ISSN 1017-6195

ICES COOPERATIVE RESEARCH REPORT

RAPPORT DES RECHERCHES COLLECTIVES

NO. 218

Atlas of North Sea Benthic Infauna

International Council for the Exploration of the Sea

Conseil International pour l'Exploration de la Mer

ICES COOPERATIVE RESEARCH REPORT

RAPPORT DES RECHERCHES COLLECTIVES

NO. 218

ATLAS OF NORTH SEA BENTHIC INFAUNA

Based on the 1986 North Sea Benthos Survey

J. A. Craeymeersch, C. H. R. Heip, and J. Buijs

Netherlands Institute of Ecology
Centre for Estuarine and Coastal Ecology
Vierstraat 28
4401 EA Yerseke
The Netherlands

International Council for the Exploration of the Sea

Conseil International pour l'Exploration de la Mer

April 1997

ERRATA

to

ICES COOPERATIVE RESEARCH REPORT NO. 218

ATLAS OF NORTH SEA BENTHIC INFAUNA

Based on the 1986 North Sea Benthos Survey

Annex 3

- Page 32, Section 2: There is no DRIVER DISK. The sample CONFIG.SYS is found at the root of the floppy disk labelled CEMOMAP.
- Page 33, Section 4: Substitute BENTHOS.EXE with CEMOMAP.EXE.
- Page 33, Section 4.1: Substitute *Nepthys caeca* with *Nephrops norvegicus*.
- Page 33, Section 4.1: Substitute 'two steps' with 'four steps'.
- Page 34, Section 4.3: Substitute BENTHOS.EXE with CEMOMAP.EXE

Annex 4

- Page 35: For the file NSBS1.DB, insert 'Counts of replicates' between 'Date' and 'Macrobenthos'.
- Page 35: The file NSBS3.DB is not included on the distribution diskette.
- Page 35: The sequence of the fields in the file NBS4.DB is Sample id, Station id, Cruise id, SEDTYP, Silt%, Sand%, Median.
- Page 36: The sequence of the fields in the file NBS5.DB is Species id, Latin name, Genus, Familia, Ordo, Classis, Phylum, MCSSD-NO, Rubin-code.

DATABASE UPDATE

The database underlying the Atlas is updated regularly, and made available on the World Wide Web. To get access to the latest version of the database, open the URL http://www.ices.dk, and choose /Table of Contents/Publications/ICES Cooperative Research Report/No. 218.

TABLE OF CONTENTS

Acknowledgements

The following scientists participated in the North Sea Benthos Survey and the analyses of the data: A. Künitzer and E. Rachor (Alfred-Wegener-Institut, Bremerhaven, Germany); D. Basford and A. Eleftheriou (Marine Laboratory, Aberdeen, Scotland); C. Heip, J. A. Craeymeersch, P. M. J. Herman, R. Huys and K. Soetaert (Netherlands Institute of Ecology, Centre for Estuarine and Coastal Ecology, Yerseke, the Netherlands); J. M. Dewarumez (Station Marine, Wimereux, France); J. Dörjes (Institut für Meeresbiologie und Meeresgeologie "Senkenberg", Wilhelmshaven, Germany); G. C. A. Duineveld and P. A. J. de Wilde (Netherlands Institute for Sea Research, Texel, the Netherlands); P. Kingston (Heriot-Watt University, Institute of Offshore Engineering, Edinburgh, Scotland); U. Niermann (Biologische Anstalt Helgoland, Hamburg, Germany); H. Rumohr (Institut für Meereskunde, Kiel, Germany); T. Soltwedel (Institut für Hydrobiologie, University of Hamburg, Germany).

1 Introduction

In 1981, the International Council for the Exploration of the Sea established a Working Group on North Sea Benthos (Council Resolution 1981/2:6). One of the aims of the Working Group was to provide synoptic maps of qualitative and quantitative aspects of the status of the benthic communities in the North Sea. After reviewing the state-of-the-art of benthos investigations, the Working Group concluded that the available data were not sufficient to produce such a complete review of the faunal assemblages. The Working Group therefore recommended that a large-scale benthos survey, covering the whole North Sea and using standard sampling and processing techniques, be initiated to solve this problem (ICES, 1982; ICES, 1983). The programme was planned in more detail at the Working Group meetings in 1984 and 1985 (ICES, 1984; 1985).

The North Sea Benthos Survey (NSBS) was completed in early 1986 owing to the commitment of several marine institutes; it covered the area between 51° N and 58° N, and 3° W and 9° E. Samples were taken by grab and box-corer for macrobenthic infauna, with additional samples for epifauna and meiobenthic infauna. The complete list of replicates, dates, samples and stations has been reported to ICES (ICES, 1986) and is also contained in Annex 1 to this report. Data from the northern North Sea have been gathered during eight cruises from 1980 to 1985, always in spring and early summer (Eleftheriou and Basford, 1989). The northern area covered extends between 65°15'N and 60°45'N.

Together these results provided a database for the description of the benthic fauna of the entire North Sea. Results have been reported in Heip *et al.* (1992a; 1992b), Huys *et al.* (1992), Künitzer (1990), Künitzer *et al.* (1992) and Duineveld *et al.* (1991).

The main objective of the *Atlas of North Sea Benthic Infauna* is to make the data available to the scientific community. The diskettes enclosed contain an updated version of a program package developed to present the spatial distribution of both macro- and meiobenthic species and species groups (disk NSBS1), and the data as included in the North Sea Benthos Database BEDMAN (ICES, 1994) (disk NSBS2). Installation instructions and a user manual for the distribution program are given in Annex 3, and the database is described in Annex 4. A hardcopy of the distribution maps of 100 selected macrobenthic species (out of the almost 1000 species or taxa found) is presented in Annex 5; a brief general description of these maps is contained in Section 4 of this report. Distribution maps of the major meiobenthic taxa and copepod species have been reported previously by Huys (1991).

A main problem encountered in the macrobenthos data treatment was taxonomic. Although many taxonomical problems were solved during a special workshop on the taxonomy of North Sea benthos, held on Helgoland in 1988 (Heip and Niermann, 1988) where invited experts on certain taxonomic groups checked the identification of species, this turned out to be a major task. Therefore, the way the final species list (given in Annex 2) was generated is described in Section 2, below; this has previously been reported in Künitzer *et al.* (1992).

2 Generation of the species list

A species list integrating all species found by the different participants (including species sampled by box-corer, grab or trawl surveys, and some species recorded in earlier years) was circulated at the meeting of the Benthos Ecology Working Group in 1989 in Vigo, Spain. The list was checked for a) typing errors and different spellings, and b) synonyms. Spelling and synonyms were checked using the Marine Conservation Society species directory, a coded checklist of the marine fauna and flora of the British isles and its surrounding seas (Howson, 1987). The directory includes most of the species recorded during the NSBS. Further uniformity was achieved by, e.g., eliminating the second i at the end of certain species names (e.g., hartmanni instead of hartmannii), using the abbreviation 'sp.' if the species names were unknown, and 'indet.' for all higher taxa. If there is only one species (genus,...) within a genus (family,...), the lowest taxonomic level was used.

At a final workshop in Texel in 1989, the remaining taxonomic problems were resolved. For this workshop, a list of 'suspect' species was drawn up by calculating an index of particularity, expressing the degree to which species were found exclusively by one or a few laboratories. Depending on the number S_{obs} of stations in which a species is found, one can calculate the number L_{exp} of laboratories that should have found this species, if it were homogeneously distributed over the whole North Sea:

$$L_{exp} = \sum_{i=1}^{L_{tot}} \left[1 - \left(\frac{S_{tot} - S_i}{S_{obs}} \right) \Big/ \left(\frac{S_{tot}}{S_{obs}} \right) \right]$$

where

S_{tot} = total number of stations,
S_i = number of stations sampled by laboratory i,
L_{tot} = total number of laboratories.

The index of particularity describes the degree of digression from this hypothesis of homogeneity, by calculating

$$PISP = L_{exp} - L_{obs}$$

where L_{obs} = number of laboratories that have found the species.

The assumption of homogeneous distribution over the North Sea is in itself nonsensical, but the index provided a basis for a thorough discussion of the taxonomy used among the participants. An auxiliary basis for this discussion was a computerized atlas showing the spatial distribution of all species, genera, families and phyla (Herman and Braat, 1989).

The list of 'suspect' species proved very useful. Although many species were recognized by everyone, and were restricted to a few laboratories due to chance or their geographical distribution, several tens of species in the list turned out to be identified to different levels by different laboratories, or simply given different names following different taxonomical handbooks. It was noted that even well-established laboratories have different opinions on the taxonomy of some species. It was felt that at least some of these taxa need a review (e.g., Capitellidae, Sabellidae, Cirratulidae) before accurate identification can be made. It was decided to remove all species from the dataset for which the sampling gear (box-corer or grab) has clearly been inappropriate, namely, all fishes, meiobenthic species or groups (for example, Kinorhyncha indet., Platyhelminthes indet., Copepoda indet., Ostracoda indet.), other species only or mostly retained by a 0.5 mm sieve (e.g., *Ophelina modesta*, Oligochaeta indet.), larval stadia of crustaceans, all hyperiids (genera *Themisto, Euthemisto, Parathemisto*) as they are pelagic, all hyperbenthic and epibenthic species or groups (all shrimps, pagurids, seastars, the mysid *Schistomysis kervillei*, the euphausiid *Thyanoessa inermis*, and *Thia scutella*).

The revised species list ultimately contained 954 different taxa. Initially, there had been 1270 taxa. A total of 709 infauna macrobenthic taxa was found on the NSBS and Aberdeen stations (see Annex 2).

In spite of the very large effort, at least two errors remained in the species list. First, the species *Nephtys ciliata* should have been combined with *N. caeca* (as *N. ciliata* was also identified as a variety of *N. caeca*). Secondly, according to the Marine Conservation Society species directory, the correct spelling of *Pseudoeulalia exigua* should be *Pseudeulalia exigua*.

3 Density and biomass

Macrobenthic infauna was sampled by box corer and van Veen grab. The numbers of corers and/or grabs per sample, i.e., per station and per participant, are given in Annex 1. Average sample-values were used for mapping and further analyses. The biomass was measured either directly as ash-free dry weight or calculated from wet weight using appropriate conversion factors (Salzwedel *et al.*, 1985; Rumohr *et al.*, 1987).

4 Distribution maps

The distribution of all species and species groups can be seen using the enclosed computer program package CEMOMAP (for a description, see Annex 3). The distribution maps of selected species are also included in this atlas as a hardcopy in Annex 5. Occurrences of species are indicated by circles on the maps. The radius of the circle is proportional to the log-transformed abundance of the species. In contrast with the maps given by CEMOMAP, the scale on the maps in Annex 5 has not been adapted for each map and, hence, the circles can be compared directly from one map to another. A box-and-whisker plot expresses the frequency distribution of the non-zero observations on a logarithmic scale. Annex 3 contains an explanation of this kind of plot.

The selection of species included in this atlas (Annex 5) was done on basis of 1) their importance in the different North Sea assemblages, and 2) their sensitivity to human impact.

4.1 Species distribution and assemblages

The most important species for discriminating assemblages are given by Künitzer *et al.* (1992). These authors describe the macrofauna communities from the North Sea Benthos Survey and the northern North Sea surveys as based on a TWINSPAN classification using either presence/absence or density data (see Figure 1). The results have been summarized by Heip and Craeymeersch (1995) as given in the following paragraphs.

The species with the highest frequencies of occurrence in the North Sea are *Spiophanes bombyx, Pholoe* sp., *Goniada maculata* and *Amphiura filiformis*. They occur widely at nearly all depths and in a wide variety of sediments. A list of the thirty most frequent macrobenthic species of the North Sea is given in Table 1.

Indicator and preferential species of the TWINSPAN analysis of the macrofauna show one of three distribution types. Most species are either distributed south of a parallel to the northern edge of the Dogger Bank (50-m depth contour) or north of it. Species with a southern distribution may occur also in the central North Sea but

Table 1 The most frequent macrobenthic species of the North Sea Benthos Survey and the northern North Sea surveys combined (N=number of stations on which a species has been found; the total number of stations was 281) (Heip and Craeymeersch, 1995).

N	species
217	*Spiophanes bombyx*
196	*Scoloplos armiger*
188	*Pholoe* sp.
185	*Goniada maculata*
183	*Amphiura filiformis*
170	Anthozoa indet.
161	*Nephtys hombergii*
159	*Chaetozone setosa*
147	*Phoronis* sp.
143	*Owenia fusiformis*
136	*Myriochele* sp.
132	*Mysella bidentata*
130	*Ophelia borealis*
127	*Bathyporeia elegans*
122	*Lunatia poliana*
122	*Magelona* sp.
109	*Nephtys longosetosa*
108	*Echinocardium cordatum*
107	*Abra prismatica*
107	*Spiophanes kroyeri*
106	*Ophiura albida*
105	*Harpinia antennaria*
105	*Spio filicornis*
97	*Sthenelais limicola*
92	*Amphictene auricoma*
91	*Notomastus latericeus*
89	*Chamelea gallina*
89	*Phaxas pellucidus*
88	Capitellidae indet.
86	*Arctica islandica*
85	*Aonides paucibranchiata*
85	*Tellimya ferruginosa*

never north of the 100-m contour at 57–58°N; examples are *Ophiura albida*, *Echinocardium cordatum*, *Chamelea gallina* and *Tellimya ferruginosa*. Some of these species occur mainly in the central North Sea; these include *Chaetoderma nitidulum* and *Ampelisca tenuicornis*. Species with a northern distribution were usually not found south of the 50-m depth contour; these include, e.g., *Ophiura affinis*, *Montacuta substriata*, *Antalis entalis* and *Minuspio cirriferia*.

Some species are restricted to certain sediment types. On coarse sediments *Echinocyamus pusillus, Pisione remota, Glycera lapidum* and *Spisula elliptica* occur all over the North Sea, while *Sphaerosyllis bulbosa* and *Glycera celtica* are restricted to coarse sediments along the Scottish coast, and *Polycirrus medusa* and *Phoxocephalus holbolli* are restricted to coarse sediments in the southern and eastern parts of the North Sea. On fine sands, *Aricidea minuta, Bathyporeia elegans* and *Ophelia borealis* occur all over the North Sea, but *Bathyporeia guilliamsoniana, Fabulina fabula, Urothoe poseidonis* and *Sigalion mathildae* are only found in the southern North Sea on fine sand at depths less than 30 m. Sediments of muddy fine sand occur mainly in the southern North Sea at 3–50 m depth and in the western parts of the northern North Sea. Species with a wide distribution on this type of sediment are *Eudorella truncatula, Glycinde nordmanni* and *Harpinia antennaria. Callianassa subterranea, Nucula nitidosa, Chaetopterus variopedatus* and *Synelmis klatti* are restricted to the southern North Sea and *Leucon nasica, Thyasira ferruginea, Laonice sarsi* and *Molgula* sp. are restricted to the northern North Sea.

