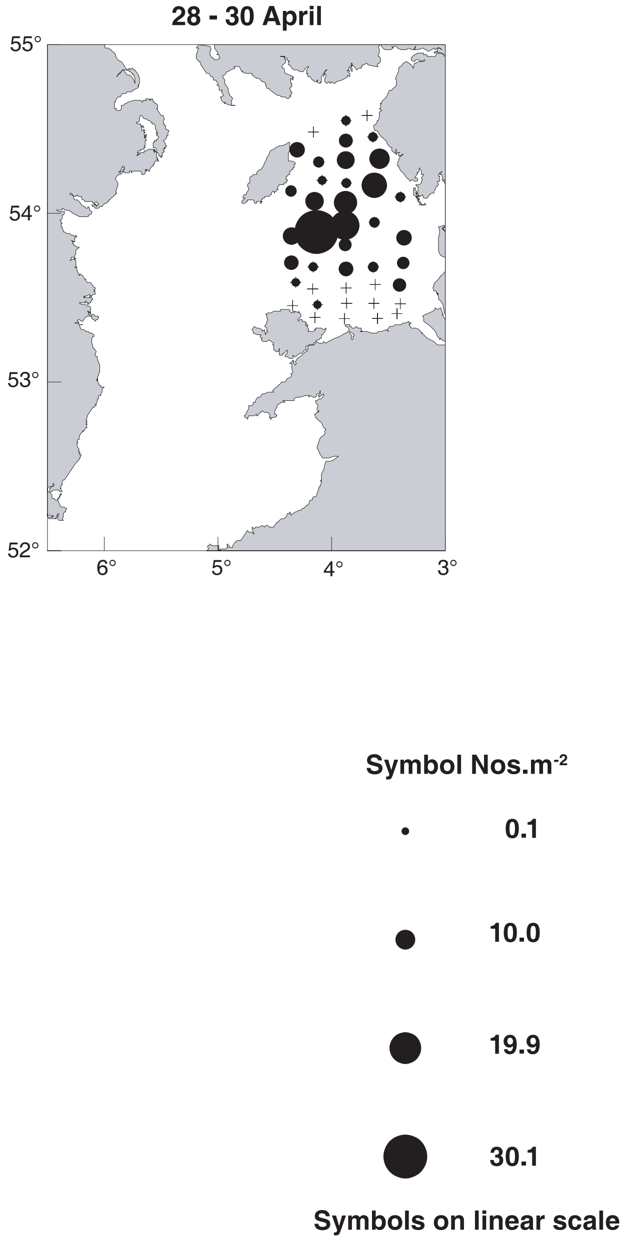


Figure 66. continued

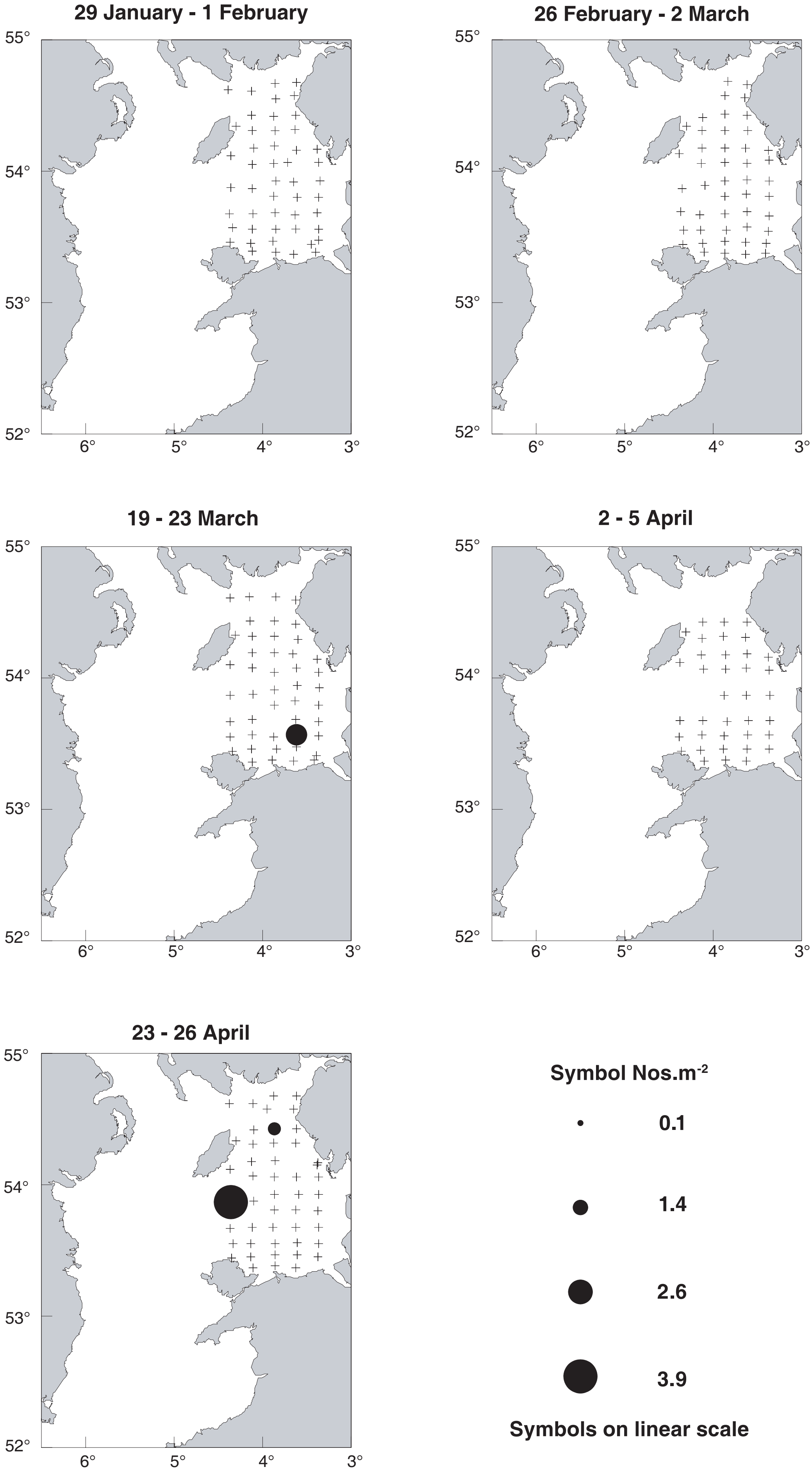


Figure 67. Concentration of ling (Molva molva) eggs (nos.m^{-2}) in 2001

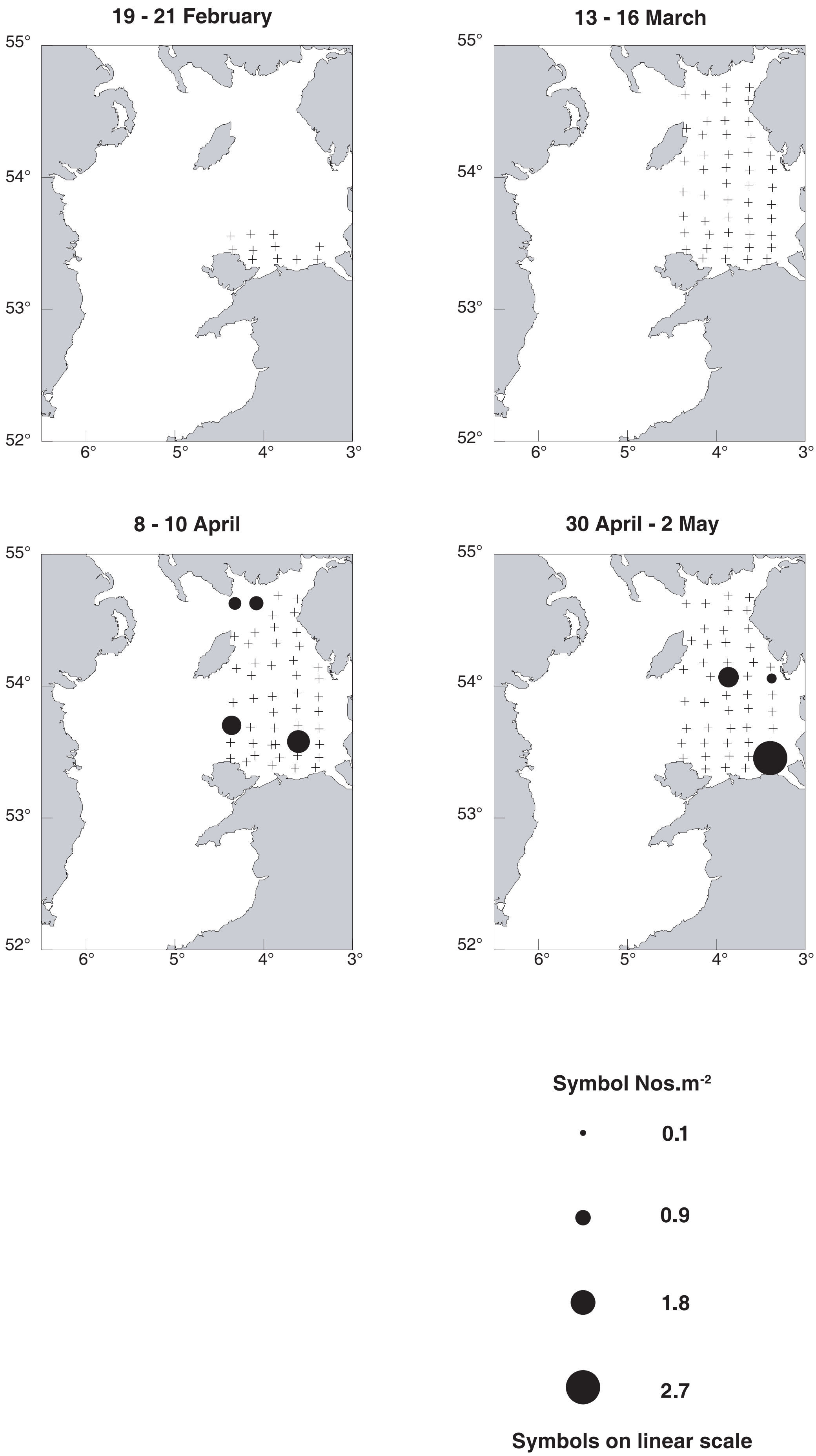


Figure 68. Concentration of ling (Molva molva) eggs (nos.m^{-2}) in 2002

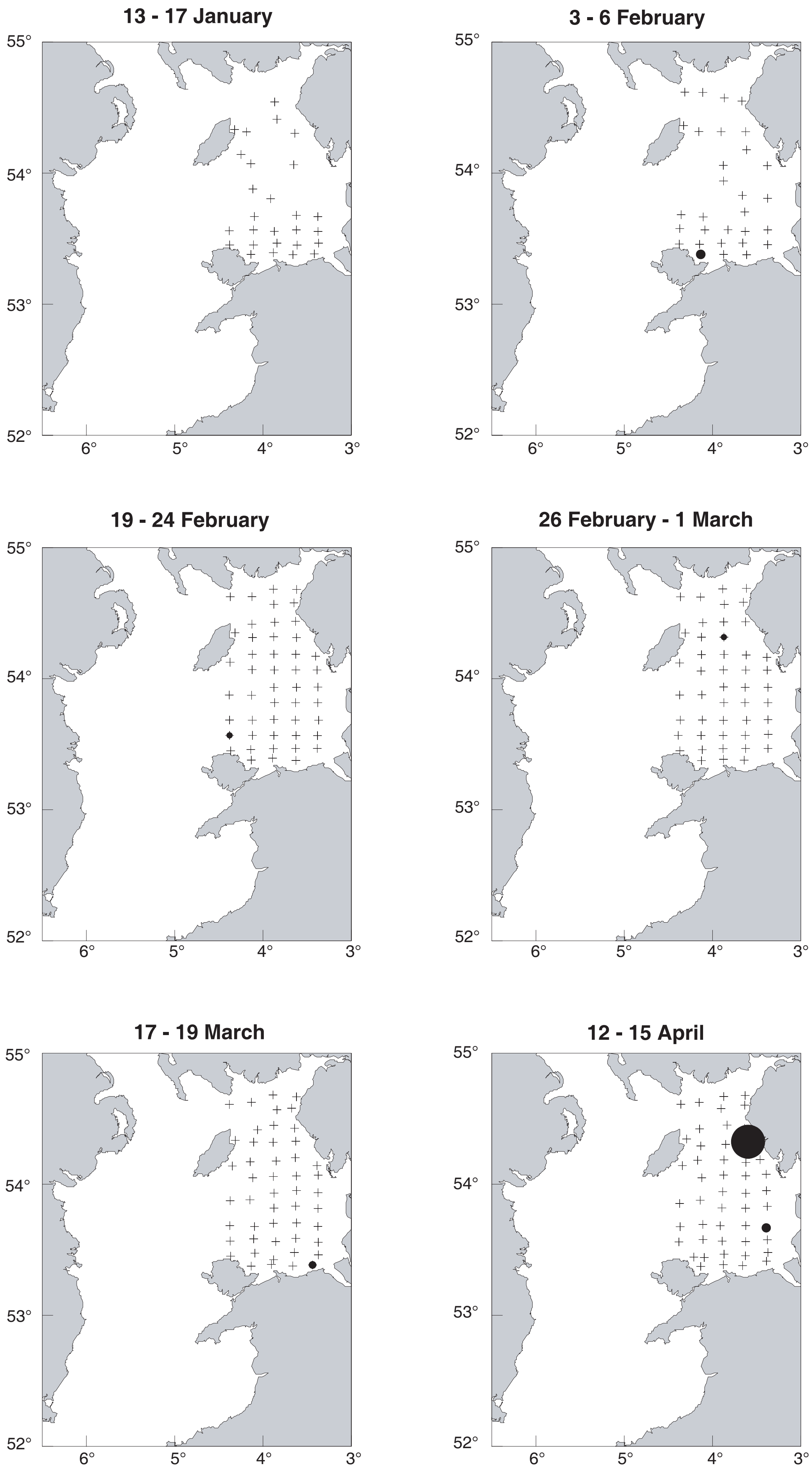


Figure 69. Concentration of ling (Molva molva) eggs (nos.m^{-2}) in 2003

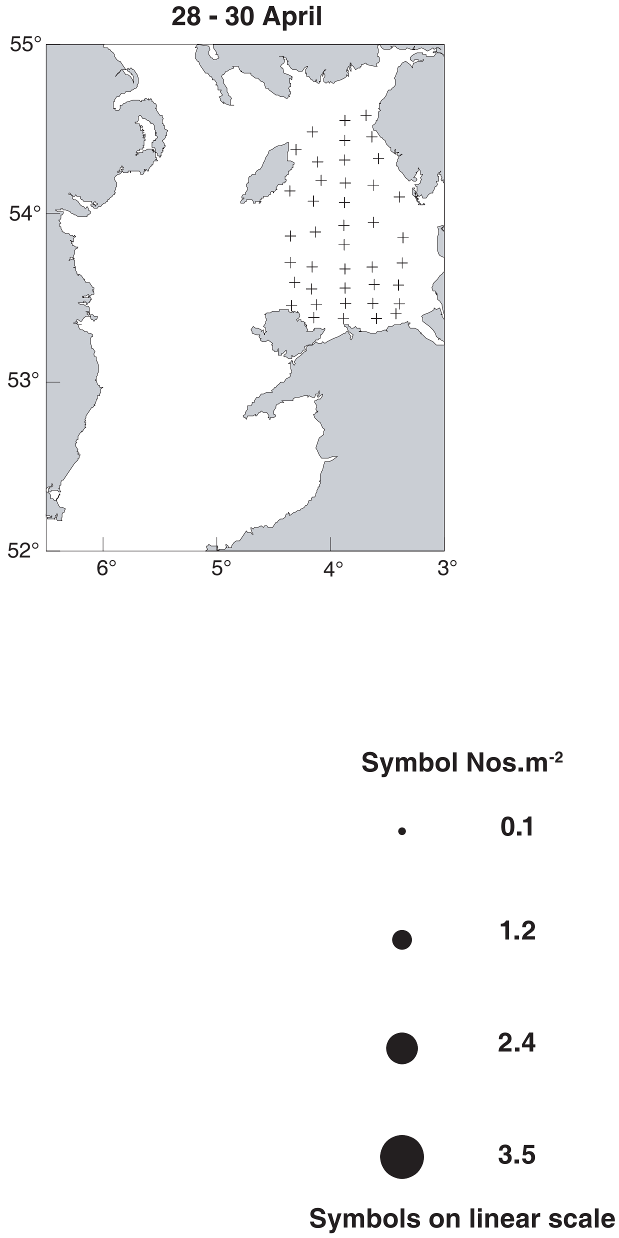


Figure 69. continued

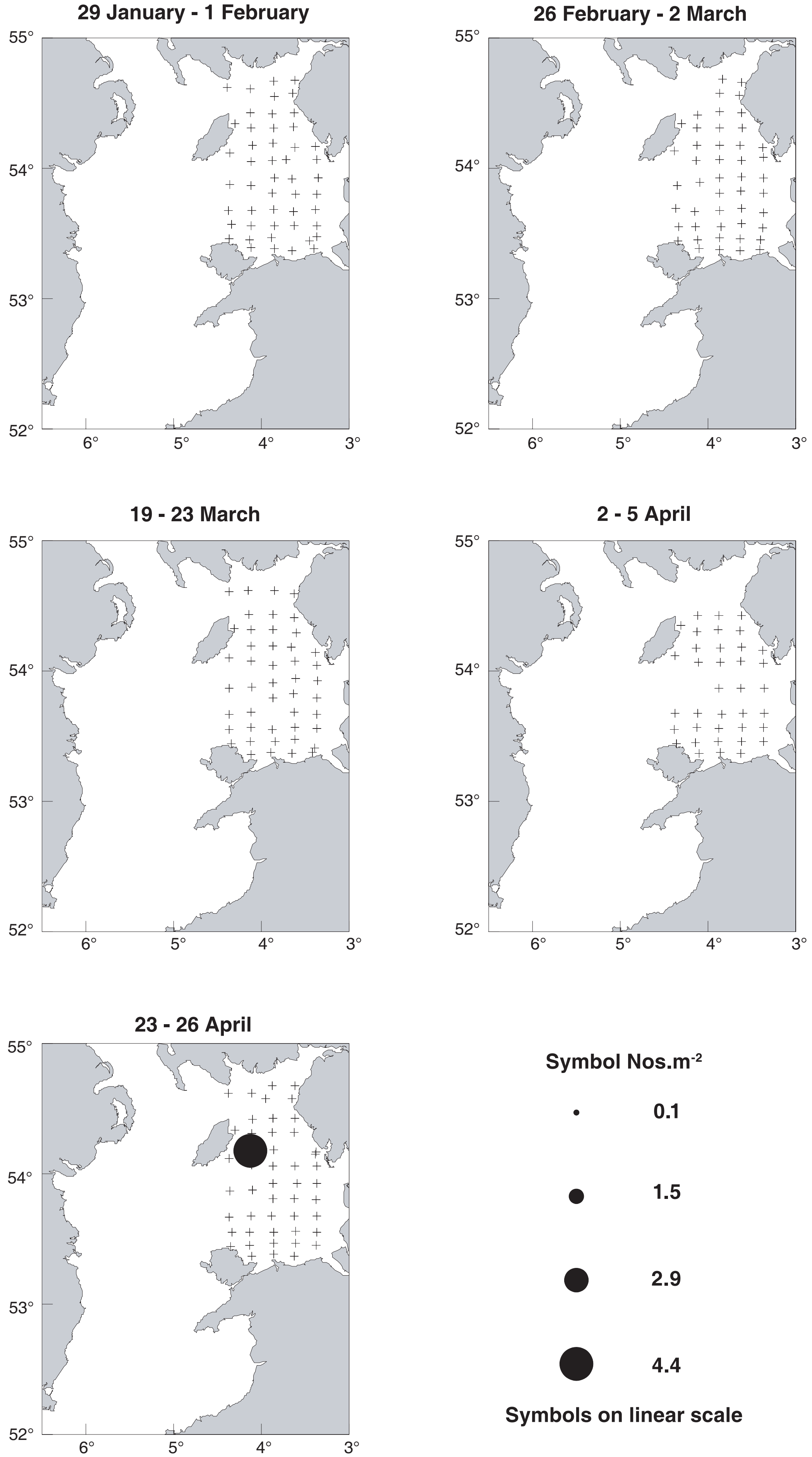


Figure 70. Concentration of ling (Molva molva) larvae (nos.m^{-2}) in 2001

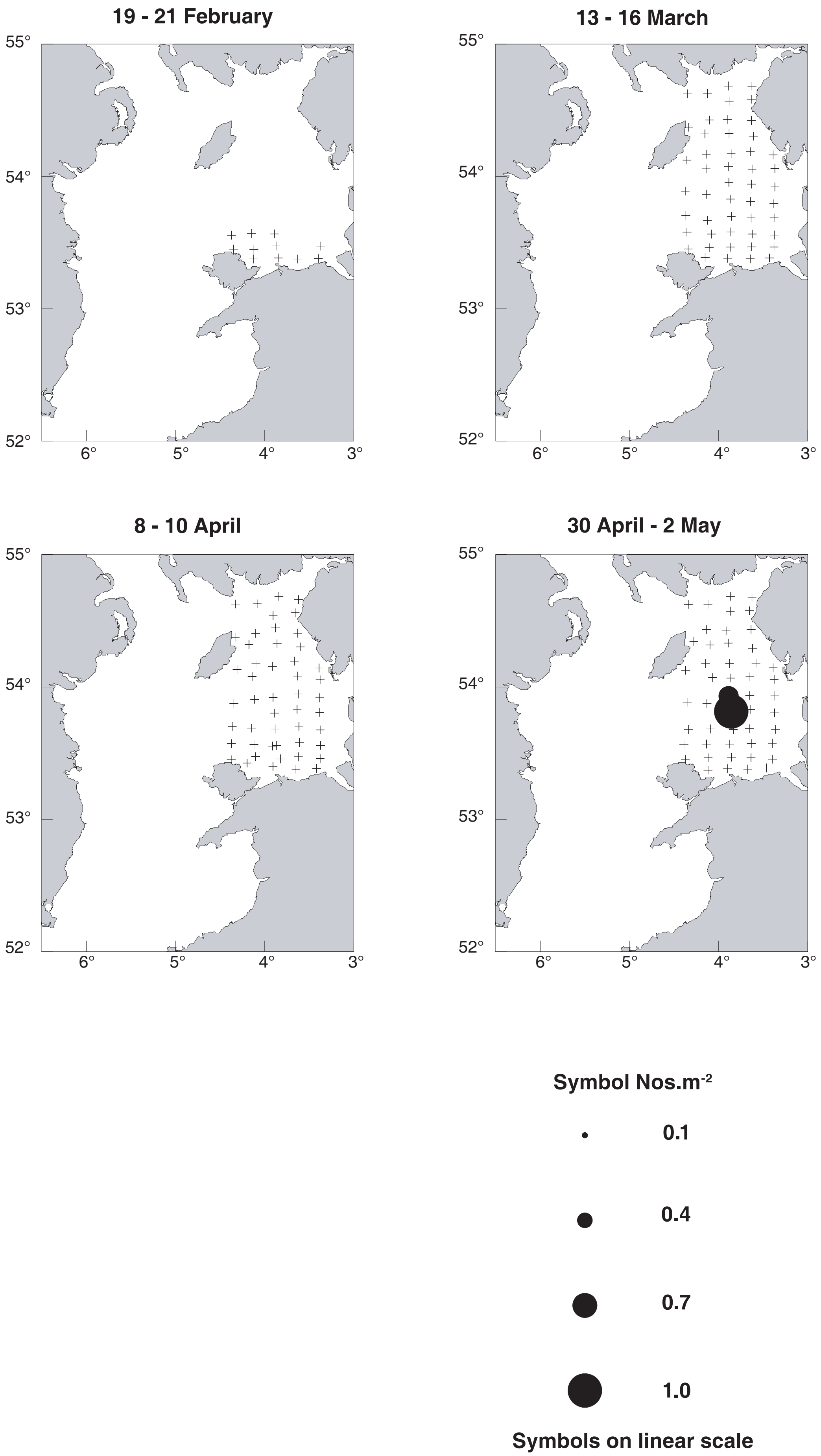


Figure 71. Concentration of ling (Molva molva) larvae (nos.m^{-2}) in 2002

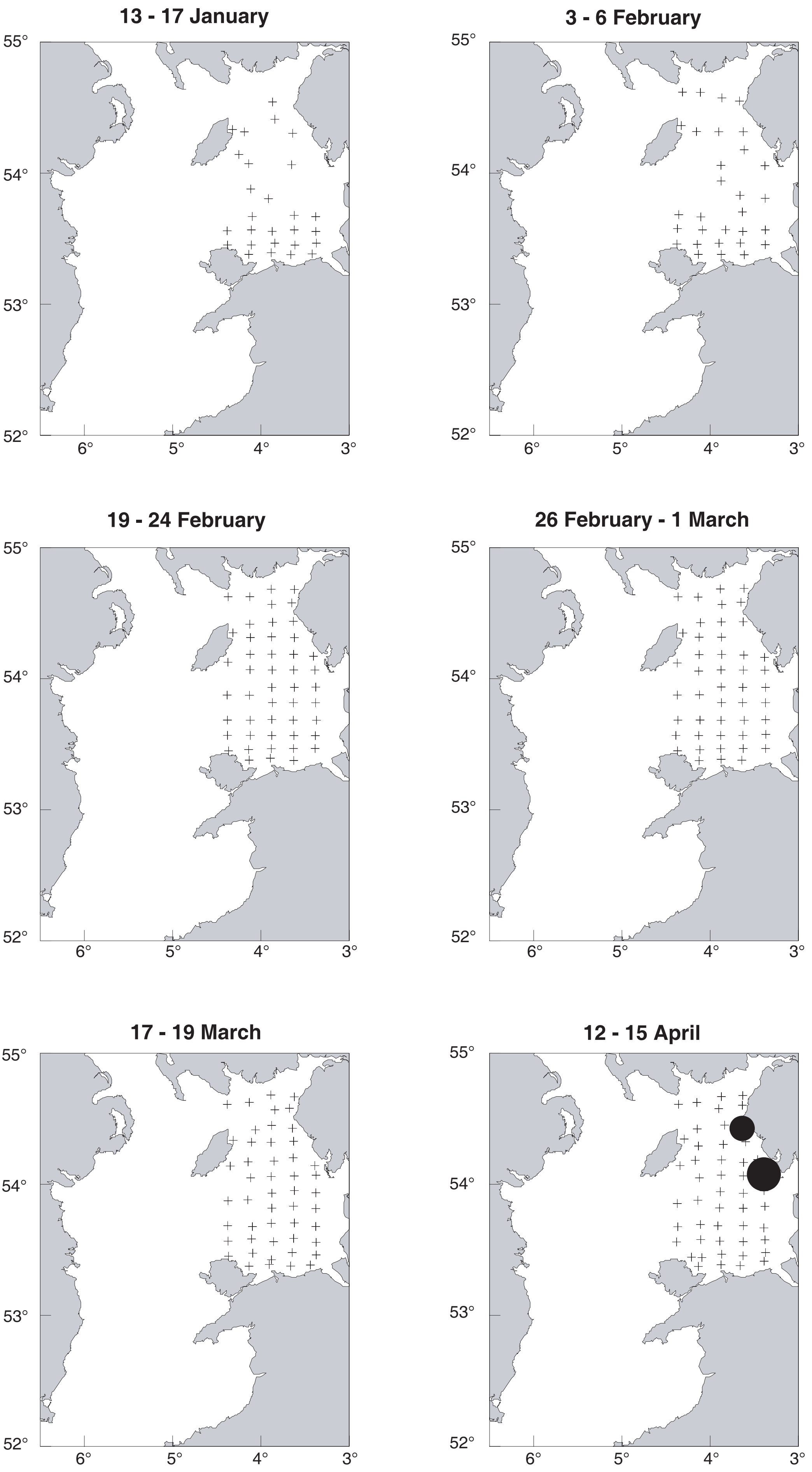


Figure 72. Concentration of ling (Molva molva) larvae (nos.m⁻²) in 2003

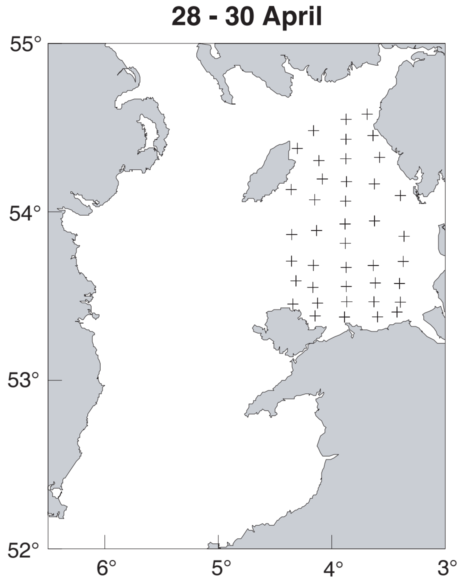


Figure 72. continued

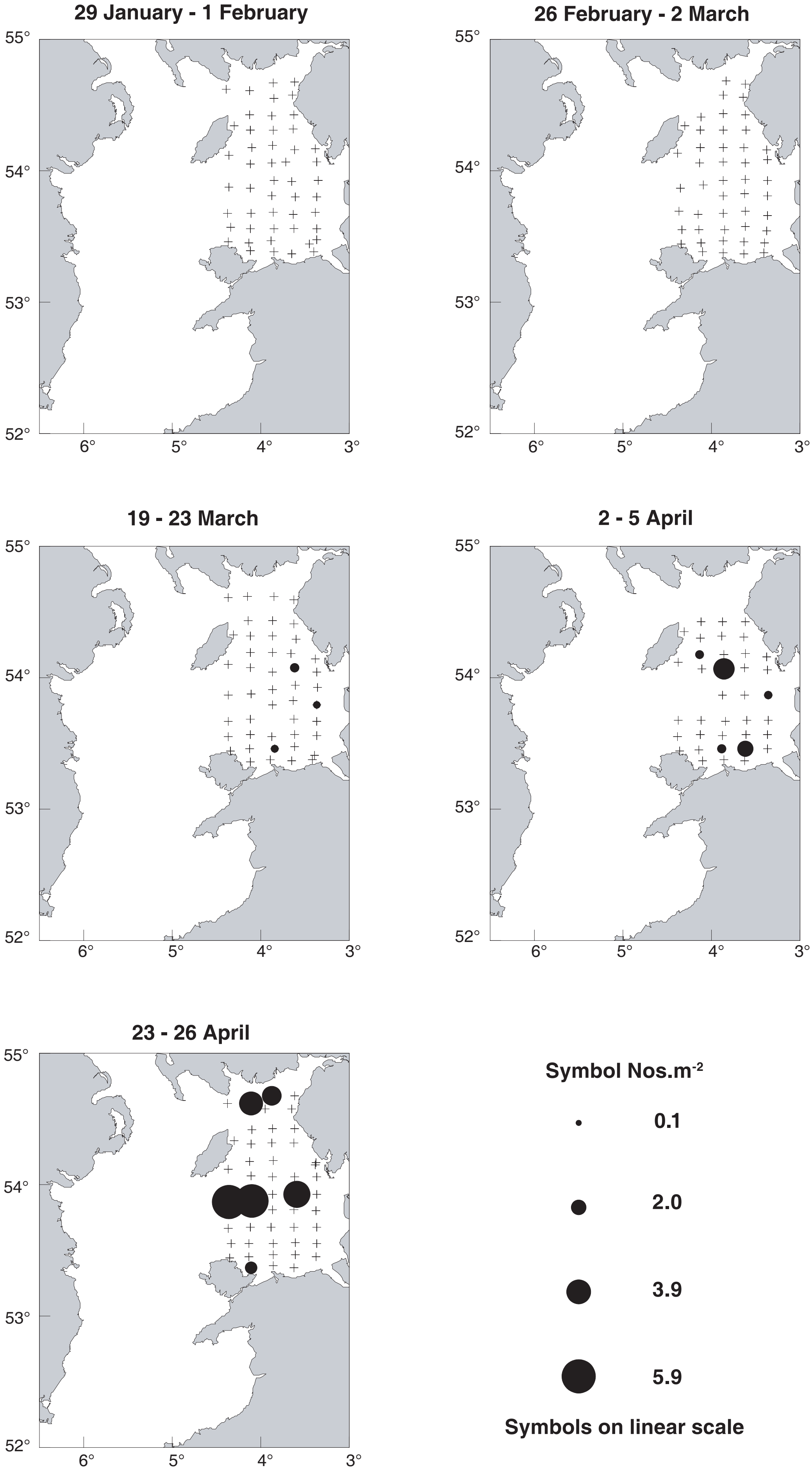


Figure 73. Concentration of gurnard (Triglidae) eggs (nos.m^{-2}) in 2001

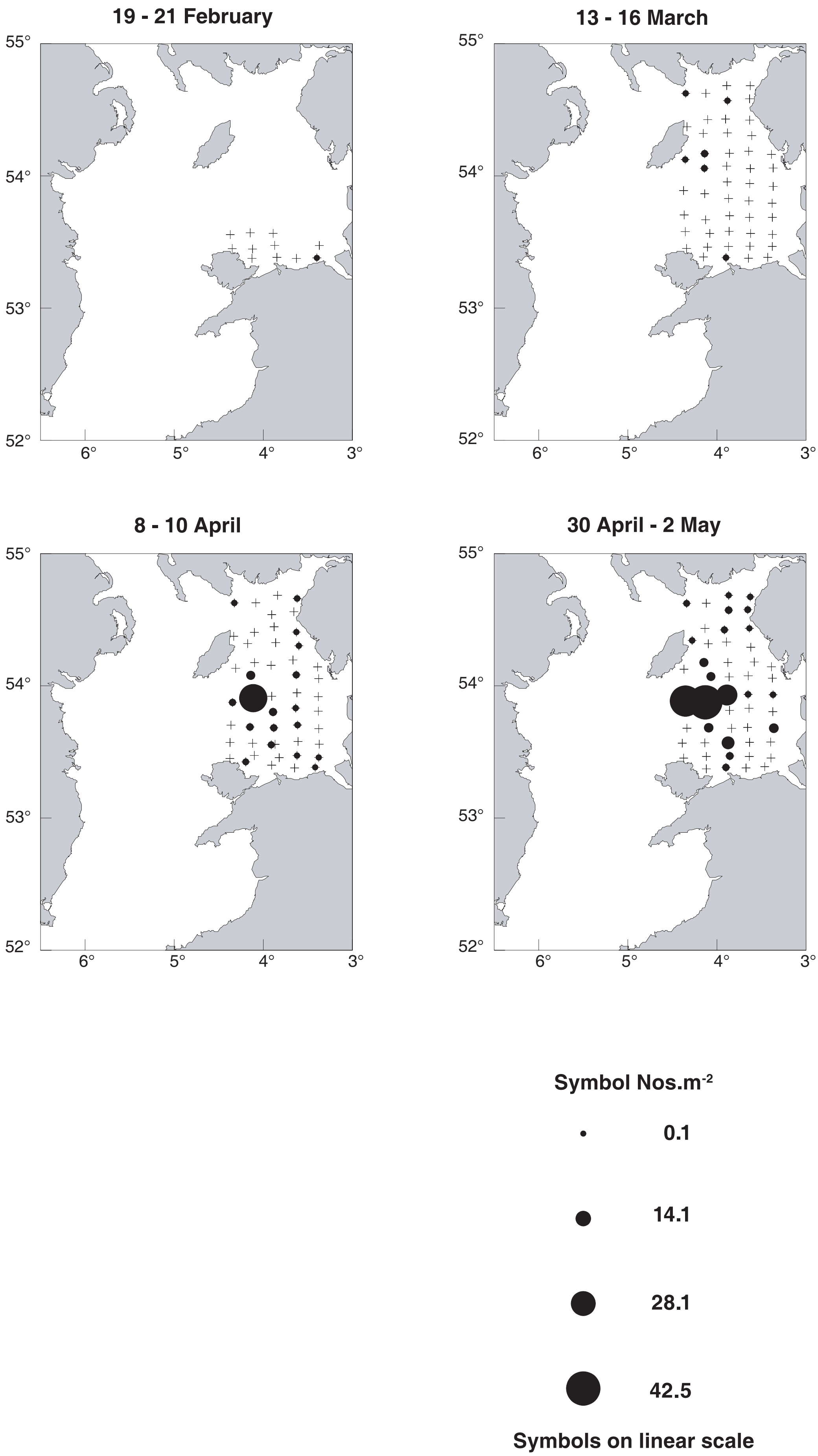


Figure 74. Concentration of gurnard (Triglidae) eggs (nos.m^{-2}) in 2002

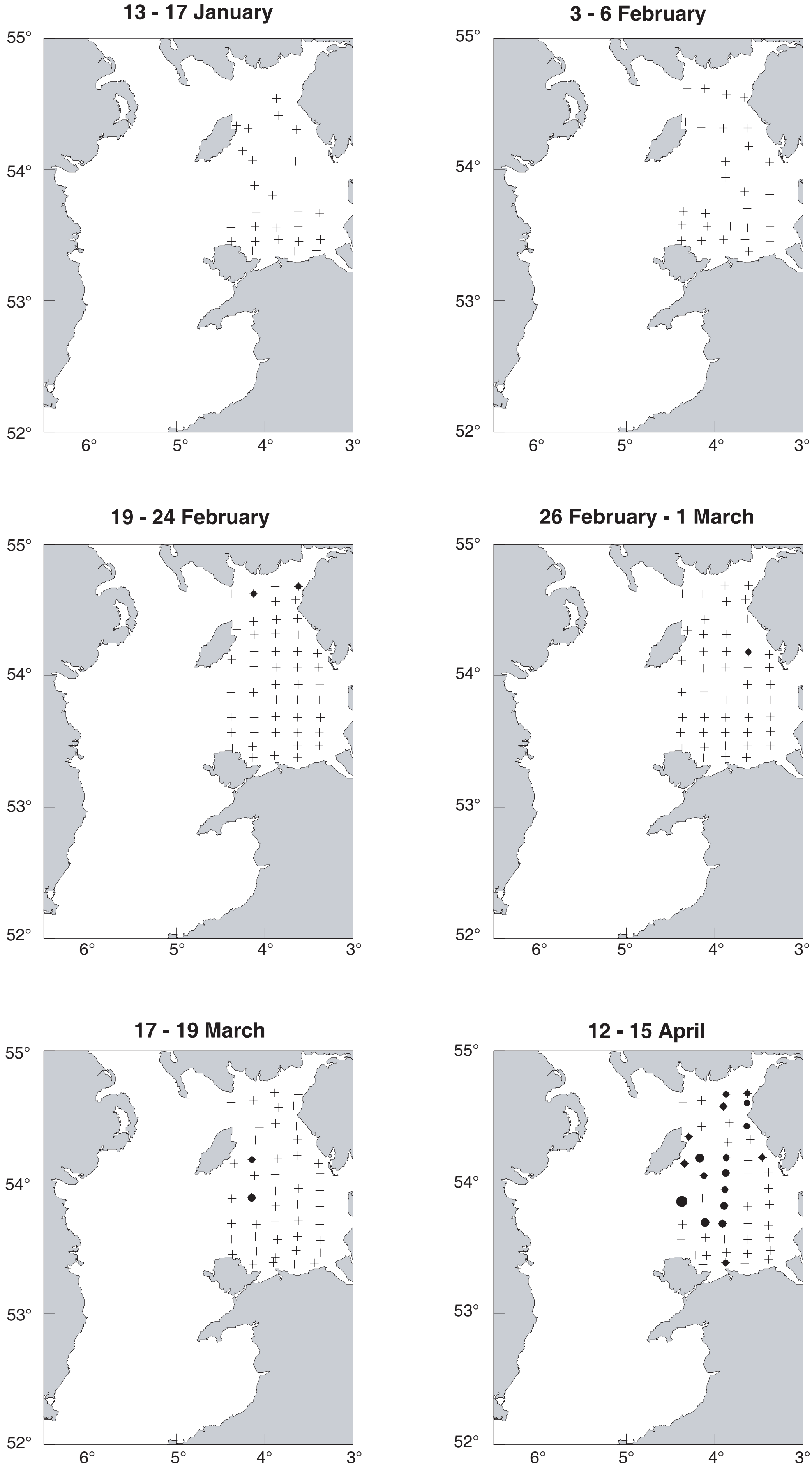
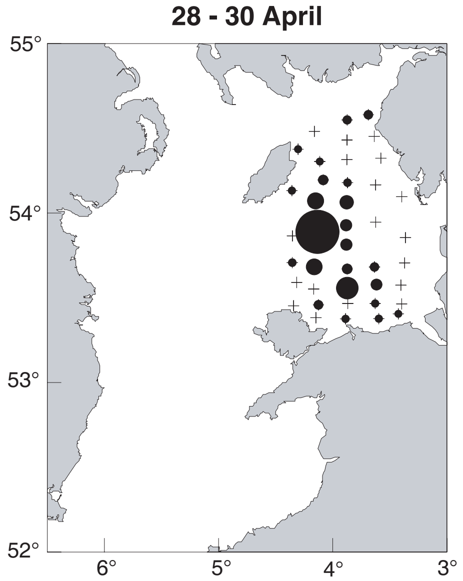


