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SPRING PLANKTON SURVEYS OF THE IRISH SEA IN 1995: THE DISTRIBUTION OF FISH EGGS AND LARVAE

(Compiled from data collected under AIR3 CT94-2263)

C. J. Fox, M. Dickey-Collas and A. J. Winpenny

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CEFAS is an Executive Agency of the Ministry of Agriculture, Fisheries and Food (MAFF)
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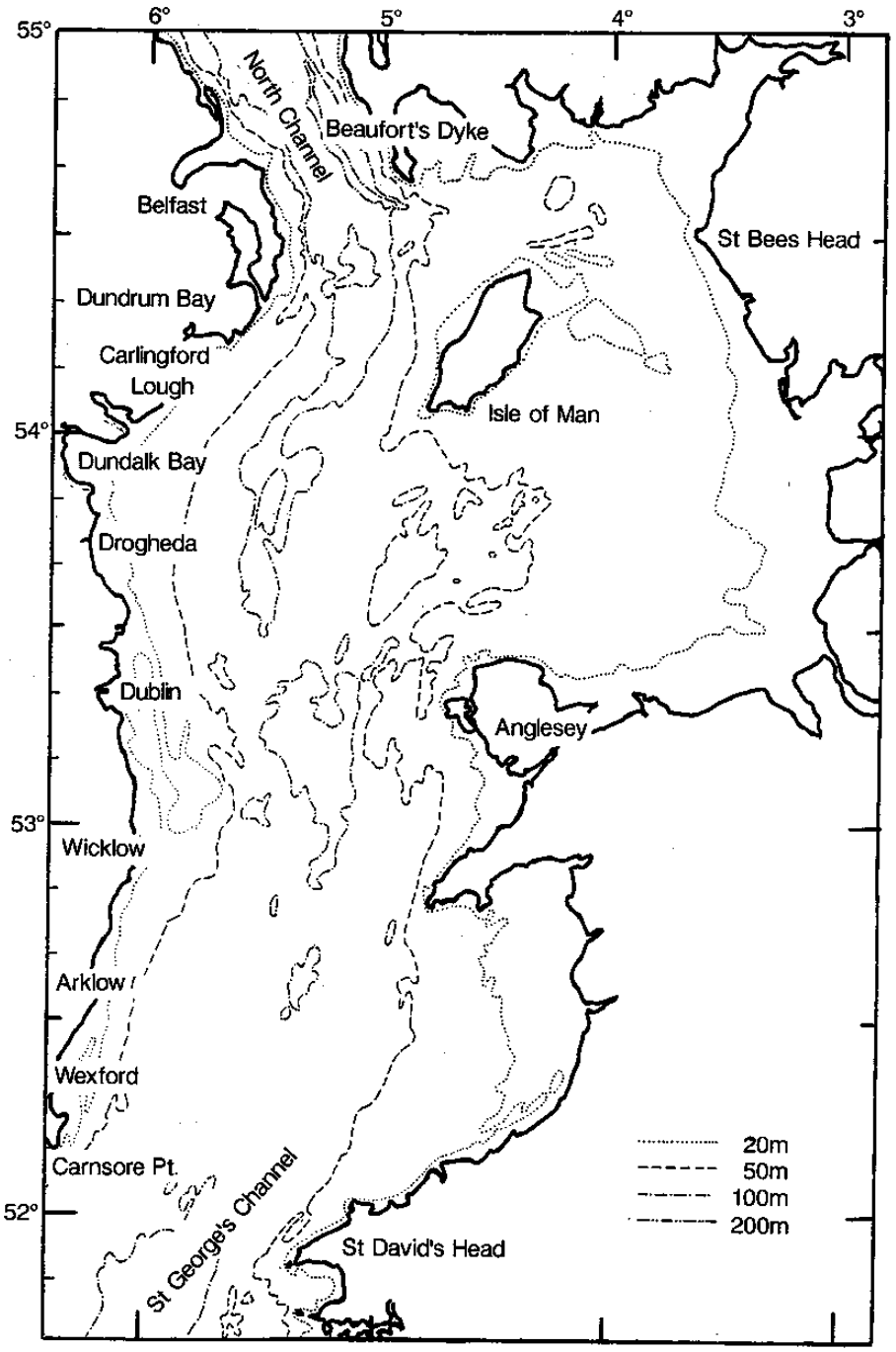


Bathymetry of the Irish Sea (Dickson and Boelens, 1988)

1. INTRODUCTION

Between February and May of 1995 a series of plankton surveys were carried out in the Irish Sea as part of a programme to calculate the spawning stock biomass of cod, sole and plaice. The surveys were partly funded by the European Commission (Grant AIR3 CT94-2263). Five research institutes took part: Centre for Environment, Fisheries and Aqauculture Science (CEFAS, formerly Directorate of Fisheries Research), Fisheries Research Centre, Department of the Marine, Dublin (DOM), The Queens University of Belfast (QUB)/ Department of Agriculture for Northern Ireland (DANI), Port Erin Marine Laboratory, University of Liverpool (PEML) and the Rijksstation voor Zeevisserij, Belgium. Eggs and larvae from the target species were sorted and identified as part of the AIR programme. The samples were subsequently analysed for the eggs and larvae of all remaining fish species.

2. SURVEY COVERAGE

Table 1 summarises the geographical and temporal coverage of the surveys. The northern Irish Sea was surveyed at approximately fortnightly intervals over the period 11 February until 14 June 1995. Cardigan Bay was also surveyed up until 25 April. The plankton sampling grids were designed to cover as fully as possible (both temporally and spatially) the spawning of cod, sole and plaice, based upon information from Simpson (1959), Griffith (1971), Nichols *et al.* (1993) and Brander (1994). The planned grids changed slightly as the spawning season progressed to reflect the expected change in spawning distribution from one target species to the next.

For a brief overview of the geography and major hydrographic features of the region see Nichols *et al*., 1993.

3. SAMPLING METHODS AND EQUIPMENT

3.1 Shipboard plankton sampling

The Gulf III type plankton samplers used on these surveys were 76 cm diameter, un-encased frames fitted with 40 cm diameter aperture, conical nosecones. The standard net was made of 270 µm aperture mesh (Milligan and Riches, 1983).

A 'Valeport' flowmeter was centrally mounted inside the nosecone of each sampler, with its boss 2.5 cm back from the leading edge. A similar flowmeter was mounted externally on the sampler frame to provide a measure of distance travelled through the water. The ratio between internal and external flowmeter revolutions provided an index of net clogging and enabled the volume of water filtered on each deployment to be calculated.

Table 1. Geographical areas and timing of surveys described in this report

Date	Survey Location	Vessel	Laboratory
11 - 19 February	Northern Irish Sea and Cardigan Bay	Cirolana	Centre for Environment and Aquaculture Science (CEFAS) *
21 - 27 February	Northern Irish Sea and Cardigan Bay	Cirolana	Centre for Environment and Aquaculture Science (CEFAS) *
08 - 14 March	North Western Irish Sea	L. Beltra	Fisheries Research Centre, Department of Marine (DOM, Dublin)
13 - 14 March	North Eastern Irish Sea	Roagan	Port Erin Marine Laboratory (PEML)
15 - 22 March	Northern Irish Sea and Cardigan Bay	L. Foyle	Queens University of Belfast (QUB/DANI)
30 March - 06 April	Northern Irish Sea and Cardigan Bay	Corystes	Centre for Environment and Aquaculture Science (CEFAS) *
12 - 15 April	Northern Irish Sea and Cardigan Bay	L.Beltra	Fisheries Research Centre, Department of Marine (DOM, Dublin)
10 - 21 April	Northern Irish Sea and Cardigan Bay	Roagan	Port Erin Marine Laboratory (PEML)
18 - 25 April	Northern Irish Sea and Cardigan Bay	L. Foyle	Queens University of Belfast (QUB/DANI)
30 April - 07 May	Northern Irish Sea	L. Foyle	Queens University of Belfast (QUB/DANI)
14 - 20 May	Northern Irish Sea	Philomena	Port Erin Marine Laboratory (PEML)
23 - 28 May	Northern Irish Sea	Cirolana	Centre for Environment and Aquaculture Science (CEFAS) *
05 - 14 June	Northern Irish Sea	Roagan	Port Erin Marine Laboratory (PEML)

Notes: This table gives actual survey data and coverage, for plots data have been re-combined in some cases to generate consistent coverage
** Formerly Directorate of Fisheries Research*

The samplers used by CEFAS have been extensively calibrated over a range of speeds and simulated clogged conditions either in a large circulating water channel or a towing tank (Harding and Arnold, 1971; Arnold, Holford and Milligan, 1990; Brander, Milligan and Nichols, 1993). From these experiments linear regression co-efficients 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.

'Pro-net' CTD packages (Spartel Ltd.) were used by DANI, DOM and PEML. The supplied computer software was used to compute the volume of water filtered on each deployment using the following formulae. The speed of the water turning the flowmeter blades was calculated for both internal and external flowmeters using different regression co-efficients. The electronic frequency generated by the flowmeter blades was converted to speed using the linear regression :

$$y = a*x + b$$

where y = water speed (ms^{-1}),
x = flowmeter frequency (Hz),
a = 0.0806 for the internal flowmeter and 0.107 for the external flowmeter,
b = intercept adjusted for each system to allow for slightly different electrical characteristics of each circuit. Typical values for both internal and external flowmeters were 0.005.

The calculated speed was then converted to volume by multiplying by the area of the nose cone aperture.

Where clogging occurred (i.e. where the ratio of internal to external flowmeters fell below 0.6), nets of 400 µm aperture mesh replaced the standard 270 µm net. Where clogging continued to be a problem a smaller (30 cm diameter aperture) nosecone was used.

The aim was to deploy the sampler on a double oblique tow, at 4.5 knots, from the surface to within 2 metres of the bottom, or as near as bottom topography would allow. 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 10 seconds in each 1 metre depth band. At shallow stations, multiple double-oblique dives were necessary to enable a sufficient volume of water to be filtered. A minimum sampler deployment time of 15 minutes was recommended.

3.2 Preservation of samples

After deployment the net was gently washed down 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 participating laboratories for plankton sorting and identification.

3.3 Identification of fish eggs and larvae

The main source of information for the identification of the ichthyoplankton from these surveys was Russell (1976). This information was supplemented by various identification sheets produced by the International Council for the Exploration of the Sea, (Saville, 1964; Macer, 1967; Nichols, 1971; Nichols, 1976; Demir, 1976). Using these sources fish larvae were readily identified unless they had been badly damaged during collection. For some groups such as the sandeels (Ammodytidae) and the group of Gadidae commonly called rocklings, individuals were not identified to the species level. Fish eggs were initially split into three groups on the basis of the 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 identify. This is especially so in the early stages, before embryonic pigmentation develops. Some of these species, such as cod (*Gadus morhua*), were identified on the basis of size alone.

Fish eggs and larvae were picked out of all samples by eye and whenever practicable the whole sample was sorted. However, sub-sampling was at times necessary, especially for certain fish eggs. Sub-sampling was carried out using a Folsom splitter.

3.4 Data analysis and data storage

Plankton data were expressed as number of organisms m^{-3} obtained by dividing the numbers per sample by the volume filtered. The plankton distributions in this report are plotted as numbers m^{-2} which were obtained by multiplying the number m^{-3} by the sampled depth during a deployment. Numbers m^{-2} were plotted as bubbles on the same linear scale for a species for all the surveys. Bubble diameter is linearly related to numbers m^{-2} above a non-zero baseline (Surfer version 6.04, Golden Software Inc., Colorado, U.S.A.). The full dataset is stored on an ACCESS (Microsoft Inc.) database held at the institutions which took part in the original surveys.

4. RESULTS

4.1 The ichthyoplankton

In 1995, fish eggs from 28 species and larvae from 37 species were identified. A further five groups of eggs and 14 groups of larvae were, for practical reasons, identified to the family or genus level only (e.g. Onos spp., Triglidae, Ammodytidae, Gobiidae). In addition, a large group of unidentified eggs were measured generating an egg diameter size distribution. Clupeoid larvae were not routinely positively identified to species but the majority of these were most likely sprat and for the purposes of plotting they have been grouped together. All species and taxonomic groups are listed in Tables 2 (a-d) (see pages 102-105). These tables also give the maximum density recorded on each survey and occurrence as a percentage of the stations where a positive record was obtained.

4.1.1 The distributions of total eggs and total larvae (Figures 1 and 2)

Fish eggs were found from early February across the area in low numbers but with the highest concentrations off the North Wales coast. By March, 1995 eggs were being caught off the Irish coast in higher numbers. The distribution of eggs in the eastern Irish Sea had begun to spread northwards. From April onwards eggs were found on the majority of coastal stations. Concentrations of eggs began to decline by early May with geographical spread becoming confined to coastal regions.

Low concentrations of larvae were recorded in February. During March larvae were caught in low numbers in Liverpool Bay. By early April higher concentrations were recorded in Cardigan Bay and larvae began to be caught off the Irish coast. By mid-April larval distribution had spread across almost the entire region with higher concentrations off the Irish coast, in Cardigan Bay and in the eastern Irish Sea. This pattern continued throughout May with a gradual decline in larval concentrations, the decline being more obvious off the Irish coast.

4.1.2 Sprattus sprattus (Sprat) and Clupeoids (Figures 3 and 4)

Sprat eggs were recorded on all surveys with highest concentrations in mid-May. The maximum density recorded was 1,123 eggs m^{-2} off Liverpool Bay during 14-20 May (Figure 3, Table 2(a)). The highest abundances in all the surveys tended to be in shallower, generally coastal waters. Positive separation of sprat and herring larvae is time-consuming requiring counts on myotome block numbers to be made. Since the Irish Sea herring stock spawns in the autumn it was assumed that all the larvae caught in these spring surveys were those of *S. sprattus.*

The geographical distribution of larvae (Figure 4) tended to reflect the egg distribution with peak concentrations near the coasts. Small numbers of larvae were recorded in early April off the Irish coast. By mid-May, the highest concentrations of sprat larvae were found in the eastern Irish Sea off the Cumbrian and North Wales coasts.

4.1.3 Argentina sphyraena (Lesser silver smelt) (Figures 5 and 6)

A few eggs of this species were recorded from late March onwards and were most abundant in the western Irish Sea.

Low concentrations of larvae (<1.3 m^{-2}) were recorded in the western Irish Sea from late March onwards. This species is on the edge of its distribution in the Irish Sea and would not be expected to spawn there in large numbers.

4.1.4 Gadidae (Norway Pout and Poor Cod) (Figure 7)

The eggs of these two species are similar to those of *M. merlangus* (whiting) and can thus not be identified in plankton samples. The larvae of *Trisopterus minutus* (Norway Pout) and *T. esmarkii* (Poor cod) are similar in appearance and have been grouped together. The highest concentration occurred in Cardigan Bay in early April. Later in the season they were recorded across the region.

4.1.5 Gadus morhua (Cod) (Figures 8 and 9)

The early stages of the eggs of cod, before the development of embryonic pigmentation, are impossible to distinguish from those of *Melanogrammus aeglefinus* (haddock). Early stage eggs between 1.24 and 1.7 mm diameter were classified as being those of *G. morhua*. This size range was designed to exclude the eggs of whiting. Very few late stage haddock eggs were identified, suggesting that the majority of eggs in the above size range were indeed those of cod. The main spawning area for *G. morhua* occurred off the coast of County Down south to Dublin Bay. Spawning also occurred east of the Isle of Man and in an area southwest of the Isle of Man. Some spawning also occurred in Liverpool Bay and off the North Wales coast. The peak of spawning was during the first three weeks of April.

Cod larvae appeared from mid-March in the shallow coastal waters of Dundalk Bay south to Dublin and to a limited extent in Liverpool Bay. By mid-April larvae were most abundant in two regions, off Dublin and north-east of the Isle of Man. The maximum cod larval density recorded was 12.2 m^{-2}.

4.1.6 *Melanogrammus aeglefinus (Haddock)* (Figures 10 and 11)

The eggs of haddock can only be positively identified in the later stages when they can be distinguished from the eggs of *G. morhua*. They were recorded in low concentrations (<3.1m^{-2}) in a restricted area of the western Irish Sea from mid-March to mid-April and on one station off Anglesey. This was reflected in the areas in which haddock larvae were caught in early April. However in late April and early May, some haddock larvae were caught in the eastern Irish Sea, even though no Stage IV or V haddock eggs had been reported in this area. A possible explanation is that even late stage haddock eggs are quite difficult to identify and may thus have been mis-reported. Maximum concentrations of haddock larvae were low at 2.1 m^{-2}.

4.1.7 *Merlangius merlangus (Whiting)* (Figure 12)

The eggs of this species are not separately identified but are included in a group of measured eggs with no oil globules. Their eggs are spherical and range in diameter from 0.97-1.32 mm in diameter.

The adults of this species are widely distributed in this region. This was reflected in the larval distributions. Spawning probably began in late February in the eastern Irish Sea. Larvae continued to be caught in this area throughout the 1995 surveys. From late March onwards larvae were also caught off the Irish coast and in Cardigan Bay. Larval concentrations off the Irish coast had declined by mid-May.

4.1.8 *Trisopterus luscus (Bib, Pout whiting)* (Figure 13)

The eggs of this species range in diameter from 0.9-1.23 mm and cannot be readily separated from those of similar size with no oil globules. Therefore no direct information is available on the distribution and timing of spawning.

Larvae began to appear in significant numbers in the eastern Irish Sea from early April onwards. The greatest concentrations occurred to the south-east of the Isle of Man. The maximum larval density was 2.7 m^{-2}.

4.1.9 *Pollachius pollachius (Pollack)* (Figure 14)

The eggs of this species, which range in diameter from 1.1- 1.22 mm, are similar in size to those of *Merlangius merlangus* and *Trisopterus luscus* and cannot therefore be separately identified. Larvae were caught in low numbers from early April through to the end of May. The highest concentration of 3.1 m^{-2} was recorded to the north of the Isle of Man.

4.1.10 *Molva molva (Ling)* (Figures 15 and 16)

This is a deep-water species reputed to spawn mainly in depths of around 200 m. From late February to early May the majority of spawning occurred in the deeper waters of the western Irish Sea and North Channel but the eggs of this species were recorded in Liverpool Bay at concentrations of up to 37.3 m^{-2} in June (Figure 15). However, larvae were only found to the west of the Isle of Man (Figure 16). This suggests that some of the eggs classified as *M. molva* may have actually been from another group, perhaps from the Triglidae.

4.1.11 *Onos spp. (Rocklings)* (Figures 17 and 18)

These members of the Gadidae are ubiquitous in North-west European shelf waters occurring over a wide range of habitats and depths (Wheeler, 1969). Four species occur in the Irish Sea, *Gaidropsarus meditteraneus* (shore rockling), *Gaidropsarus vulgaris* (three-bearded rockling), *Enchelyopus cimbrius* (four-bearded rockling) and *Ciliata mustela* (five-bearded rockling). *G. meditteraneus* spawns inshore in June and July and is therefore not likely to feature significantly in these surveys. However, the other three species may have been present since *G. vulgaris* spawns in shallow water in January and February, *E. cimbrius* spawns in deeper water (>50 m) from May to August and *C. mustela* spawns off-shore in winter and spring although the adults occur in the littoral zone. Maximum egg concentrations occurred close inshore in early April 1995 (Figure 17). Possible identification problems with distinguishing the eggs of Onos spp. from those of *P. norvegicus* may mean that the egg concentrations recorded for 15-22 March and 18 April-7 May are under-estimated by up to 25%. Larvae began to be caught in significant numbers at the beginning of April in Irish coastal waters, Cardigan Bay and the eastern Irish Sea. By late April the distributions had spread to cover almost the whole region.

4.1.12 *Triglidae (Gurnards)* (Figures 19 and 20)

Neither the eggs nor larvae of this group are routinely identified to genus or species. Four species occur in the Irish Sea. The commonest is *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), the largest of the gurnards, which spawns from May to July and the less common *Trigloporus lastoviza* (streaked gurnard) which spawns from June to August. In the western Irish Sea Triglidae eggs were recorded from February through to May and were distributed away from the coast. These were

probably the eggs of *E. gurnadus* (Figure 19). Spawning was noted later in the year in the eastern Irish Sea and was probably attributable to the other two main species, *A. cuculus* and *T. lucerna*. Some spawning was also noted in Cardigan Bay in April. Very low numbers of larvae were caught throughout the surveys in the eastern Irish Sea. Triglidae larvae rarely feature strongly in plankton samples although they can be caught with larger gear such as the MIK net.

4.1.13 *Cottidae (Bullheads and Sculpins)* (Figure 21)

These are a shallow water family with a benthic egg generally requiring a rocky or weedy substrate for adhesion. Larvae were recorded from late February onwards in the shallow waters throughout the region at concentrations of <8.9 m^{-2}.

4.1.14 *Agonus cataphractus (Pogge)* (Figure 22)

The eggs of this species are benthic. Larval distributions were confined to coastal regions with concentrations of up to 4.0 m^{-2}.

4.1.15 *Liparis spp. (Sea-snails)* (Figure 23)

This group tends to occur in shallow coastal waters and has a benthic egg. The larval distributions reflected this. Larvae were caught from February onwards in the coastal waters. Highest concentrations were reported in early April to the south-west of the Isle of Man and in Cardigan Bay. By late May low concentrations of larvae were also being caught to the south-east of the Isle of Man down to Anglesey.

4.1.16 *Chirolophis ascanii (Yarroll's blenny)* (Figure 24)

The eggs are benthic. Larvae of this species were caught from early March until late April across the region at concentrations of up to 3.2 m^{-2} mainly in the waters around the Isle of Man.

4.1.17 *Pholis gunnellus (Butterfish)* (Figure 25)

The eggs of this species are benthic and most commonly occur inshore on a rocky substrate. They may also be found offshore on sand or mud where the eggs may be laid in bivalve shells (Wheeler, 1969). Their spawning period in the Irish Sea is from January to March (Qasim, 1956). Larvae of this species were caught from March onwards in the coastal regions off the Irish coast, Cardigan Bay and in the eastern Irish Sea. The highest densitiy recorded was 39.7 m^{-2}.

4.1.18 *Ammodytidae (Sandeels)* (Figure 26)

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* is common off-shore and spawns from January to March, *Gymnammodytes semisquamatus* spawns from April to July and *Hyperoplus lanceolatus*, which is very common and widely distributed, spawns in April and May. The eggs of this group are all benthic and are therefore not caught regularly in the plankton.

Early in the year, larvae were found close to the Irish coast and in Cardigan Bay. By mid-March greater concentrations were found off County Down to Dublin, in Cardigan Bay and in the shallow parts (<40 m) of the eastern Irish Sea. Two months later, larval concentrations had declined off the Irish coast but significant numbers of larvae were still being caught in the eastern Irish Sea through to the end of the survey series.

4.1.19 *Callionymidae (Dragonets)* (Figures 27 and 28)

The 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 reputed to spawn from late January through to August (Russell, 1976) in shallow water <50 m depth. *Callionymus maculatus* (spotted dragonet) spawns from April to August and tends to favour deeper water. There is no information on the spawning of *C. reticulatus* (reticulated dragonet) in the Irish Sea. This species is uncommon but has been recorded from the northern Irish Sea (Wheeler, 1969). It is reputed to frequent shallow water and in the English Channel may spawn from April to September (Demir, 1976). The distributions of eggs and larvae are therefore likely to be mainly a mixture of *C. lyra* and *C. maculatus*. The eggs were abundant throughout the survey period in 1995, with a maximum density of 864 m^{-2} in late March (Table 2a). The eggs were found mainly in shallow coastal waters throughout the region (Figure 27). Larvae were caught from early-April onwards, mainly in Cardigan Bay, off the Irish coast and in Liverpool Bay (Figure 28). By late April this distribution had spread to cover most of the western and eastern Irish Sea. Lower concentrations of larvae were recorded in the deeper waters to the south-west of the Isle of Man.

4.1.20 *Gobiidae* (Figure 29)

These are a diverse group of predominantly inshore fish which produce benthic eggs. As many as 11 species may occur in the Irish Sea. A few larvae were caught off the Irish coast in April but larger concentrations were recorded in the eastern Irish Sea from early May onwards.

4.1.21 *Scomber scombrus (Mackerel)* (Figure 30)

Although the main spawning area for the western stock of this species is along the edge of the continental shelf, the spread of spawning into shallower waters during late spring has been noted (Nichols *et al*., 1993). This was also apparent in 1995 with a maximum egg density of 163.8 m^{-2} recorded at the end of May in Liverpool Bay. Mackerel larvae were not caught in this survey series.

4.1.22 *Phrynorhombus norvegicus (Norwegian top-knot)* (Figures 31 and 32)

The temporal distributions of the eggs of this species were erratic from survey to survey. This suggests that there were possible problems in the identifcation of the eggs of this species which may have been confused with those of Onos spp.(Rocklings). Larvae were recorded sporadically throughout the region at low concentrations (<4.4 m^{-2})from April onwards.

4.1.23 *Zeugopterus punctatus (Topknot)* (Figures 33 and 34)

The temporal distributions of the eggs of this species were erratic from survey to survey. Although eggs were reported in the western Irish Sea, no larvae were subsequently found in this area. This may suggest that there was some difficulty with identification. The eggs of this species could be confused with those of Onos spp (Rocklings). A few eggs were recorded in late March with more occurences during the surveys in May. Larvae appeared in low numbers in the eastern Irish Sea from mid-April onwards.

4.1.24 *Pleuronectes platessa (Plaice)* (Figures 35 and 36)

Nichols *et al*. (1993) suggested that there were three main plaice spawning areas in the Irish Sea, one off the Irish coast, one between the Isle of Man and the Cumbrian coast and the third off the North Wales coast. The 1995 results tend to confirm this pattern (Figure 35). Extensive spawning along the Irish coast from Dundrum Bay to Dublin was noted from early February until mid-April 1995. In the eastern Irish Sea, plaice eggs were recorded from February through to late May. Moderate concentrations of eggs were caught off Cumbria but the highest concentrations occurred off the North Wales coast (93.2 eggs m^{-2}). Larvae were caught off the North Wales coast from February until the end of March. Higher concentrations of larvae (up to 12.1 m^{-2}) were then found off Dundalk Bay, in Cardigan Bay and in the middle of the eastern Irish Sea. Only low concentrations of larvae were recorded from mid-April onwards.

4.1.25 *Platicthys flesus (Flounder)* (Figure 37)

The eggs of this species range in diameter from 0.8-1.13 mm and are indistinguishable from eggs of similar size in the plankton such as those of *L. limanda* and *T. luscus*. Although the adult frequents coastal areas, estuaries and brackish waters, it is known that their spawning occurs off-shore. The highest concentrations of flounder larvae were recorded in the eastern Irish Sea (up to 48.3 m^{-2}), from mid-April to mid-May. Limited numbers were caught off the Irish coast earlier in the season.

4.1.26 *Limanda limanda (Dab)* (Figure 38)

The planktonic eggs of the dab are small and do not contain oil globules. They range from 0.66 mm to 1.2 mm in diameter and are indistinguishable from other species with eggs of similar size. Larvae were recorded from mid-March onwards in coastal regions off Ireland and in Liverpool Bay. By late May they occurred across virtually the entire region. The maximum density recorded was 2,070.2 m^{-2} in Cardigan Bay in April.

4.1.27 *Microstomus kitt (Lemon sole)* (Figure 39)

Eggs of this species can be only positively identified at a late stage of development when the characteristic pigmentation of the embryo can be seen. They were recorded on a few stations in late May (Table 2(c)). Larvae were recorded from late-April onwards in the western Irish Sea off Dublin and to the south-west of the Isle of Man. Low concentrations were found in late May in the eastern Irish Sea.

4.1.28 *Glyptocephalus cynoglossus (Witch)* (Figure 40)

The planktonic eggs of this species, like those of the *Microstomus kitt*, can only be identified in the late embryonic stages. Wheeler (1969) stated that spawning of this species occurred in the Irish Sea from late March to May and the timing of the occurrence of larvae on the surveys confirms that observation (Figure 40). The highest larval concentrations were found off Dublin in April with a few larvae being caught to the east of the Isle of Man in May.

4.1.29 *Hippoglossoides platessoides (Long-rough dab)* (Figures 41 and 42)

The eggs of this species are large (1.38-2.64 mm diameter) with a notably wide perivittelline space. As a result they are easily recognised in a plankton sample and can be readily sorted. They were recorded over a limited geographical range, predominantly in the western Irish Sea from mid-March to late April. The larvae of long-rough dab were found inshore off the Irish coast in early April. By mid-May they were found at higher concentrations further offshore in the western Irish Sea.

4.1.30 *Solea solea (Sole)* (Figures 43 and 44)

The main spawning areas for this species in the Irish Sea are east of longitude 04° 30′W, between the Solway Firth and the North Wales coast (Figure 43). However, the surveys also recorded moderate egg concentrations along the Irish coast and in Cardigan Bay. Peak concentrations off the North Wales coast occurred approximately two weeks before the peak off the Solway Firth. Limited spawning was noted to the southwest of the Calf of Man. A few larvae were recorded in March and April but the highest concentrations (up to 14.0 m^{-2}) occurred during May and June in the eastern Irish Sea, particularly off the North Wales coast.

4.1.31 *Buglossidium luteum (Solenette)* (Figure 45)

Eggs of this species were found at highest concentrations in the eastern Irish Sea with limited numbers recorded off Dundalk Bay. Their larvae also occurred in low numbers but have not been plotted.

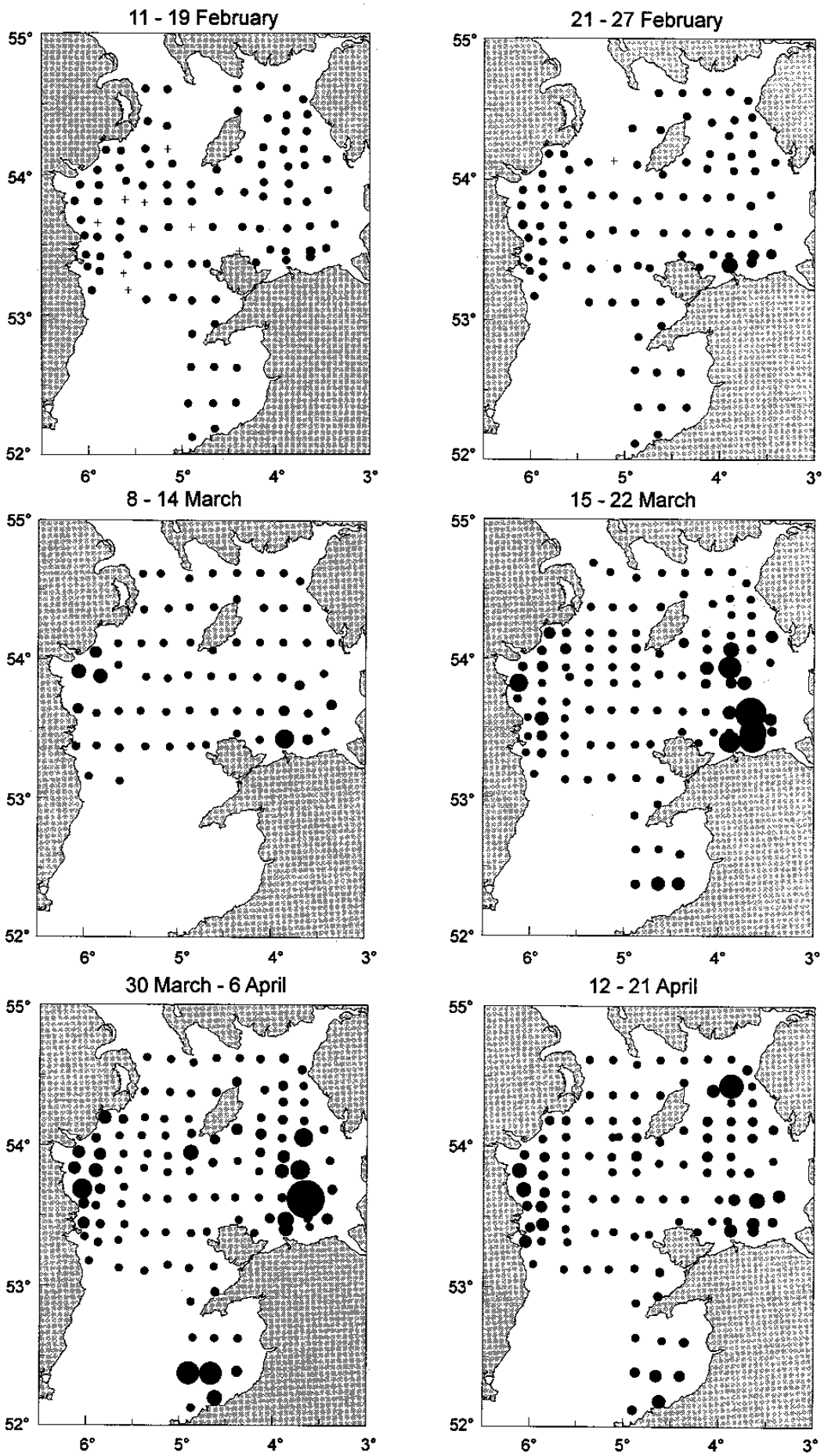
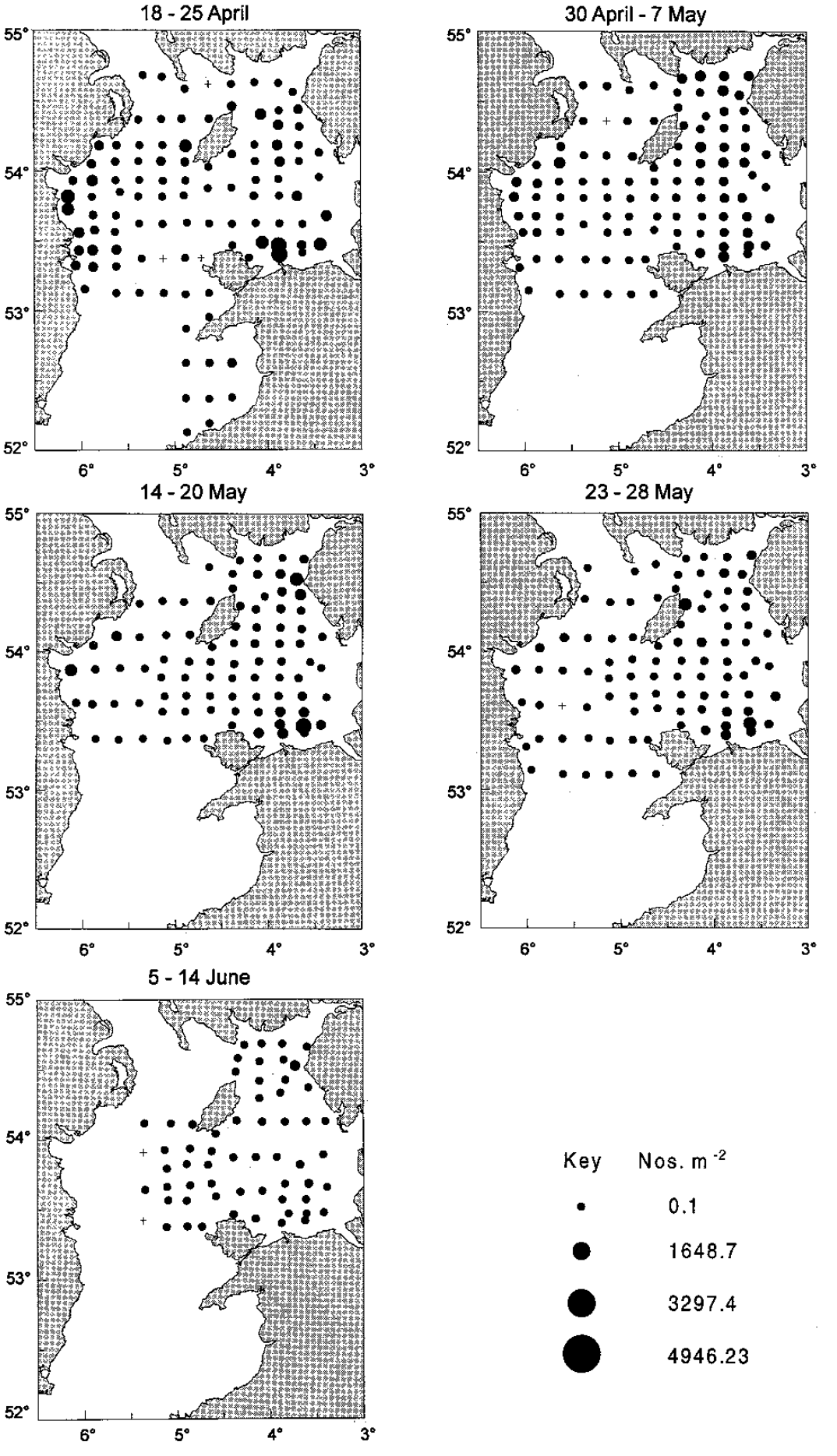


Figure 1. Total egg concentrations (nos.m^{-2}) in 1995



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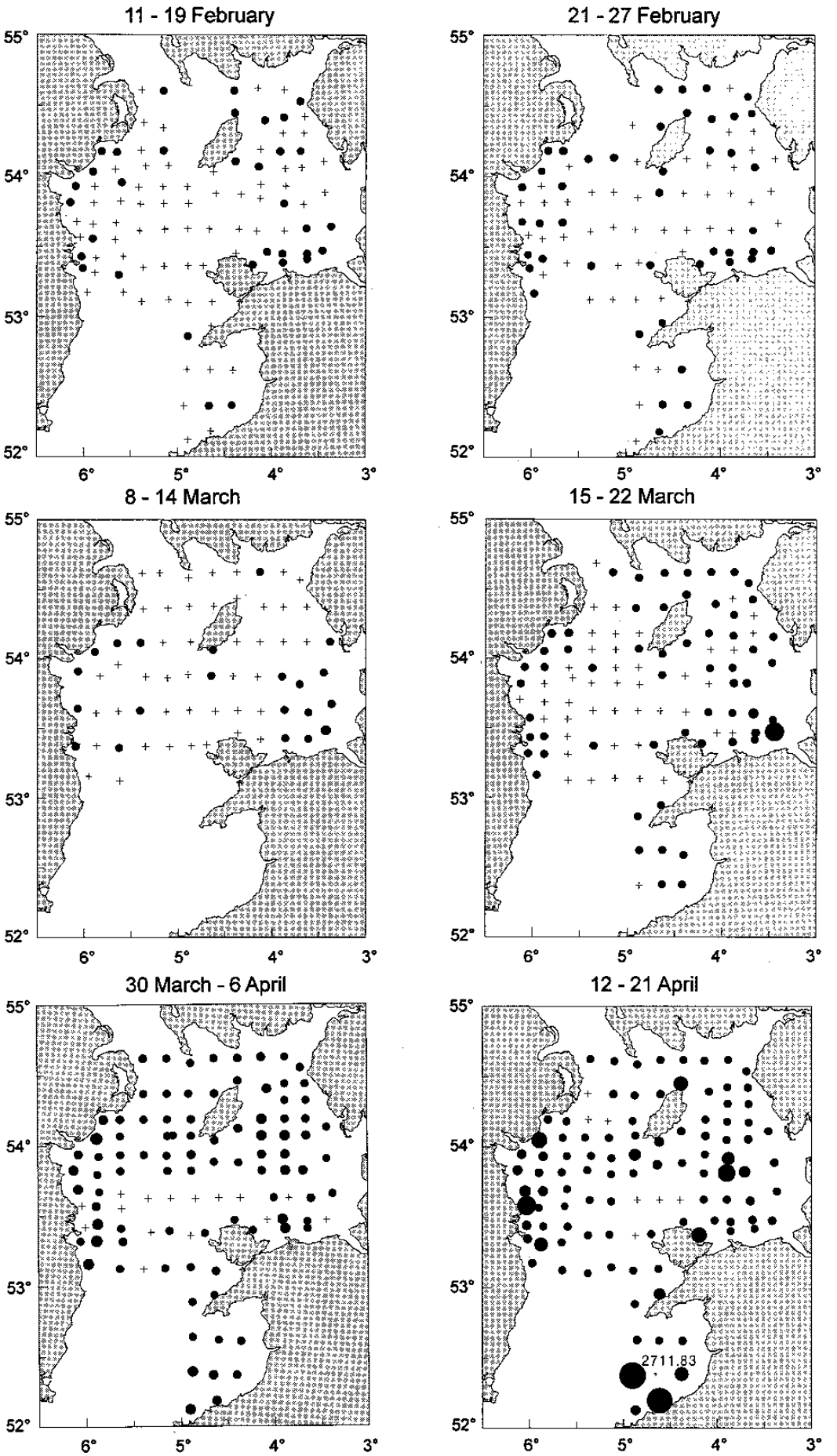


Figure 2. Total larvae concentrations (nos.m^{-2}) in 1995

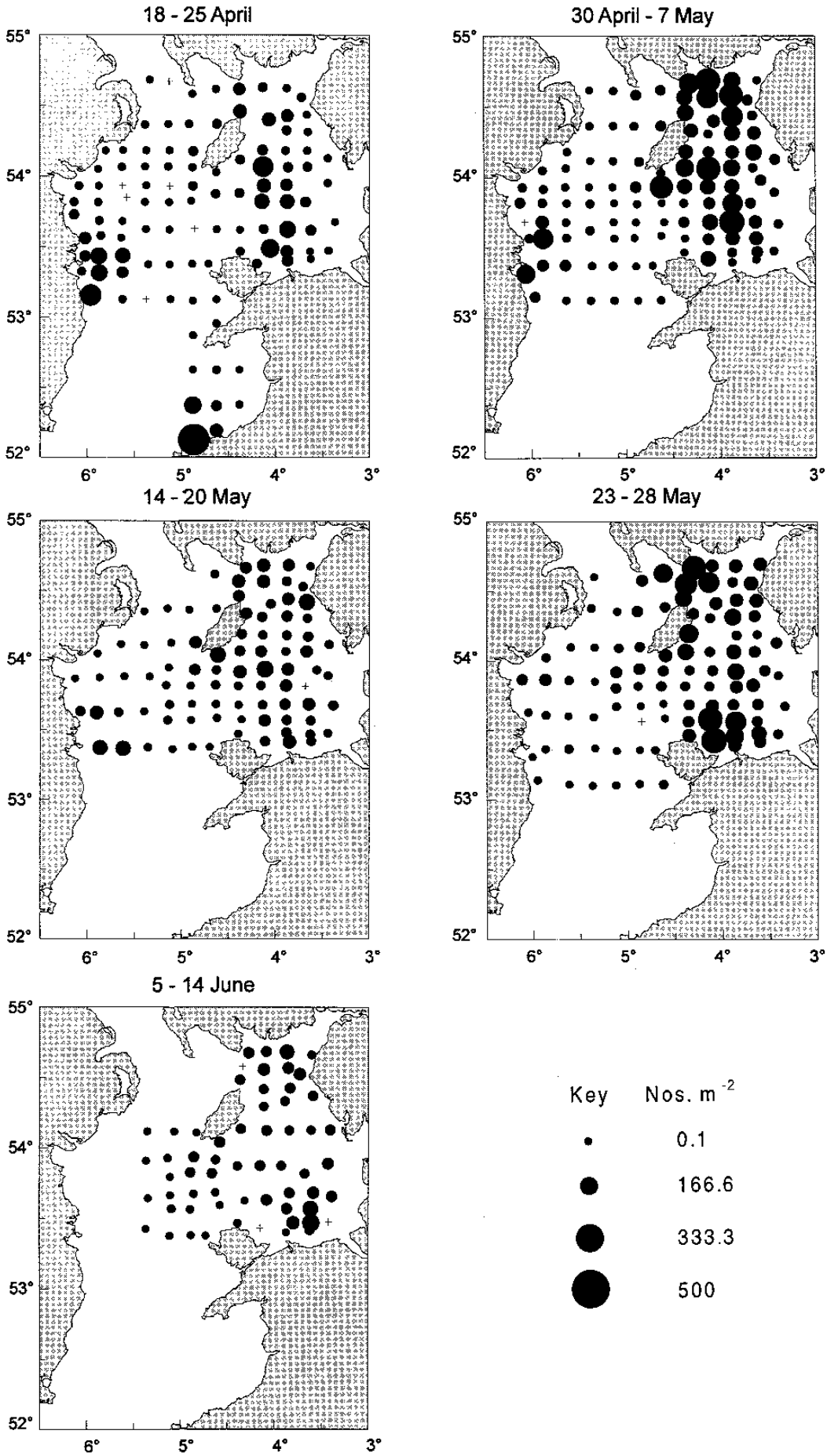


Figure 2. continued

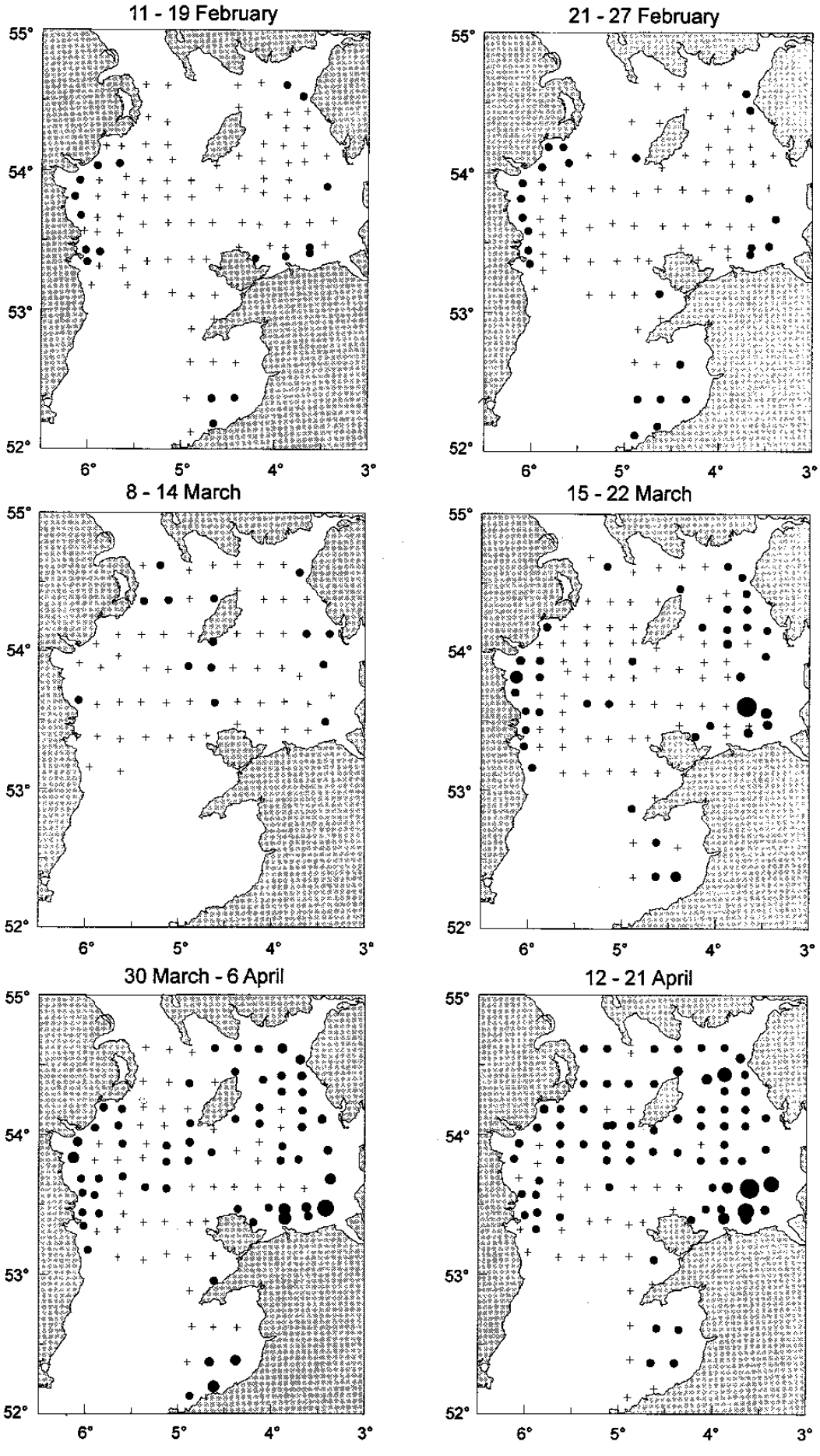


Figure 3. Concentration of sprat (Sprattus sprattus) eggs (nos.m^{-2}) in 1995

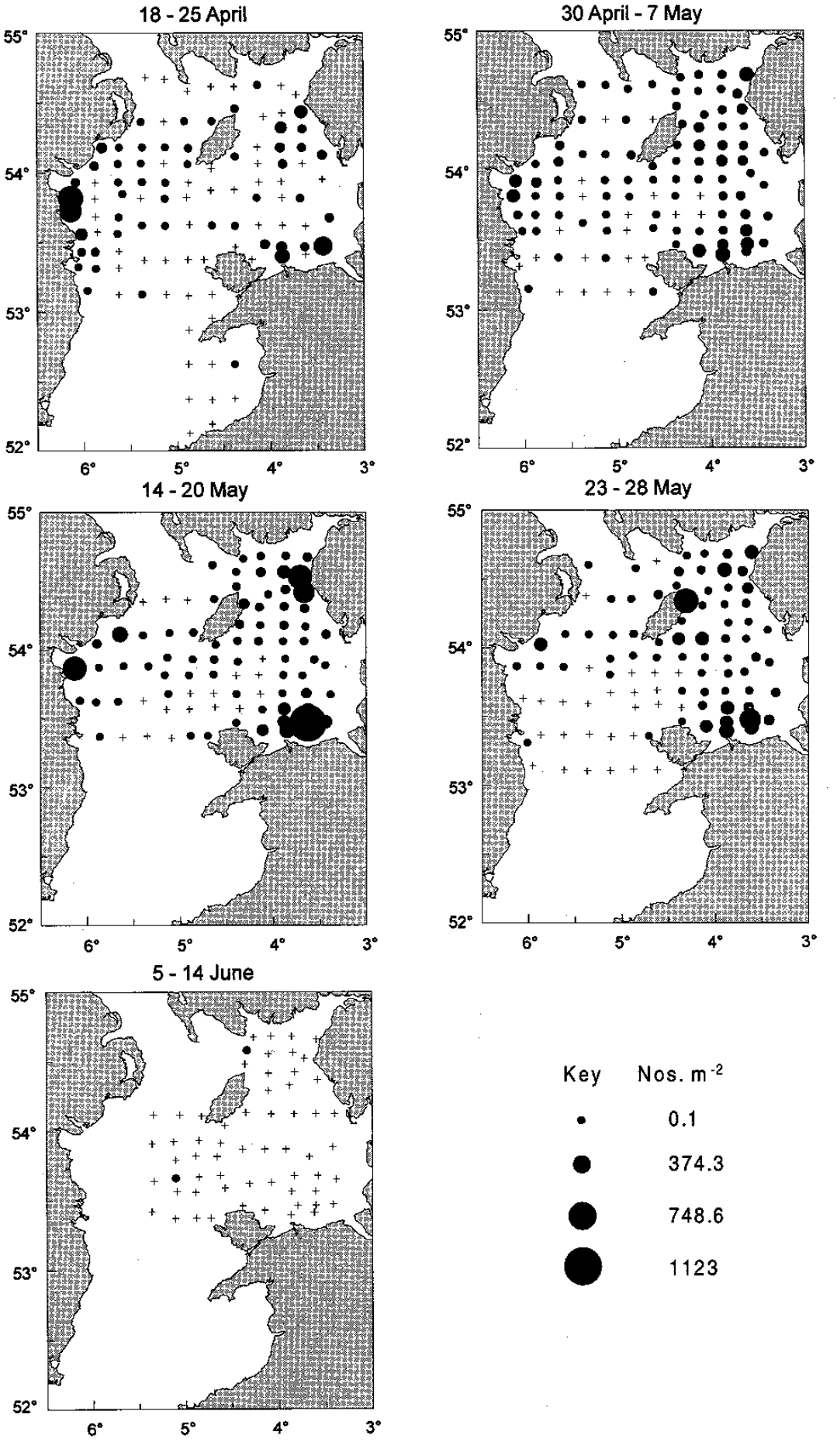


Figure 3. continued

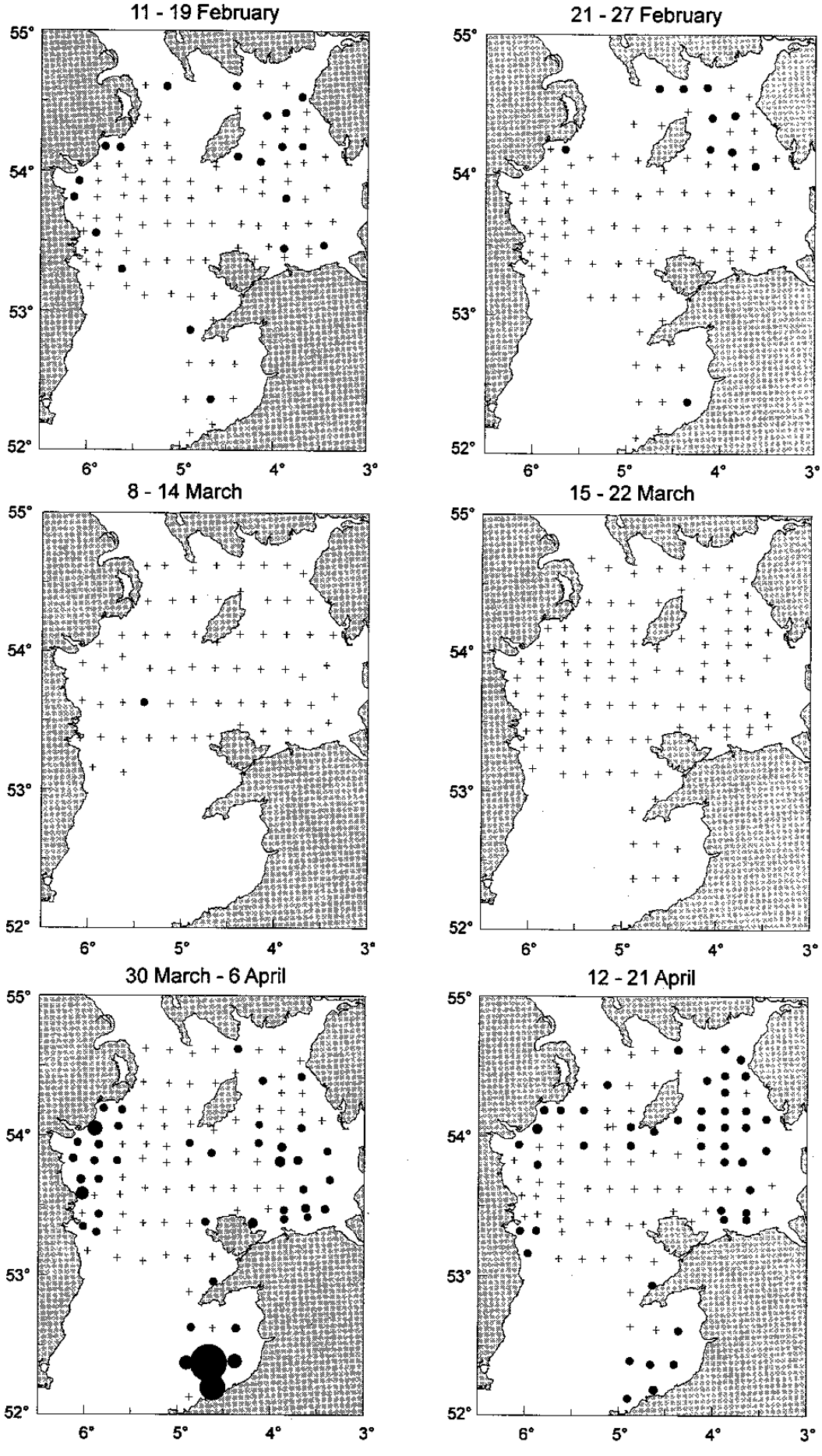


Figure 4. Concentration of sprat and Clupeidae (Sprattus sprattus and Clupeidae) larvae (nos.m^{-2}) in 1995