Table 2 Average density (individuals m^{-2}) per TWINSPAN group (see Figure 1) of the ten most abundant species (Heip and Craeymeersch, 1995).

TWIN 1a	TWIN IIa	TWIN IIIa	TWIN IVa
70 *Bathyporeia elegans*	469 *Amphiura filiformis*	333 *Myriochele* sp.	344 *Ophelia borealis*
69 *Magelona* sp.	270 *Mysella bidentata*	131 *Amphiura filiformis*	139 *Exogone hebes*
53 *Scoloplos armiger*	112 *Myriochele* sp.	48 *Diastylis lucifera*	108 *Glycera lapidum*
48 *Urothoe poseidonis*	95 *Phoronis* sp.	25 *Scoloplos armiger*	93 *Prionospio malmgreni*
36 *Ophelia borealis*	91 *Pholoe* sp.	20 *Goniada maculata*	81 *Echinocyamus pusillus*
34 *Angulus fabulus*	91 *Magelona* sp.	20 *Eudorella emarginata*	78 Ophiuroidea indet.
28 *Nicomache* sp.	70 *Scoloplos armiger*	17 *Spiophanes bombyx*	58 *Sphaerosyllis bulbosa*
28 *Spisula subtruncata*	51 *Chamelea gallina*	15 *Mysella bidentata*	48 *Spiophanes bombyx*
27 *Bathyporeia guilliamsoniana*	50 *Spiophanes bombyx*	14 *Spiophanes kroyeri*	48 Sipunculida indet.
27 *Spiophanes bombyx*	43 *Nucula nitidosa*	12 *Rhodine gracilior*	46 *Pisione remota*
TWIN Ib	**TWIN IIb**	**TWIN IIIb**	**TWIN IVb**
128 *Pisione remota*	93 *Spiophanes bombyx*	215 *Thyasira* sp.	145 *Pisione remota*
71 *Protodorvillea kefersteini*	85 *Bathyporeia elegans*	195 Capitellidae indet.	135 *Protodrilus* sp.
60 *Ophelia borealis*	81 *Amphiura filiformis*	158 *Myriochele* sp.	75 *Glycera lapidum*
43 *Goniadella bobretzkii*	56 *Magelona* sp.	123 Ophiuroidea indet.	71 *Echinocyamus pusillus*
36 *Scoloplos armiger*	55 *Mysella bidentata*	114 *Spiophanes kroyeri*	71 Sabellidae indet.
36 *Aonides paucibranchiata*	51 *Phoronis* sp.	112 *Owenia fusiformis*	45 *Aonides paucibranchiata*
23 *Branchiostoma lanceolatum*	49 *Myriochele* sp.	81 *Prionospio cirrifera*	45 *Goniada norvegica*
21 *Goodallia triangularis*	38 *Scoloplos armiger*	68 *Pholoe* sp.	40 *Owenia fusiformis*
21 *Echinocyamus pusillus*	34 Anthozoa indet.	65 *Paradoneis lyra*	35 *Hesionura elongata*
18 *Chaetozone setosa*	29 *Ophiura albida*	62 *Amphiura filiformis*	25 Sipunculida indet.

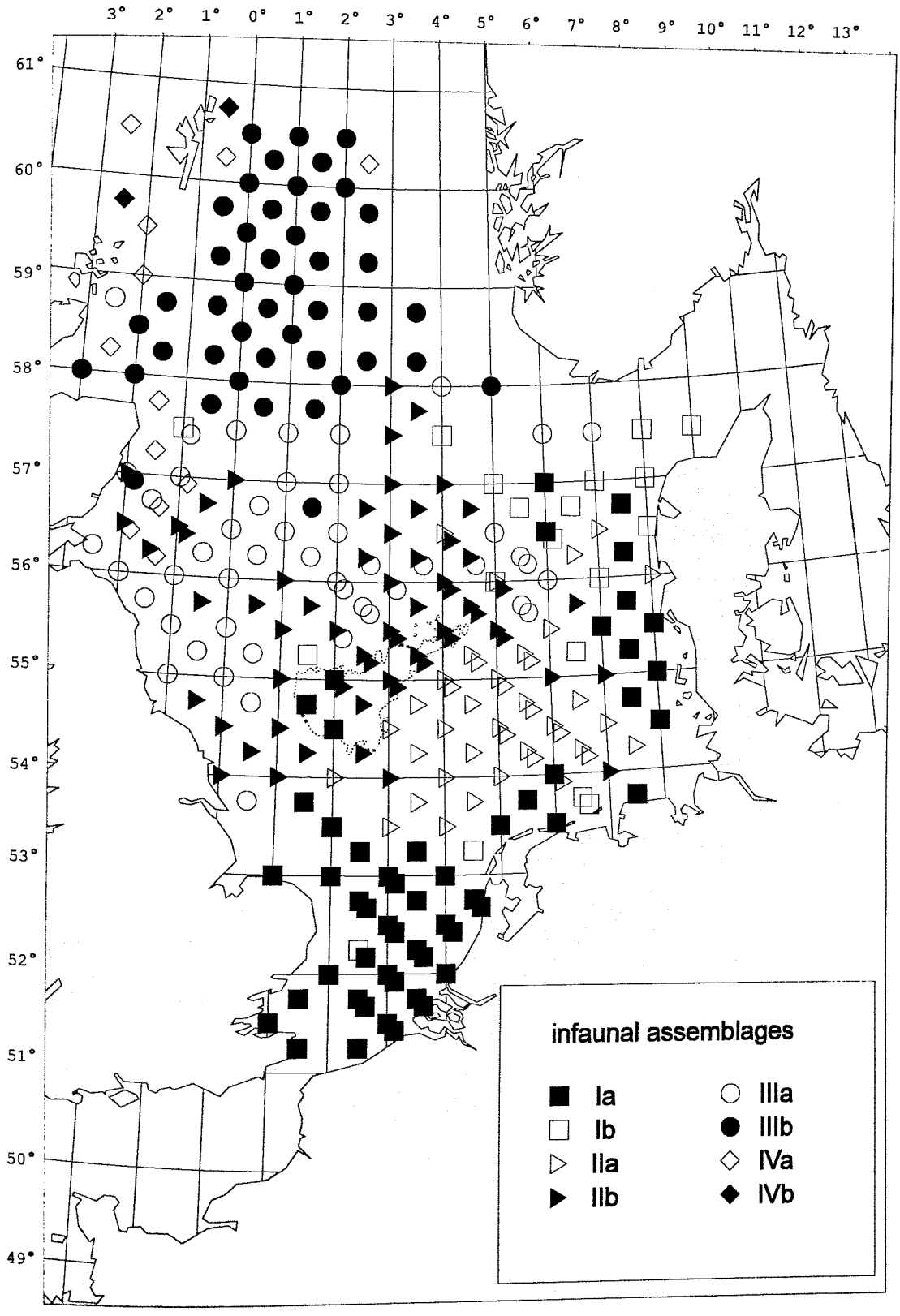


Figure 1 Classification of stations by TWINSPAN (species abundance data) (Künitzer *et al.*, 1992).

4.2 Anthropogenic effects

Among the maps showing the distribution of various species, presented in Annex 5, are included maps of species known to be affected by man by fishing activities, sand and gravel extraction, offshore oil activities, pollution, and/or eutrophication. No attempt has been made to review all relevant literature and, thus, to give a complete overview of species sensitive to disturbances of anthropogenic origin. The distribution of species mentioned but found at fewer than ten stations is not shown.

1 Impact of fishing activities

In addition to the catch of the target species, fishing involves by-catches of non-target fish and other organisms. In the case of benthos, towed fishing gears in contact with the seabed cause the mortality of infauna and epifauna. Infauna are most affected by gears or gear parts that penetrate the seabed, such as beam trawls or otter boards of bottom trawls. Depending on the type of substrate, beam trawls may penetrate the sediment to a depth of 6 cm or more (NSTF, 1993).

Effects of fishing on benthic communities have been described by, e.g., Graham (1955), Bridger (1970), Houghton *et al.* (1971), de Groot and Apeldoorn (1971), Margetts and Bridger (1971), de Groot (1973), Riesen and Reise (1982), Bergman *et al.* (1991), Rees and Dare (1993), and de Groot and Lindeboom (1994). Damage, mortality and reduction in numbers have been reported for *Arctica islandica*, *Echinocardium* sp., *Lanice conchilega, Ophiura ophiura, Astropecten irregularis, Lagis koreni, Liocarcinus holsatus, Cancer pagurus, Corystes cassivelaunus*, *Tellina* sp., *Hya* sp., and *Spiophanes bombyx*. The presence (and condition) of infaunal benthos in beam trawls appears to confirm the extent of damage to other species such as *Lagis* sp., *Ensis* sp., *and Solen* sp. On local scales the loss of target populations, such as oysters, and the destruction of physical structures such as *Sabellaria* reefs is well documented. The disappearance of species such as *Ostrea edulis, Modiolus modiolus, Dosinia exoleta, Glycymeris glycymeris, Arctica islandica,* and *Neptunea antiqua* has been ascribed as being caused by the beam trawl fishery.

2 Impact of sand and gravel extraction

During the process of sand and gravel extraction, the benthic community present will be destroyed. Recolonization will depend on the magnitude of extraction, the new surface sediments, the water quality of the burrow site, and the types of organisms involved (QSR4, 1993). In a study on the Klaverbank, it has been shown that many species managed to survive by rapid recolonization or by adaptations which enable them to withstand aggregate redistribution. However, large bivalves (*Arctica islandica, Gari fervensis, Arcopagia crassa, Paphia rhomboides, Dosinia exoleta, Ensis* sp.), an important component of the biomass, had not yet recovered from gravel extraction two years after the extraction activities ceased (van Moorsel, 1993).

3 Impact of offshore oil exploration and exploitation

Offshore oil exploration and exploitation activities can, as a result of discharges of cuttings contaminated with (washed or unwashed) oil-based muds (OBM), result in long-term local effects on the benthic system. Effects of water-based muds cannot be ruled out, but will be found in smaller areas over a shorter period of time than the effects of oil-based muds. Daan *et al.* (1990; 1991; 1992) provided the following list of species which had shown susceptibility to contamination by oil-based muds by their relatively low densities, or even absence: *Tellimya ferruginosa, Scalibregma inflatum, Pholoe minuta, Amphictene auricoma, Amphiura filiformis, Echinocardium cordatum, Mysella bidentata, Nephtys hombergi, Lumbrineris latreilli, Chaetozone setosa, Owenia fusiformis, Nucula nitidosa, Gattyana cirrosa, Harpinia antennaria, Lagis koreni, Glycinde nordmanni, Cylichna cilindracea, Harmothoe longisetis, Callianassa subterranea, Magelona papillicornis, Fabulina fabula, Lunatia alderi, Spiophanes bombyx, Ophiodromus flexuosus, Notomastus latericeus, Lumbrineris fragilis, Amphiura chiajei, Leucothoe incisa, Chaetopterus variopedatus, Tharyx marioni, Ophiura albida, Gyptis capensis, Lanice conchilega, Perioculodes longimanus, Diplocirrus glaucus, Abra alba, Turritella communis, Sthenelais limicola, Mysella bidentata, Corbula gibba, Thracia convexa, Ampelisca brevicornis,* and *Glycera rouxi*. The distribution of these species in the Dutch sector of the continental shelf of the North Sea has been reported previously by Bergman and Duineveld (1990).

4 Effects of pollution

Due to the complexity of the processes occurring in the marine environment and the occurrence of numerous contaminants, it is generally very difficult to find full proof of the effects of a specific contaminant on the ecosystem. It is even more difficult to determine the consequences of the exposure of biota to the total mix of contaminants (QSR4, 1993). The best known effect is probably the increased frequency of imposex in *Buccinum undatum, Nucella lapillus* and, probably, *Nassarius reticulatus* (Bryan *et al.*, 1986; ten Hallers-Tjabbers *et al.*, 1994). Rygg (1985) made a list of species indicative of the impact of contaminants based on the assumption that increased contaminant loads and lowered diversity are correlated and that different species respond differently to contamination. The following species were significantly absent from low-diversity stations, and defined as non-tolerant: *Paramphinome jeffreysi, Harmothoe* sp., *Synelmis klatti, Ceratocephale loveni, Glycera rouxi, Lumbrineris* sp., *Drilonereis filum, Orbinia norvegica, Levinsenia gracilis, Laonice cirrata, Minuspio cirrifera, Spiophanes kroyeri, Diplocirrus glaucus, Brada villosa, Ophelina* sp., *Notomastus latericeus, Maldane sarsi, Asychis biceps, Rhodine* sp.,

Amphictene auricoma, Melinna cristata, Eclysippe vanelli, Streblosoma bairdi, Terebellides stroemi, Eudorella emarginata, Harpinia sp., *Westwoodilla caecula, Eriopisa elongata, Calocaris macandreae, Nucula sulcata, Nuculoma tenuis, Yoldiella lucida, Thyasira equalis, Kelliella miliaris, Mysella bidentata, Abra nitida, Amphiura chiajei, Amphiura filiformis, Amphilepis norvegica, Brissopsis lyrifera,* and *Labidoplax buski.*

5 Effects of eutrophication

Increased rates of plankton sedimentation or amounts of macroalgal debris resulting from an increased production and biomass of phytoplankton due to nutrient enrichment, will increase the quantity of organic seston that will affect the nutrient supply to the benthos as well as the oxygen requirement of the sediment (NSTF, 1993). Changes in zoobenthic biomass and community structure have been documented in the Kattegat, the eastern Skagerrak, the Wadden Sea, parts of the Southern Bight, and the German Bight. Increased food resources have resulted in an increased benthic biomass, accompanied by a shift towards greater dominance of small, opportunistic, short-lived species. In several areas these species have taken over the niche of more long-lived species.

On the Dogger Bank, polychaete species such as *Spiophanes bombyx* and *Scoloplos armiger* have increased in numbers (Kröncke, 1992). In muddy areas in the inner German Bight, *Echinocardium cordatum* and *Nucula nitidosa* have become less important (Rachor, 1990). The ophiurid *Amphiura filiformis* was found in increasing densities in several studies related to enrichment of organic matter. Duineveld *et al.* (1987) suggested that the increase of *A. filiformis* in the shallower parts of the North Sea (1938/1950–1986) could indicate an enhanced food supply for the benthos, which may have some relation to the eutrophication in nearshore areas.

The decomposition of organic matter may result in low oxygen concentrations or even oxygen deficiencies, causing mortality of benthic organisms. Dyer *et al.* (1983) found many dead macrobenthic animals (*Echinocardium cordatum, Aphrodite aculeata, Corystes cassivelaunus* and *Astropecten irregularis*) in his dredge samples (emergence behaviour). Niermann *et al.* (1990) found *Owenia fusiformis, Lanice conchilega, Spio filicornis*, juvenile bivalves, and especially juveniles of the echinoderms *Ophiura albida* and *Echinocardium cordatum* either reduced in abundance or not occurring at all under the hypoxic conditions in the German Bight in the summer of 1983.