Figure 75. Concentration of gurnard (Triglidae) eggs (nos.m⁻²) in 2003



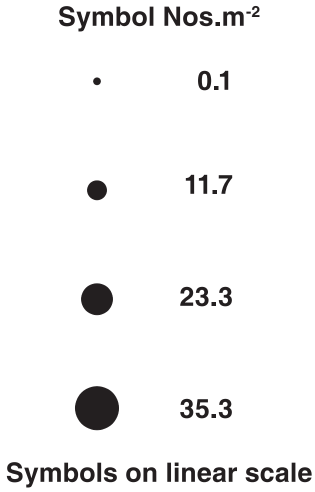


Figure 75. continued

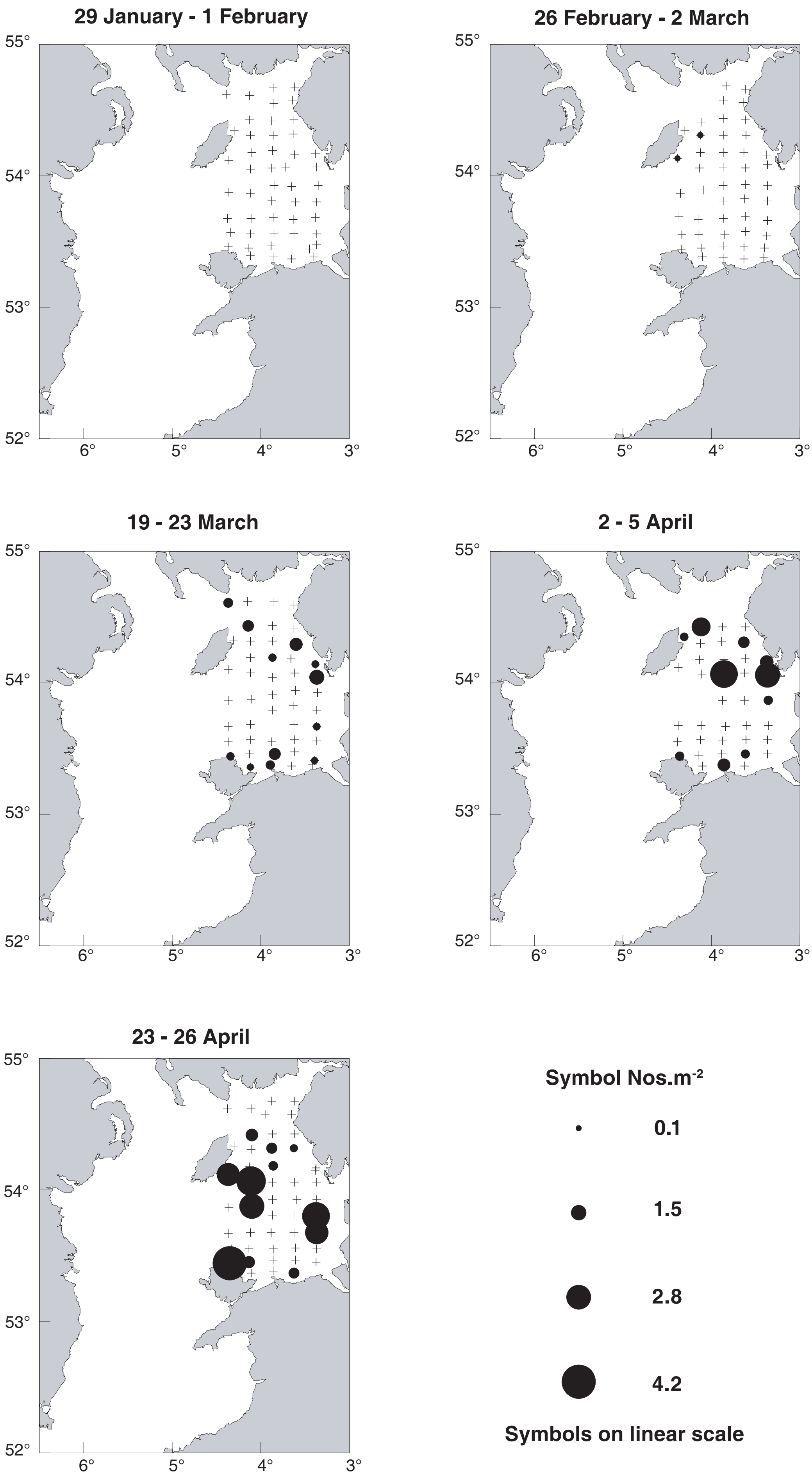


Figure 76. Concentration of Cottidae larvae (nos.m^{-2}) in 2001

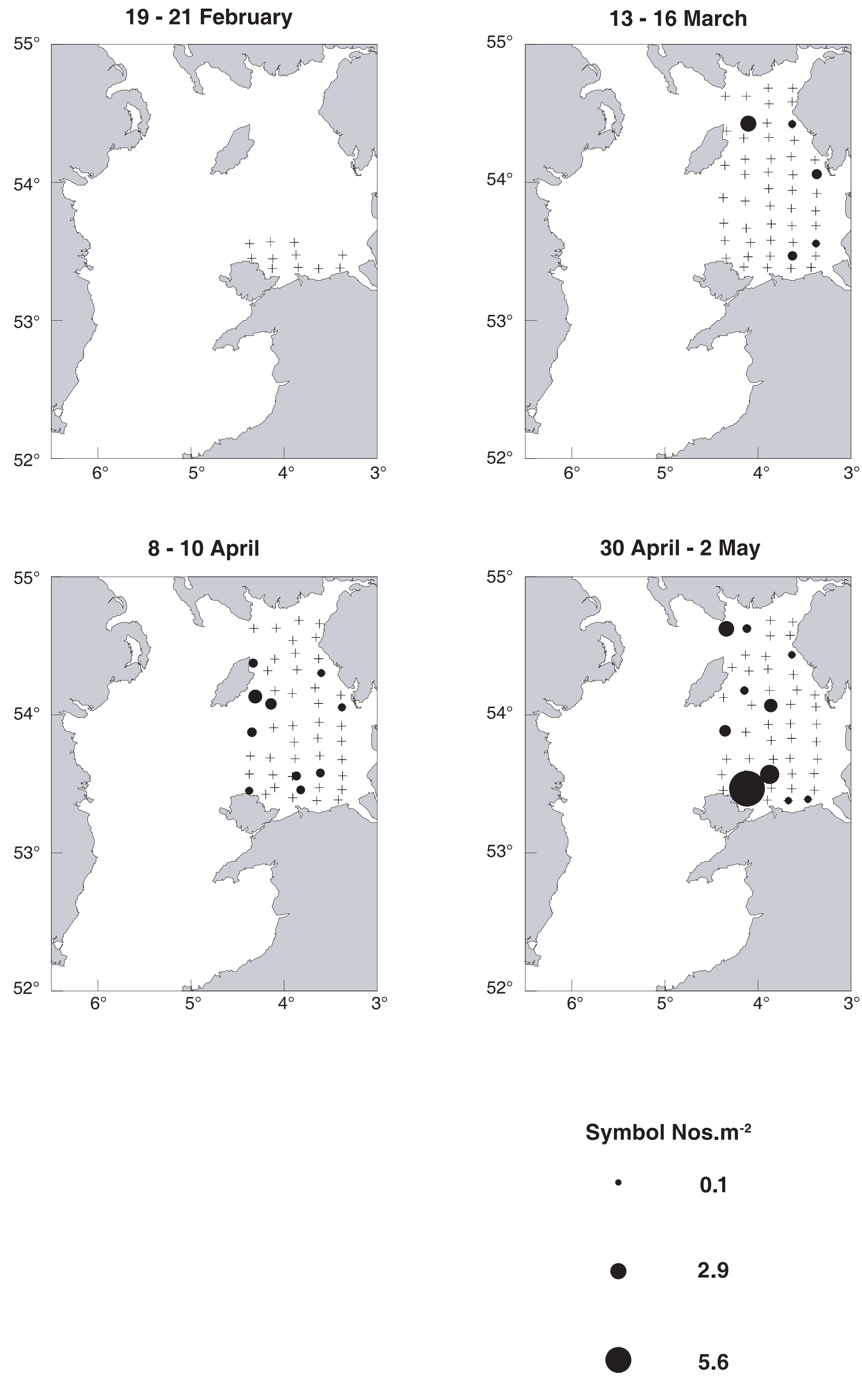


Figure 77. Concentration of Cottidae larvae (nos.m^{-2}) in 2002

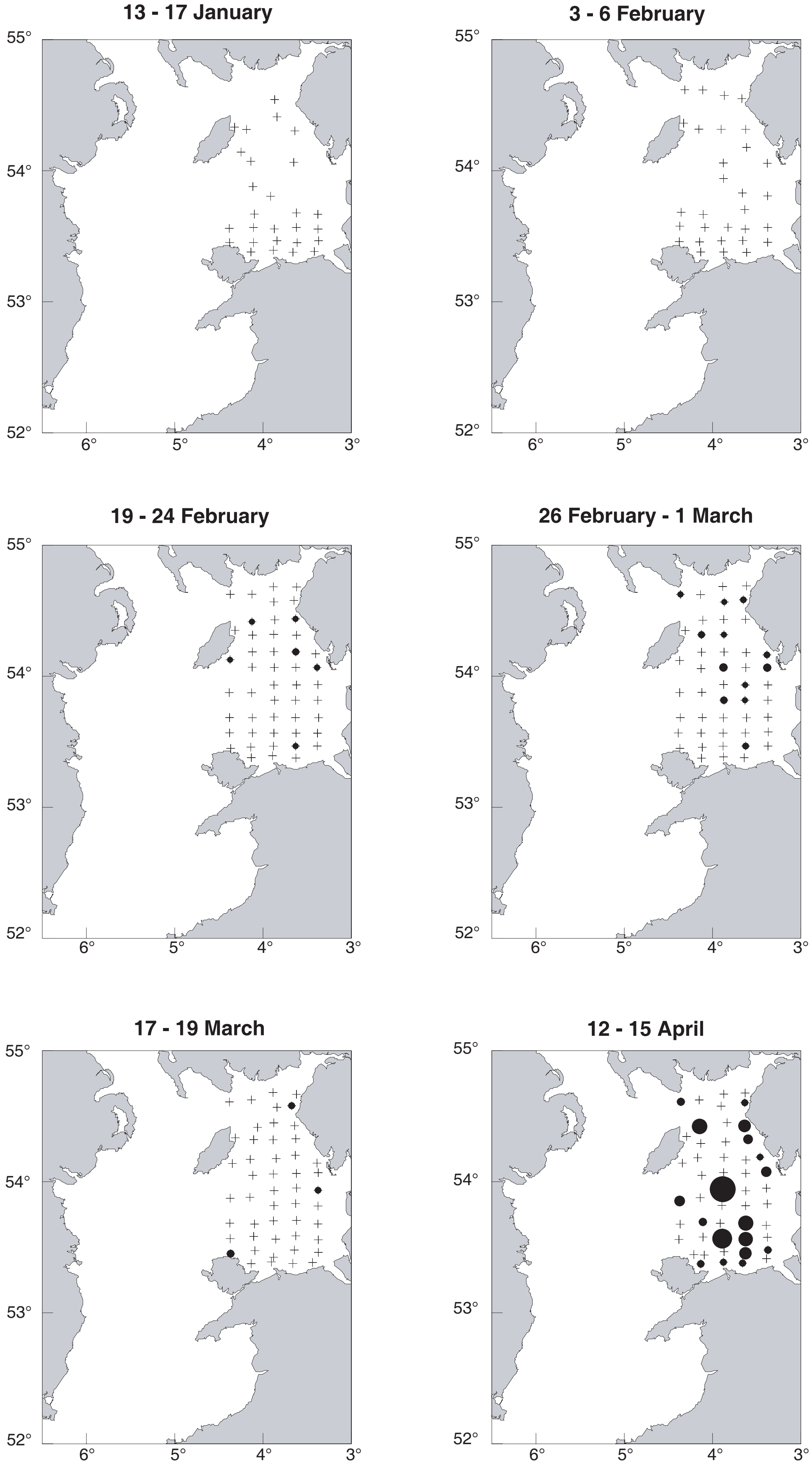
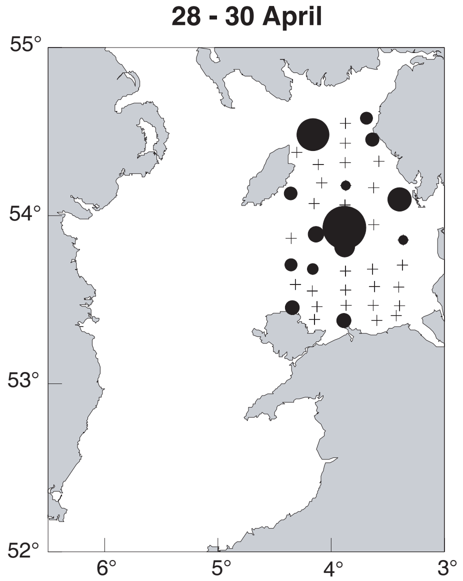


Figure 78. Concentration of Cottidae larvae (nos.m⁻²) in 2003



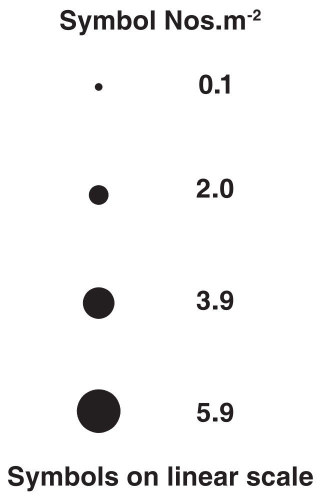


Figure 78. continued

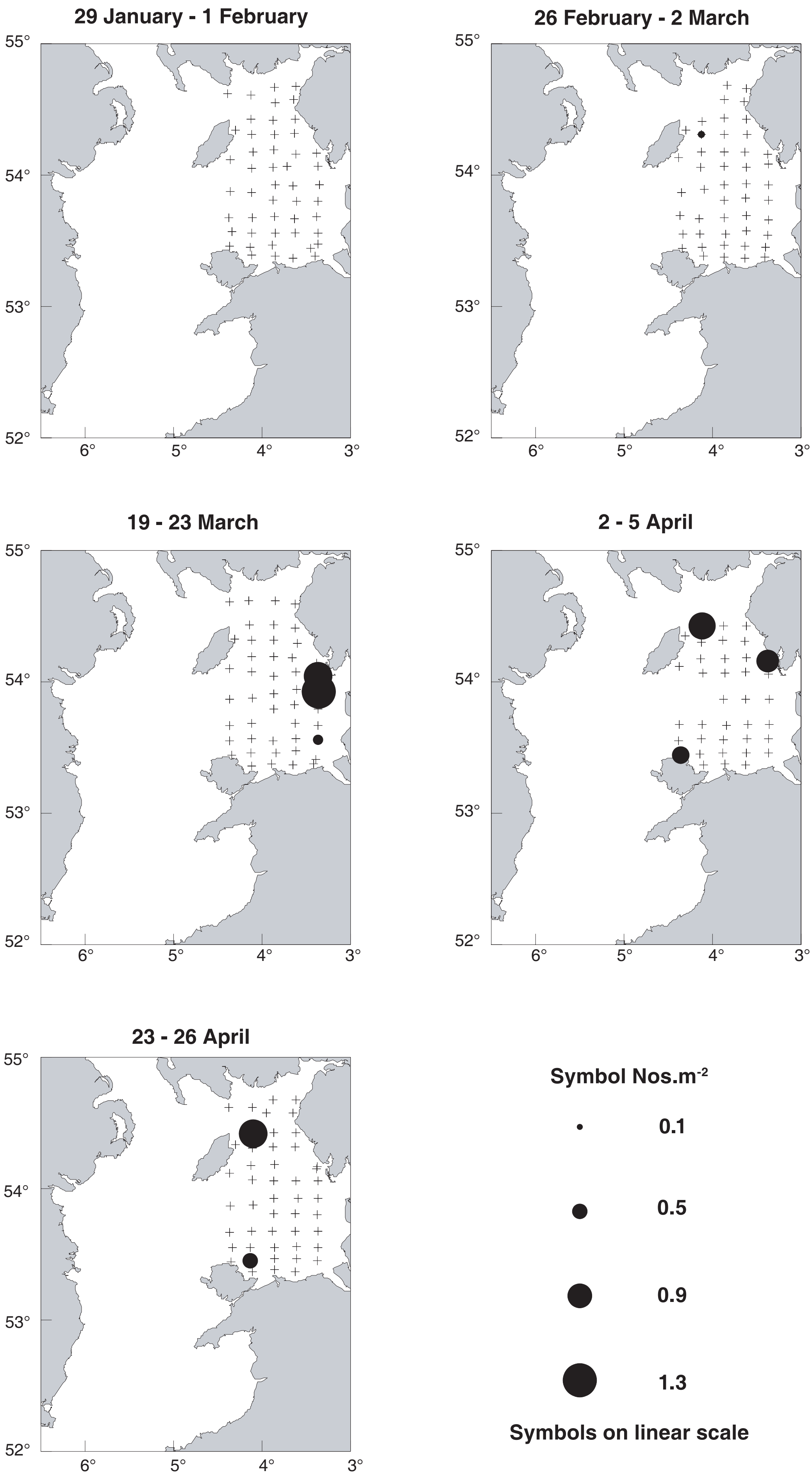


Figure 79. Concentration of pogge (Agonus cataphractus) larvae (nos.m^{-2}) in 2001

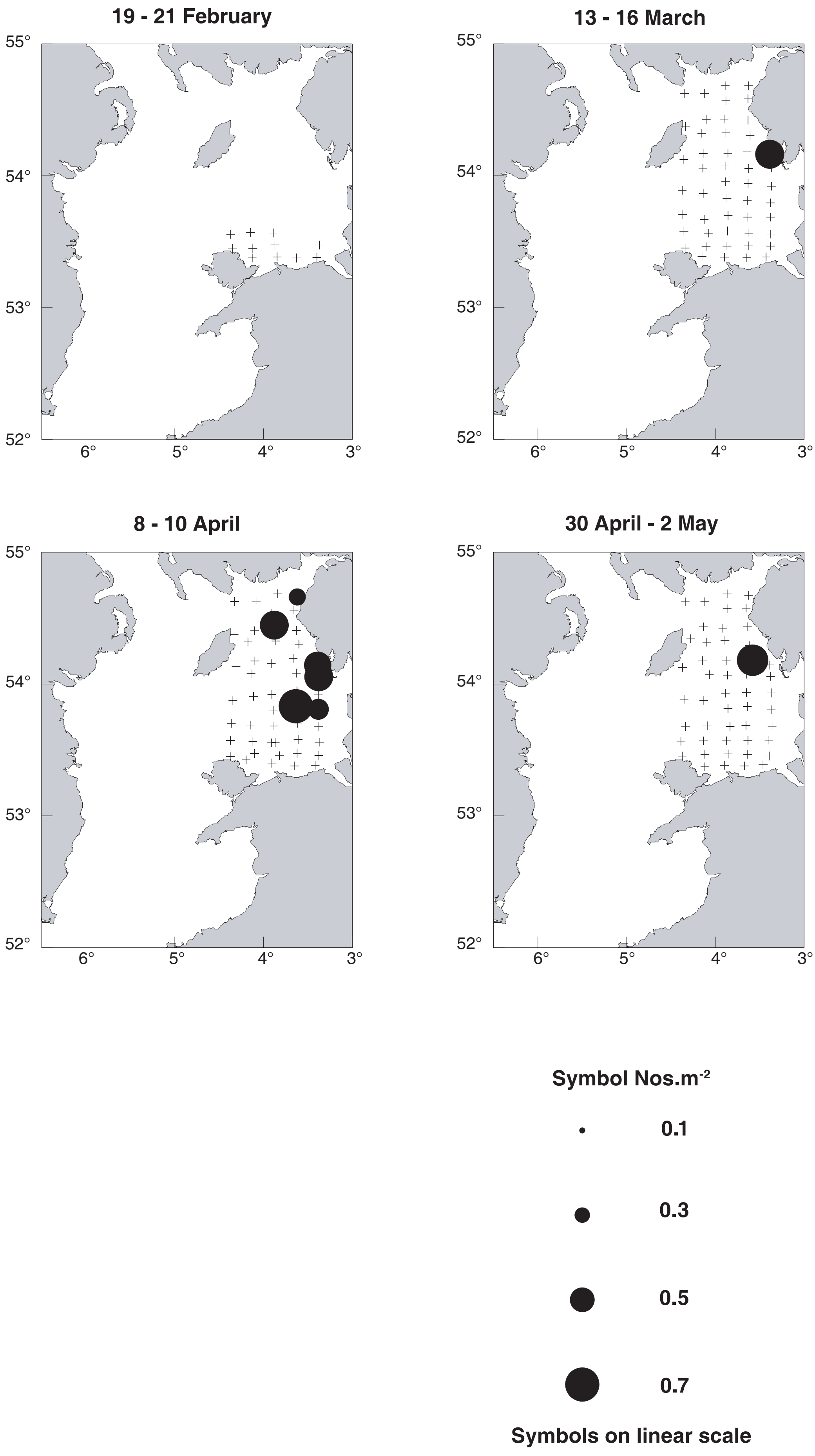


Figure 80. Concentration of pogge (Agonus cataphractus) larvae (nos.m^{-2}) in 2002

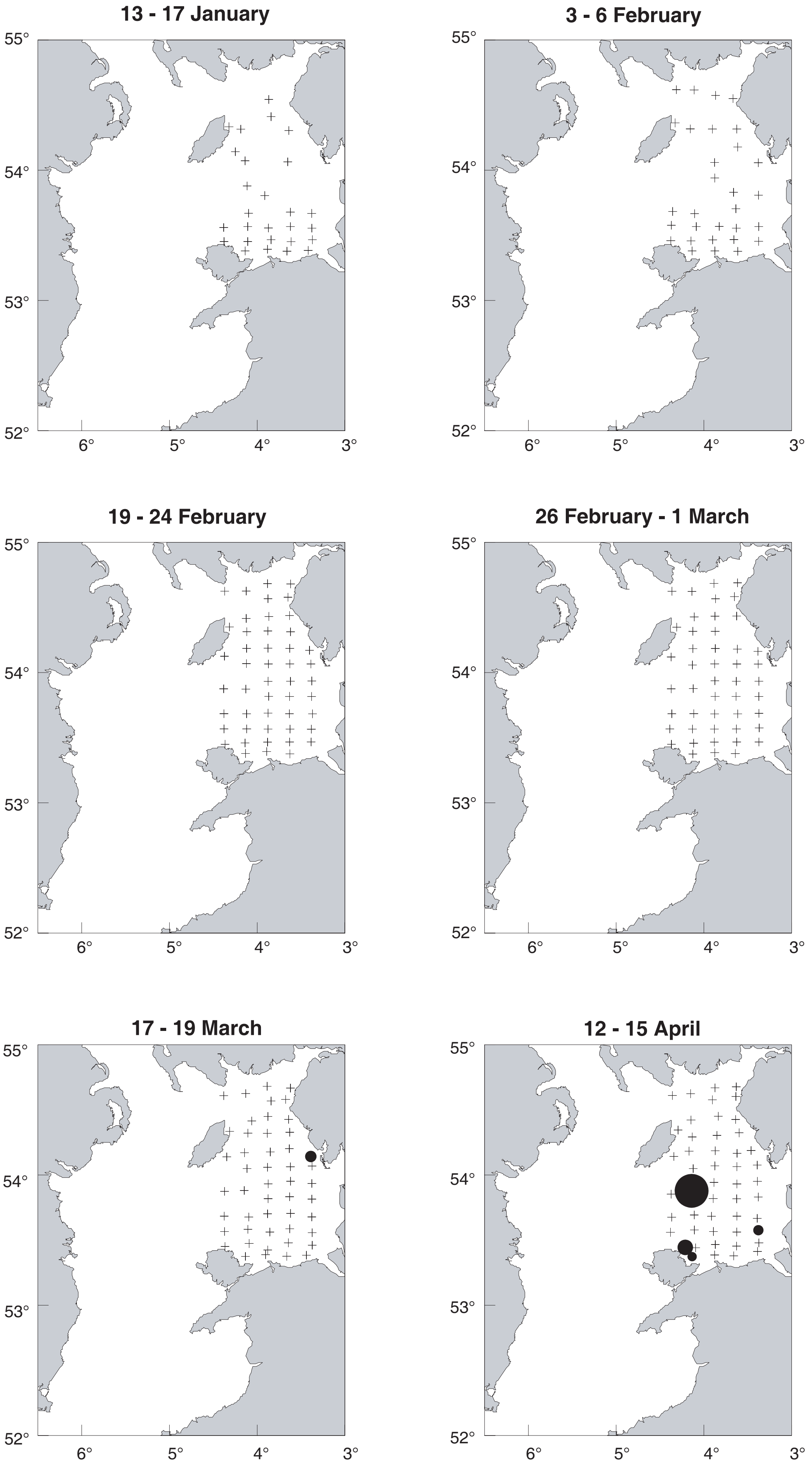


Figure 81. Concentration of pogge (Agonus cataphractus) larvae (nos.m^{-2}) in 2003

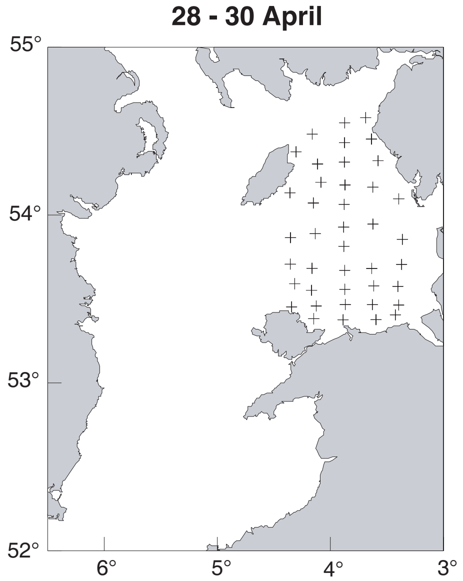


Figure 81. continued

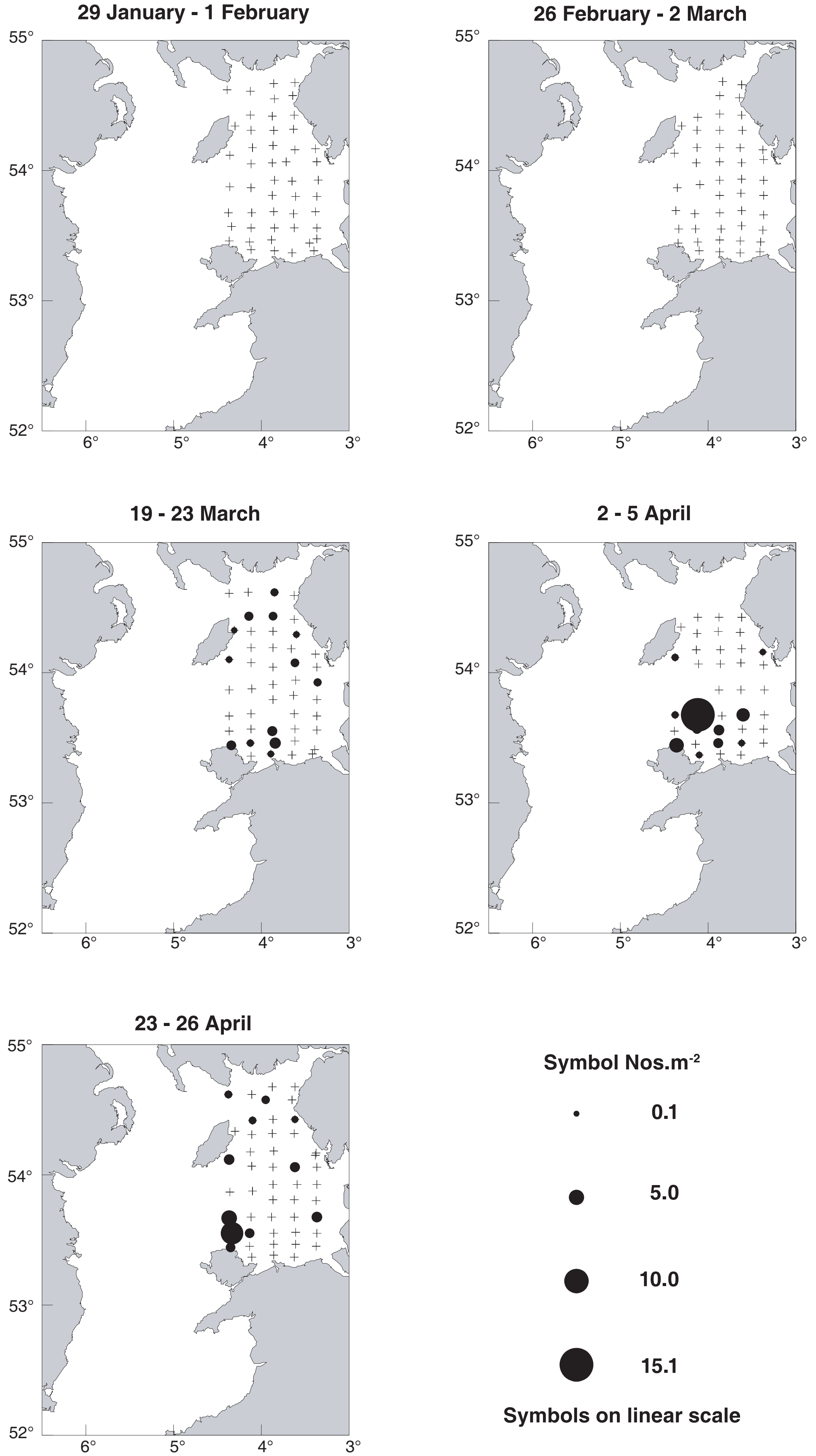


Figure 82. Concentration of sea snail (Liparis spp.) larvae (nos.m^{-2}) in 2001

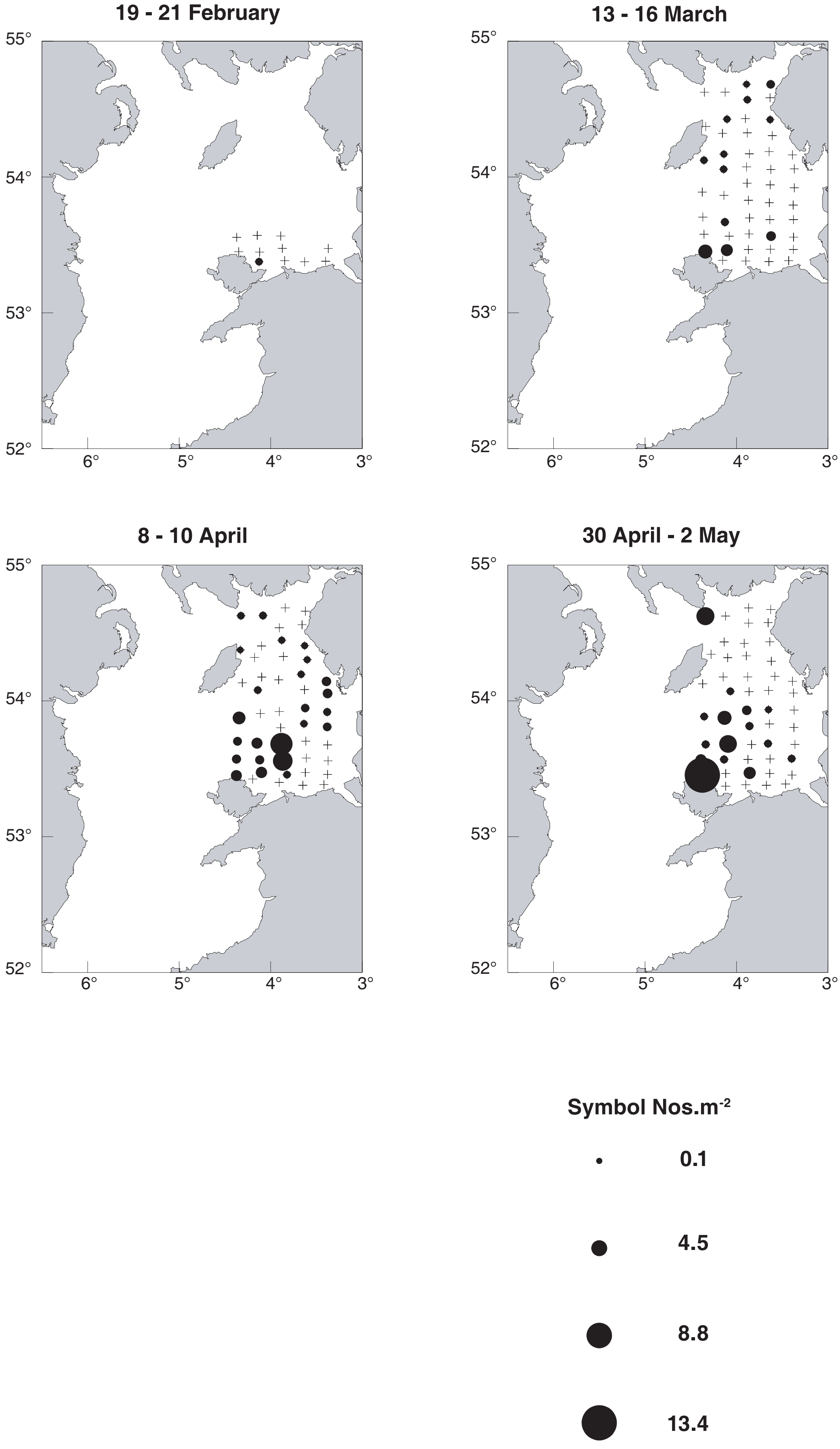


Figure 83. Concentration of sea snail (Liparis spp.) larvae (nos.m^{-2}) in 2002

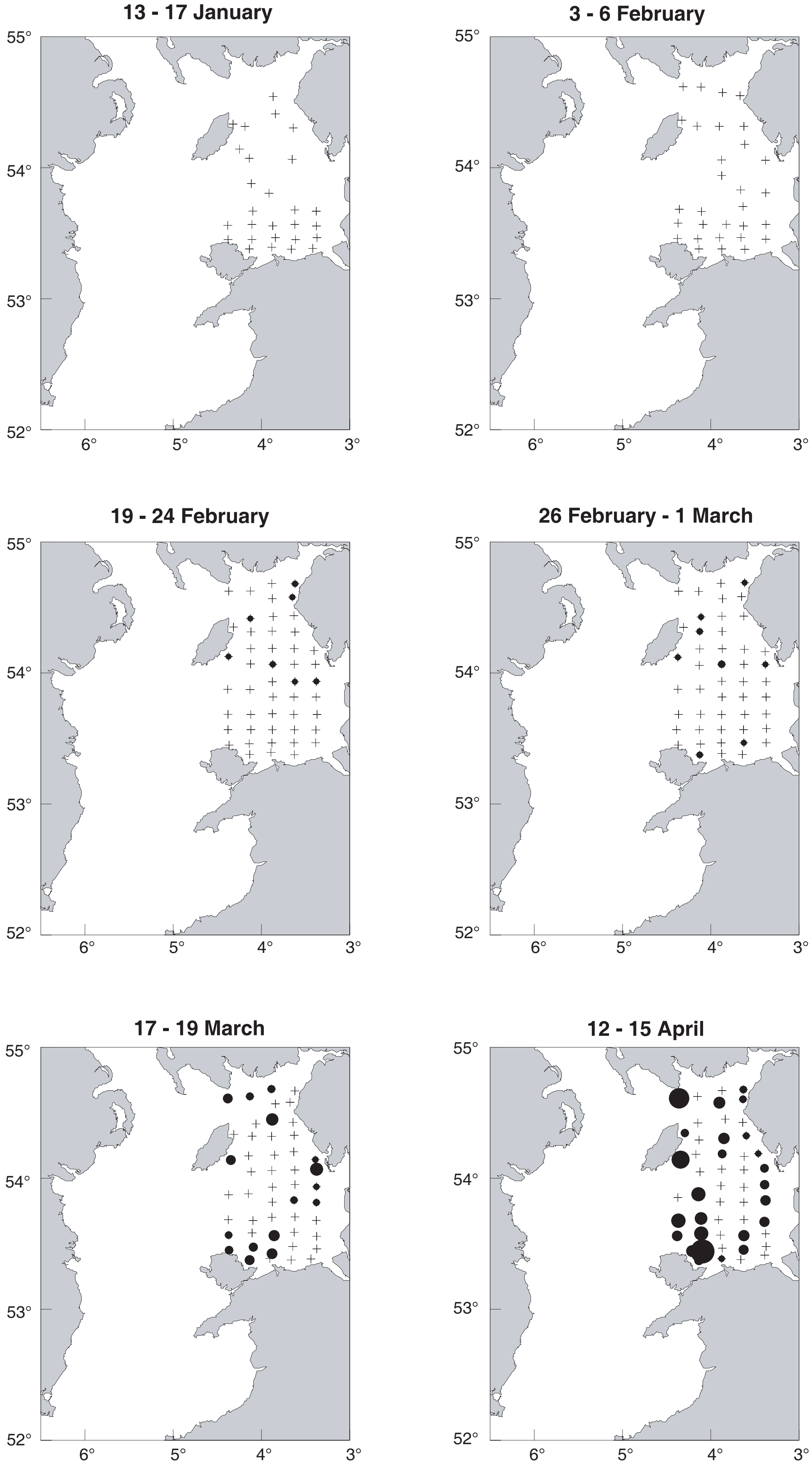


Figure 84. Concentration of sea snail (Liparis spp.) larvae (nos.m⁻²) in 2003

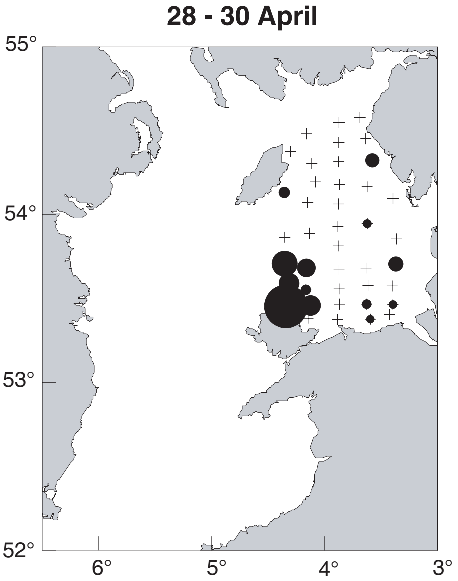


Figure 84. continued

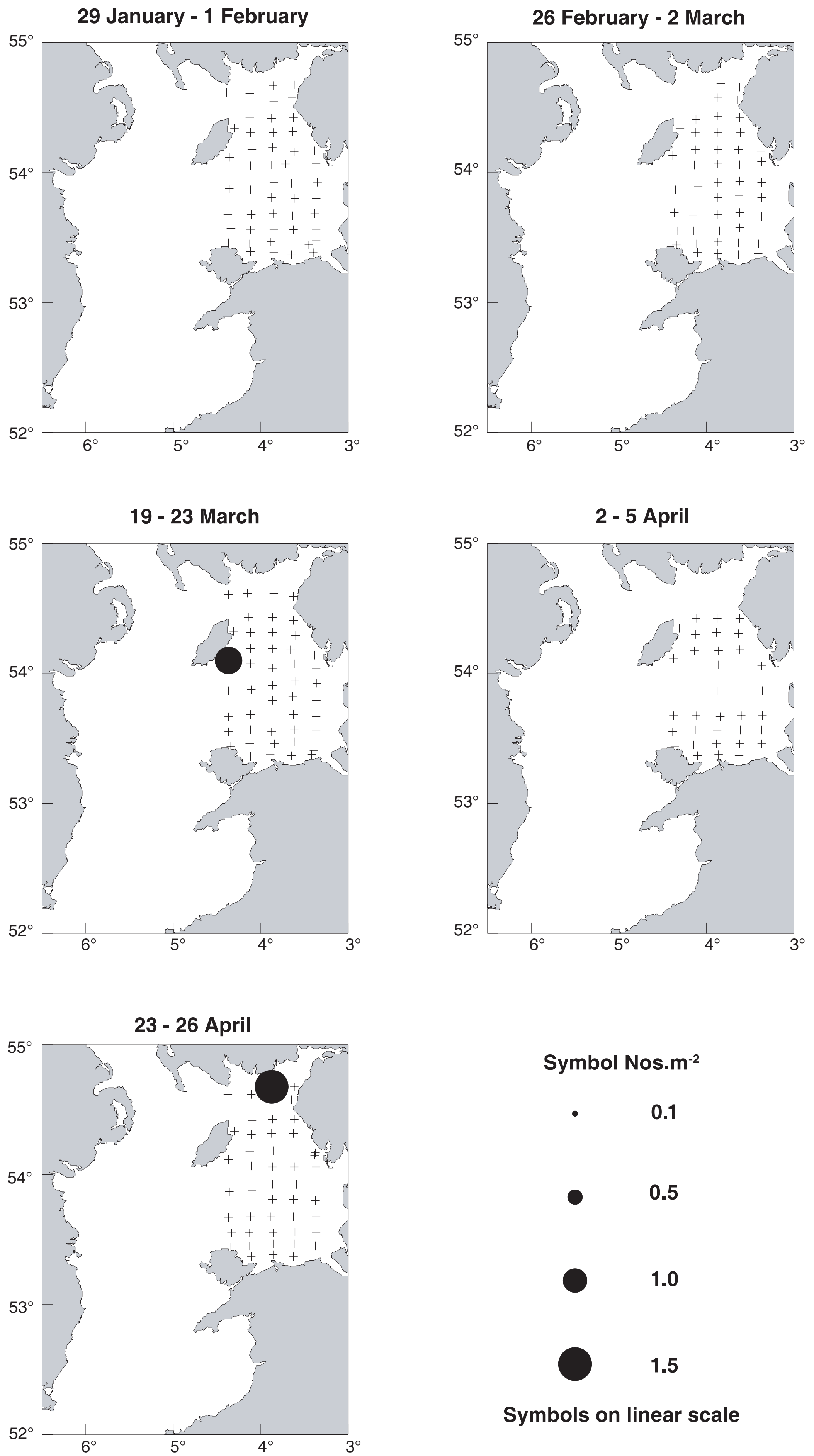


Figure 85. Concentration of Yarrell's blenny (Chirolophis ascanii) larvae (nos.m^{-2}) in 2001

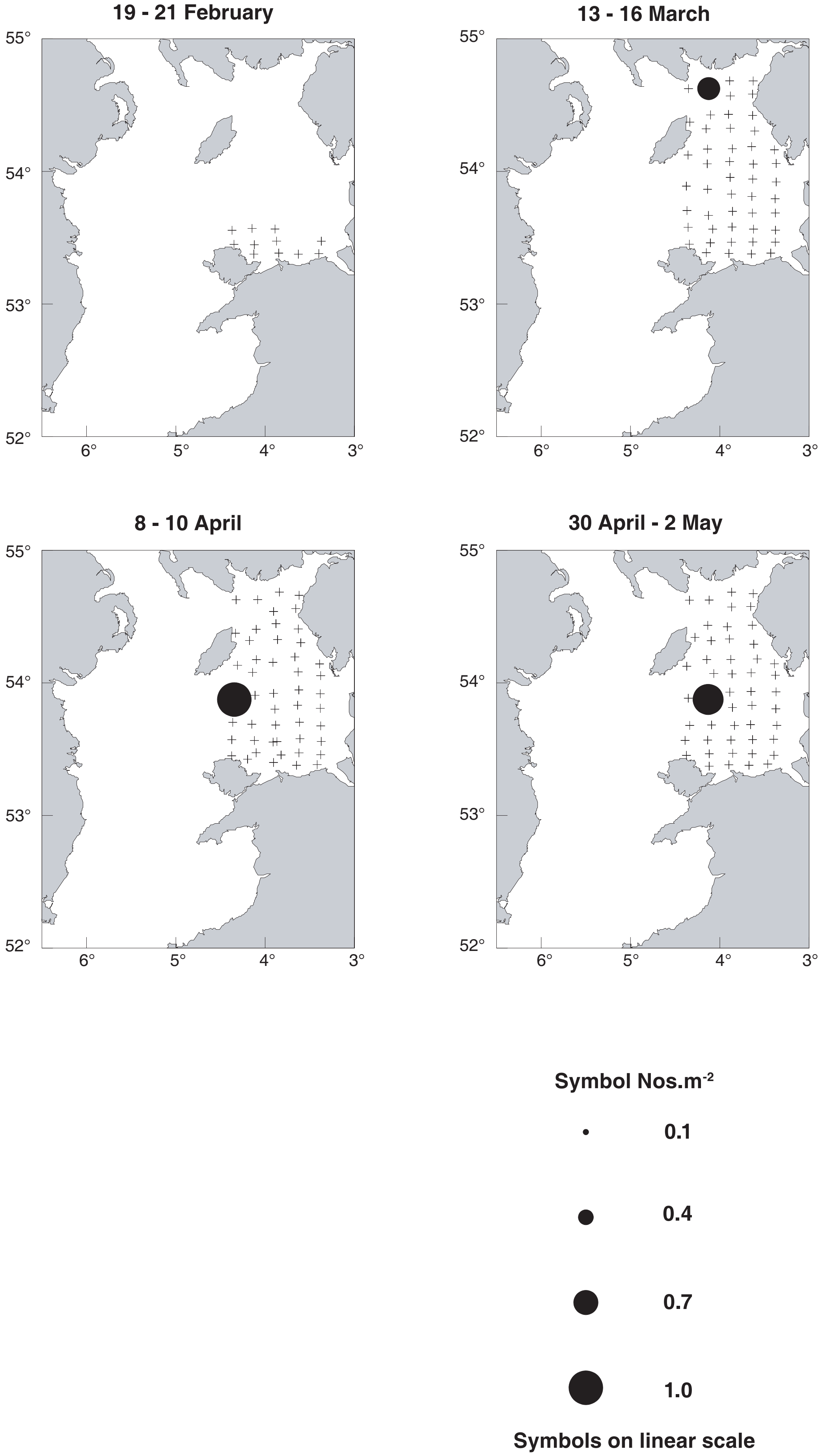


Figure 86. Concentration of Yarrell's blenny (Chirolophis ascanii) larvae (nos.m^{-2}) in 2002

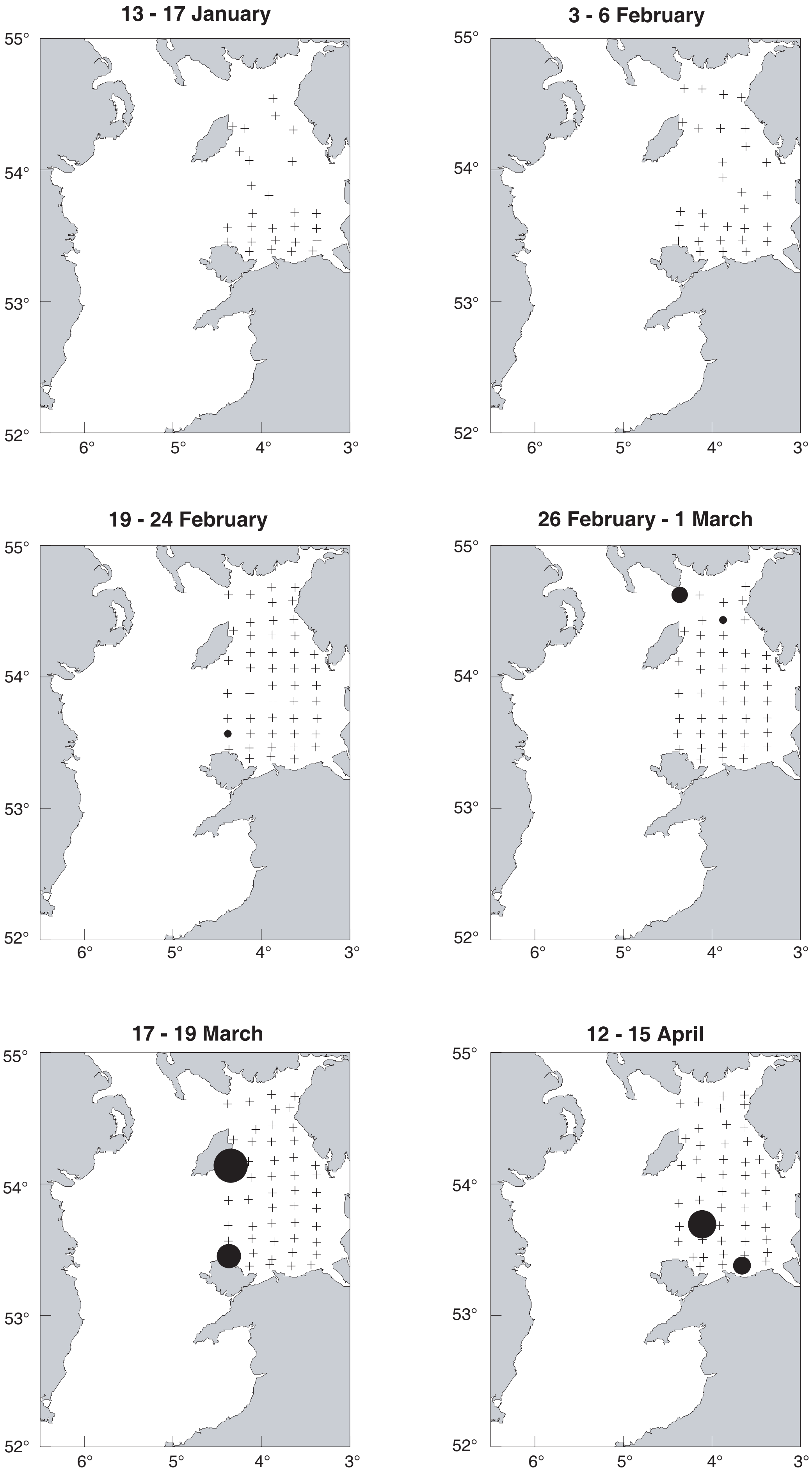


Figure 87. Concentration of Yarrell's blenny (Chirolophis ascanii) larvae (nos.m^{-2}) in 2003