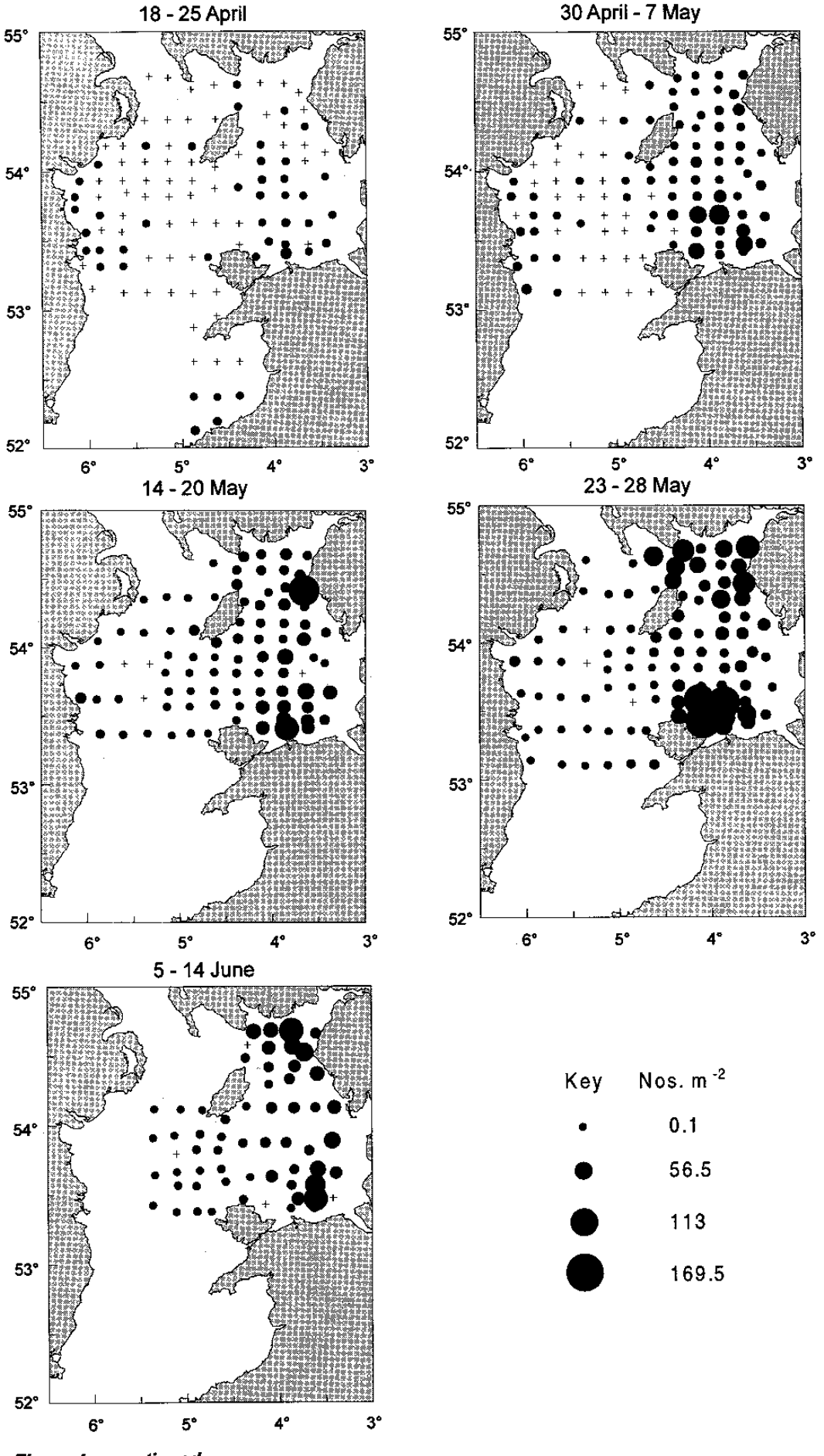


Figure 4. continued

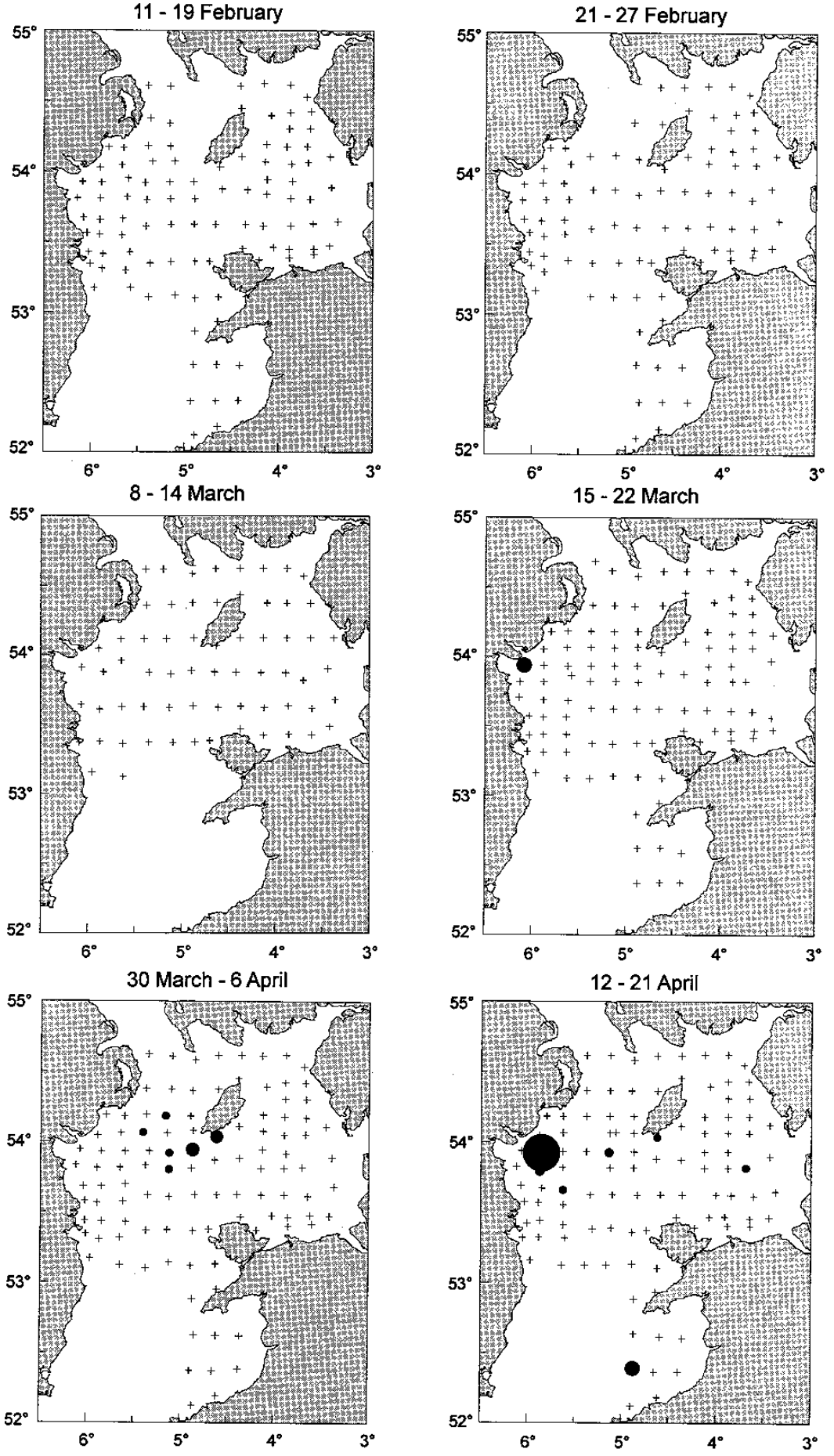
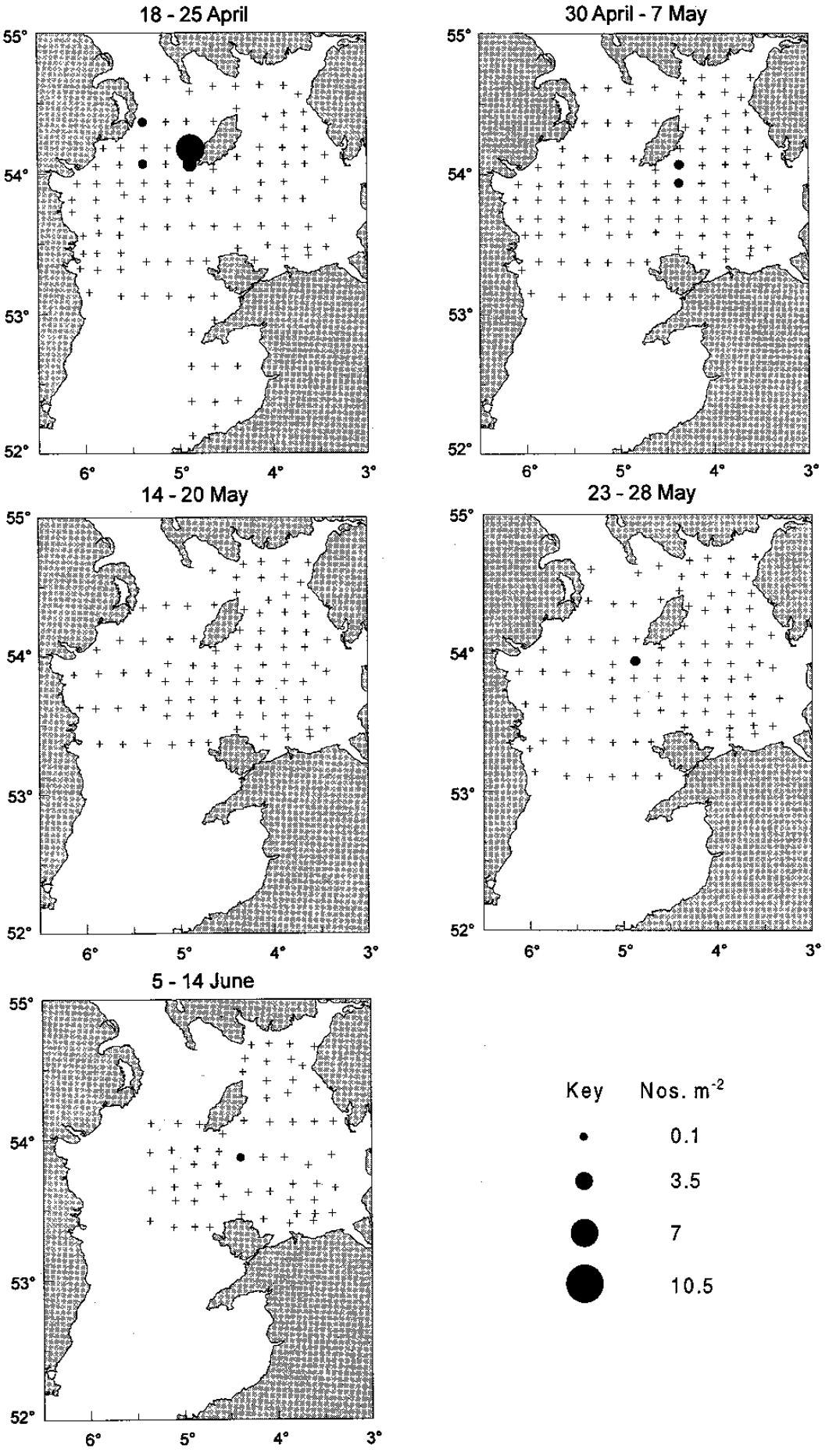


Figure 5. Concentration of Lesser silver smelt (Argentina sphyraena) eggs (nos.m^{-2}) in 1995



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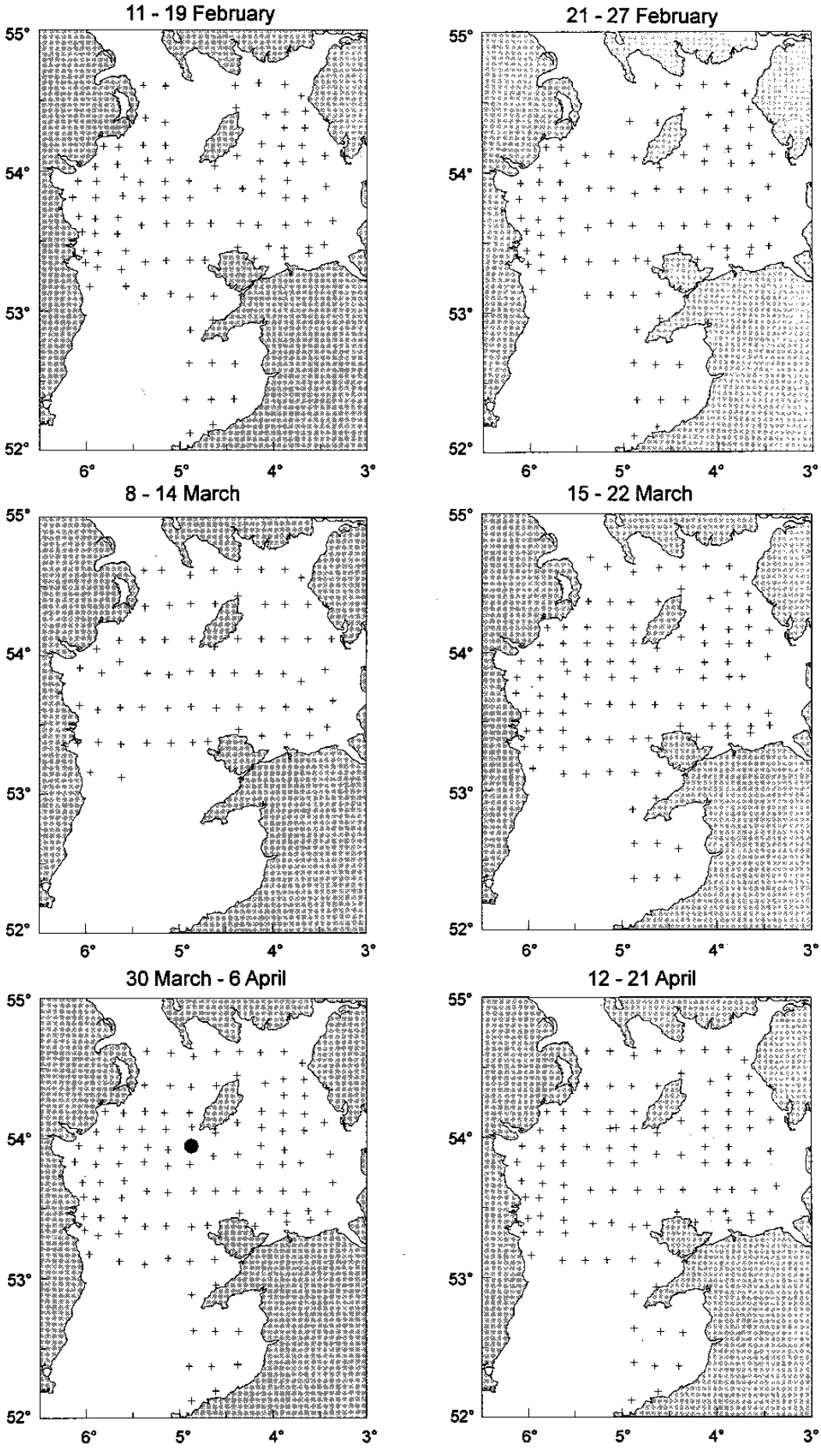
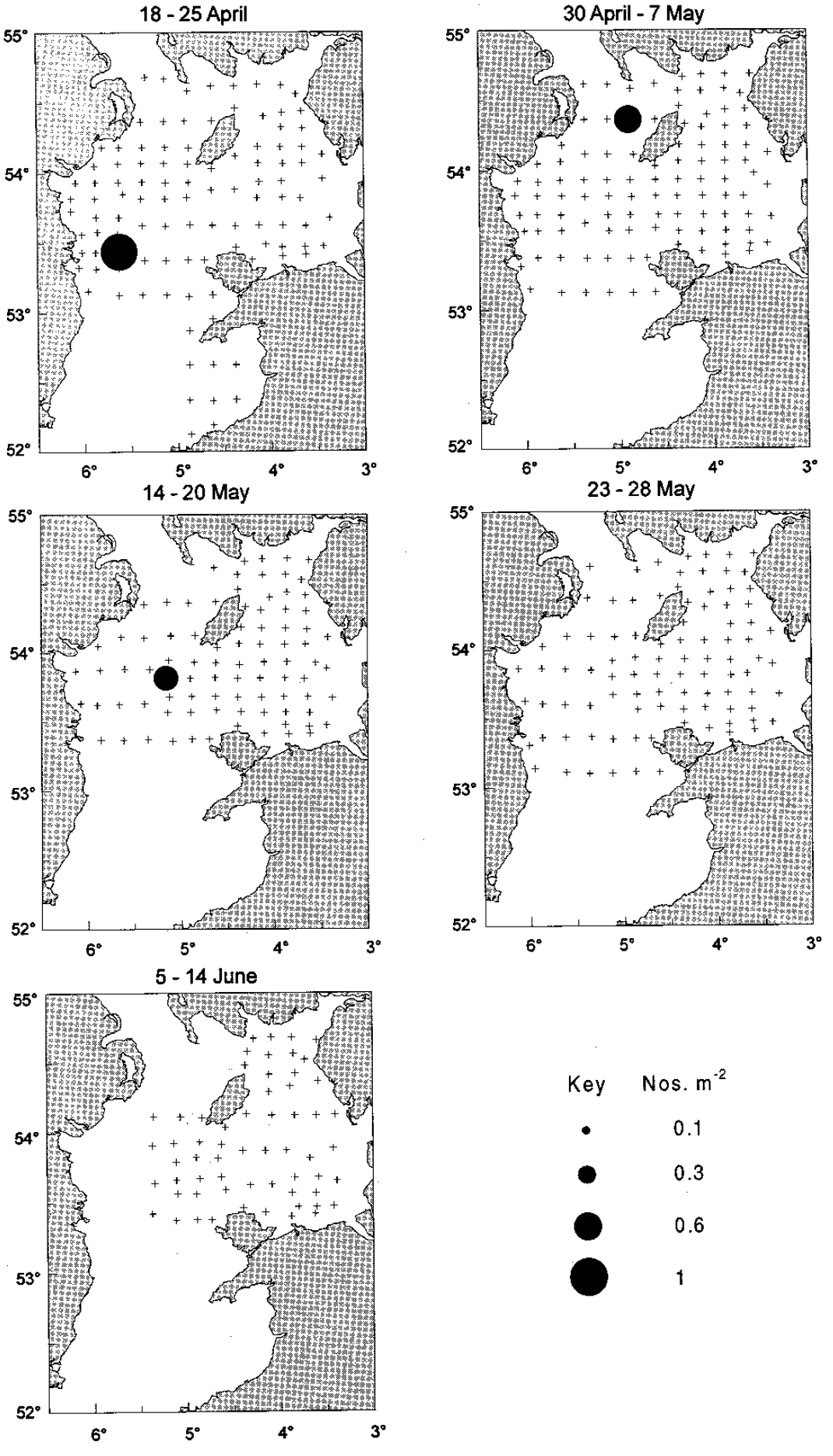


Figure 6. Concentration of Lesser silver smelt (Argentina sphyraena) larvae (nos.m^{-2}) in 1995



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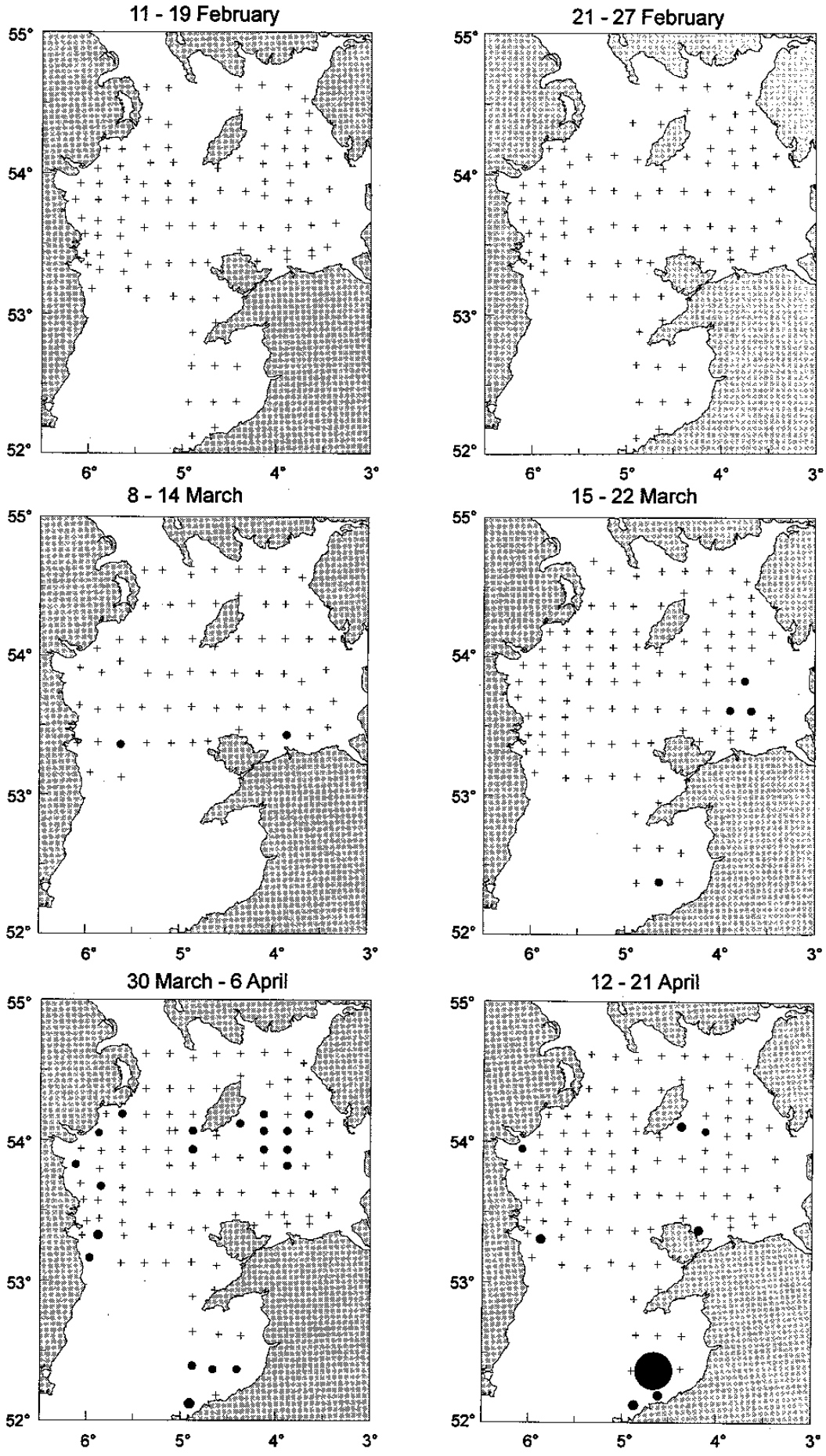
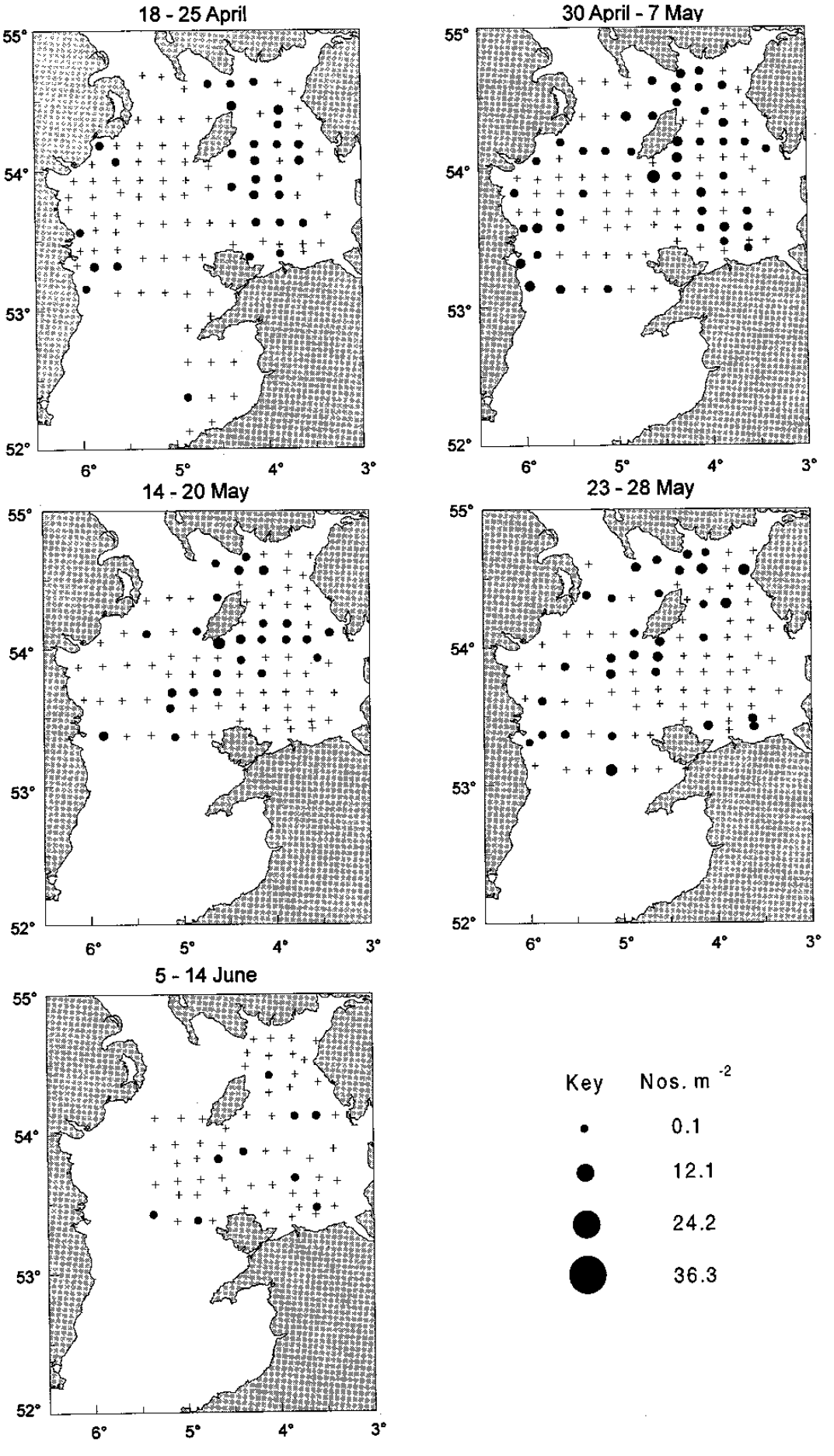


Figure 7. Concentration of Norway pout and poor cod (Gadidae) larvae (nos.m^{-2}) in 1995



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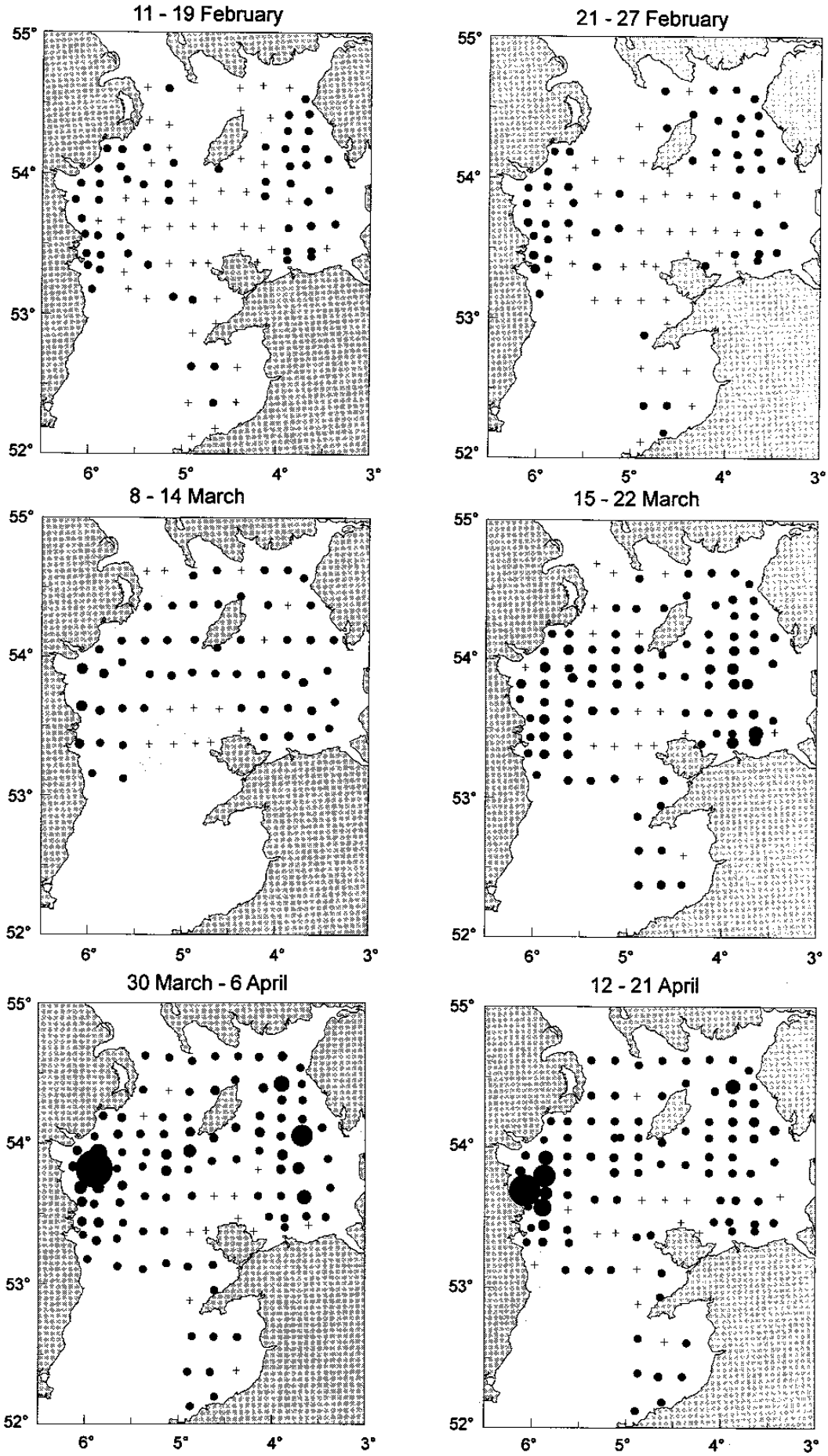
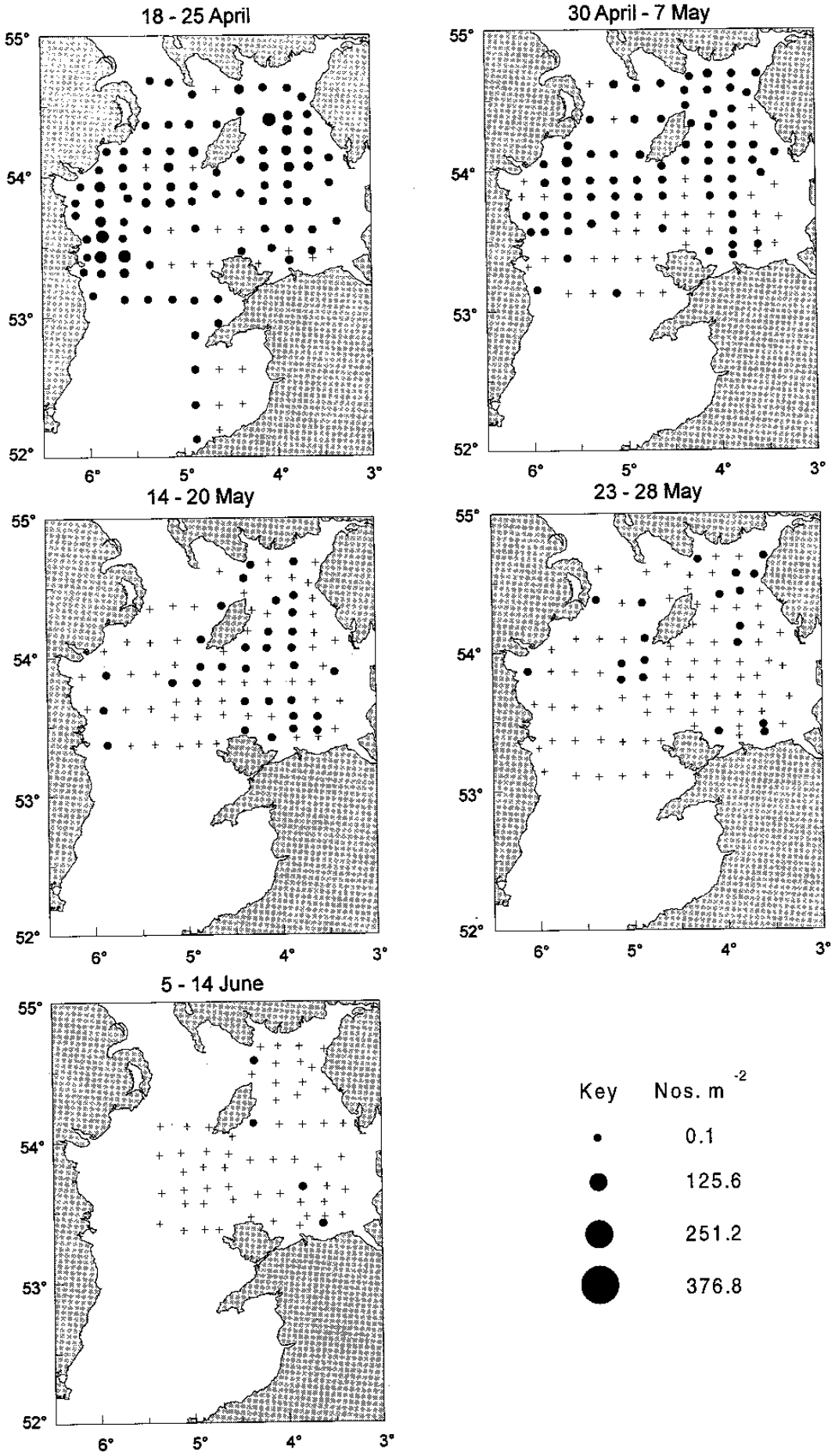


Figure 8. Concentration of cod (Gadus morhua) eggs (nos.m^{-2}) in 1995



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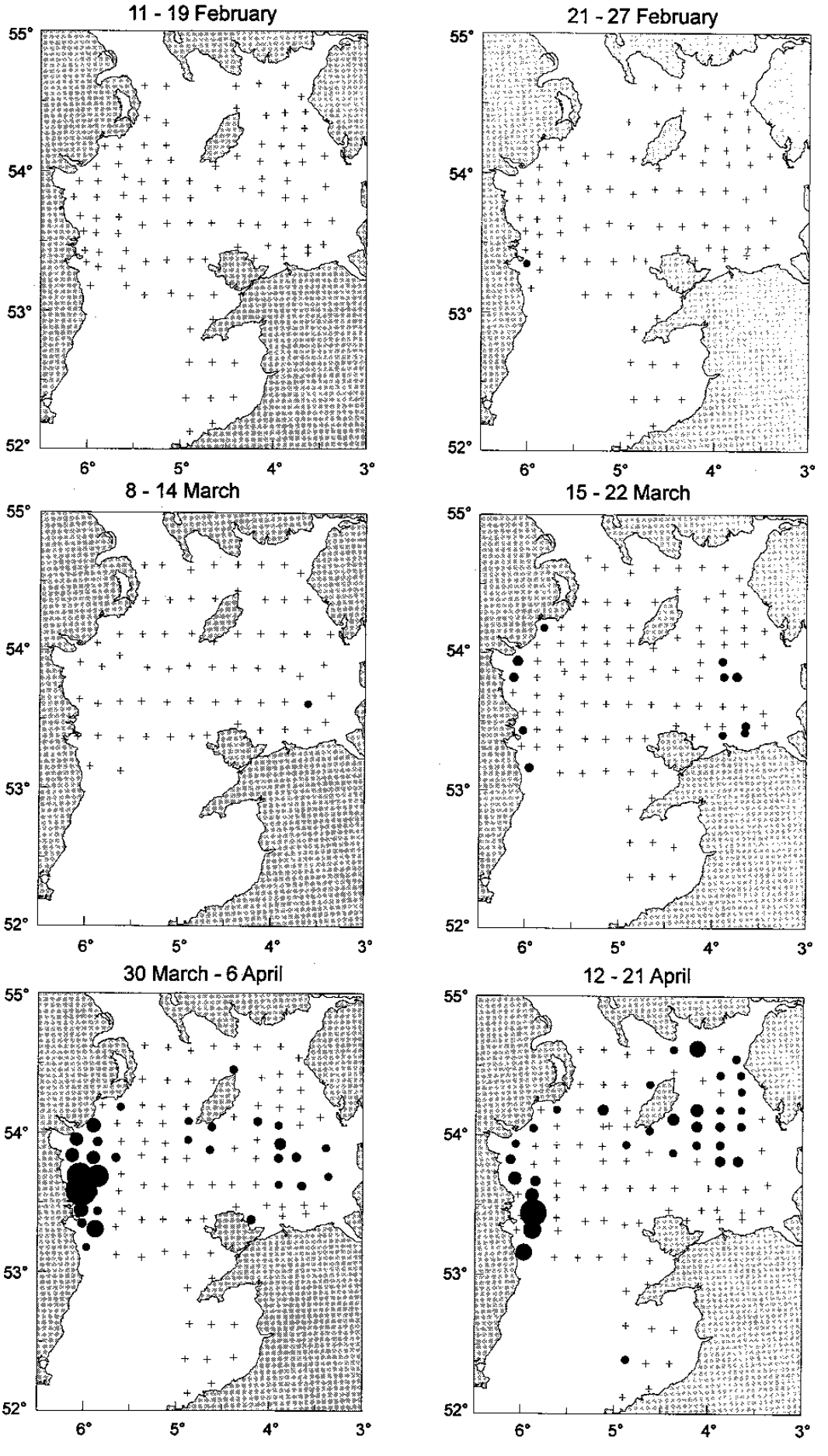
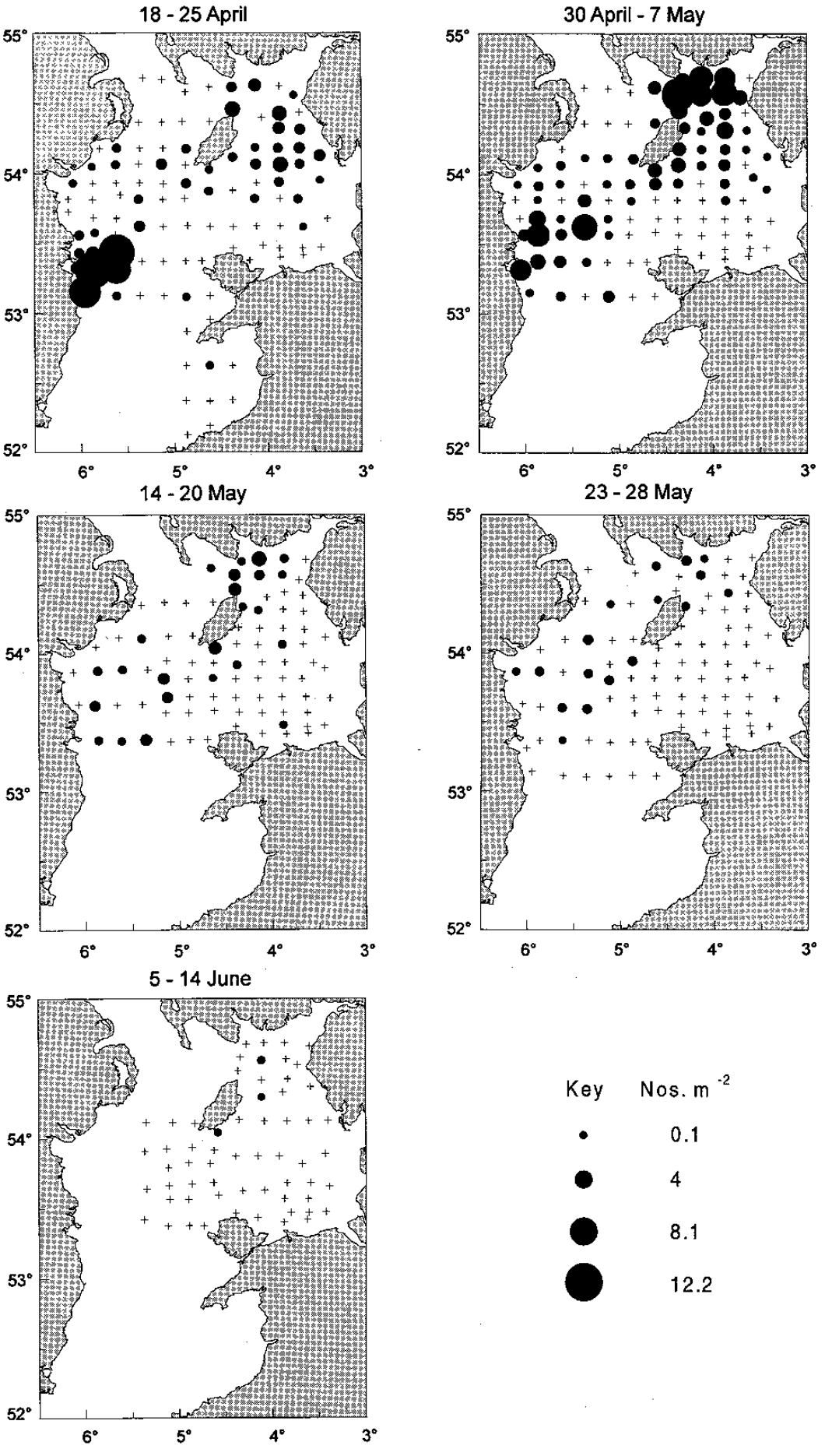