5 References

Bergman, M. J. N., and Duineveld, G. C. A. 1990. Verspreiding van OBM-gevoelige macrobenthos-soorten in de Noordzee. NIOZ Rapport 1990-7.

Bergman, M. J. N., Lindeboom, H. J., Peet, G., Nelissen, P. H. M., Nijkamp, H., and Leopold, M. F. 1991. Beschermde gebieden Noordzee - noordzaak en modelijkheden. NIOZ Rapport 1991-3.

Bridger, J. P. 1970. Some effects of the passage of a trawl over a seabed. ICES CM 1970/B:10.

Bryan, G. W., Gibbs, P. E., Hummerstone, L. G., and Burt, G. R. 1986. The decline of the gastropod *Nucella lapillus* around south-west England: evidence for the effect of tributyltin from antifouling paints. Journal of the Marine Biological Association of the UK, 66: 767-777.

Daan, R., Lewis, W. E., and Mulder, M. 1990. Biological effects of discharged oil-contaminated drill cuttings in the North Sea. Netherlands Institute for Sea Research, Report 1990-5: 1-77.

Daan, R., Lewis, W. E., and Mulder, M. 1991. Biological effects of washed OBM drill cuttings discharged on the Dutch Continental Shelf. Netherlands Institute for Sea Research, Report 1991-8: 1-33.

Daan, R., Mulder, M., and Lewis, W. E. 1992. Long-term effects of discharges of washed and unwashed OBM drill cuttings on the Dutch Continental Shelf. Netherlands Institute for Sea Research, Report 1992-9: 1-39.

de Groot, S. J. 1973. De invloed van trawlen op de zeebodem. Visserij, 26: 401-409.

de Groot, S. J., and Apeldoorn, J. M. 1971. Some experiments on the influence of the beamtrawl on the bottomfauna. ICES CM 1971/B:2.

de Groot, S. J., and Lindeboom, H. J. (eds.) 1994. Environmental impact of bottom gears on benthic fauna in relation to natural resources management and protection of the North Sea. Netherlands Institute for Fisheries Research (RIVO-DLO) Report CO26/94, Netherlands Institute for Sea Research (NIOZ) Report 1994-11. 257 pp.

Duineveld, G. C. A., Künitzer, A., and Heymann, R. P. 1987. *Amphiura filiformis* (Ophiuroidea: Echinodermata) in the North Sea. Distribution, present and former abundance and size composition. Netherlands Journal of Sea Research, 21: 317-329.

Duineveld, G. C. A., Künitzer, A., Niermann, U., de Wilde, P. A. W. J., and Gray, J. S. 1991. The macrobenthos of the North Sea. Netherlands Journal of Sea Research, 28: 53–65.

Dyer, M. F., Pope, J. G., Fry, P. D., Law, R. J., and Portmann, J. E. 1983. Changes in fish and benthos catches off the Danish coast in September 1981. Journal of the Marine Biological Association of the UK, 63: 767–775.

Eleftheriou, A., and Basford, D. J. 1989. The macrobenthic infauna of the offshore northern North Sea. Journal of the Marine Biological Association of the UK, 69: 123–143.

Graham, M. 1955. Effects of trawling on animals of the sea-bed. Deep Sea Research, 3: 1–6.

Heip, C., and Niermann, U. (eds.) 1988. Taxonomy of North Sea benthos. Proceedings of a workshop organized in Helgoland 8–12 February 1988. Delta Institute for Hydrobiological Research, Yerseke.

Heip, C., and Craeymeersch, J. A. 1995. Benthic community structure in the North Sea. Helgoländer Meeresuntersuchungen, 49: 313–328.

Heip, C., Basford, D., Craeymeersch, J. A., Dewarumez, J. M., Dörjes, J., de Wilde, P., Duineveld, G., Eleftheriou, A., Herman, P. M. J., Niermann, U., Kingston, P., Künitzer, A., Rachor, E., Rumohr, H., Soetaert, K., and Soltwedel, T. 1992a. Trends in biomass, density and diversity of North Sea macrofauna. ICES Journal of Marine Science, 49: 13–22.

Heip, C., Basford, D., Craeymeersch, J. A., Dewarumez, J. M., de Wilde, P., Dörjes, J., Duineveld, G., Eleftheriou, A., Herman, P. M. J., Huys, R., Irion, G., Niermann, U., Kingston, P., Künitzer, A., Rachor, E., Rumohr, H., Soetaert, K., and Soltwedel, T. 1992b. The benthic communities of the North Sea: A summary of the results of the North Sea Benthos Survey. *In* Report of the ICES Advisory Committee on Marine Pollution, 1992. ICES Cooperative Research Report, No 190: 148–175.

Herman, P. M. J., and Braat, M. P. W. J. 1989. BENTMAP. Installation and user manual. Delta Institute for Hydrobiological Research, Yerseke.

Houghton, R. G., Williams T., and Blacker, R. W. 1971. Some effects of double beam trawling. ICES CM 1971/B:5.

Howson, C. M. (ed.) 1987. Directory of the British marine fauna and flora. A coded checklist of the marine fauna and flora of the British Isles and its surrounding seas. Marine Conservation Society. 471 pp.

Huys, R. 1991. The meiobenthos of the North Sea. Final Report. Delta Institute for Hydrobiological Research, Yerseke, the Netherlands.

Huys, R., Herman, P. M. J., Heip, C. H. R., and Soetaert, K. 1992. The meiobenthos of the North Sea: density, biomass trends and distribution of copepod communities. ICES Journal Marine Science, 49: 23–44.

ICES. 1982. First Report of the North Sea Benthos Working Group, Texel, 8–12 March 1982. ICES CM 1982/L:39.

ICES. 1983. Second Report of the Benthos Methodics Working Group, Hamburg, 5–8 April 1983. ICES CM 1983/L:38.

ICES. 1984. Third Report of the Benthos Methodics Working Group, Hirtshals, 15–18 May 1984. ICES CM 1984/L:36.

ICES. 1985. Fourth Report of the Benthos Methodics Working Group, Bremerhaven, 25–29 March 1985. ICES CM 1985/L:33.

ICES. 1986. Fifth Report of the Benthos Ecology Working Group, Ostende, 12–15 May 1986. ICES CM 1986/C:27.

ICES. 1994. Report of the Benthos Ecology Working Group, Yerseke, 9–13 May 1994. ICES CM 1994/L:4.

Kröncke, I. 1992. Macrofauna standing stock of the Dogger Bank. A camparison: III. 1950–54 versus 1985–87. A final summary. Helgoländer Meeresuntersuchungen, 46: 137–169.

Künitzer, A. 1990. The infauna and epifauna of the central North Sea. Meeresforschung, 33: 23–37.

Künitzer, A., Basford, D., Craeymeersch, J. A., Duineveld, G. C. A., Dewarumez, J. M., Dörjes, J., Heip, C., Herman, P., Kingston, P., Niermann, U., Rachor, E., Rumohr, H., and de Wilde, P. A. J. 1992. The benthic infauna of the North Sea: species distribution and assemblages. ICES Journal of Marine Science, 49: 127–143.

Margetts, A. R., and Bridger, J. P. 1971. The effect of a beamtrawl on the sea bed. ICES CM 1971/B:8.

Niermann, U., Bauerfield, E., Hickel, W., and von Westernhagen, H. 1990. The recovery of benthos following the impact of low oxygen content in the German Bight. Netherlands Journal of Sea Research, 25: 215-226.

NSTF. 1993. North Sea Quality Status Report 1993. North Sea Task Force. Oslo and Paris Commissions, London. 132 pp.

QSR4. 1993. North Sea Subregion 4 Assessment Report 1993.

Rachor, E. 1990. Changes in sublittoral zoobenthos in the German Bight with regard to eutrophication.Netherlands Journal of Sea Research, 25: 209-214.

Rees, H. L., and Dare, P. J. 1993. Sources of mortality and associated life-cycle traits of selected benthic species: a review. Data Report, MAFF Directorate Fisheries Research, Lowestoft (33), 36 pp.

Riesen, W., and Reise, K. 1982. Macrobenthos of the subtidal Wadden Sea: revisited after 55 years. Heloglander Meeresuntersuchungen, 35: 409-423.

Rumohr, H., Brey, T., and Ankar, S. 1987. A comparison of biometric conversion factors for benthic invertebrates in the Baltic Sea. Baltic Marine Biologists Publication No. 9: 1-56.

Rygg, B. 1985. Distribution of species along pollution-induced diversity gradients in benthic communities in Norwegian fjords. Marine Pollution Bulletin, 16: 469-474.

Salzwedel, H., Rachor, E., and Gerdes, D. 1985. Benthic macrofauna communities in the German Bight.Veröffentlichungen des Instituts für Meeresforschung in Bremerhaven, 20: 199-267.

ten Hallers-Tjabbers, C. C., Kemp, J. F., and Boon, J. P. 1994. Imposex in whelks (*Buccinum undatum*) from the open North Sea: relation to shipping traffic intensities. Marine Pollution Bulletin, 28: 311-313.

van Moorsel, G. W. N. M. 1993. Long-term recovery of geomorphology and population development of large molluscs after gravel extraction at the Klaverbank (North Sea). Bureau Waardenburg, Culemborg, the Netherlands.

Annex 1

1986 North Sea Benthos Survey: field sampling

Institute/ship	Station number	Number of samples			Dates	°Beaufort
		Corer	van Veen	Dredge or beamtrawl		
RUG/BELGICA	3	1	-	-	08/04/86	7-10
RUG/BELGICA	4	2	1	-	02/04/86	
RUG/BELGICA	6	1	3	-	08/04/86	7-10
RUG/BELGICA	7	3	1	-	01/04/86	
NIOZ/TYRO	7	5	-	-	17/04/86	0
RUG/BELGICA	8	1	3	-	08/04/86	7-10
RUG/BELGICA	9	1	3	-	29/04/86	
NIOZ/TYRO	9	5	-	1	18/04/86	
RUG/BELGICA	10	2	1	-		7-10
NIOZ/TYRO	10	5	-	1	17/04/86	2
RUG/BELGICA	11	2	-	-	08/04/86	7-10
RUG/BELGICA	12	1	3	-	29/04/86	
NIOZ/TYRO	12	5	-	-	18/04/86	2
RUG/BELGICA	13	-	5	-	10/04/86	7-10
NIOZ/TYRO	13	5	-	1	17/04/86	5
RUG/BELGICA	14	1	3	-	08/04/86	7-10
NIOZ/TYRO	14	5	-	-	18/04/86	2
RUG/BELGICA	15	1	3	-	30/04/86	
NIOZ/TYRO	15	5	-	-	17/04/86	2
RUG/BELGICA	16	-	-	-	08/04/86	7-10
RUG/BELGICA	17	1	3	-	29/04/86	
NIOZ/TYRO	17	5	-	-	18/04/86	3
RUG/BELGICA	18	1	3	-	30/04/86	
RWS/HOLLAND	18	2	1	1	02/05/86	
NIOZ/TYRO	18	5	-	1	17/04/86	3
NIOZ/TYRO	19	5	-	-	19/04/86	3
RUG/BELGICA	19	1	3	-	30/04/86	
RWS/HOLLAND	19	2	1	1	02/05/86	
RUG/BELGICA	20	-	5	-	09/04/86	7-10
NIOZ/TYRO	20	5	-	1	17/04/86	2
RUG/BELGICA	21	-	-	-		
NIOZ/TYRO	21	5	-	1	16/04/86	3
RUG/BELGICA	22	-	-	-		
RUG/BELGICA	23	-	5	-	09/04/86	7-10
NIOZ/TYRO	23	5	-	-	19/04/86	4
RUG/BELGICA	24	-	5	-	09/04/86	7-10

Institute/ship	Station number	Number of samples			Dates	°Beaufort
		Corer	van Veen	Dredge or beamtrawl		
NIOZ/TYRO	24	5	-	1	19/04/86	3
NIOZ/TYRO	25	5	-	1	16/04/86	4
NIOZ/TYRO	26	-	-	-		
RUG/BELGICA	27	-	-	-		
RUG/BELGICA	28	-	5	-	09/04/86	7-10
RUG/BELGICA	29	-	5	-	09/04/86	7-10
NIOZ/TYRO	29	5	-	1	19/04/86	3
NIOZ/TYRO	30	5	-	1	19-20 "	3
NIOZ/TYRO	31	5	-	-	01/05/86	2
RUG/BELGICA	32	-	2	-	09/04/86	7-10
RUG/BELGICA	33	-	5	-	09/04/86	7-10
NIOZ/TYRO	33	2	3	-	21/04/86	3
NIOZ/TYRO	34	5	-	1	20/04/86	6
NIOZ/TYRO	35	5	-	1	20/04/86	2
NIOZ/TYRO	36	5	--	1	01/05/86	
NIOZ/TYRO	37	5	-	1	30/04/86	0
RWS/HOLLAND	39	2	1	-	22/04/86	
RWS/HOLLAND	40	2	1	1	01/05/86	
NIOZ/TYRO	41	-	-	-	20/04/86	3
NIOZ/TYRO	42	5	-	1	20/04/86	5
NIOZ/TYRO	43	5	-	1	01/05/86	3
NIOZ/TYRO	44	5	-	1	30/04/86	2
NIOZ/TYRO	45	5	-	1	30/04/86	2
Wilhelmshaven/SENCKENBERG	45	3	-	1	21/04/86	6
Wilhelmshaven/SENCKENBERG	46	3	-	1	24/04/86	4
RWS/HOLLAND	47	2	1	-	22/04/86	5
RWS/HOLLAND	48	2	1	I	01/05/86	
NIOZ./TYRO	49	5	-	1	21/04/86	3
NIOZ/TYRO	50	5	-	-	21/04/86	6
NIOZ/TYRO	51	2	-	1	22/04/86	8
NIOZ/TYRO	52	5	-	1	30/04/86	2
NIOZ/TYRO	53	5	-	1	29/04/86	3
Wilhelmshaven/SENCKENBERG	53	3	-	-	21/04/86	6
Wilhelmshaven/SENCKENBERG	54	3	-	-	21/04/86	6
Bremerhaven/VICT. HENSEN	55	3	1	-	25/04/86	
RWS/HOLLAND	56	2	1	-	22/04/86	3