28 - 30 April

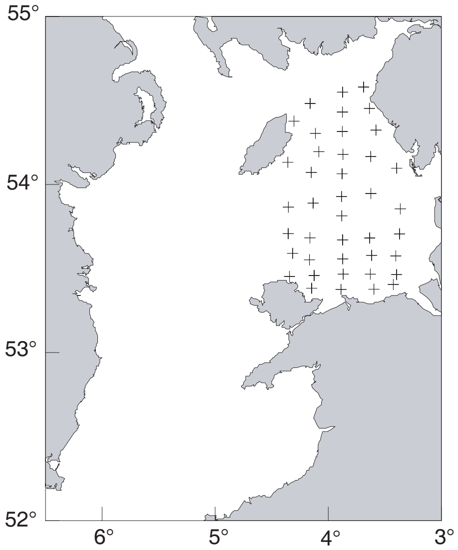


Figure 87. continued

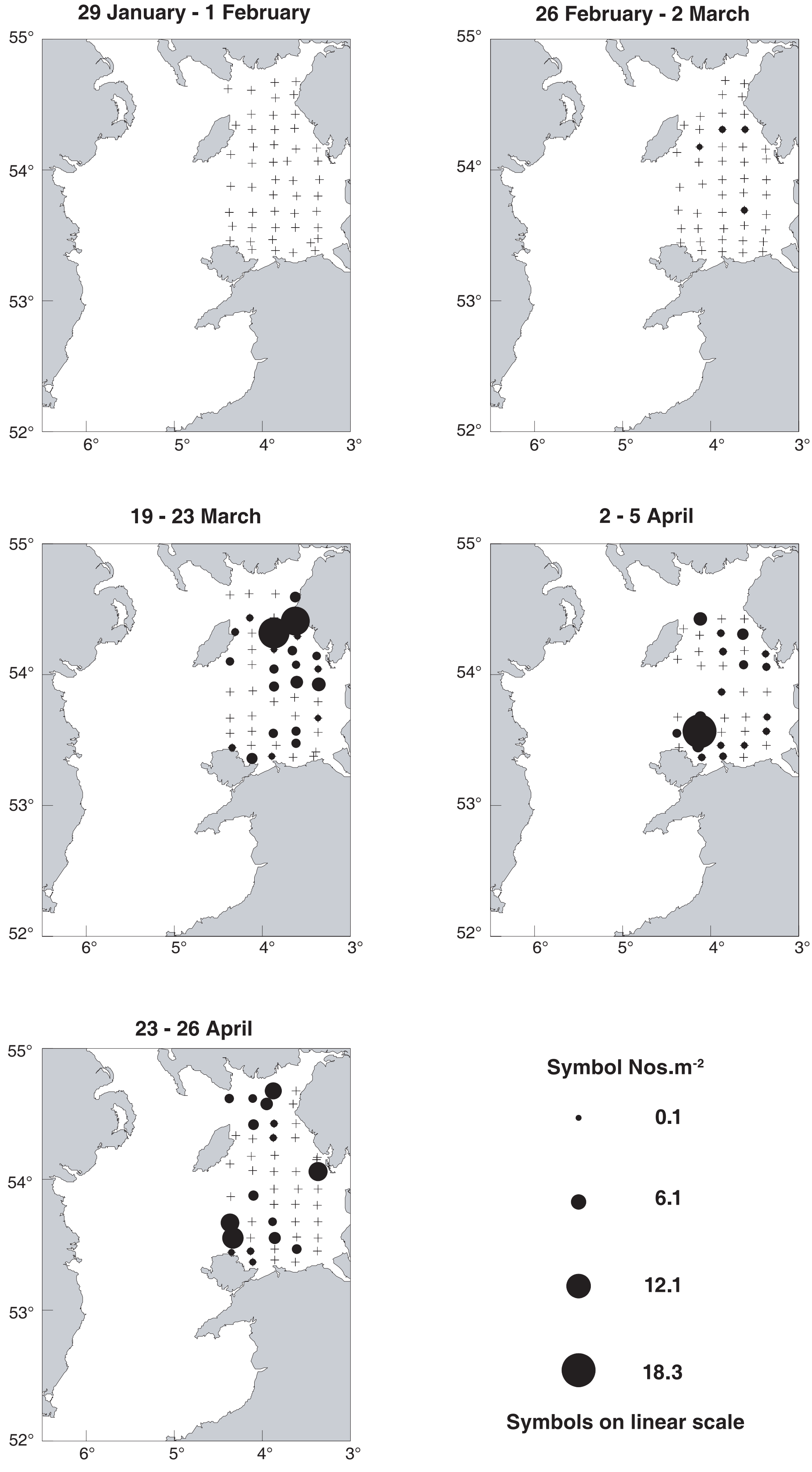


Figure 88. Concentration of butterfish (Pholis gunnellus) larvae (nos.m^{-2}) in 2001

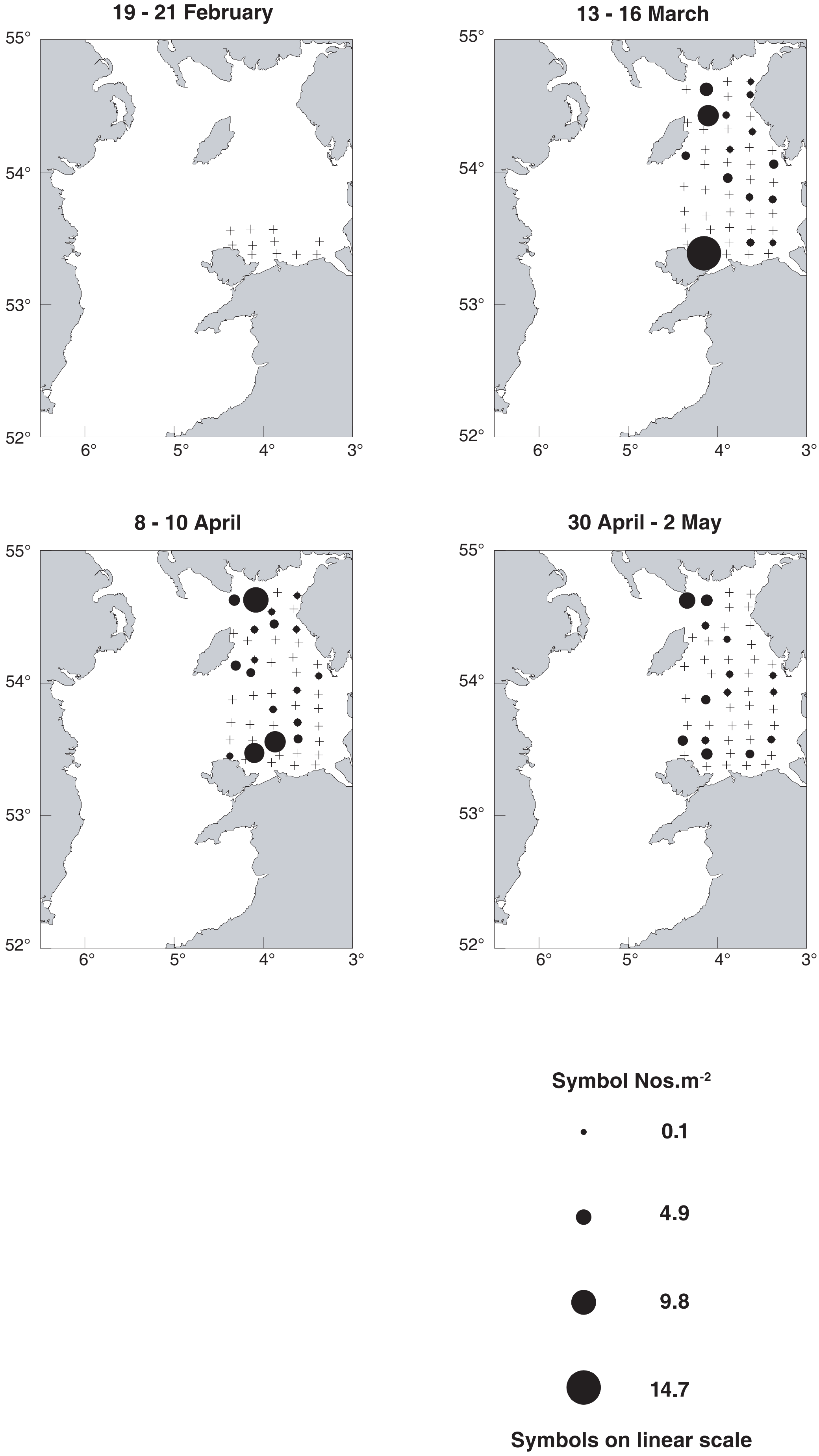


Figure 89. Concentration of butterfish (Pholis gunnellus) larvae (nos.m^{-2}) in 2002

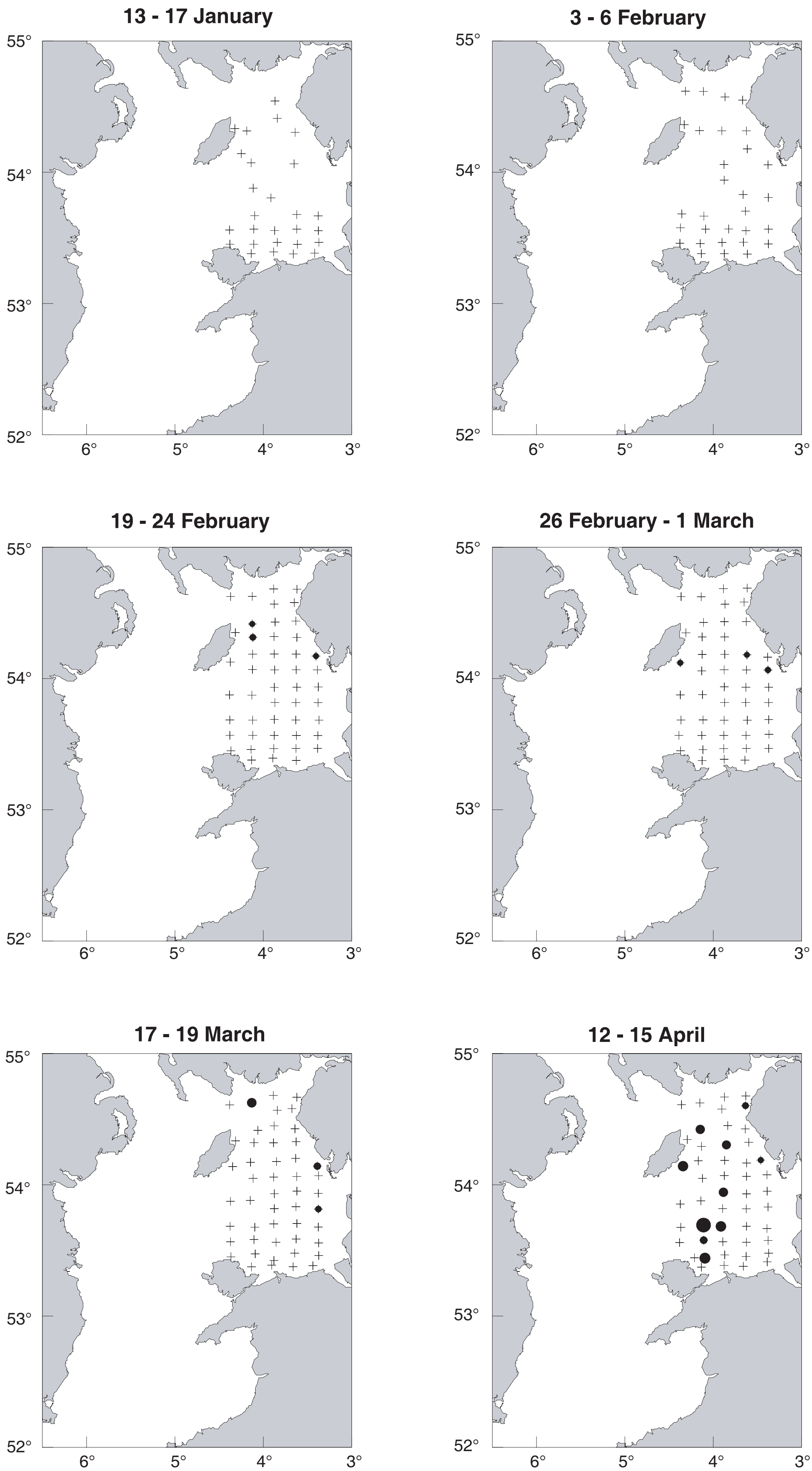
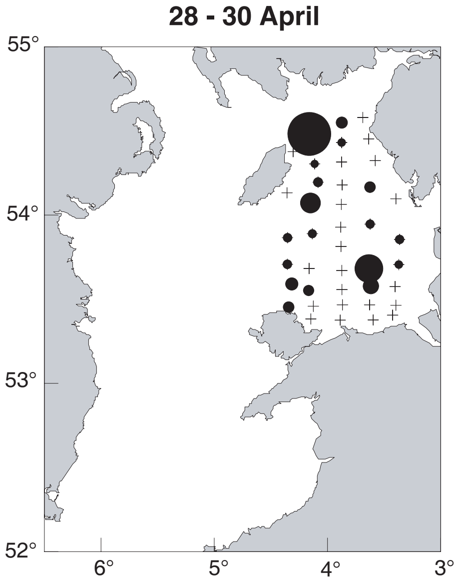


Figure 90. Concentration of butterfish (Pholis gunnellus) larvae (nos.m^{-2}) in 2003



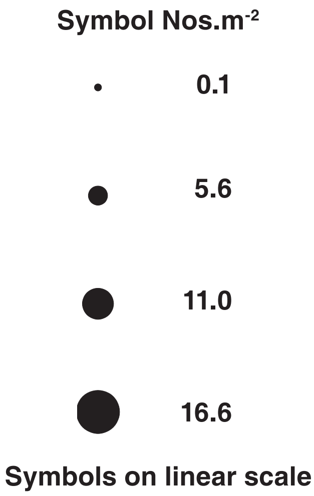


Figure 90. continued

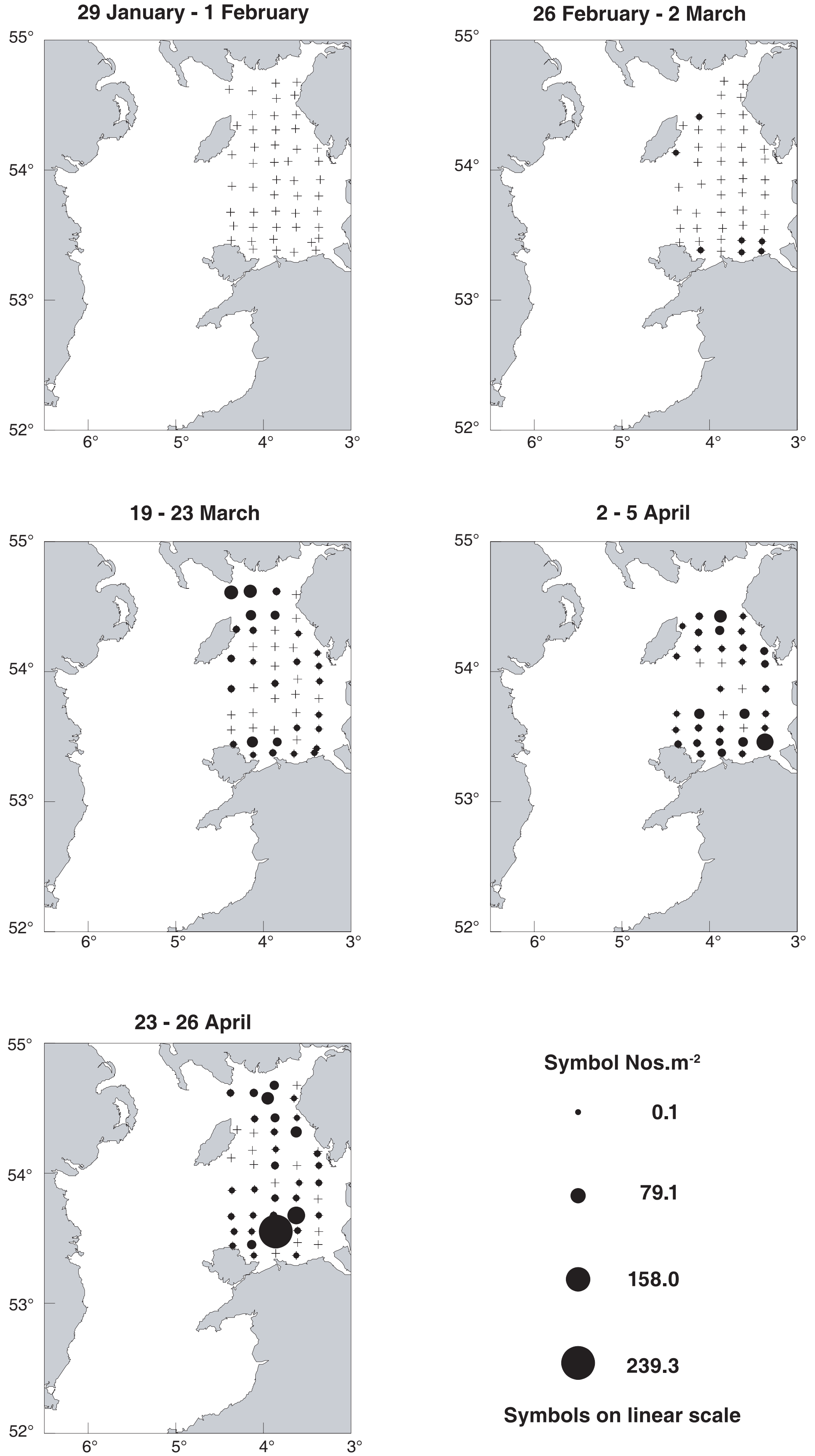


Figure 91. Concentration of sandeel (Ammodytidae) larvae (nos.m^{-2}) in 2001

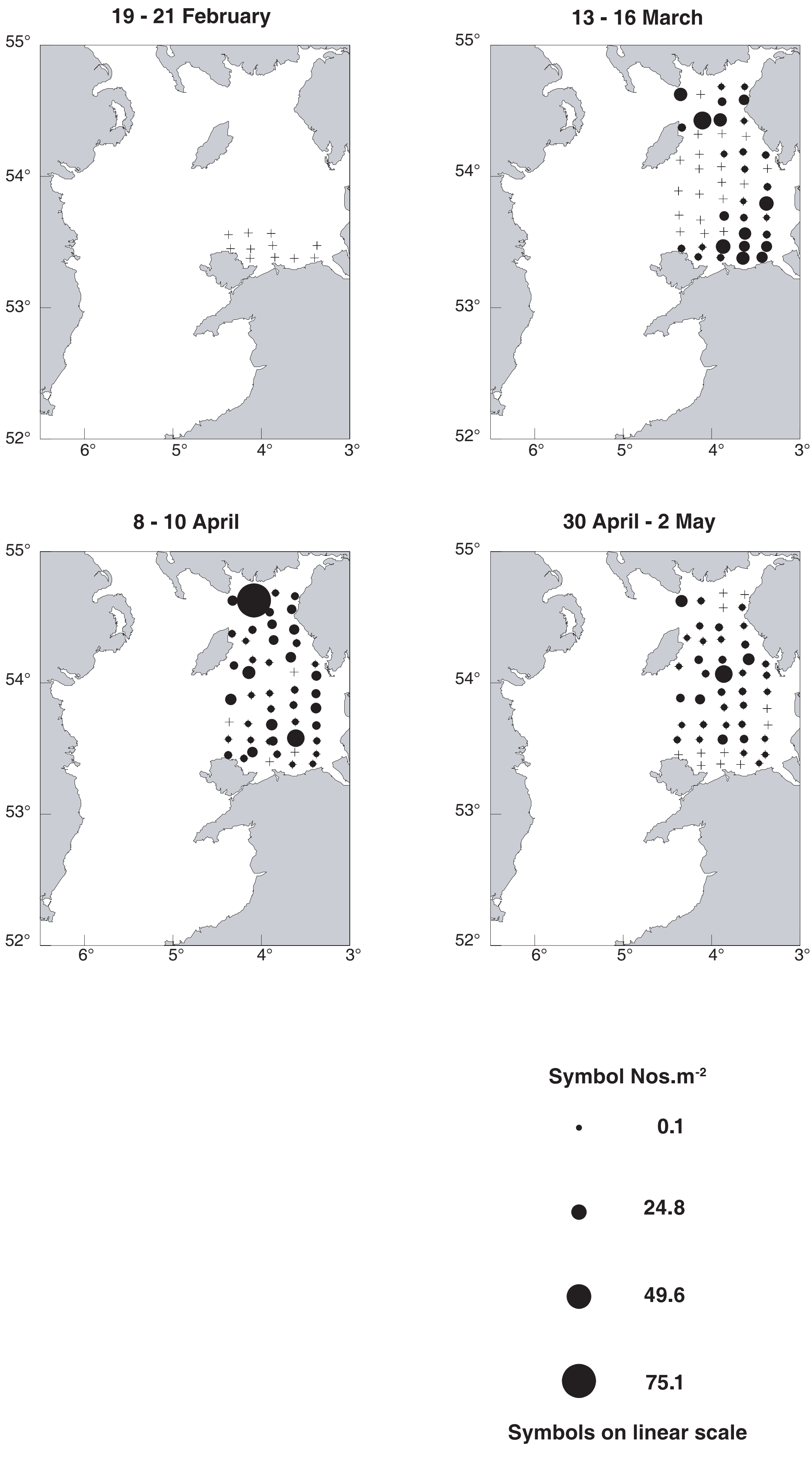


Figure 92. Concentration of sandeel (Ammodytidae) larvae (nos.m^{-2}) in 2002

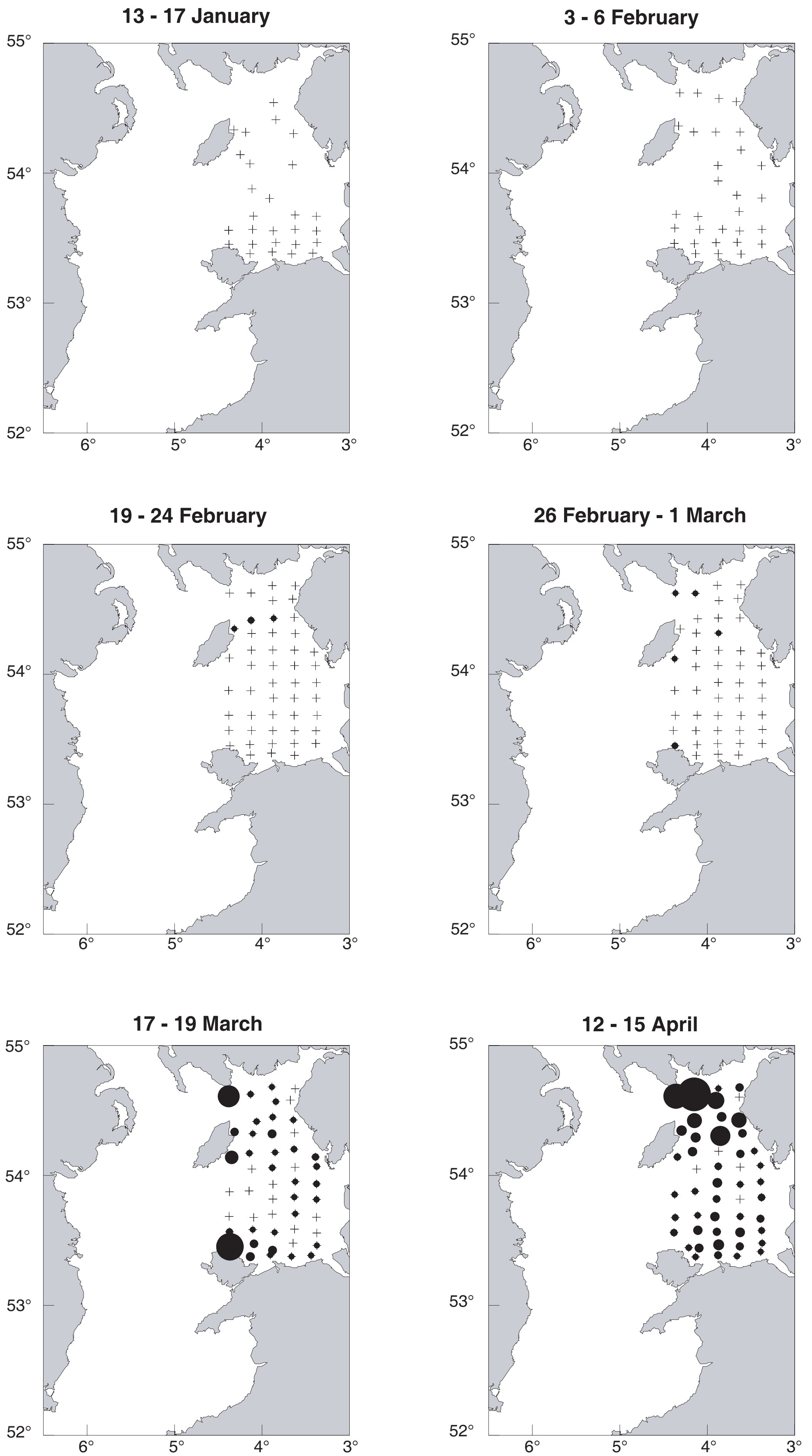
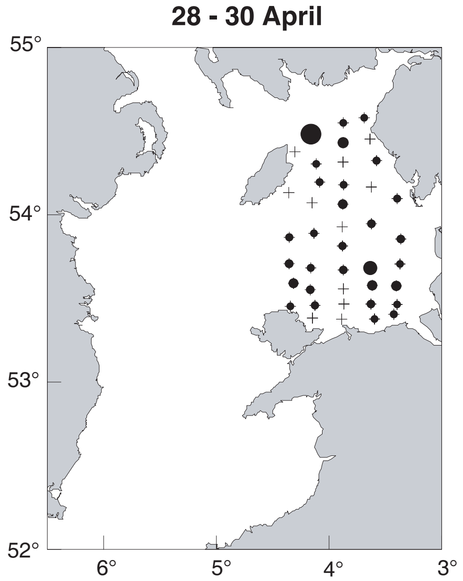