Figure 9. Concentration of cod (Gadus morhua) larvae (nos.m^{-2}) in 1995



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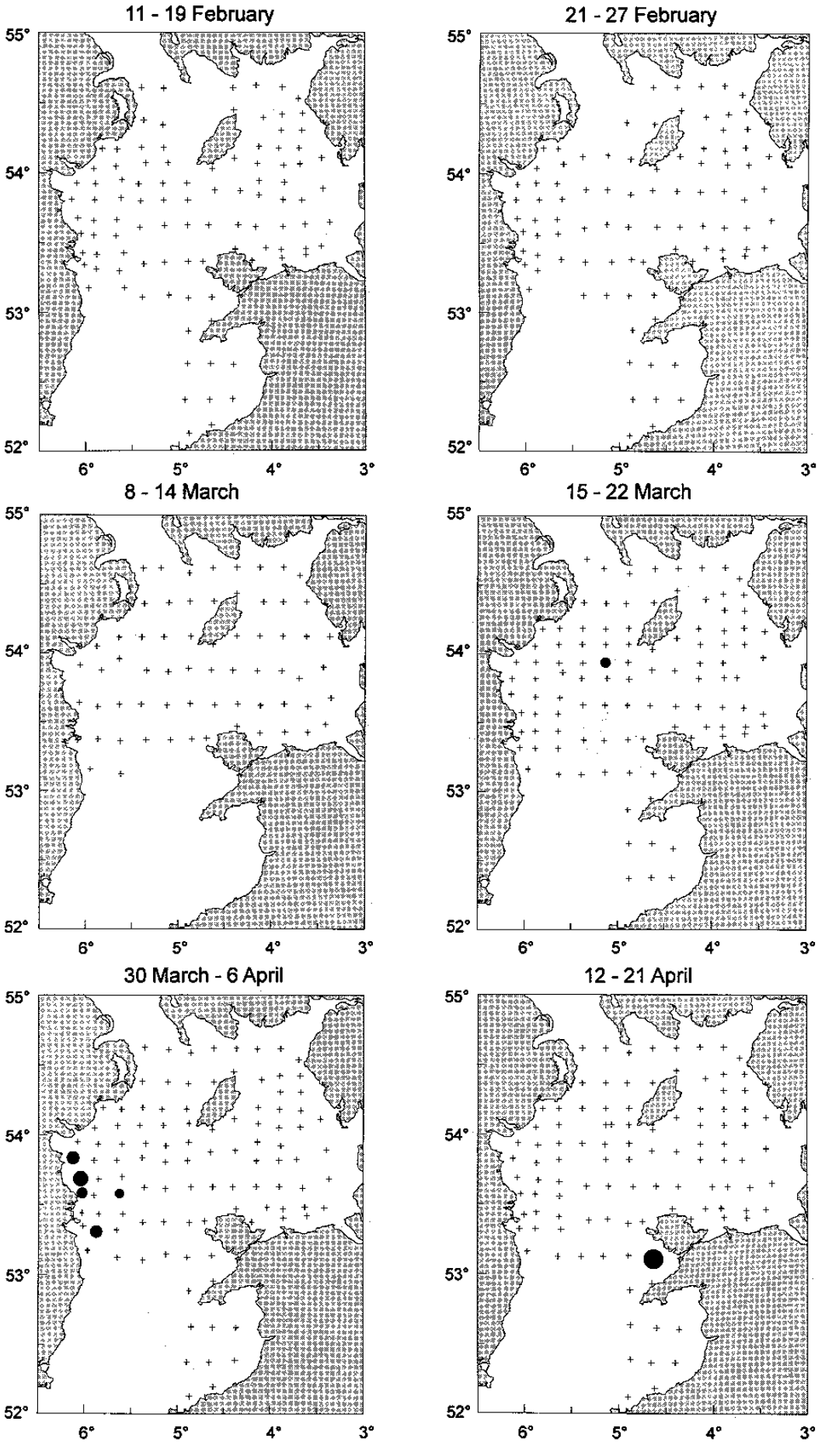
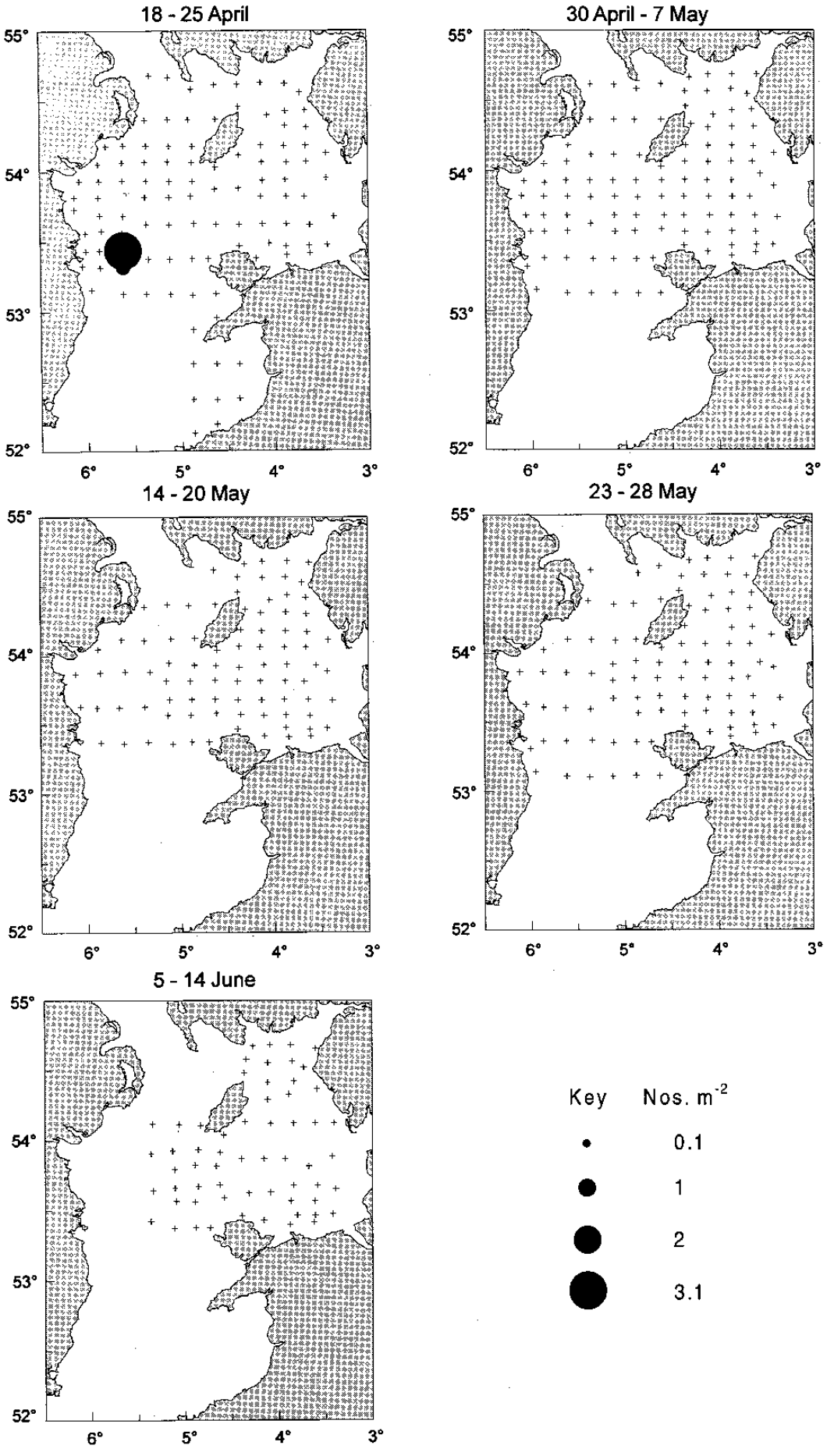


Figure 10. Concentration of haddock (Melanogrammus aeglefinus) eggs (nos.m^{-2}) in 1995



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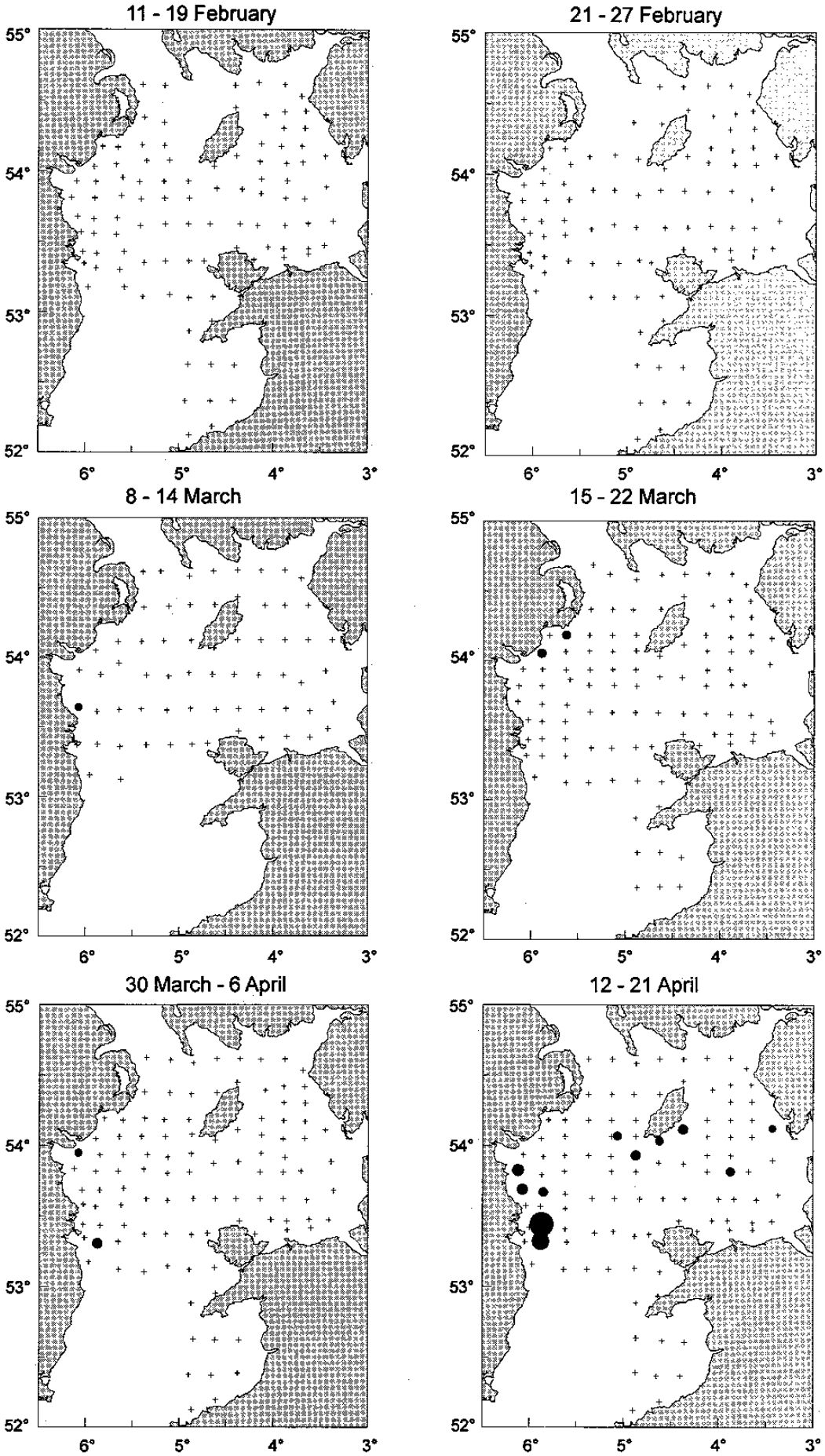
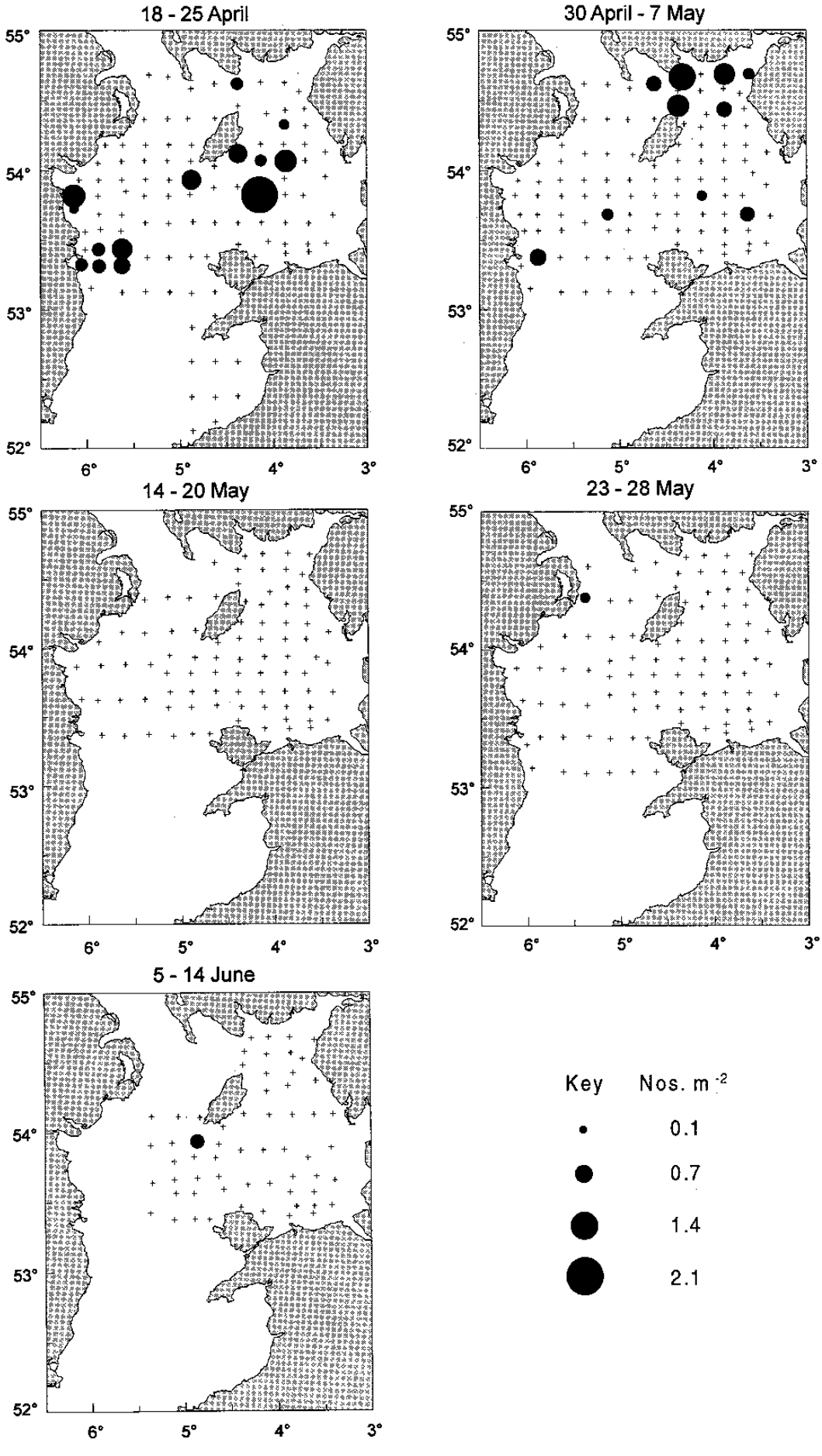


Figure 11. Concentration of haddock (Melanogrammus aeglefinus) larvae (nos.m^{-2}) in 1995



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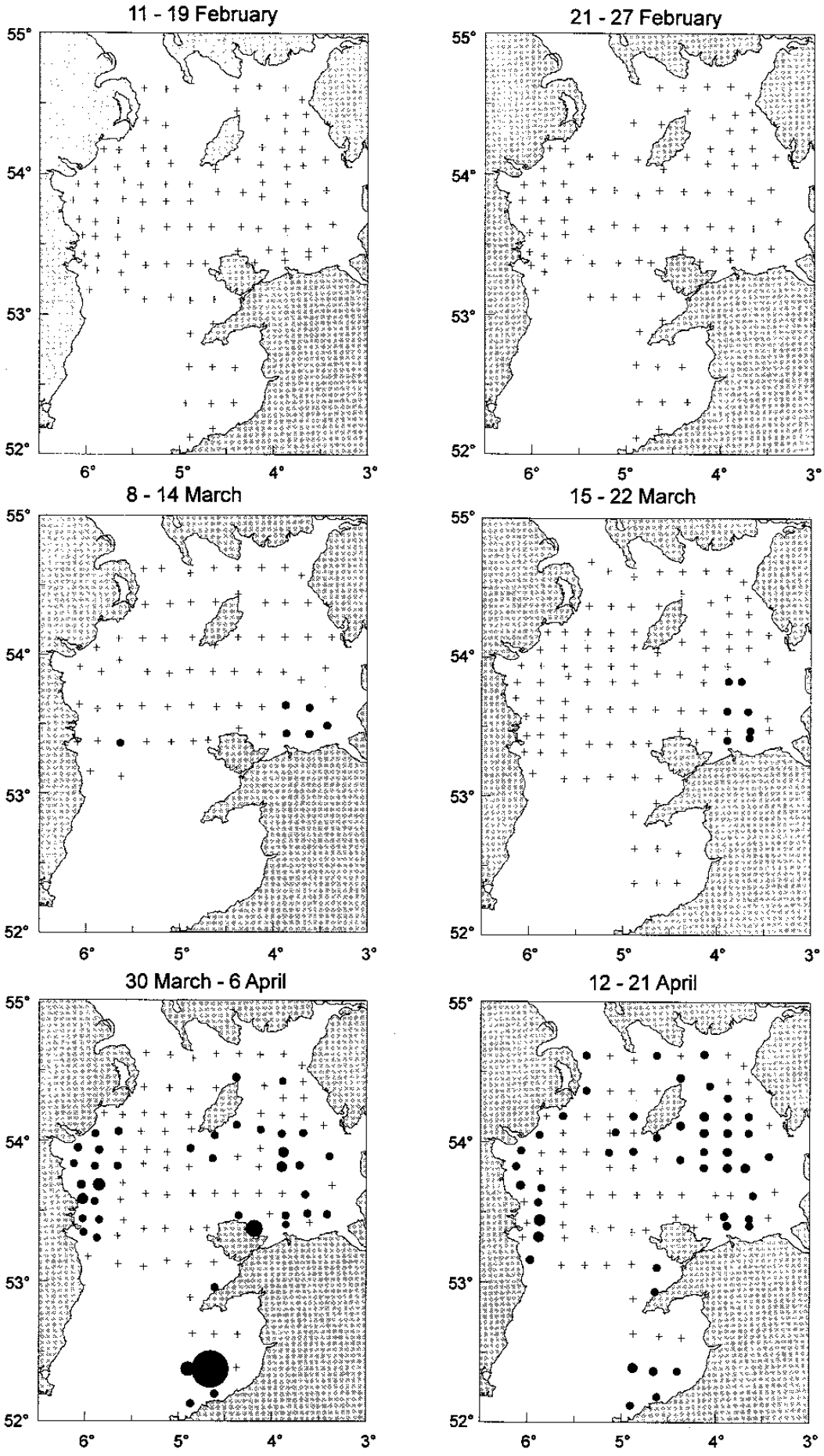
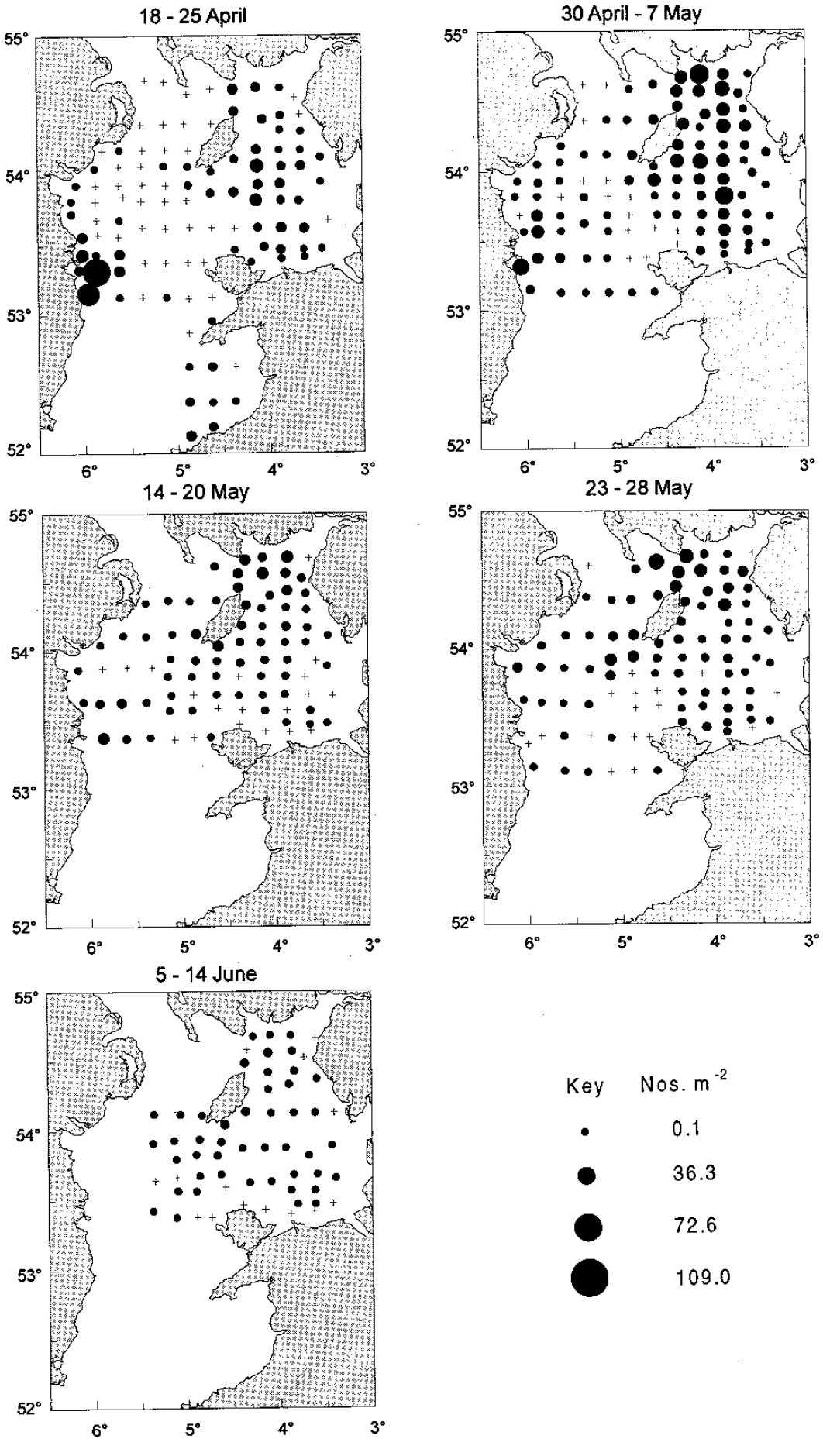


Figure 12. Concentration of whiting (Merlangius merlangus) larvae (nos.m^{-2}) in 1995



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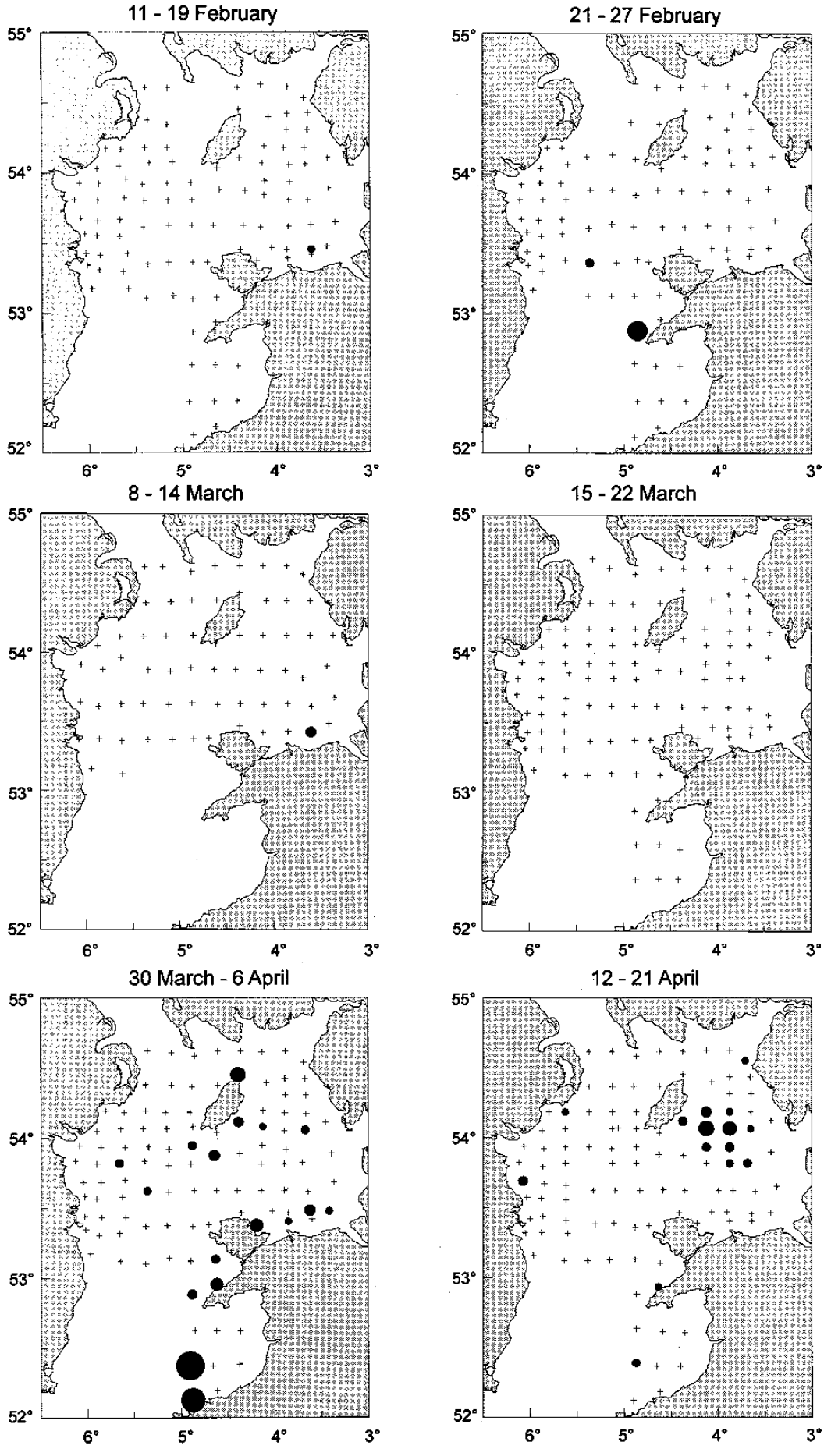


Figure 13. Concentration of Pout whiting (Trisopterus luscus) larvae (nos.m^{-2}) in 1995

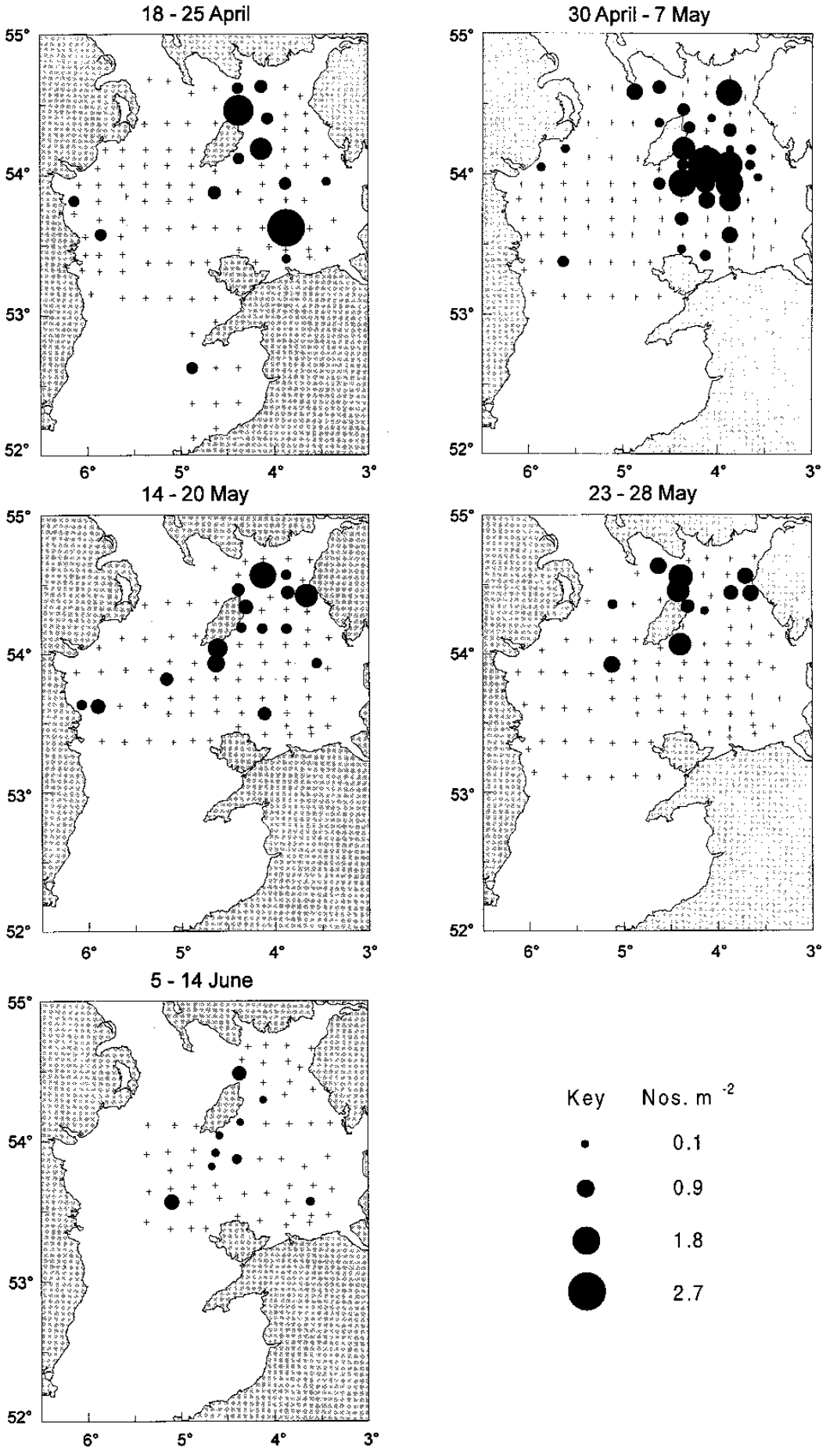


Figure 13. continued

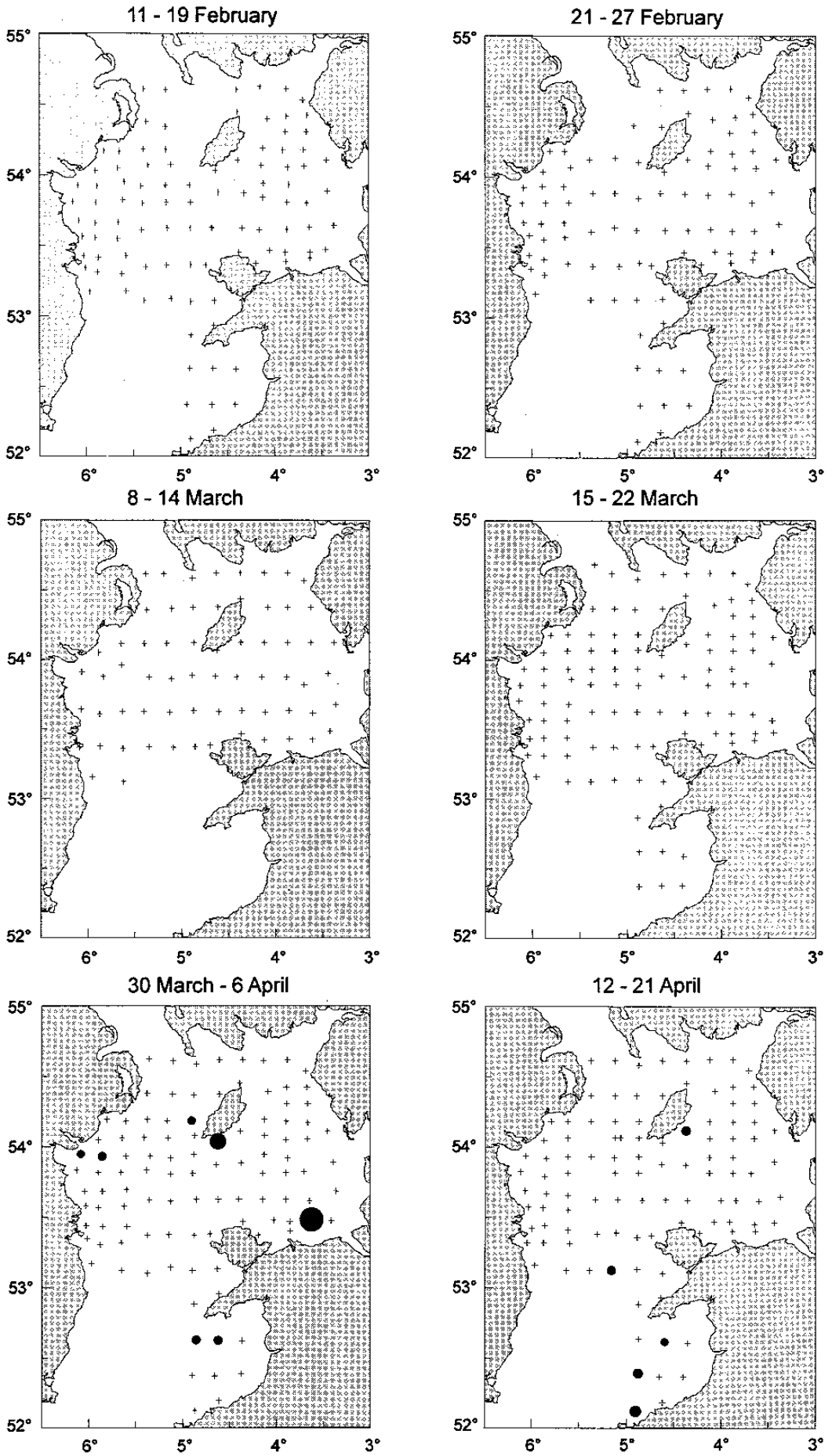


Figure 14. Concentration of pollack (Pollachius pollachius) larvae (nos.m^{-2}) in 1995