Institute/ship	Station number	Number of samples			Dates	°Beaufort
		Corer	van Veen	Dredge or beamtrawl		
RWS/HOLLAND	57	2	1	1	01/05/86	
NIOZ/TYRO	58	5	-	I	21/04/86	3
NIOZ/TYRO	59	5	-	1	21/04/86	5
NIOZ/TYRO	60	-	-	-	22/04/86	8
NIOZ/TYRO	60	5	-	1	01/05/86	3
NIOZ/TYRO	61	5	-	1	29/04/86	3
Wilhelmshaven/SENCKENBERG	61	3	-	1	21/04/86	6
NIOZ/TYRO	62	5	-	1	29/04/86	0
Wilhelmshaven/SENCKENBERG	62	3	-	1	21/04/86	6
Bremerhaven/VICT. HENSEN	63	3	1	x	25/04/86	
Hamburg/FRIED. HEINCKE	64	-	-	-		
RWS/HOLLAND	65	2	1	-	22/04/86	3
RWS/HOLLAND	66	2	1	1	01/05/86	
NIOZ/TYRO	67	5	-	1	23/04/86	3
NIOZ/TYRO	68	5	-	1	23/04/86	4
NIOZ/TYRO	69	5	-	1	22/04/86	6
NIOZ/TYRO	70	5	-	1	22/04/86	3
Wilhelmshaven/SENCKENBERG	70	3	-	-	21/04/86	6
NIOZ/TYRO	71	5	-	1	29/04/86	
Wilhelmshaven/SENCKENBERG	71	3	-	-	23/04/86	4
Bremerhaven/VICT. HENSEN	72	-	3	-	25/04/86	
Bremerhaven/VICT. HENSEN	72	-	3	-	25/04/86	
Hamburg/FRIED. HEINCKE	73	2	1	1	13/04/86	
RWS/HOLLAND	74	2	1	-	23/04/86	2-3
RWS/HOLLAND	75	2	1	1	01/05/86	
RWS/HOLLAND	76	2	1	1	01/05/86	
NIOZ/TYRO	77	5	-	1	23/04/86	3
NIOZ/TYRO	78	5	-	1	23/04/86	3
NIOZ/TYRO	79	-	-	-	22/04/86	7
NIOZ/TYRO	79	5	-	1	24/04/86	3
Wilhelmshaven/SENCKENBERG	79	-	-	-	23/04/86	
NIOZ/TYRO	80	5	-	1	28/04/86	3
Wilhelmshaven/SENCKENBERG	80	3	-	1	23/04/86	4
Bremerhaven/VICT. HENSEN	81	3	1	x	25/04/86	
Hamburg/FRIED. HEINCKE	82	1-2	3	1	15/04/86	
RWS/HOLLAND	83	2	1	-	23/04/86	2-3

Institute/ship	Station number	Number of samples			Dates	°Beaufort
		Corer	van Veen	Dredge or beamtrawl		
Wilhelmshaven/SENCKENBERG	84	3	-	-	19/04/86	
Wilhelmshaven/SENCKENBERG	85	3	-	-	19/04/86	4
Wilhelmshaven/SENCKENBERG	86	3	-	-	20/04/86	5
NIOZ/TYRO	86	5	--	1	23/04/86	3
Wilhelmshaven/SENCKENBERG	87	3	-	-	20/04/86	6
NIOZ/TYRO	87	5	-	1	24/04/86	4
Wilhelmshaven/SENCKENBERG	88	3	-	-	20/04/86	6
NIOZ/TYRO	88	5	--	1	24/04/86	3
Wilhelmshaven/SENCKENBERG	89	3	-	-	23/04/86	4
NIOZ/TYRO	89	5	-	1	28/04/86	3
Bremerhaven/VICT. HENSEN	90	-	3	-	25/04/86	
Hamburg/FRIED. HEINCKE	91	2	3	1	15/04/86	
Hamburg/FRIED. HEINCKE	92	2	3	1	15/04/86	
RWS/HOLLAND	93	2	1	-	23/04/86	2-3
Wilhelmshaven/SENCKENBERG	94	3	-	1	19/04/86	4
Wilhelmshaven/SENCKENBERG	95	3	-	1	20/04/86	5
Wilhelmshaven/SENCKENBERG	96	3	-	1	20/04/86	5
NIOZ/TYRO	96	5	-	1	24/04/86	3
Wilhelmshaven/SENCKENBERG	97	3	-	-	18/04/86	2
NIOZ/TYRO	97	5	-	1	24/04/86	3
Wilhelmshaven/SENCKENBERG	98	3	-	1	23/04/86	4
NIOZ/TYRO	98	5	-	1	25/04/86	3
NIOZ/TYRO	99	5	-	1	28/04/86	2
Bremerhaven/VICT. HENSEN	99	-	3	2	25/04/86	
Bremerhaven/VICT. HENSEN	100	3	I	x	19/04/86	
Hamburg/FRIED. HEINCKE	101	2	3	1	16/04/86	
Hamburg/FRIED. HEINCKE	102					
RWS/HOLLAND	103	2	1	-	23/04/86	3
Wilhelmshaven/SENCKENBERG	104	3	-	-	19/04/86	
Wilhelmshaven/SENCKENBERG	105	3	-	-	19/04/86	4
Wilhelmshaven/SENCKENBERG	106	3	-	-	19/04/86	2
NIOZ/TYRO	106	5	-	1	26/04/86	
Wilhelmshaven/SENCKENBERG	107	3	-	-	18/04/86	2
NIOZ/TYRO	107	5	-	-	25/04/86	
Wilhelmshaven/SENCKENBERG	108	3	-	-	18/04/86	2
NIOZ/TYRO	108	5	-	1	25/04/86	3

Institute/ship	Station number	Number of samples			Dates	°Beaufort
		Corer	van Veen	Dredge or beamtrawl		
NIOZ/TYRO	109	5	-	1	28/04/86	2
Bremerhaven/VICT. HENSEN	109	-	3	-	25/04/86	
Bremerhaven/VICT. HENSEN	110	3	1	-	19/04/86	
Hamburg/FRIED. HEINCKE	111	2	3	1	17/04/86	
Hamburg/FRIED. HEINCKE	112	2	3	1	17/04/86	
RWS/HOLLAND	113	2	1	-	23/04/86	2
RWS/HOLLAND	114	2	1	1	29/04/86	
Wilhelmshaven/SENCKENBER	115	3	-	1	19/04/86	4
Wilhelmshaven/SENCKENBER	116	3	-	1	19/04/86	4
Wilhelmshaven/SENCKENBER	117	3	-	1	18/04/86	2
NIOZ/TYRO	117	5	-	1	25/04/86	0
NIOZ/TYRO	118	5	-	1	25/04/86	3
Bremerhaven/VICT. HENSEN	118	-	3	x	24/04/86	
NIOZ/TYRO	119	5	-	1	25/04/86	3
Bremerhaven/VICT. HENSEN	119	-	3	x	24/04/86	
NIOZ/TYRO	120	5	-	1	28/04/86	0
Bremerhaven/VICT. HENSEN	120	3	1	x	19/04/86	
Hamburg/FRIED. HEINCKE	121	2	3	1	18/04/86	
Hamburg/FRIED. HEINCKE	122	2	3	1	18/04/86	
RWS/HOLLAND	123	2	1	-	23/04/86	
RWS/HOLLAND	124	2	1	1	29/04/86	
Bremerhaven/VICT. HENSEN	125	3	1	-	23/04/86	
Bremerhaven/VICT. HENSEN	126	-	3	-	23/04/86	
Bremerhaven/VICT. HENSEN	127	3	1	-	23/04/86	
NIOZ/TYRO	127	5	-	1	26/04/86	3
Bremerhaven/VICT. HENSEN	128	-	3	-	24/04/86	
NIOZ/TYRO	128	5	-	1	26/04/86	
Bremerhaven/VICT. HENSEN	129	-	3	-	24/04/86	
NIOZ/TYRO	129	5	-	1	27/04/86	3
Bremerhaven/VICT. HENSEN	130	-	3	-	24/04/86	
NIOZ/TYRO	130	5	-	1	27/04/86	4
Bremerhaven/VICT. HENSEN	131	3	1	-	19/04/86	
Hamburg/FRIED. HEINCKE	132	2	3	1	18/04/86	
Hamburg/FRIED. HEINCKE	133	2	3	1	18/04/86	
RWS/HOLLAND	134	2	1	1	23/04/86	
RWS/HOLLAND	135	2	1	-	23/04/86	

Institute/ship	Station number	Number of samples			Dates	°Beaufort
		Corer	van Veen	Dredge or beamtrawl		
RWS/HOLLAND	136	2	1	1	30/04/86	
Bremerhaven/VICT. HENSEN	137	3	1	x	23/04/86	
Bremerhaven/VICT. HENSEN	138	-	3	x	23/04/86	
Bremerhaven/VICT. HENSEN	139	-	3	x	24/04/86	
NIOZ/TYRO	139	5	-	1	26/04/86	2
Bremerhaven/VICT. HENSEN	140	-	4	x	24/04/86	
NIOZ/TYRO	140	5	-	1	27/04/86	3
Bremerhaven/VICT. HENSEN	141	-	3	x	24/04/86	
NIOZ/TYRO	141	5	-	1	27/04/86	3
NIOZ/TYRO	142	5	-	1	27/04/86	2
Bremerhaven/VICT. HENSEN	142	3	1	x	19/04/86	
Hamburg/FRIED. HEINCKE	143	2	3	1	19/04/86	
Hamburg/FRIED. HEINCKE	144	2	3	1	19/04/86	
RWS/HOLLAND	145	2	1	1	23/04/S6	1
RWS/HOLLAND	146	2	1	1	24/04/86	1
Bremerhaven/VICT. HENSEN	147	-	3	-	23/04/86	
Bremerhaven/VICT. HENSEN	148	-	3	-	22/04/86	
Bremerhaven/VICT. HENSEN	149	-	3	-	21/04/86	
Bremerhaven/VICT. HENSEN	150	-	3	-	21/04/86	
Bremerhaven/VICT. HENSEN	151	-	3	-	20/04/86	
Bremerhaven/VICT. HENSEN	152	3	1	-	20/04/86	
Hamburg/FRIED. HEINCKE	153	2	3	1	20/04/86	
Bremerhaven/VICT. HENSEN	153	3	1	-	20/04/86	
Hamburg/FRIED. HEINCKE	154	2	3	1	20/04/86	
Hamburg/FRIED. HEINCKE	155	2	3	1	19/04/86	
RWS/HOI.LAND	156	2	1	1	24/04/86	1
RWS/HOLLAND	157	2	1	1	24/04/86	1
Bremerhaven/VICT. HENSEN	158	-	4	x	23/04/86	
Bremerhaven/VICT. HENSEN	159	-	3	x	22/04/86	
Bremerhaven/VICT. HENSEN	160	-	3	x	21/04/86	
Bremerhaven/VICT. HENSEN	161	-	3	x	21/04/86	
Bremerhaven/VICT. HENSEN	162	-	3	-2	20/04/86	
Bremerhaven/VICT. HENSEN	163	3	1	x	20/04/86	
Hamburg/FRIED. HEINCKE	164	-	3	1	20/04/86	
Hamburg/FRIED. HEINCKE	165	-	3	1	20/04/86	
RWS/HOLLAND	166	2	1	1	24/04/86	1

Institute/ship	Station number	Number of samples			Dates	°Beaufort
		Corer	van Veen	Dredge or beamtrawl		
RWS/HOLLAND	167	2	1	1	24/04/86	
Bremerhaven/VICT. HENSEN	168	-	4	-	23/04/86	
Bremerhaven/VICT. HENSEN	169	-	3	-	22/04/86	
Bremerhaven/VICT. HENSEN	170	-	3	-	22/04/86	
Bremerhaven/VICT. HENSEN	171	-	3	-	21/04/86	
Bremerhaven/VICT. HENSEN	172	-	3	-	21/04/86	
Bremerhaven/VICT. HENSEN	173	3	1	-	20/04/86	
Hamburg/FRIED. HEINCKE	174	-	2	-	21/04/86	
Hamburg/FRIED. HEINCKE	175	2	3	1	21/04/86	
Hamburg/FRIED. HEINCKE	176	-	2	1	21/04/86	
Kiel/LITTORINA	177	3	1	1	16/05/86	
Kiel/LITTORINA	177a	-	-	1	16/05/86	
Kiel/LITTORINA	178	-	3	1	19/05/86	
Kiel/LITTORINA	179	-	3	1	20/05/86	
Kiel/LITTORINA	180	-	3	1	20/05/86	
Kiel/LITTORINA	181	3	1	1	20/05/86	
Kiel/LITTORINA	182	3	1	1	20/05/86	
Kiel/LITTORINA	183	-	-	-		
Kiel/LITTORINA	184	3	1	1	14/05/86	
Kiel/LITTORINA	185	3	1	1	14/05/86	
Kiel/LITTORINA	186	3	1	1	14/05/86	
Kiel/LITTORINA	187	3	1	1	14/05/86	
Kiel/LITTORINA	188-193	-	-	-		
Kiel/LITTORINA	194	3	1	1	20/05/86	
Kiel/LITTORINA	195	3	1	1	20/05/86	
Kiel/LITTORINA	196	-	4	1	15/05/86	

Annex 2

List of macrobenthic species

Phylum	Familia	Genus	Species
Annelida	Ampharetidae	Ampharetidae indet.	Ampharetidae indet.
		Ampharete	*Ampharete acutifrons*
			Ampharete baltica
			Ampharete falcata
			Ampharete finmarchica
			Ampharete sp.
		Amphicteis	*Amphicteis gunneri*
		Amythasides	*Amythasides macroglossus*
		Anobothrus	*Anobothrus gracilis*
		Eclysippe	*Eclysippe vanelli*
		Glyphanostomum	*Glyphanostomum macroglossum*
		Melinna	*Melinna cristata*
		Mugga	*Mugga wahrbergi*
		Sabellides	*Sabellides octocirrata*
			Sabellides sp.
		Samytha	*Samytha sexcirrata*
	Amphinomidae	*Paramphinome*	*Paramphinome jeffreysi*
		Pseudeurythoe	*Pseudeurythoe hemuli*
	Aphroditidae	*Aphrodita*	*Aphrodita aculeata*
		Gattyana	*Gattyana cirrosa*
		Scalisetosus	*Scalisetosus pellucidus*
	Apistobranchidae	*Apistobranchus*	*Apistobranchus tullbergi*
	Arabellidae	*Drilonereis*	*Drilonereis filum*
	Capitellidae	*Capitella*	*Capitella capitata*
		Capitellidae indet.	Capitellidae indet.
		Notomastus	*Notomastus latericeus*
		Peresiella	*Peresiella clymenoides*
	Chaetopteridae	*Chaetopterus*	*Chaetopterus variopedatus*
		Spiochaetopterus	*Spiochaetopterus typicus*
	Chrysopetalidae	*Chrysopetalum*	*Chrysopetalum fragile*
			Chrysopetalum sp.
	Cirratulidae	*Caulleriella*	*Caulleriella* sp.
		Cirratulus	*Cirratulus cirratus*
		Dodecaceria	*Dodecaceria concharum*
		Macrochaeta	*Macrochaeta clavicornis*
		Tharyx	*Tharyx* sp.
		Chaetozone	*Chaetozone setosa*
	Cossuridae	*Cossura*	*Cossura longocirrata*
	Dorvilleidae	*Ophryotrocha*	*Ophryotrocha longidentata*
			Ophryotrocha sp.
		Protodorvillea	*Protodorvillea kefersteini*
	Eunicidae	*Eunice*	*Eunice pennata*
		Marphysa	*Marphysa belli*
			Marphysa sanguinea
	Flabelligeridae	*Brada*	*Brada villosa*
		Diplocirrus	*Diplocirrus glaucus*
		Pherusa	*Pherusa plumosa*
	Glyceridae	*Glycera*	*Glycera alba*