Figure 93. Concentration of sandeel (Ammodytidae) larvae (nos.m^{-2}) in 2003



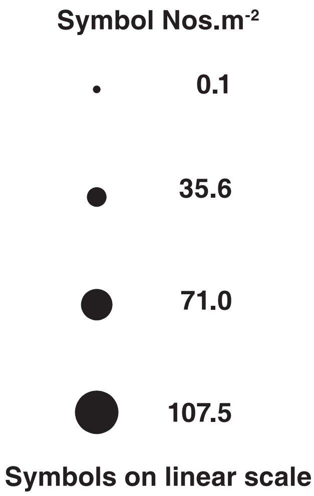


Figure 93. continued

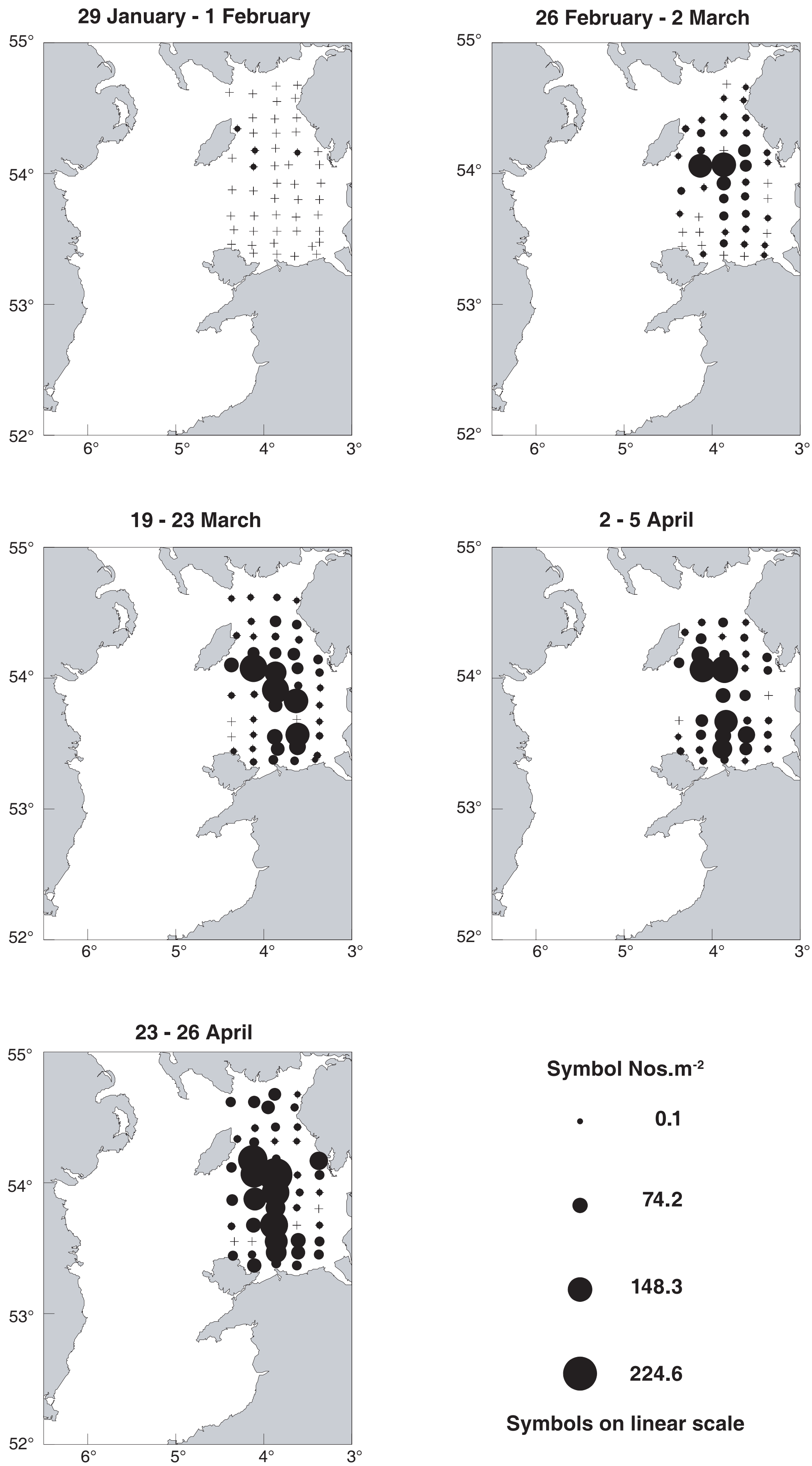


Figure 94. Concentration of dragonet (Callionymidae) eggs (nos.m^{-2}) in 2001

Figure 95. Concentration of dragonet (Callionymidae) eggs (nos.m^{-2}) in 2002

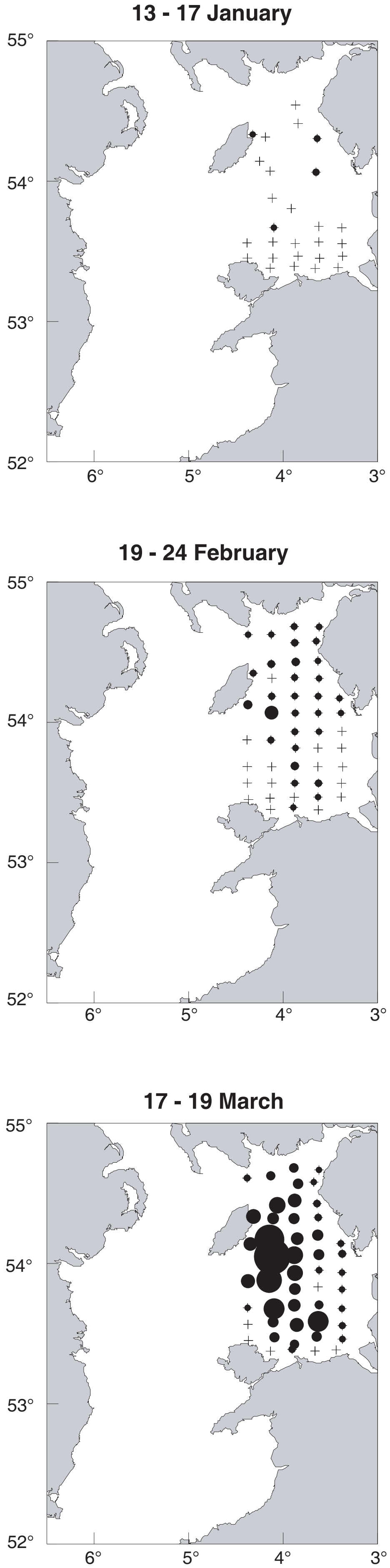


Figure 96. Concentration of dragonet (Callionymidae) eggs (nos.m^{-2}) in 2003

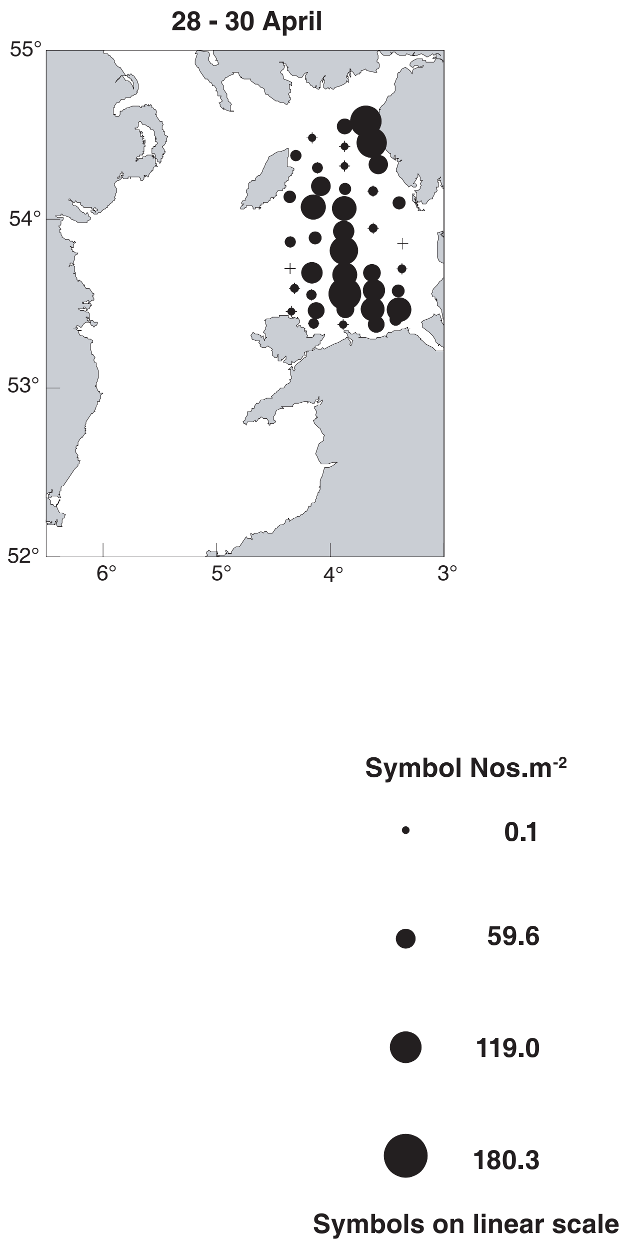


Figure 96. continued

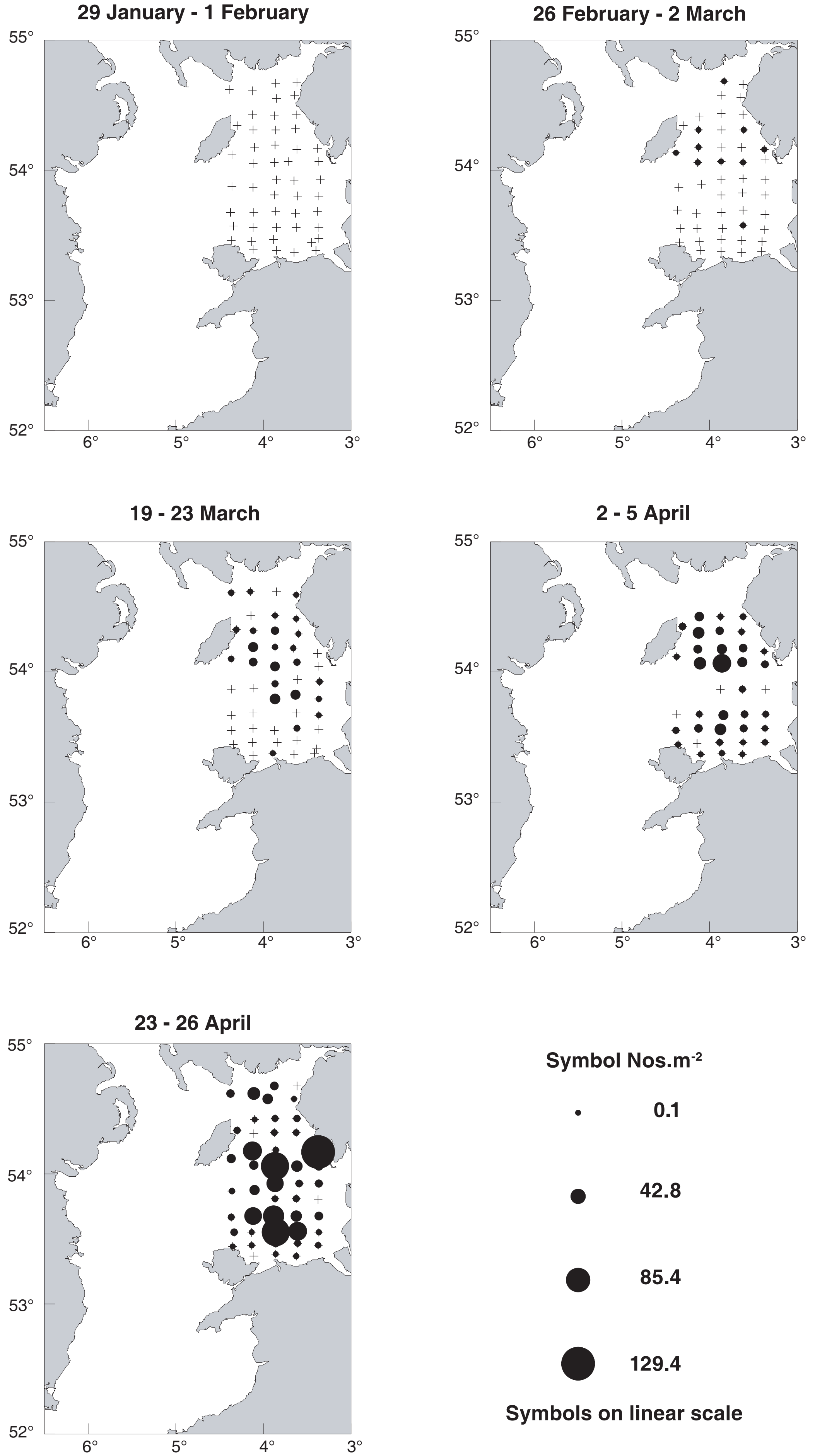


Figure 97. Concentration of dragonet (Callionymidae) larvae (nos.m^{-2}) in 2001

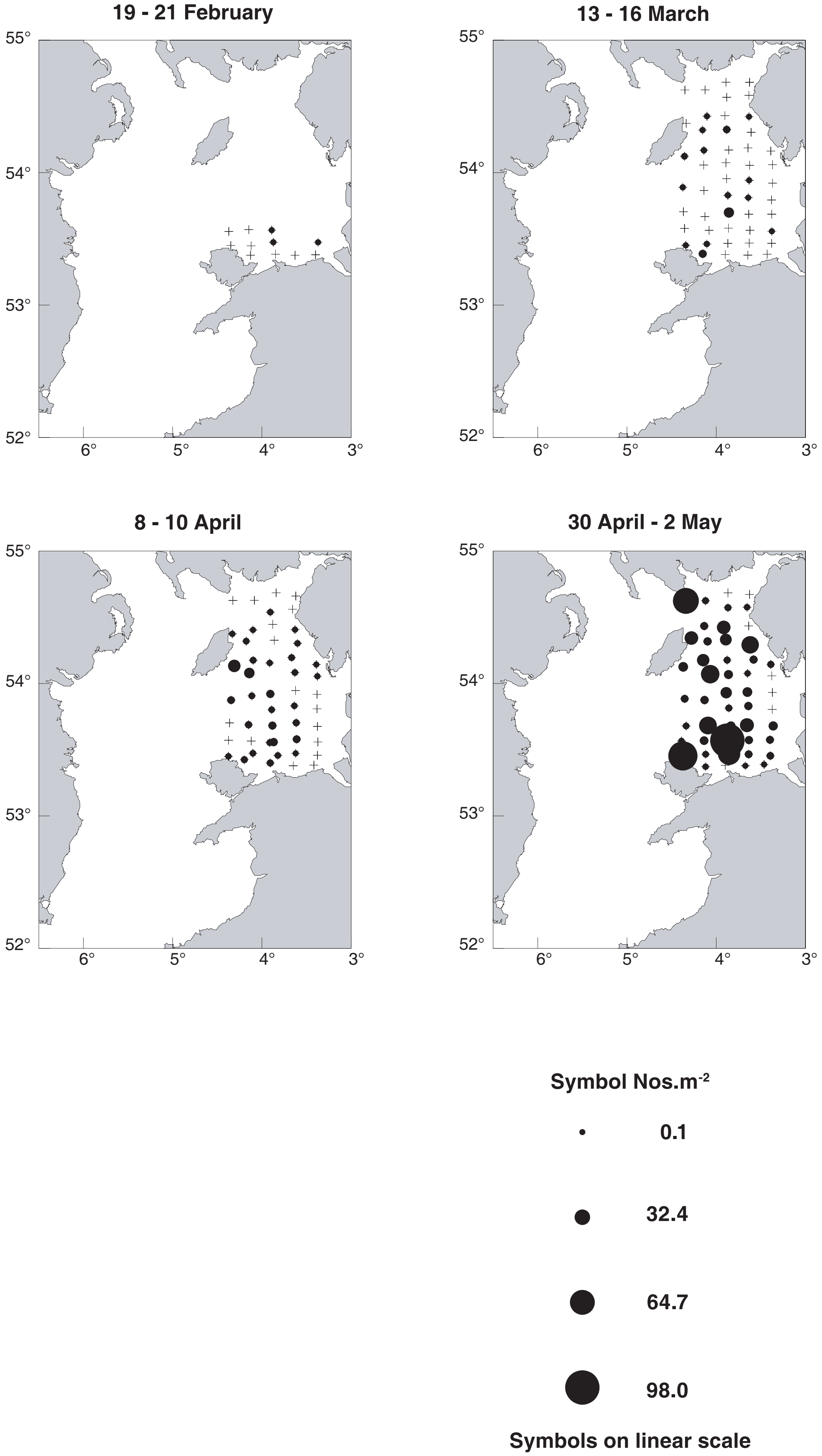


Figure 98. Concentration of dragonet (Callionymidae) larvae (nos.m^{-2}) in 2002

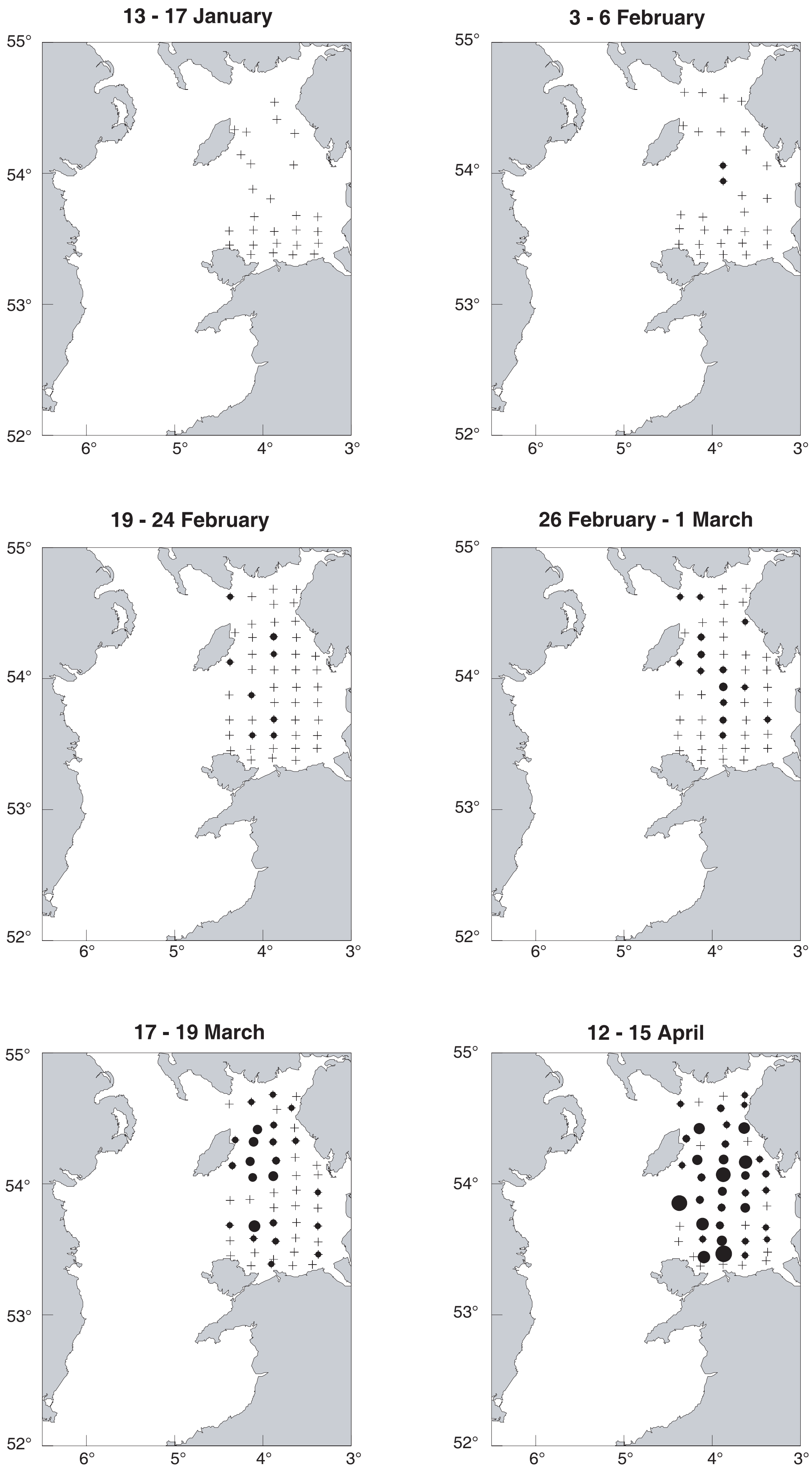


Figure 99. Concentration of dragonet (Callionymidae) larvae (nos.m⁻²) in 2003

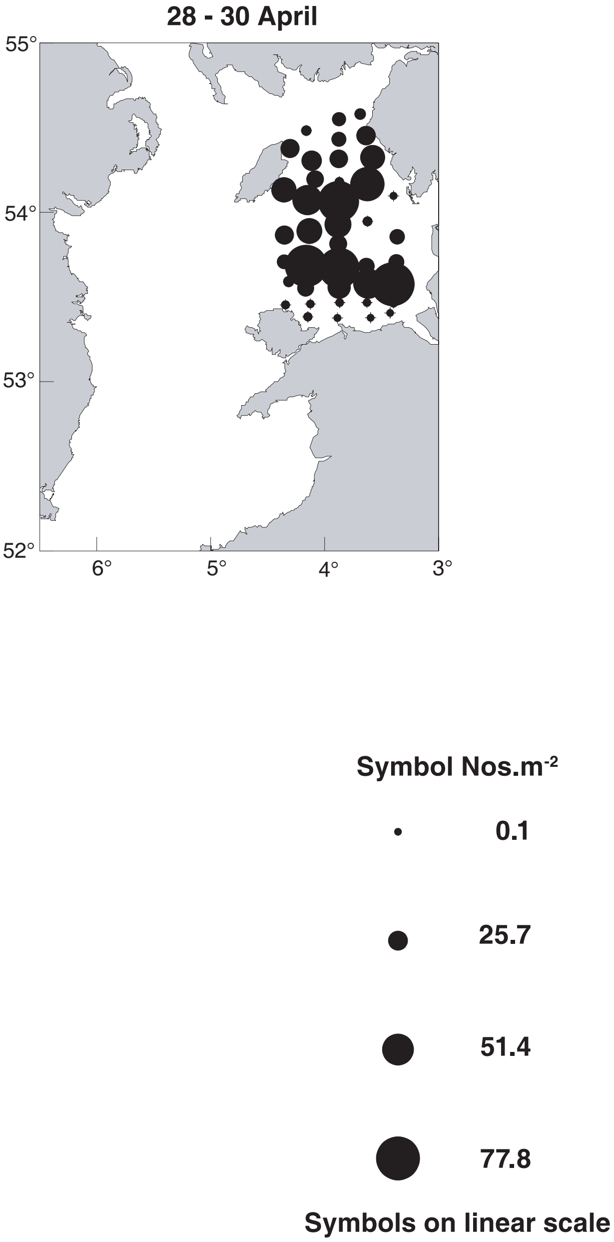


Figure 99. continued

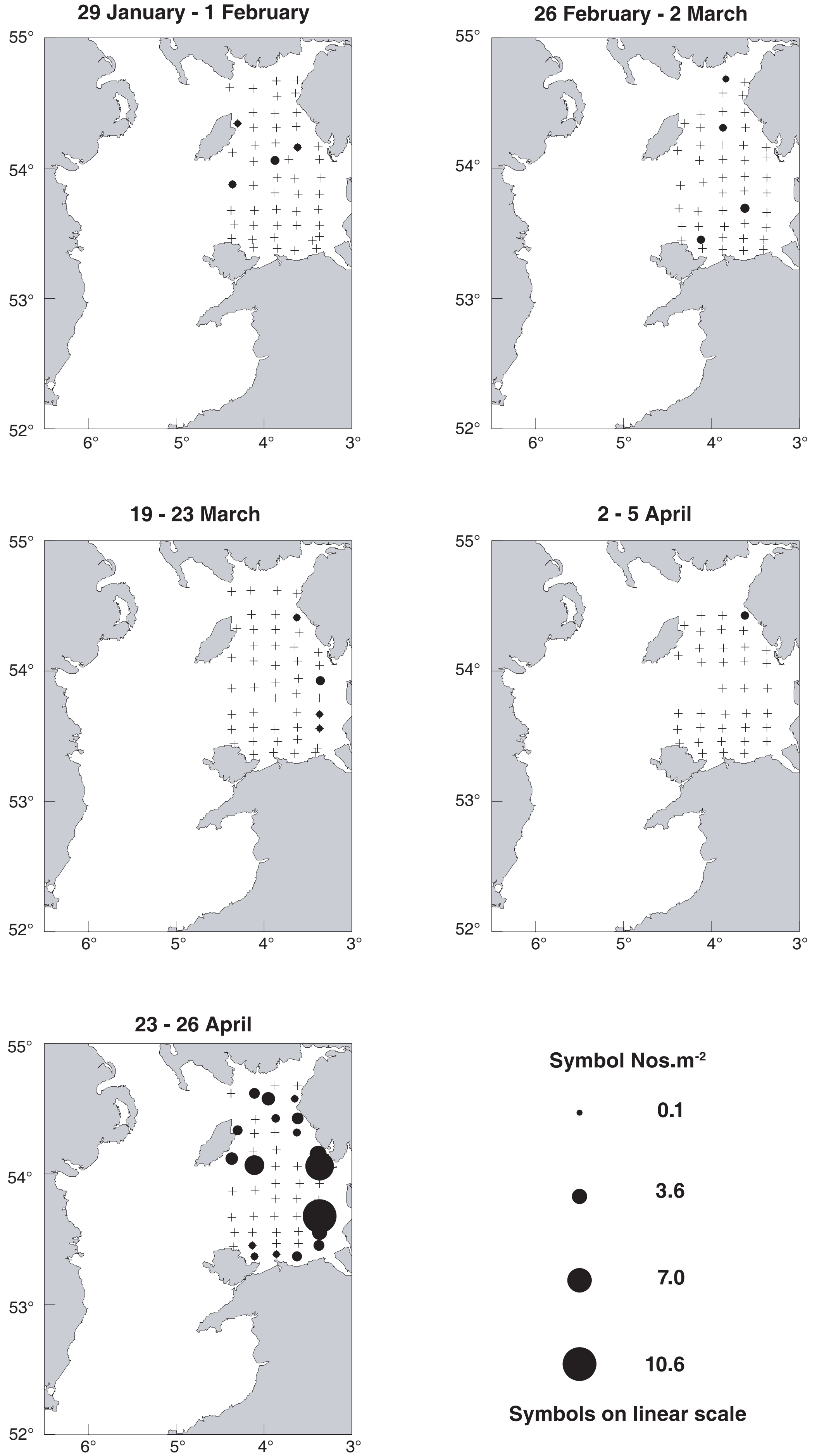


Figure 100. Concentration of Gobiidae spp. larvae (nos.m^{-2}) in 2001

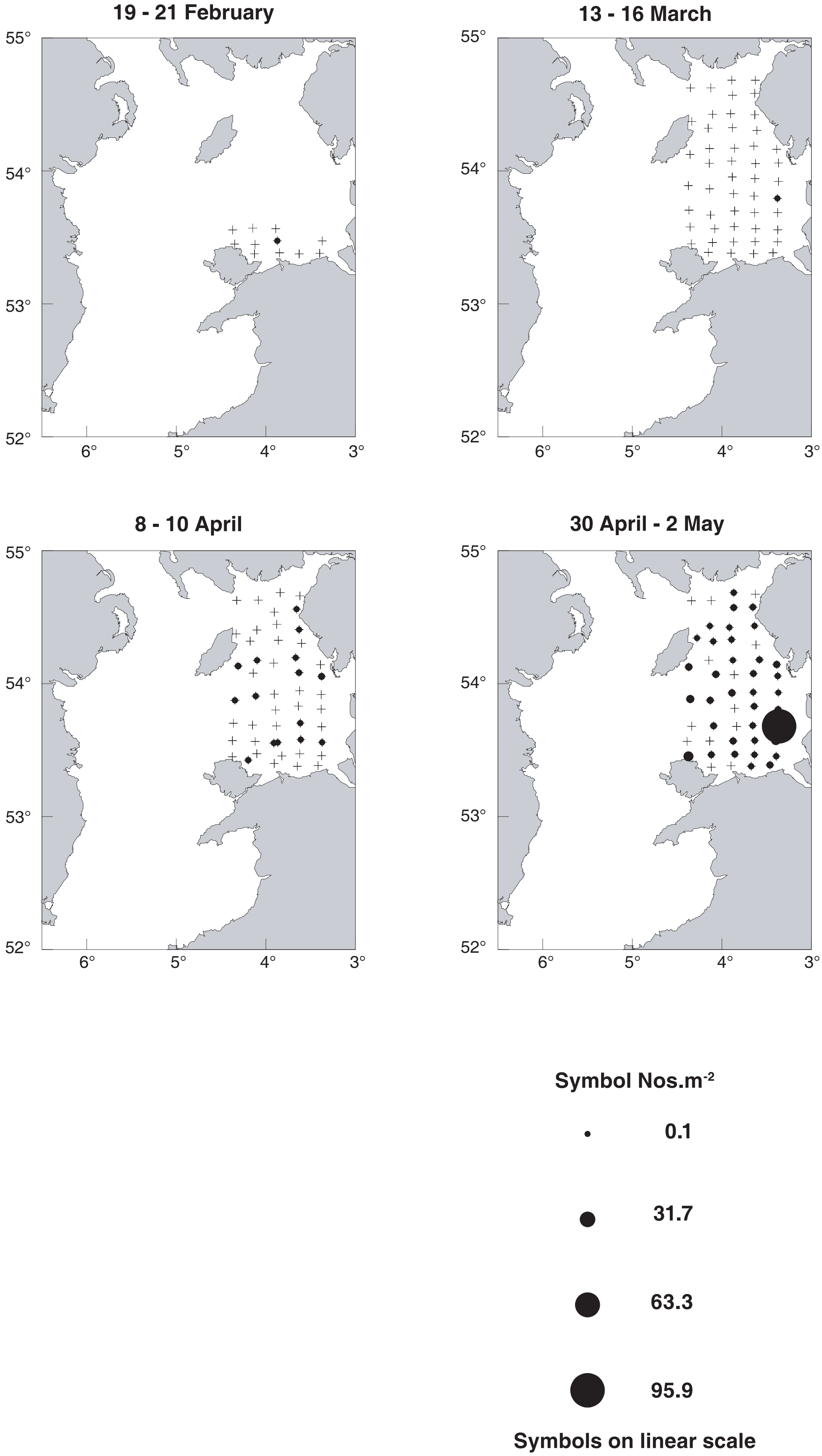


Figure 101. Concentration of Gobiidae spp. larvae (nos.m^{-2}) in 2002

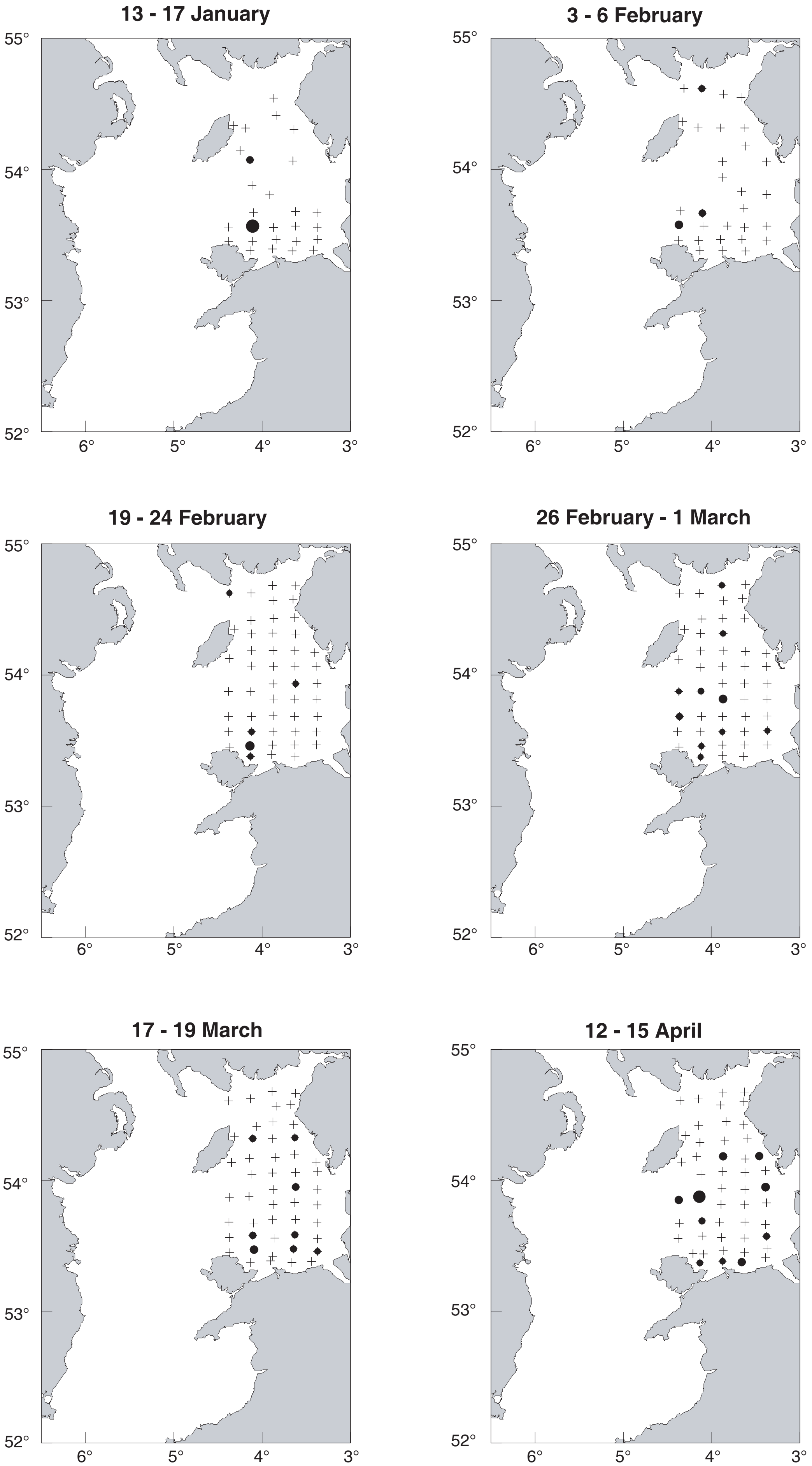


Figure 102. Concentration of Gobiidae spp. larvae (nos.m⁻²) in 2003

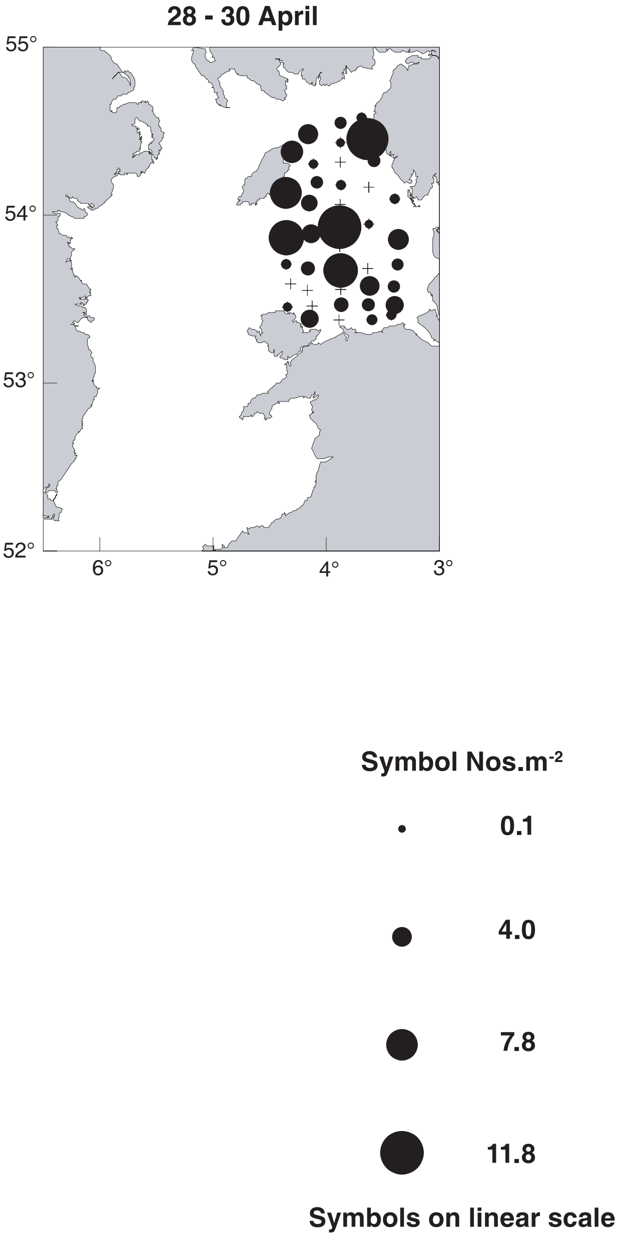


Figure 102. continued

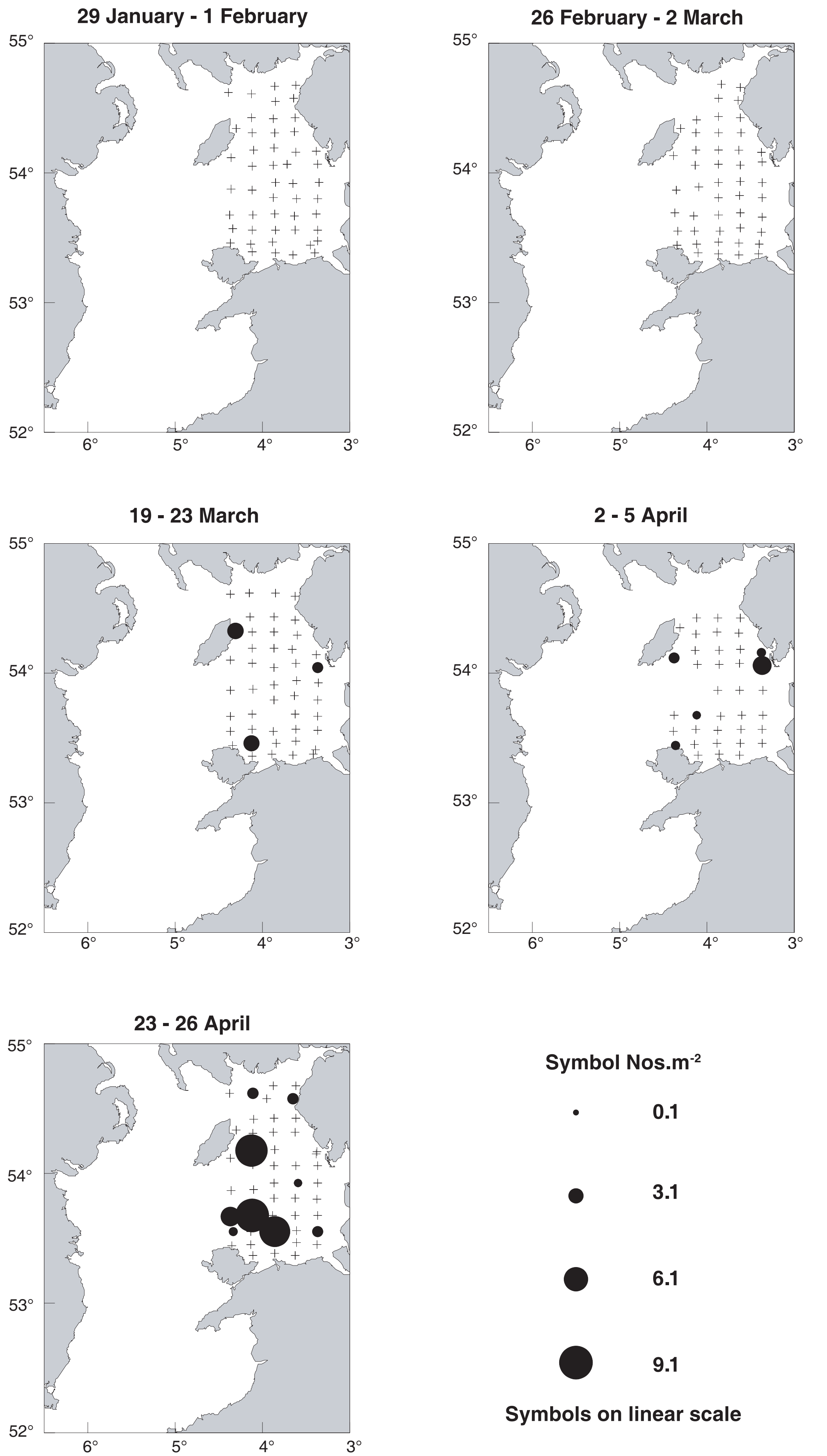


Figure 103. Concentration of Norwegian topknot (Phrynorhombus norvegicus) eggs (nos.m^{-2}) in 2001

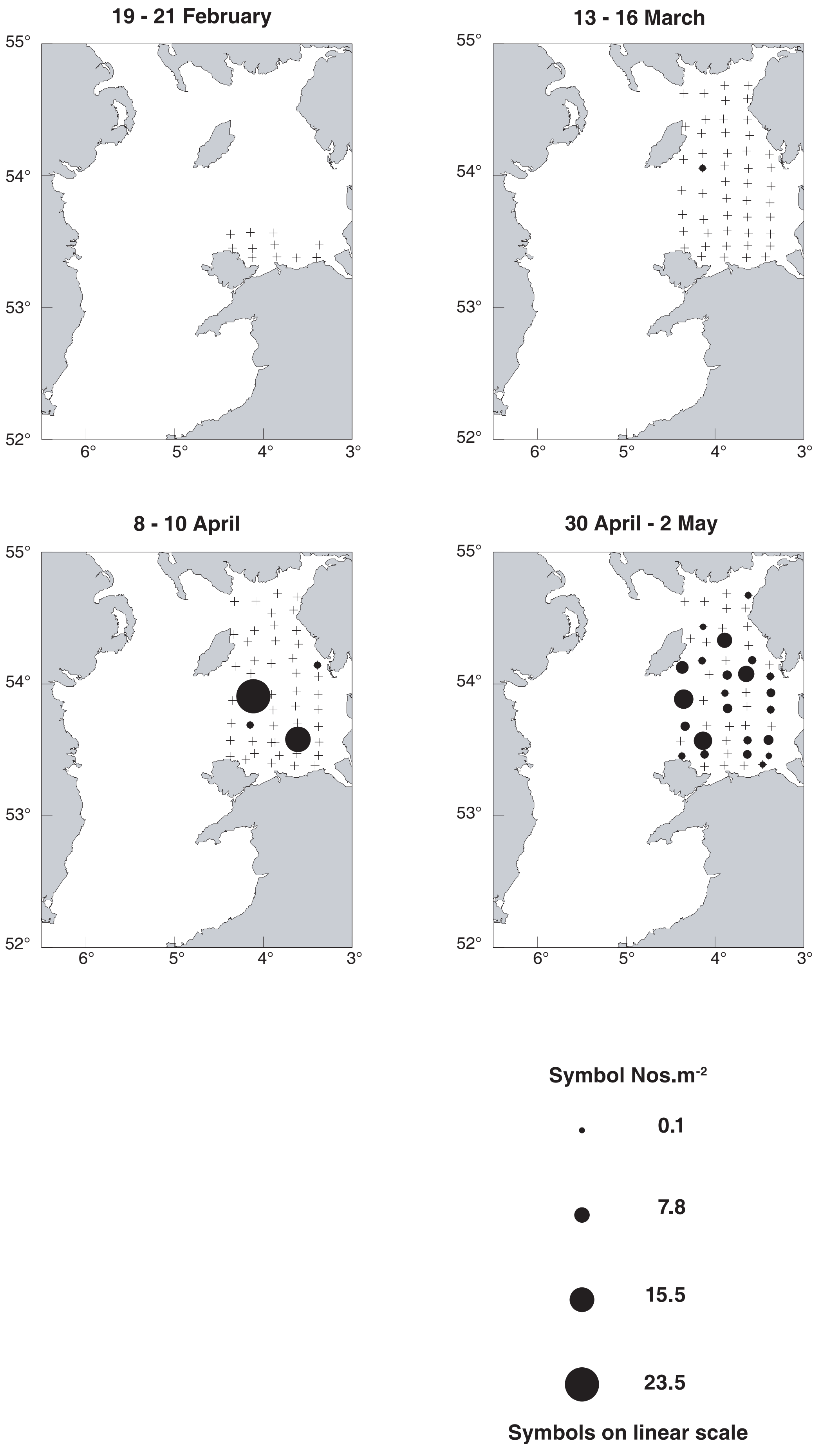


Figure 104. Concentration of Norwegian topknot (Phrynorhombus norvegicus) eggs (nos.m^{-2}) in 2002

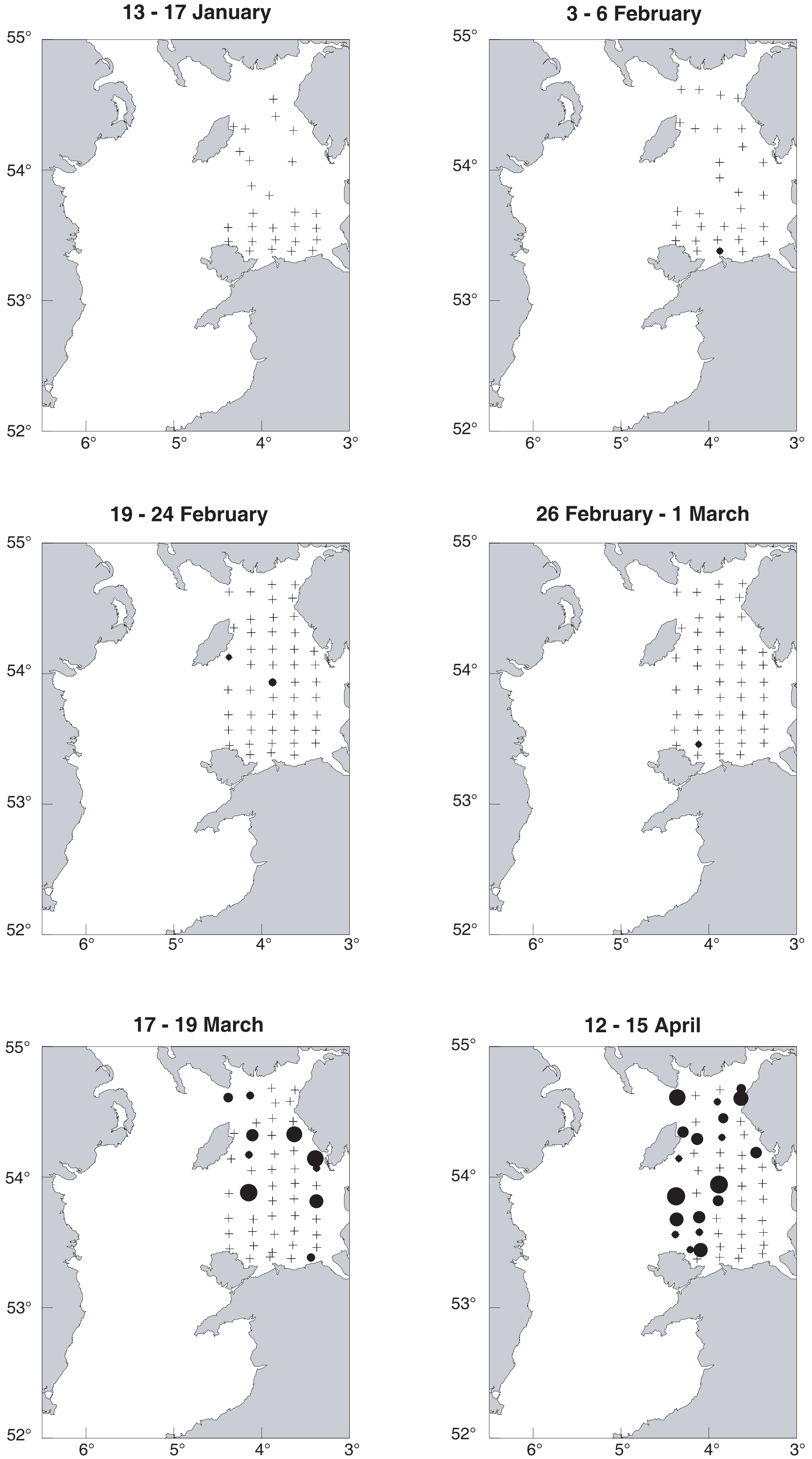
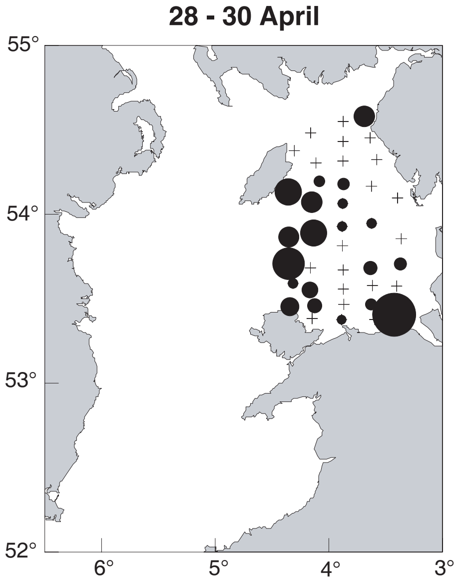


Figure 105. Concentration of Norwegian topknot (Phrynorhombus norvegicus) eggs (nos.m⁻²) in 2003



Symbol Nos.m^{-2}

•	**0.1**
●	**3.3**
●	**6.5**
●	**9.8**

Symbols on linear scale

Figure 105. continued

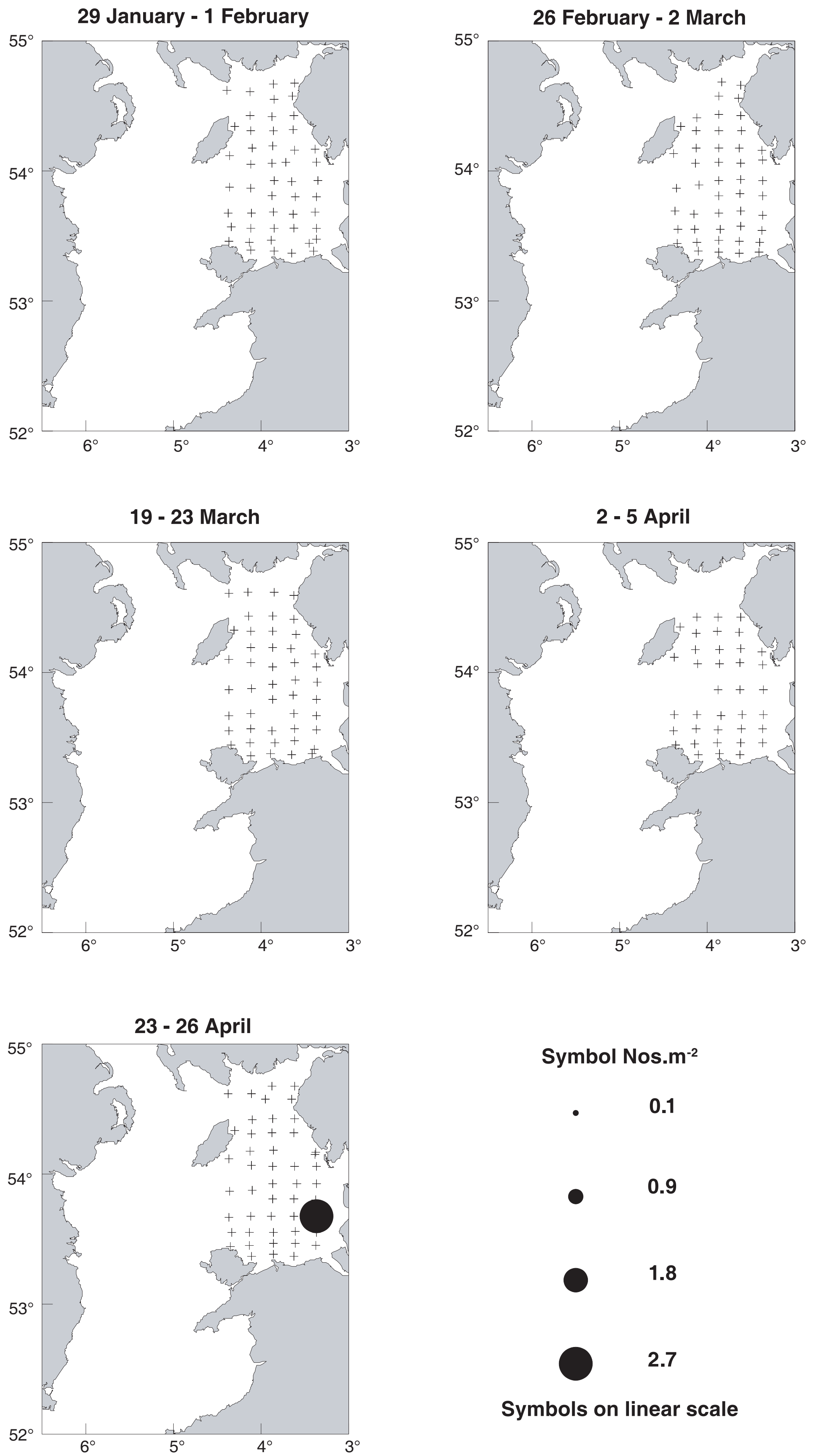


Figure 106. Concentration of Norwegian topknot (Phrynorhombus norvegicus) larvae (nos.m^{-2}) in 2001

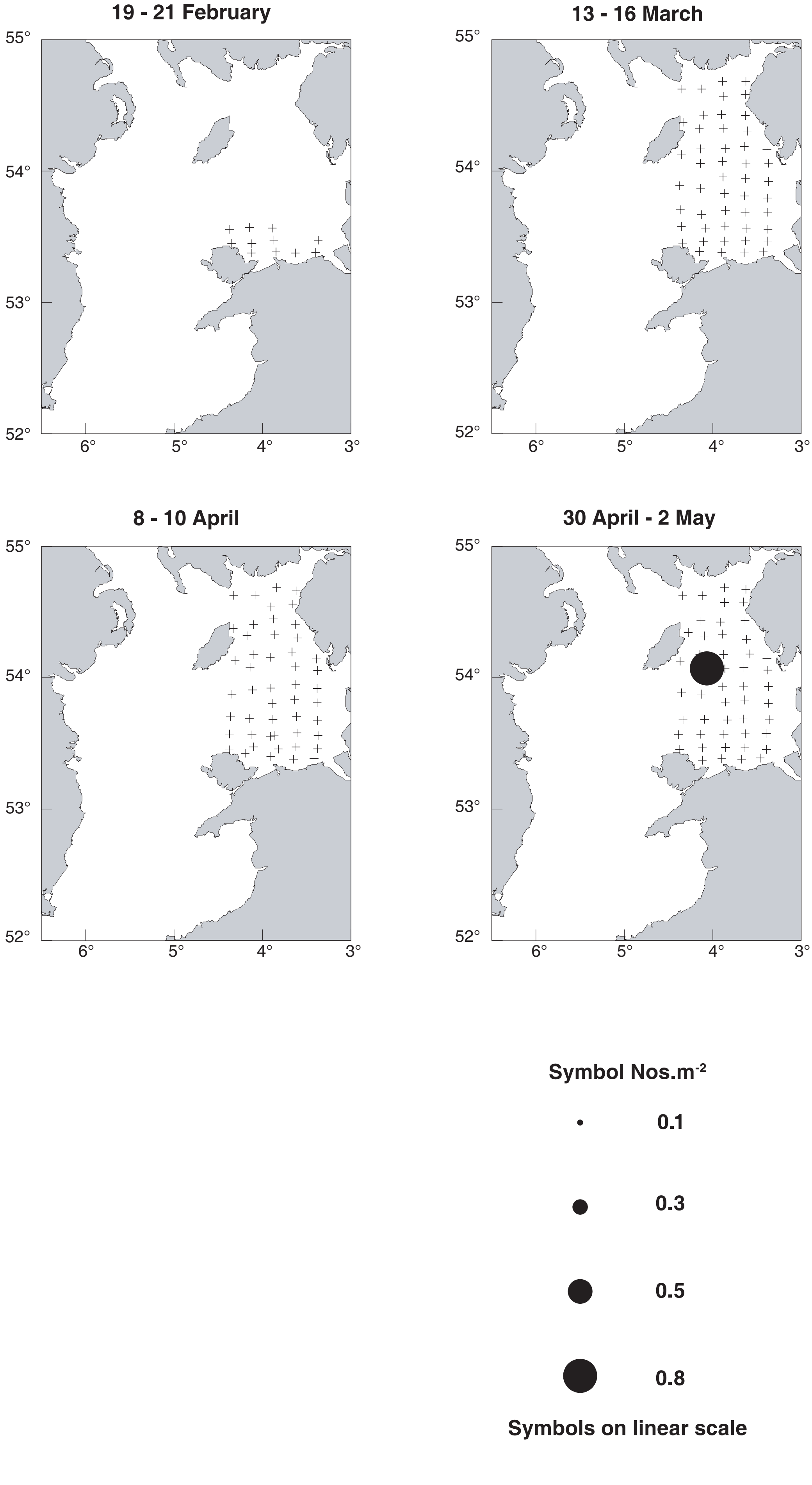


Figure 107. Concentration of Norwegian topknot (Phrynorhombus norvegicus) larvae (nos.m^{-2}) in 2002

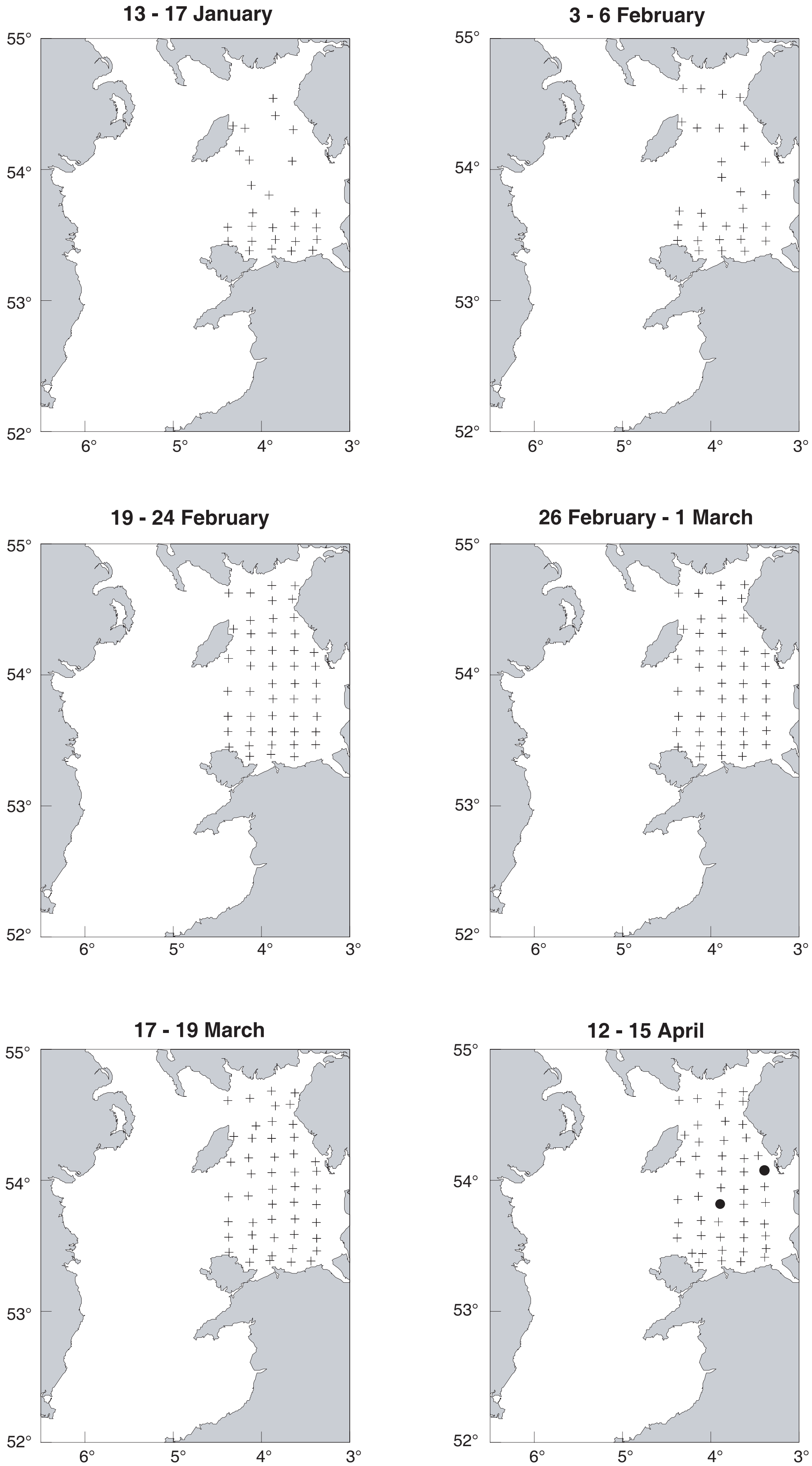


Figure 108. Concentration of Norwegian topknot (Phrynorhombus norvegicus) larvae (nos.m^{-2}) in 2003

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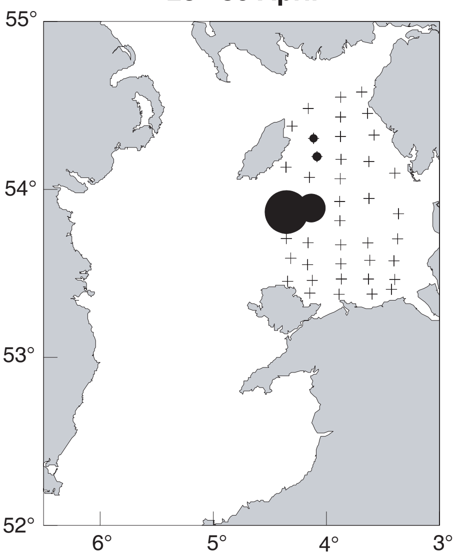


Symbol Nos.m^{-2}

•	**0.1**
●	**4.3**
●	**8.5**
●	**12.8**

Symbols on linear scale

Figure 108. continued

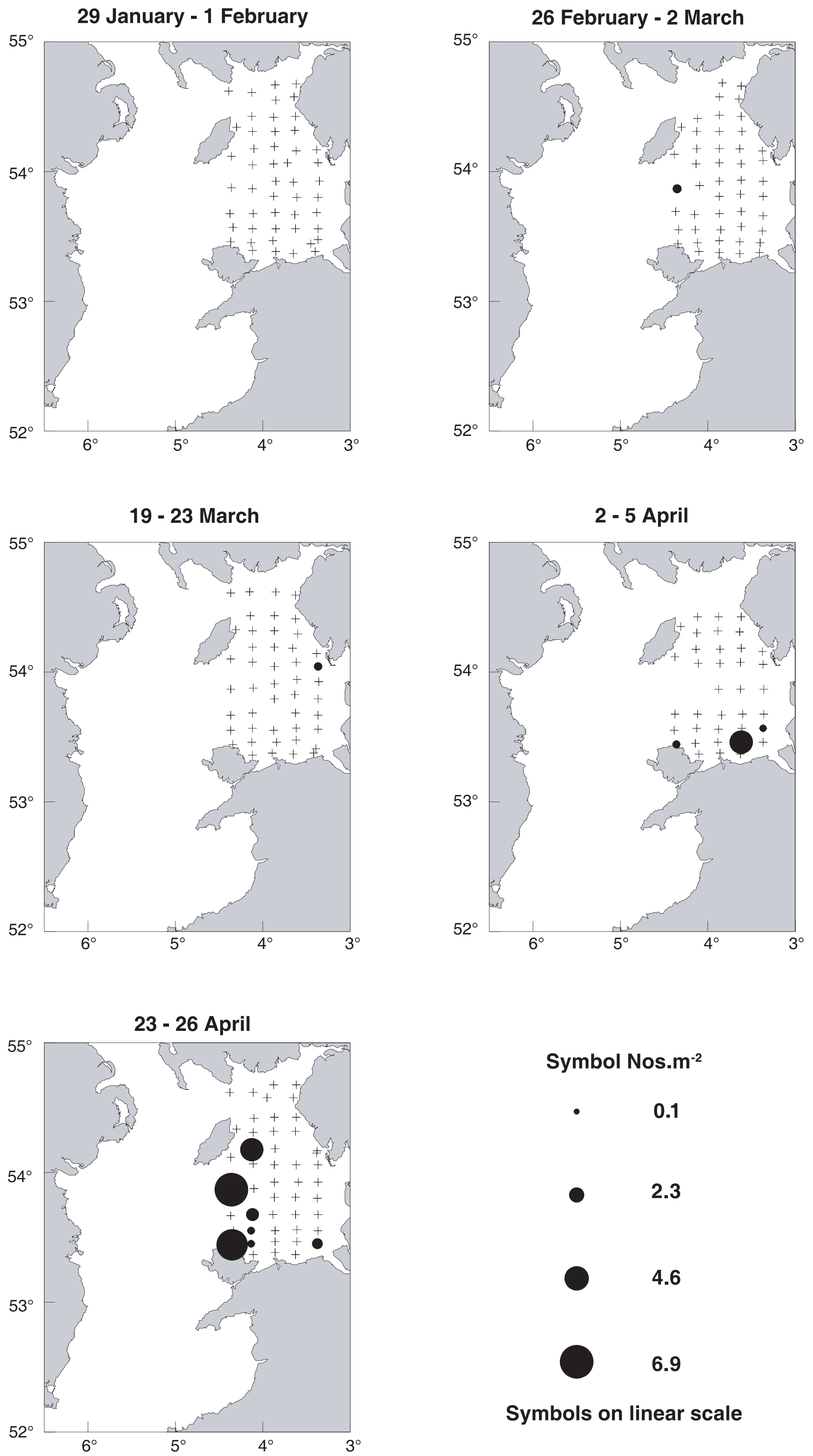


Figure 109. Concentration of topknot (Zeugopterus punctatus) eggs (nos.m^{-2}) in 2001