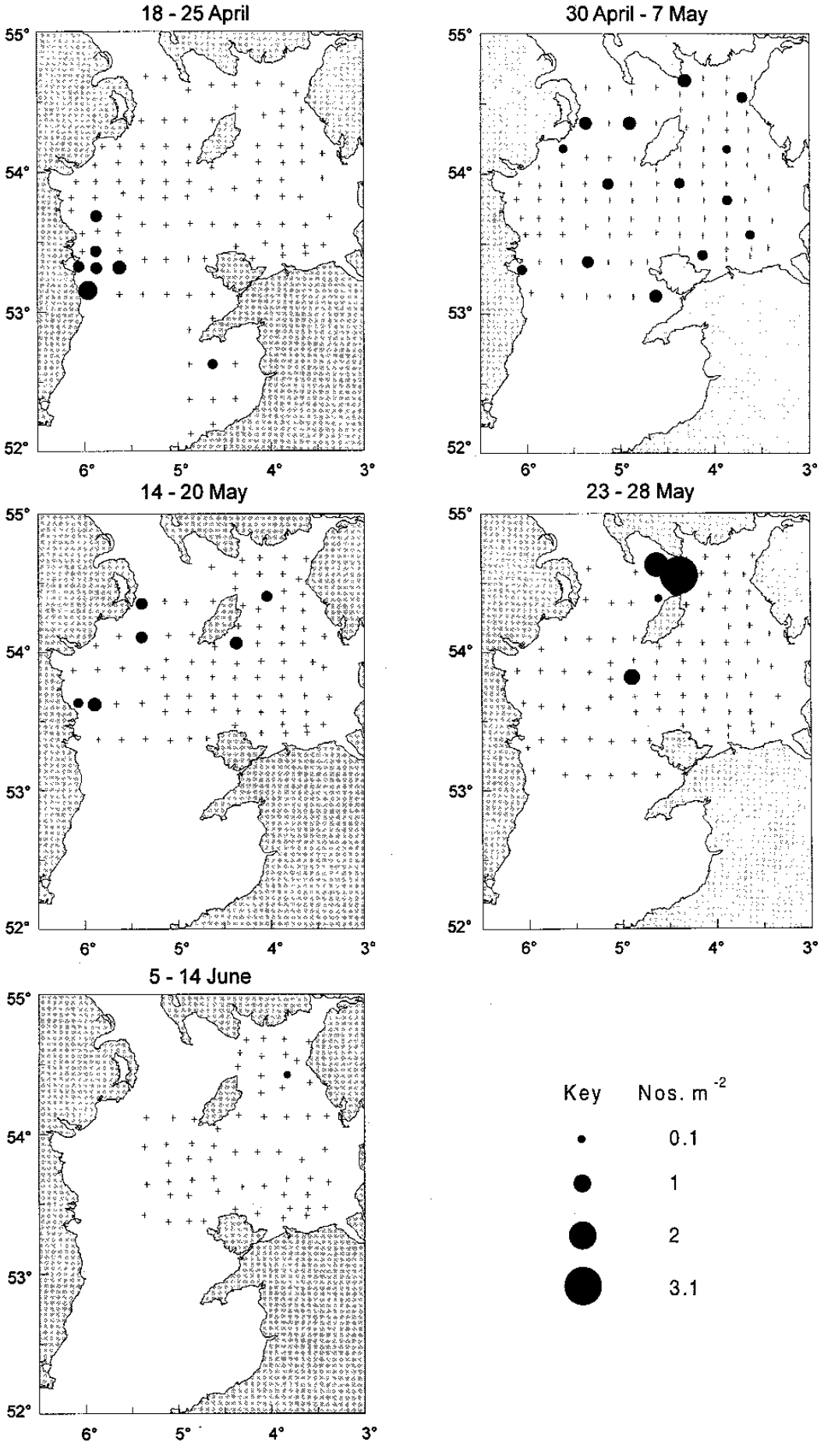


Figure 14. continued

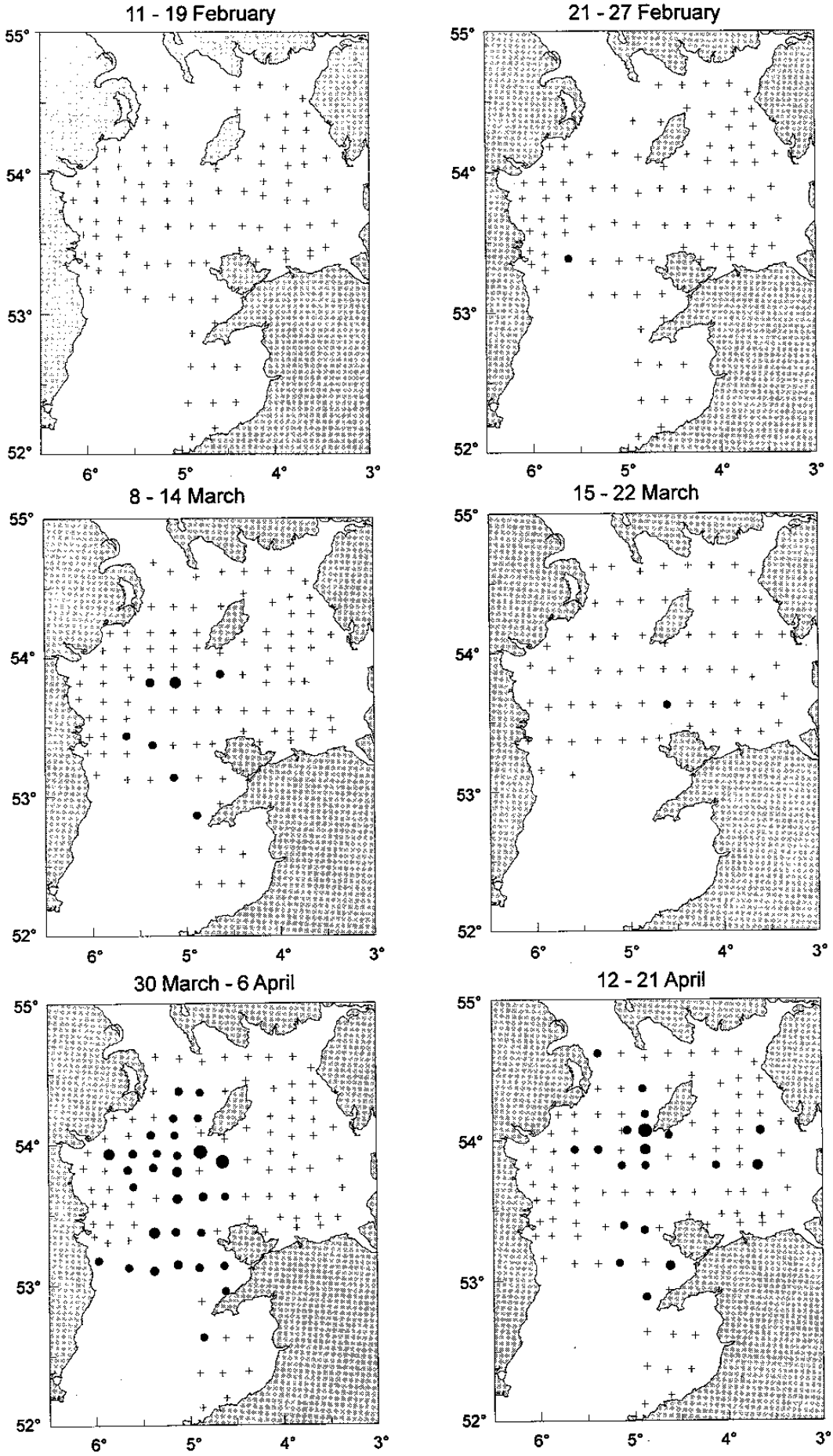


Figure 15. Concentration of ling (Molva molva) eggs (nos.m^{-2}) in 1995

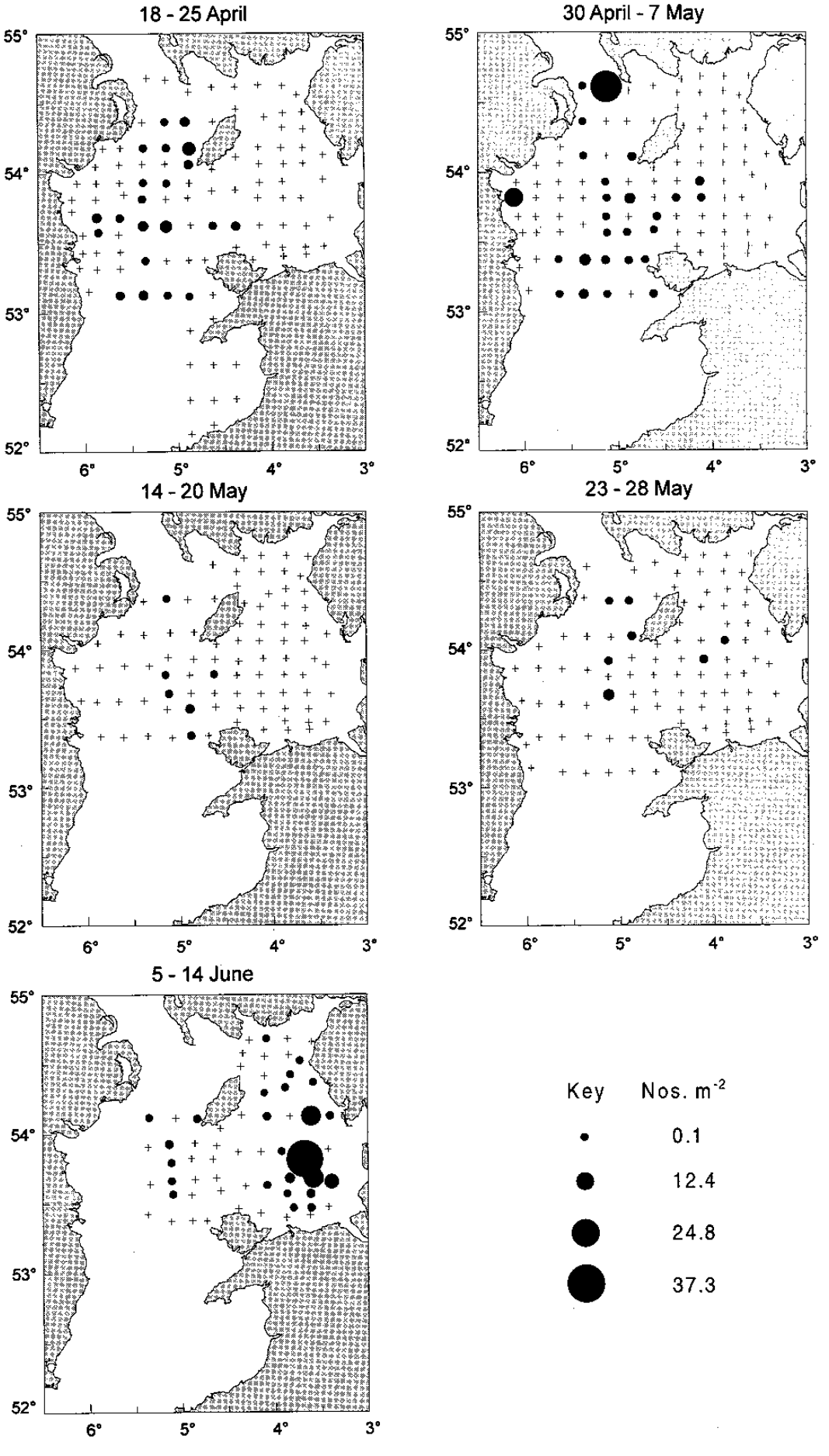


Figure 15. continued

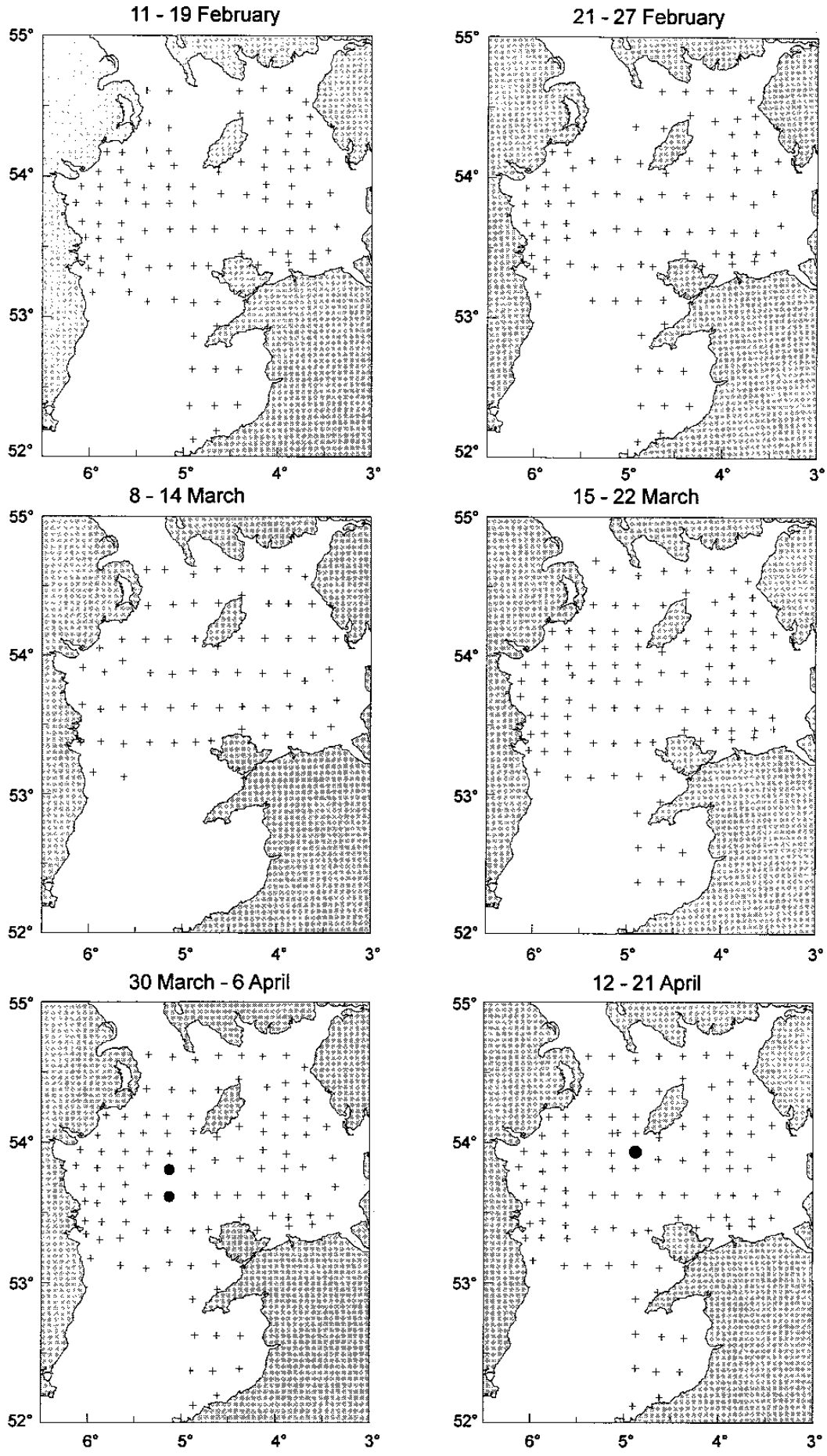


Figure 16. Concentration of ling (Molva molva) larvae (nos.m^{-2}) in 1995

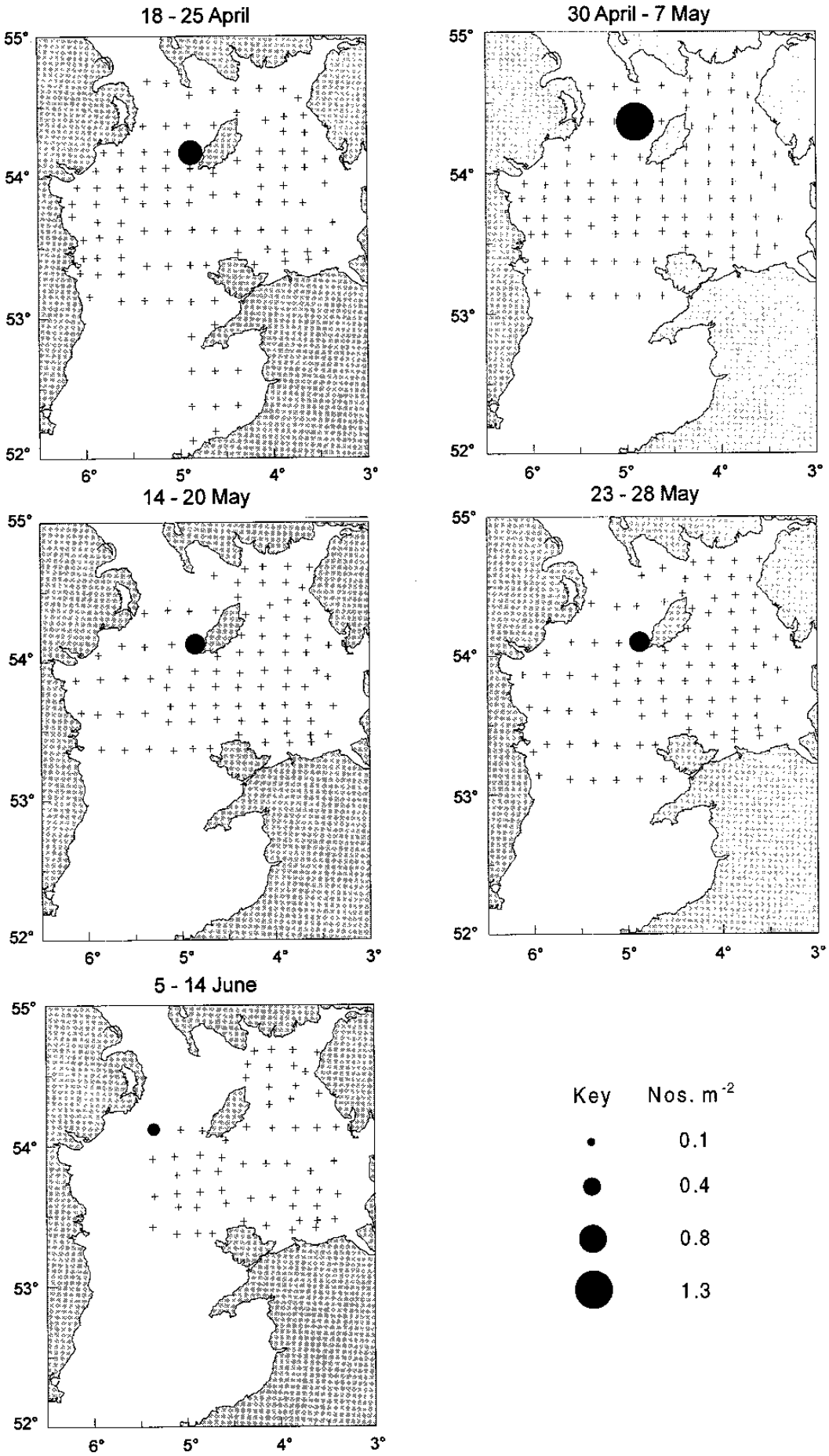


Figure 16. continued

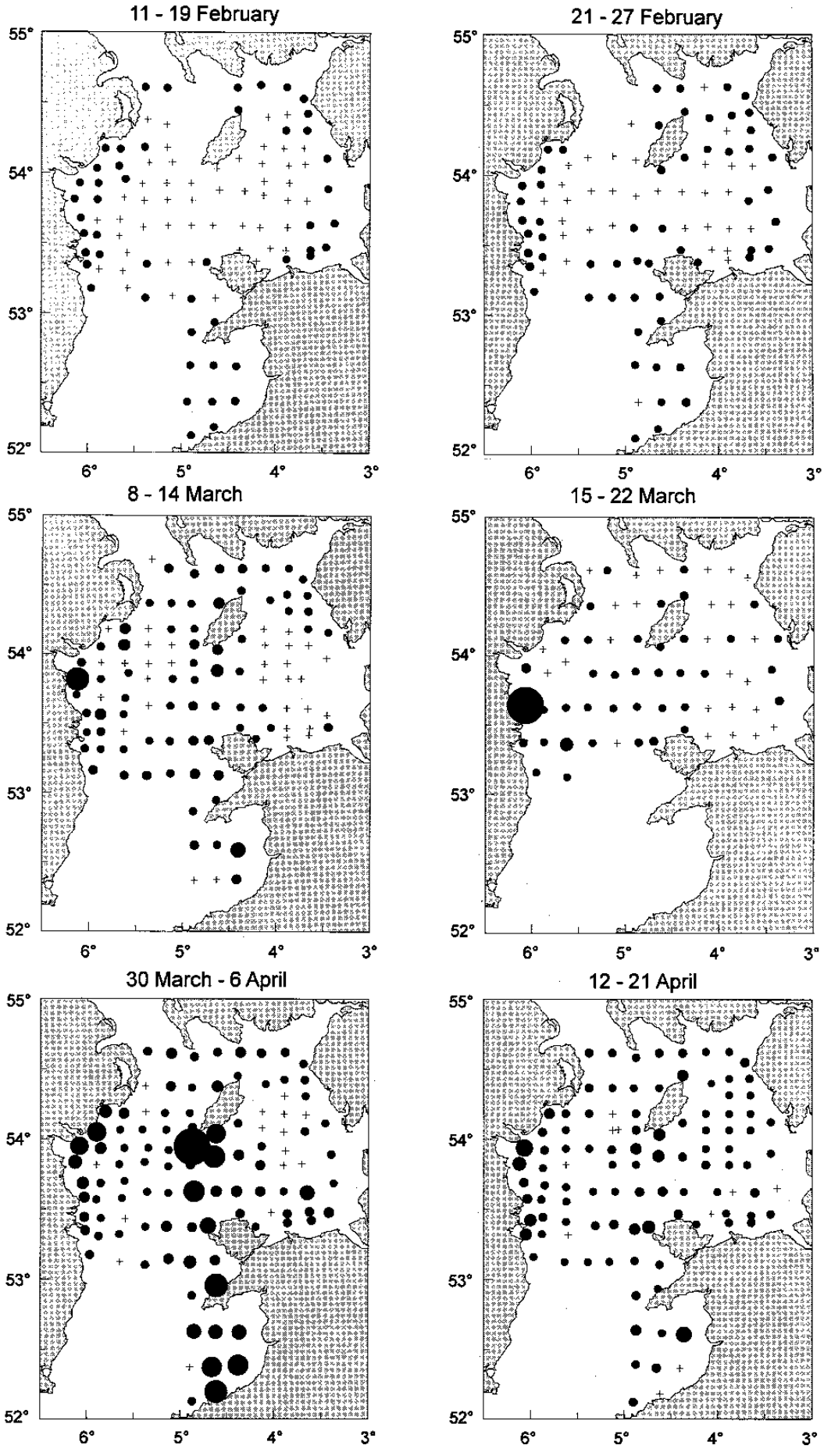


Figure 17. Concentration of rockling (Onus spp.) eggs (nos.m^{-2}) in 1995

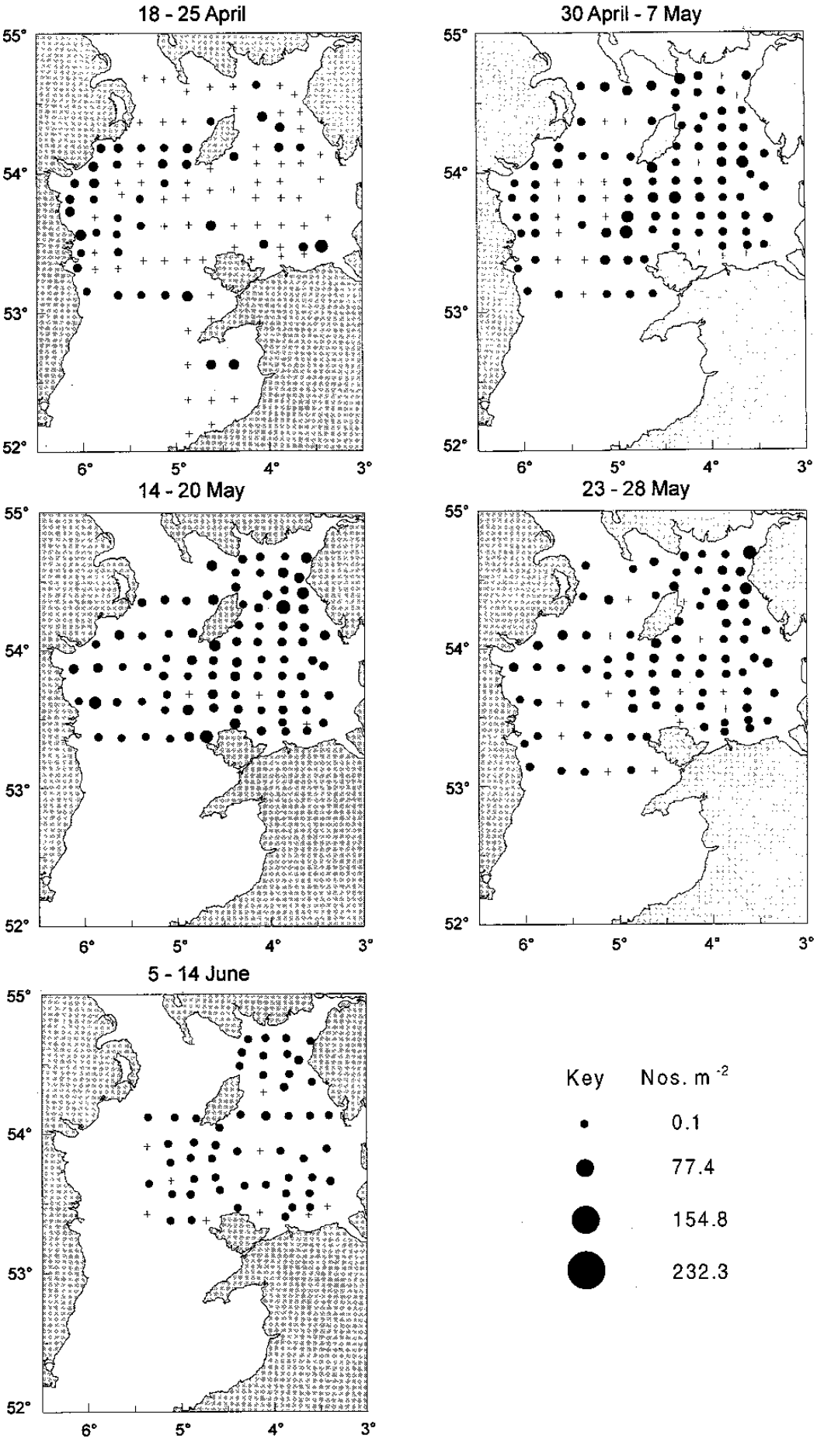


Figure 17. continued

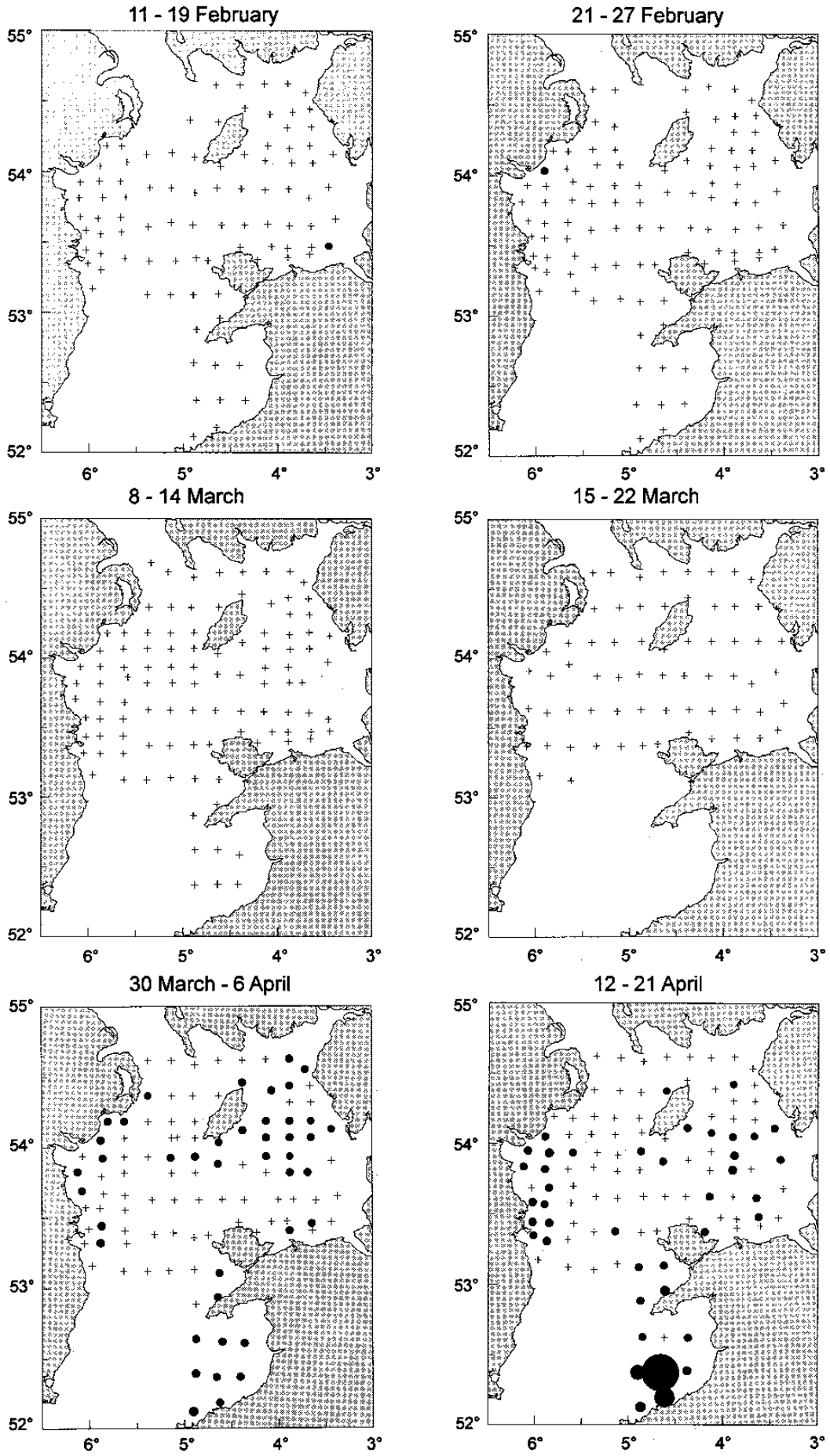


Figure 18. Concentration of rockling (Onus spp.) larvae (nos.m^{-2}) in 1995

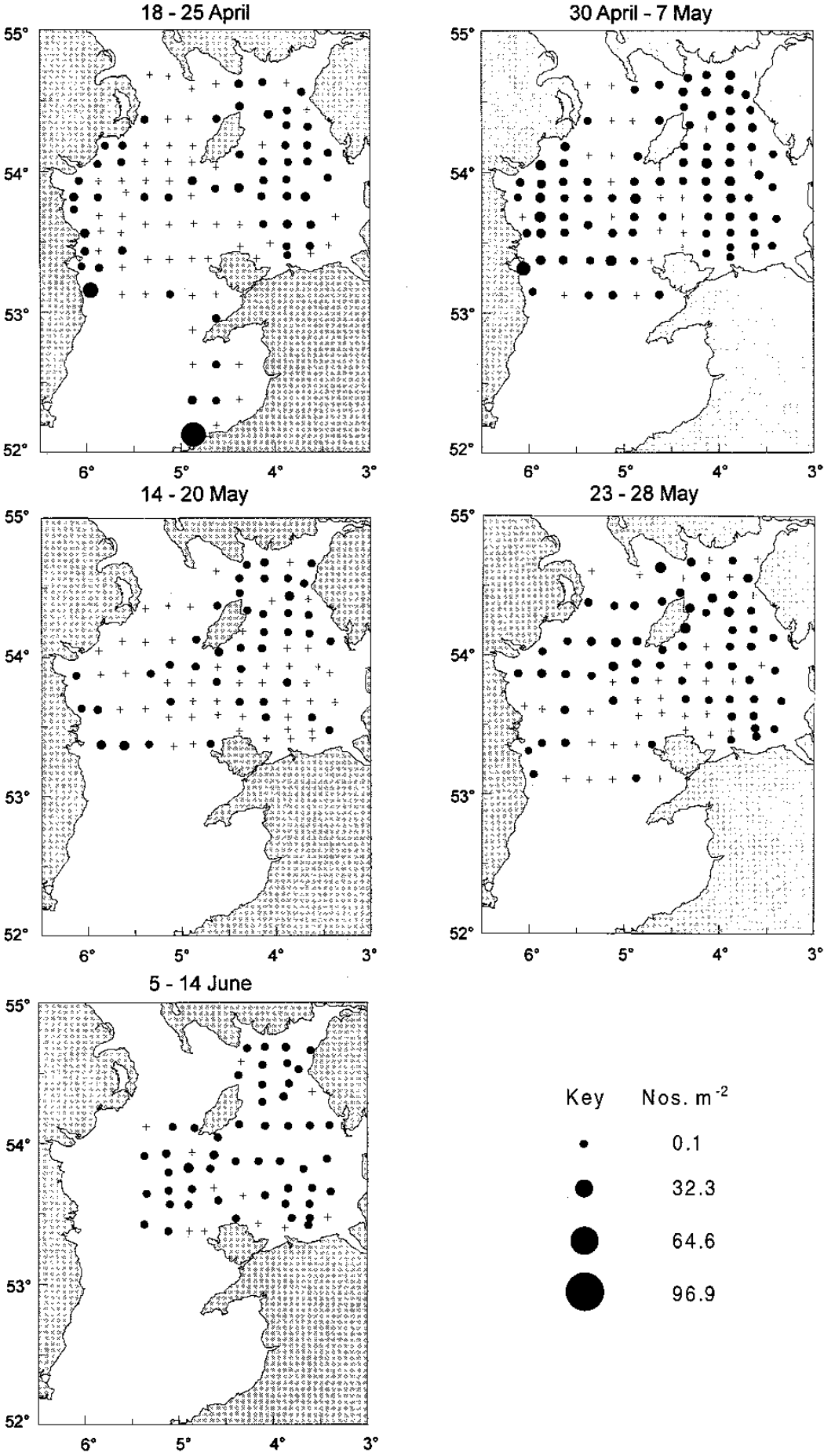


Figure 18. continued

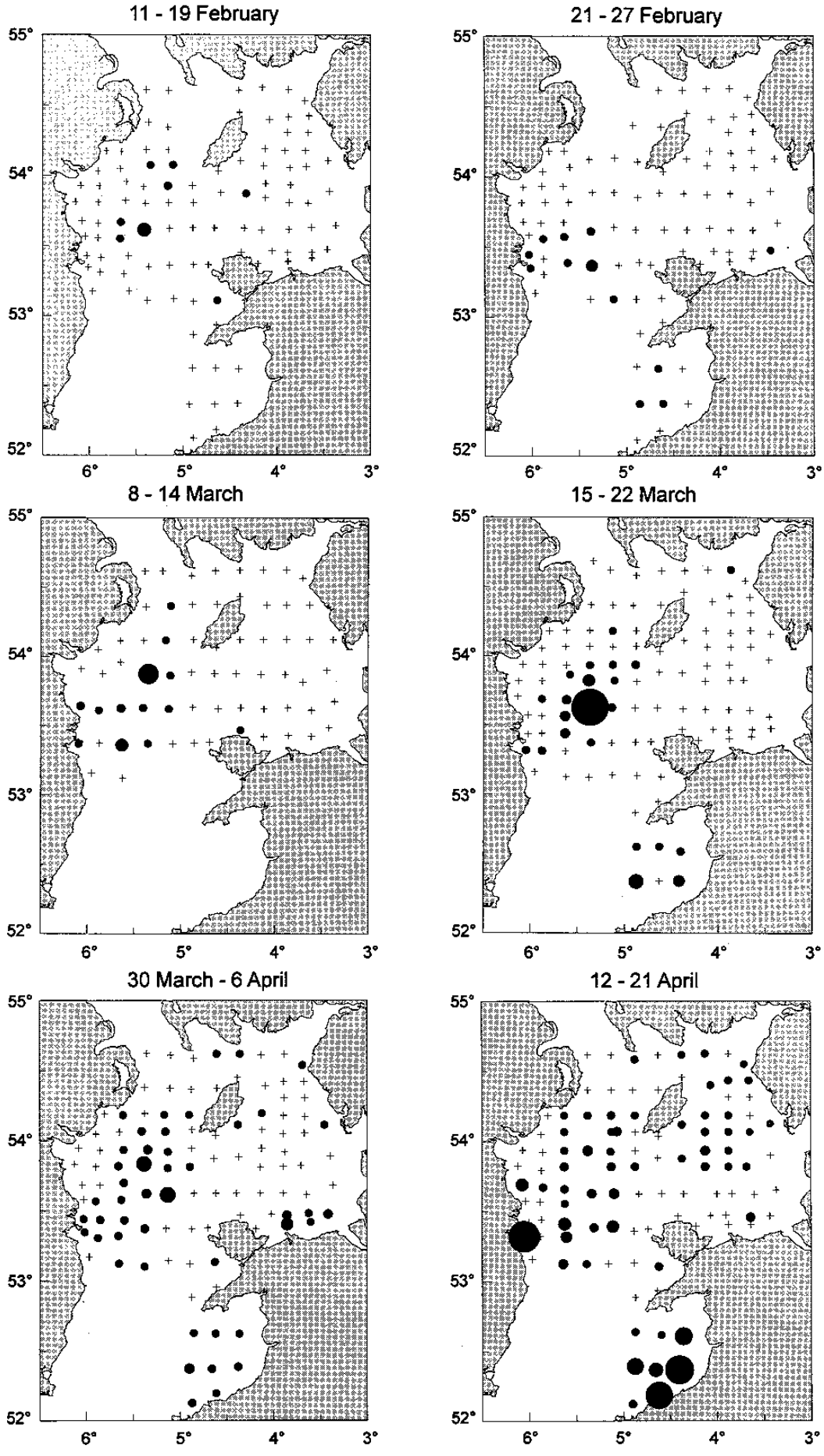


Figure 19. Concentration of gurnard (Triglidae) eggs (nos.m^{-2}) in 1995

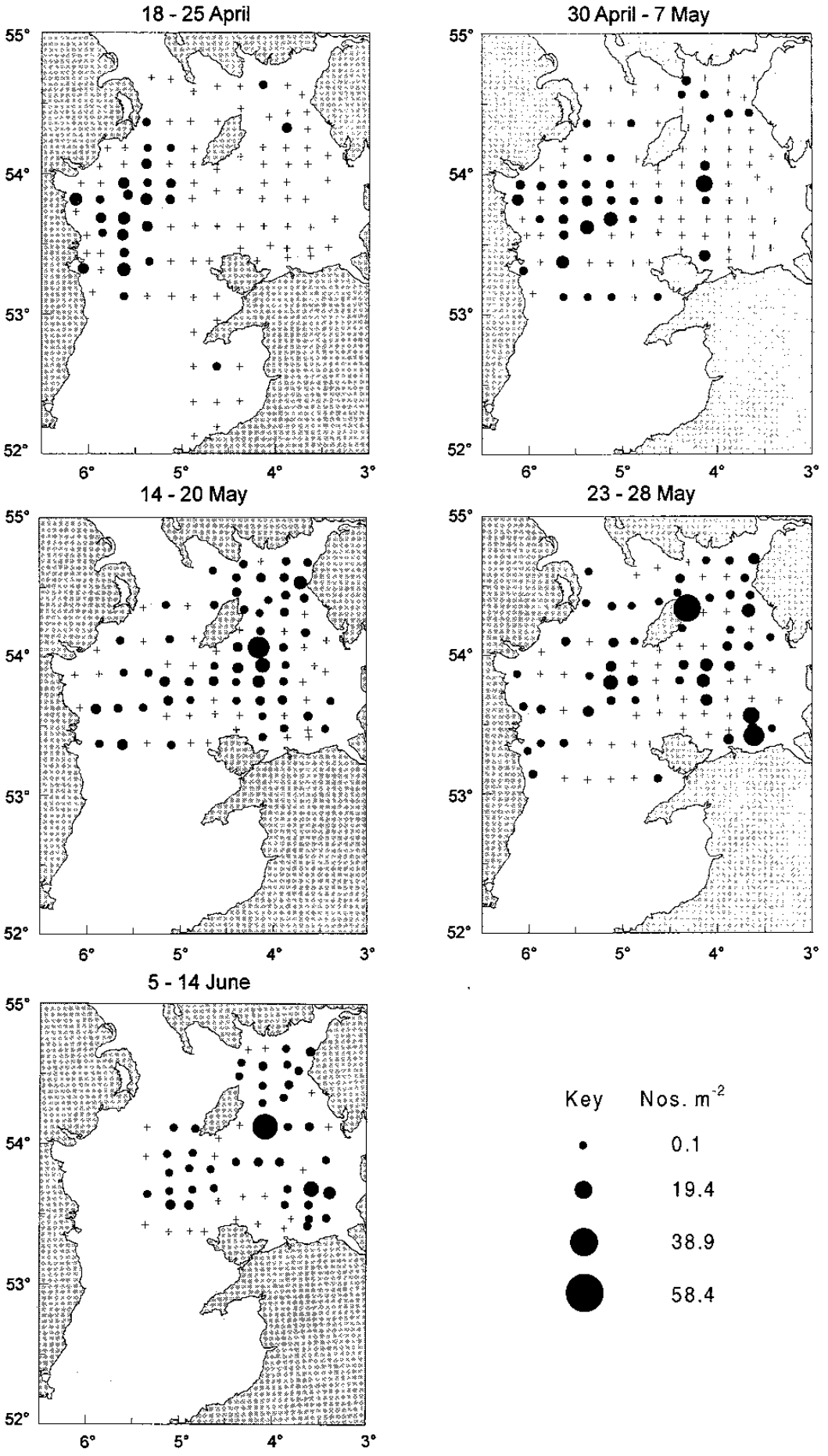


Figure 19. continued

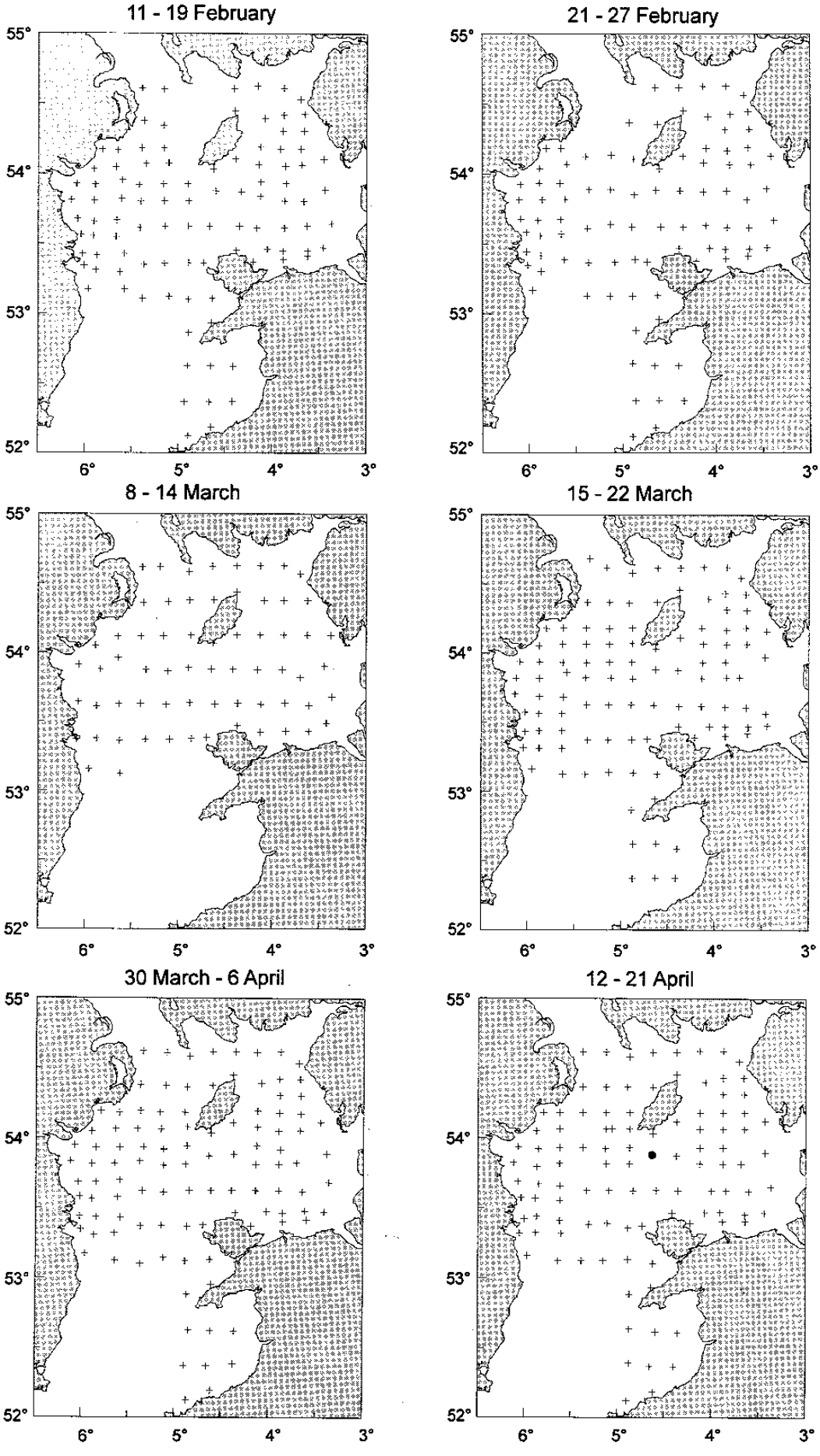


Figure 20. Concentration of gurnard (Triglidae) larvae (nos.m^{-2}) in 1995

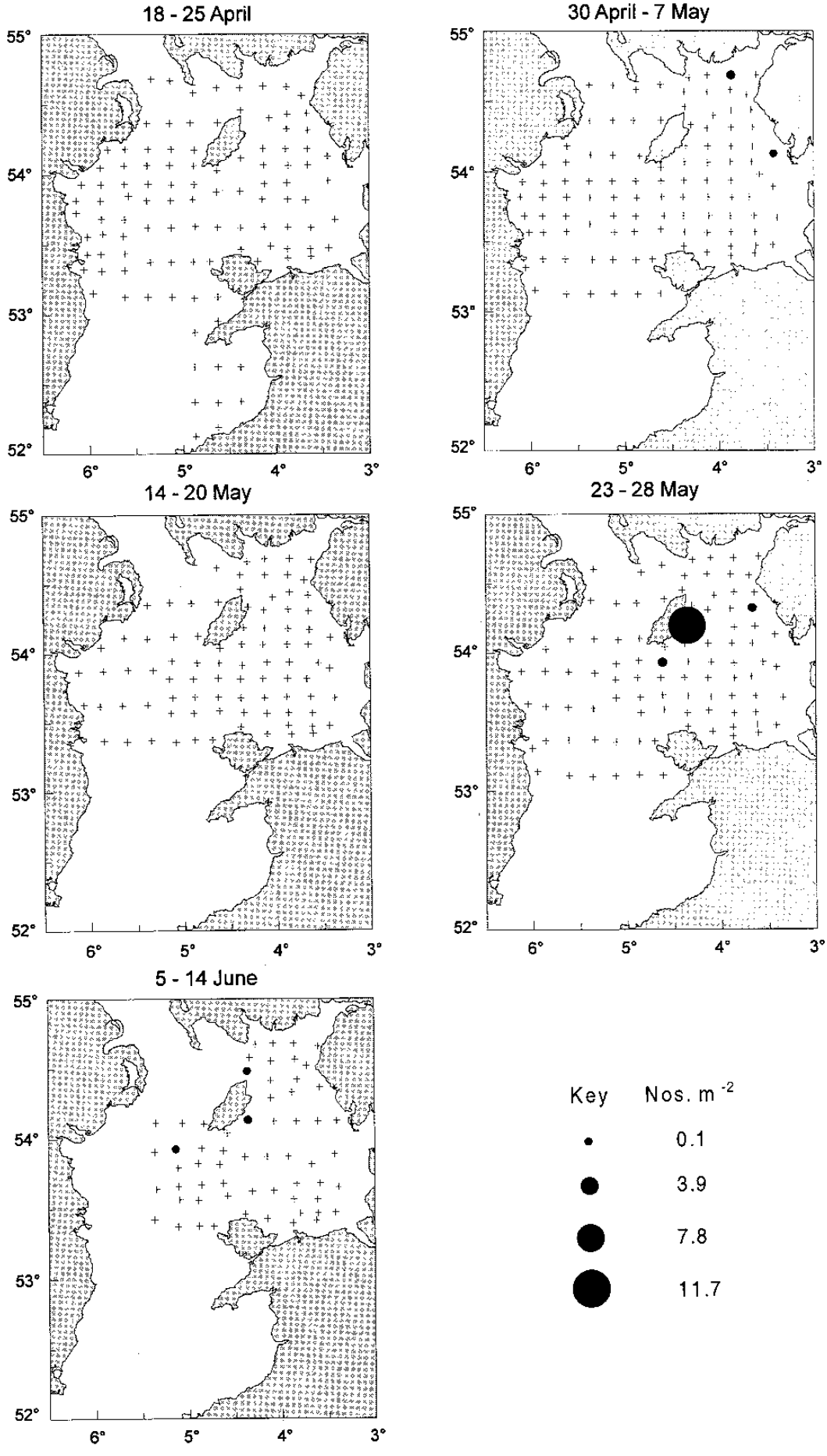


Figure 20. continued

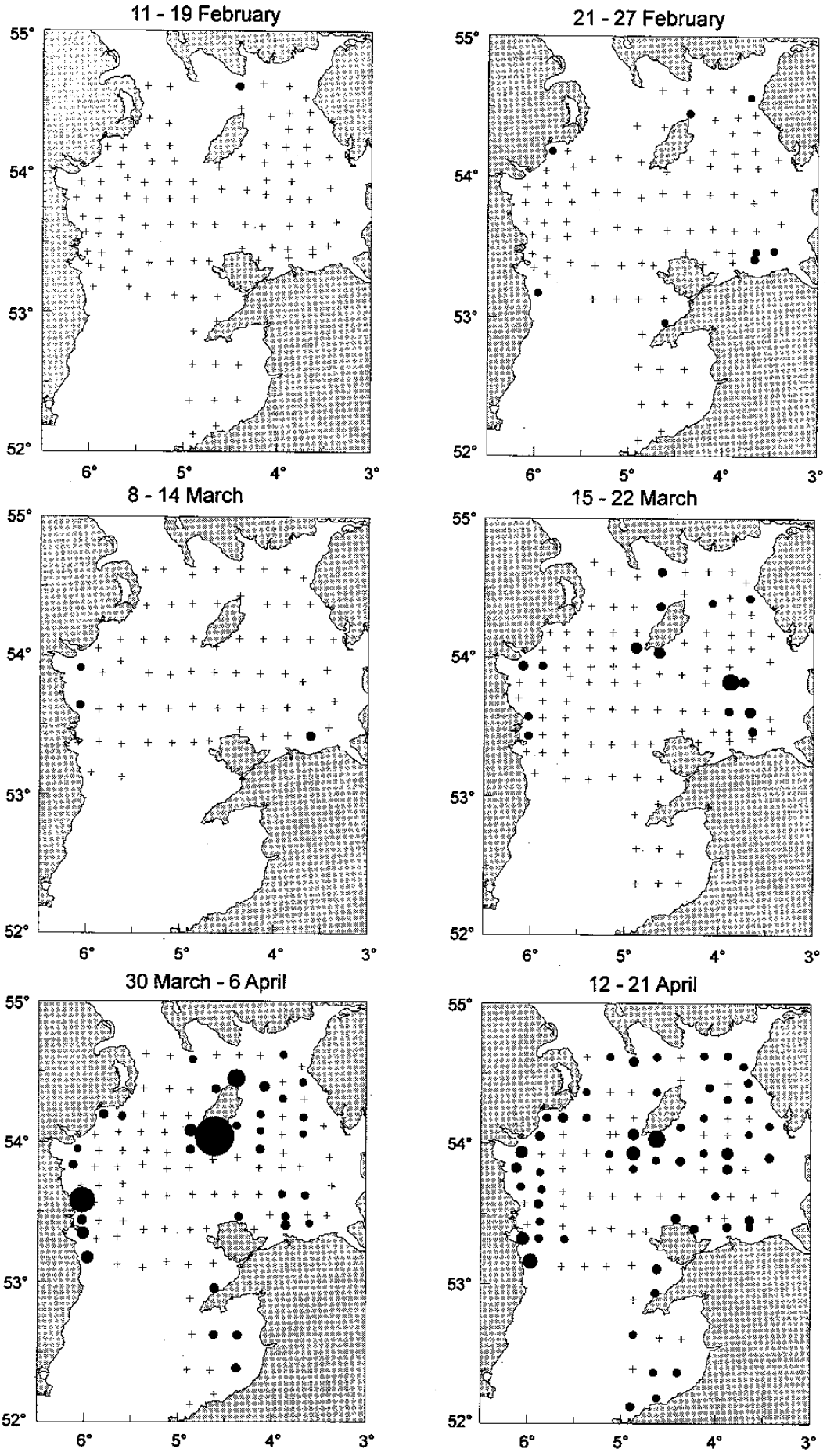
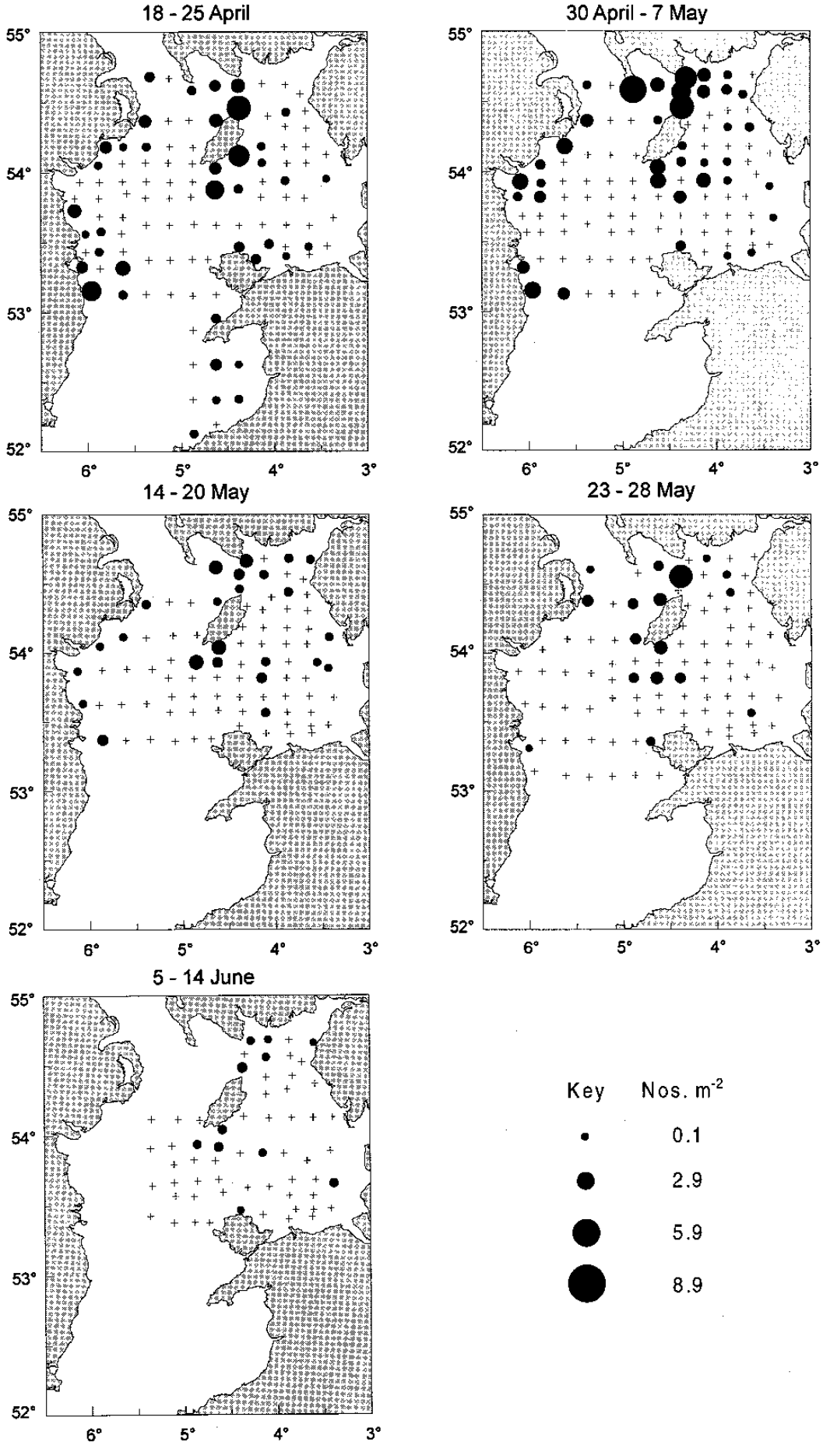


Figure 21. Concentration of Cottidae larvae (nos.m^{-2}) in 1995



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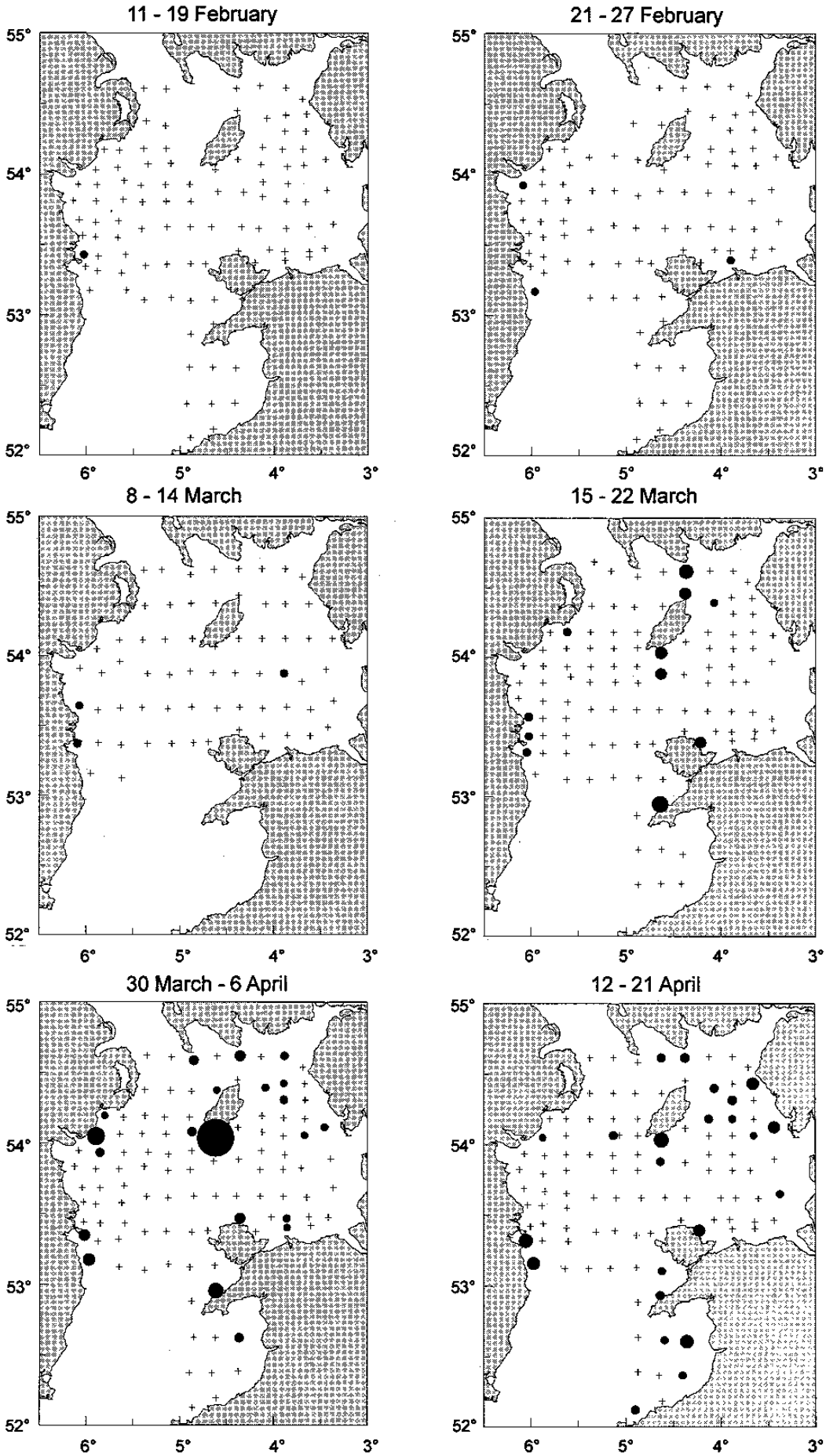
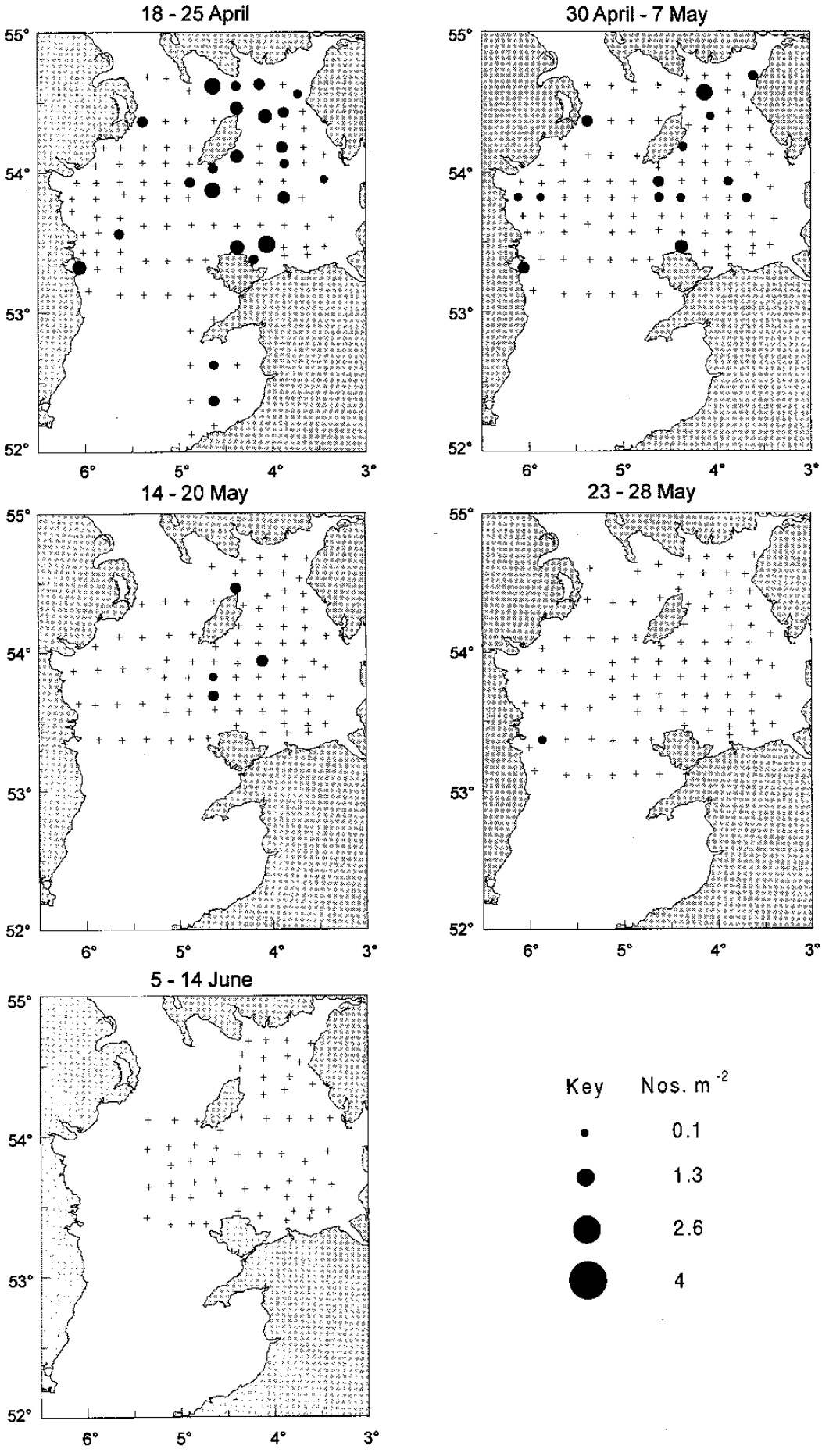