Phylum	Familia	Genus	Species
Annelida	Glyceridae	*Glycera*	*Glycera celtica*
			Glycera lapidum
			Glycera oxycephala
			Glycera rouxi
			Glycera sp.
			Glycera tridactyla
	Goniadidae	*Glycinde*	*Glycinde nordmanni*
		Goniada	*Goniada maculata*
			Goniada norvegica
		Goniadella	*Goniadella bobretzki*
			Goniadella gracilis
	Hesionidae	*Gyptis*	*Gyptis capensis*
			Gyptis rosea
		Hesionidae indet.	Hesionidae indet.
		Kefersteinia	*Kefersteinia cirrata*
		Microphthalmus	*Microphthalmus listensis*
			Microphthalmus sp.
		Nereimyra	*Nereimyra punctata*
		Ophiodromus	*Ophiodromus flexuosus*
		Podarke	*Podarke pallida*
	Lepidonotidae	*Lepidonotus*	*Lepidonotus squamatus*
	Lumbrineridae	*Lumbrineris*	*Lumbrineris fragilis*
			Lumbrineris hibernica
			Lumbrineris latreilli
			Lumbrineris sp.
			Lumbrineris tetraura
	Magelonidae	*Magelona*	*Magelona alleni*
			Magelona rosea
			Magelona sp.
	Maldanidae	*Asychis*	*Asychis biceps*
		Axiothella	*Axiothella* sp.
		Clymenura	*Clymenura borealis*
		Euclymene	*Euclymene droebachiensis*
			Euclymene lumbricoides
			Euclymene sp.
		Heteroclymene	*Heteroclymene robusta*
		Maldane	*Maldane sarsi*
		Maldanidae	Maldanidae indet.
		Nicomache	*Nicomache lumbricalis*
			Nicomache sp.
		Petaloproctus	*Petaloproctus tenuisborealis*
		Praxillella	*Praxillella affinis*
			Praxillella praetermissa
			Praxillella sp.
		Praxillura	*Praxillura longissima*
		Rhodine	*Rhodine gracilior*
			Rhodine loveni
			Rhodine sp.
	Nephtyidae	*Aglaophamus*	*Aglaophamus malmgreni*
		Micronephtys	*Micronephtys* sp.

Phylum	Familia	Genus	Species
Annelida	Nephtyidae	*Nephtys*	*Nephtys caeca*
			Nephtys ciliata
			Nephtys cirrosa
			Nephtys hombergi
			Nephtys hystricis
			Nephtys incisa
			Nephtys longosetosa
			Nephtys paradoxa
			Nephtys sp.
	Nereidae	*Ceratocephale*	*Ceratocephale loveni*
		Leptonereis	*Leptonereis glauca*
		Nereidae indet.	Nereidae indet.
		Nereis	*Nereis elitoralis*
			Nereis longissima
			Nereis sp.
			Nereis zonata
	Onuphidae	*Hyalinoecia*	*Hyalinoecia tubicola*
		Nothria	*Nothria conchylega*
	Opheliidae	*Euzonus*	*Euzonus flabelligerus*
		Ophelia	*Ophelia borealis*
		Ophelina	*Ophelina acuminata*
			Ophelina cylindricaudata
		Travisia	*Travisia forbesi*
	Orbiniidae	*Orbinia*	*Orbinia grubei*
			Orbinia kupfferi
			Orbinia latreilli
			Orbinia norvegica
			Orbinia sertulata
		Scoloplos	*Scoloplos armiger*
	Oweniidae	*Myriochele*	*Myriochele* sp.
		Owenia	*Owenia fusiformis*
	Paraonidae	*Aricidea*	*Aricidea catherinae*
			Aricidea cerruti
			Aricidea minuta
			Aricidea simonae
			Aricidea sp.
			Aricidea suecica
			Aricidea wassi
		Cirrophorus	*Cirrophorus branchiatus*
			Cirrophorus furcatus
		Levinsenia	*Levinsenia gracilis*
		Paradoneis	*Paradoneis lyra*
		Paraonis	*Paraonis fulgens*
	Pectinariidae	*Amphictene*	*Amphictene auricoma*
		Lagis	*Lagis koreni*
		Pectinaria	*Pectinaria belgica*
		Pectinariidae indet.	Pectinariidae indet.
	Phyllodocidae	*Anaitides*	*Anaitides groenlandica*
			Anaitides lineata
			Anaitides longipes

Phylum	Familia	Genus	Species
Annelida	Phyllodocidae	*Anaitides*	*Anaitides maculata*
			Anaitides mucosa
			Anaitides rosea
			Anaitides sp.
			Anaitides subulifera
		Eteone	*Eteone flava*
			Eteone foliosa
			Eteone longa
			Eteone spetsbergensis
		Eulalia	*Eulalia bilineata*
			Eulalia mustela
			Eulalia viridis
		Eumida	*Eumida bahusiensis*
			Eumida sanguinea
			Eumida sp.
		Hesionura	*Hesionura elongata*
		Hypereteone	*Hypereteone lactea*
		Mysta	*Mysta barbata*
			Mysta picta
		Mystides	*Mystides limbata*
			Mystides southerni
		Nereiphylla	*Nereiphylla* sp.
		Notophyllum	*Notophyllum foliosum*
		Paranaitis	*Paranaitis kosterensis*
		Phyllodoce	*Phyllodoce laminosa*
		Protomystides	*Protomystides bidentata*
		Pseudoeulalia	*Pseudoeulalia exigua*
		Cheatoparia	*Chaetoparia nilssoni*
	Pilargiidae	*Synelmis*	*Synelmis klatti*
	Pisionidae	*Pisione*	*Pisione remota*
	Poecilochaetidae	*Poecilochaetus*	*Poecilochaetus serpens*
	Polynoidae	*Antinoella*	*Antinoella sarsi*
		Enipo	*Enipo kinbergi*
		Eunoe	*Eunoe nodosa*
		Halosydna	*Halosydna gelatinosa*
		Harmothoe	*Harmothoe andreapolis*
			Harmothoe antilopes
			Harmothoe castanea
			Harmothoe fragilis
			Harmothoe glabra
			Harmothoe impar
			Harmothoe ljungmani
			Harmothoe lunulata
			Harmothoe mcintoshi
			Harmothoe sp.
		Polynoidae indet.	Polynoidae indet.
	Protodrillidae	*Protodrilus*	*Protodrilus* sp.
	Sabellariidae	*Sabellaria*	*Sabellaria spinulosa*
	Scalibregmidae	*Polyphysia*	*Polyphysia crassa*
		Scalibregma	*Scalibregma inflatum*

Phylum	Familia	Genus	Species
Annelida	Serpulidae	*Ditrupa*	*Ditrupa arietina*
		Hydroides	*Hydroides norvegica*
		Pomatoceros	*Pomatoceros triqueter*
		Protula	*Protula tubularia*
		Serpula	*Serpula vermicularis*
		Serpulidae	Serpulidae indet.
	Sigalionidae	Pholoe	Pholoe indet.
		Sigalion	*Sigalion mathildae*
		Sthenelais	*Sthenelais limicola*
			Sthenelais zetlandica
	Sphaerodoridae	*Ephesiella*	*Ephesiella abyssorum*
		Sphaerodoridium	*Sphaerodoridium claparedi*
		Sphaerodoropsis	*Sphaerodoropsis minuta*
			Sphaerodoropsis sp.
		Sphaerodorum	*Sphaerodorum flavum*
	Spionidae	*Aonides*	*Aonides oxycephala*
			Aonides paucibranchiata
		Laonice	*Laonice cirrata*
			Laonice sarsi
		Malacoceros	*Malacoceros vulgaris*
		Minuspio	*Minuspio cirrifera*
		Polydora	*Polydora caulleryi*
			Polydora ciliata
			Polydora flava
			Polydora giardi
			Polydora guillei
			Polydora ligni
			Polydora quadrilobata
			Polydora socialis
			Polydora sp.
		Prionospio	*Prionospio malmgreni*
			Prionospio steenstrupi
		Pseudopolydora	*Pseudopolydora* cf. *pauchibranchiata*
			Pseudopolydora pulchra
		Scolelepis	*Scolelepis bonnieri*
			Scolelepis cantabra
			Scolelepis foliosa
			Scolelepis squamata
			Scolelepis tridentata
		Spio	*Spio filicornis*
			Spio gonocephala
			Spio mecznikowianus
			Spio sp.
		Spiophanes	*Spiophanes bombyx*
			Spiophanes kroeyeri
		Streblospio	*Streblospio shrubsoli*
	Syllidae	*Autolytus*	*Autolytus* sp.
		Brania	*Brania* sp.
		Dioplosyllis	*Dioplosyllis cirrosa*

Phylum	Familia	Genus	Species
Annelida	Syllidae	*Eusyllis*	*Eusyllis blomstrandi*
		Exogone	*Exogone hebes*
			Exogone naidina
			Exogone verugera
		Langerhansia	*Langerhansia cornuta*
		Odontosyllis	*Odontosyllis gibba*
		Opisthodonta	*Opisthodonta pterochaeta*
		Sphaerosyllis	*Sphaerosyllis bulbosa*
			Sphaerosyllis hystrix
			Sphaerosyllis tetralix
		Streptosyllis	*Streptosyllis websteri*
		Syllidae indet.	Syllidae indet.
		Syllides	*Syllides longocirrata*
		Trypanosyllis	*Trypanosyllis coeliaca*
		Typosyllis	*Typosyllis armillaris*
			Typosyllis sp.
			Typosyllis variegata
	Terebellidae	*Amaeana*	*Amaeana trilobata*
		Amphitrite	*Amphitrite cirrata*
		Axionice	*Axionice maculata*
		Eupolymnia	*Eupolymnia nebulosa*
		Euthelepus	*Euthelepus setubalensis*
		Hauchiella	*Hauchiella tribullata*
		Lanice	*Lanice conchilega*
		Lysilla	*Lysilla loveni*
		Neoamphitrite	*Neoamphitrite affinis*
		Paramphitrite	*Paramphitrite tetrabranchia*
		Parathelepus	*Parathelepus collaris*
		Pista	*Pista cristata*
		Polycirrus	*Polycirrus medusa*
			Polycirrus sp.
		Proclea	*Proclea graffi*
		Streblosoma	*Streblosoma bairdi*
			Streblosoma intestinalis
		Thelepus	*Thelepus cincinnatus* sp.
	Trichobranchidae	*Octobranchus*	*Octobranchus floriceps*
		Terebellides	*Terebellides stroemi*
		Trichobranchus	*Trichobranchus glacialis*
			Trichobranchus roseus
Arthropoda	Acanthonotozomidae	*Iphimedia*	*Iphimedia obesa*
	Ampeliscidae	*Ampelisca*	*Ampelisca aequicornis*
			Ampelisca brevicornis
			Ampelisca diadema
			Ampelisca gibba
			Ampelisca macrocephala
			Ampelisca spinipes
			Ampelisca tenuicornis
			Ampelisca typica
		Byblis	*Byblis gaimardi*
		Haploops	*Haploops tubicola*

Phylum	Familia	Genus	Species
Arthropoda	Amphilochidae	*Amphilochus*	*Amphilochus manudens*
			Amphilochus spencebatei
		Gitana	*Gitana sarsi*
		Paramphilochoides	*Paramphilochoides intermedius*
			Paramphilochoides odontonyx
		Peltocoxa	*Peltocoxa damnoniensis*
	Aoridae	Aoridae	Aoridae indet.
	Apseudidae	*Apseudes*	*Apseudes spinosus*
	Arcturidae	*Arcturella*	*Arcturella dilatata*
		Astacilla	*Astacilla longicornis*
	Argissidae	*Argissa*	*Argissa hamatipes*
	Atelecyclidae	*Atelecyclus*	*Atelecyclus rotundatus*
	Atylidae	*Atylus*	*Atylus falcatus*
			Atylus swammerdami
			Atylus vedlomensis
	Axiidae	*Calocaris*	*Calocaris macandreae*
	Bodotriidae	*Bodotria*	*Bodotria arenosa*
			Bodotria scorpioides
		Cumopsis	*Cumopsis goodsiri*
		Iphinoe	*Iphinoe serrata*
			Iphinoe trispinosa
		Vaunthompsonia	*Vaunthompsonia cristata*
	Bopyridae	*Ione*	*Ione thoracica*
		Pleurocrypta	*Pleurocrypta longibranchiata*
		Pseudione	*Pseudione callianassae*
	Brachyura indet.	Brachyura indet.	Brachyura indet.
	Callianassidae	*Callianassa*	*Callianassa laticauda*
			Callianassa subterranea
			Callianassa tyrrhena
		Upogebia	*Upogebia deltaura*
			Upogebia stellata
	Calliopiidae	*Apherusa*	*Apherusa ovalipes*
	Caprellidae	*Caprella*	*Caprella linearis*
		Caprellidae indet.	Caprellidae indet.
		Phtisica	*Phtisica marina*
	Cirolanidae	*Cirolana*	*Cirolana borealis*
		Eurydice	*Eurydice pulchra*
	Cirripedia indet.	Cirripedia indet.	Cirripedia indet.
	Corophiidae	*Corophium*	*Corophium affine*
			Corophium crassicorne
			Corophium sp.
		Ericthonius	*Ericthonius difformis*
		Siphonoecetes	*Siphonoecetes kroyeranus*
			Siphonoecetes striatus
		Unciola	*Unciola crenatipalma*
			Unciola planipes
	Corystidae	*Corystes*	*Corystes cassivelaunus*
	Cypridinidae	Cypridinidae indet.	Cypridinidae indet.
		Philomedes	*Philomedes globosus*
	Dexaminidae	*Dexamine*	*Dexamine spinosa*