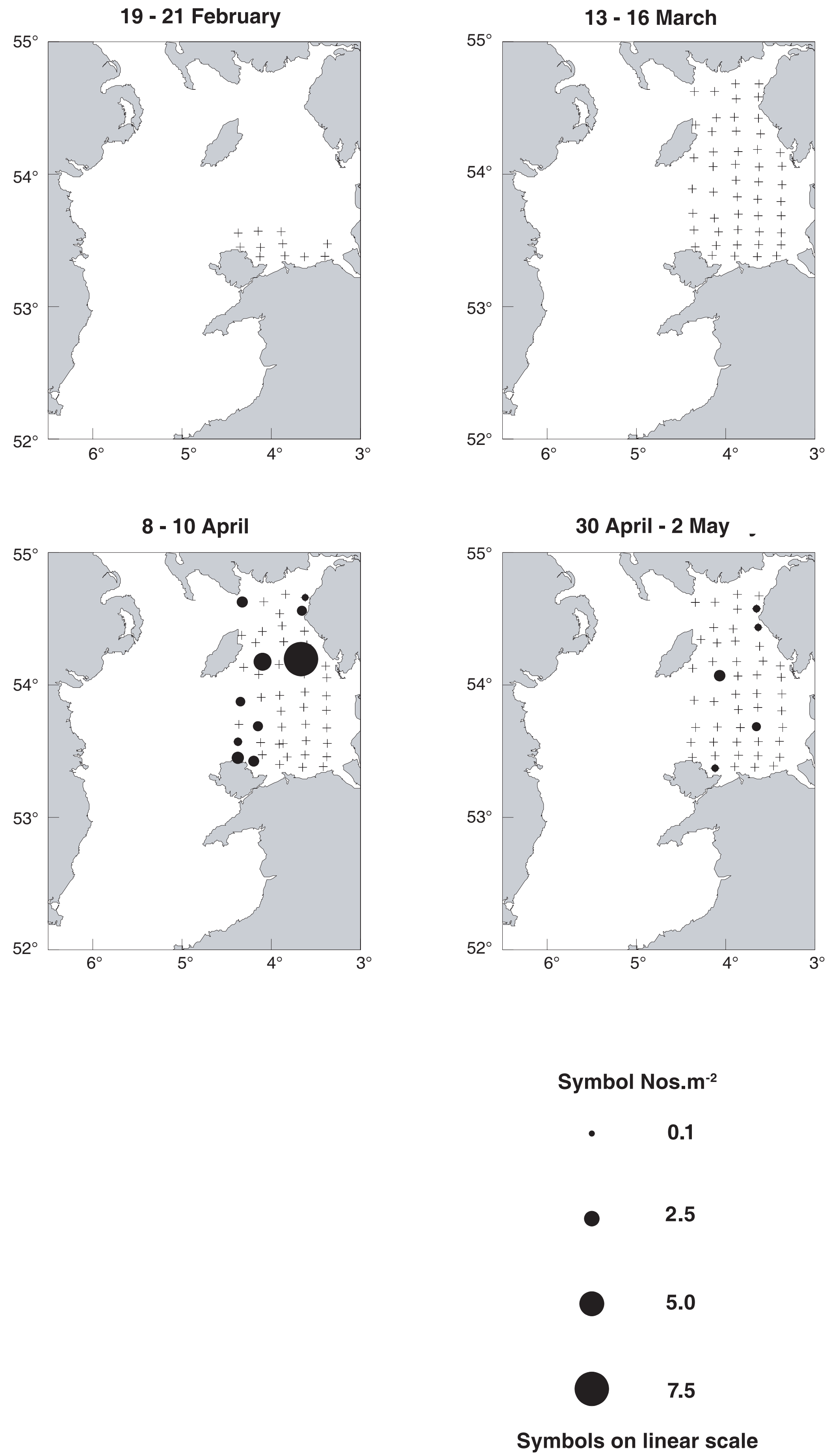


Figure 110. Concentration of topknot (Zeugopterus punctatus) eggs (nos.m^{-2}) in 2002

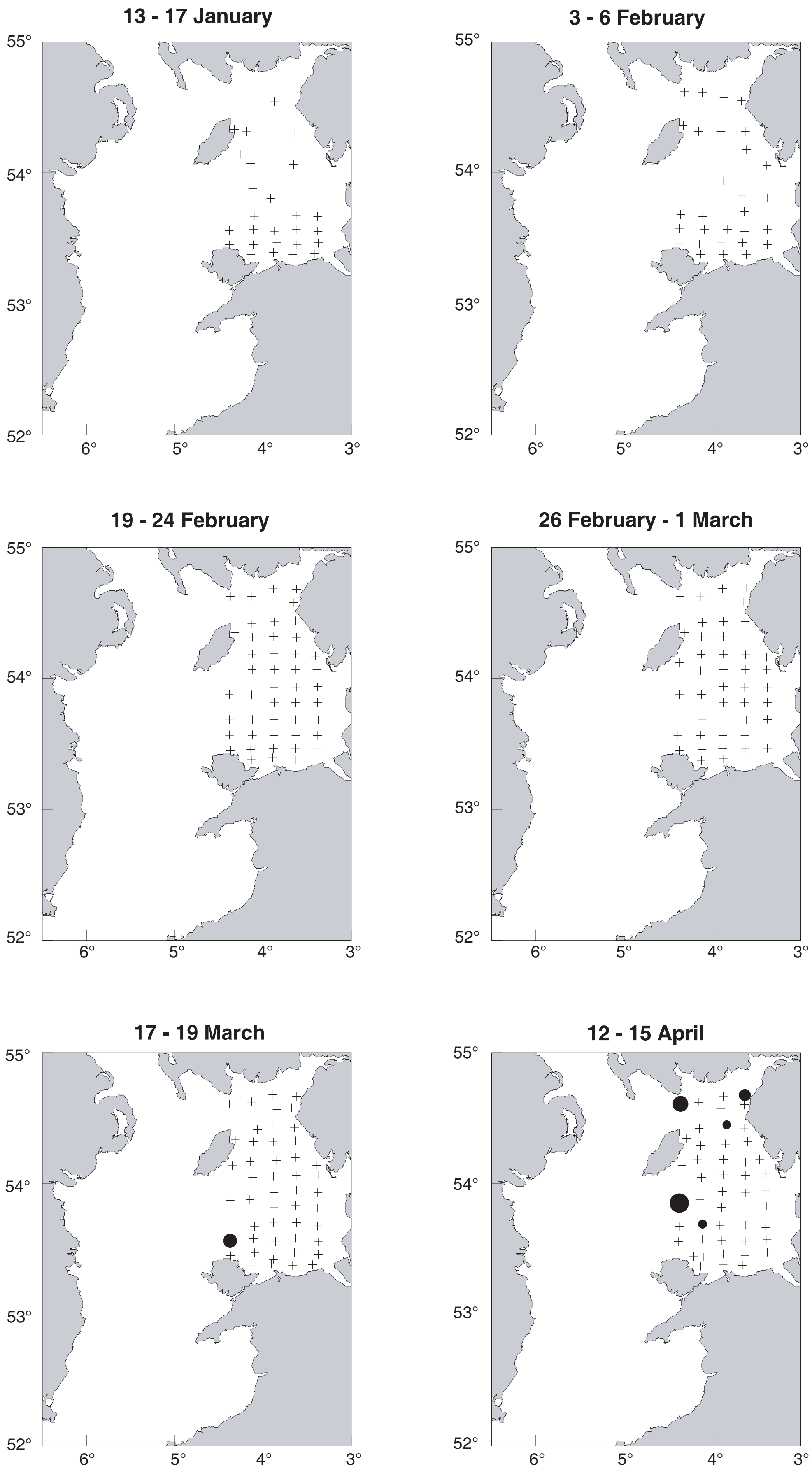
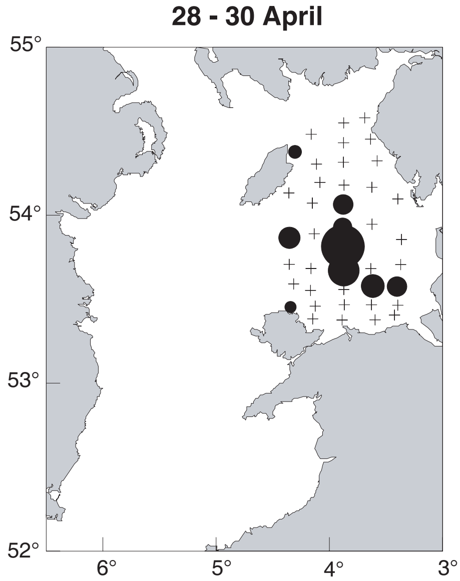


Figure 111. Concentration of topknot (Zeugopterus punctatus) eggs (nos.m^{-2}) in 2003



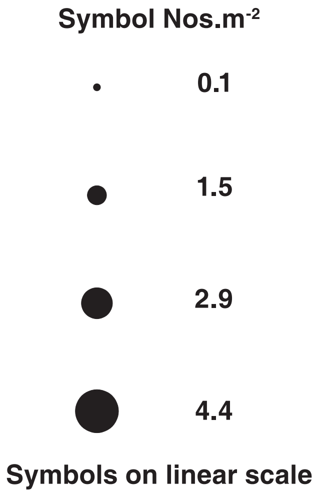


Figure 111. continued

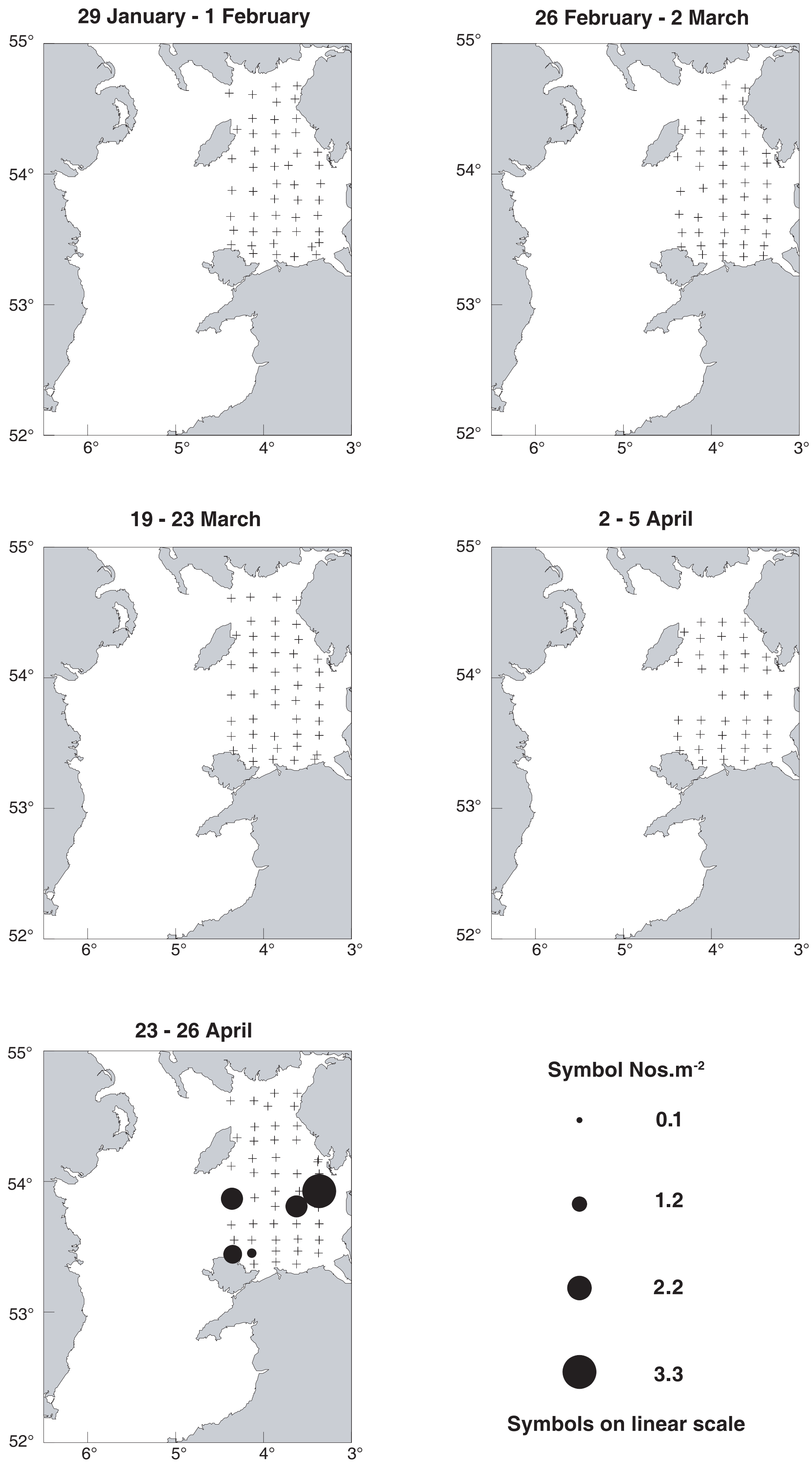


Figure 112. Concentration of topknot (Zeugopterus punctatus) larvae (nos.m^{-2}) in 2001

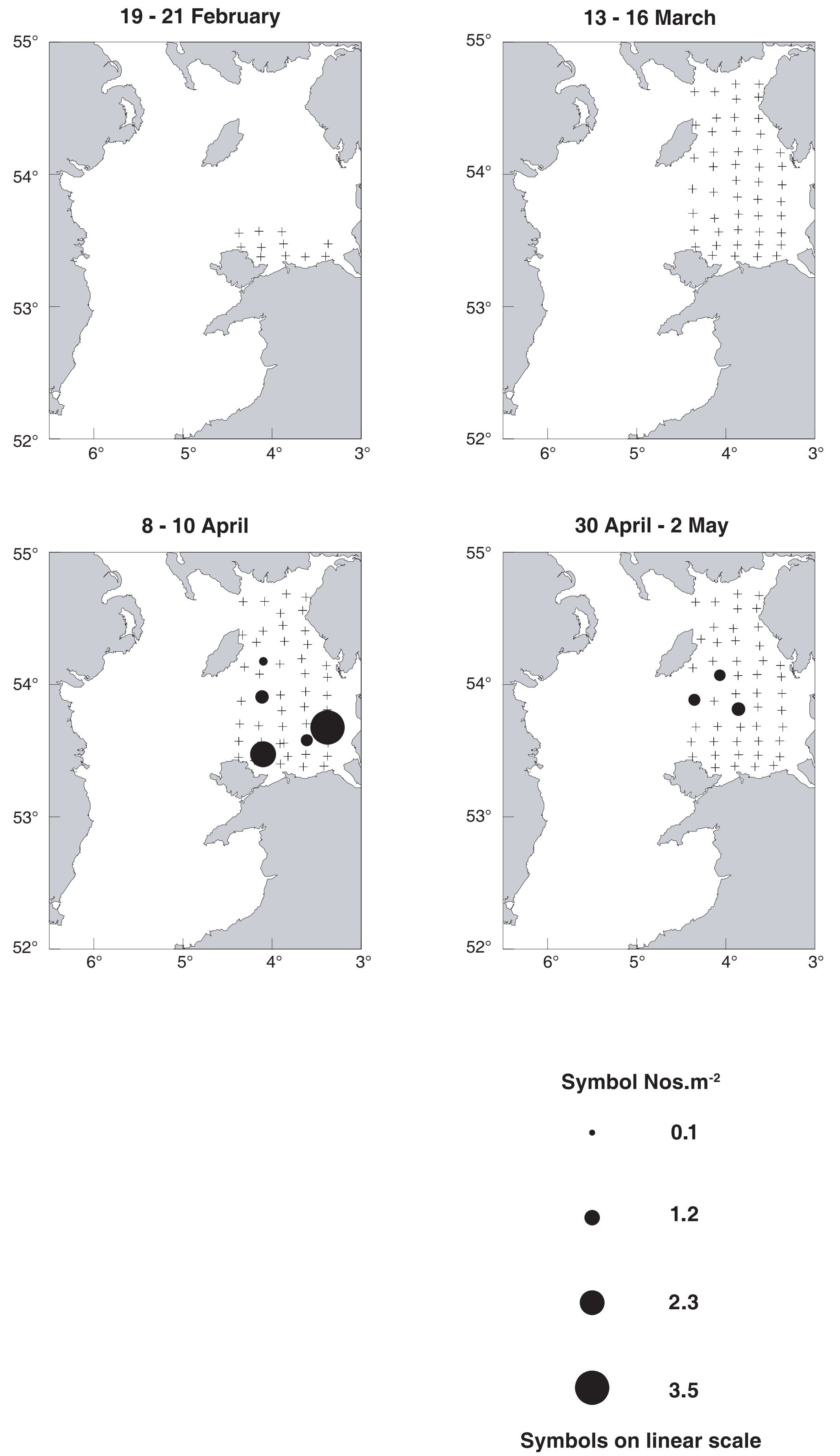


Figure 113. Concentration of topknot (Zeugopterus punctatus) larvae (nos.m^{-2}) in 2002

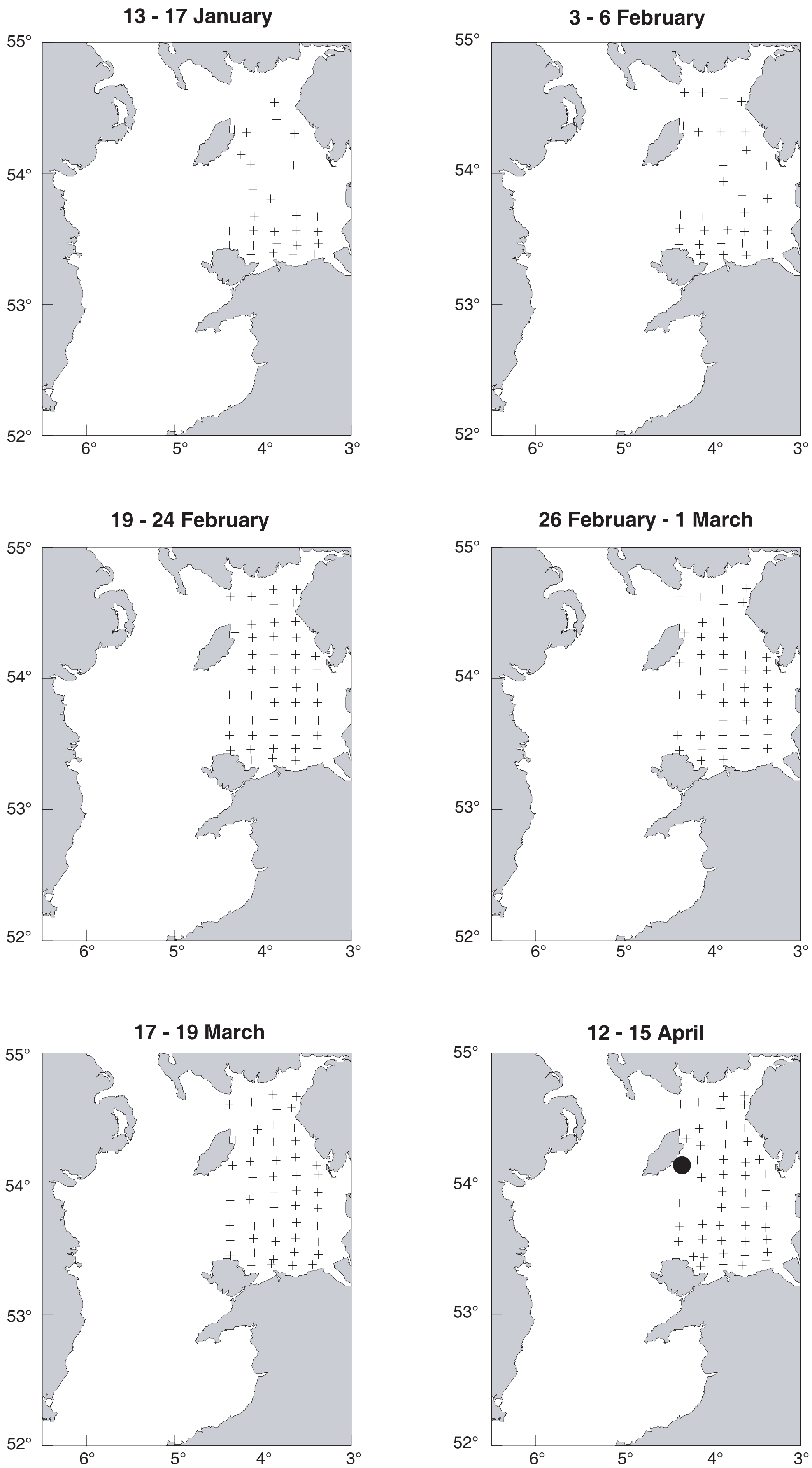
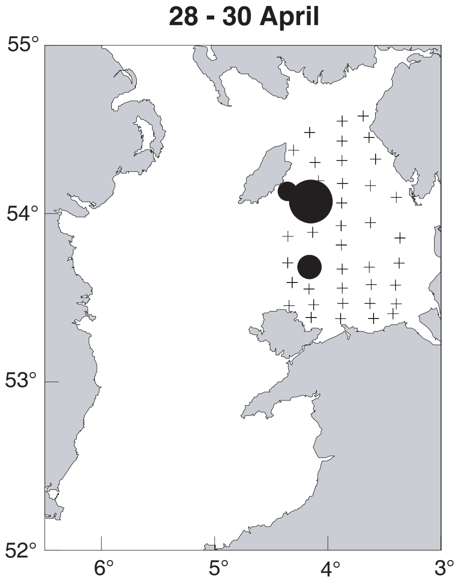


Figure 114. Concentration of topknot (Zeugopterus punctatus) larvae (nos.m⁻²) in 2003



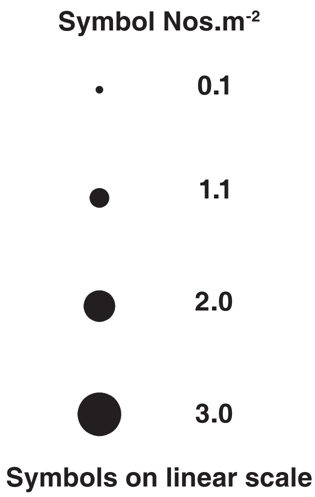


Figure 114. continued

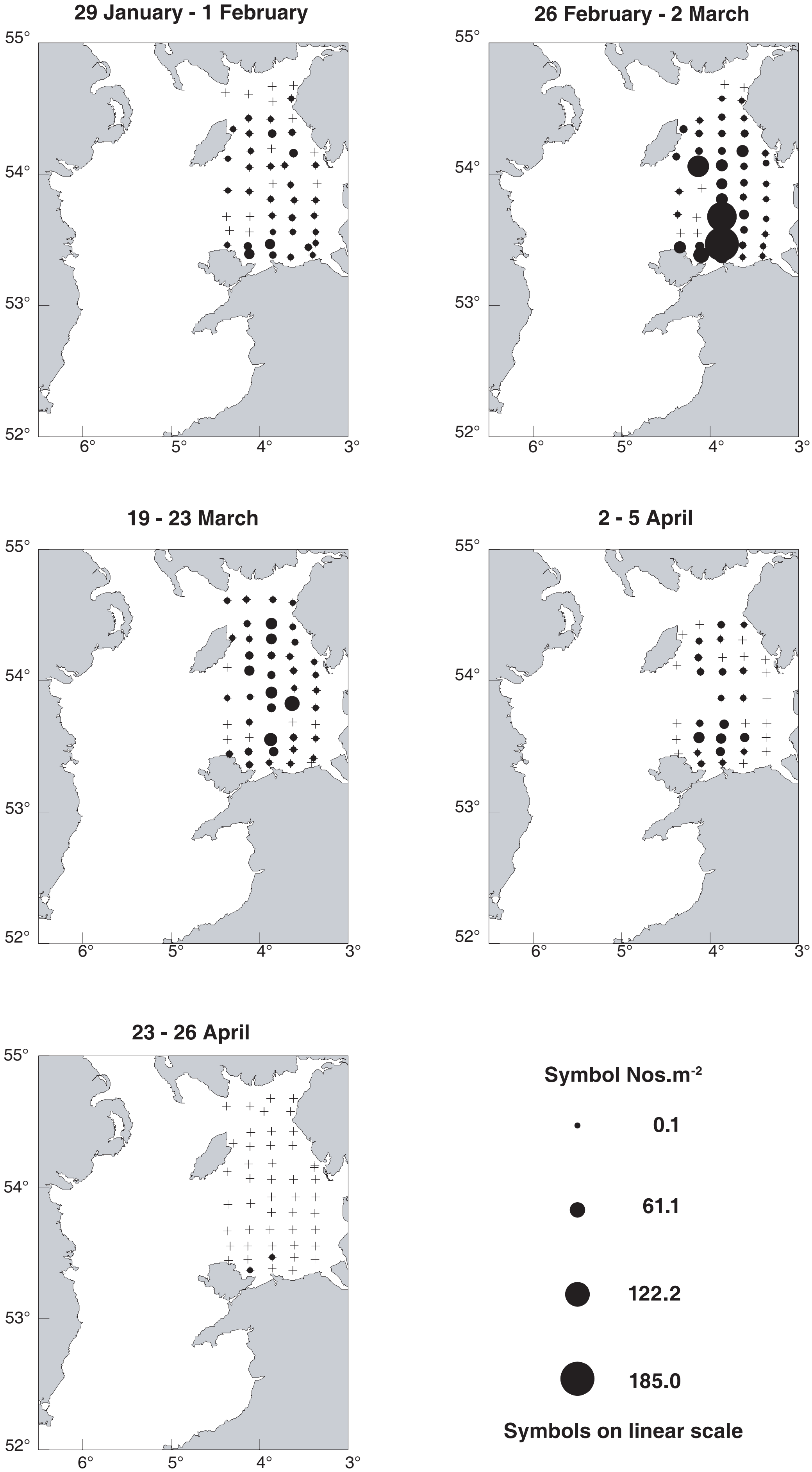


Figure 115. Concentration of plaice (Pleuronectes platessa) eggs (nos.m^{-2}) in 2001

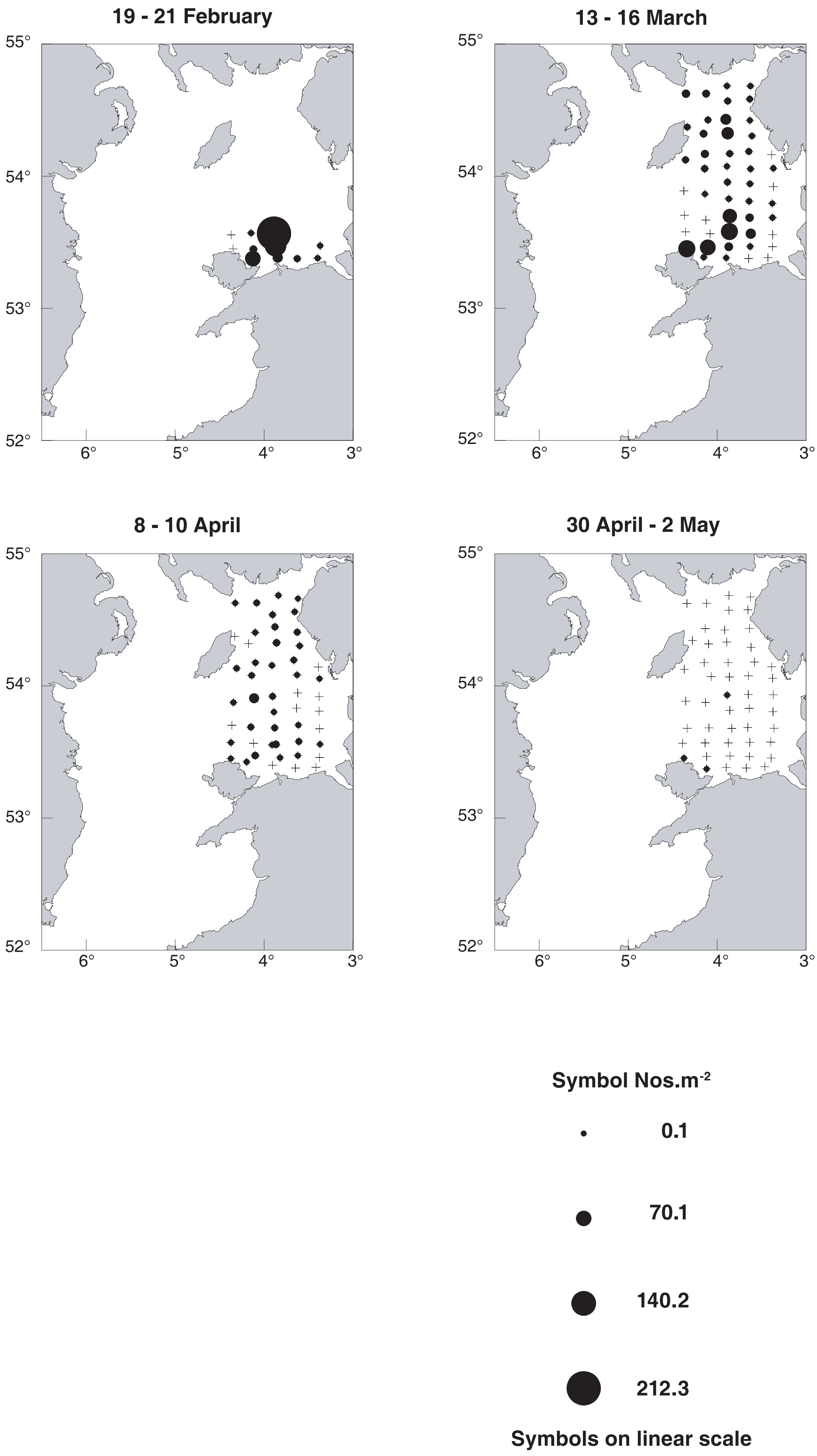


Figure 116. Concentration of plaice (Pleuronectes platessa) eggs (nos.m^{-2}) in 2002

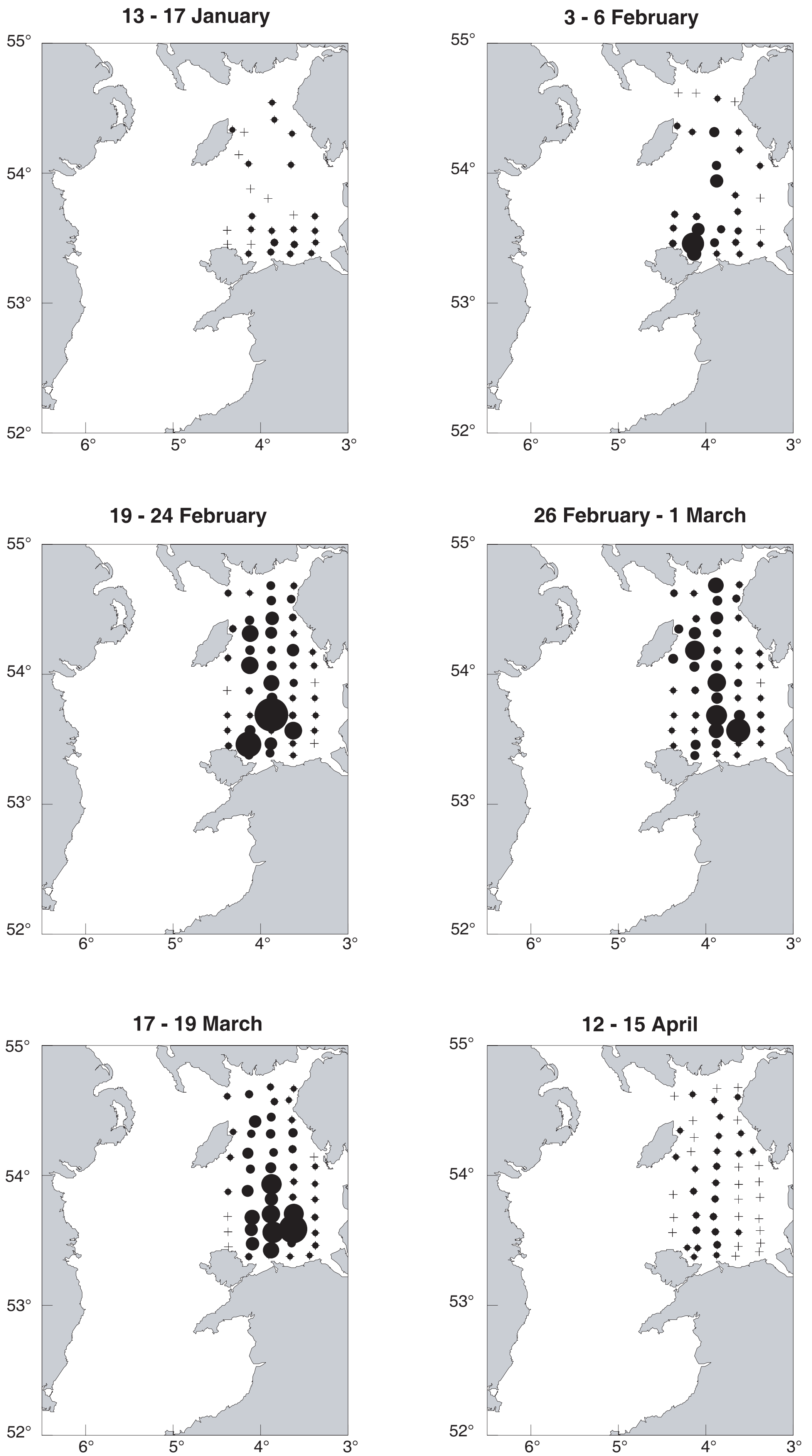


Figure 117. Concentration of plaice (Pleuronectes platessa) eggs (nos.m^{-2}) in 2003

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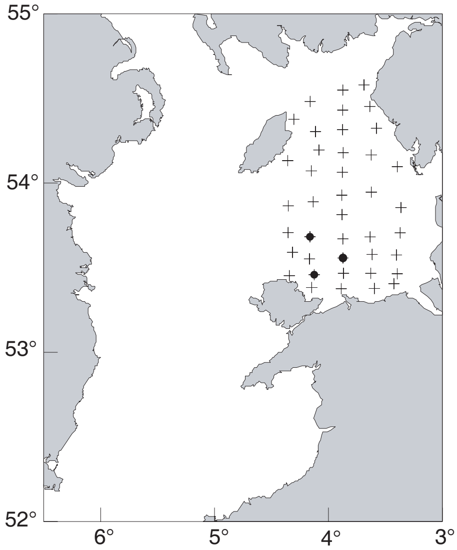

Symbol Nos.m^{-2}

•	**0.1**
●	**67.2**
●	**134.2**
●	**203.3**

Symbols on linear scale

Figure 117. continued

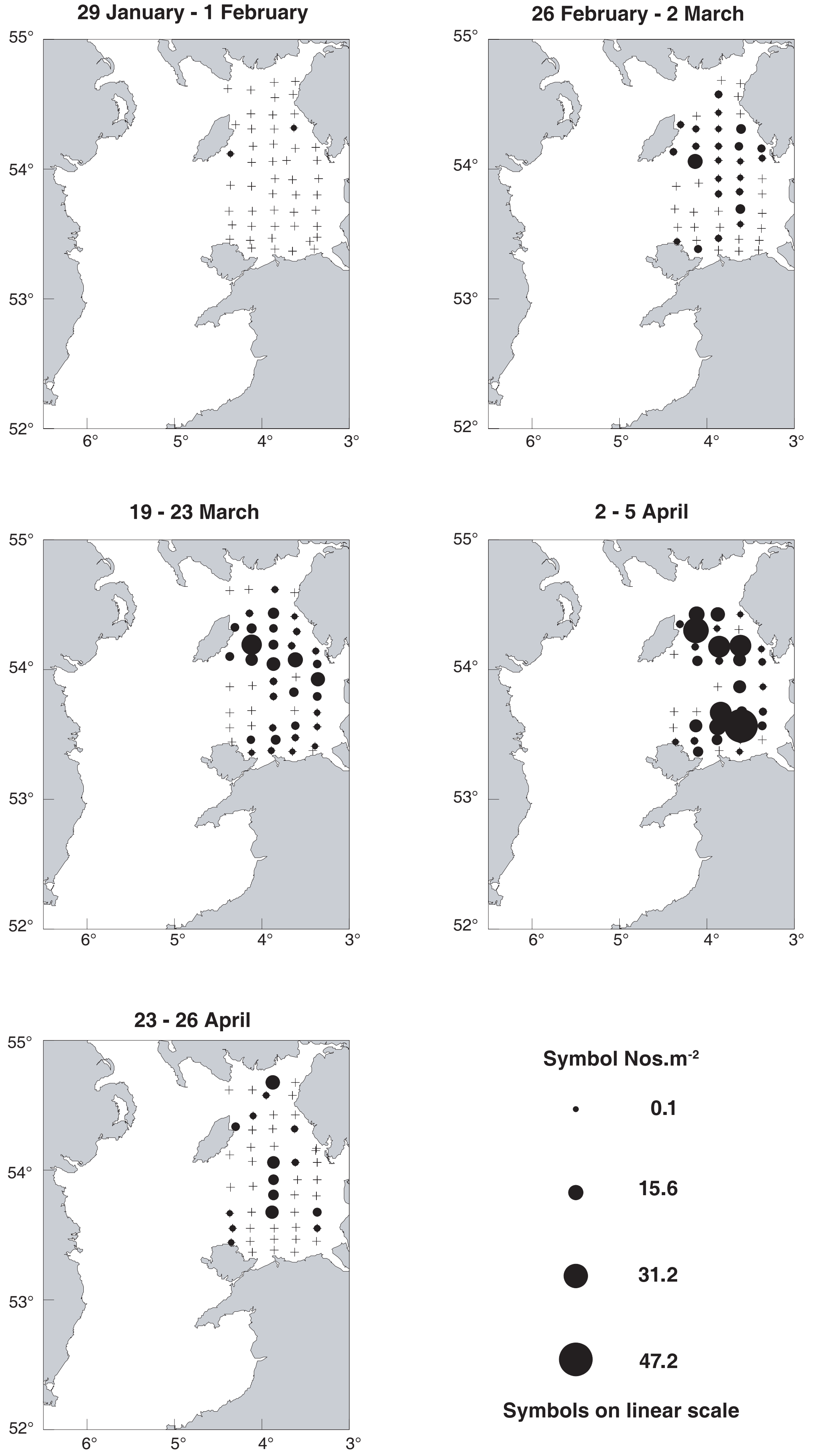

Figure 118. Concentration of plaice (Pleuronectes platessa) larvae (nos.m^{-2}) in 2001

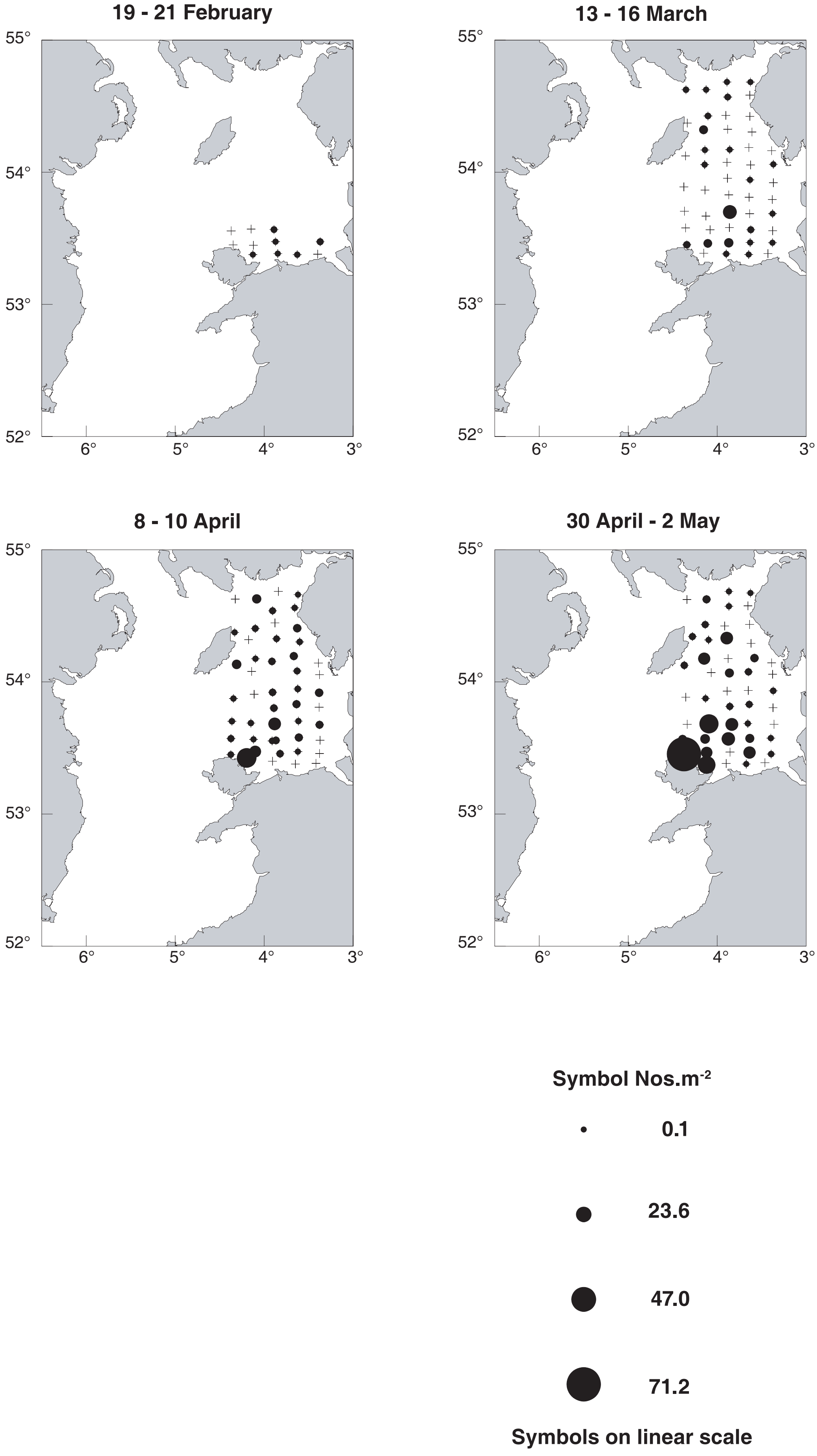

Figure 119. Concentration of plaice (Pleuronectes platessa) larvae (nos.m⁻²) in 2002

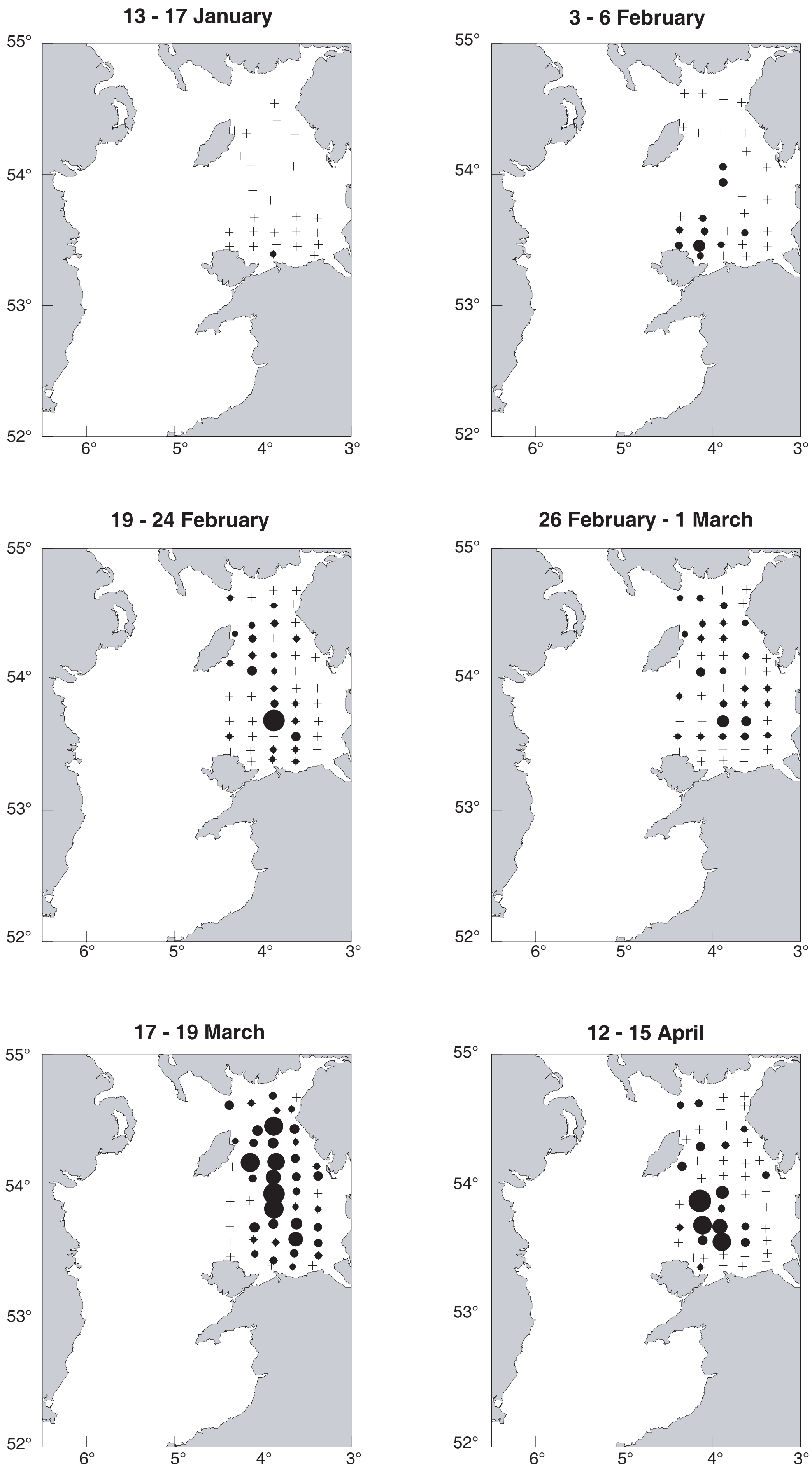

Figure 120. Concentration of plaice (Pleuronectes platessa) larvae (nos.m⁻²) in 2003