Figure 22. Concentration of pogge (Agonus cataphractus) larvae (nos.m^{-2}) in 1995



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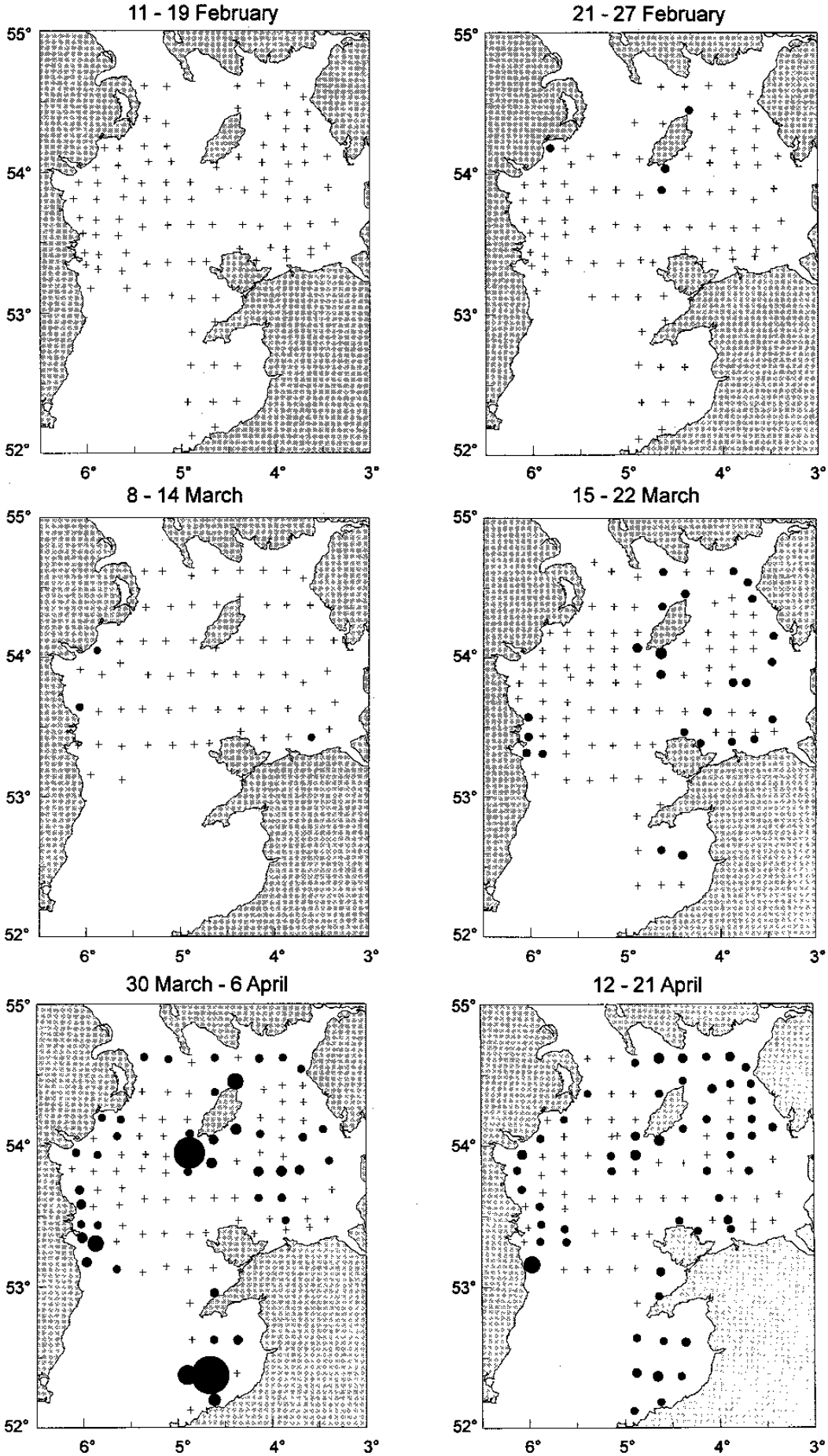
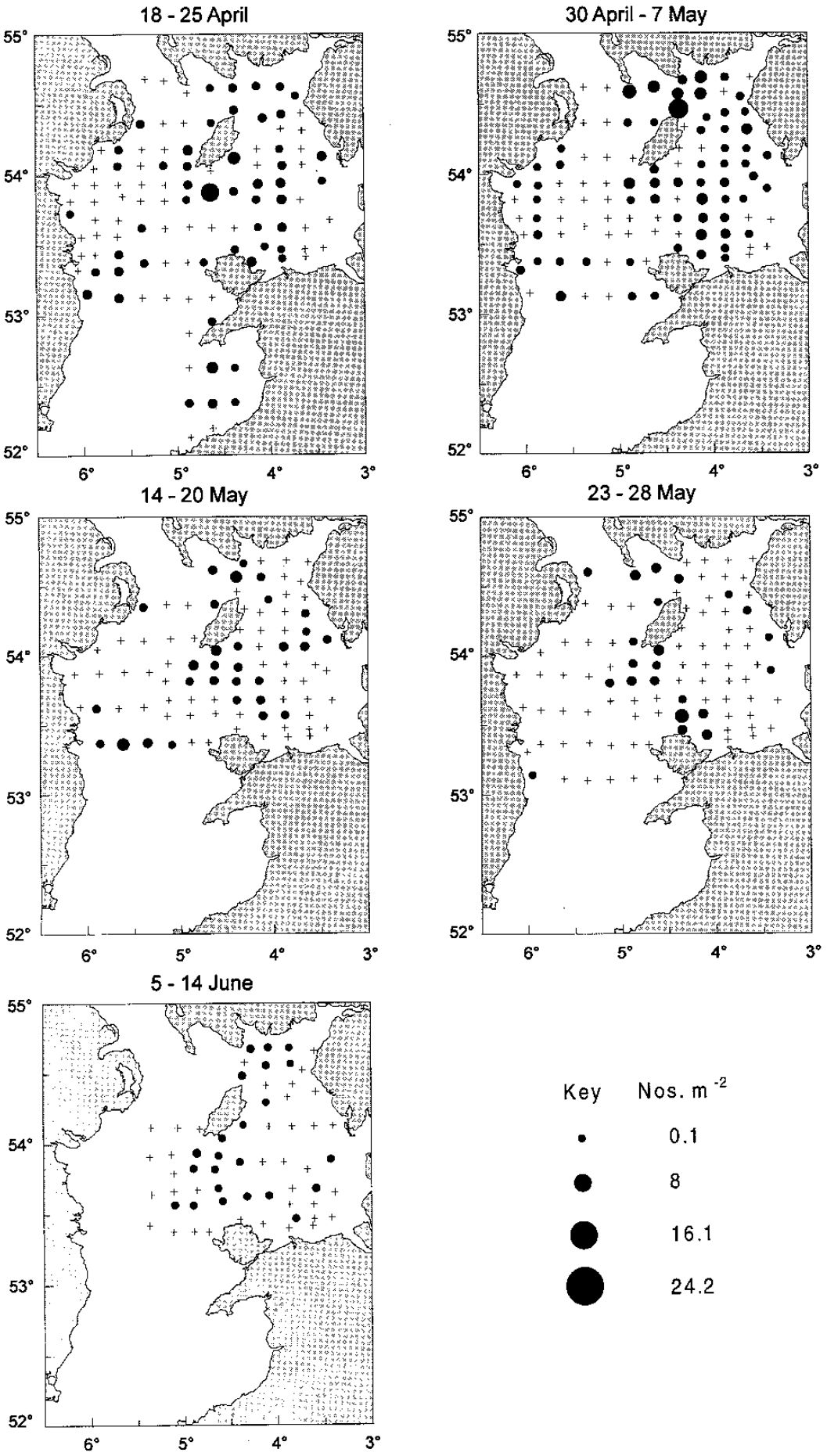


Figure 23. Concentration of sea snail (Liparis spp.) larvae (nos.m^{-2}) in 1995



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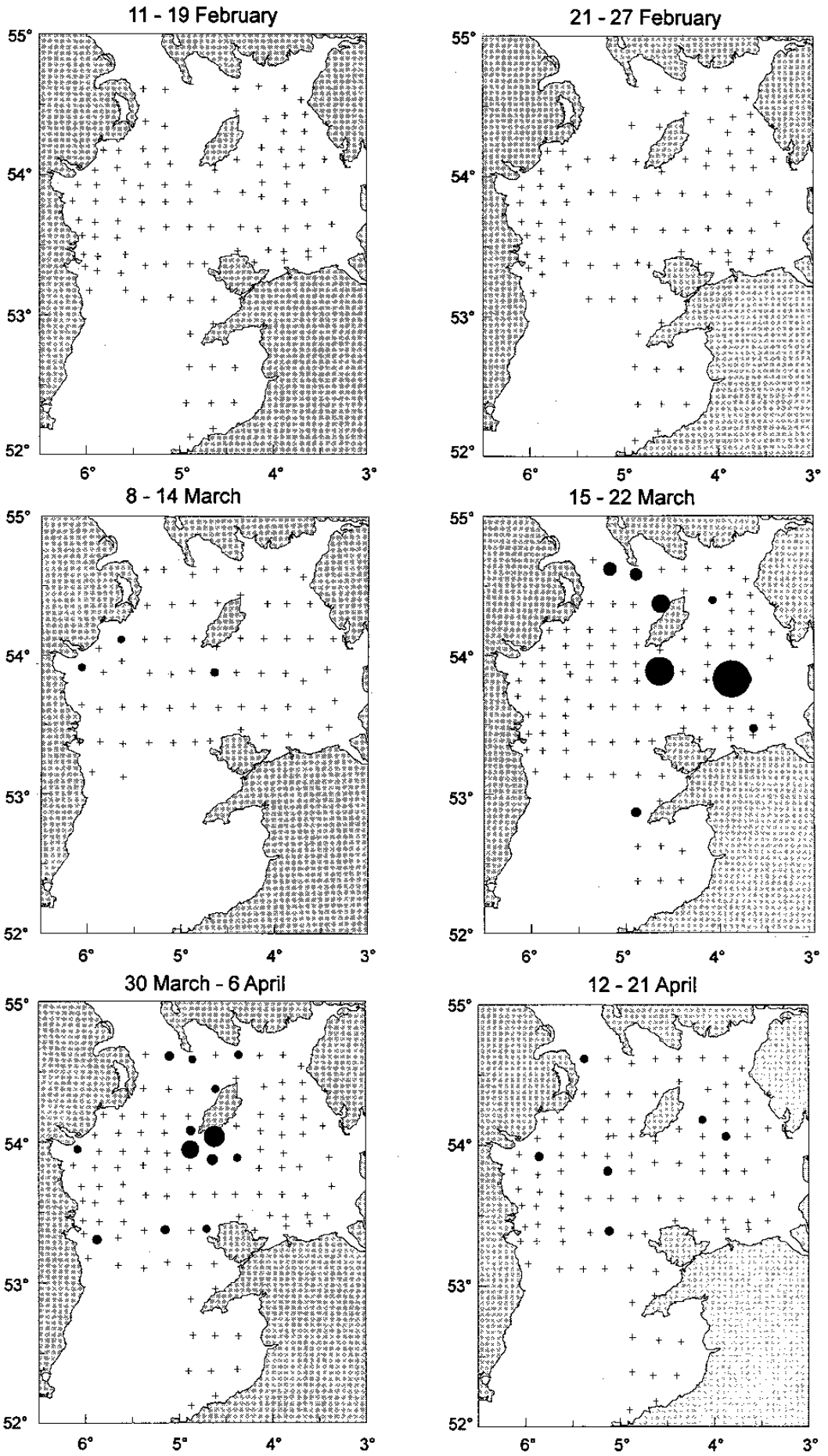
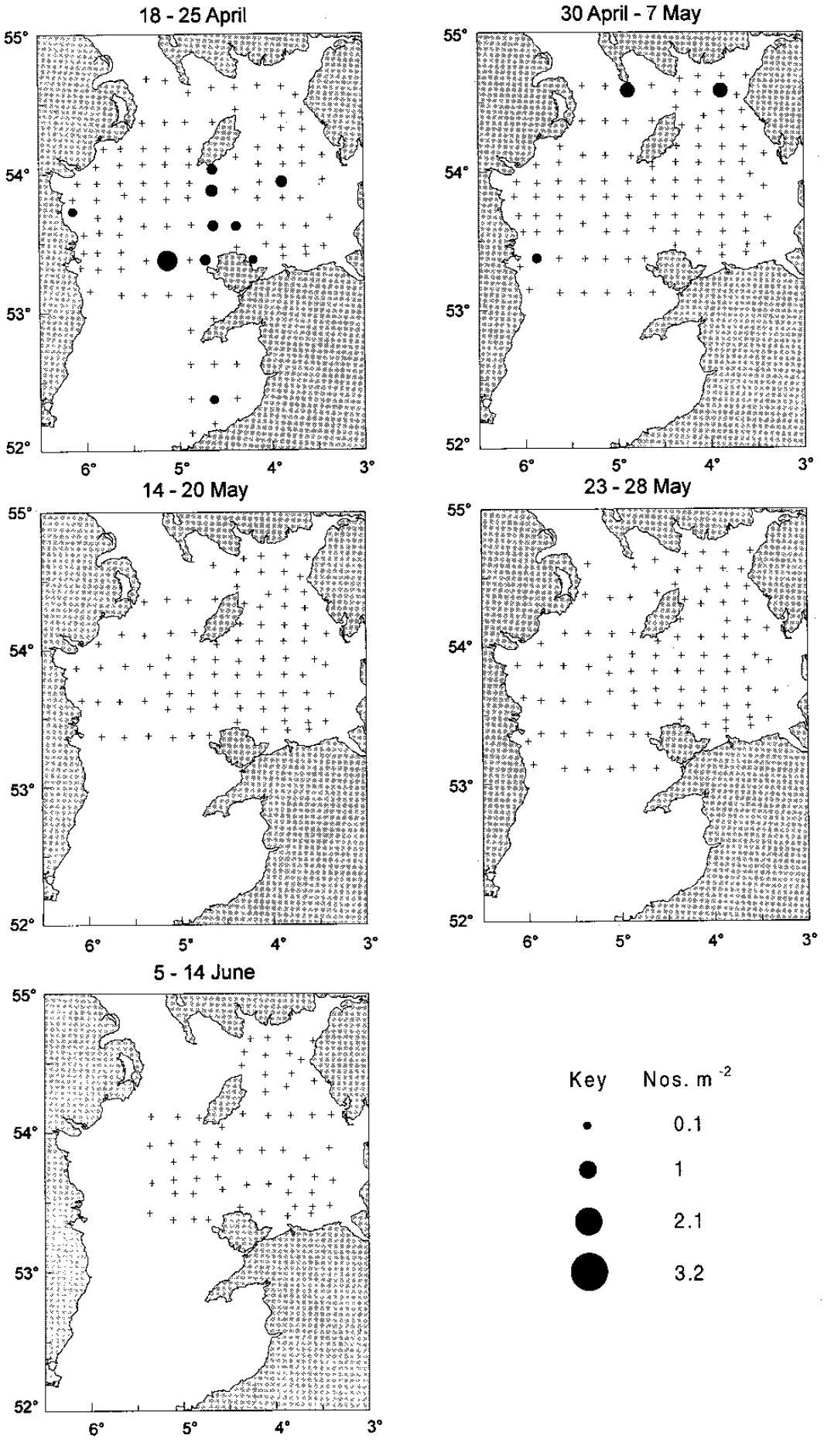


Figure 24. Concentration of Yarroll's blenny (Chirolophis ascanii) larvae (nos.m^{-2}) in 1995



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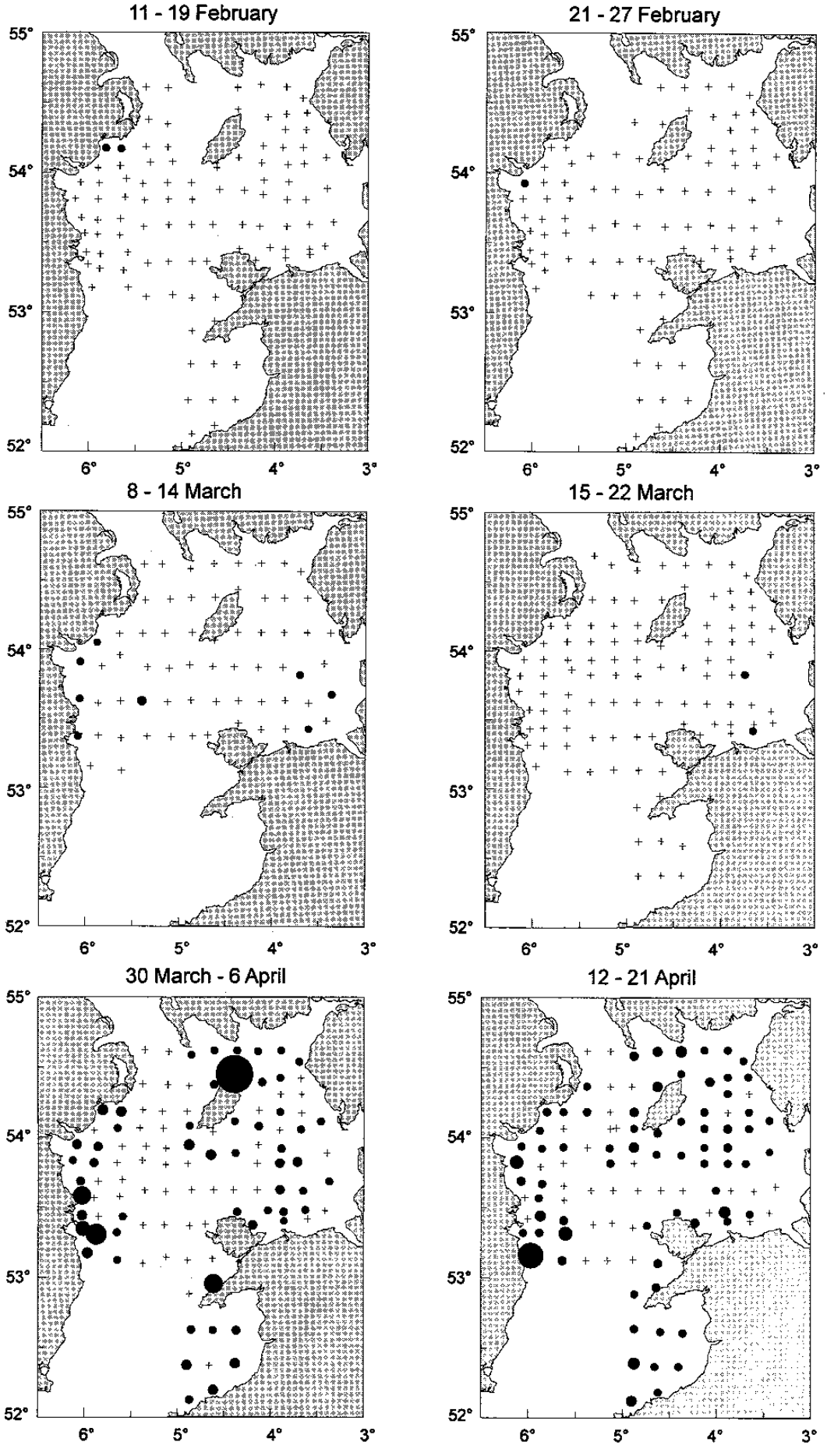
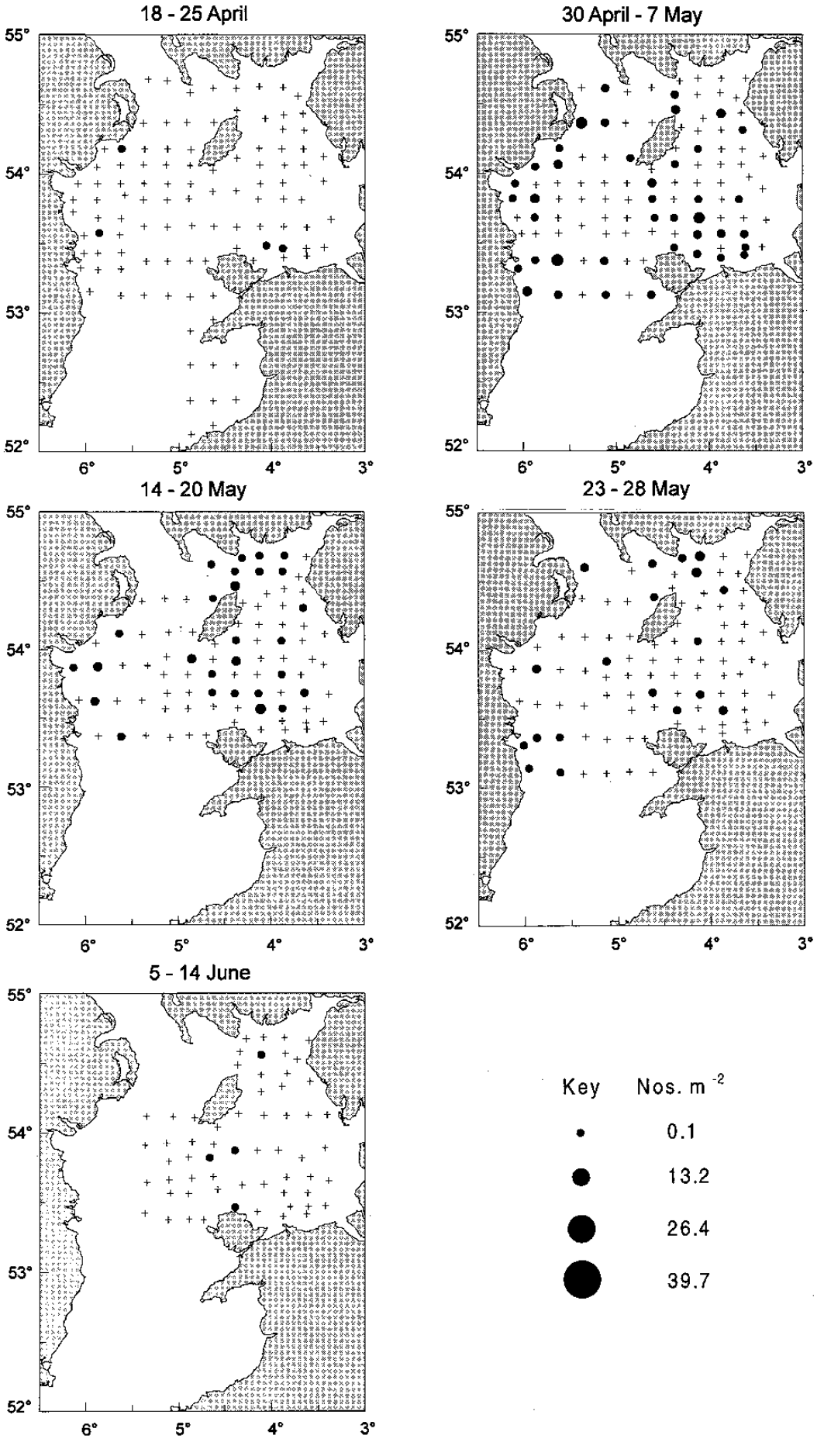


Figure 25. Concentration of butterfish (Pholis gunnellus) larvae (nos.m^{-2}) in 1995



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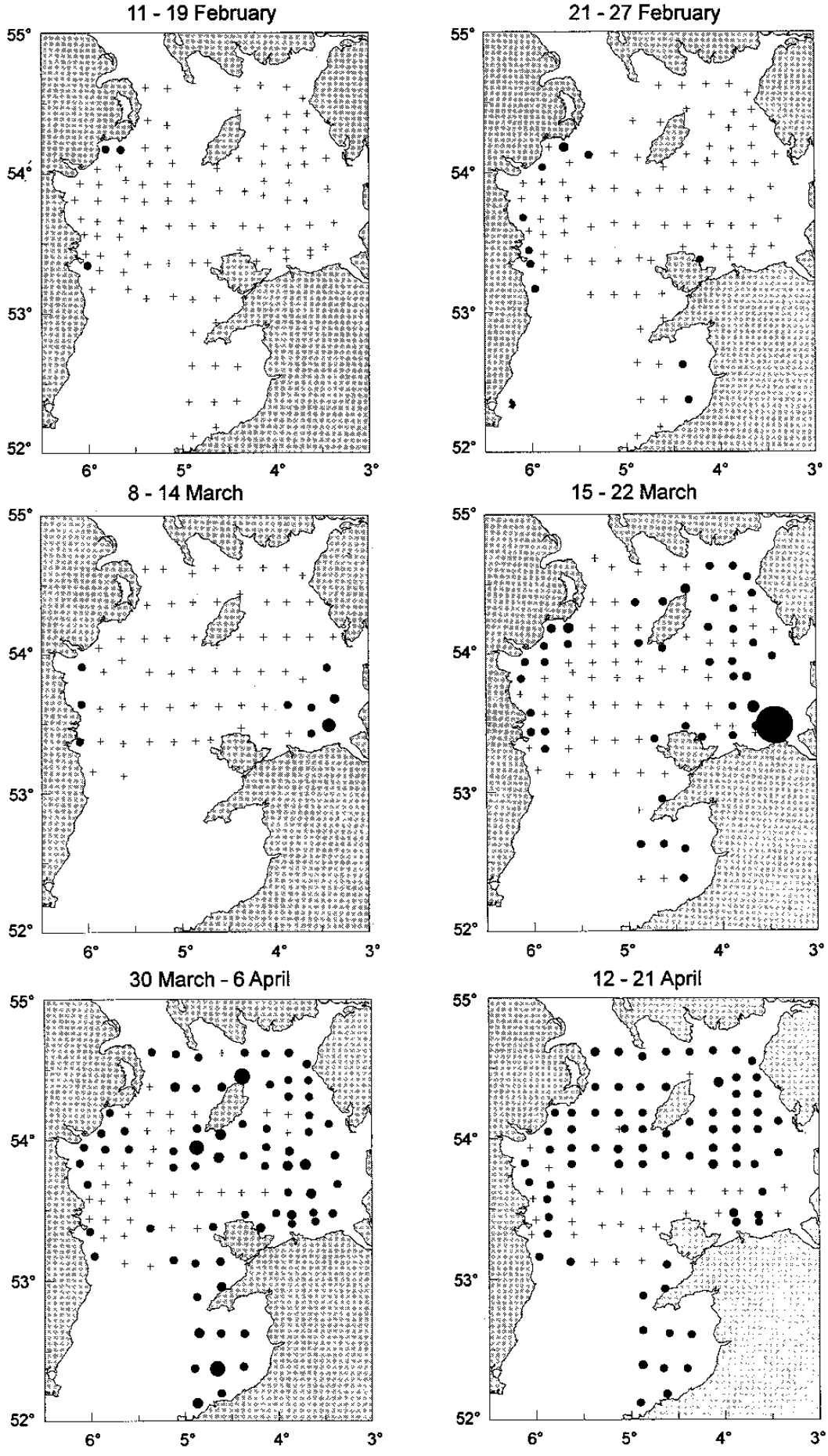
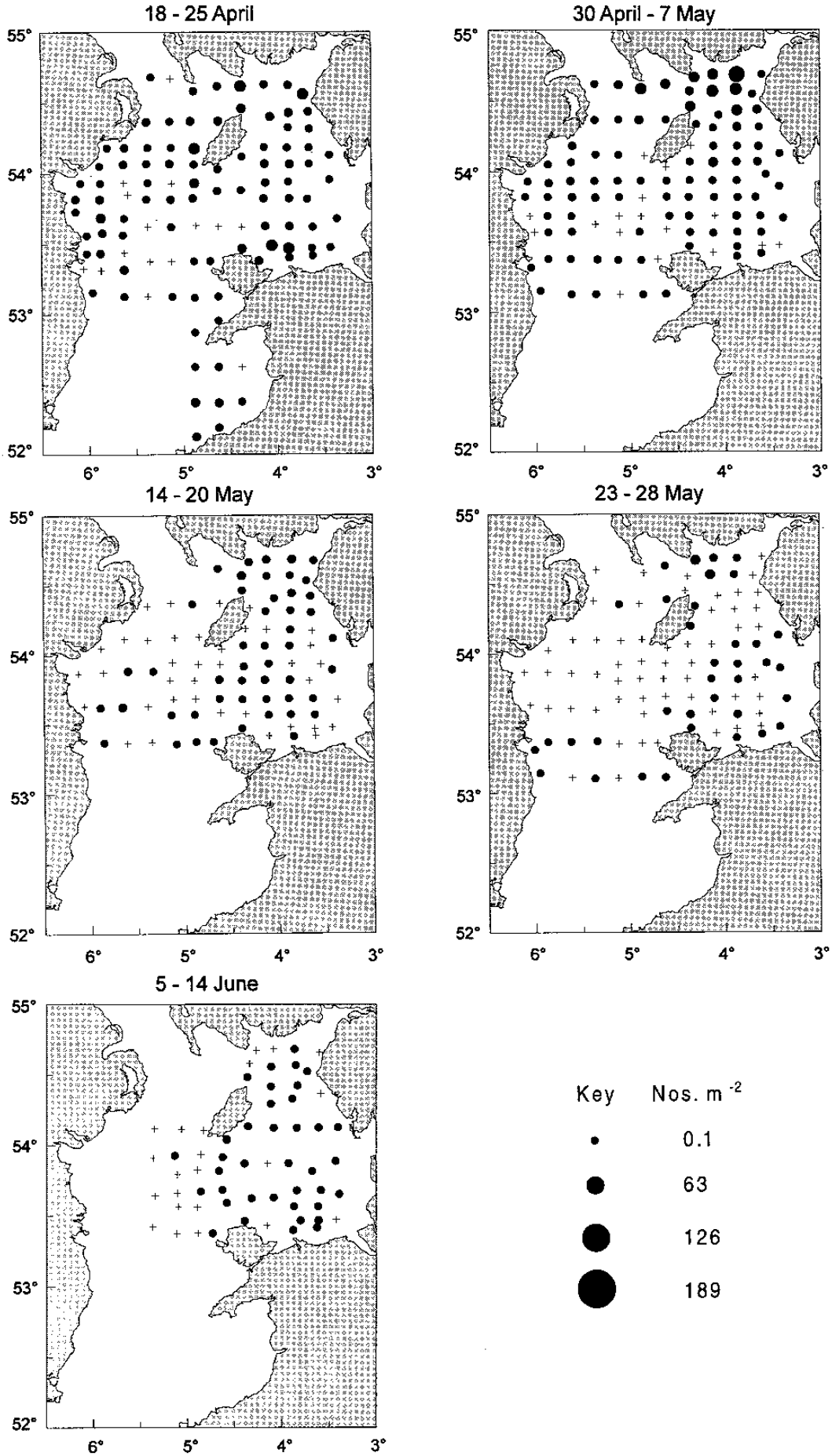


Figure 26. Concentration of sandeels (Ammodytidae) larvae (nos.m^{-2}) in 1995



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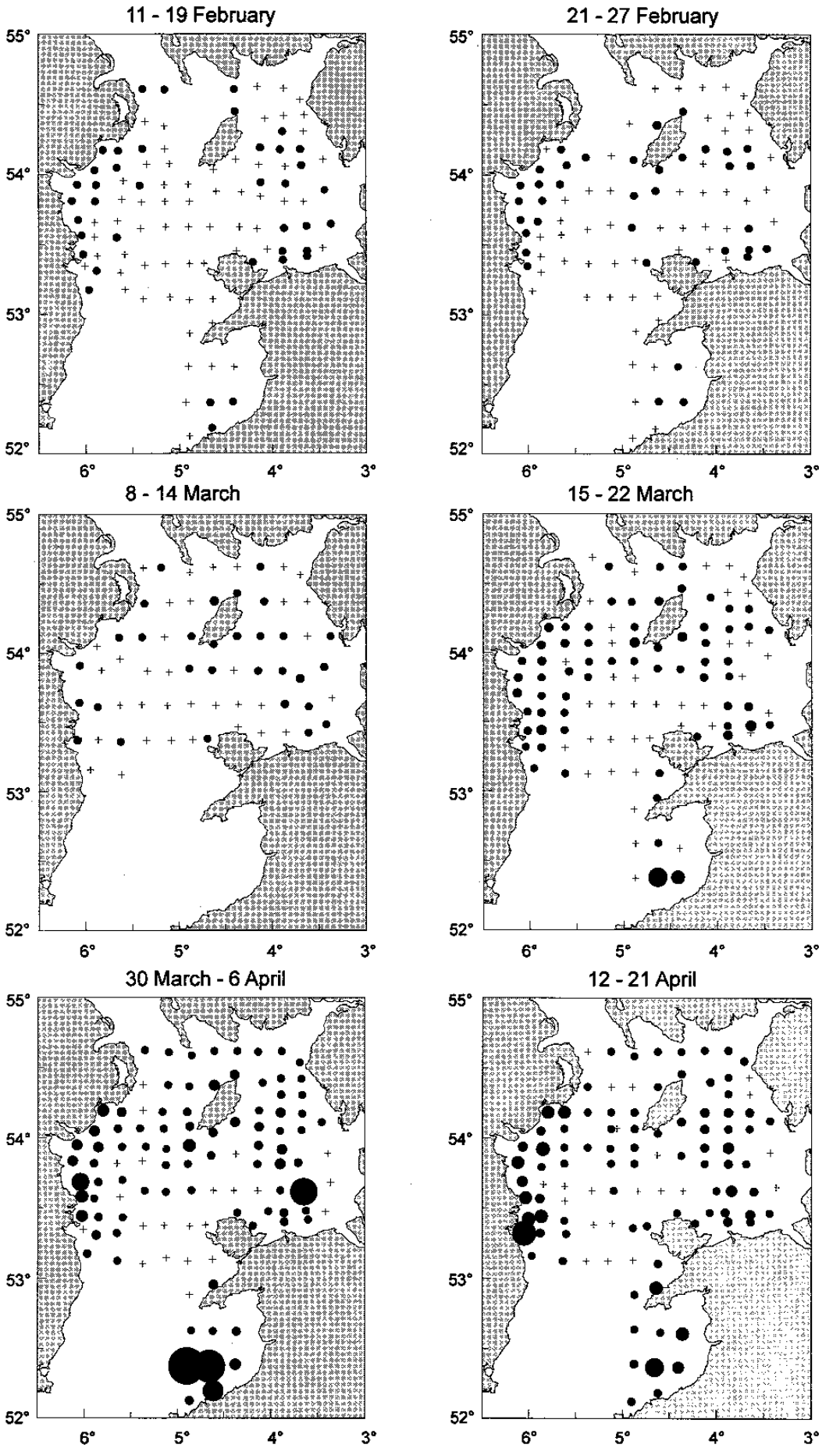
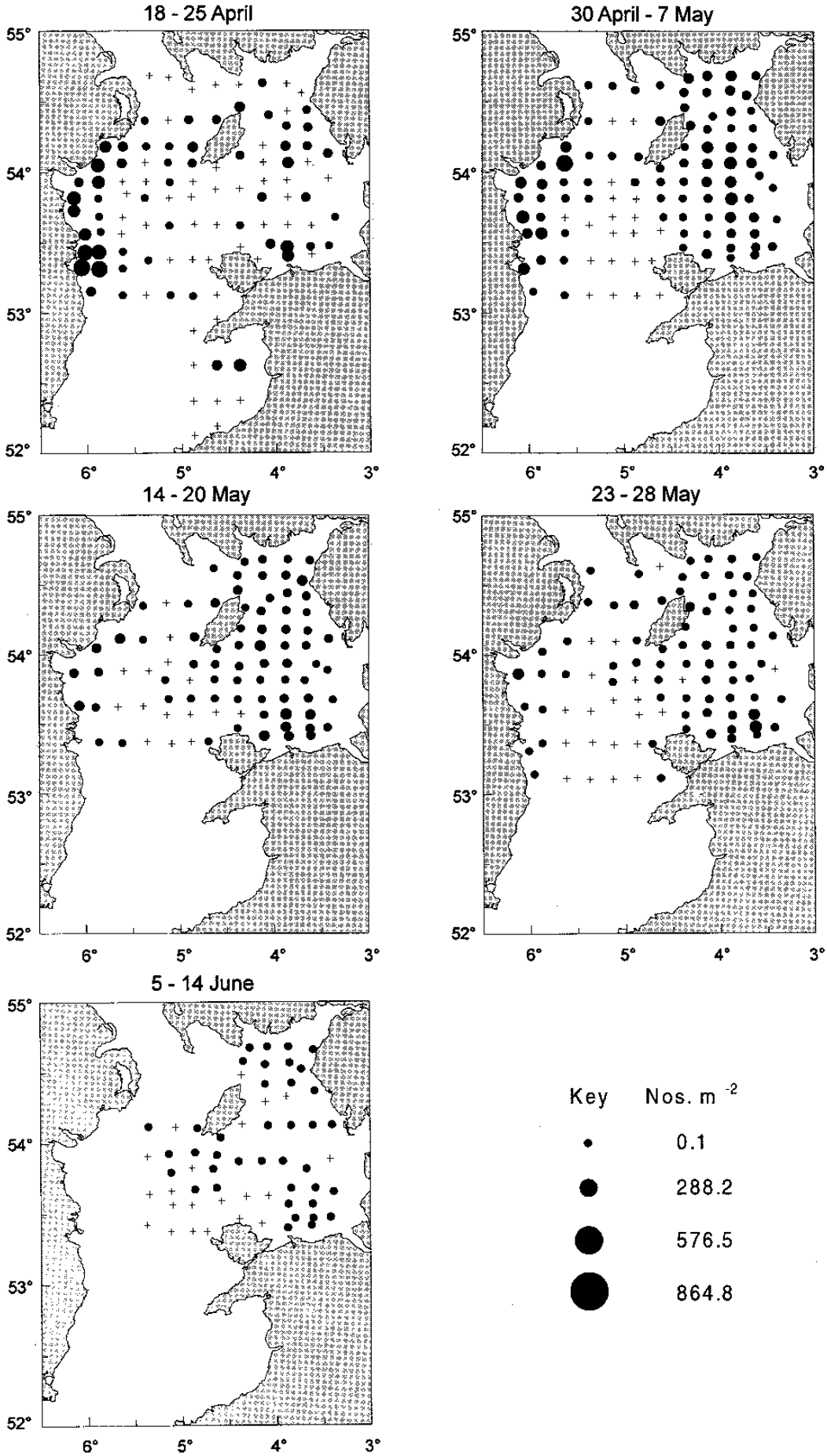


Figure 27. Concentration of dragonets (Callionymidae) eggs (nos.m^{-2}) in 1995



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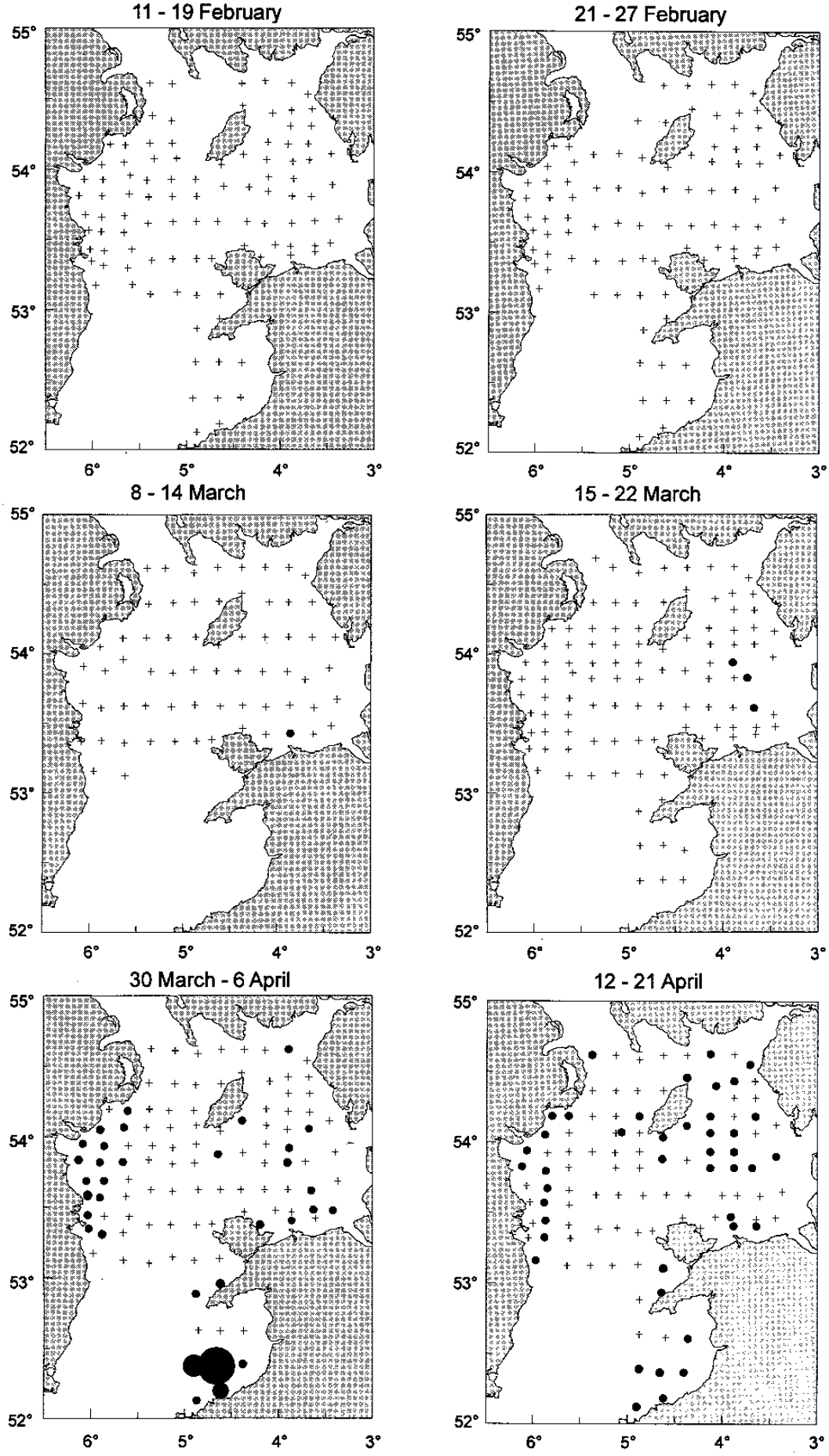


Figure 28. Concentration of dragonets (Callionymidae) larvae (nos.m^{-2}) in 1995

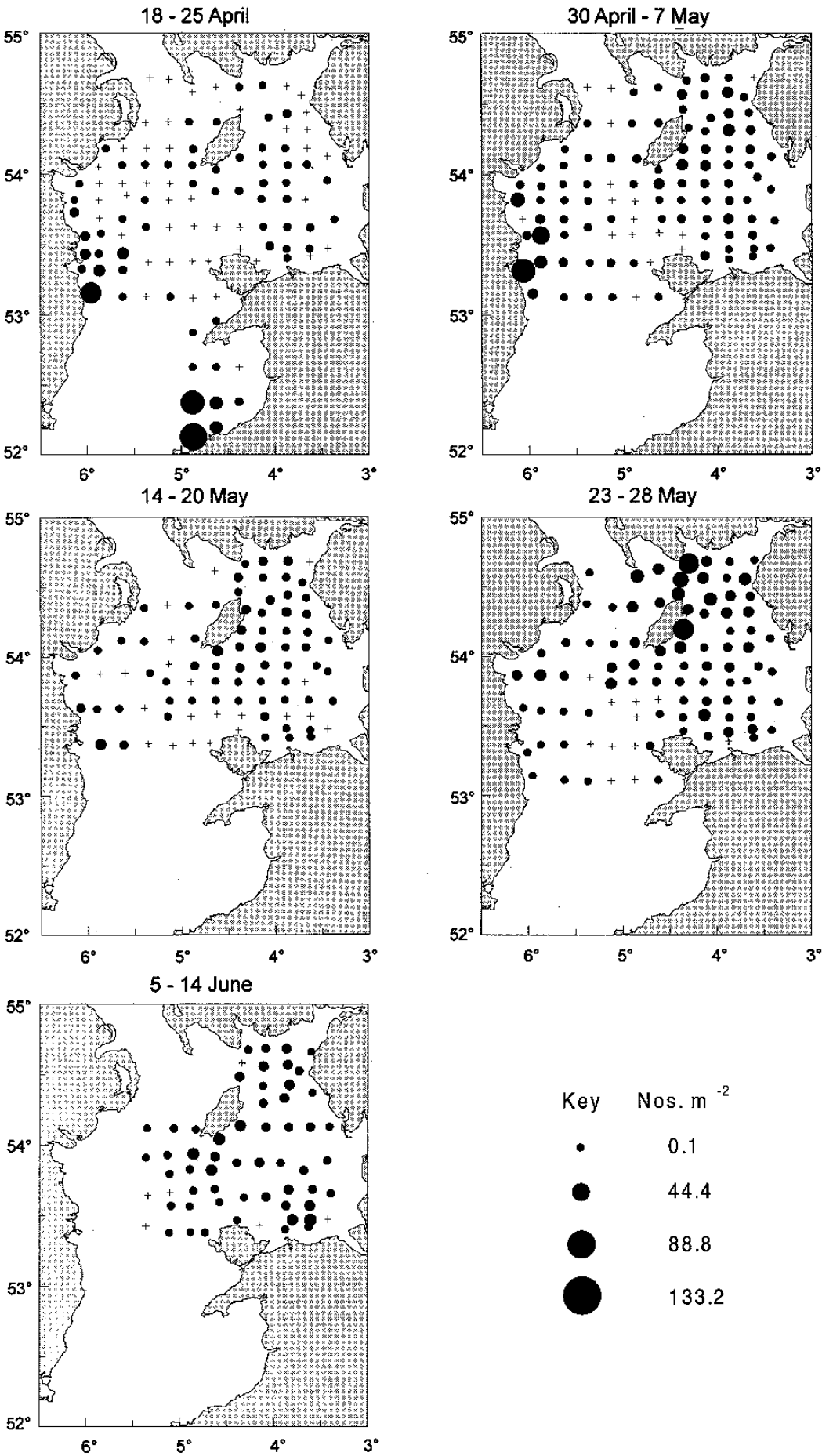


Figure 28. continued

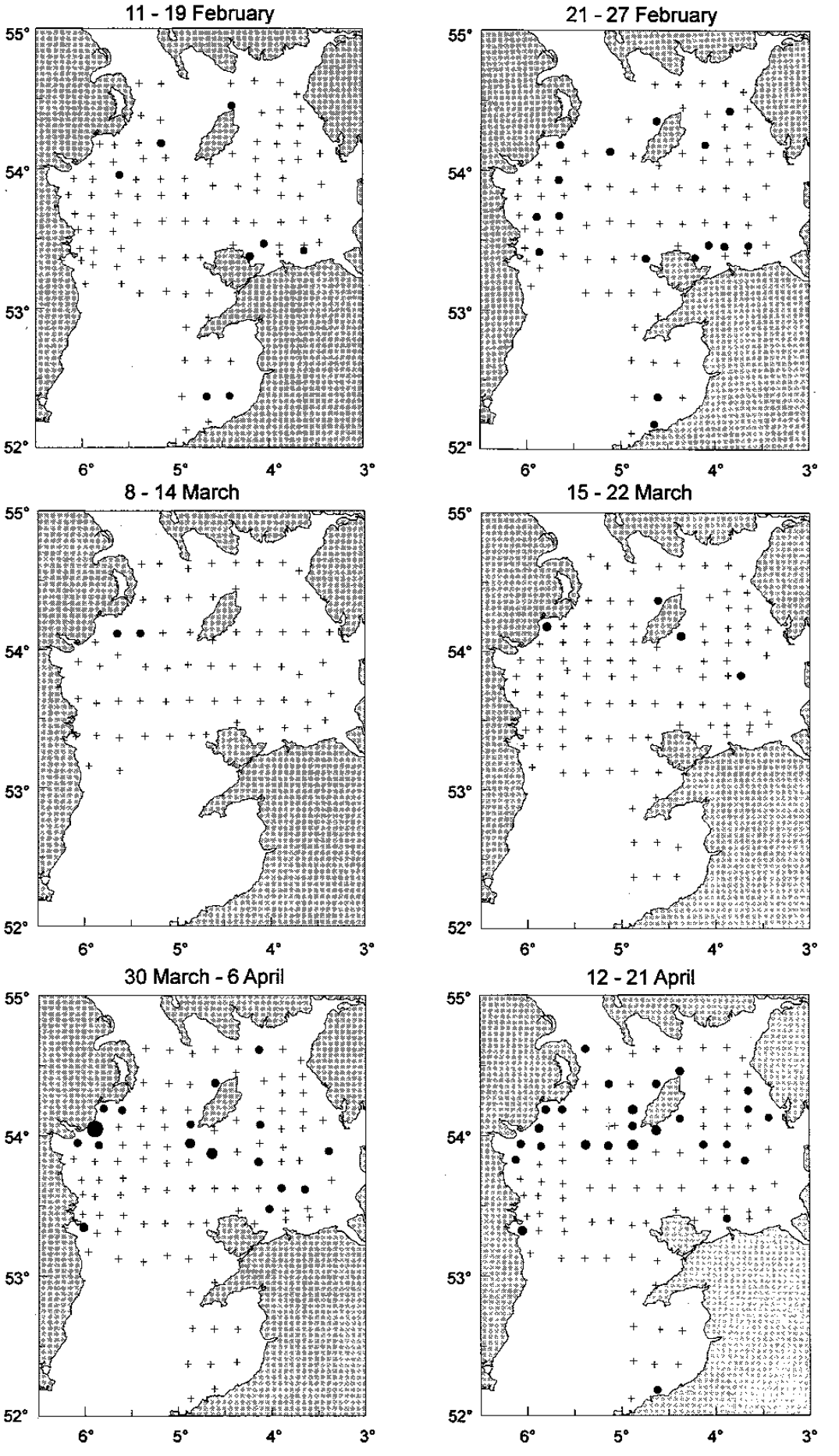
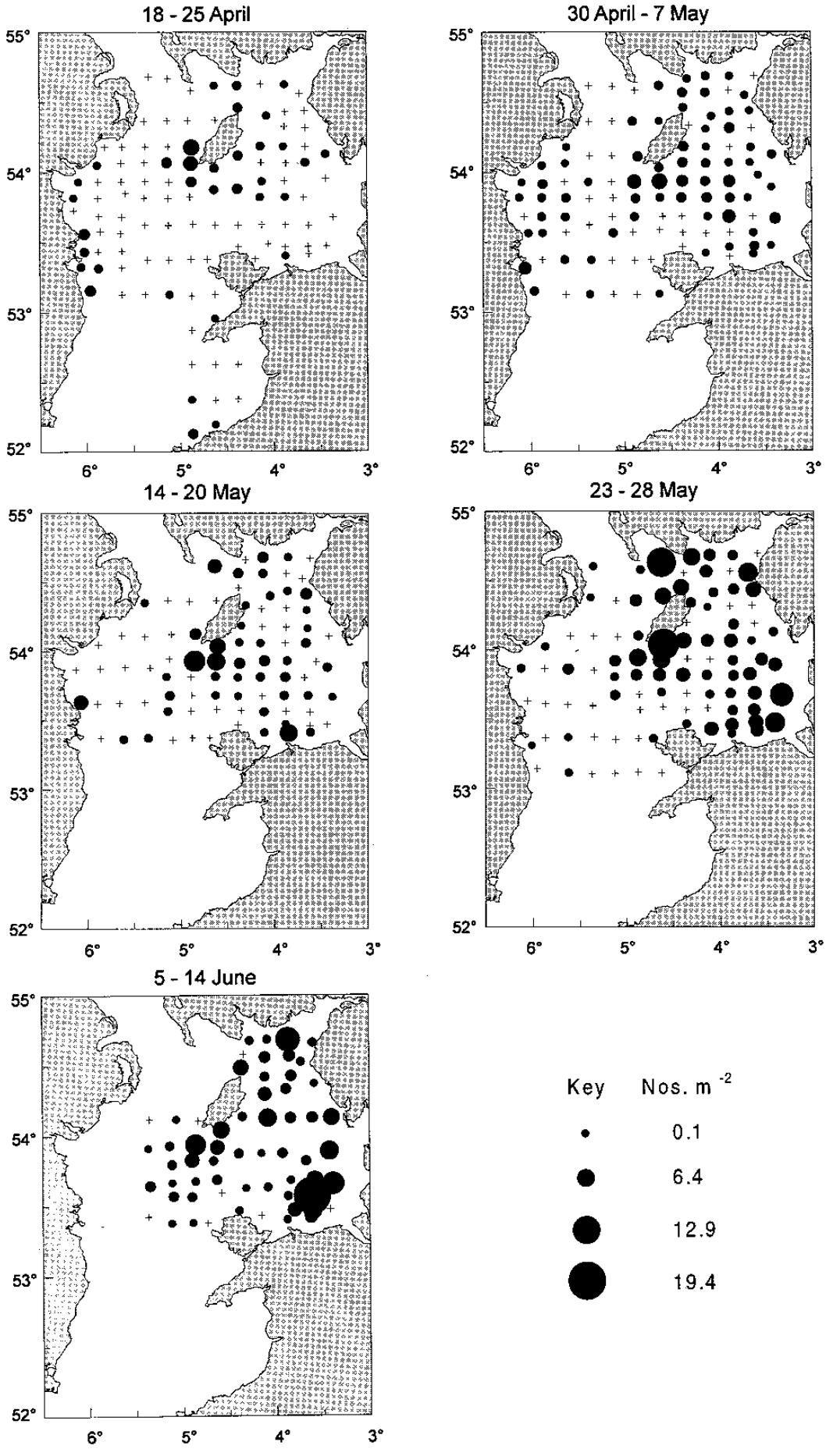