Phylum	Familia	Genus	Species
Arthropoda	Dexaminidae	*Guernea*	*Guernea coalita*
	Diastylidae	*Brachydiastylis*	*Brachydiastylis resima*
		Diastylis	*Diastylis boecki*
			Diastylis bradyi
			Diastylis cornuta
			Diastylis laevis
			Diastylis lucifera
			Diastylis rathkei
			Diastylis rugosa
			Diastylis tumida
		Diastyloides	*Diastyloides biplicata*
		Leptostylis	*Leptostylis villosa*
	Euphausiidae	*Nyctiphanes*	*Nyctiphanes couchi*
	Eusiridae	*Eusirus*	*Eusirus longipes*
	Galatheidae	*Galathea*	*Galathea intermedia*
			Galathea sp.
	Gammaridae	*Abludomelita*	*Abludomelita gladiosa*
			Abludomelita obtusata
			Abludomelita sp.
		Cheirocratus	*Cheirocratus intermedius*
			Cheirocratus sp.
			Cheirocratus sundevalli
		Eriopisa	*Eriopisa elongata*
		Maera	*Maera othonis*
		Maerella	*Maerella tenuimana*
		Megaluropus	*Megaluropus agilis*
		Megamphopus	*Megamphopus cornutus*
	Gnathiidae	*Gnathia*	*Gnathia oxyuraea*
	Haustoriidae	*Bathyporeia*	*Bathyporeia elegans*
			Bathyporeia guilliamsoniana
			Bathyporeia pelagica
			Bathyporeia pilosa
			Bathyporeia sarsi
			Bathyporeia tenuipes
		Haustorius	*Haustorius arenarius*
		Urothoe	*Urothoe brevicornis*
			Urothoe elegans
			Urothoe marina
			Urothoe poseidonis
			Urothoe pulchella
	Hippolytidae	*Eualus*	*Eualus pusiolus*
	Ischyroceridae	*Ischyrocerus*	*Ischyrocerus anguipes*
			Ischyrocerus sp.
	Isopoda indet.	Isopoda indet.	Isopoda indet.
	Janiridae	*Janira*	*Janira maculosa*
	Lampropidae	*Hemilamprops*	*Hemilamprops rosea*
		Lamprops	*Lamprops fasciata*
	Leuconidae	*Eudorella*	*Eudorella emarginata*
			Eudorella truncatula
		Eudorellopsis	*Eudorellopsis deformis*

Phylum	Familia	Genus	Species
Arthropoda	Leuconidae	*Leucon*	*Leucon nasica*
	Leucothoidae	*Leucothoe*	*Leucothoe incisa*
			Leucothoe lilljeborgi
			Leucothoe procera
			Leucothoe spinicarpa
	Lilljeborgidae	*Lilljeborgia*	*Lilljeborgia fissicornis*
			Lilljeborgia sp.
	Lysianassidae	*Acidostoma*	*Acidostoma obesum*
			Acidostoma sarsi
		Anonyx	*Anonyx lilljeborgi*
		Hippomedon	*Hippomedon denticulatus*
		Lepidepecreum	*Lepidepecreum longicorne*
		Menigrates	*Menigrates obtusifrons*
		Orchomene	*Orchomene nana*
			Orchomene sp.
		Orchomenella	*Orchomenella* cf. *groenlandica*
		Scopelocheirus	*Scopelocheirus hopei*
		Tmetonyx	*Tmetonyx cicada*
		Tryphosites	*Tryphosites longipes*
		Uristes	*Uristes ubonatus*
	Majidae	*Eurynome*	*Eurynome aspera*
		Hyas	*Hyas coarctatus*
	Melphidippidae	*Melphidippella*	*Melphidippella macra*
	Munnidae	*Munna*	*Munna fabrici*
		Pleurogonium	*Pleurogonium* sp.
	Mysidacea indet.	Mysidacea indet.	Mysidacea indet.
	Mysidae	*Gastrosaccus*	*Gastrosaccus spinifer*
		Schistomysis	*Schistomysis kervillei*
	Nannastacidae	*Campylaspis*	*Campylaspis costata*
			Campylaspis glabra
			Campylaspis rubicunda
		Cumella	*Cumella pygmaea*
	Nebaliidae	*Nebalia*	*Nebalia bipes*
		Sarsinebalia	*Sarsinebalia typhlops*
	Nephropsidae	*Nephrops*	*Nephrops norvegicus*
	Oedicerotidae	*Arrhis*	*Arrhis phyllonyx*
		Halicreion	*Halicreion* sp.
		Monoculodes	*Monoculodes subnudus*
		Perioculodes	*Perioculodes longimanus*
		Pontocrates	*Pontocrates altamarinus*
			Pontocrates sp.
		Synchelidium	*Synchelidium haplocheles*
			Synchelidium maculatum
		Westwoodilla	*Westwoodilla caecula*
	Paratanaidae	*Leptognathia*	*Leptognathia longiremis*
		Typhlotanais	*Typhlotanais* sp.
	Pardaliscidae	*Nicippe*	*Nicippe tumida*
	Pasiphaeidae	*Pasiphaea*	*Pasiphaea sivado*
	Photidae	*Gammaropsis*	*Gammaropsis maculata*
			Gammaropsis nitida

Phylum	Familia	Genus	Species
Arthropoda	Photidae	*Gammaropsis*	*Gammaropsis palmata*
		Leptocheirus	*Leptocheirus hirsutimanus*
		Microprotopus	*Microprotopus maculatus*
			Microprotopus sp.
		Photis	*Photis longicaudata*
			Photis reinhardi
		Protomedeia	*Protomedeia fasciata*
			Protomedeia sp.
	Phoxocephalidae	*Harpinia*	*Harpinia antennaria*
			Harpinia crenulata
			Harpinia laevis
			Harpinia pectinata
		Metaphoxus	*Metaphoxus fultoni*
		Paraphoxus	*Paraphoxus oculatus*
		Phoxocephalus	*Phoxocephalus holbolli*
	Pinnotheridae	*Pinnotheres*	*Pinnotheres pisum*
	Pirimelidae	*Pirimela*	*Pirimela denticulata*
	Pleustidae	*Parapleustes*	*Parapleustes bicuspis*
	Podoceridae	*Dulichia*	*Dulichia* sp.
		Dyopedos	*Dyopedos monacanthus*
			Dyopedos porrectus
		Paradulichia	*Paradulichia* sp.
	Porcellanidae	*Pisidia*	*Pisidia longicornis*
	Portunidae	*Liocarcinus*	*Liocarcinus depurator*
			Liocarcinus holsatus
			Liocarcinus marmoreus
			Liocarcinus pusillus
	Processidae	*Processa*	*Processa nouveli*
			Processa parva
	Pseudocumidae	*Petalosarsia*	*Petalosarsia declivis*
		Pseudocuma	*Pseudocuma longicornis*
			Pseudocuma similis
	Pycnogonida indet.	Pycnogonida indet.	Pycnogonida indet.
	Pycnogonidae	*Anaplodactylus*	*Anoplodactylus petiolatus*
		Pycnogonidae indet.	Pycnogonidae sp.
		Pycnogonum	*Pycnogonum littorale*
	Stegocephalidae	*Stegocephaloides*	*Stegocephaloides christianiensis*
	Stenothoidae	*Metopa*	*Metopa bruzeli*
			Metopa latimana
			Metopa propinqua
			Metopa pusilla
		Parametopa	*Parametopa* sp.
		Stenothoe	*Stenothoe marina*
			Stenothoe monoculoides
		Stenula	*Stenula rubrovittata*
	Synopiidae	Synopiidae indet.	Synopiidae indet.
	Tironidae	*Tiron*	*Tiron spiniferum*
	Verrucidae	*Verruca*	*Verruca stroemia*
Brachiopoda	Craniidae	*Neocrania*	*Neocrania anomala*

Phylum	Familia	Genus	Species
Bryozoa	Cellariidae	*Cellaria*	*Cellaria fistulosa*
	Celleporidae	*Cellepora*	*Cellepora pumicosa*
	Cleidochasmatidae	*Microporella*	*Microporella ciliata*
	Crisiidae	*Crisia*	*Crisia eburnea*
	Electridae	*Pyripora*	*Pyripora catenularia*
	Escharellidae	*Escharella*	*Escharella immersa*
	Flustridae	*Flustra*	*Flustra foliacea*
	Lichenoporidae	Lichenoporidae indet.	Lichenoporidae indet.
	Schizoporellidae	*Phaeostachys*	*Phaeostachys spinifera*
	Smittinidae	*Porella*	*Porella concinna*
	Vesiculariidae	*Bowerbankia*	*Bowerbankia* sp.
Chordata	Branchiostomidae	*Branchiostoma*	*Branchiostoma lanceolatum*
	Corellidae	*Corella*	*Corella parallelogramma*
	Molgulidae	*Molgula*	*Molgula* sp.
	Styelidae	*Botryllus*	*Botryllus schlosseri*
		Dendrodoa	*Dendrodoa grossularia*
		Pelonaia	*Pelonaia corrugata*
		Polycarpa	*Polycarpa fibrosa*
		Styela	*Styela coriacea*
Cnidaria	Anthozoa indet.	Anthozoa indet.	Anthozoa indet.
	Ascidiacea indet.	Ascidiacea indet.	Ascidiacea indet.
	Coelenterata indet.	Coelenterata indet.	Coelenterata indet.
	Hydrozoa indet.	Hydrozoa indet.	Hydrozoa indet.
Echinodermata	Amphiuridae	*Acrocnida*	*Acrocnida brachiata*
		Amphipholis	*Amphipholis squamata*
		Amphiura	*Amphiura chiajei*
			Amphiura filiformis
			Amphiura securigera
		Amphiuridae indet.	Amphiuridae indet.
	Echinidae	*Echinus*	*Echinus elegans*
			Echinus esculentus
		Psammechinus	*Psammechinus miliaris*
	Fibulariidae	*Echinocyamus*	*Echinocyamus pusillus*
	Holothurioidea indet.	Holothurioidea indet.	Holothurioidea indet.
	Ophiactidae	*Ophiactis*	*Ophiactis balli*
	Ophiolepidae	*Ophiura*	*Ophiura affinis*
			Ophiura albida
			Ophiura ophiura
	Ophiotrichidae	*Ophiothrix*	*Ophiothrix fragilis*
	Ophiuroidea indet.	Ophiuroidea indet.	Ophiuroidea indet.
	Solasteridae	*Crossaster*	*Crossaster papposus*
	Spatangidae	*Brissopsis*	*Brissopsis lyrifera*
		Echinocardium	*Echinocardium cordatum*
			Echinocardium flavescens
			Echinocardium pennatifidum
		Spatangus	*Spatangus purpureus*
	Stichasteridae	*Stichastrella*	*Stichastrella rosea*
Echiura	Echiuridae	*Echiurus*	*Echiurus echiurus*
Hemichordata	Enteropneusta indet.	Enteropneusta indet.	Enteropneusta indet.
Mollusca	Acteonidae	*Acteon*	*Acteon tornatilis*

Phylum	Familia	Genus	Species
Mollusca	Anomiidae	*Anomia*	*Anomia ephippium*
		Pododesmus	*Pododesmus patelliformis*
	Aplysiidae	*Aplysia*	*Aplysia* sp.
	Aporrhaidae	*Aporrhais*	*Aporrhais pespelecani*
	Arcidae	*Bathyarca*	*Bathyarca petunculoides*
	Arminidae	*Armina*	*Armina loveni*
	Asaphidae	*Gari*	*Gari fervensis*
			Gari sp.
	Astartidae	*Astarte*	*Astarte sulcata*
		Goodallia	*Goodallia triangularis*
		Tridonta	*Tridonta borealis*
			Tridonta elliptica
			Tridonta montagui
	Bivalvia indet.	Bivalvia indet.	Bivalvia indet.
	Buccinidae	*Buccinum*	*Buccinum undatum*
		Colus	*Colus gracilis*
			Colus sp.
		Neptunea	*Neptunea antiqua*
	Capulidae	*Capulus*	*Capulus ungaricus*
	Cardiidae	*Acanthocardia*	*Acanthocardia echinata*
			Acanthocardia tuberculata
		Cardiidae indet.	Cardiidae indet.
		Cerastoderma	*Cerastoderma edule*
			Cerastoderma ovale
		Laevicardium	*Laevicardium crassum*
		Parvicardium	*Parvicardium exiguum*
			Parvicardium minimum
			Parvicardium ovale
			Parvicardium scabrum
	Caudofoveata indet.	Caudofoveata indet.	Caudofoveata indet.
	Cerithiopsidae	*Cerithiella*	*Cerithiella metula*
	Chaetodermatidae	*Chaetoderma*	*Chaetoderma nitidulum*
	Conidae	*Oenopota*	*Oenopota turricula*
	Cuspidariidae	*Cuspidaria*	*Cuspidaria costellata*
			Cuspidaria rostrata
	Cyprinidae	*Arctica*	*Arctica islandica*
	Dentaliidae	*Antalis*	*Antalis entalis*
	Diaphanidae	*Diaphana*	*Diaphana minuta*
	Donacidae	*Donax*	*Donax vittatus*
	Epitoniidae	*Epitonium*	*Epitonium trevelyanum*
	Erodonidae	*Corbula*	*Corbula gibba*
	Eulimidae	*Curveulima*	*Curveulima devians*
			Curveulima macrophthalmica
		Eulima	*Eulima bilineata*
		Eulimidae indet.	Eulimidae indet.
		Melanella	*Melanella alba*
		Vitreolina	*Vitreolina philippi*
	Facelinidae	*Facelina*	*Facelina bostoniensis*
	Fissurellidae	*Puncturella*	*Puncturella noachina*
	Galeommatidae	*Devonia*	*Devonia perrieri*
	Glycymeridae	*Glycymeris*	*Glycymeris glycymeris*
	Hanleyidae	*Hanleya*	*Hanleya hanleyi*
	Hiatellidae	*Hiatella*	*Hiatella arctica*
		Panomya	*Panomya arctica*