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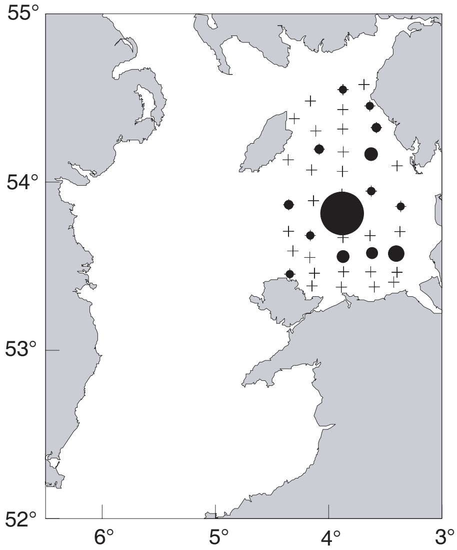


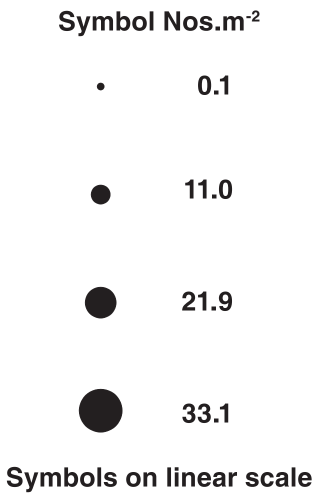


Figure 120. continued

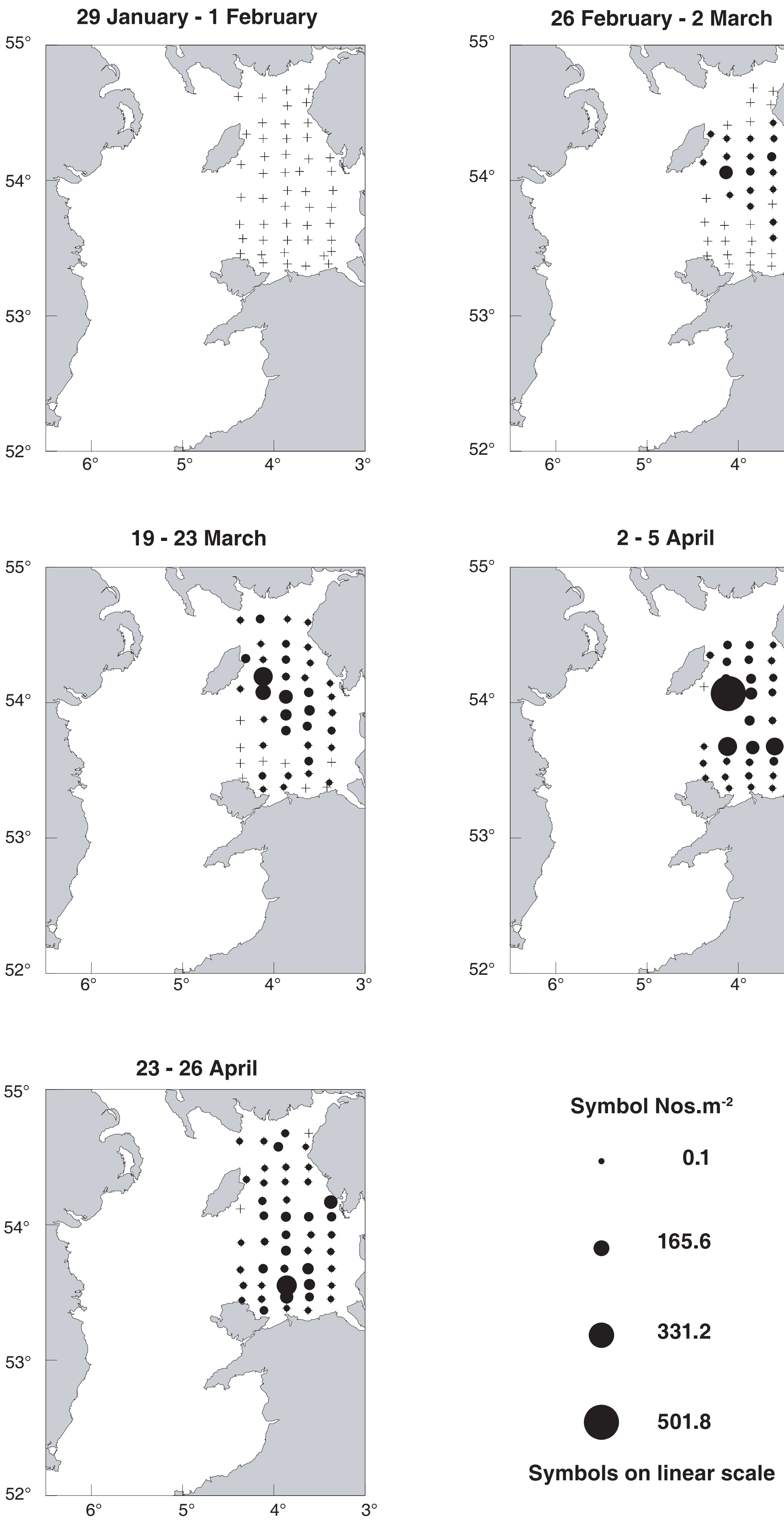


Figure 121. Concentration of flounder (Platichthys flesus) larvae (nos.m^{-2}) in 2001

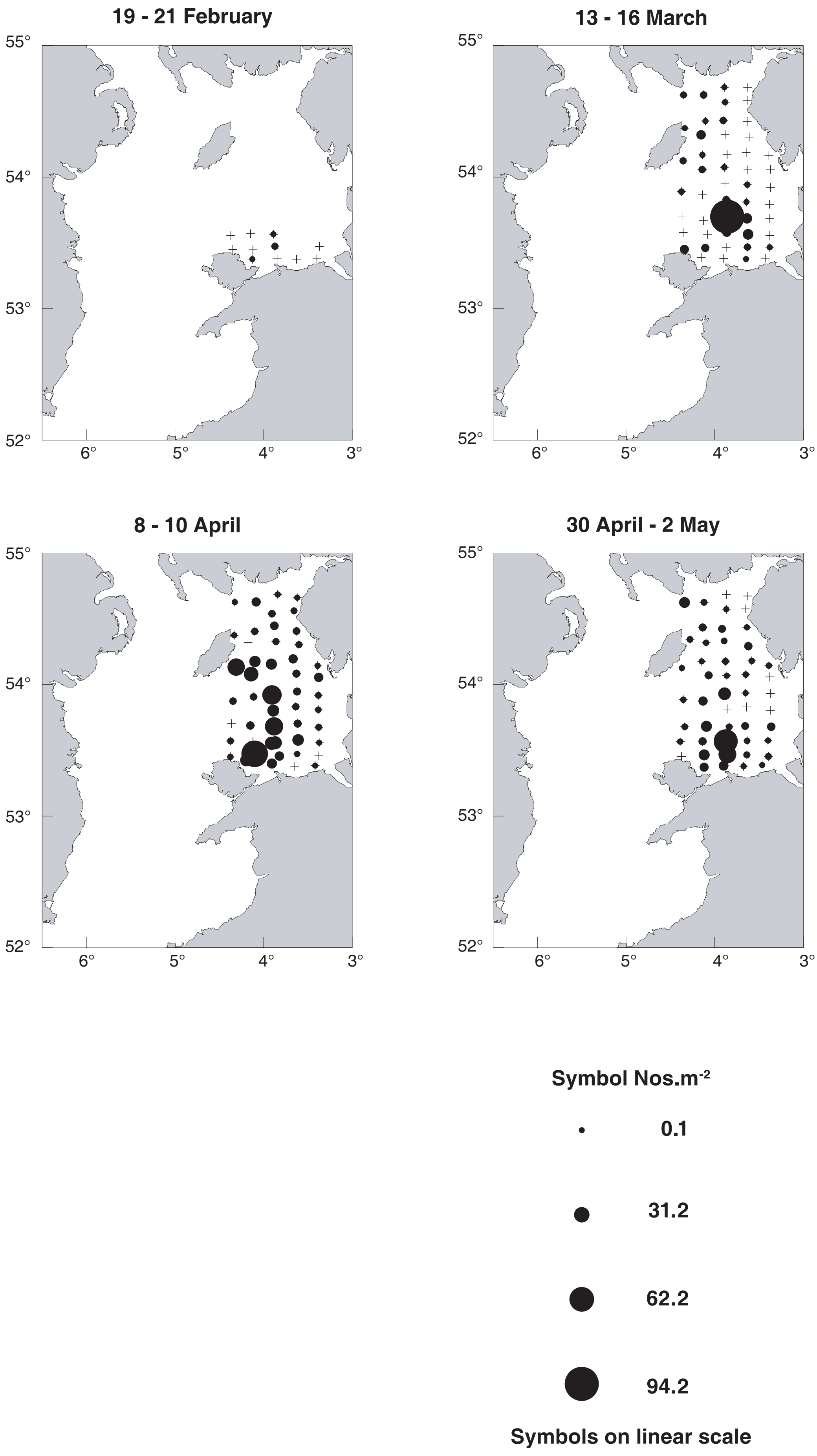


Figure 122. Concentration of flounder (Platichthys flesus) larvae (nos.m^{-2}) in 2002

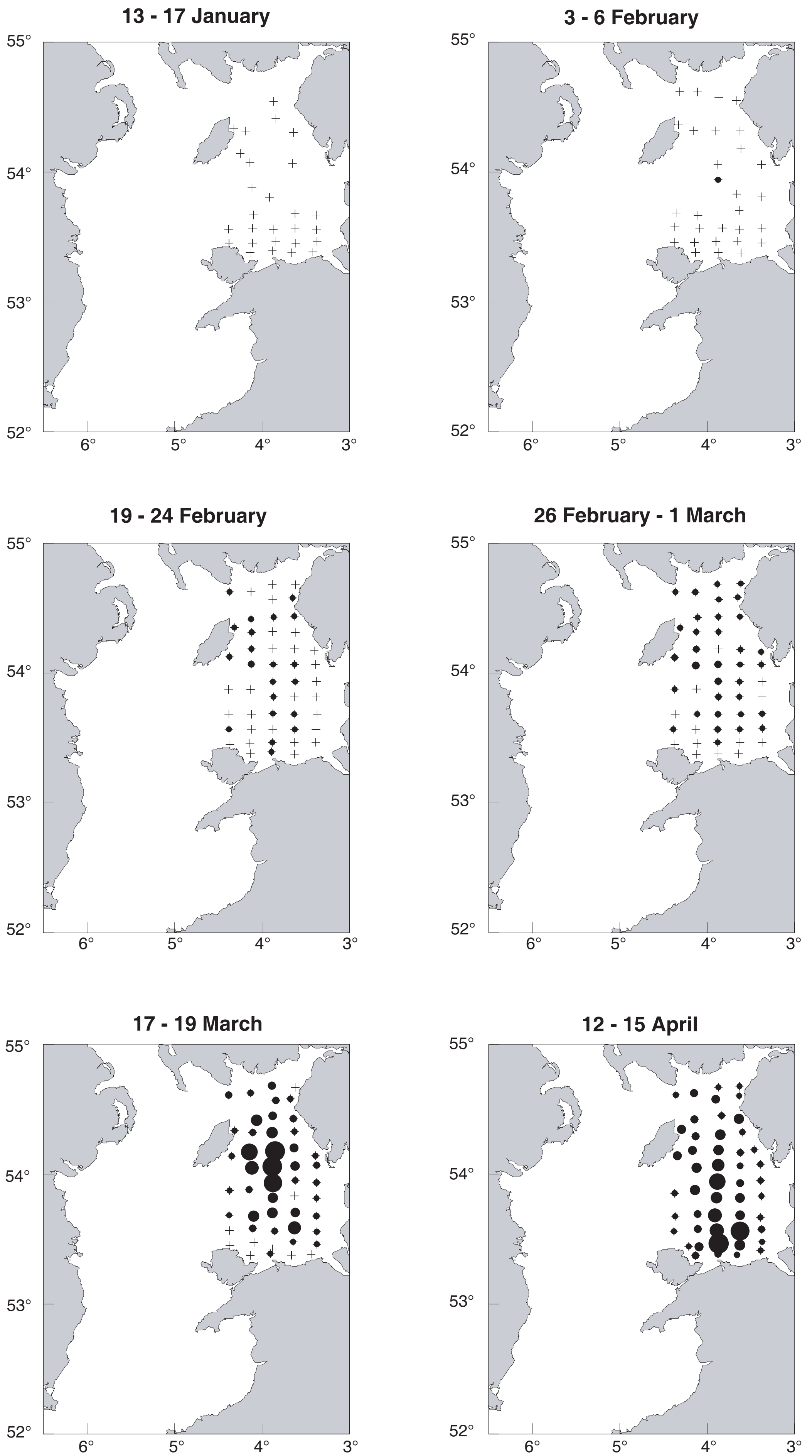
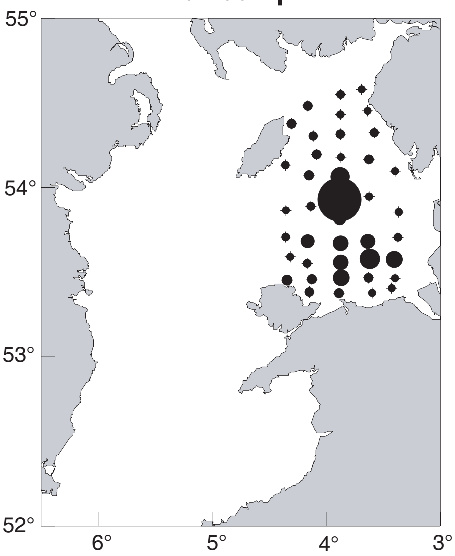


Figure 123. Concentration of flounder (Platichthys flesus) larvae (nos.m^{-2}) in 2003

28 - 30 April



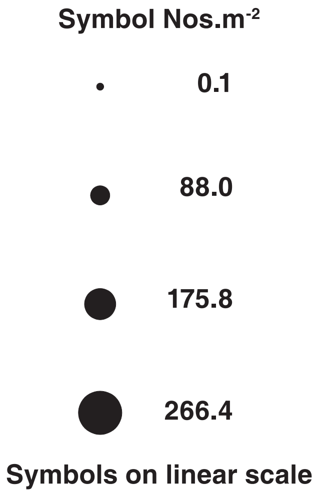


Figure 123. continued

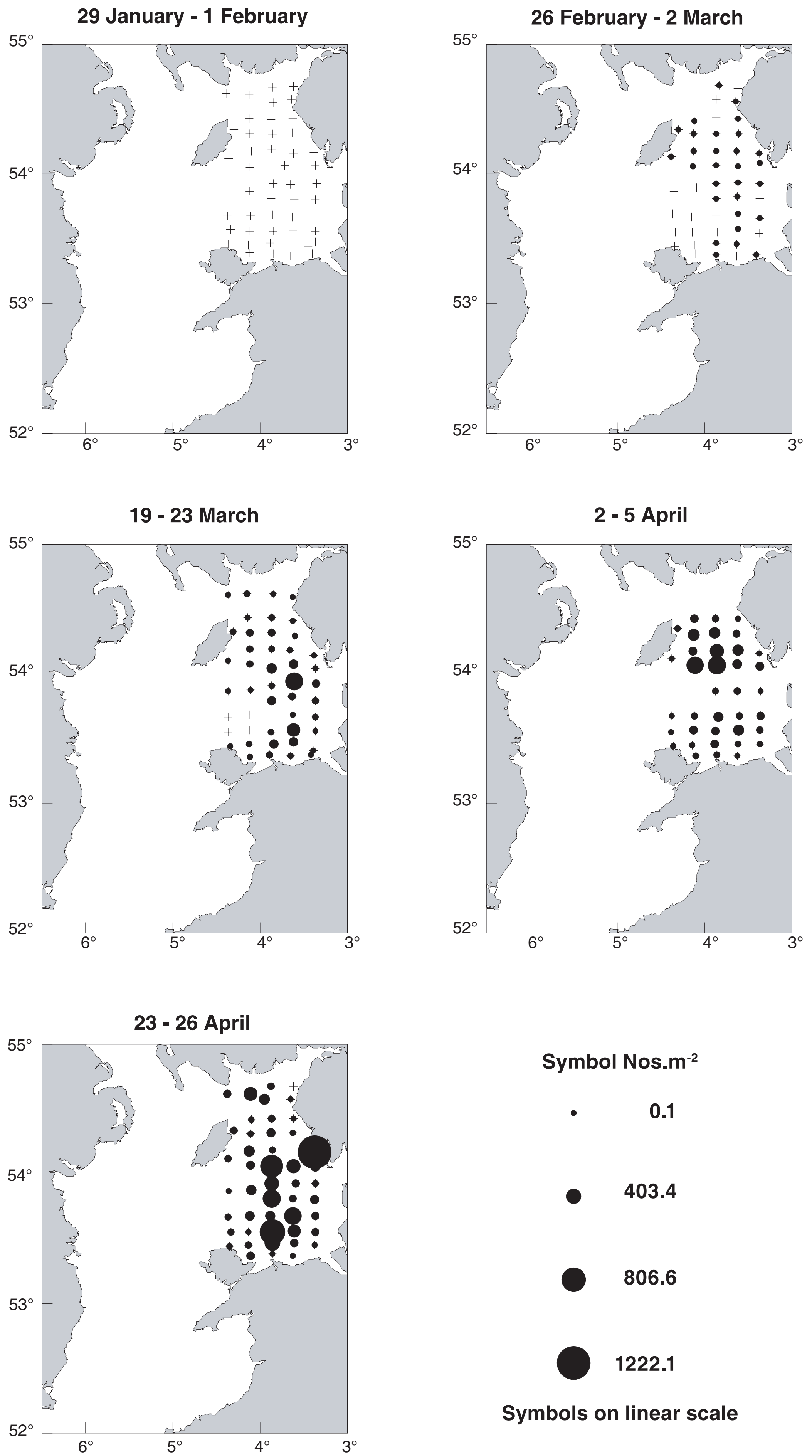


Figure 124. Concentration of dab (Limanda limanda) larvae (nos.m^{-2}) in 2001

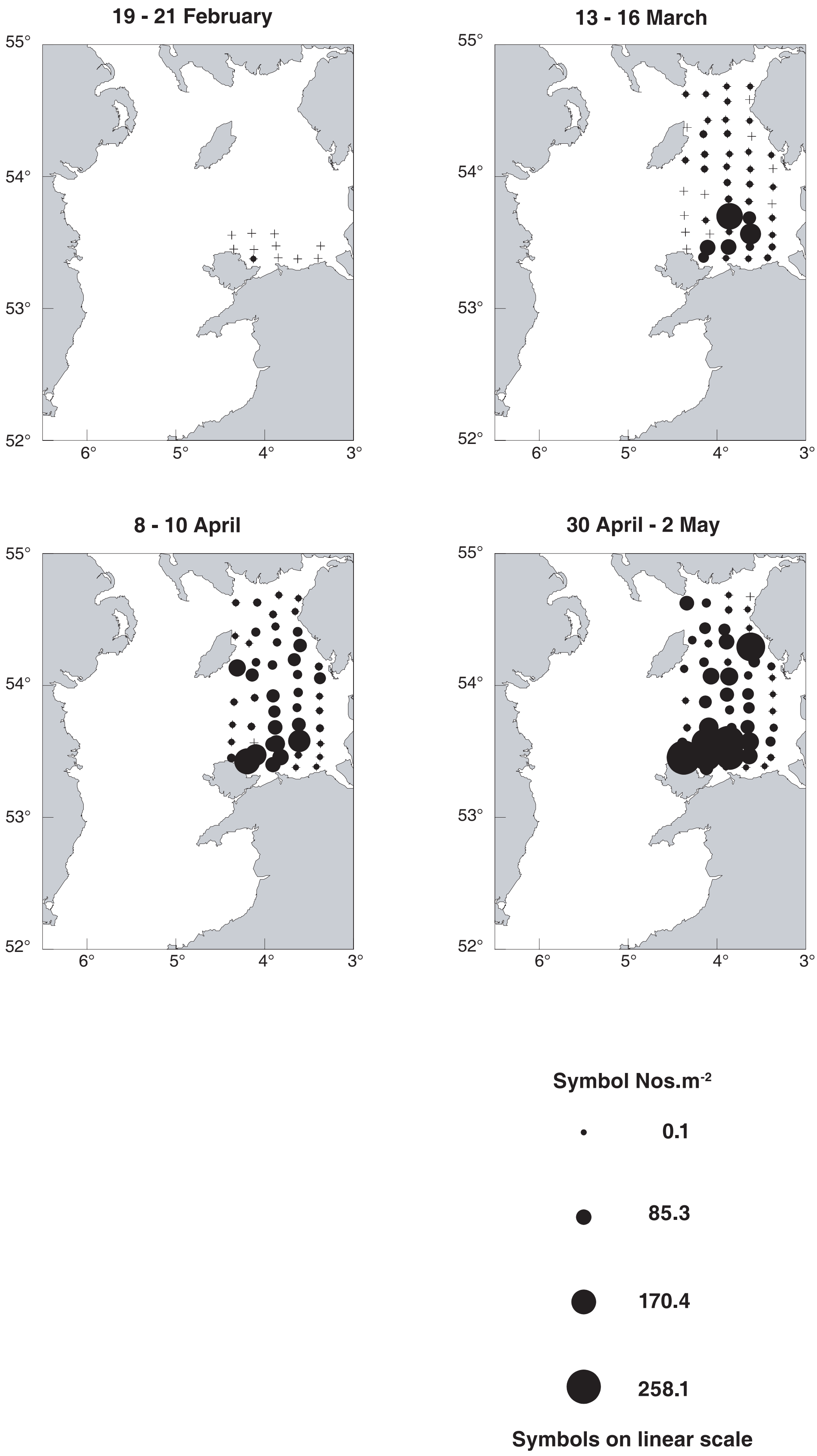


Figure 125. Concentration of dab (Limanda limanda) larvae (nos.m $^{-2}$***) in 2002***

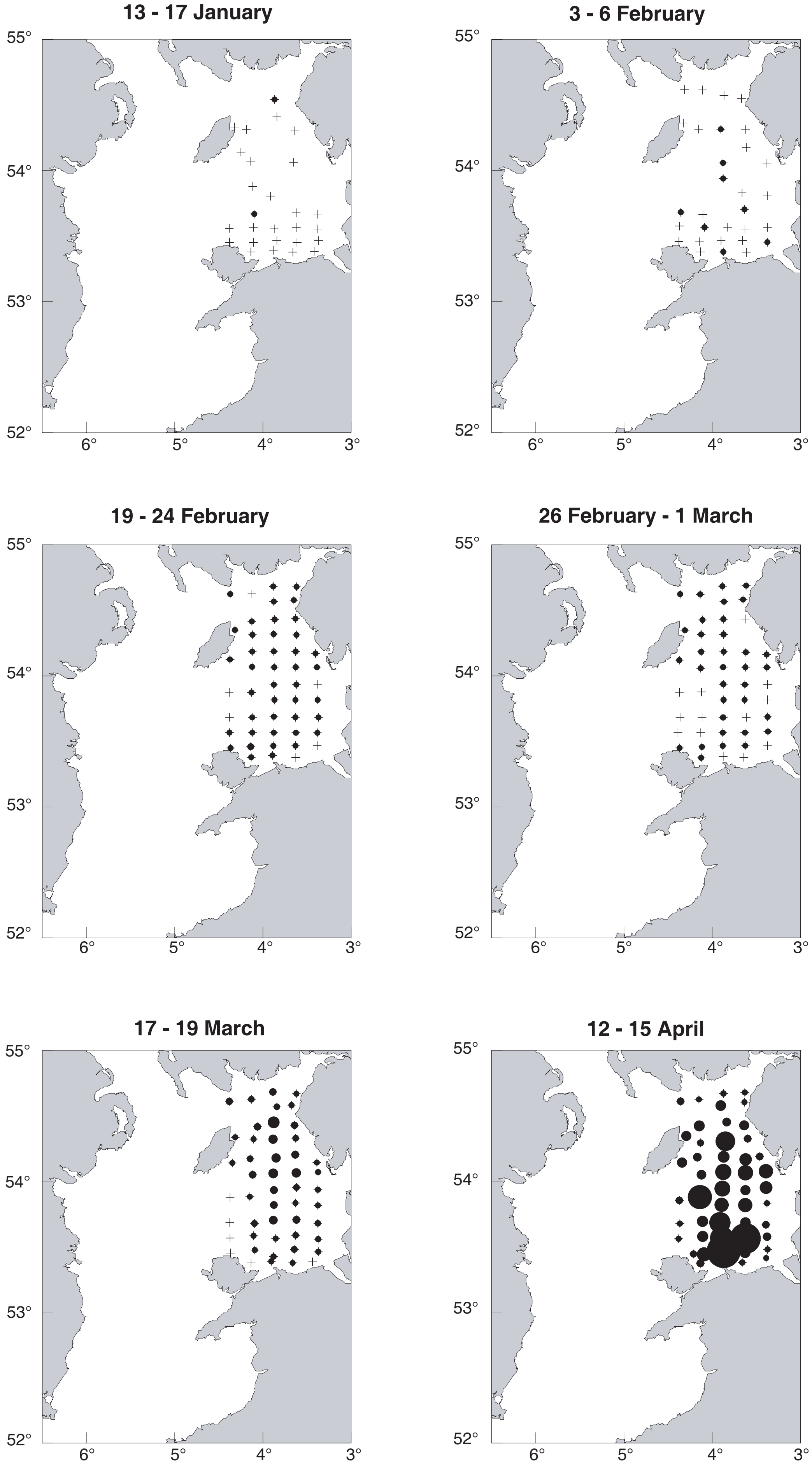
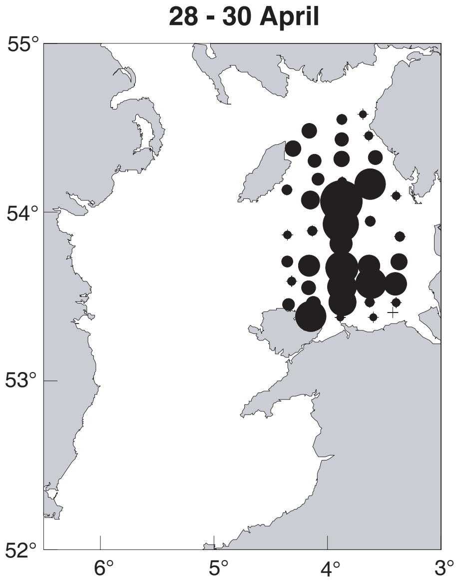


Figure 126. Concentration of dab (Limanda limanda) larvae (nos.m⁻²) in 2003



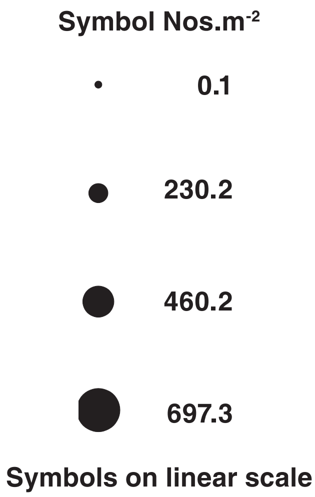


Figure 126. continued

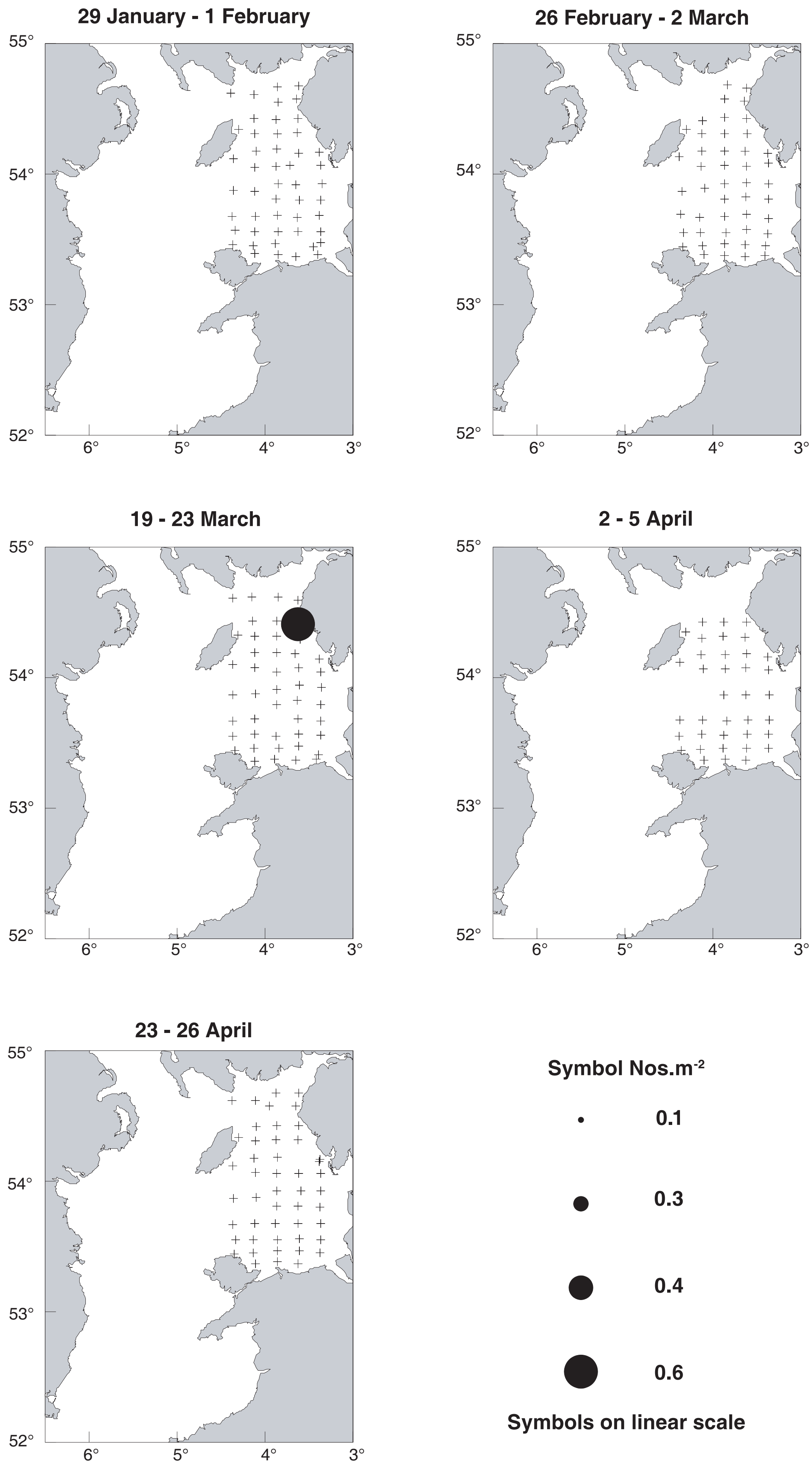


Figure 127. Concentration of late-stage lemon sole (Microstomus kitt) eggs (nos.m^{-2}) in 2001

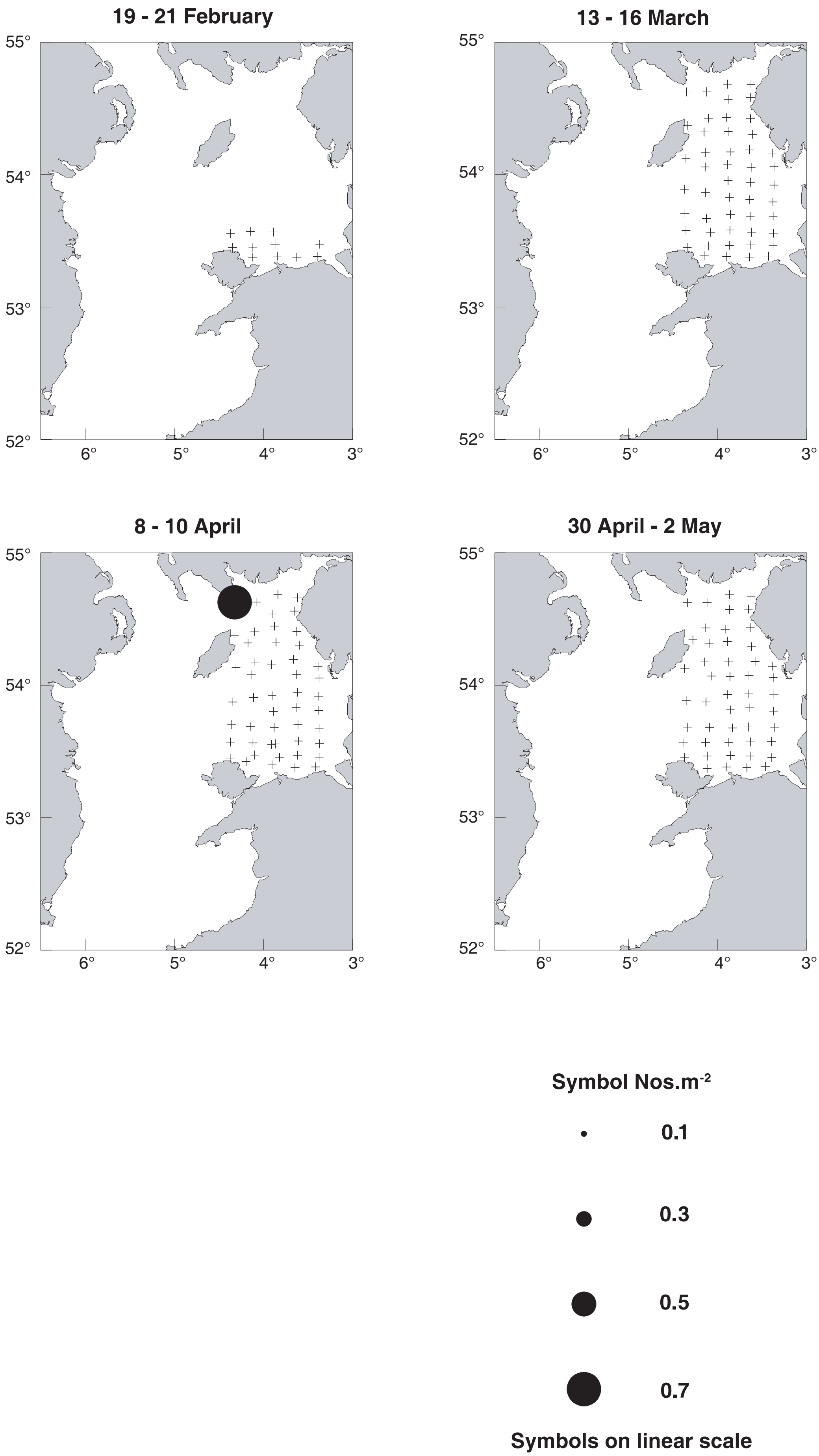


Figure 128. Concentration of late-stage lemon sole (Microstomus kitt) eggs (nos.m^{-2}) in 2002

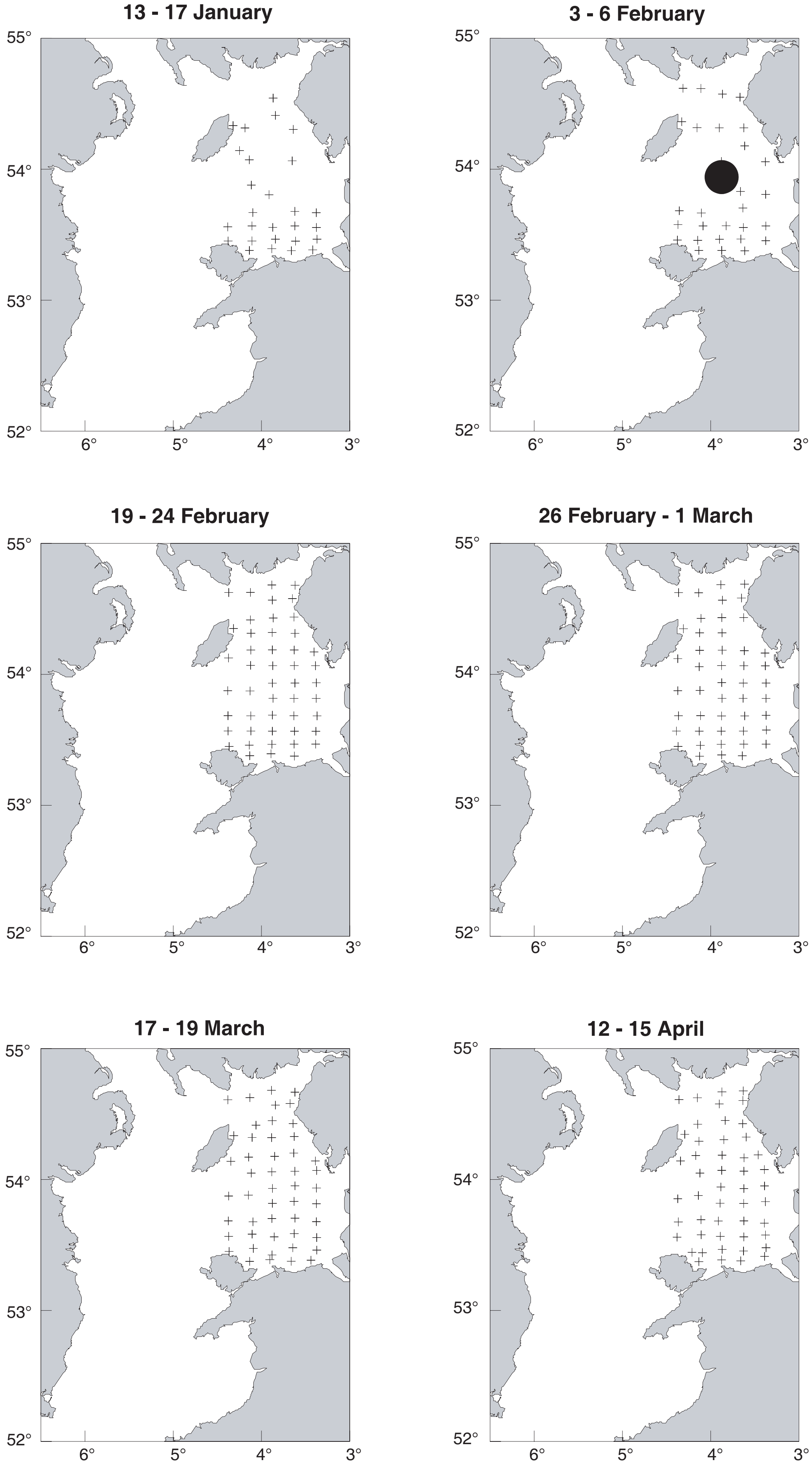
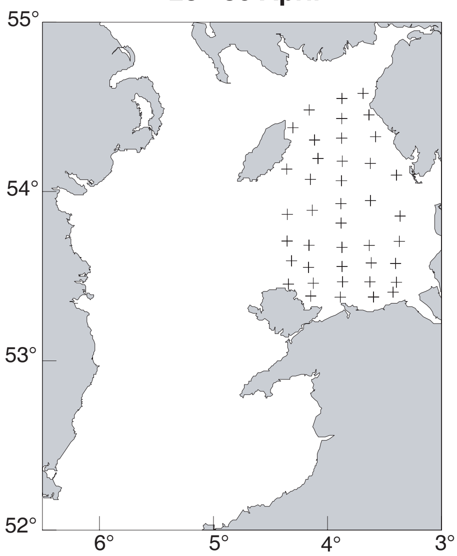


Figure 129. Concentration of late-stage lemon sole (Microstomus kitt) eggs (nos.m^{-2}) in 2003

28 - 30 April



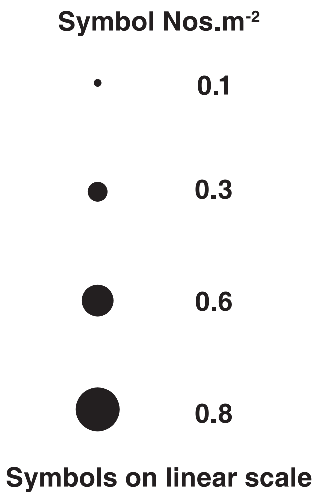


Figure 129. continued

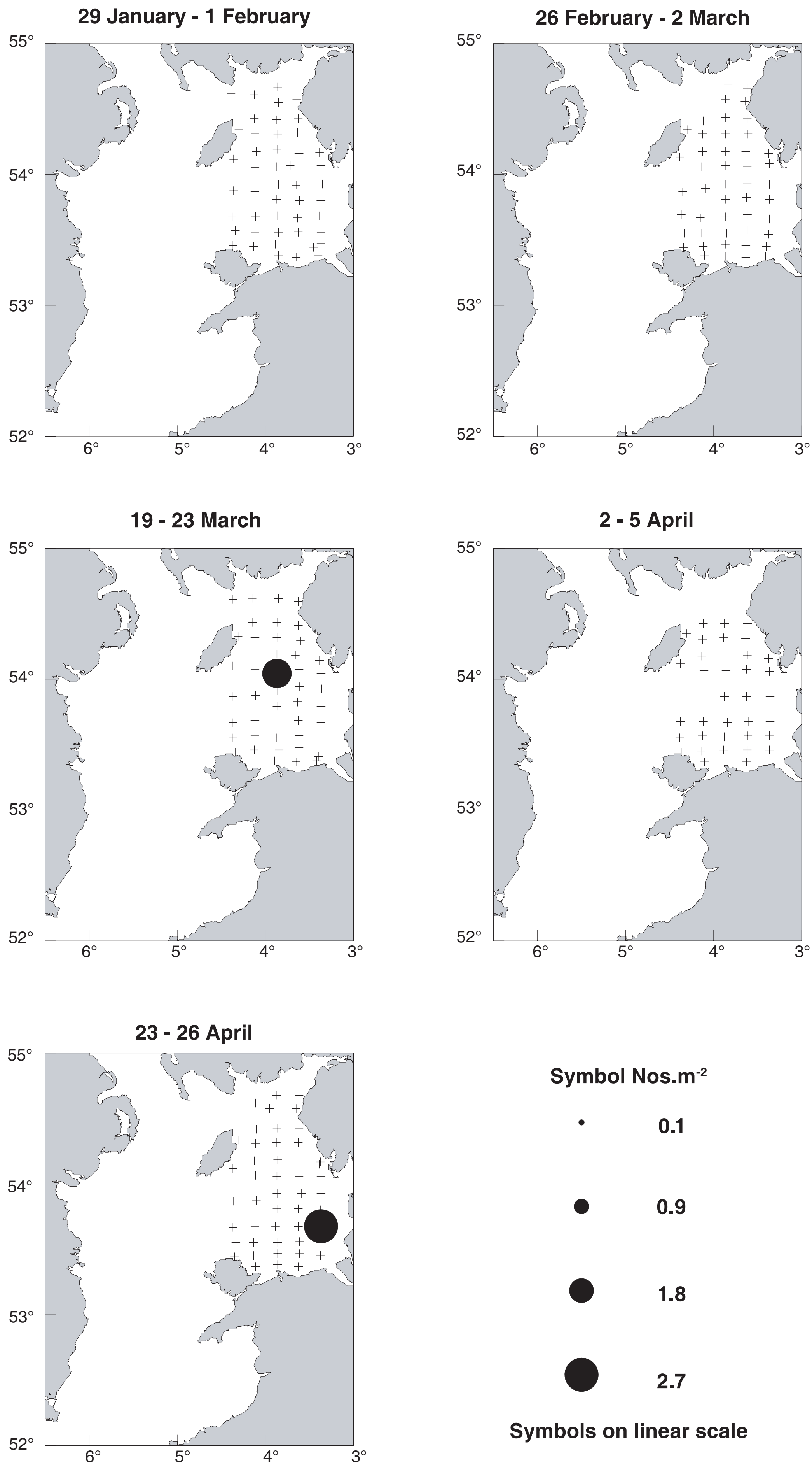


Figure 130. Concentration of lemon sole (Microstomus kitt) larvae (nos.m^{-2}) in 2001