Figure 29. Concentration of Gobiidae spp. larvae (nos.m^{-2}) in 1995



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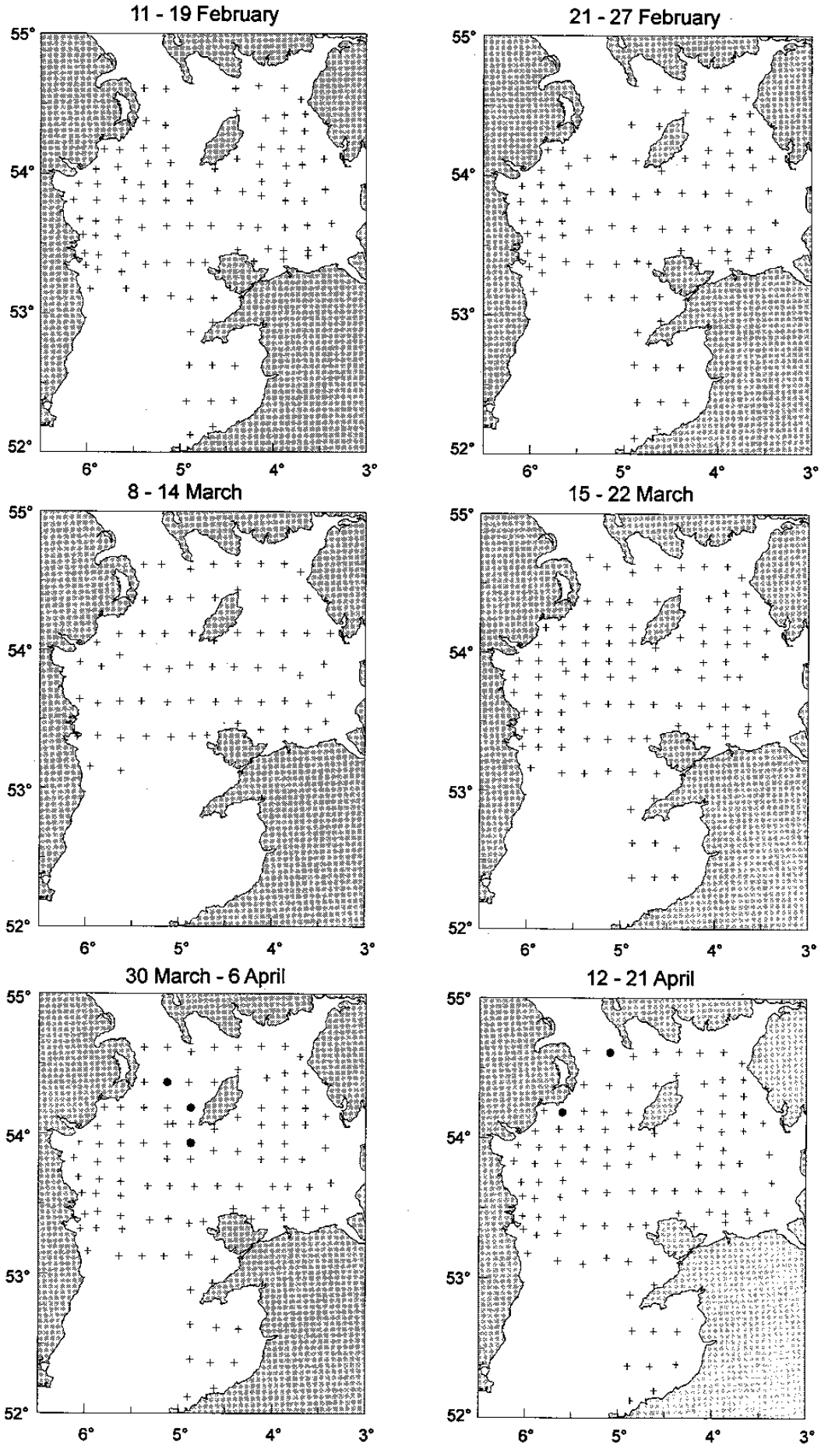

Figure 30. Concentration of mackerel (Scomber scombrus) eggs (nos.m^{-2}) in 1995

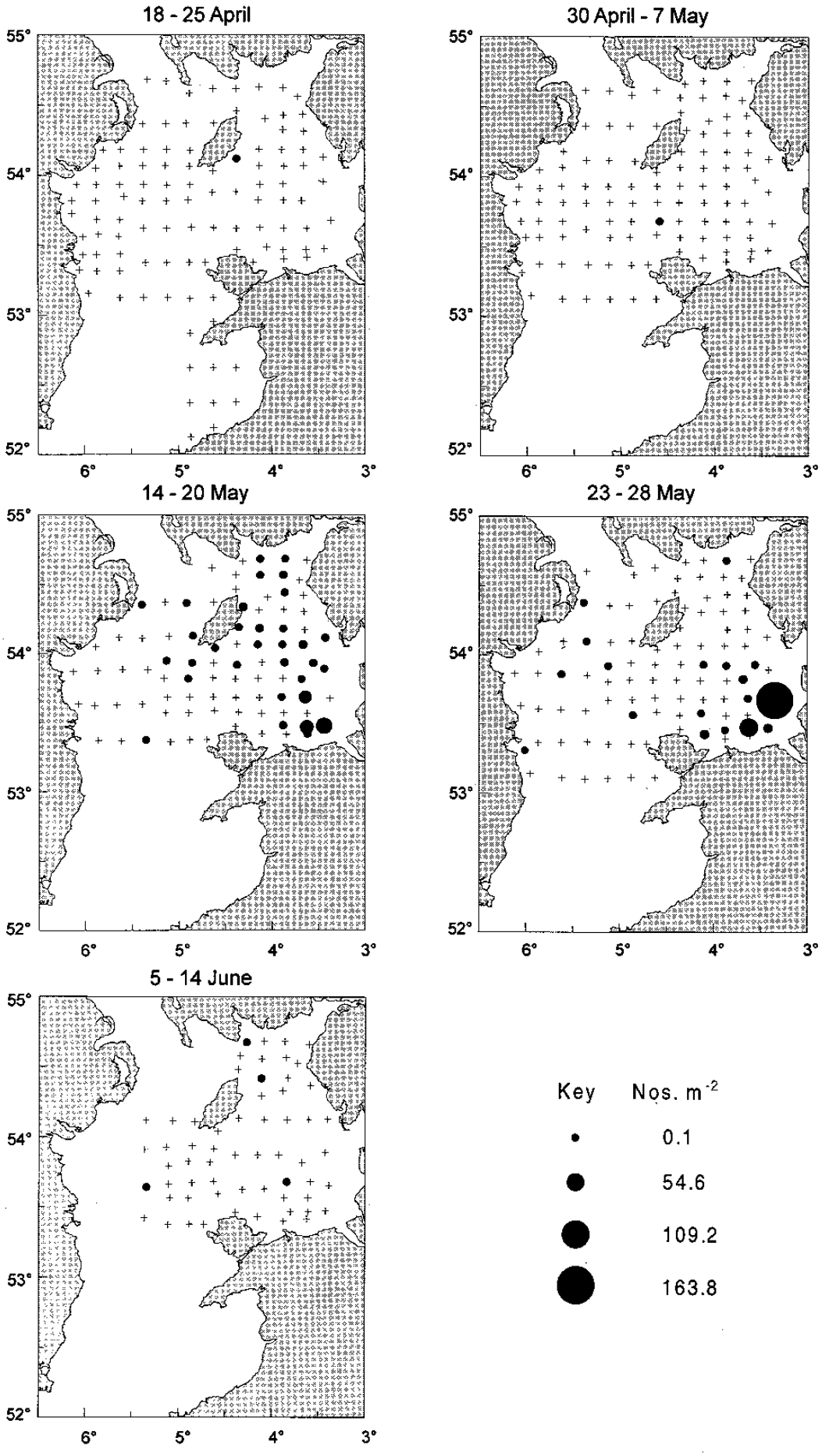

Figure 30. continued

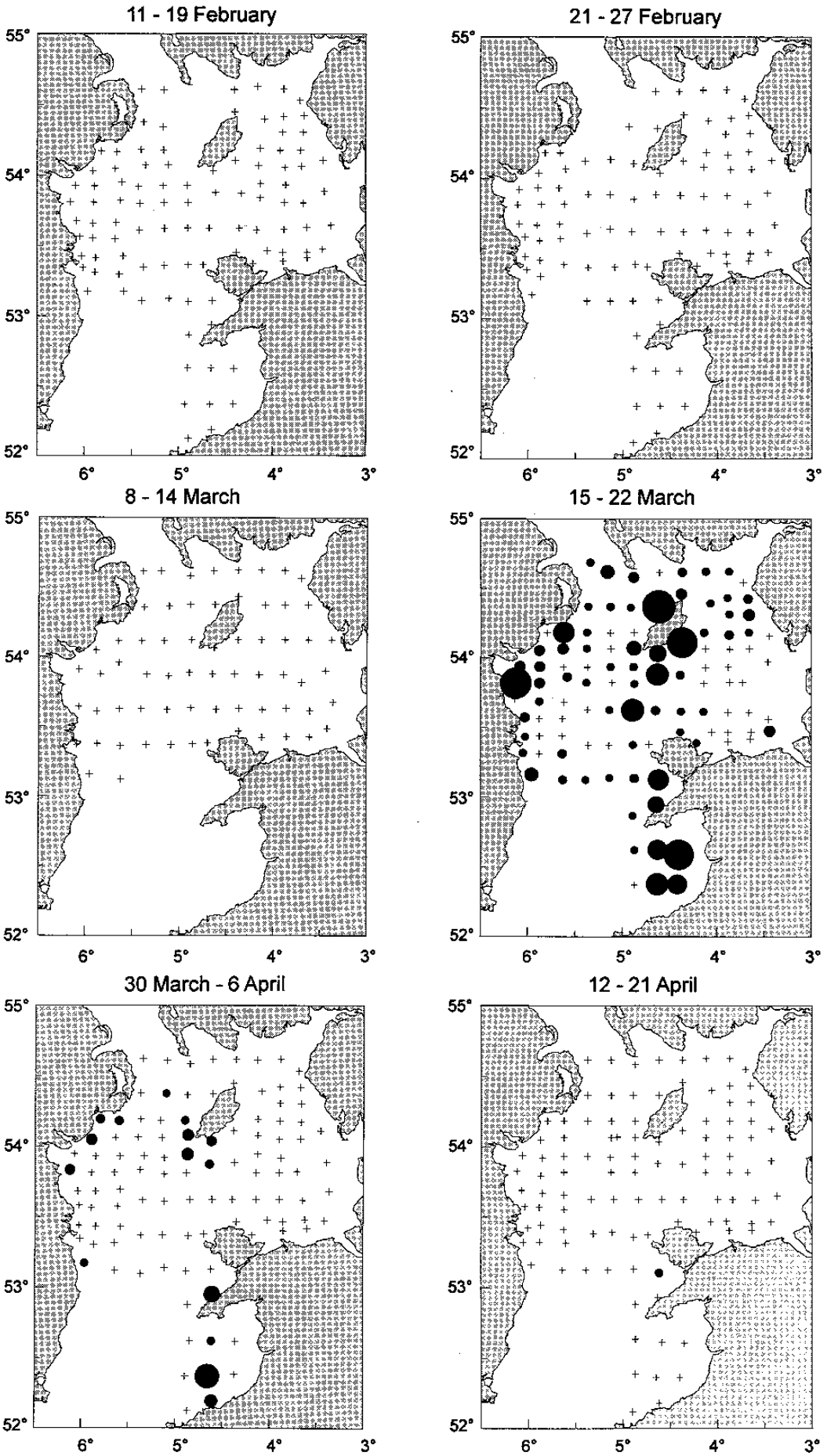

Figure 31. Concentration of Norwegian top-knot (Phrynorhombus norvegicus) eggs (nos.m^{-2}) in 1995

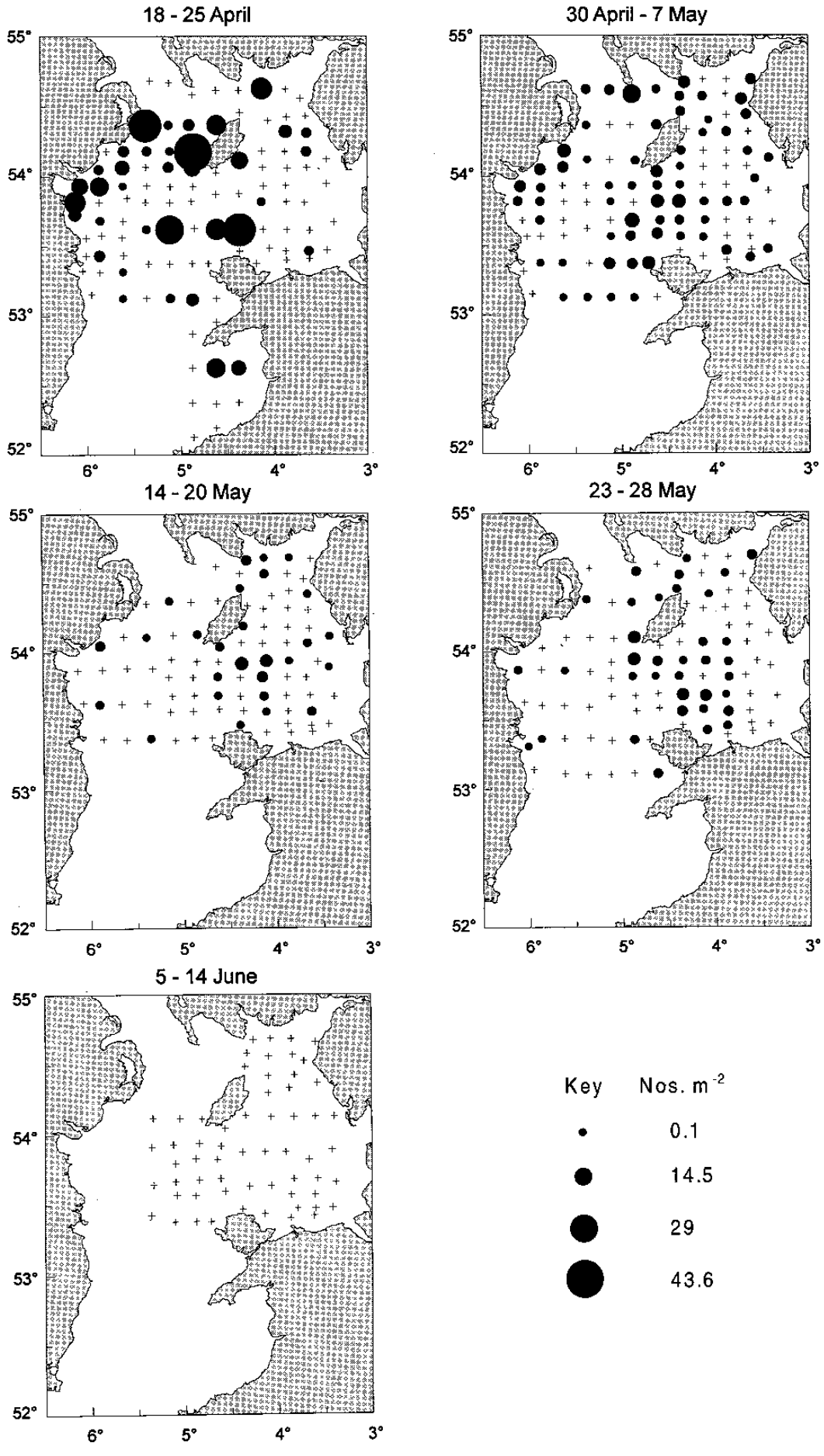

Figure 31. continued

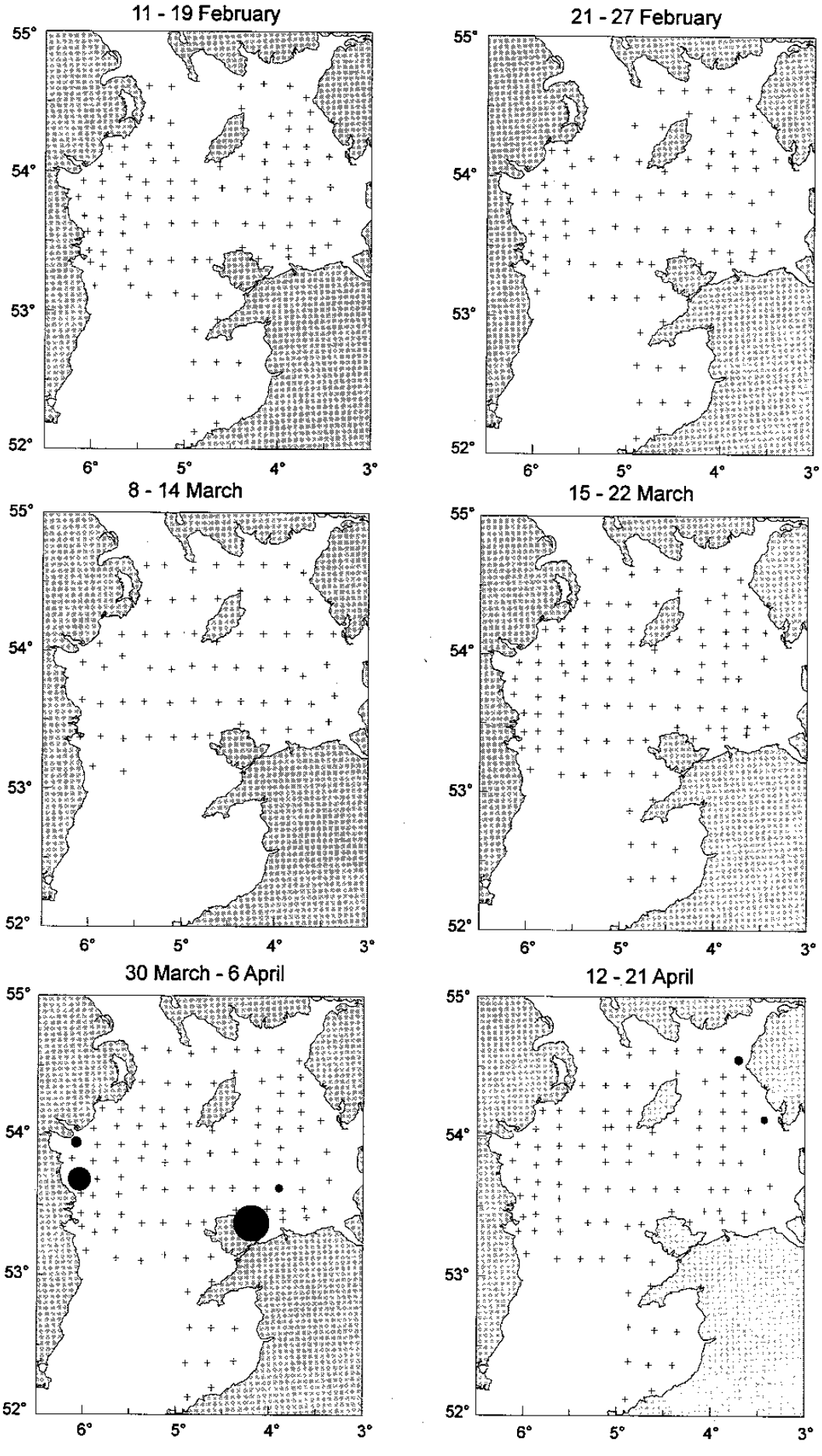

Figure 32. Concentration of Norwegian top-knot (Phrynorhombus norvegicus) larvae (nos.m^{-2}) in 1995

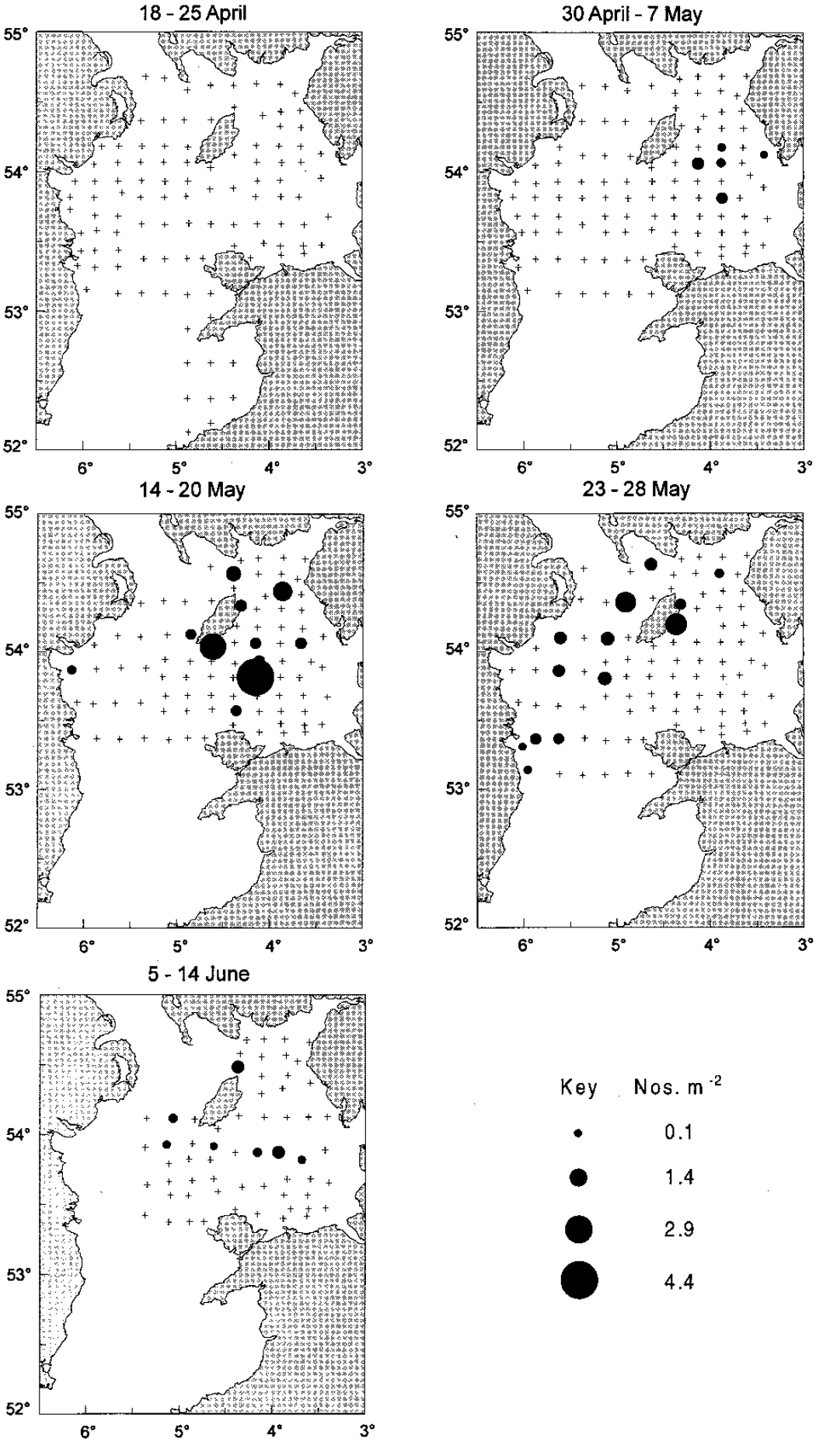

Figure 32. continued

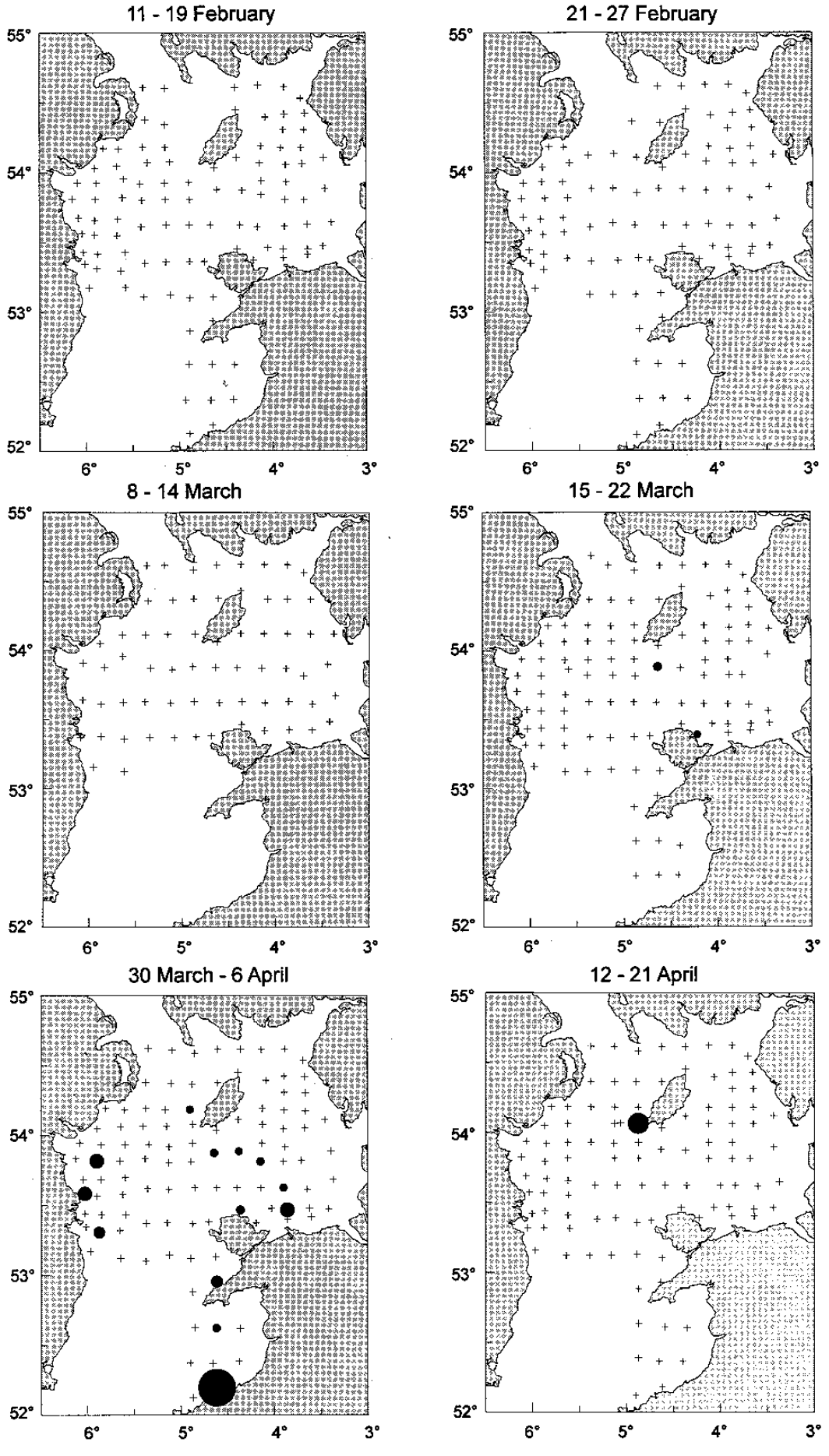

Figure 33. Concentration of topknot (Zeugopterus punctatus) eggs (nos.m^{-2}) in 1995

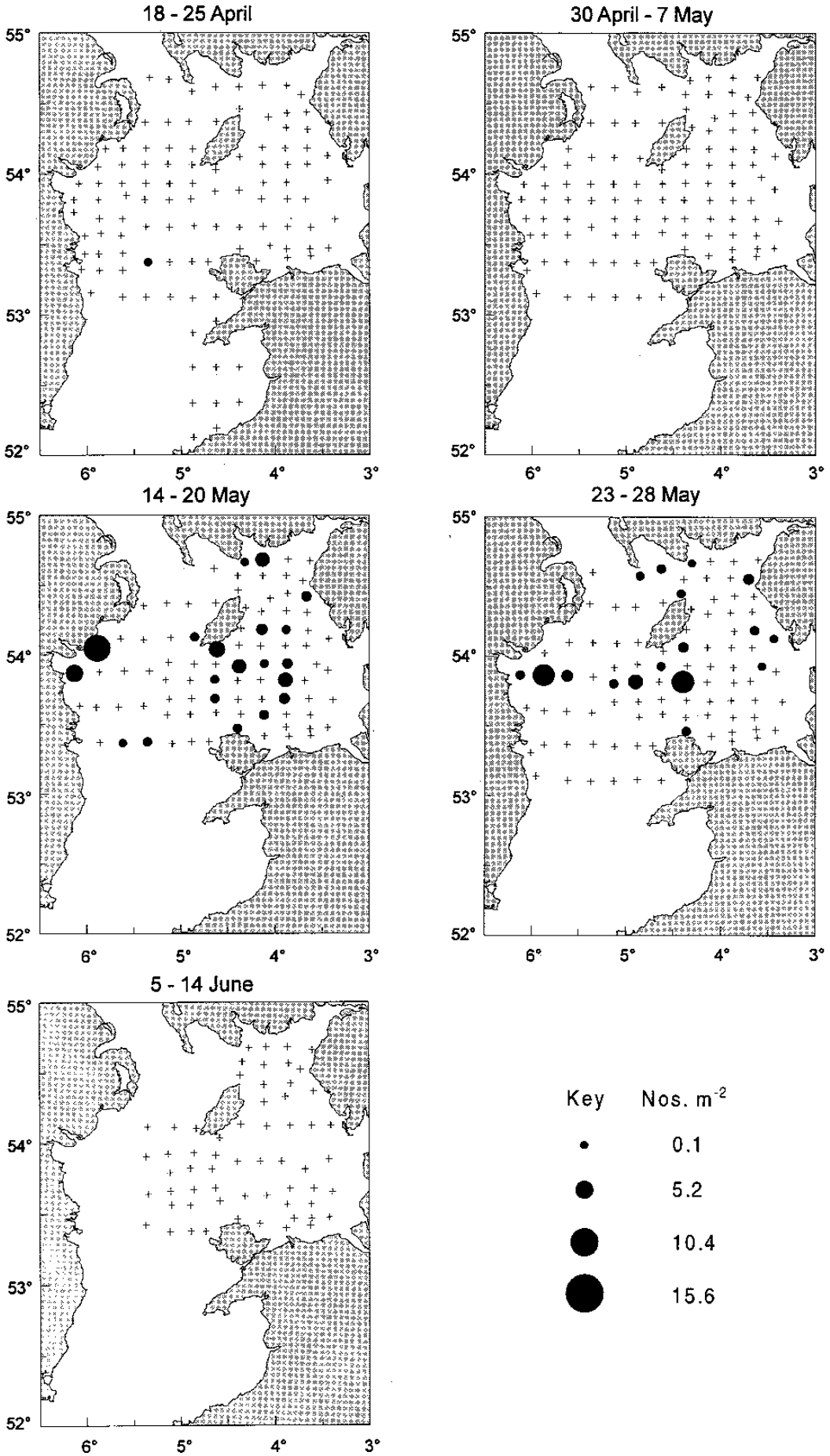

Figure 33. continued

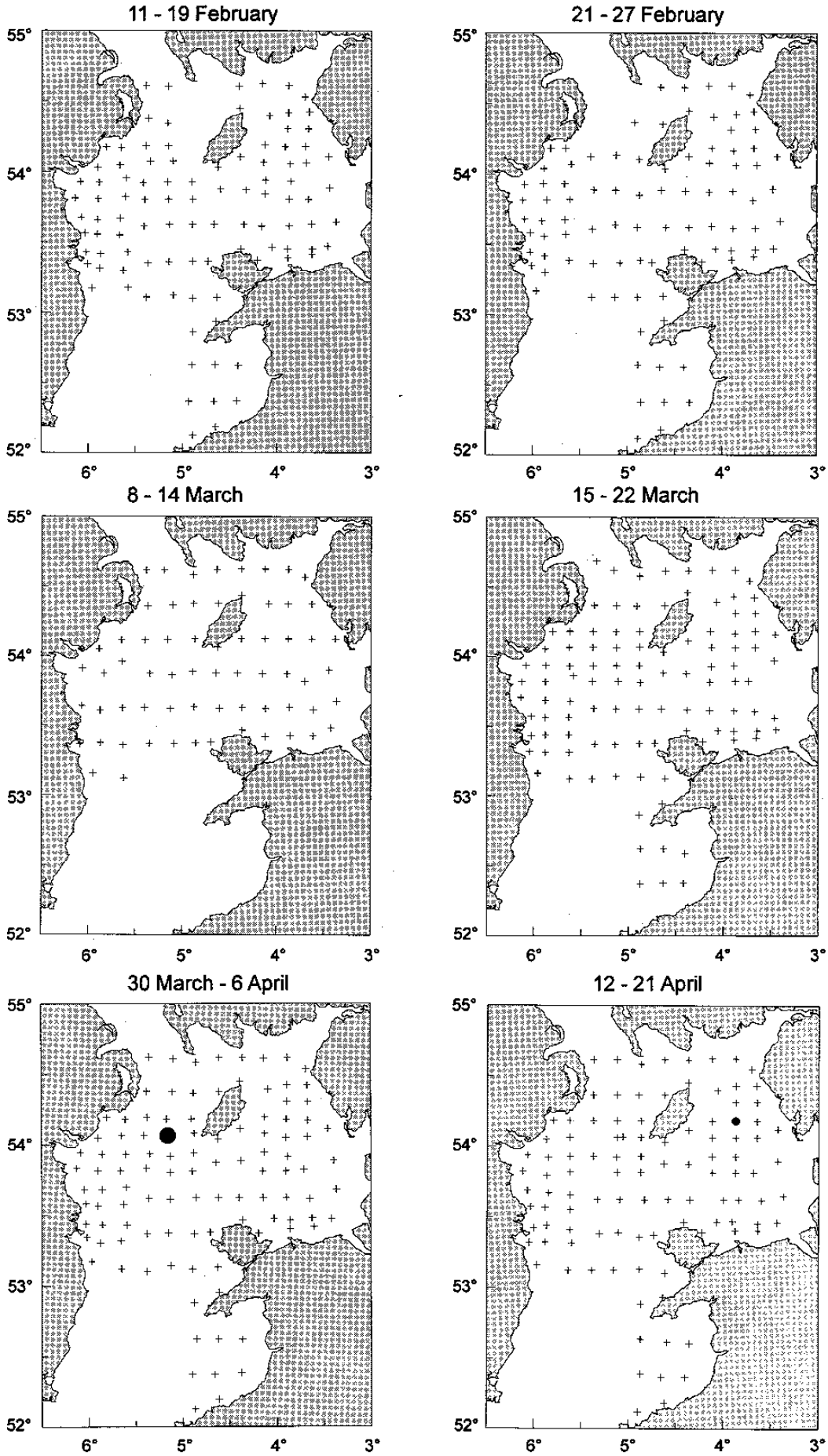

Figure 34. Concentration of topknot (Zeugopterus punctatus) larvae (nos.m^{-2}) in 1995

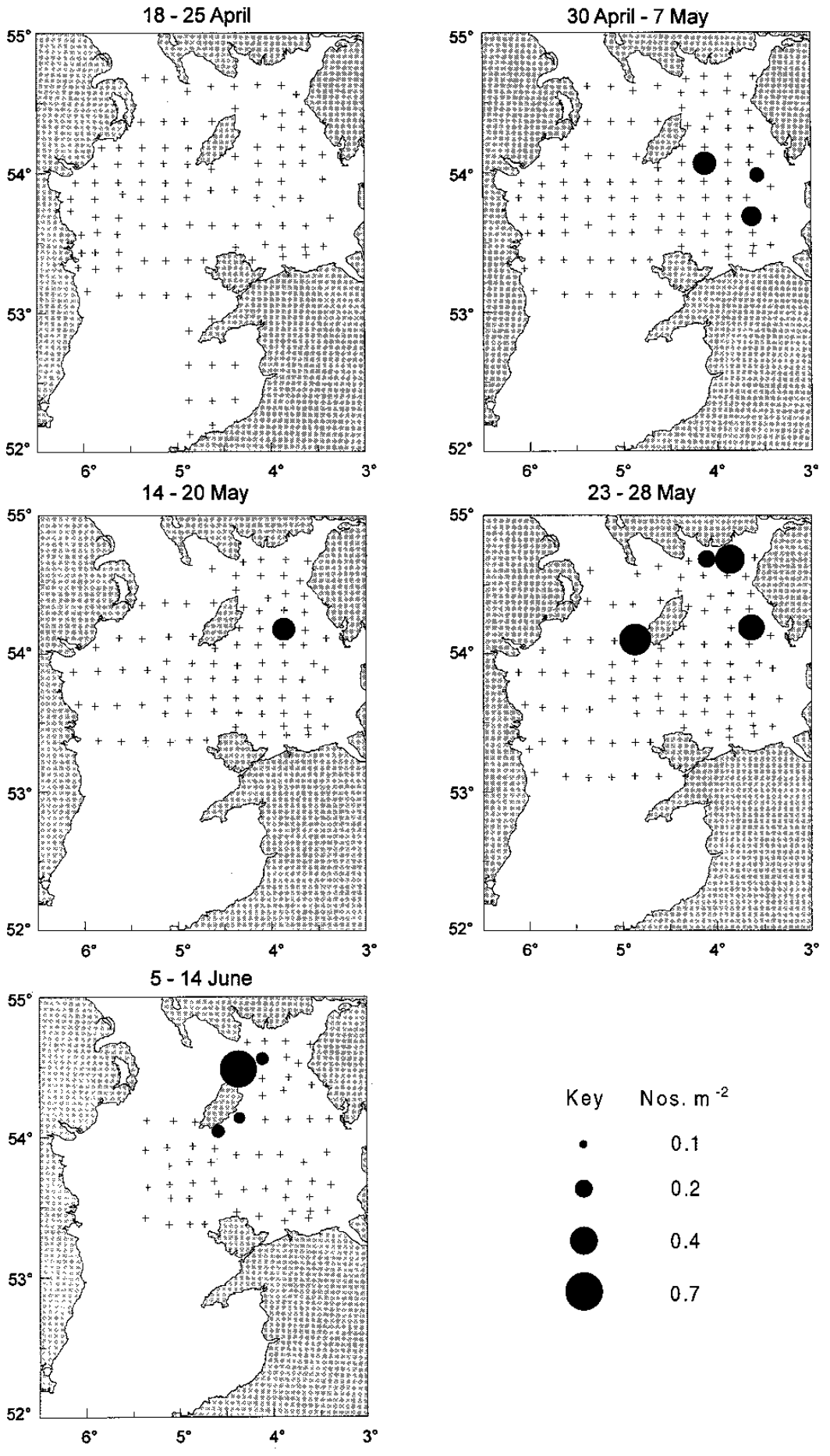

Figure 34. continued

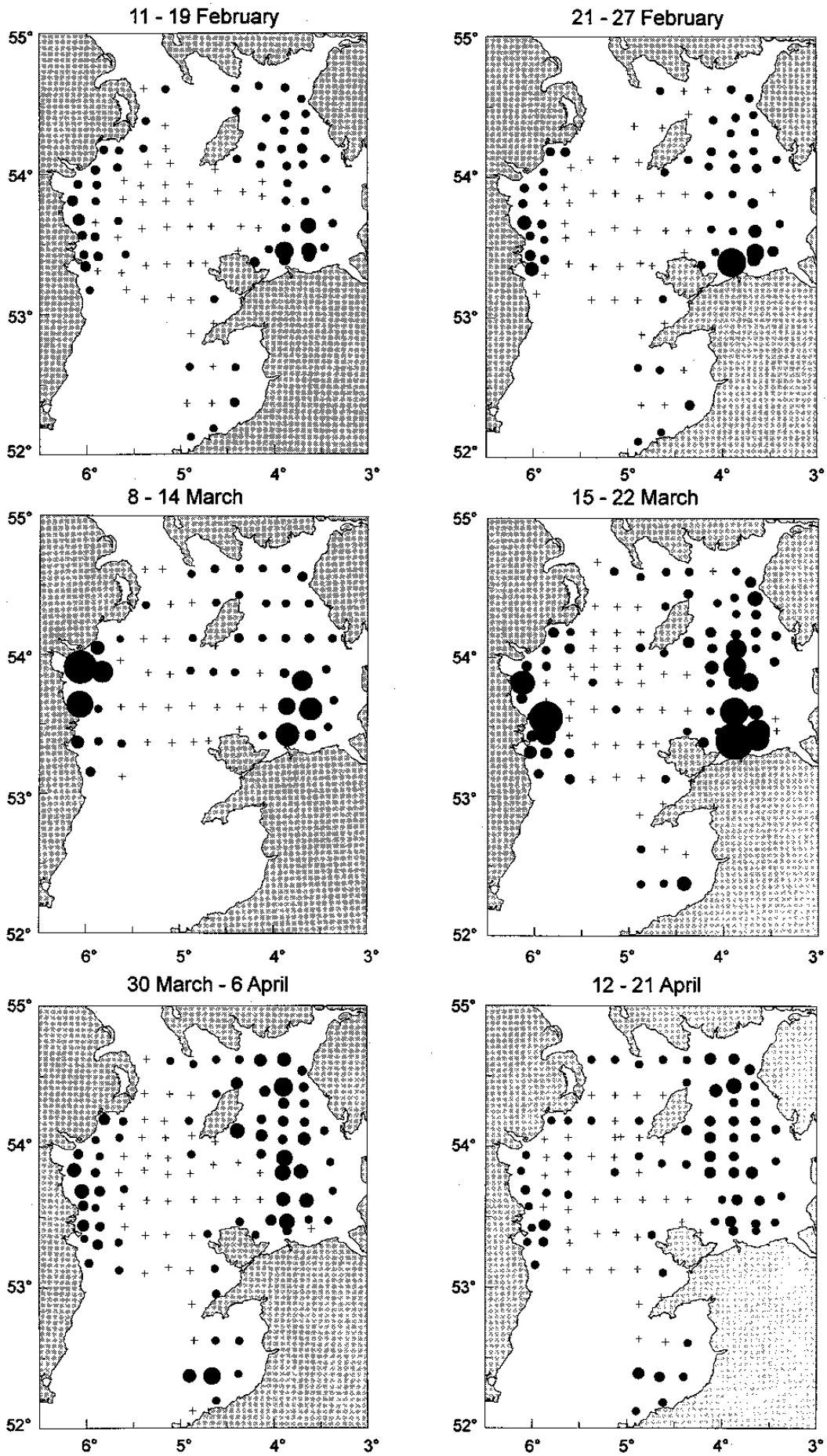

Figure 35. Concentration of plaice (Pleuronectes platessa) eggs (nos.m^{-2}) in 1995