Phylum	Familia	Genus	Species
Mollusca	Hiatellidae	*Saxicavella*	*Saxicavella jeffreysi*
	Hydrobiidae	*Hydrobia*	*Hydrobia ulvae*
	Kelliellidae	*Kelliella*	*Kelliella miliaris*
	Kelliidae	*Kellia*	*Kellia suborbicularis*
	Lamellariidae	*Velutina*	*Velutina velutina*
	Laternulidae	*Cochlodesma*	*Cochlodesma praetenue*
	Lepidopleuridae	*Leptochiton*	*Leptochiton asellus*
			Leptochiton sp.
	Leptonidae	*Lepton*	*Lepton squamosum*
	Limidae	*Limatula*	*Limatula gwyni*
			Limatula subauriculata
	Limopsidae	*Limopsis*	*Limopsis* sp.
	Lucinidae	*Lucinoma*	*Lucinoma borealis*
	Mactridae	*Mactra*	*Mactra stultorum*
		Spisula	*Spisula elliptica*
			Spisula solida
			Spisula subtruncata
	Montacutidae	*Montacuta*	*Montacuta substriata*
		Mysella	*Mysella bidentata*
		Tellimya	*Tellimya ferruginosa*
			Tellimya tenella
	Muricidae	*Nucella*	*Nucella lapillus*
		Trophonopsis	*Trophonopsis muricatus*
	Myacidae	*Mya*	*Mya arenaria*
			Mya sp.
			Mya truncata
		Myrtea	*Myrtea spinifera*
		Sphenia	*Sphenia binghami*
	Mytilidae	*Crenella*	*Crenella decussata*
		Modiolus	*Modiolus barbatus*
			Modiolus modiolus
			Modiolus sp.
		Musculus	*Musculus discors*
			Musculus niger
		Mytilus	*Mytilus edulis*
	Naticidae	*Lunatia*	*Lunatia catena*
			Lunatia montagui
			Lunatia poliana
			Lunatia sp.
	Neomeniidae	*Neomenia*	*Neomenia carinata*
	Nuculanidae	*Nuculana*	*Nuculana minuta*
	Nuculidae	*Nucula*	*Nucula nitidosa*
			Nucula sp.
		Nuculoma	*Nuculoma tenuis*
	Nudibranchia indet.	Nudibranchia indet.	Nudibranchia indet.
	Onchidoridae	*Onchidoris*	*Onchidoris bilamellata*
			Onchidoris muricata
	Pectinidae	*Chlamys*	*Chlamys distorta*
			Chlamys varia
		Palliolum	*Palliolum furtivum*
			Palliolum striatum
		Pectinidae indet.	Pectinidae indet.
	Petricolidae	*Mysia*	*Mysia undata*

Phylum	Familia	Genus	Species
Mollusca	Philinidae	*Philine*	*Philine catena*
			Philine quadrata
			Philine scabra
			Philine sp.
	Pleurobranchidae	*Pleurobranchus*	*Pleurobranchus membranaceus*
	Polyplacophora indet.	Polyplacophora indet.	Polyplacophora indet.
	Pyramidellidae	*Ondina*	*Ondina divisa*
		Turbonilla	*Turbonilla crenata*
	Retusidae	*Retusa*	*Retusa umbilicata*
	Rissoidae	*Hyala*	*Hyala vitrea*
	Scaphandridae	*Cylichna*	*Cylichna cylindracea*
			Cylichna sp.
			Cylichna umbilicata
		Scaphander	*Scaphander lignarius*
			Scaphander sp.
	Scrobiculariidae	*Abra*	*Abra alba*
			Abra nitida
			Abra prismatica
			Abra tenuis
	Siphonodentaliidae	*Pulsellum*	*Pulsellum* sp.
	Solecurtidae	*Azorinus*	*Azorinus chamasolen*
	Solenidae	*Ensis*	*Ensis* sp.
		Phaxas	*Phaxas pellucidus*
		Solen	*Solen marginatus*
		Solenacea indet.	Solenacea indet.
	Solenogastres indet.	Solenogastres indet.	Solenogastres indet.
	Tellinidae	*Angulus*	*Angulus tenuis*
		Fabulina	*Fabulina fabula*
		Macoma	*Macoma balthica*
		Moerella	*Moerella donacina*
			Moerella pygmaea
	Thraciidae	*Thracia*	*Thracia convexa*
			Thracia phaseolina
			Thracia villosiuscula
	Thyasiridae	*Thyasira*	*Thyasira ferruginea*
			Thyasira sp.
	Trichotropidae	*Trichotropis*	*Trichotropis borealis*
	Tritoniidae	*Tritonia*	*Tritonia hombergi*
	Trochidae	*Margarites*	*Margarites helicinus*
	Turritellidae	*Turritella*	*Turritella communis*
	Veneridae	*Chamelea*	*Chamelea gallina*
		Circomphalus	*Circomphalus casina*
		Dosinia	*Dosinia exoleta*
			Dosinia lupinus
		Gouldia	*Gouldia minima*
		Paphia	*Paphia rhomboides*
		Timoclea	*Timoclea ovata*
	Yoldiidae	*Portlandia*	*Portlandia philippiana*
Nemertea	Nemertea indet.	Nemertea indet.	Nemertea indet.
Phoronida	Phoronidae	*Phoronis*	*Phoronis hippocrepia*
			Phoronis muelleri
			Phoronis sp.
Pogonophora	Siboglinidae	*Siboglinum*	*Siboglinum* sp.
Priapulida	Priapulida indet.	Priapulida indet.	Priapulida indet.

Phylum	Familia	Genus	Species
Priapulida	Priapulidae	*Priapulus*	*Priapulus caudatus*
Sipunculida	Sipunculida indet.	Sipunculida indet.	Sipunculida indet.

Annex 3

CEMOMAP

1 Introduction

The program package CEMOMAP has been developed at the Centre for Estuarine and Marine Ecology (CEMO) of the Netherlands Institute of Ecology (formerly Delta Institute for Hydrobiological Research) during autumn 1989 (Herman and Braat, 1989; BENTMAP release 1.0 issued 31 November 1989). It is aimed at producing a rapid on-screen presentation of the spatial distribution of species and species groups, based on the data collected during the ICES Benthos Ecology Working Group (1986) North Sea Benthos Survey. A full description of this survey is provided in the body of the present report. Here, we are only concerned with a description of the installation and use of the program.

The package is developed for personal computers running MS-DOS with 640 Kb internal memory, two disk drives (either one floppy disk and one hard disk or two floppy disks), and one of the following graphics cards:

- VGA (Video Graphics Array);
- EGA (Enhanced Graphics Adapter);
- CGA (IBM Color Graphics Adapter);
- Hercules (monochrome).

A minimal knowledge of the MS-DOS operating system is necessary for using the program. However, the installation of the program is somewhat more complicated. You should consult your local DOS-expert when you encounter problems.

Do not try to run the program before completion of the installation.

2 Installation

Before installing the package, you should make sure that the file CONFIG.SYS, which specifies the system configuration and can be found in the root directory, contains the command 'FILES=20'. If 'FILES=' already occurs with another number, this number should be at least 20. Although not strictly necessary, the command 'BUFFERS=20' (or instead of 20 a higher number equalling the number following 'FILES=') enhances the execution speed. These two commands should precede any commands of the type 'DEVICE=' or other in the CONFIG.SYS file.

Note: If CONFIG.SYS does not yet occur in your root directory (an improbable situation), you can copy it from the 'DRIVER DISK' into the root. But BEWARE: if you do this when CONFIG.SYS already occurs, you will surely destroy important configuration information! If you do not know how to change an existing configuration file, ask someone who does.

Make a backup copy of the distribution floppy. Keep the distribution floppy in a safe place. Make a sub-directory on the hard disk. You are entirely free in chosing a name for this directory. Copy the floppy (including the sub-directories but excluding CONFIG.SYS and AUTOEXEC.BAT) to this directory. Make the directory containing the programs your current directory. Customize the system by running SYS_INST (see Section 3, below).

If your system does not have a hard disk, format a floppy as a self-booting disk with the 'FORMAT <drive> /s' MS-DOS command, and copy all directories and files onto this disk. Put this disk into drive a: and customize the system by running SYS_INST (see below). Reboot your system. Your computer will automatically start up the mapping program.

3 Customizing the package with SYS_INST.EXE

Make the drive or sub-directory containing the programs your current drive. Start up this program with the command SYS_INST. (Note that the fourth character is an underscore, not a space.)

First, the program asks where to find the drivers. Secondly, the program requests the name of the directory into which metafiles should be placed (see printing a map, Section 4.4, below).

Next, the program asks what colours to use in the MAP program. For each type of text, choose a colour by pointing to one (using the cursor keys) and pressing <RETURN>.

Notes:

1) The default colours (giving good results on black and white EGA and VGA screens, but not really tested for other screens) are, in the order in which they are asked by the program:

   1: Yellow
   2: Black
   3: Red
   4: Cyan
   5: Light grey
   6: Brown
   7: Green

2) Anywhere in the colour determination sequence one

can press <ESC>. The program then installs the chosen colours up to the point reached, and the default colours for the rest.

The installation data are stored in the file CEMOMAP.SYS, which is kept in the same directory as the program files. When working on double floppy systems, your program disk can only be write-protected after this file has been created.

Customization is never final. At any time, you can rerun this program to adapt it to your changed taste or circumstances.

Notes:

1) If SYS_INST is run when the file CEMOMAP.SYS already exists, you get the message "System file already exists, overwrite ?". Overwrite it to save the new installation. Do not overwrite if you think that the old one, after all, was better than what you have now produced.

2) After proper execution, the program SYS_INST returns the message "DONE !".

4 Using the MAP program

After the installation procedure, you can activate the program with the command MAP. Note that if you changed anything in the CONFIG.SYS file, you should reboot your system to make the changes active.

In the case of a two-floppy system (for which a self-booting floppy has been prepared), insert your program disk in drive a: and reset the computer. It will now come right into the MAP program without any further action on your part.

With a hard disk system, make the program directory your current directory. Give the command MAP. The file MAP.BAT is a batch file which first activates a memory-resident graphics program, and then executes the program BENTHOS.EXE. Do not give the command benthos directly. Your screen will turn black, and your computer will be out of function.

4.1 Selecting a single species

Before selecting a species, you must select a database: macrobenthos or meiobenthos.

The first menu then offers two possibilities for the selection of species to be mapped. "Go through all menus" leads you in a number of steps along taxonomic paths to the species required. "Type in species name" leads you to the species with the aid of an alphabetical list.

The first option (using a hierarchical sequence of steps) requires knowledge of a species' taxonomic position. First, one obtains a list of PHYLA. One of these is chosen by positioning the cursor on it and pressing <RETURN>. One then obtains a list of FAMILIES belonging to that phylum. After selecting a family, a GENUS can be chosen, and finally a SPECIES. After selection of the species the map is drawn.

In the second option (typing in), a window appears in which the name can be typed. Again, there are two possibilities:

1) If a name occurring in the species list is typed in correctly (the search is case-insensitive: it does not matter whether you type capital or lower-case characters), the map of the species is displayed directly.

2) If the name typed in is not found in the list, a window appears with all the species names ordered alphabetically.

The cursor is positioned where the name typed in should normally be found in the list. Note that, with this method, it is not necessary to type in the name of a species completely. If one wants to display the distribution of *Nepthys hombergi*, one can type in 'nep'. The cursor is then positioned on the name *Nepthys caeca*. Moving it down two steps brings it on *Nepthys hombergi*. Pressing <RETURN> draws the required map.

4.2 Selecting a group of species

A group of species can only be selected by the first method (using the taxonomical menus), implying that only taxonomically defined groups can be displayed. If one wants to display the distribution of all species belonging to a certain genus, for example, one goes through the phyla and families windows, positions the cursor on the right genus name, and presses <CTRL> and <RETURN> simultaneously. Instead of seeing the species window, one receives a warning that this operation takes some time, and then a map of the genus is produced. The same procedure can be applied for families and phyla.

Note: If the group selected contains only one species, the name of the species is still displayed on the graph. Otherwise 'ALL' is given as name of species, genus or family. The number of species, genera or families selected is indicated between brackets after the word 'ALL' in the place where normally the name of species, genus or family is displayed.

4.3 Drawing the map

After the selection, the map is drawn on the screen. The resolution of this drawing depends on the resolution of

the graphics card used. A VGA card will give a far better resolution than a CGA. The maps are drawn in two-colour mode to enhance the graphical resolution.

If the screen turns black when normally a map should appear, you most probably have not used the program MAP.BAT, but instead used the program BENTHOS.EXE directly. Reread the manual and restart the computer.

The map is drawn on the left side of the screen. A schematic drawing of the land surrounding the North Sea is shaded. Full degrees of longitude East and West, and half degrees of latitude North are indicated by stippled lines. Bar lines underneath and to the right of the map indicate degrees. It was impossible to write the actual coordinate values on the screen maps. Consult a real map for reference.

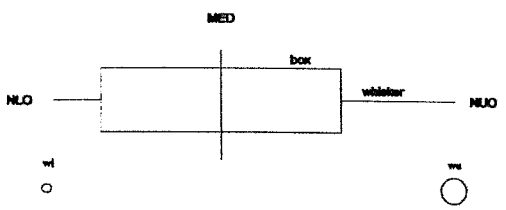
Occurrences of the species are indicated on the map by circles. The radius of the circle is proportional to the (log-transformed) abundance of the species. The scale is adapted for each map. Thus, the circles cannot be compared directly from one map to another.

Two overlapping circles may be seen at some stations. This is caused by double sampling of these stations. Some zones were sampled by two different research groups and, instead of averaging their results, they are shown superimposed.

The scaling of the circles is detailed in the box-and-whisker plot in the right-hand side of the screen. (This plot is only drawn when more than five observations are available. It is replaced by a straight line in the other cases.) It expresses the frequency distribution of the non-zero observations. Observations were transformed by the log-transformation, defined by:

$$y = 1 + \log(x) \quad (x>0)$$
$$y = 0 \quad (x=0)$$

where x are densities per m^2.



The plot shows the median observation (MED) as a thick vertical line. Its value is written on top of the box. Note: This value is back-transformed to density per m^2 (to make it more easily readable), but the scale used in this box-and-whisker plot is logarithmic. The box is determined, on its left-hand right-hand sides, by the first and third quartiles of the data.

To either side of the box extend the whiskers. These are limited by the most extreme observation lying within the bound quartile value plus (or minus) 1.5 times the interquartile distance. Their value (also back-transformed) is given under the box-and-whisker plot (wl, (whisker, lower), wu (whisker, upper)). Observations falling beyond the whiskers are called outliers. Their number (not their value!) is given by the numbers to the left (NLO (number of lower outliers)) and right (NUO (number of upper outliers)) of the box-and-whisker plot.

The circles representing the densities of the species are scaled using the whiskers. Thus, individual outliers do not influence the scaling. The smallest circle is used for all values smaller than or equal to the lowest whisker. The largest circle is for all values larger than or equal to the upper whisker. The radius of the circle varies linearly with the logarithm of the density between the two extremes.

4.4 Printing the map

To make a hard copy of the screen map, press <m> or <M>. A metafile is created and put into the sub-directory specified during the customization of the program (see Section 3, above). With the program METAHPGL.EXE all META-files found can be converted into HPGL-files (HP-GL/2). The latter can be imported in other programs (word processors, graphics programs).

Annex 4

Database

This database consists of several files (tables). Each table contains data about some specific item. For example, the NSBS2 table contains the information on density. The information about the original station name is given in another table called NSBS6. Using different tables to keep track of different types of information offers several advantages, e.g., saving time when entering information, saving disk space, saving maintainance time.

Cruise	A collection of samples taken in a relatively short time, e.g. on one boat or other field trip.
Sample	Total of one to several replicate grabs, cores, or other basic entities. The sample is used to estimate the density and biomass of the benthos at a particular station at a particular moment in time.
Replicate	One grab, core, or other basic entity. One to several replicates are combined to form a sample.

The different tables are linked by common fields: identification numbers for samples, stations, cruises, and species. This enables the user to ask questions of several tables in a single query.