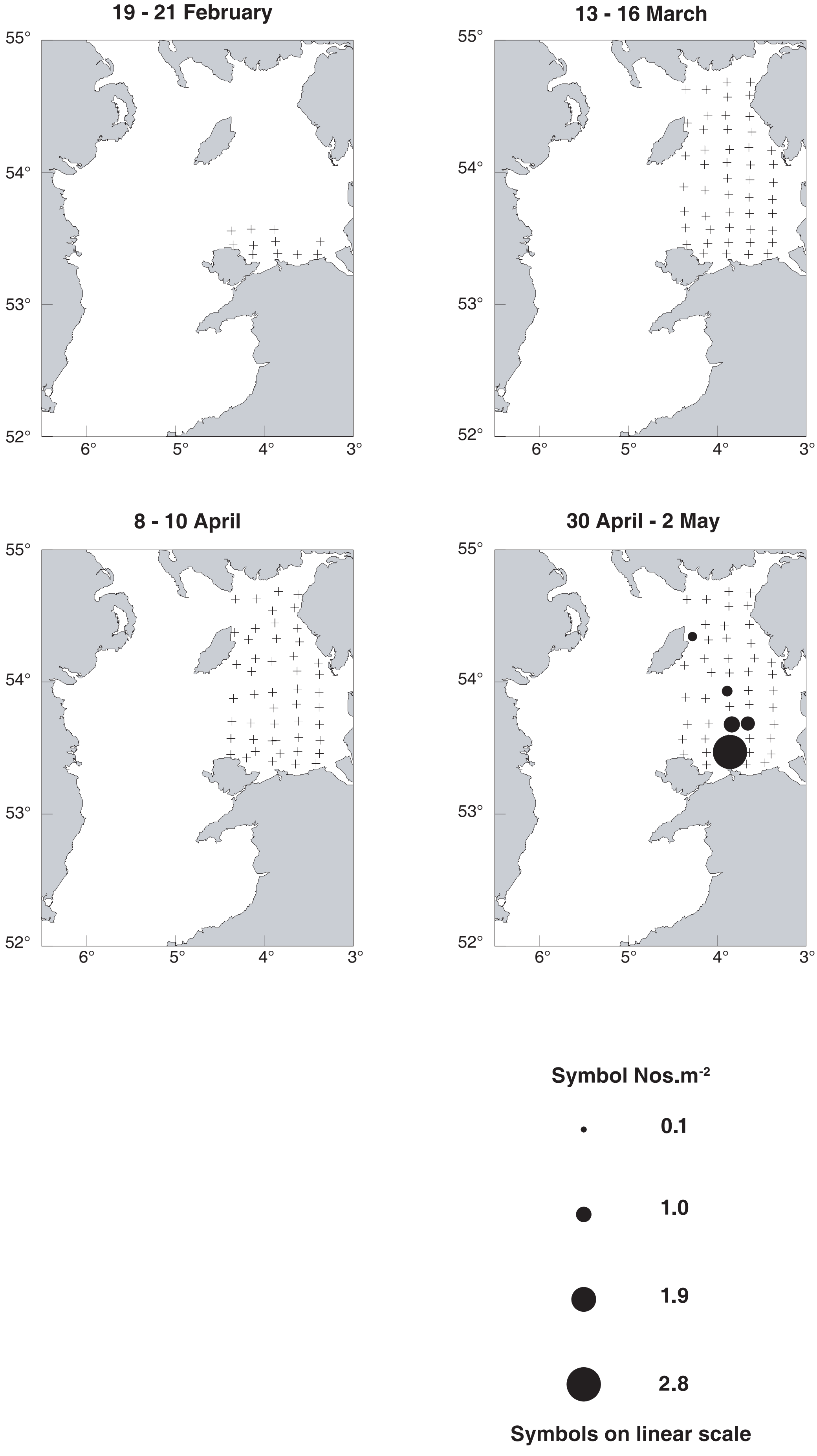


Figure 131. Concentration of lemon sole (Microstomus kitt) larvae (nos.m^{-2}) in 2002

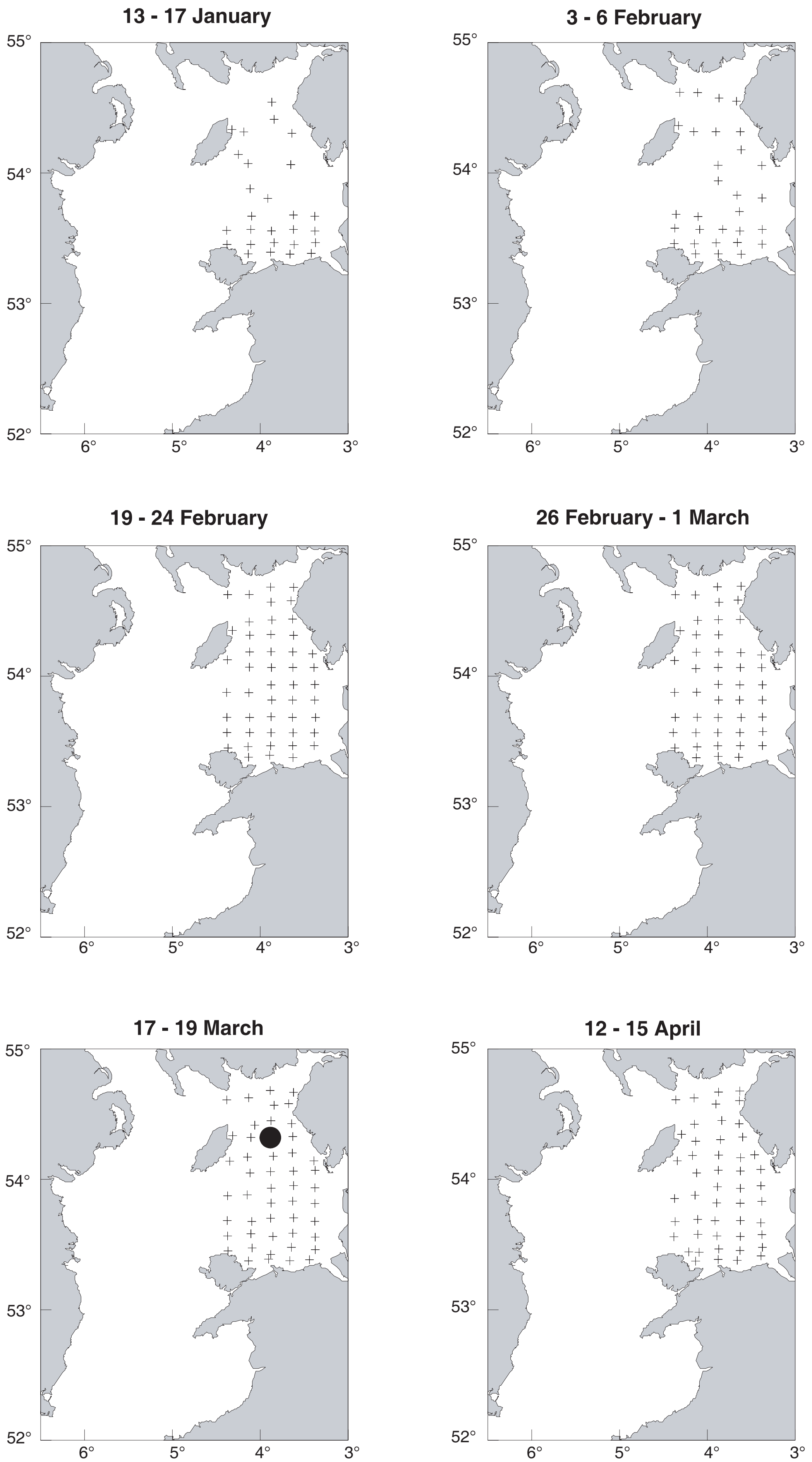


Figure 132. Concentration of lemon sole (Microstomus kitt) larvae (nos.m^{-2}) in 2003

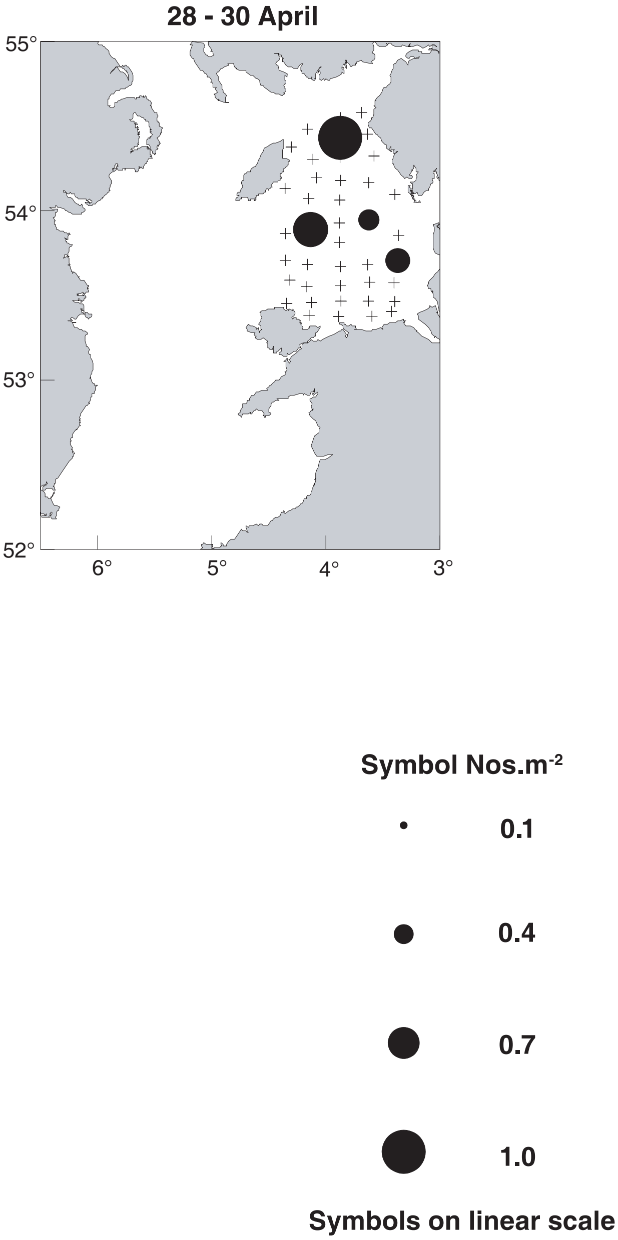


Figure 132. continued

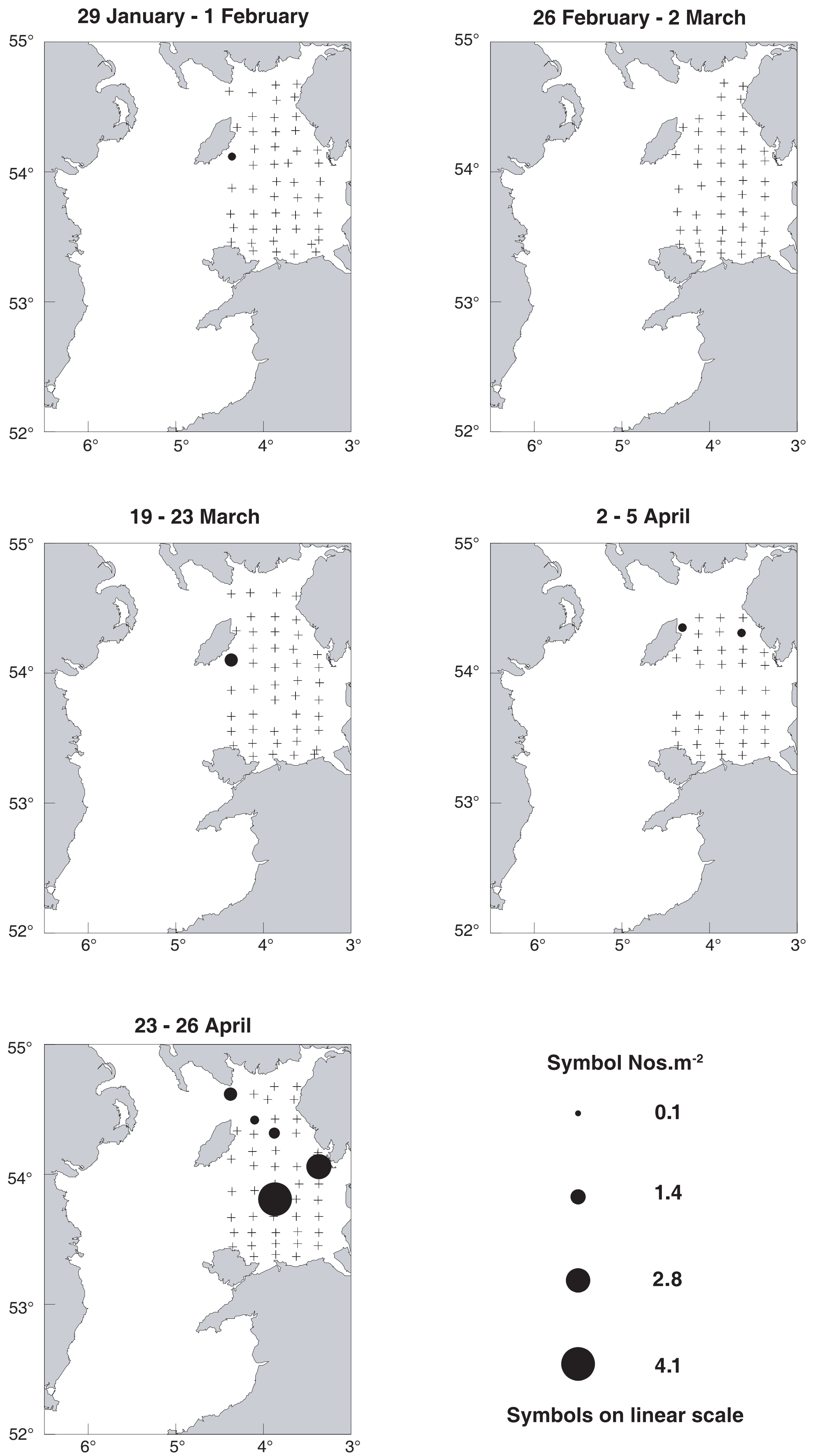


Figure 133. Concentration of witch (Glyptocephalus cynoglossus) larvae (nos.m^{-2}) in 2001

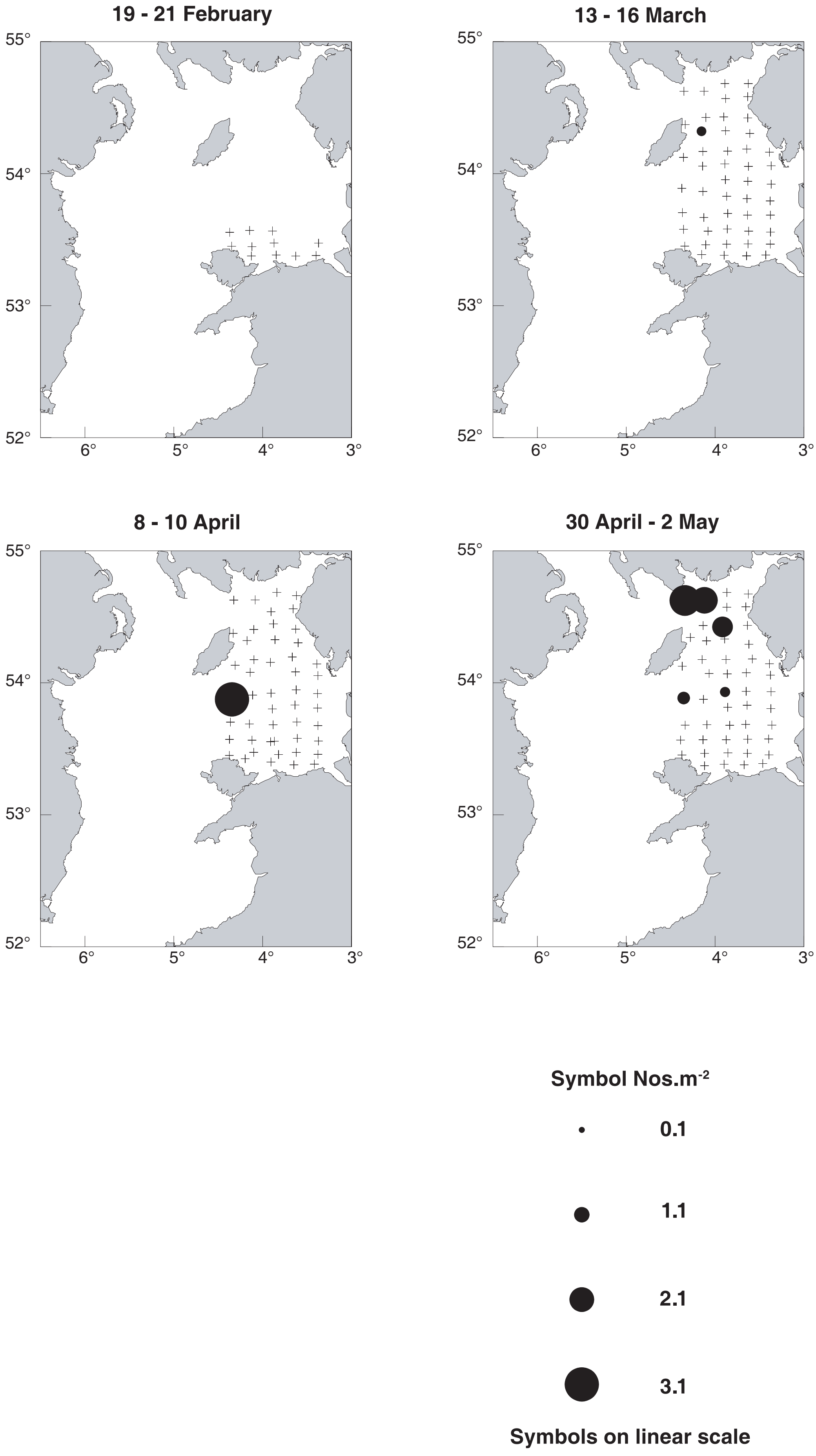


Figure 134. Concentration of witch (Glyptocephalus cynoglossus) larvae (nos.m^{-2}) in 2002

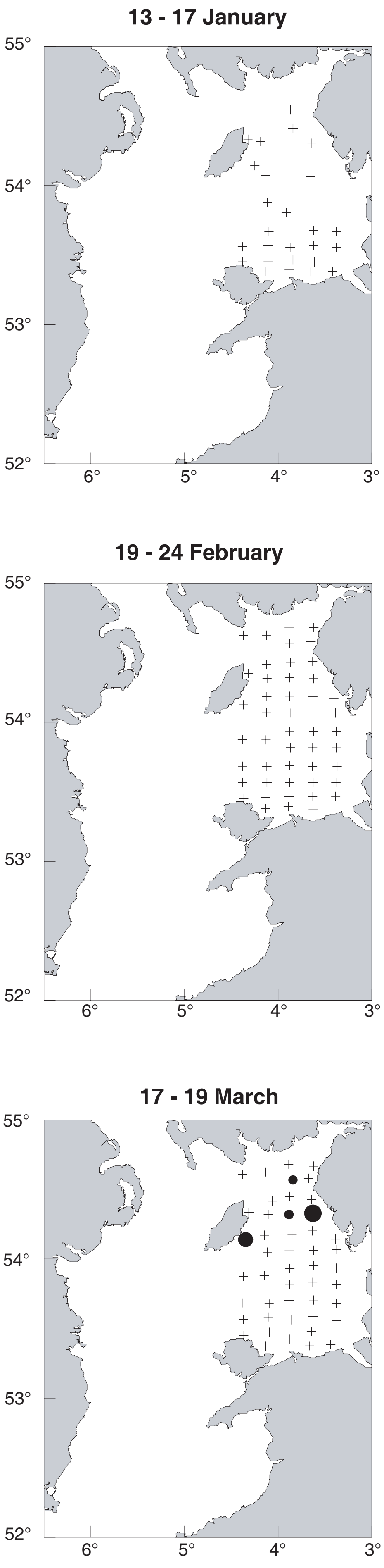


Figure 135. Concentration of witch (Glyptocephalus cynoglossus) larvae (nos.m^{-2}) in 2003

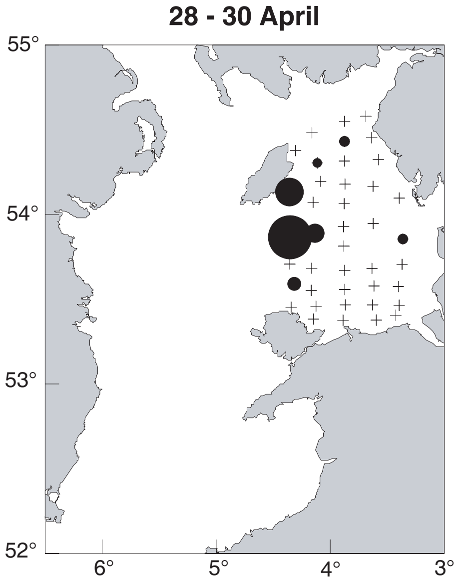


Figure 135. continued

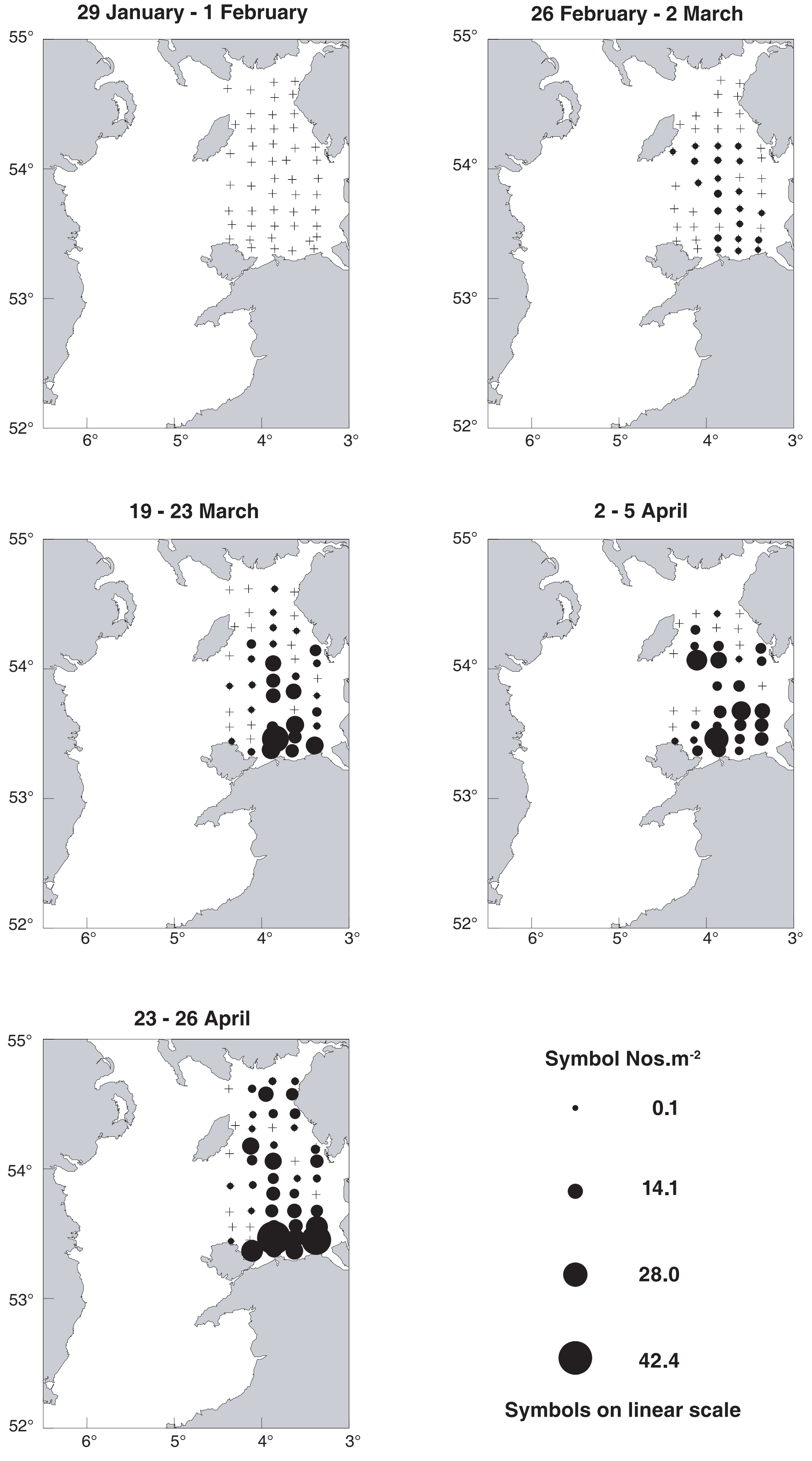


Figure 136. Concentration of sole (Solea solea) eggs (nos.m^{-2}) in 2001

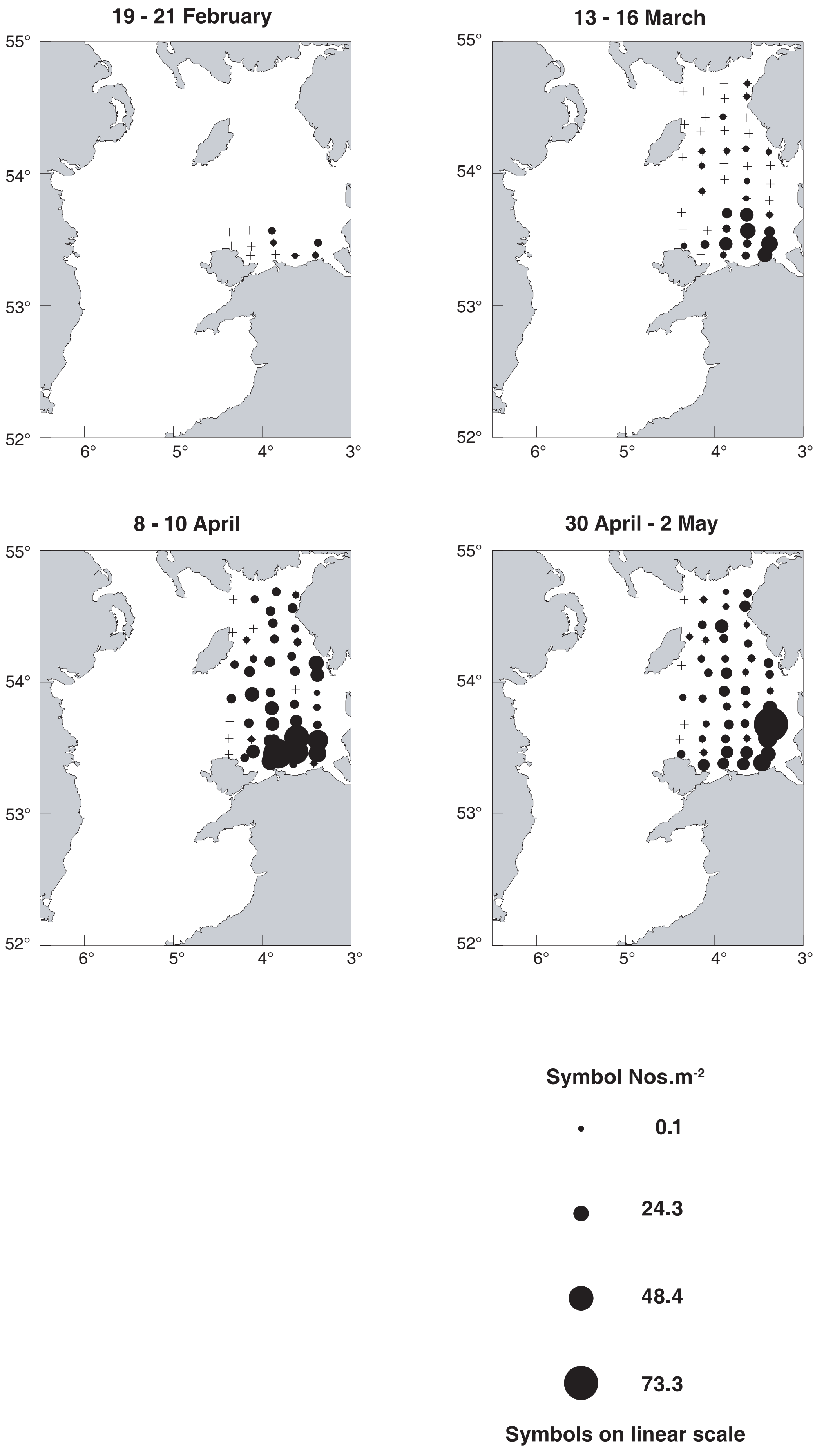


Figure 137. Concentration of sole (Solea solea) eggs (nos.m^{-2}) in 2002

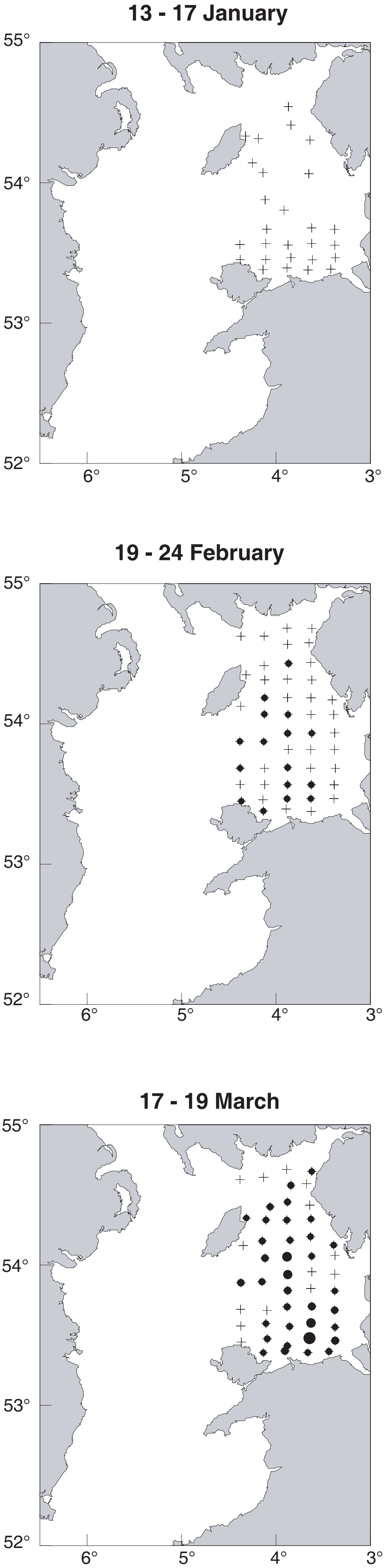
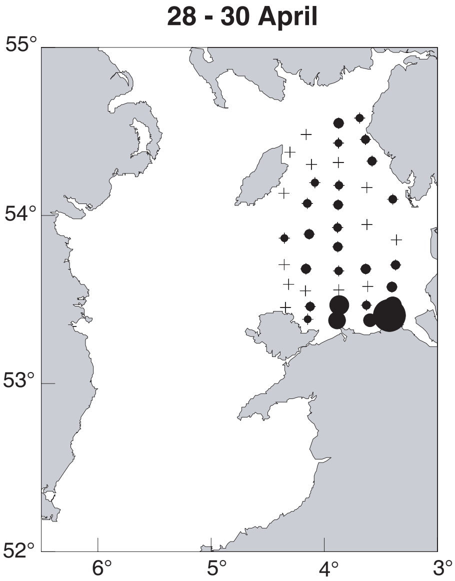


Figure 138. Concentration of sole (Solea solea) eggs (nos.m^{-2}) in 2003



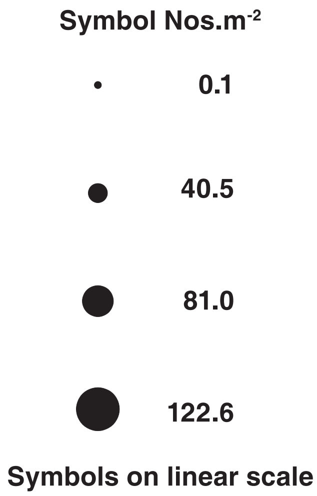


Figure 138. continued

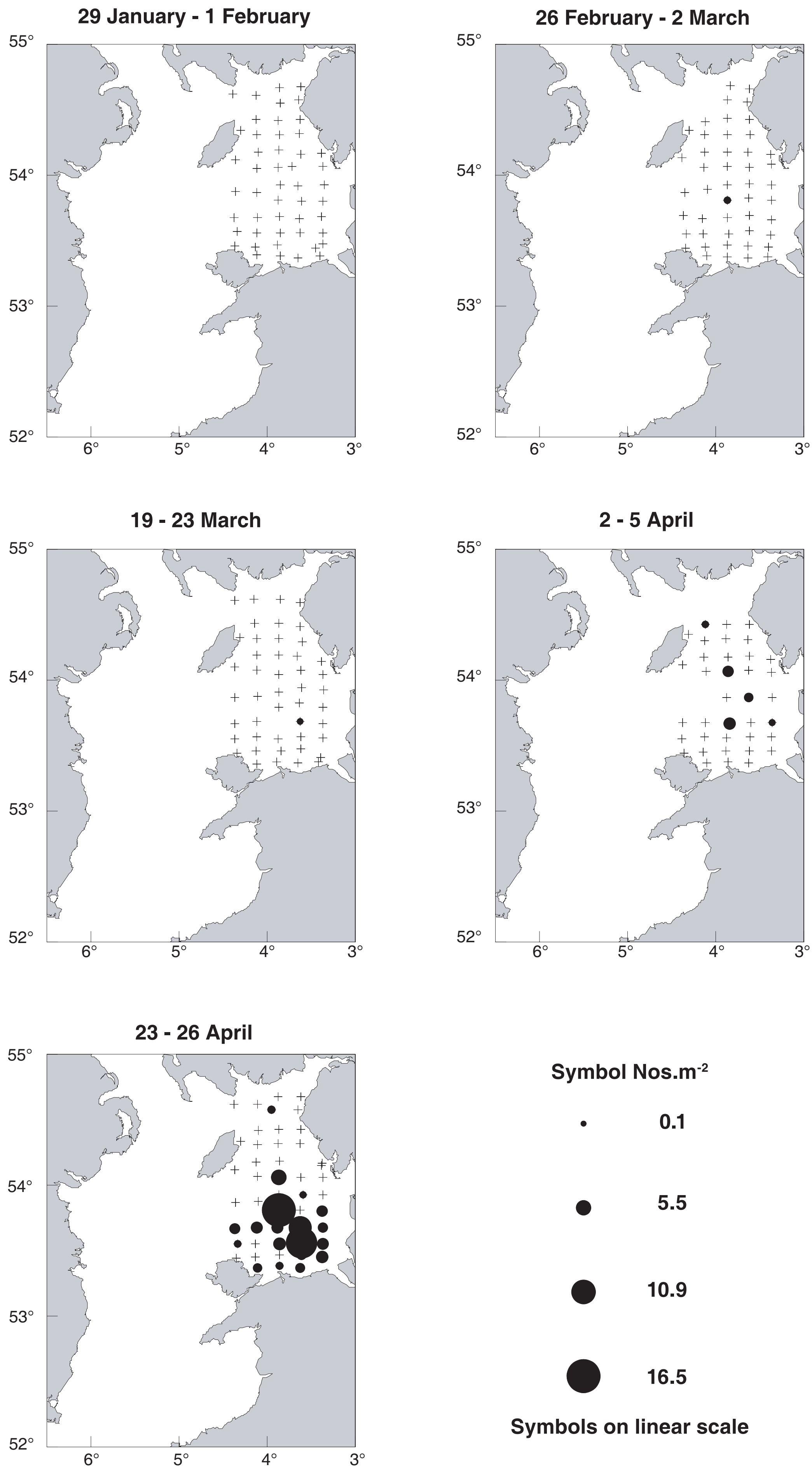


Figure 139. Concentration of sole (Solea solea) larvae (nos.m^{-2}) in 2001

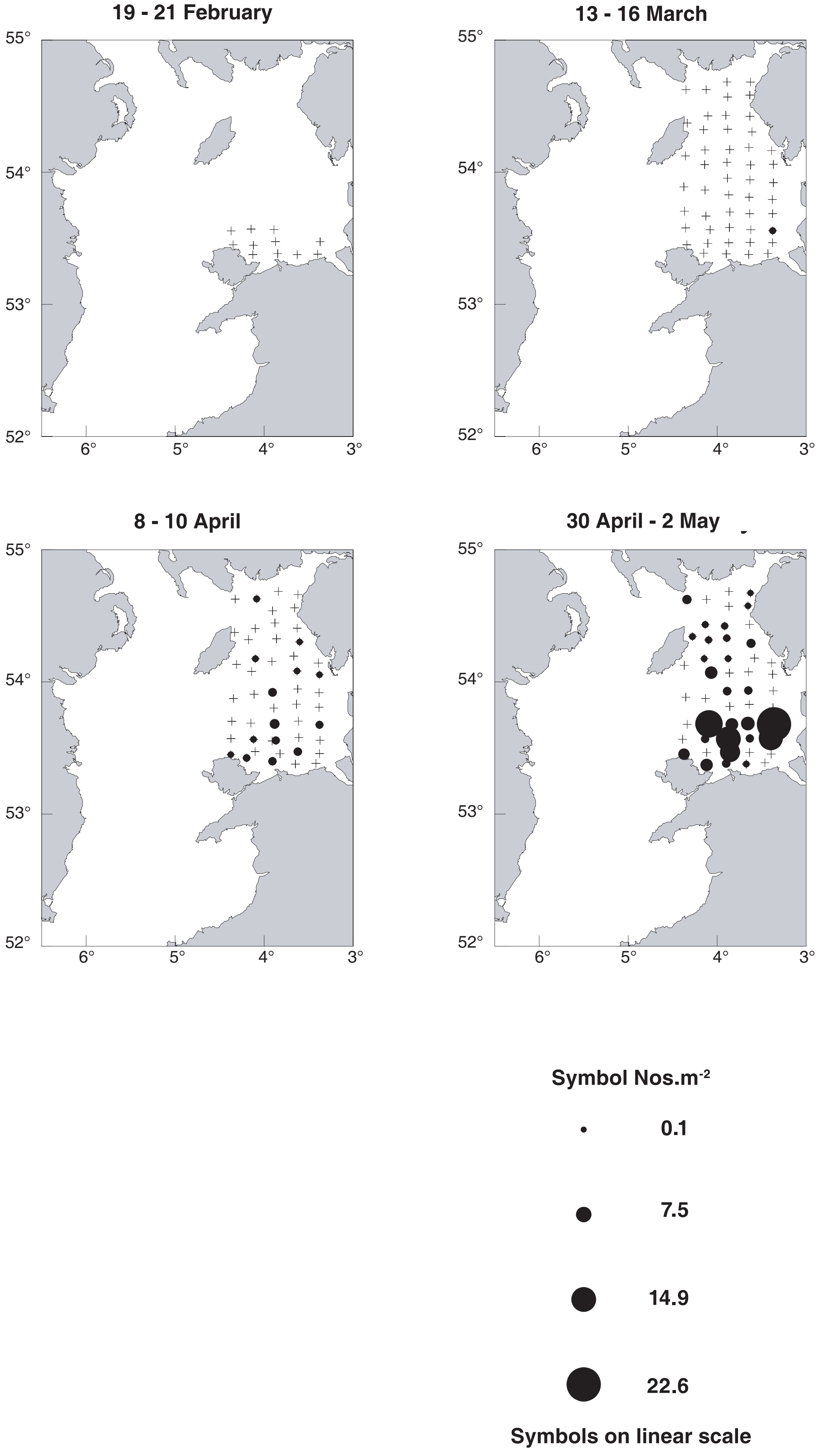


Figure 140. Concentration of sole (Solea solea) larvae (nos.m^{-2}) in 2002

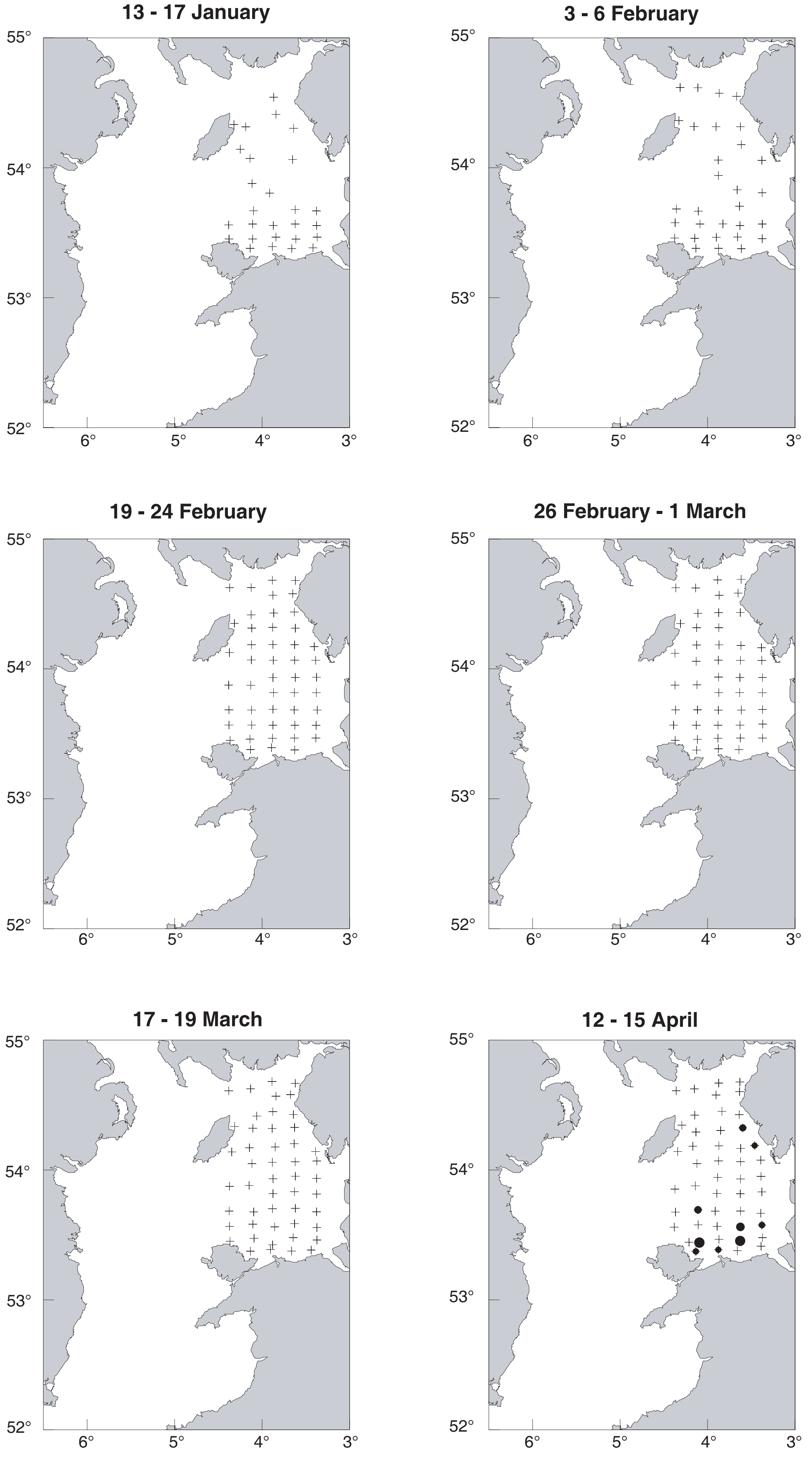
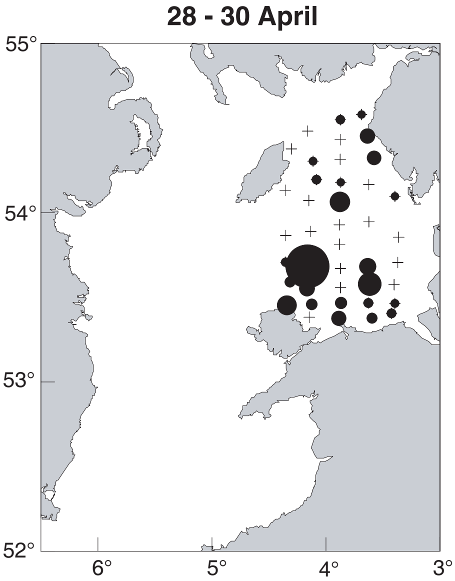


Figure 141. Concentration of sole (Solea solea) larvae (nos.m^{-2}) in 2003



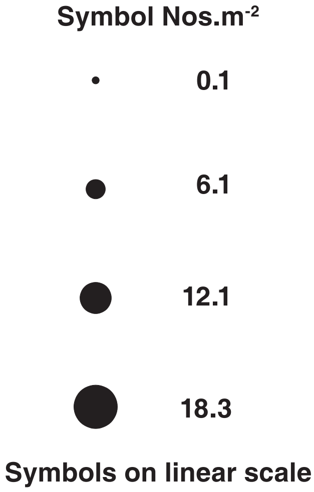


Figure 141. continued

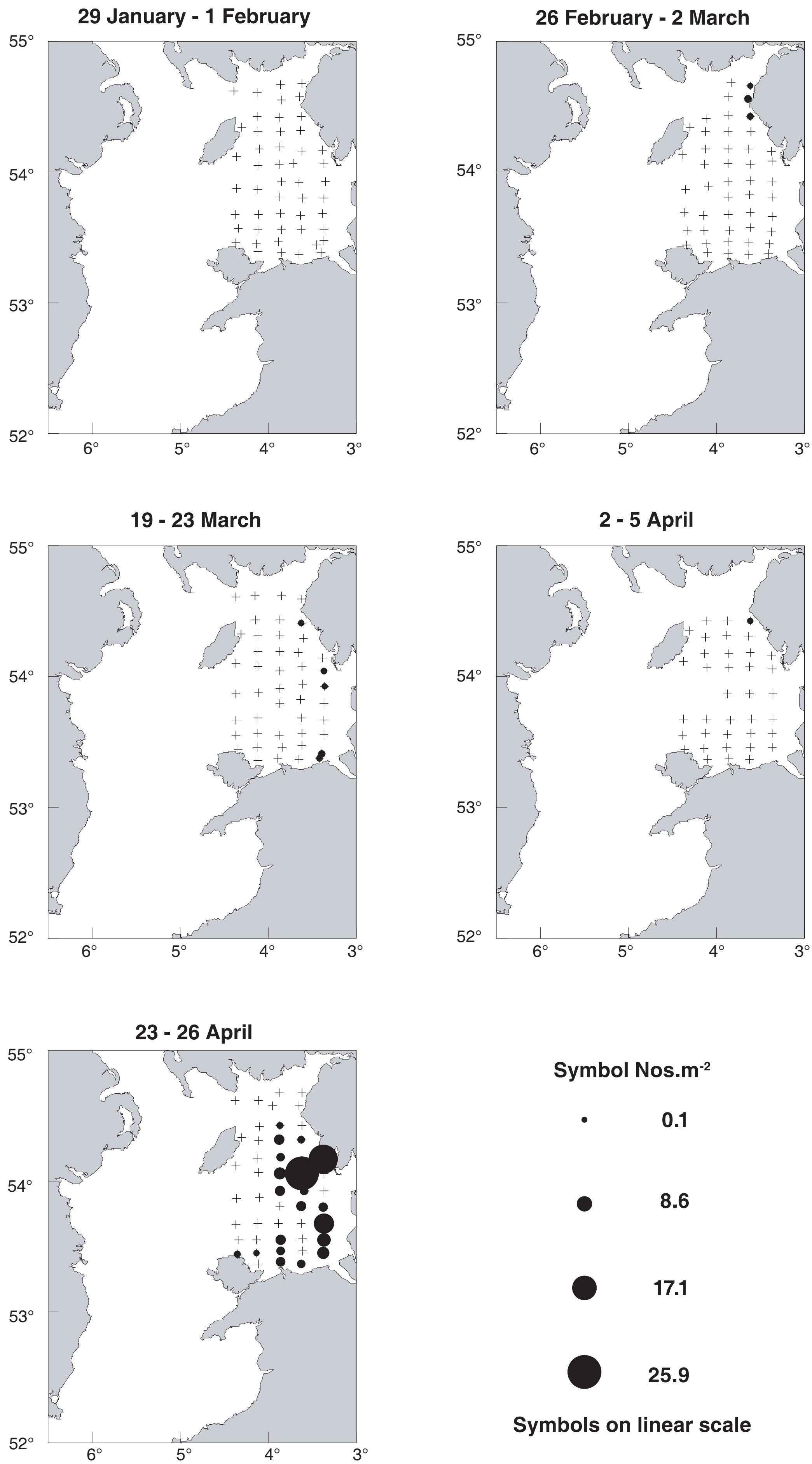


Figure 142. Concentration of solenette (Buglossidium luteum) eggs (nos.m^{-2}) in 2001