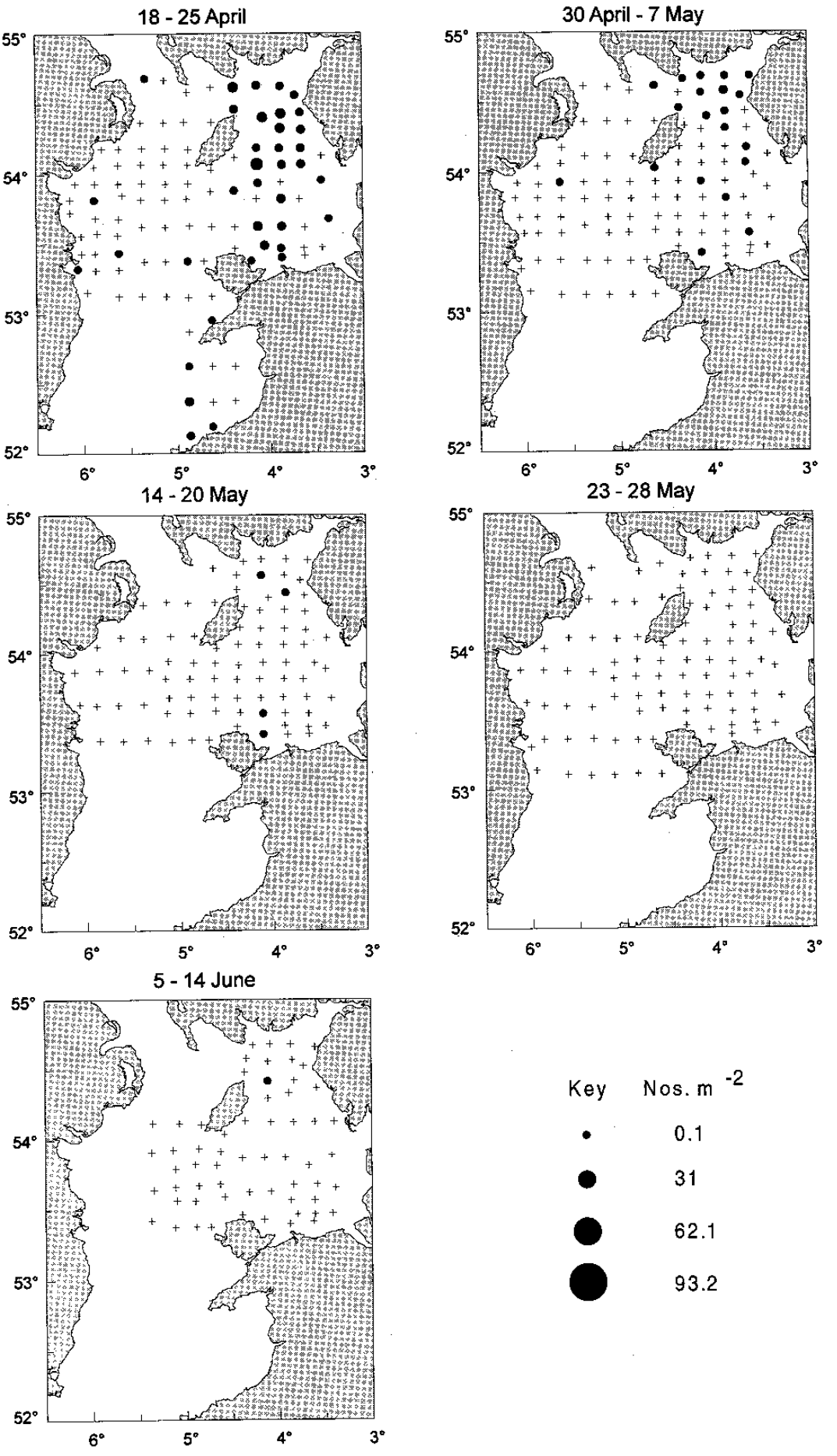

Figure 35. continued

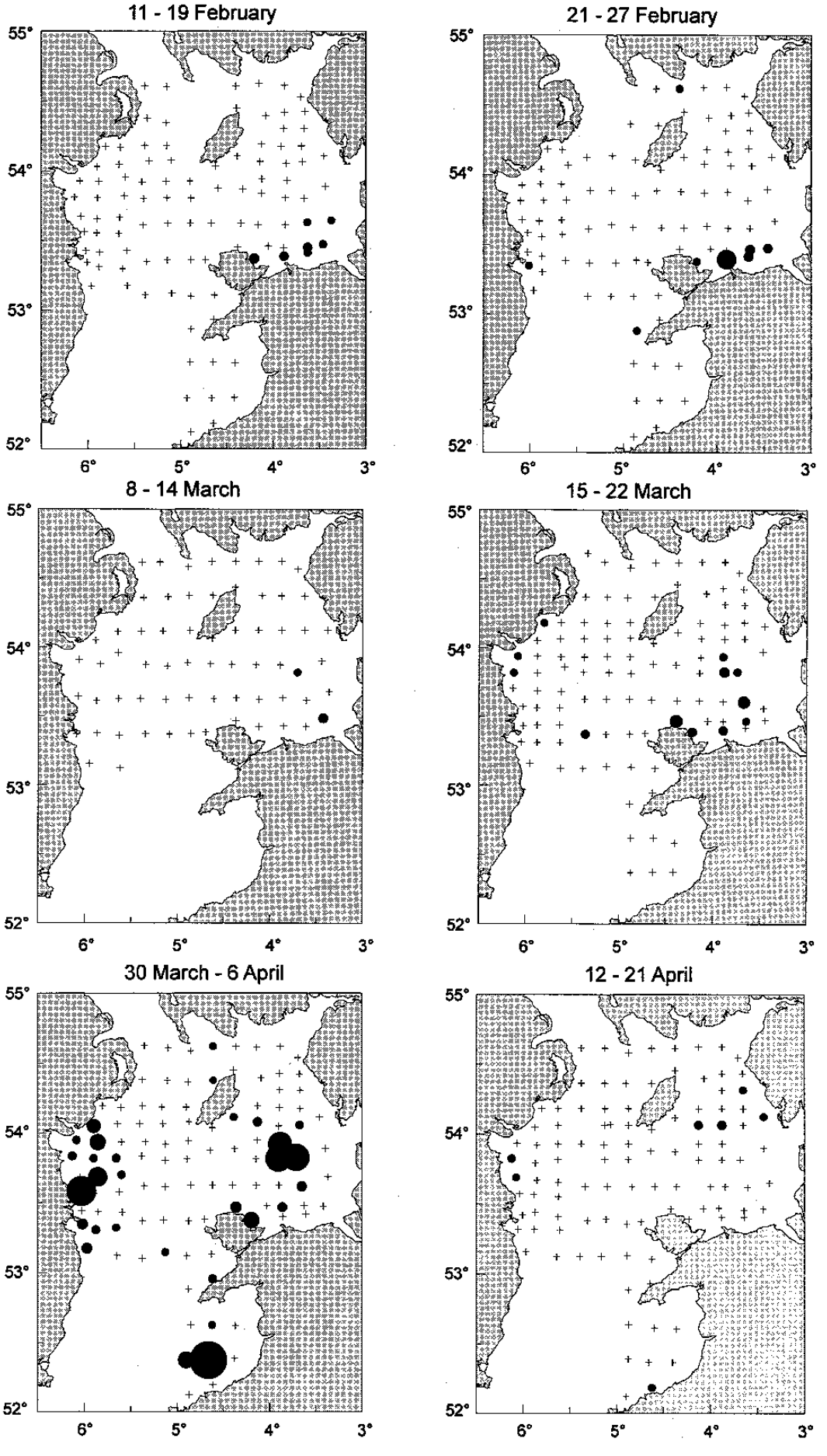

Figure 36. Concentration of plaice (Pleuronectes platessa) larvae (nos.m^{-2}) in 1995

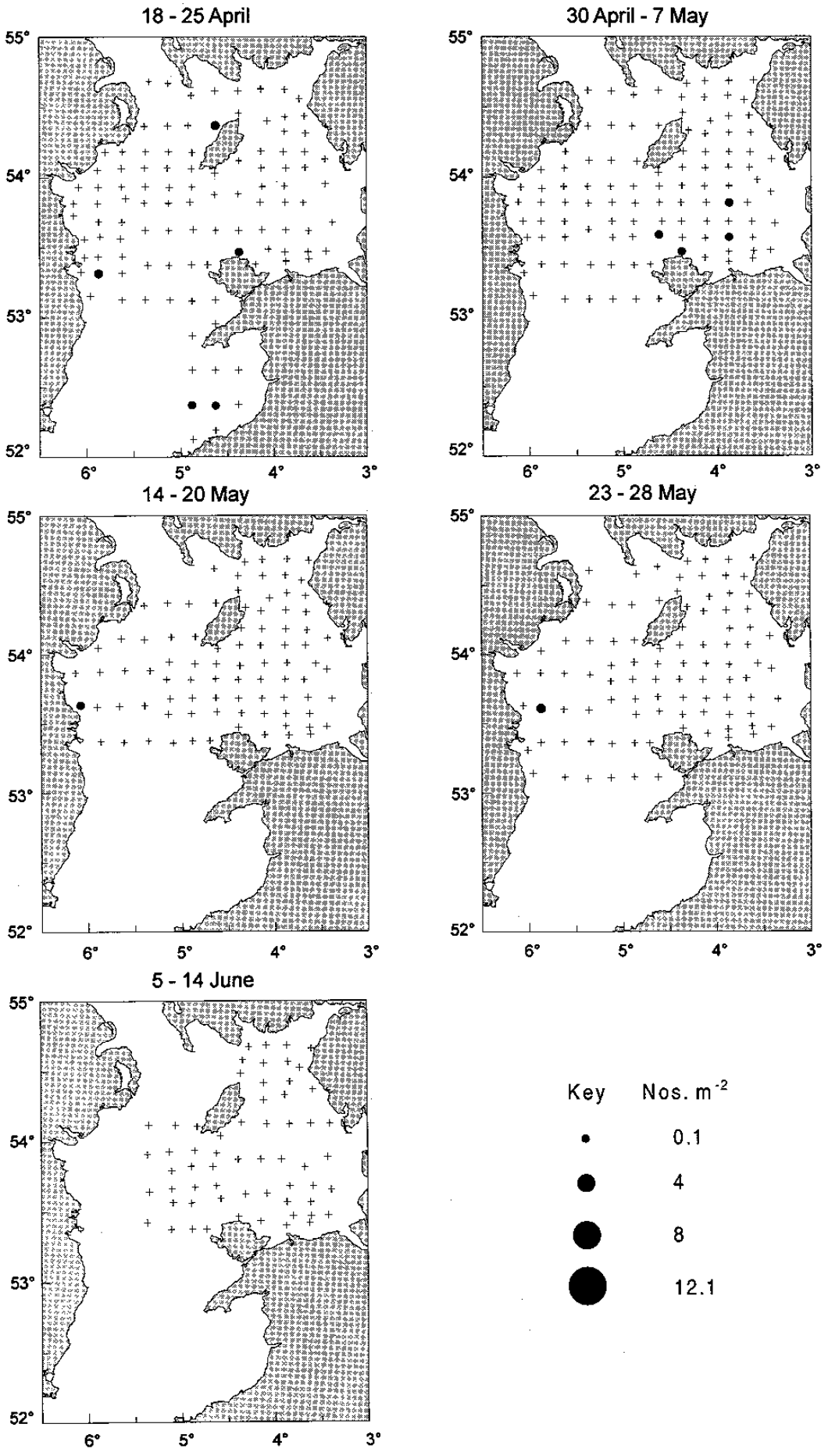

Figure 36. continued

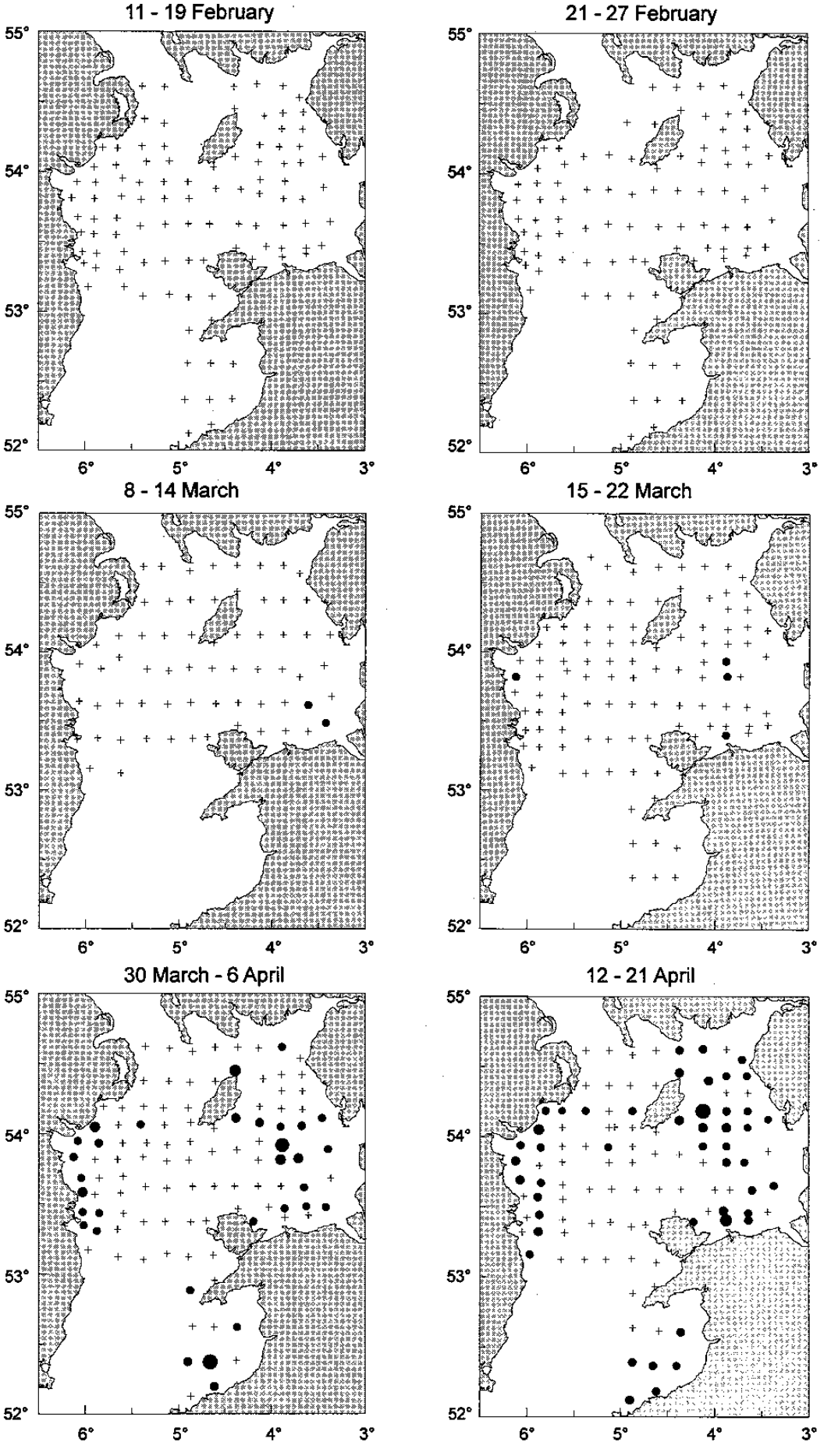

Figure 37. Concentration of flounder (Platicthys flesus) larvae (nos.m^{-2}) in 1995

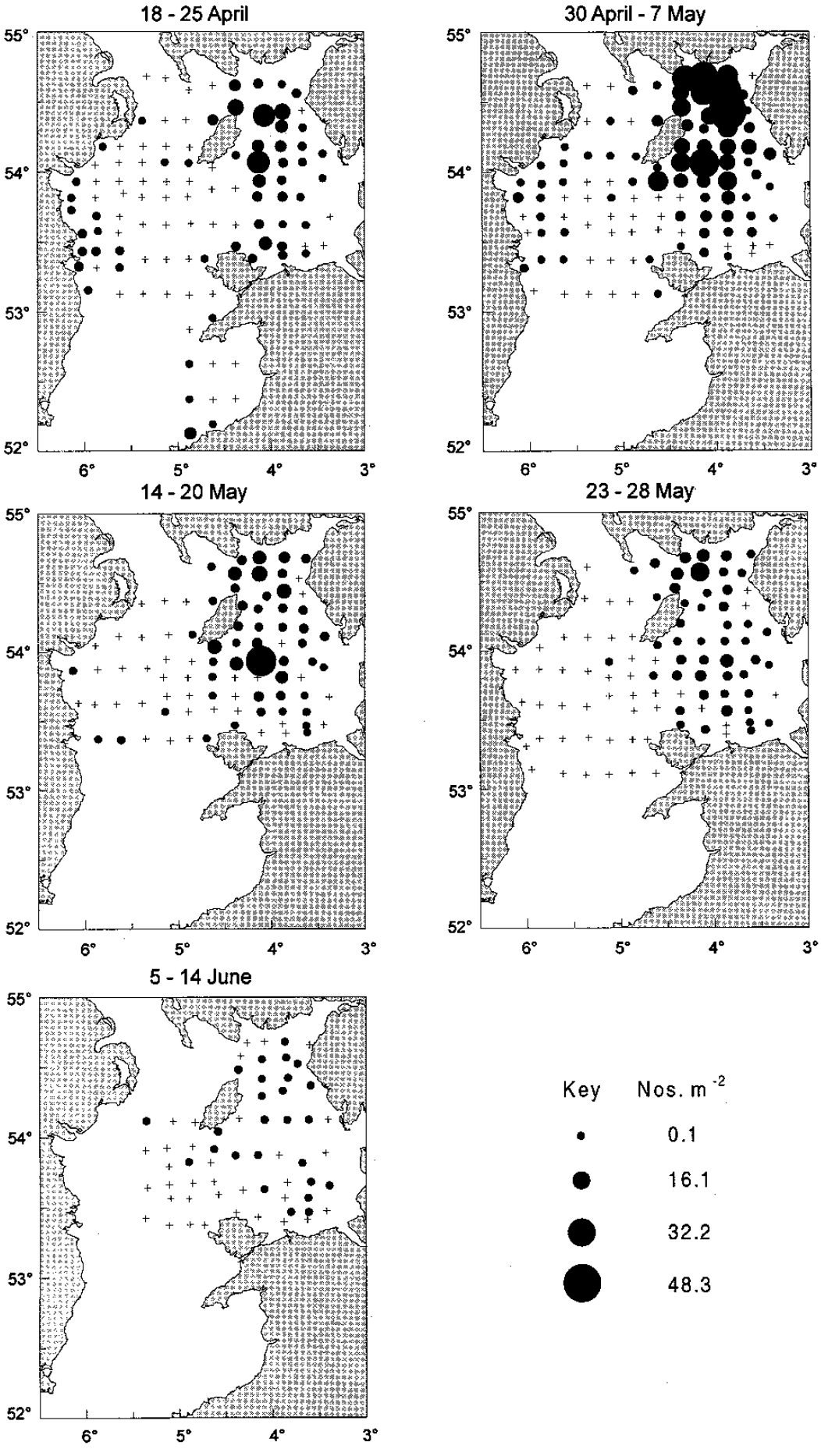

Figure 37. continued

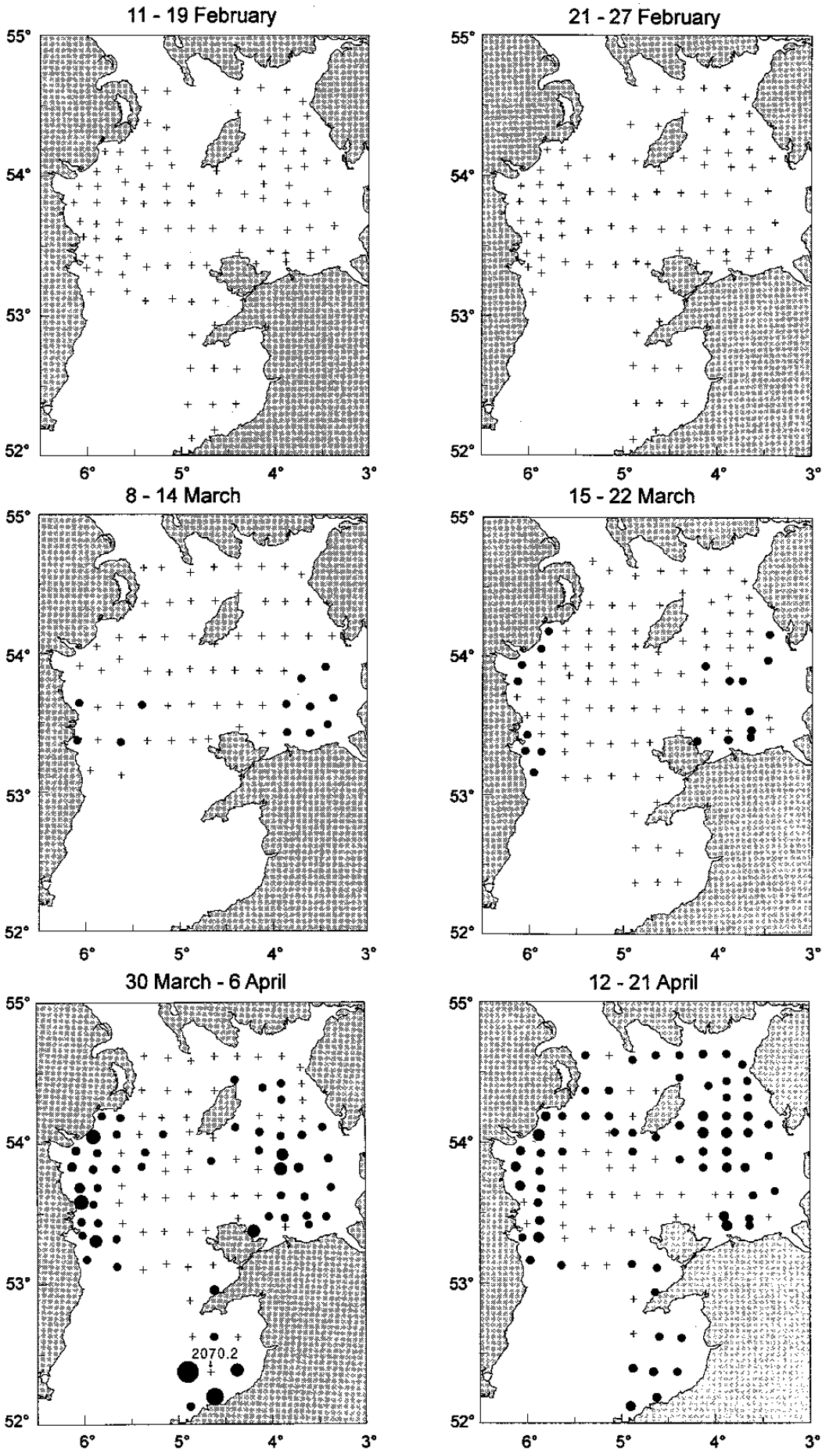

Figure 38. Concentration of dab (Limanda limanda) larvae (nos.m^{-2}) in 1995

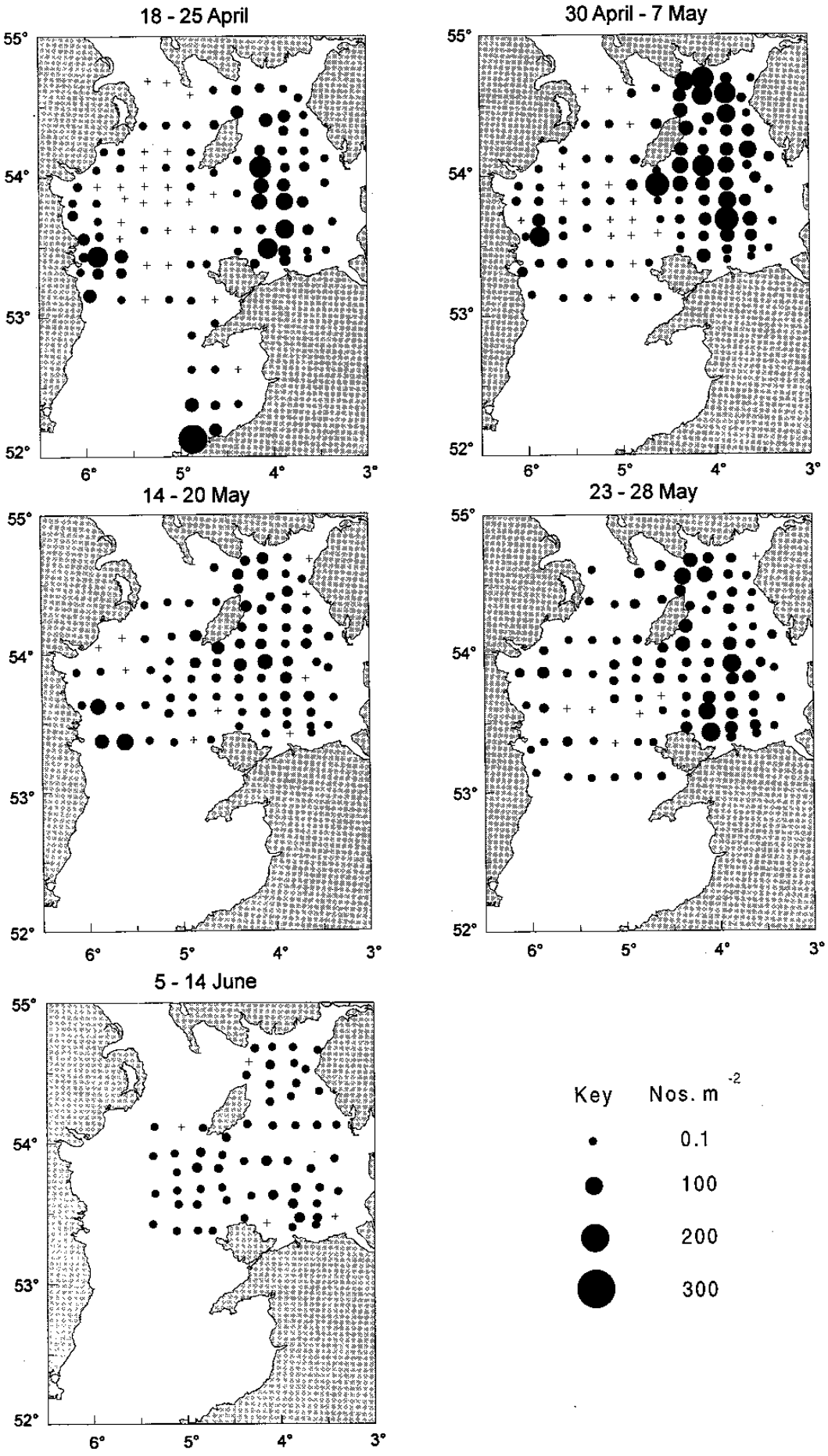

Figure 38. continued

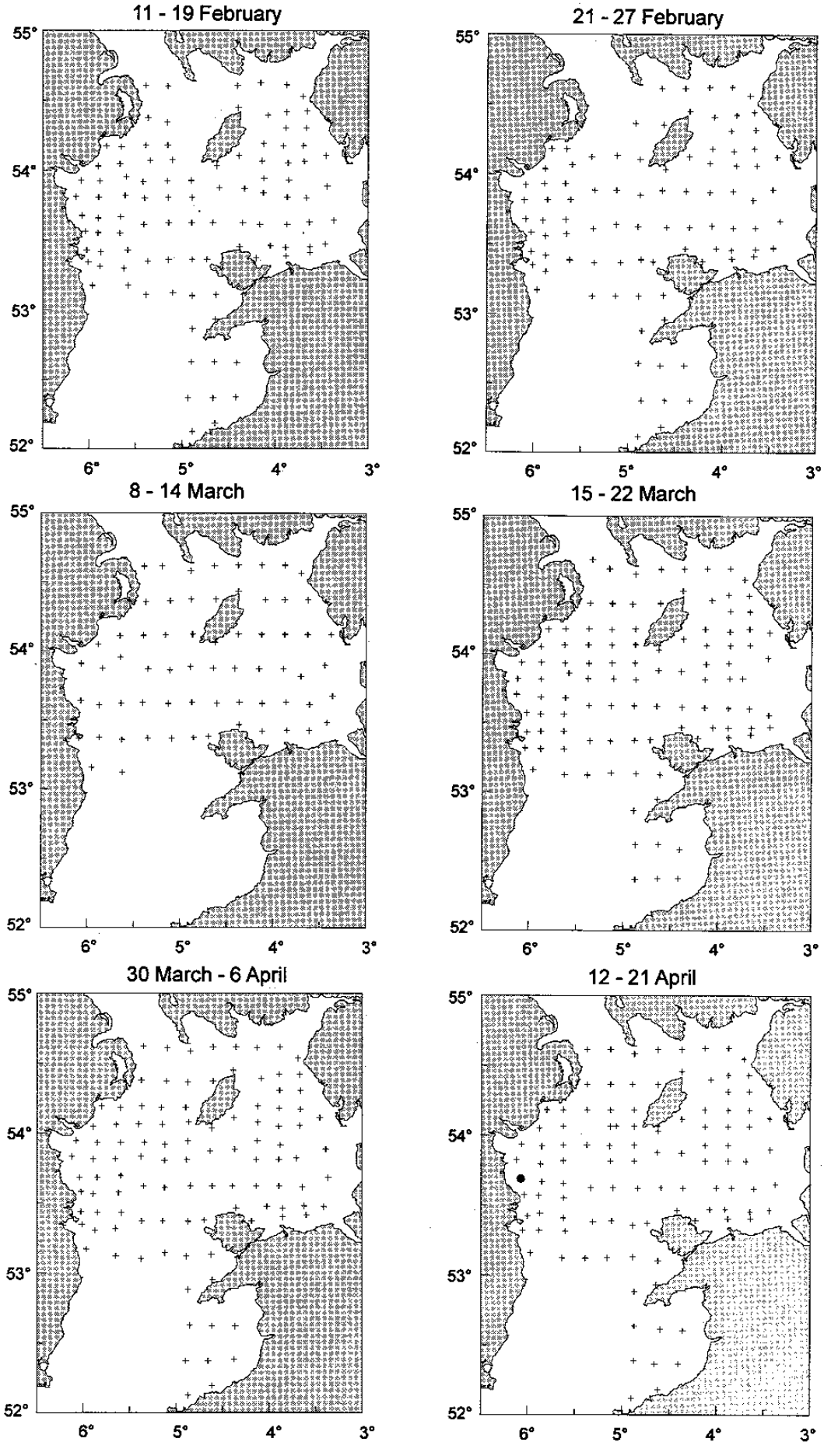

Figure 39. Concentration of lemon sole (Microstomus kitt) larvae (nos.m^{-2}) in 1995

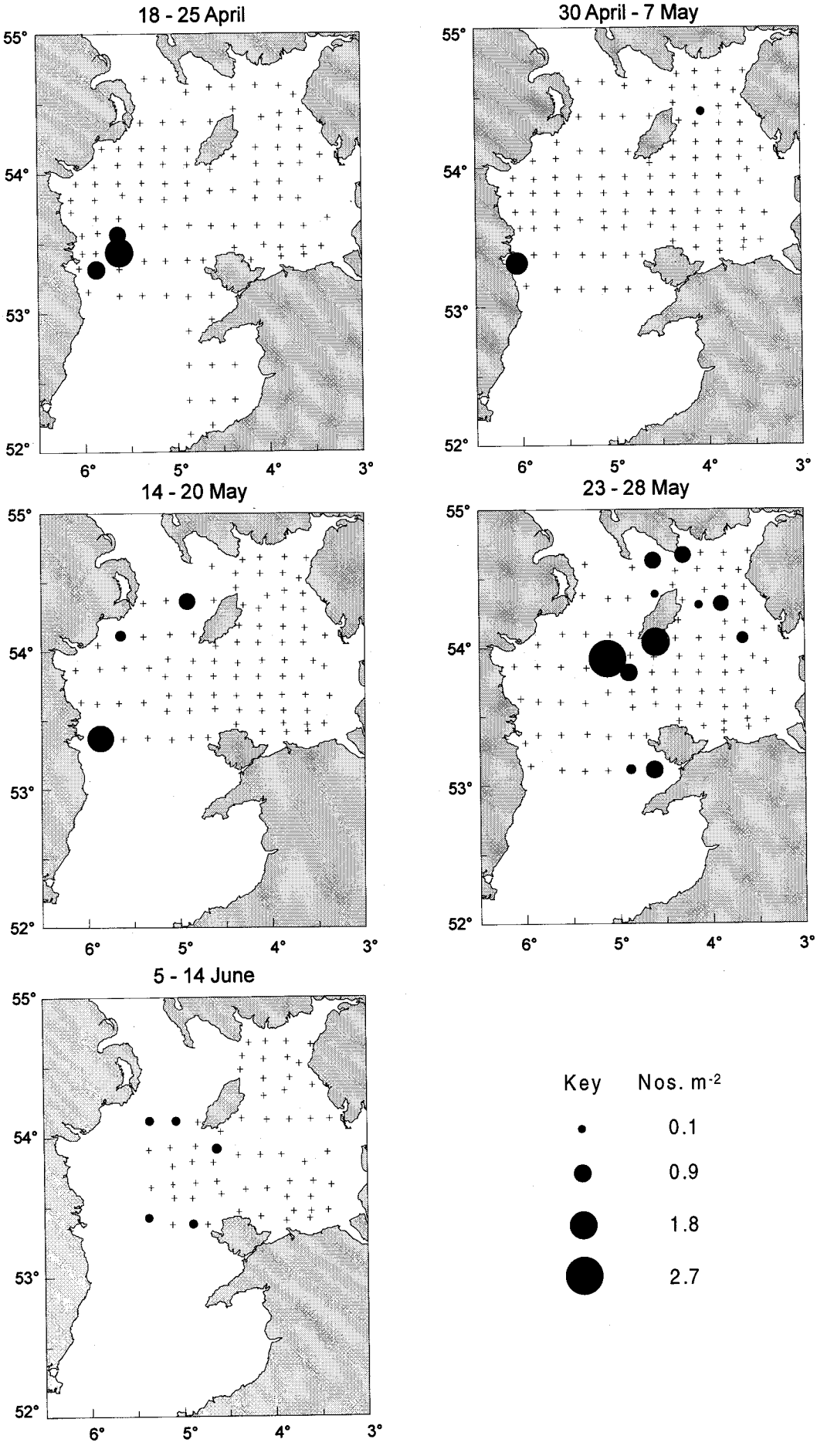

Figure 39. continued

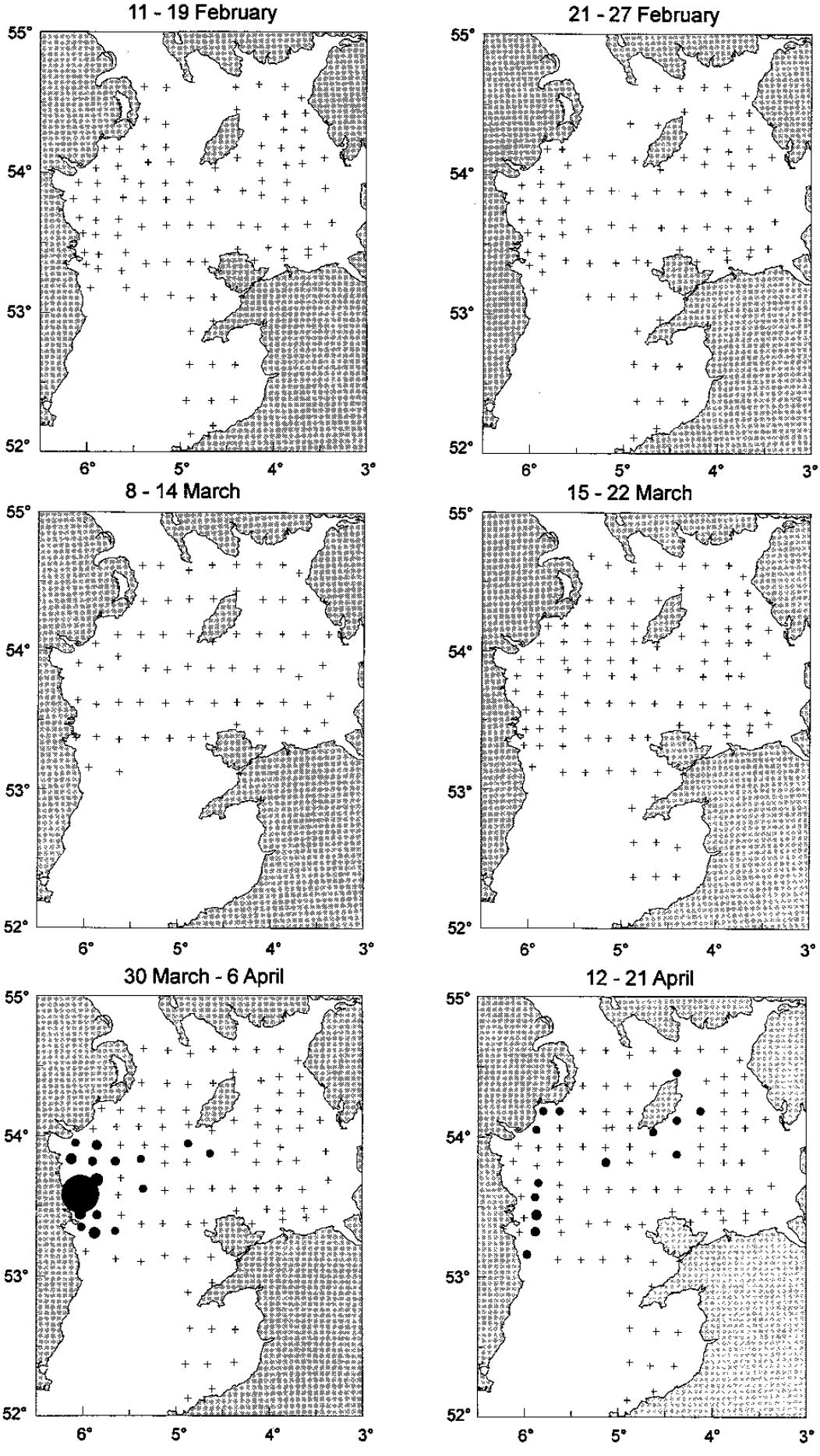

Figure 40. Concentration of witch (Glyptocephalus cynoglossus) larvae (nos.m^{-2}) in 1995

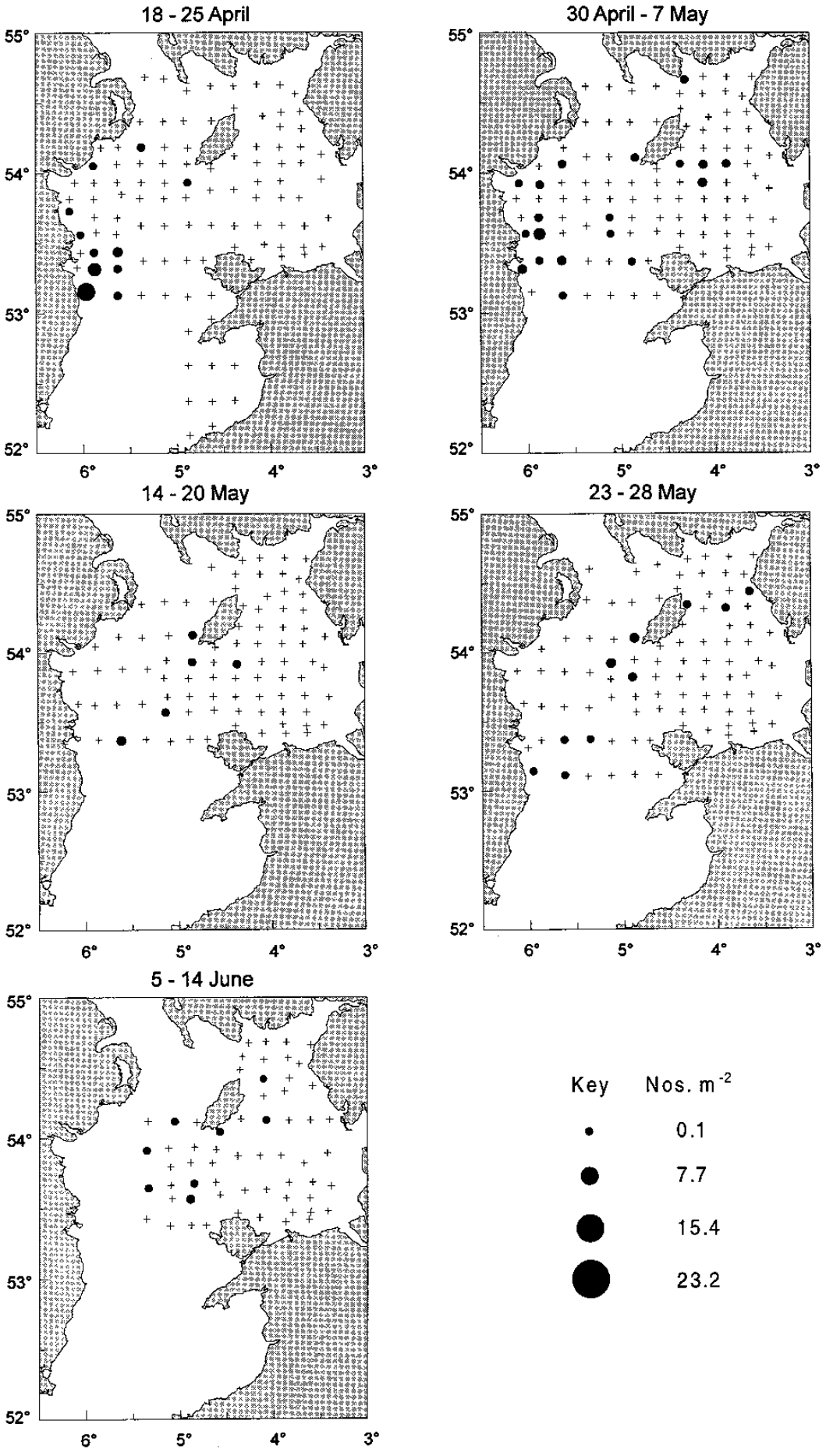

Figure 40. continued

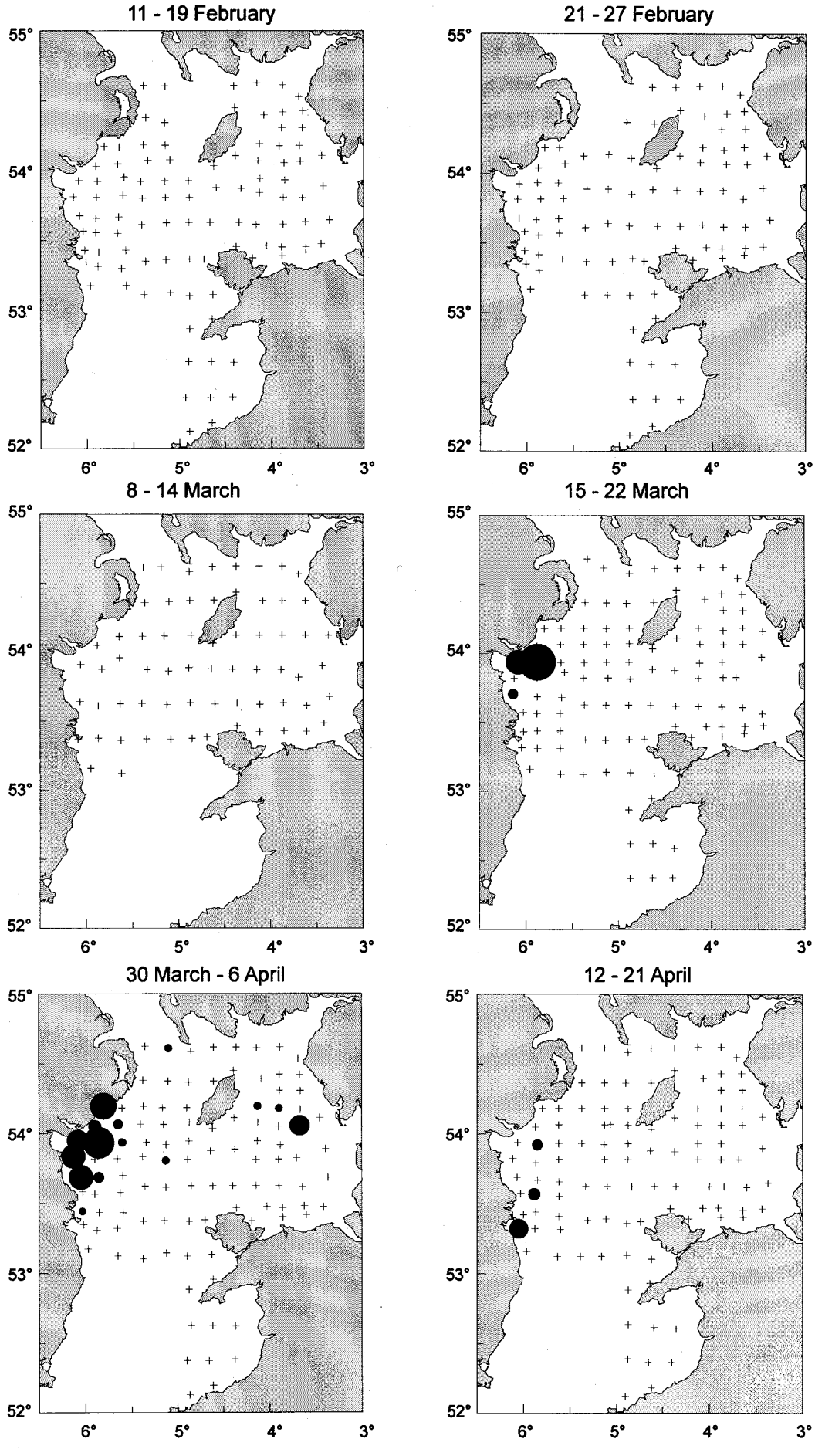

Figure 41. Concentration of long-rough dab (Hippoglossoides platessoides) eggs (nos.m^{-2}) in 1995

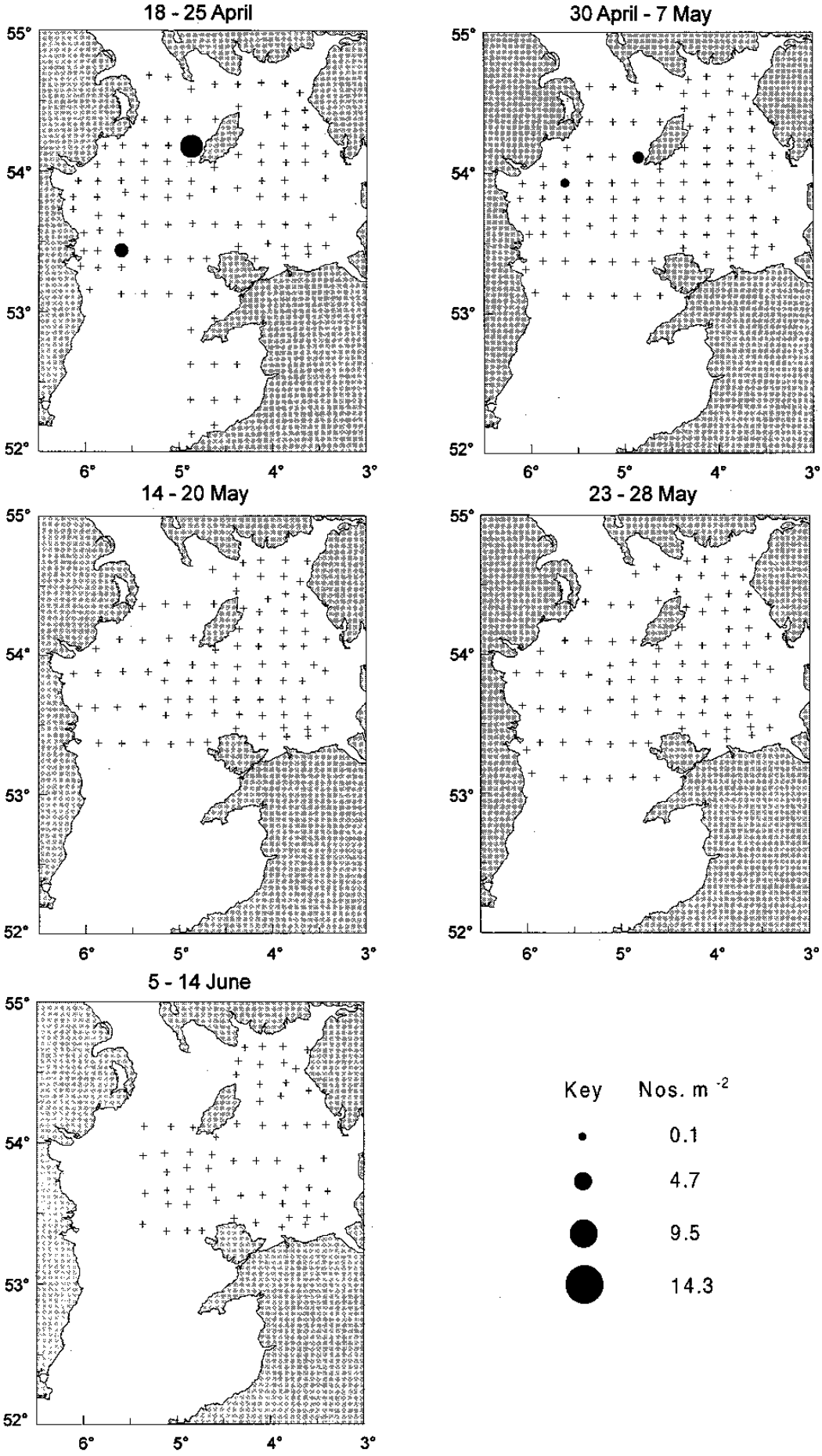

Figure 41. continued

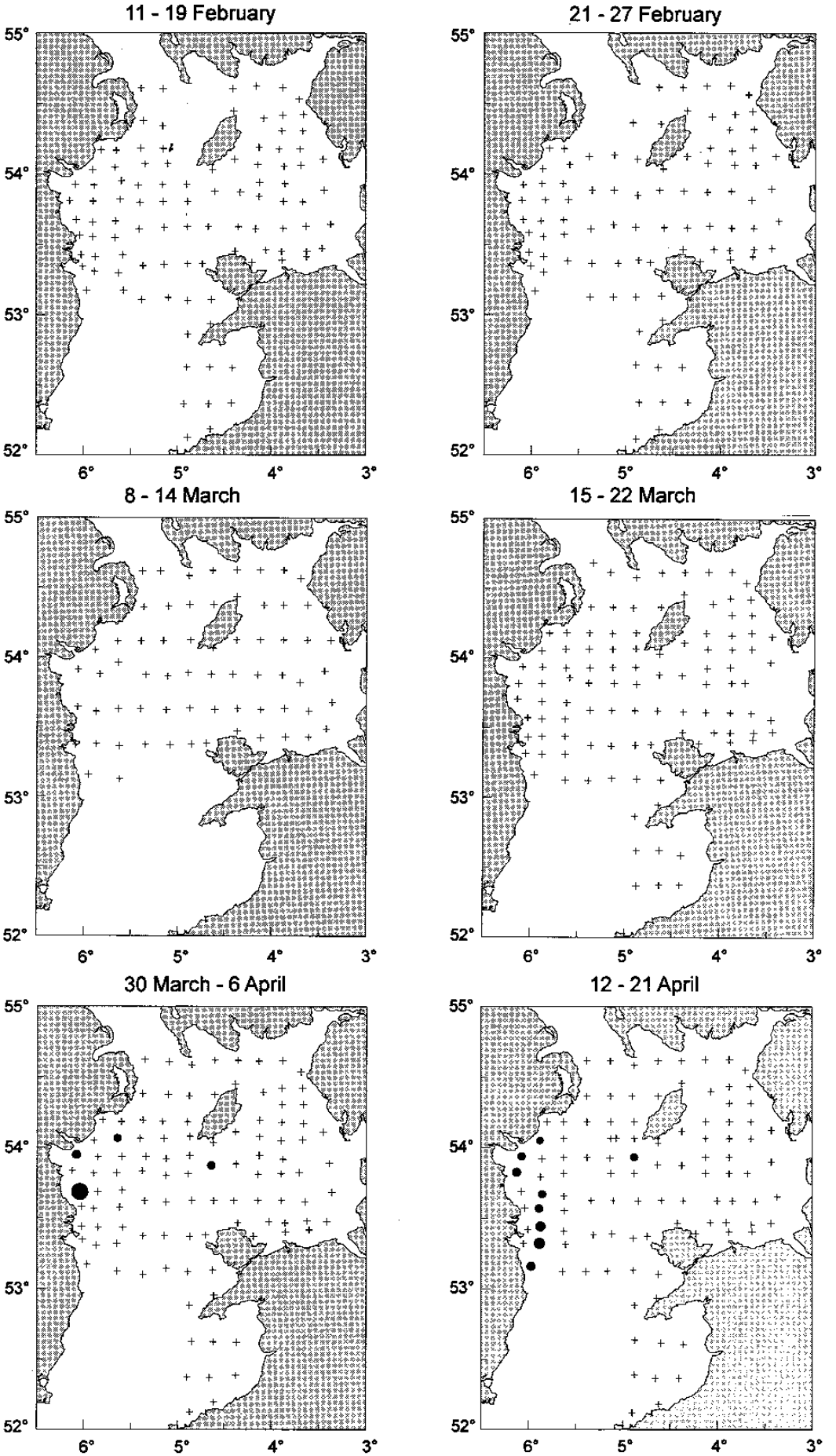

Figure 42. Concentration of long-rough dab (Hippoglossoides platessoides) larvae (nos.m^{-2}) in 1995

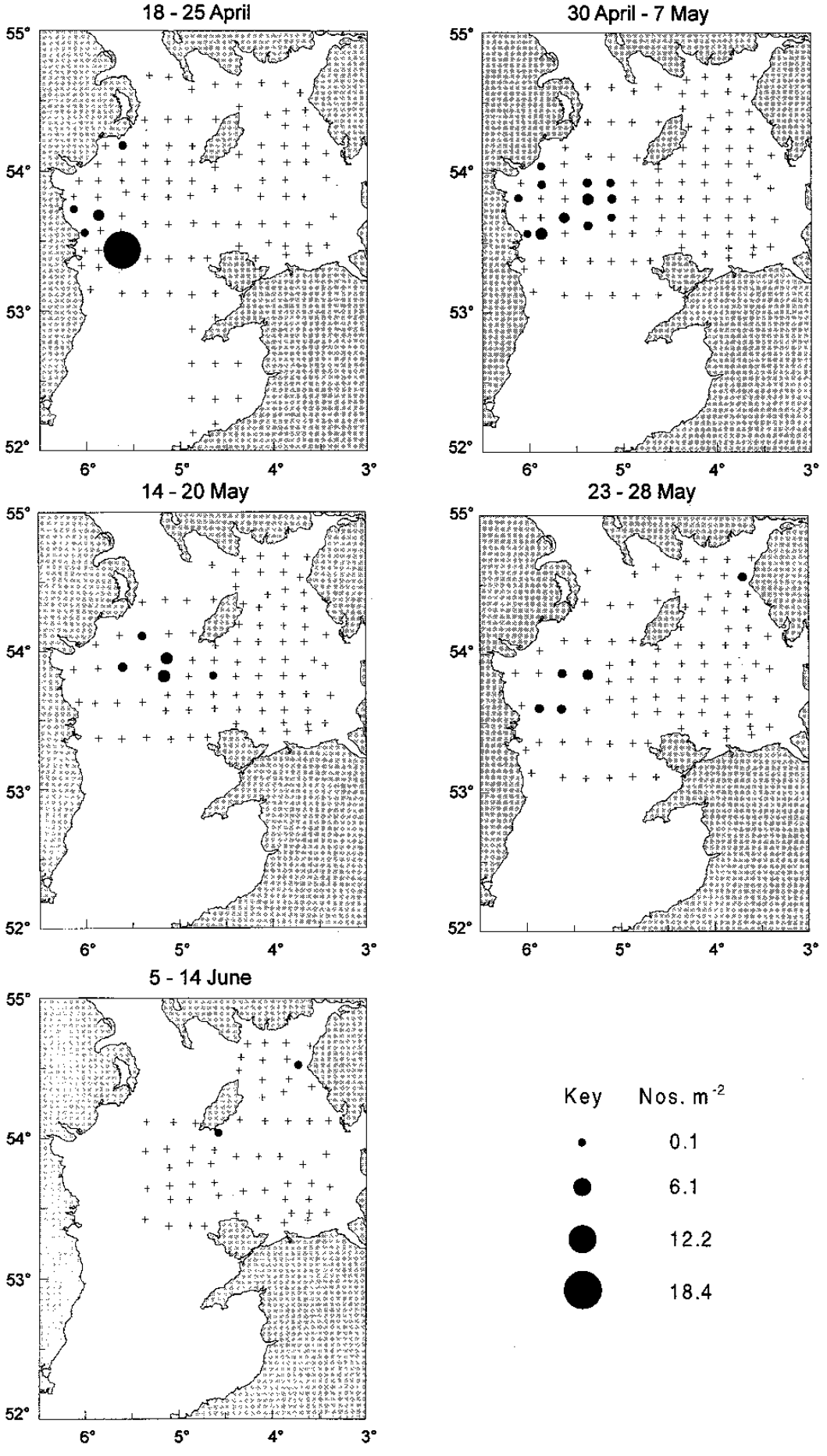

Figure 42. continued

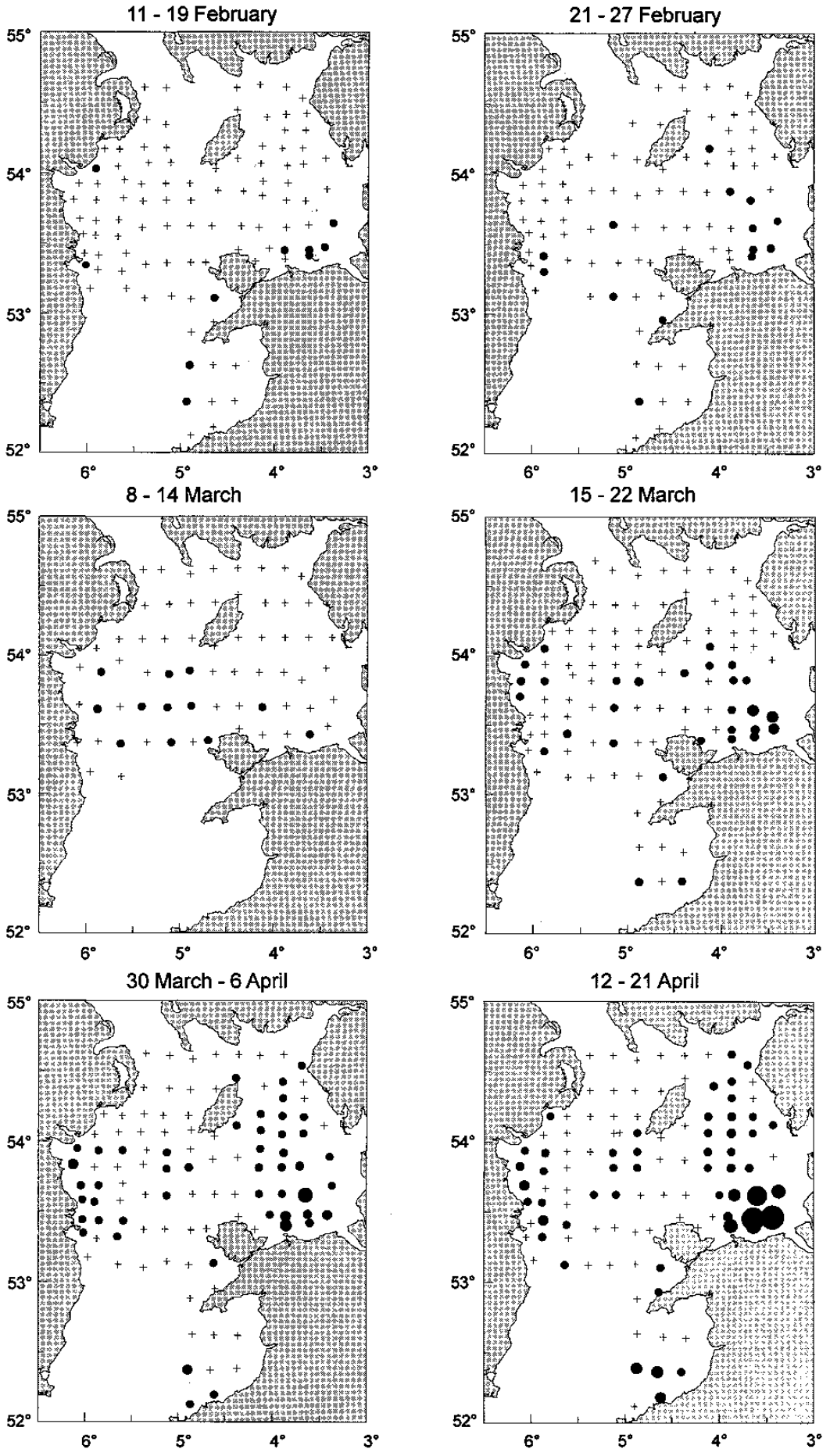

Figure 43. Concentration of sole (Solea solea) eggs (nos.m^{-2}) in 1995

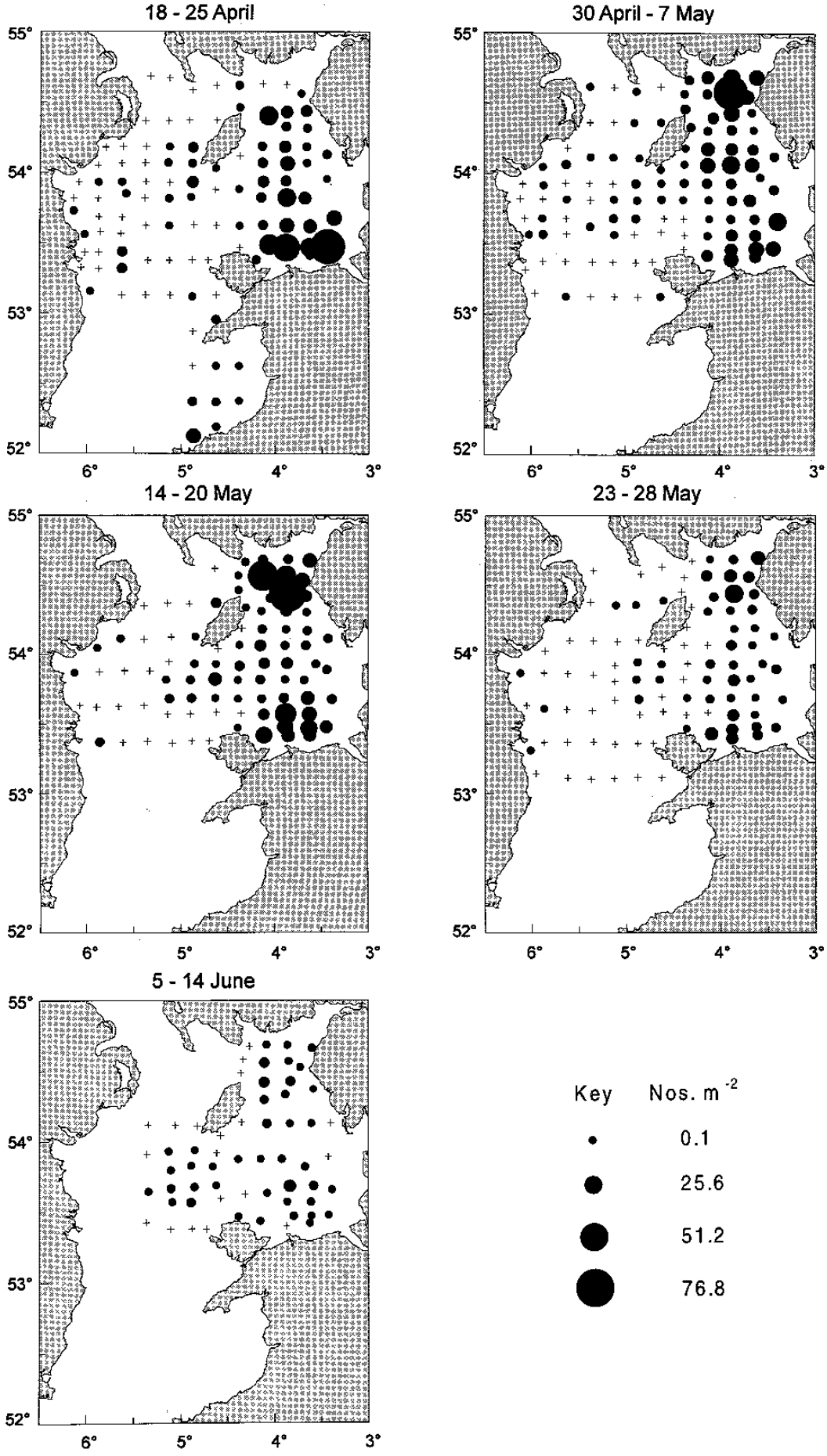

Figure 43. continued

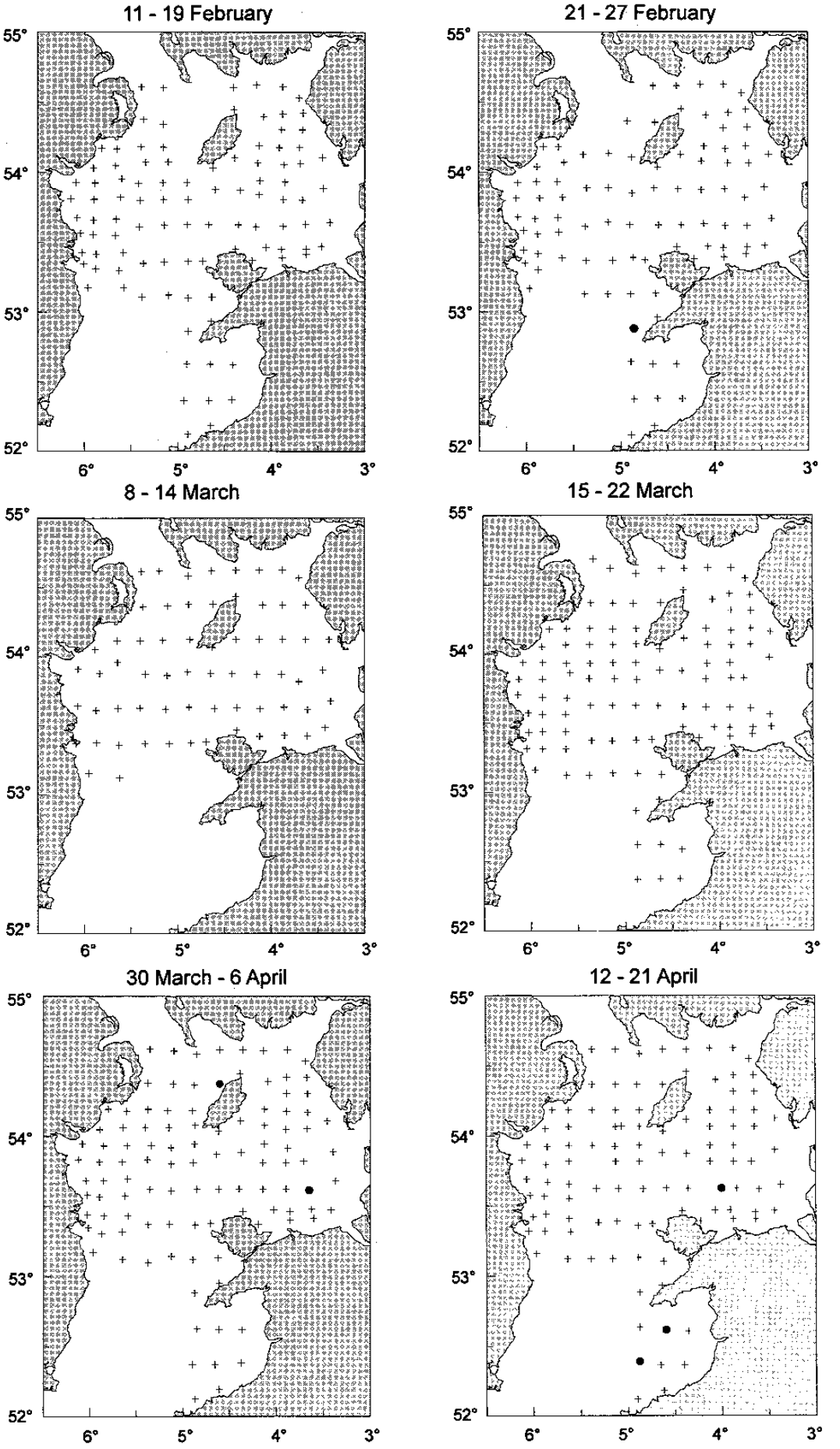

Figure 44. Concentration of sole (Solea solea) larvae (nos.m^{-2}) in 1995

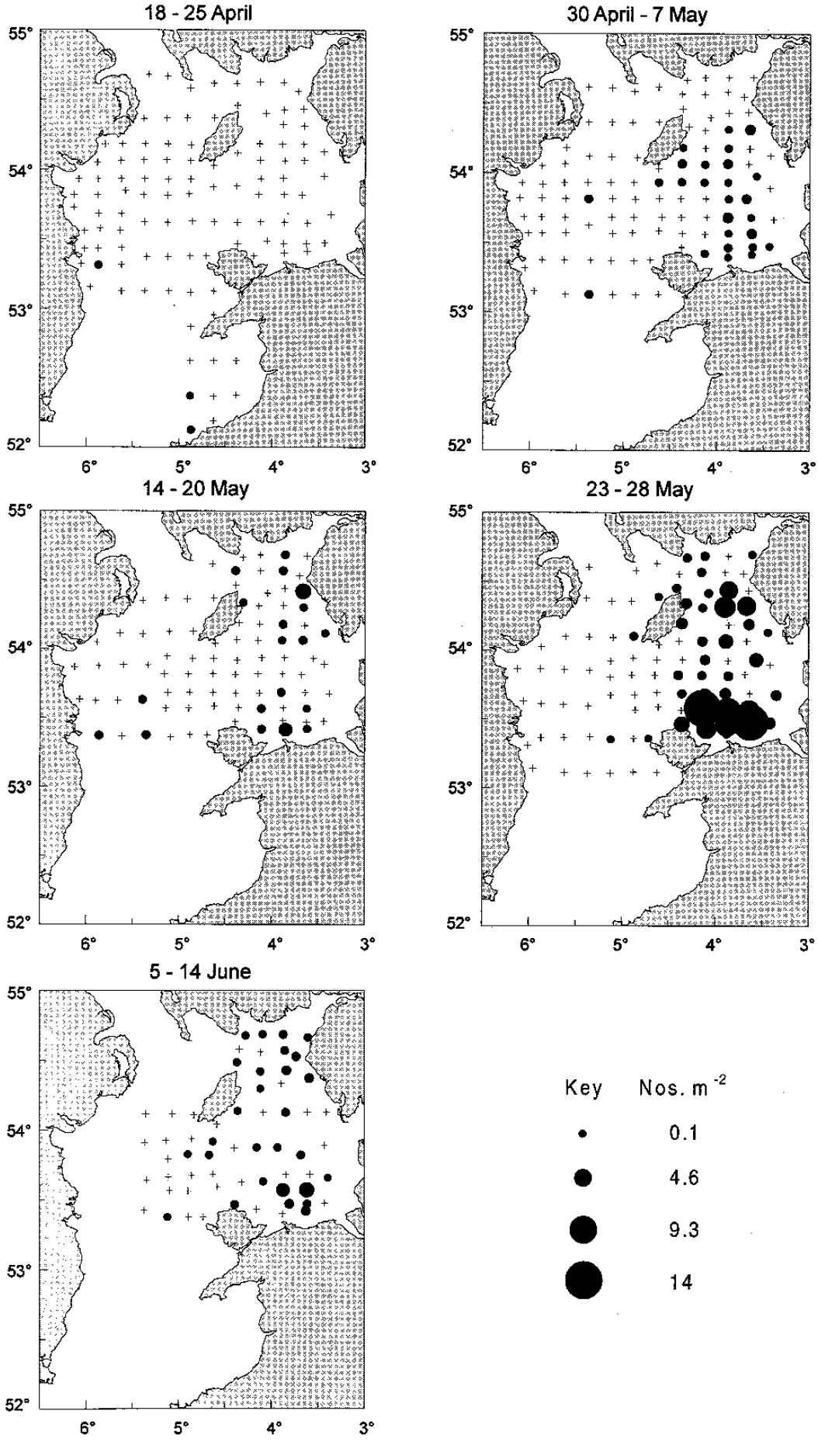

Figure 44. continued

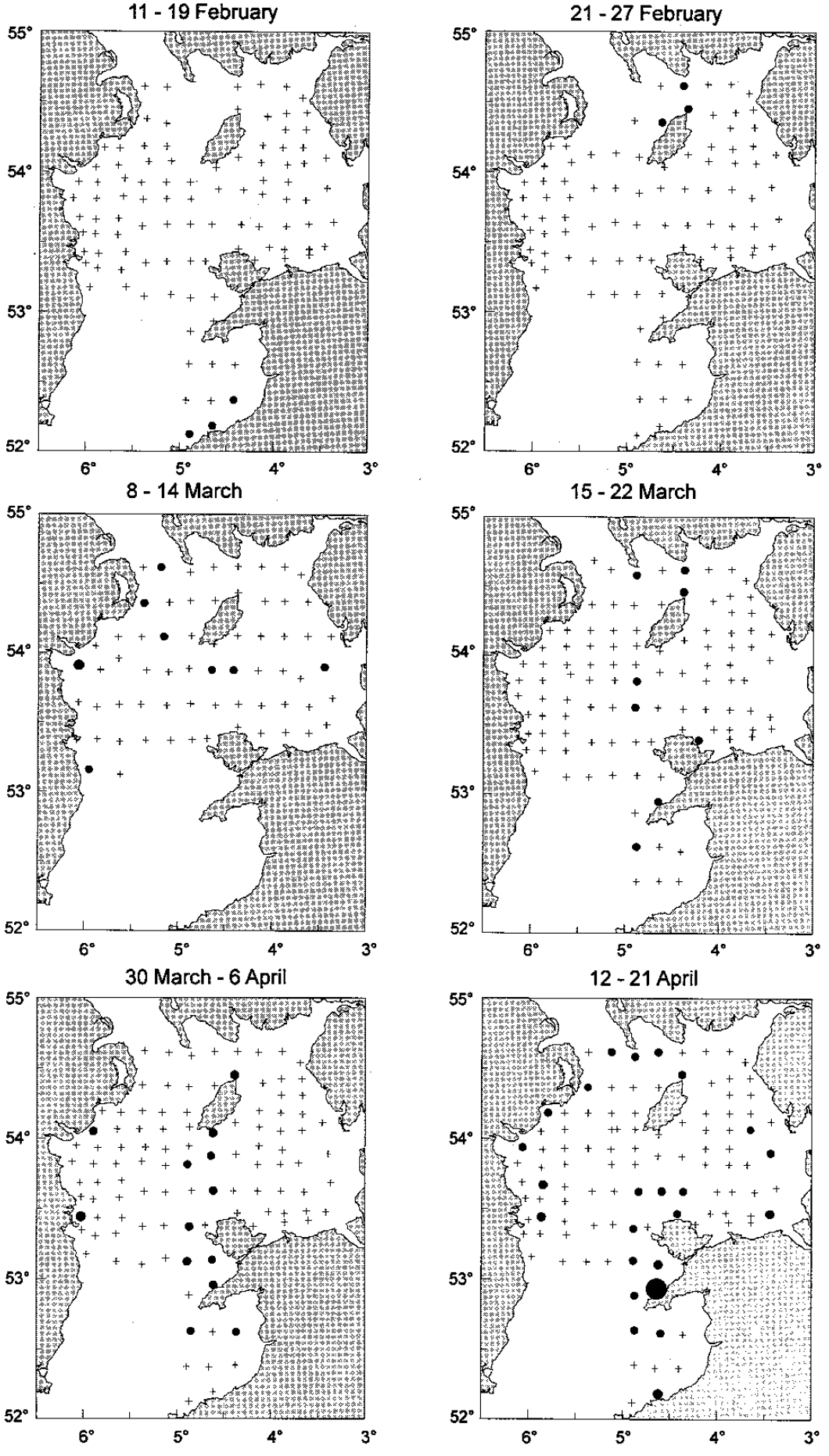

Figure 45. Concentration of solenette (Buglossidium luteum) eggs (nos.m^{-2}) in 1995

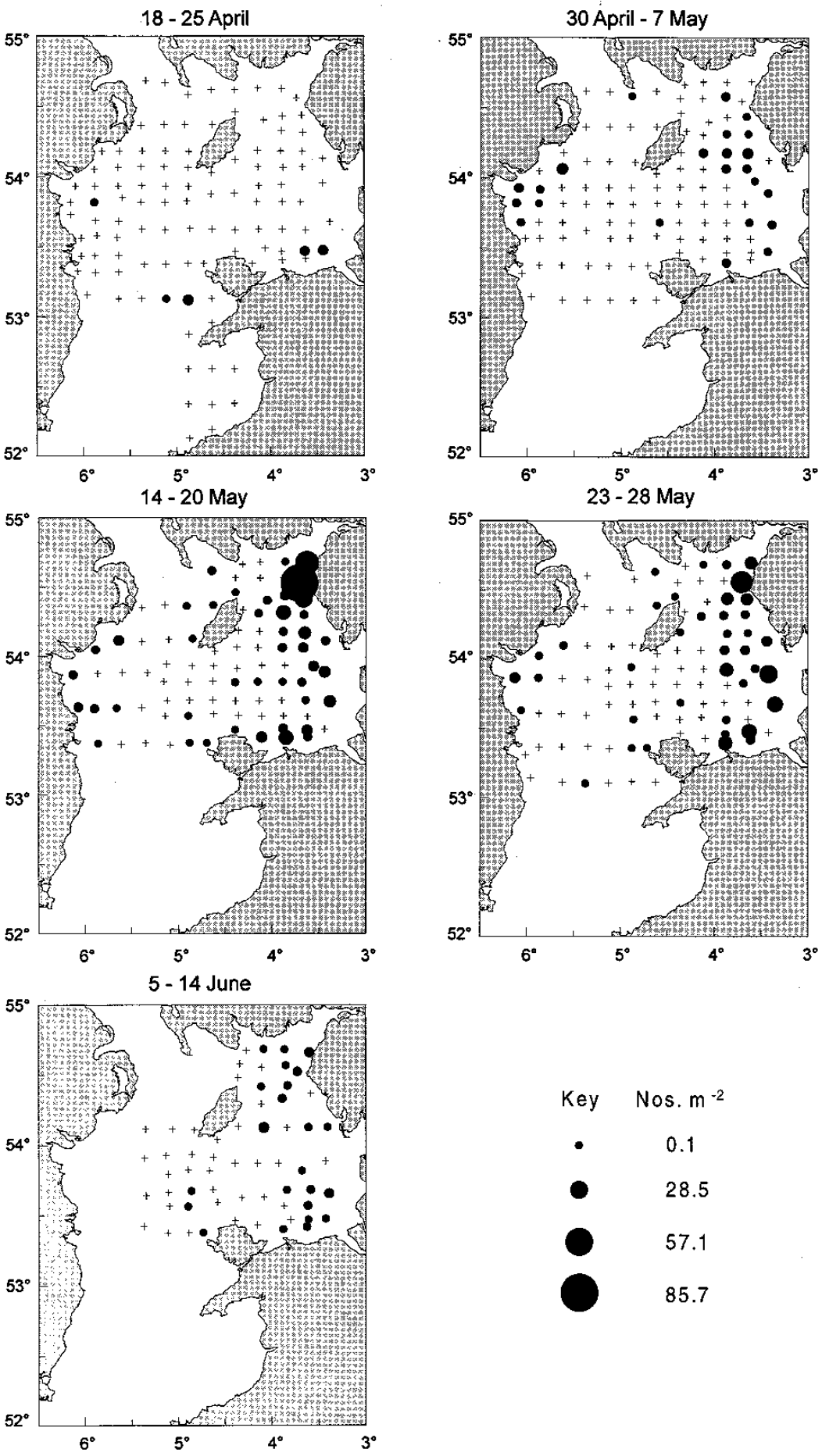

Figure 45. continued

Table 2(a). List of species occurring as eggs and the maximum concentration on each of 11 surveys in the Irish Sea in 1995. Species marked * have been plotted

Species	Maximum concentrations (nos.m^{-2})										
	11-19 Feb	21-27 Feb	8-14 Mar	15-22 Mar	30 Mar-06-Apr	12 -21 April	18 - 25 April	30 April-07-May	14-20 May	23-28 May	5-14 June
Clupeidae	-	-	-	-	-	-	-	-	5.2	-	-
Sprattus sprattus *	1.8	5.4	21.5	455.8	342.3	435.1	658.8	265.8	1123.0	654.1	1.4
Sardina pilchardus	-	-	-	-	-	-	0.8	-	-	-	0.9
Clupea harengus	-	-	-	-	-	-	-	-	-	-	-
Argentina sphyraena *	-	-	-	2.8	2.1	10.5	7.3	0.7	-	0.9	0.1
Gadus morhua *	8.6	21.2	80.7	83.6	376.8	295.3	63.4	34.2	3.3	4.1	0.4
Melanogrammus aeglefinus *	-	-	-	0.4	0.9	1.3	3.1	-	-	-	-
Onos spp. *	7.7	11.1	232.3	120.9	227.2	74.1	41.3	41.8	50.3	44.5	12.6
Molva molva *	-	0.2	0.1	4.9	7.3	7.7	7.3	29.8	2.2	4.7	37.3
Merluccius merluccius	-	-	-	-	-	4.7	-	-	-	-	-
Triglidae *	12.2	8.6	25.0	58.4	16.5	46.1	11.07	17.8	28.2	38.9	34.2
Cottidae.	-	-	-	-	-	-	1.41	-	-	-	-
Dicentrarchus labrax	-	-	-	-	1.7	0.2	-	1.5	-	8.4	0.6
Trachurus trachurus	-	-	-	-	-	2.5	0.5	5.9	-	-	-
Trachinus vipera	-	-	1.6	0.7	-	30.6	-	0.4	19.0	40.8	3.2
Trachinus draco	-	-	-	-	-	-	-	0.9	-	-	-
Hyperoplus lanceolatus	-	-	-	0.6	-	-	-	-	-	-	-
Ammodytidae	-	-	-	-	-	-	-	-	15.5	-	-
Callionymiidae*	4.4	37.5	47.7	339.3	864.8	483.7	269.3	251.1	104.7	136.3	9.2
Scomber scombrus *	-	-	-	-	0.6	3.3	1.3	0.28	47.9	163.8	1.6
Scophthalamus rhombus	-	-	-	-	-	-	-	0.4	-	-	-
Scophthalmus maximus	-	-	-	0.9	-	2.9	7.3	4.9	-	0.6	2.4
Arnoglossus laterna	-	-	-	17.6	-	-	8.5	2.1	-	-	-
Phrynorhombus norvegicus *	-	-	-	37.1	24.2	1.3	43.6	15.6	8.5	7.5	-
Zeugopterus punctatus	-	-	-	1.7	15.6	7.7	0.6	-	10.0	7.7	-
Pleuronectidae	-	-	-	-	0.1	-	-	-	-	-	-
Pleuronectes platessa *	33.9	64.2	80.7	93.2	35.1	24.8	14.7	4.6	1.1	-	0.2
Platichthys flesus	-	-	-	-	-	-	-	-	2.2	-	-
Limanda limanda	-	-	-	-	-	5.1	-	-	5.4	-	-
Microstomus kitt	-	-	-	-	-	-	-	-	2.1	0.5	-
Glyptocephalus cynoglossus	-	-	-	-	48.2	-	-	-	1.4	1.9	-
Hippoglossoides platessoides *	-	-	-	14.3	11.7	5.8	7.3	1.9	-	-	-
Solea solea *	1.1	1.8	1.5	10.9	18.6	41.9	70.4	66.7	76.8	27.4	12.7
Buglossidium luteum *	0.3	0.2	7.4	2.1	6.3	38.2	9.3	10.9	85.7	40.7	9.2
Microchirus variegatus	-	-	-	-	17.2	7.7	-	2.1	11.0	13.1	29.0
Unidentified spp.	249.0	1275.8	1756.4	3253.0	4198.0	2288.1	1069.9	360.8	161.6	253.9	404.2
Total number of stations worked	100	91	65	104	106	106	106	105	87	94	60

Table 2(b). List of species occurring as larvae and the maximum concentration on each of 11 surveys in the Irish Sea in 1995. Species marked * have been plotted

Species	Maximum concentrations (nos.m^{-2})										
	11-19 Feb	21-27 Feb	8-14 Mar	15-22 Mar	30 Mar-06-Apr	12 -21 April	18 - 25 April	30 April-07-May	14-20 May	23-28 May	5-14 June
Clupeidae *	2.8	1.3	0.3	-	169.5	12.5	-	73.0	135.1	156.2	96.2
Sprattus sprattus *	-	-	-	-	2.4	-	21.9	24.0	-	-	-
Sardina pilchardus	-	-	-	-	-	-	-	-	-	-	-
Clupea harengus	-	0.1	-	-	-	-	-	-	-	-	-
Argentina sphyraena *	-	-	-	-	0.2	-	1.0	0.7	0.6	-	-
Gobiesocidae	-	-	-	-	-	-	-	-	-	2.1	2.0
Diplecogaster bimaculata	-	-	-	-	-	-	-	-	-	-	1.7
Gadidae*	-	-	0.2	0.7	36.3	3.6	2.1	5.9	5.2	4.7	0.8
Gadus morhua *	-	0.1	0.1	1.2	9.7	7.8	12.2	10.2	3.0	1.1	0.4
Melanogrammus aeglefinus *	-	-	0.1	0.2	0.3	1.2	2.1	1.4	-	0.3	0.5
Merlangius merlangus *	-	-	1.2	0.9	109.0	13.4	74.5	42.0	18.2	30.9	7.2
Trisopterus minutus	-	-	-	-	-	-	0.3	-	-	-	-
Trisopterus luscus *	0.1	1.2	0.4	-	1.9	0.8	2.7	2.6	1.7	1.6	0.8
Pollachius pollachius *	-	-	-	-	1.7	0.5	1.2	0.7	0.7	3.1	0.1
Onos spp. *	0.1	0.1	-	-	96.9	5.7	54.3	20.4	8.0	10.6	7.8
Molva molva *	-	-	-	-	0.2	0.2	0.7	1.3	0.5	0.6	0.2
Merluccius merluccius	-	-	-	-	-	-	-	-	-	-	-
Scorpaenidae *	-	-	-	-	-	-	-	1.6	-	-	-
Triglidae *	-	-	-	-	-	0.2	-	0.5	-	11.7	0.4
Cottidae *	0.1	0.3	0.4	-	8.9	2.9	-	2.8	2.3	4.7	0.9
Myoxocephalus scorpius *	-	-	0.3	0.7	1.8	2.3	3.4	4.4	0.4	0.1	-
Taurulus bubalis *	-	-	-	2.9	0.1	0.1	2.5	0.8	-	-	-
Agonus cataphractus *	0.1	0.2	0.2	1.2	4.0	1.1	1.4	1.2	0.7	0.2	-
Cyclopterus lumpus	-	-	-	-	-	-	-	-	0.6	-	-
Liparis spp. *	-	0.5	1.2	3.1	24.2	7.5	8.7	9.6	4.0	5.0	1.1
Dicentrarchus labrax	-	-	-	-	-	-	-	-	-	-	-
Trachurus trachurus	-	-	-	-	-	-	-	-	-	-	-
Labrus bergylta	-	-	-	-	-	-	-	-	0.4	-	0.5
Trachinus vipera	-	-	-	-	-	-	-	-	-	-	0.9
Chirolophis ascanii *	-	-	0.2	3.2	1.5	0.2	1.4	0.9	-	-	-
Lumpenus lampretaeformis	-	-	-	-	0.5	1.7	-	-	0.6	-	-
Pholis gunnellus *	0.2	0.4	2.3	0.4	39.7	23.4	0.5	5.5	3.6	3.3	0.6
Ammodytidae *	0.4	10.0	37.9	189.0	50.6	15.0	23.9	50.5	9.2	13.7	6.3
Callionymiidae *	-	-	0.1	0.4	133.2	4.5	87.3	71.7	16.9	59.6	21.4
Gobiidae *	0.4	0.3	0.3	0.9	5.6	1.9	5.8	5.4	9.0	15.5	19.4
Scomber scombrus	-	-	-	-	-	-	-	-	-	-	-
Scophthalmus maximus	-	-	-	-	-	-	-	0.6	-	-	-
Phrynorhombus norvegicus *	-	-	-	-	4.2	0.3	-	0.8	4.4	2.1	0.9
Zeugopterus punctatus *	-	-	-	-	0.2	0.1	-	0.4	0.4	0.6	0.7
Pleuronectidae spp.	-	-	-	-	45.6	-	-	-	-	-	-
Pleuronectes platessa	1.2	4.8	1.1	2.1	12.1	0.8	0.6	0.4	0.3	0.9	-
Platichthys flesus *	-	-	0.8	0.4	12.1	11.7	24.3	48.3	37.4	18.4	1.4
Limanda limanda *	-	-	3.1	8.2	2070.2	42.4	211.6	164.7	93.7	114.8	25.5
Microstomus kitt *	-	-	-	-	-	0.2	1.9	1.4	1.8	2.7	0.3
Glyptocephalus cynoglossus *	-	-	-	-	23.2	2.1	8.1	3.2	2.0	1.8	0.9
Hippoglossoides platessoides *	-	-	-	-	5.8	2.0	18.4	2.6	2.9	1.7	0.1
Soleidae	-	-	-	-	-	0.2	-	-	0.5	4.3	0.1
Solea solea *	-	0.5	-	-	0.1	0.2	0.5	1.7	4.0	14.0	3.6
Buglossidium luteum	-	-	-	-	-	0.1	-	0.5	0.5	1.2	24.8
Microchirus variegatus	-	-	-	-	-	-	-	-	2.0	-	0.3
Unidentified spp.	-	-	-	0.8	-	-	14.3	0.4	-	-	-
Total number of stations worked	100	91	65	104	106	106	106	105	87	94	60

Table 2(c). List of species occurring as eggs and the frequency of their occurrence on each of 11 surveys in the Irish Sea in 1995

Species	% Positive stations										
	11-19 Feb	21-27 Feb	8-14 Mar	15-22 Mar	30 Mar-06-Apr	12 -21 April	18 - 25 April	30 April-07-May	14-20 May	23-28 May	5-14 June
Clupeidae	-	-	-	-	-	-	-	-	***1.1***	-	-
Sprattus sprattus	18.0	27.5	21.5	36.5	56.6	70.8	49.1	78.7	80.5	71.3	3.3
Sardina pilchardus	-	-	-	-	-	-	0.9	-	-	-	3.3
Clupea harengus	-	-	-	-	-	-	-	-	-	-	-
Argentina sphyraena	-	-	-	1.0	5.7	6.6	3.8	1.9	-	1.1	1.7
Gadus morhua	56.0	58.2	80.0	83.7	88.7	91.5	83.0	66.7	36.8	21.8	6.7
Melanogrammus aeglefinus	-	-	-	1.0	4.7	0.9	1.9	-	-	-	-
Onos spp.	49.0	62.6	60.0	68.3	84.9	90.6	39.6	79.6	96.6	86.2	85.0
Molva molva	-	1.1	1.5	6.7	28.3	18.9	19.8	24.1	6.9	7.4	41.7
Merluccius merluccius	-	-	-	-	-	2.8	-	-	-	-	-
Triglidae	8.0	13.2	20.0	21.2	43.4	53.8	23.6	34.3	60.9	53.2	65.0
Cottidae	-	-	-	-	-	-	0.9	-	-	-	-
Dicentrarchus labrax	-	-	-	-	2.8	1.9	-	3.7	-	14.9	5.0
Trachurus trachurus	-	-	-	-	-	6.6	0.9	13.9	-	-	-
Trachinus vipera	-	-	1.5	1.0	-	2.8	-	0.9	19.5	31.9	10.0
Trachinus draco	-	-	-	-	-	-	-	0.9	-	-	-
Hyperoplus lanceolatus	-	-	-	2.9	-	-	-	-	-	-	-
Ammodytidae	-	-	-	-	-	-	-	-	1.1	-	-
Callionymiidae	39.0	40.7	46.2	62.5	79.2	79.2	52.8	78.7	82.8	77.7	65.0
Scomber scombrus	-	-	-	-	1.9	2.8	0.9	0.9	36.8	82.6	6.7
Scophthalmus rhombus	-	-	-	-	-	-	-	0.9	-	-	-
Scophthalmus maximus	-	-	-	1.9	-	3.8	3.8	7.4	-	1.1	25.0
Arnoglossus laterna	-	-	-	5.8	-	-	5.7	2.8	-	-	-
Phrynorhombus norvegicus	-	-	-	62.5	14.2	0.9	34.0	58.3	31.0	38.3	-
Zeugopterus punctatus	-	-	-	1.0	12.3	0.9	0.9	-	23.0	18.1	-
Pleuronectidae	-	-	-	-	0.9	-	-	-	-	-	-
Pleuronectes platessa	58.0	54.9	63.1	60.6	64.2	62.3	34.9	19.0	4.6	-	1.7
Platichthys flesus	-	-	-	-	-	-	-	-	1.1	-	-
Limanda limanda	-	-	-	-	-	0.9	-	-	1.1	-	-
Microstomus kitt	-	-	-	-	-	-	-	-	5.7	1.1	-
Glyptocephalus cynoglossus	-	-	-	-	14.2	-	-	-	4.6	20.2	-
Hippoglossoides platessoides	-	-	-	2.9	14.2	2.8	1.9	1.9	-	-	-
Solea solea	10.0	15.4	18.5	27.9	45.3	48.1	56.6	69.5	71.3	52.1	68.3
Buglossidium luteum	3.0	3.3	12.3	7.7	12.3	22.6	4.7	21.3	49.4	41.5	38.3
Microchirus variegatus	-	-	-	-	3.8	2.8	-	2.8	35.6	25.5	60.0
Unidentified spp.	76.0	86.8	100.0	100.0	99.1	99.1	63.2	97.1	94.3	90.4	85.0
Total number of stations worked	100	91	65	104	106	106	106	105	87	94	60

Table 2(d). List of species occurring as larvae and the frequency of their occurrence on each of 11 surveys in the Irish Sea in 1995

Species	% Positive stations										
	11-19 Feb	21-27 Feb	8-14 Mar	15-22 Mar	30 Mar-06-Apr	12 -21 April	18 - 25 April	30 April-07-May	14-20 May	23-28 May	5-14 June
Clupeidae	20.0	11.0	1.5	-	39.6	43.4	-	57.1	95.4	96.8	93.3
Sprattus sprattus	-	-	-	-	0.9	-	41.5	25.7	-	-	-
Sardina pilchardus	-	-	-	-	-	-	-	-	-	-	-
Clupea harengus	-	1.1	-	-	-	-	-	-	-	-	-
Argentina sphyraena	-	-	-	-	0.9	-	0.9	1.0	1.1	-	-
Gobiesocidae	-	-	-	-	-	-	-	-	-	6.4	5.0
Diplecogaster bimaculata	-	-	-	-	-	-	-	-	-	-	3.3
Gadidae	-	-	3.1	3.8	7.5	18.9	27.4	41.9	28.7	31.9	15.0
Gadus morhua	-	1.1	1.5	10.6	29.2	31.1	40.6	56.2	27.6	18.1	5.0
Melanogrammus aeglefinus	-	-	1.5	1.9	1.9	10.4	13.2	9.5	-	1.1	1.7
Merlangius merlangus	-	-	9.2	6.7	37.7	45.3	59.4	84.8	78.2	80.9	76.7
Trisopterus minutus	-	-	-	-	-	-	0.9	-	-	-	-
Trisopterus luscus	1.0	2.2	1.5	-	16.0	14.2	13.2	28.6	18.4	11.7	15.0
Pollachius pollachius	-	-	-	-	6.6	4.7	6.6	13.3	6.9	5.3	1.7
Onos spp.	1.0	1.1	-	-	38.7	39.6	50.9	78.1	47.1	64.9	81.7
Molva molva	-	-	-	-	1.9	0.9	0.9	1.0	1.1	1.1	1.7
Merluccius merluccius	-	-	-	-	-	-	-	-	-	-	-
Scorpaenidae	-	-	-	-	-	-	-	7.6	-	-	-
Triglidae	-	-	-	-	-	0.9	-	1.9	-	3.2	5.0
Cottidae	1.0	8.8	6.2	-	27.4	43.4	-	23.8	27.6	17.0	18.3
Myoxocephalus scorpius	-	-	3.1	3.8	14.2	18.9	32.1	17.1	1.1	1.1	-
Taurulus bubalis	-	-	-	14.4	0.9	1.9	17.9	5.7	-	-	-
Agonus cataphractus	1.0	3.3	4.6	10.6	19.8	21.7	21.7	13.3	4.6	1.1	-
Cyclopterus lumpus	-	-	-	-	-	-	-	-	1.1	-	-
Liparis spp.	-	4.4	6.2	24.0	40.6	50.0	47.2	59.0	34.5	23.4	38.3
Dicentrarchus labrax	-	-	-	-	-	-	-	-	-	-	-
Trachurus trachurus	-	-	-	-	-	-	-	-	-	-	-
Labrus bergylta	-	-	-	-	-	-	-	-	1.1	-	3.3
Trachinus vipera	-	-	-	-	-	-	-	-	-	-	3.3
Chirolophis ascanii	-	-	4.6	8.7	12.3	5.7	9.4	2.9	-	-	-
Lumpenus lampretaeformis	-	-	-	-	1.9	4.7	-	-	1.1	-	-
Pholis gunnellus	2.0	1.1	15.4	1.9	51.9	66.0	3.8	38.1	31.0	20.2	6.7
Ammodytidae	3.0	11.0	13.8	42.3	67.0	71.7	85.8	83.8	56.3	38.3	63.3
Callionymiidae	-	-	1.5	2.9	31.1	40.6	57.5	84.8	75.9	88.3	90.0
Gobiidae	8.0	17.6	3.1	3.8	16.0	24.5	32.1	64.8	50.6	63.8	86.7
Scomber scombrus	-	-	-	-	-	-	-	-	-	-	-
Scophthalmus maximus	-	-	-	-	-	-	-	1.9	-	-	-
Phrynorhombus norvegicus	-	-	-	-	3.8	1.9	-	4.8	12.6	13.8	11.7
Zeugopterus punctatus	-	-	-	-	0.9	0.9	-	2.9	1.1	4.3	6.7
Pleuronectidae	-	-	-	-	0.9	-	-	-	-	-	-
Pleuronectes platessa	7.0	8.8	3.1	11.5	28.3	6.6	4.7	3.8	1.1	1.1	-
Platichthys flesus	-	-	3.1	3.8	30.2	44.3	51.9	66.7	56.3	51.1	43.3
Limanda limanda	-	-	18.5	17.3	50.9	64.2	77.4	84.8	89.7	93.6	93.3
Microstomus kitt	-	-	-	-	-	0.9	2.8	1.9	3.4	11.7	8.3
Glyptocephalus cynoglossus	-	-	-	-	17.0	13.2	10.4	18.1	5.7	10.6	13.3
Hippoglossoides platessoides	-	-	-	-	3.8	8.5	4.7	11.4	5.7	5.3	3.3
Soleidae	-	-	-	-	-	0.9	-	-	1.1	9.6	3.3
Solea solea	-	1.1	-	-	1.9	2.8	2.8	24.8	21.8	41.5	46.7
Buglossidium luteum	-	-	-	-	-	1.9	-	2.9	2.3	4.3	46.7
Microchirus variegatus	-	-	-	-	-	-	-	-	3.4	-	1.7
Unidentified spp.	-	-	-	6.7	-	-	24.5	1.9	-	-	-
Total number of stations worked	100	91	65	104	106	106	106	105	87	94	60

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