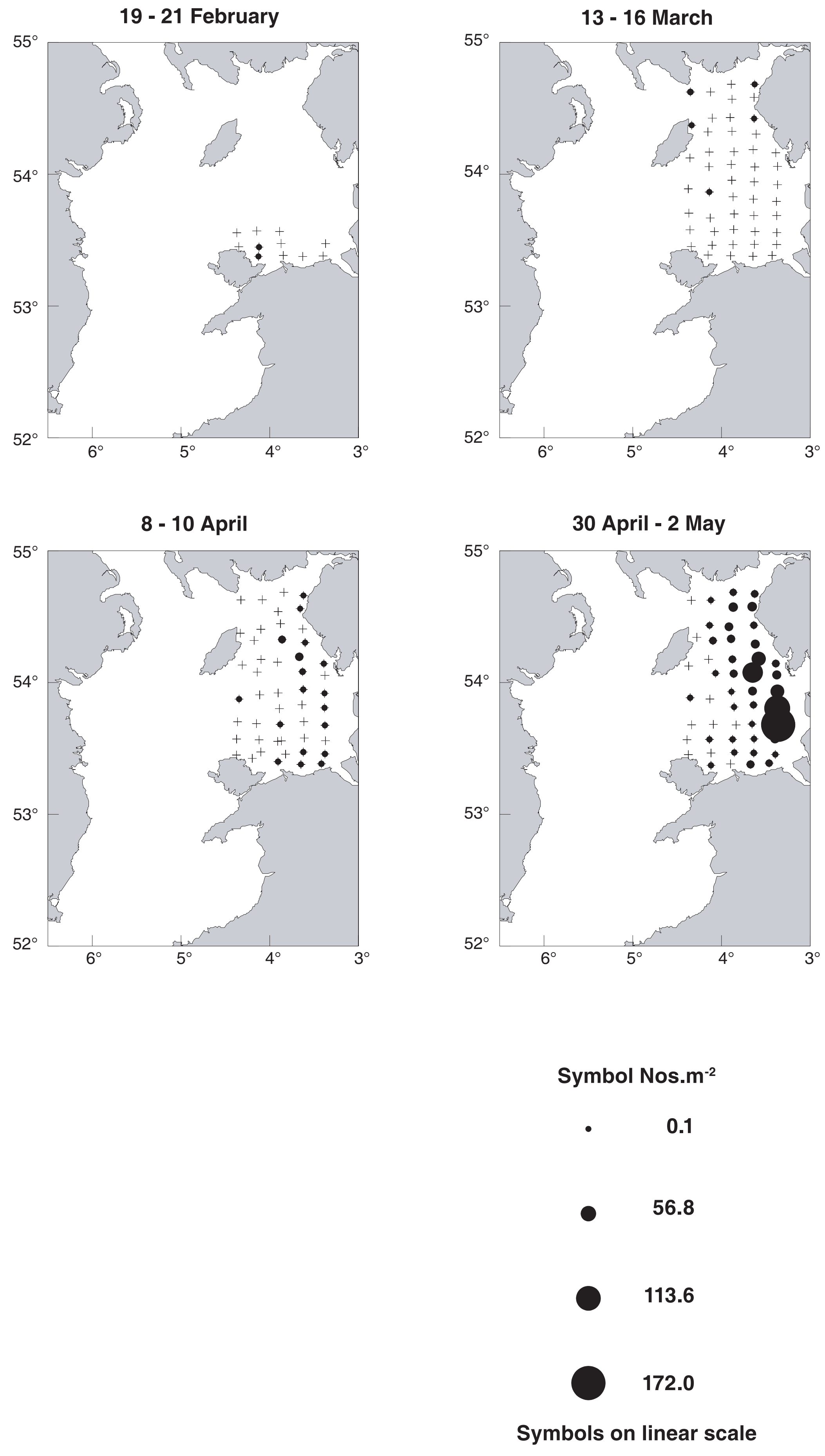


Figure 143. Concentration of solenette (Buglossidium luteum) eggs (nos.m^{-2}) in 2002

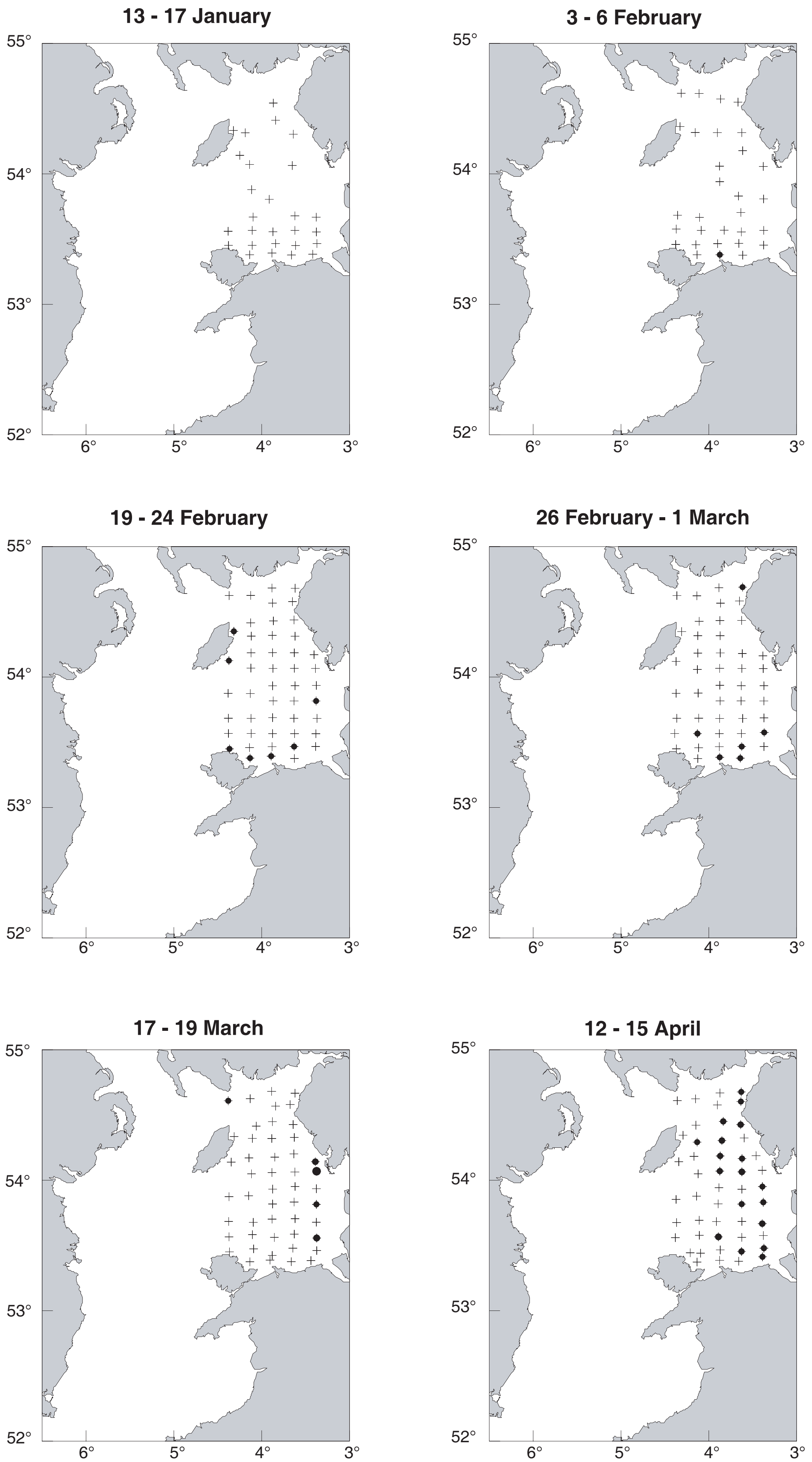


Figure 144. Concentration of solenette (Buglossidium luteum) eggs (nos.m^{-2}) in 2003

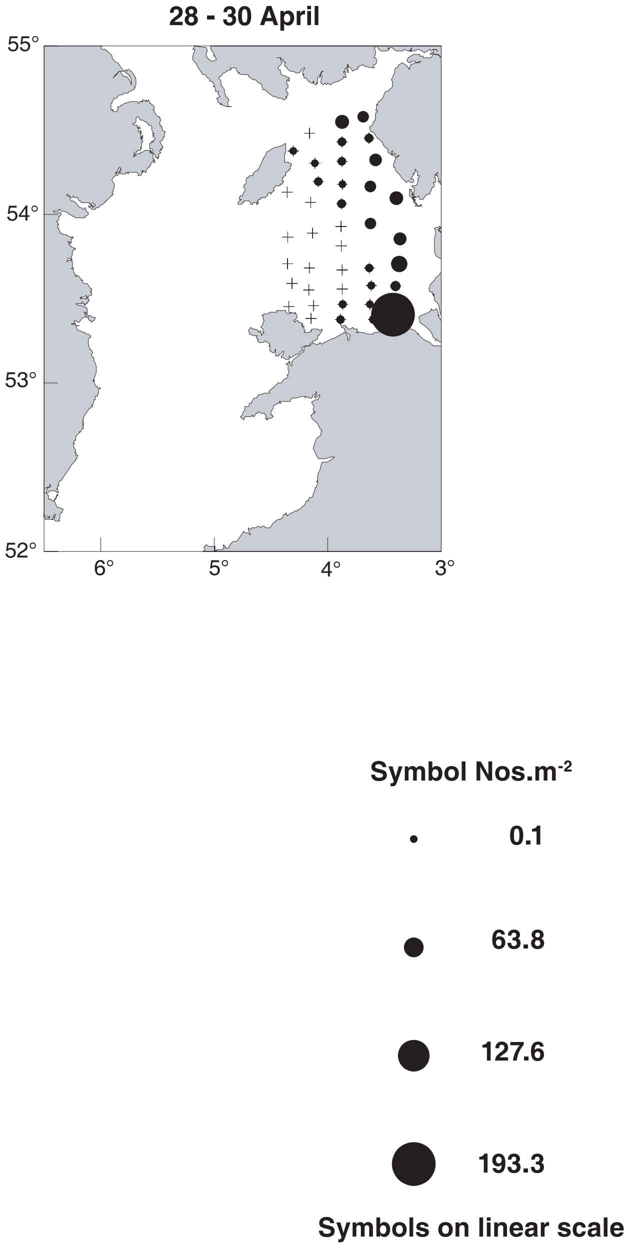


Figure 144. continued

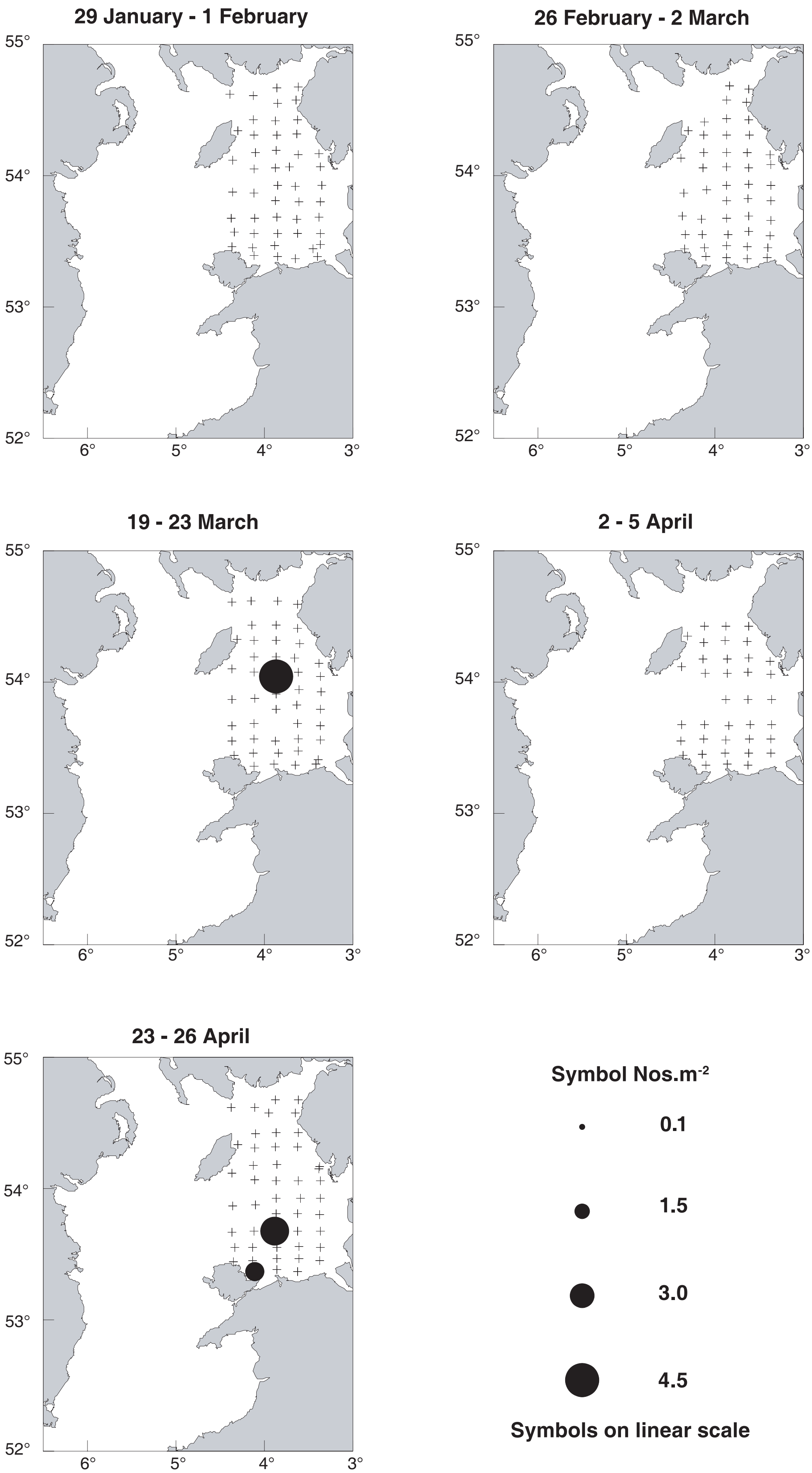


Figure 145. Concentration of solenette (Buglossidium luteum) larvae (nos.m^{-2}) in 2001

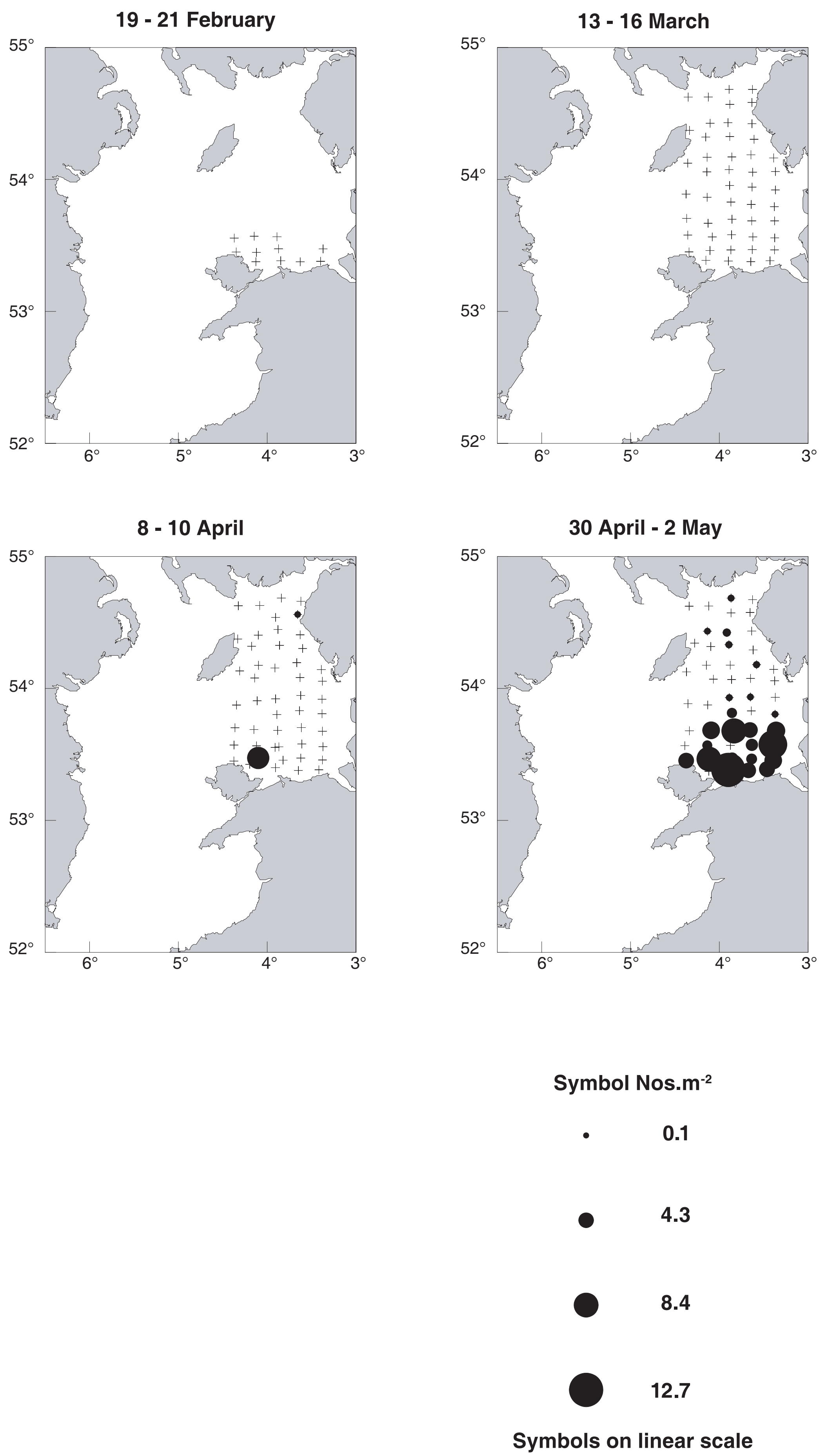


Figure 146. Concentration of solenette (Buglossidium luteum) larvae (nos.m^{-2}) in 2002

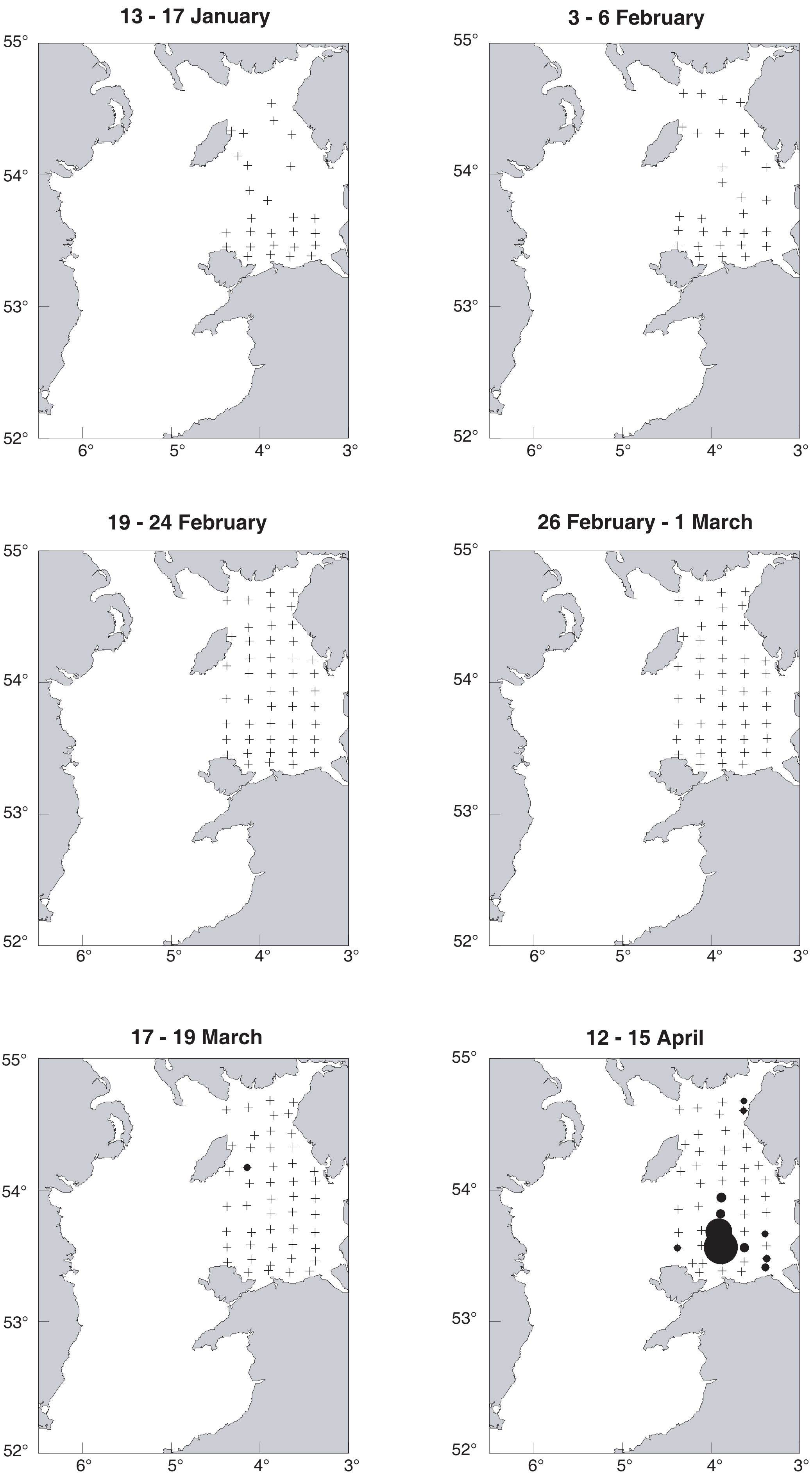
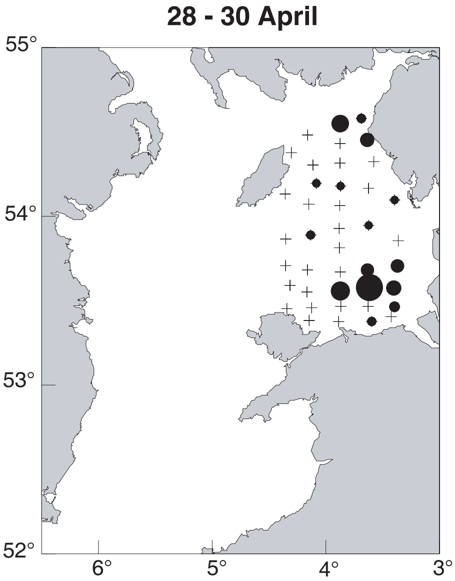


Figure 147. Concentration of solenette (Buglossidium luteum) larvae (nos.m⁻²) in 2003



Symbol Nos.m^{-2}

•	**0.1**
●	**5.0**
●	**9.9**
●	**14.9**

Symbols on linear scale

Figure 147. continued

Table 2a. List of identified species occurring as eggs and the maximum concentration on each of the surveys in the eastern Irish Sea in 2001, 2002 and 2003. Species marked * have been plotted

Species	2001					2002				2003						
	29 Jan-1 Feb	26 Feb-2 Mar	19-23 Mar	2-5 Apr	23-26 Apr	19-21 Feb	13-16 Mar	8-10 Apr	30 Apr-2 May	13-17 Jan	3-6 Feb	19-24 Feb	26 Feb-1 Mar	17-19 Mar	12-15 Apr	28-30 Apr
*Sprattus sprattus**	1.3	825.7	304.7	696.5	460.8	69.8	534.4	375.6	309.6	-	17.5	23.3	28.2	105.8	484.2	445.4
Sardina pilchardus	-	-	-	-	-	-	-	1.8	-	-	-	-	-	-	-	-
Engraulis encrasicolus	-	-	-	0.8	-	-	-	-	-	-	-	-	-	-	-	-
Argentina sphyraena	-	-	-	-	-	-	-	-	1.1	-	-	-	-	-	-	-
*Gadus morhua+**	0.6	25.4	37.4	22.8	4.4	8.8	33.9	10.6	1.7	-	1.7	3.1	2.4	8.1	1.6	-
*Melanogrammus aeglefinus+**	-	-	0.7	-	-	-	0.7	-	-	-	-	0.1	0.3	-	-	-
Gadidae (rocklings)*	1.0	11.7	42.7	43.4	21.1	12.1	71.8	62.3	121.3	1.7	5.8	13.7	28.2	39.3	53.0	93.2
*Molva molva**	-	-	2.2	-	3.9	-	-	1.6	2.7	-	0.5	0.1	0.1	0.3	3.5	-
Triglidae*	-	-	0.8	3.3	5.9	0.3	2.2	33.3	42.5	-	-	0.2	0.2	2.5	6.5	35.3
Dicentrarchus labrax	-	-	-	-	-	-	-	-	3.2	-	-	-	-	-	-	-
Echiichthys vipera	-	-	2.8	-	-	-	-	-	2.8	-	-	-	-	-	-	-
Ammodytidae	-	-	-	-	-	-	-	-	-	-	-	-	0.8	-	-	15.1
Callionymiidae*	0.8	150.3	175.2	170.8	224.6	52.5	80.0	223.2	154.0	5.6	2.5	44.6	52.1	180.3	148.9	125.1
*Phrynorhombus norvegicus**	-	-	3.6	4.4	9.1	-	0.7	23.5	11.3	-	0.3	0.7	0.2	4.1	4.3	9.8
*Zeugopterus punctatus**	-	0.9	0.7	4.4	6.9	-	-	7.5	1.5	-	-	-	-	1.3	2.2	4.4
Arnoglossus laterna	-	-	-	-	1.1	-	0.9	1.2	0.9	-	-	-	-	-	-	-
*Pleuronectes platessa**	29.2	185.0	60.1	34.5	0.7	212.3	83.8	30.3	1.1	12.7	119.6	203.3	133.5	165.9	12.4	4.8
Platichthys flesus	-	-	-	-	-	-	0.9	-	-	-	-	-	-	-	-	-
*Microstomus kitt+**	-	-	0.6	-	-	-	-	0.7	-	-	0.8	-	-	-	-	-
Hippoglossoides platessoides	-	0.1	1.8	-	-	-	-	0.6	-	-	-	0.1	-	-	-	-
*Solea solea**	-	3.0	32.1	28.0	42.4	5.4	27.7	61.0	73.3	-	1.1	2.2	2.2	23.2	122.6	85.8
*Buglossidium luteum**	-	1.7	1.4	0.5	25.9	0.8	4.0	15.0	172.0	-	0.3	0.8	0.8	18.2	6.0	193.3
Microchirus variegatus	-	-	-	-	-	-	-	3.0	8.5	-	-	-	-	-	0.4	4.4
Unidentified spp.	93.2	3330.4	2641.9	1005.5	169.9	1168.1	2806.6	1564.3	502.0	5.7	686.2	2902.6	2205.4	7722.1	1433.4	179.0
Total number of stations worked	49	47	46	37	48	11	49	49	49	27	30	48	47	49	49	41

+ late-stage eggs only (stages IV and V)

Table 2b. List of identified species occurring as larvae and the maximum concentration on each of the surveys in the eastern Irish Sea in 2001, 2002 and 2003. Species marked * have been plotted

Species	2001					2002				2003						
	29 Jan-1 Feb	26 Feb-2 Mar	19-23 Mar	2-5 Apr	23-26 Apr	19-21 Feb	13-16 Mar	8-10 Apr	30 Apr-2 May	13-17 Jan	3-6 Feb	19-24 Feb	26 Feb-1 Mar	17-19 Mar	12-15 Apr	28-30 Apr
Clupeidae	0.4	-	-	-	-	0.9	1.7	2.2	-	-	-	0.3	0.1	0.7	-	-
*Clupea harengus**	9.0	2.1	2.2	1.1	-	1.6	0.8	-	-	2.6	8.9	31.0	3.4	2.1	2.1	3.7
*Sprattus sprattus**	0.4	23.3	157.9	345.0	848.3	-	74.3	114.2	116.9	-	-	0.1	2.6	14.9	61.8	78.2
Sardina pilchardus	-	-	-	-	-	-	0.4	1.2	-	-	-	-	-	0.5	-	-
Gobiesocidae	-	-	-	-	-	-	-	-	-	-	-	-	0.7	-	-	-
*Gadus morhua**	-	4.7	7.1	11.6	14.4	-	5.4	5.2	0.6	-	1.0	0.6	1.5	9.3	21.7	5.5
*Melanogrammus aeglefinus**	-	-	2.8	1.1	1.8	-	-	5.2	-	-	-	-	0.7	2.7	0.7	4.8
*Merlangius merlangus**	-	17.1	96.3	32.9	69.1	0.5	64.5	39.4	57.9	-	11.8	9.3	9.8	107.7	127.7	48.1
Micromesistius poutassou	-	-	-	-	1.6	-	-	-	-	-	-	-	-	-	-	-
Gadidae*†	-	0.1	4.5	6.4	3.4	-	-	2.0	2.3	-	-	0.6	2.2	-	0.6	3.0
Trisopterus minutus†	-	-	-	-	1.6	-	-	-	2.8	-	-	-	1.2	25.1	-	-
Trisopterus esmarkii†	-	-	-	-	-	-	-	-	0.5	-	-	-	-	19.2	6.1	-
*Trisopterus luscus**	-	6.2	8.3	15.2	24.8	1.6	2.9	5.9	7.5	-	-	0.4	2.2	37.7	2.0	4.2
*Pollachius pollachius**	-	1.2	2.8	3.8	3.7	-	0.7	0.8	4.5	-	-	0.4	-	0.7	1.4	3.0
Gadidae* (rocklings)	-	0.9	4.5	22.8	20.6	-	2.1	12.7	17.5	-	-	0.2	3.6	4.4	8.4	30.1
*Molva molva**	-	-	-	-	4.4	-	-	-	1.0	-	-	-	-	-	1.0	-
Syngnathidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5
Triglidae	-	-	-	-	-	-	-	-	0.8	-	-	-	-	0.4	-	0.8
Cottidae*‡	-	0.1	0.9	2.9	3.5	-	2.3	2.2	3.8	-	-	0.4	0.6	0.5	2.1	4.2
Myoxocephalus scorpius‡	-	0.1	1.0	3.3	2.9	-	0.6	-	-	-	-	-	0.3	-	4.2	5.9
Taurulus bubalis‡	-	-	1.1	0.5	4.2	-	-	-	8.5	-	-	-	0.2	0.3	3.0	0.6
*Agonus cataphractus**	-	0.1	1.3	1.0	1.1	-	0.6	0.7	0.6	-	-	-	0.1	0.6	2.8	-
Liparis spp.*	-	-	3.0	15.1	9.0	0.8	3.7	7.4	13.4	-	-	0.3	0.6	2.4	6.0	9.3
Trachurus trachurus	-	-	-	-	-	-	-	0.7	-	-	-	-	-	-	-	-
Labrus bergylta	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.6
*Chirolophis ascanii**	-	-	1.2	-	1.5	-	0.7	1.0	0.9	-	-	0.1	0.3	0.7	0.6	-
*Pholis gunnellus**	-	0.7	16.4	18.3	10.1	-	14.7	10.1	5.5	-	-	0.5	0.3	2.2	5.2	16.6
Ammodytidae*	-	3.7	68.5	95.8	239.3	-	32.1	75.1	31.2	-	-	3.8	3.0	83.7	74.3	39.5
Callionymiidae*	-	1.6	21.8	59.1	129.4	0.7	14.9	22.5	98.0	-	1.0	3.0	7.1	16.1	29.5	77.8
Gobiidae*	1.2	1.3	1.3	1.0	10.6	0.7	0.5	3.4	95.9	3.1	1.2	1.5	1.2	1.2	2.8	11.8

† plotted together as Gadidae
‡ plotted together as Cottidae

Table 2b. continued

Species	2001					2002				2003						
	29 Jan-1 Feb	26 Feb-2 Mar	19-23 Mar	2-5 Apr	23-26 Apr	19-21 Feb	13-16 Mar	8-10 Apr	30 Apr-2 May	13-17 Jan	3-6 Feb	19-24 Feb	26 Feb-1 Mar	17-19 Mar	12-15 Apr	28-30 Apr
*Phrynorhombus norvegicus**	-	-	-	-	2.7	-	-	-	0.8	-	-	-	-	-	2.1	12.8
*Zeugopterus punctatus**	-	-	-	-	3.3	-	-	3.5	1.0	-	-	-	-	-	1.4	3.0
*Pleuronectes platessa**	0.4	15.6	24.8	47.2	14.6	2.9	19.8	34.4	71.2	0.5	7.2	18.6	7.5	18.3	19.6	33.1
*Platichthys flesus**	-	129.1	225.6	501.8	243.5	4.1	94.2	68.9	60.3	-	2.5	9.9	18.3	133.9	137.5	266.4
*Limanda limanda**	-	20.2	530.0	542.1	1222.1	1.1	188.4	182.9	258.1	0.7	4.4	24.2	8.4	146.2	697.3	671.6
*Microstomus kitt**	-	-	2.2	-	2.7	-	-	-	2.8	-	-	-	-	0.6	-	1.0
*Glyptocephalus cynoglossus**	0.4	-	1.2	0.5	4.1	-	0.5	3.1	2.8	-	-	-	0.1	1.8	3.0	4.6
Soleidae	-	-	-	-	-	-	-	-	0.9	-	-	-	-	-	-	-
*Solea solea**	-	1.0	0.6	3.9	16.5	-	0.9	3.2	22.6	-	-	-	-	-	3.0	18.3
*Buglossidium luteum**	-	-	4.5	-	3.7	-	-	7.4	12.7	-	-	-	-	0.6	14.9	8.1
Microchirus variegatus	-	-	-	-	-	-	-	-	0.9	-	-	-	-	-	1.1	0.8
Unidentified spp.	-	49.8	85.1	75.6	25.1	1.5	55.6	34.9	18.9	0.8	8.5	10.5	10.3	105.6	20.1	4.9
Total number of stations worked	49	47	46	37	48	11	49	49	49	27	30	48	47	49	49	41

Table 2c. List of identified species occurring as eggs and their frequency on each of the surveys in the eastern Irish Sea in 2001, 2002 and 2003

Species	2001					2002				2003						
	29 Jan-1 Feb	26 Feb-2 Mar	19-23 Mar	2-5 Apr	23-26 Apr	19-21 Feb	13-16 Mar	8-10 Apr	30 Apr-2 May	13-17 Jan	3-6 Feb	19-24 Feb	26 Feb-1 Mar	17-19 Mar	12-15 Apr	28-30 Apr
Sprattus sprattus	4.1	78.7	91.3	91.9	93.8	72.7	91.8	95.9	95.9	-	26.7	75.0	63.8	89.8	98.0	95.1
Sardina pilchardus	-	-	-	-	-	-	-	2.0	-	-	-	-	-	-	-	-
Engraulis encrasicolus	-	-	-	2.7	-	-	-	-	-	-	-	-	-	-	-	-
Argentina sphyraena	-	-	-	-	-	-	-	-	2.0	-	-	-	-	-	-	-
Gadus morhua+	2.0	42.6	39.1	32.4	8.3	9.1	38.8	53.1	18.4	-	3.3	43.8	40.4	36.7	20.4	-
Melanogrammus aeglefinus+	-	-	2.2	-	-	-	2.0	-	-	-	-	4.2	2.1	-	-	-
Gadidae spp. (rocklings)	16.3	59.6	84.8	70.3	83.3	63.6	83.7	98.0	93.9	18.5	50.0	72.9	78.7	81.6	87.8	92.7
Molva molva	-	-	2.2	-	4.2	-	-	8.2	6.1	-	3.3	2.1	2.1	2.0	4.1	-
Trigla spp.	-	-	6.5	13.5	12.5	9.1	12.2	36.7	40.8	-	-	8.3	2.1	4.1	36.7	56.1
Dicentrarchus labrax	-	-	-	-	-	-	-	-	6.1	-	-	-	-	-	-	-
Echiichthys vipera	-	-	6.5	-	-	-	-	-	8.2	-	-	-	-	-	-	-
Ammodytidae	-	-	-	-	-	-	-	-	-	-	-	-	2.1	-	-	2.4
Callionymiidae	8.2	74.5	93.5	94.6	91.7	18.2	77.6	93.9	95.9	14.8	20.0	62.5	63.8	87.8	98.0	95.1
Phrynorhombus norvegicus	-	-	6.5	13.5	18.8	-	2.0	8.2	46.9	-	3.3	4.2	2.1	20.4	38.8	48.8
Zeugopterus punctatus	-	2.1	2.2	8.1	14.6	-	-	20.4	10.2	-	-	-	-	2.0	10.2	22.0
Arnoglossus laterna	-	-	-	-	2.1	-	6.1	2.0	2.0	-	-	-	-	-	-	-
Pleuronectes platessa	71.4	87.2	84.8	54.1	4.2	81.8	77.6	71.4	6.1	70.4	83.3	93.8	97.9	91.8	53.1	7.3
Platichthys flesus	-	-	-	-	-	-	2.0	-	-	-	-	-	-	-	-	-
Microstomus kitt+	-	-	2.2	-	-	-	-	2.0	-	-	3.3	-	-	-	-	-
Hippoglossoides platessoides	-	2.1	2.2	-	-	-	-	2.0	-	-	-	2.1	-	-	-	-
Solea solea	-	44.7	65.2	70.3	77.1	45.5	51.0	85.7	91.8	-	6.7	45.8	21.3	71.4	85.7	65.9
Buglossidium luteum	-	6.4	10.9	2.7	43.8	18.2	10.2	36.7	75.5	-	3.3	14.6	17.0	10.2	36.7	61.0
Microchirus variegatus	-	-	-	-	-	-	-	4.1	14.3	-	-	-	-	-	4.1	12.2
Unidentified spp.	73.5	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	63.0	90.0	100.0	100.0	100.0	100.0	100.0
Total number of stations worked	49	47	46	37	48	11	49	49	49	27	30	48	47	49	49	41

+ late-stage eggs only (stages IV and V)

Table 2d. List of identified species occurring as larvae and their frequency on each of the surveys in the eastern Irish Sea in 2001, 2002 and 2003

Species	2001					2002				2003						
	29 Jan-1 Feb	26 Feb-2 Mar	19-23 Mar	2-5 Apr	23-26 Apr	19-21 Feb	13-16 Mar	8-10 Apr	30 Apr-2 May	13-17 Jan	3-6 Feb	19-24 Feb	26 Feb-1 Mar	17-19 Mar	12-15 Apr	28-30 Apr
Clupeidae	2.0	-	-	-	-	18.2	2.0	4.1	-	-	-	2.1	4.3	2.0	-	-
Clupea harengus	32.7	12.8	10.9	8.1	-	27.3	10.2	-	-	40.7	23.3	66.7	51.1	10.2	8.2	7.3
Sprattus sprattus	2.0	68.1	84.8	97.3	100.0	-	67.3	98.0	100.0	-	-	2.1	12.8	71.4	95.9	100.0
Sardina pilchardus	-	-	-	-	-	-	2.0	8.2	-	-	-	-	-	2.0	-	-
Gobiesocidae	-	-	-	-	-	-	-	-	-	-	-	-	0.7	-	-	-
Gadus morhua	-	25.5	30.4	37.8	29.2	-	8.2	44.9	4.1	-	6.7	41.7	48.9	69.4	69.4	22.0
Melanogrammus aeglefinus	-	-	4.3	5.4	2.1	-	-	2.0	-	-	-	-	2.1	10.2	4.1	9.8
Merlangius merlangus	-	36.2	58.7	78.4	97.9	18.2	59.2	85.7	87.8	-	26.7	75.0	68.1	79.6	95.9	97.6
Micromesistius poutassou	-	-	-	-	4.2	-	-	-	-	-	-	-	-	-	-	-
Gadidae	-	2.1	6.5	13.5	10.4	-	-	10.2	4.1	-	-	2.1	4.3	-	2.0	7.3
Trisopterus minutus	-	-	-	-	2.1	-	-	-	2.0	-	-	-	2.1	20.4	-	-
Trisopterus esmarkii	-	-	-	-	-	-	-	-	2.0	-	-	-	-	36.7	20.4	-
Trisopterus luscus	-	27.7	41.3	48.6	43.8	18.2	6.1	46.9	36.7	-	-	16.7	21.3	49.0	18.4	29.3
Pollachius pollachius	-	2.1	4.3	2.7	18.8	-	2.0	2.0	6.1	-	-	2.1	-	2.0	4.1	7.3
Gadidae (rocklings)	-	2.1	19.6	43.2	54.2	-	24.5	59.2	71.4	-	-	14.6	19.1	51.0	67.3	68.3
Molva molva	-	-	-	-	2.1	-	-	-	4.1	-	-	-	-	-	4.1	-
Syngnathidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.4
Trigla spp.	-	-	-	-	-	-	-	-	4.1	-	-	-	-	2.0	-	2.4
Cottidae	-	4.3	10.9	21.6	12.5	-	10.2	20.4	8.2	-	-	22.9	21.3	4.1	16.3	24.4
Myoxocephalus scorpius	-	4.3	10.9	8.1	10.4	-	2.0	-	-	-	-	-	8.5	-	12.2	9.8
Taurulus bubalis	-	-	8.7	2.7	4.2	-	-	-	12.2	-	-	-	2.1	2.0	8.2	2.4
Agonus cataphractus	-	2.1	6.5	8.1	4.2	-	2.0	12.2	2.0	-	-	-	2.1	2.0	8.2	-
Liparis spp.	-	-	28.3	29.7	22.9	9.1	24.5	51.0	30.6	-	-	20.8	21.3	32.7	51.0	31.7
Trachurus trachurus	-	-	-	-	-	-	-	4.1	-	-	-	-	-	-	-	-
Labrus bergylta	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.4
Chirolophis ascanii	-	-	2.2	-	2.1	-	2.0	2.0	2.0	-	-	6.3	4.3	4.1	4.1	-
Pholis gunnellus	-	8.5	50.0	48.6	35.4	-	32.7	36.7	28.6	-	-	6.3	12.8	6.1	20.4	43.9
Ammodytidae	-	17.0	58.7	86.5	70.8	-	61.2	91.8	77.6	-	-	12.5	12.8	67.3	89.8	73.2
Callionymiidae	-	21.3	52.2	89.2	91.7	27.3	30.6	63.3	85.7	-	6.7	25.0	34.0	46.9	71.4	100.0
Gobiiidae	8.2	10.6	8.7	2.7	37.5	9.1	2.0	30.6	73.5	7.4	10.0	14.6	34.0	16.3	20.4	75.6

Table 2d. continued

Species	2001					2002				2003						
	29 Jan-1 Feb	26 Feb-2 Mar	19-23 Mar	2-5 Apr	23-26 Apr	19-21 Feb	13-16 Mar	8-10 Apr	30 Apr-2 May	13-17 Jan	3-6 Feb	19-24 Feb	26 Feb-1 Mar	17-19 Mar	12-15 Apr	28-30 Apr
Phrynorhombus norvegicus	-	-	-	-	2.1	-	-	-	2.0	-	-	-	-	-	4.1	9.8
Zeugopterus punctatus	-	-	-	-	10.4	-	-	10.2	6.1	-	-	-	-	-	2.0	7.3
Pleuronectes platessa	4.1	51.1	71.7	78.4	31.3	54.5	44.9	71.4	63.3	3.7	33.3	52.1	70.2	77.6	36.7	34.1
Platichthys flesus	-	40.4	80.4	94.6	95.8	27.3	51.0	89.8	81.6	-	3.3	47.9	72.3	81.6	100.0	100.0
Limanda limanda	-	61.7	91.3	100.0	97.9	9.1	77.6	98.0	98.0	7.4	26.7	89.6	76.6	87.8	100.0	97.6
Microstomus kitt	-	-	2.2	-	2.1	-	-	-	10.2	-	-	-	-	2.0	-	9.8
Glyptocephalus cynoglossus	2.0	-	2.2	5.4	10.4	-	2.0	2.0	10.2	-	-	-	2.1	8.2	16.3	17.1
Soleidae	-	-	-	-	-	-	-	-	2.0	-	-	-	-	-	-	-
Solea solea	-	2.1	2.2	13.5	39.6	-	2.0	28.6	55.1	-	-	-	-	-	18.4	56.1
Buglossidium luteum	-	-	2.2	-	4.2	-	-	4.1	49.0	-	-	-	-	2.0	22.4	36.6
Microchirus variegatus	-	-	-	-	-	-	-	-	2.0	-	-	-	-	-	6.1	4.9
Unidentified spp.	-	55.3	84.8	81.1	45.8	36.4	53.1	89.8	32.7	3.7	6.7	58.3	63.8	77.6	65.3	22.0
Total number of stations worked	49	47	46	37	48	11	49	49	49	27	30	48	47	49	49	41

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