Note: Only the average data (number of individuals and biomass per square meter) per sample (total of all replicates taken by one research group) are stored, not the raw data for each replicate.

The database was developed using the PARADOX database management system on a personal computer (PC). The disk NSBS-2 includes the database both as PARADOX files and as DBASE-IV files. To install the database on your PC, copy the file NSBS.EXE (a self-extracting file) onto your hard disk. Then, change to the sub-directory you copied the file onto, and enter the name of the self-extractor. The contents of the file will now extract (1,626k in 16 files).

Description of the files constituting the database

Field types are given between brackets (A=Alpha numeric; N=Number; S=Short number; D=Date; M=Memo)

NSBS1.DB

Sample id	number sample [S]
Replicate id	number replicate [S]
Cruise id	number cruise [S]
Station id	number station [S]
Date	date of sampling [D]
Macrobenthos	code macrobenthos data available (1 if available) [S]
Meiobenthos	code meiobenthos data available [S]
Sediment	code sediment data available [S]
Depth	depth in meters below sea level [N]
Lgrad	geographical position degrees longitude [S]
Lminute	geographical position minutes longitude [S]
Lsec	geographical position seconds longitude [S]
Bgrad	geographical position degrees latitude [S]
Bmin	geographical position minutes latitude [S]
Bsec	geographical position seconds latitude [S]
West/East	geographical position West or East of Greenwich [A1]

NSBS2.DB

Sample id	keyfield [S]
Replicate id	keyfield [S]
Species id	number of species [S]
Density	density of species: Macro (N/cm^2) Meio (N/10 cm^2) [N]

NSBS3.DB

Sample id	keyfield [S]
Replicate id	keyfield [S]
Species id	number of Nematoda species [S]
Number	number of individuals found [S]

NSBS4.DB

Sample id	keyfield [S]
SEDTYP	sediment type [A2] CS= coarse sand [phi 0-1] MS= medium sand [phi 1-2]

FS= fine sand [phi 2-3]
VS= very fine sand [phi 3-4]
SI= silt [phi >4]

Silt%	percentage silt [N]
Sand%	percentage sand [N]
Median	median grain size (phi) [N]
Sorting	sorting grain (mu of phi) [N]

NSBS5.DB

Phylum	[A30]
Classis	[A20]
Ordo	[A20]
Familia	[A25]
Genus	[A25]
Latin name	Latin name of species [A65]
Species id	keyfield [S]
MCSSD-NO	Marine Conservation Society Species Directory code [A8]
Rubin-code	Rubin code [A8]

NSBS6.DB

Station id	keyfield [S]
Station name	original station name [A8]
Description	description station name [A50]

NSBS8.DB

Cruise id	keyfield [S]
Description cruise	cruise description [A50]
Region	region of sampling [A75]
Number of stations	number of locations [S]
Vessel	name of research vessel [A25]
First day of cruise	first sampling day of survey [D]
Last day of cruise	last sampling day of survey [D]
Resp. scientist	responsible scientist for survey [A25]
Resp. data	responsible scientist for data conservation [A25]
Publications	available publications [M20]

NSBS9.DB

Sample id	keyfield [S]
Cruise id	keyfield [S]
Poly	biomass polychaetes [N]
Moll	biomass mollusca [N]
Crust	biomass crustacea [N]
Echi	biomass echinodermates [N]
Rest	biomass others [N]
Sum	biomass total [N]

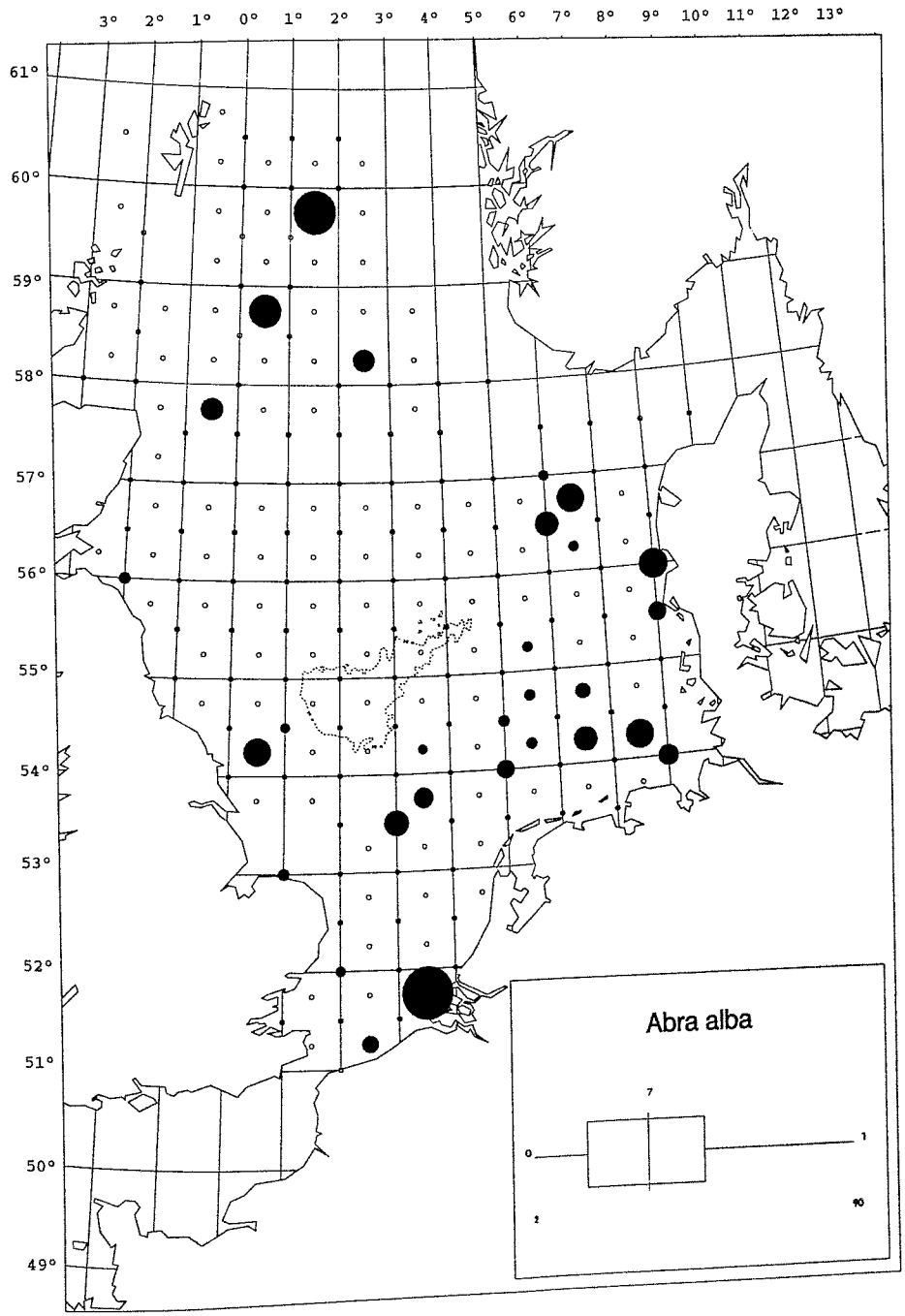
Biomass values are given as gAFDW/m^2.

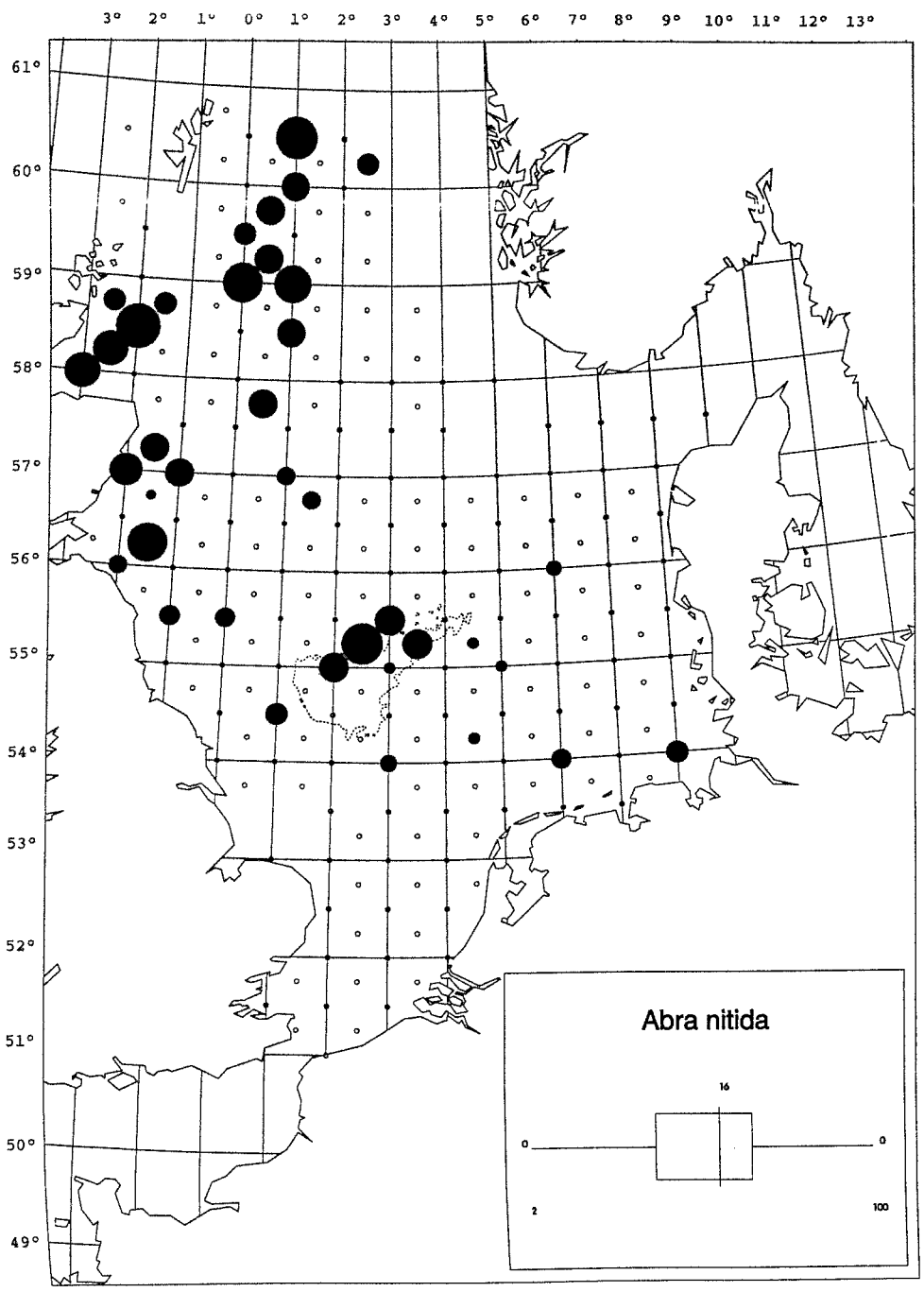
Annex 5

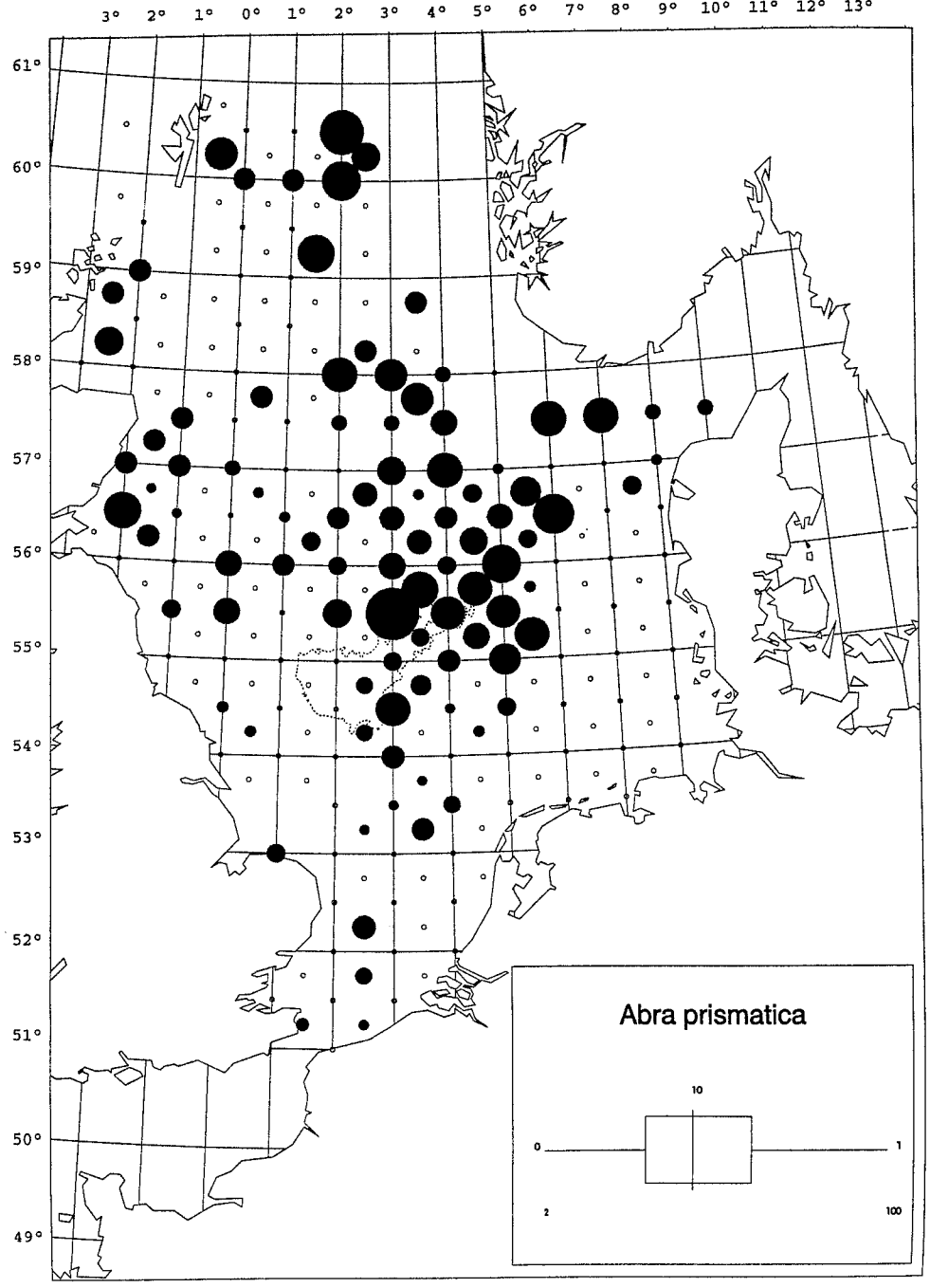
The macrobenthic infauna of the North Sea: distribution maps

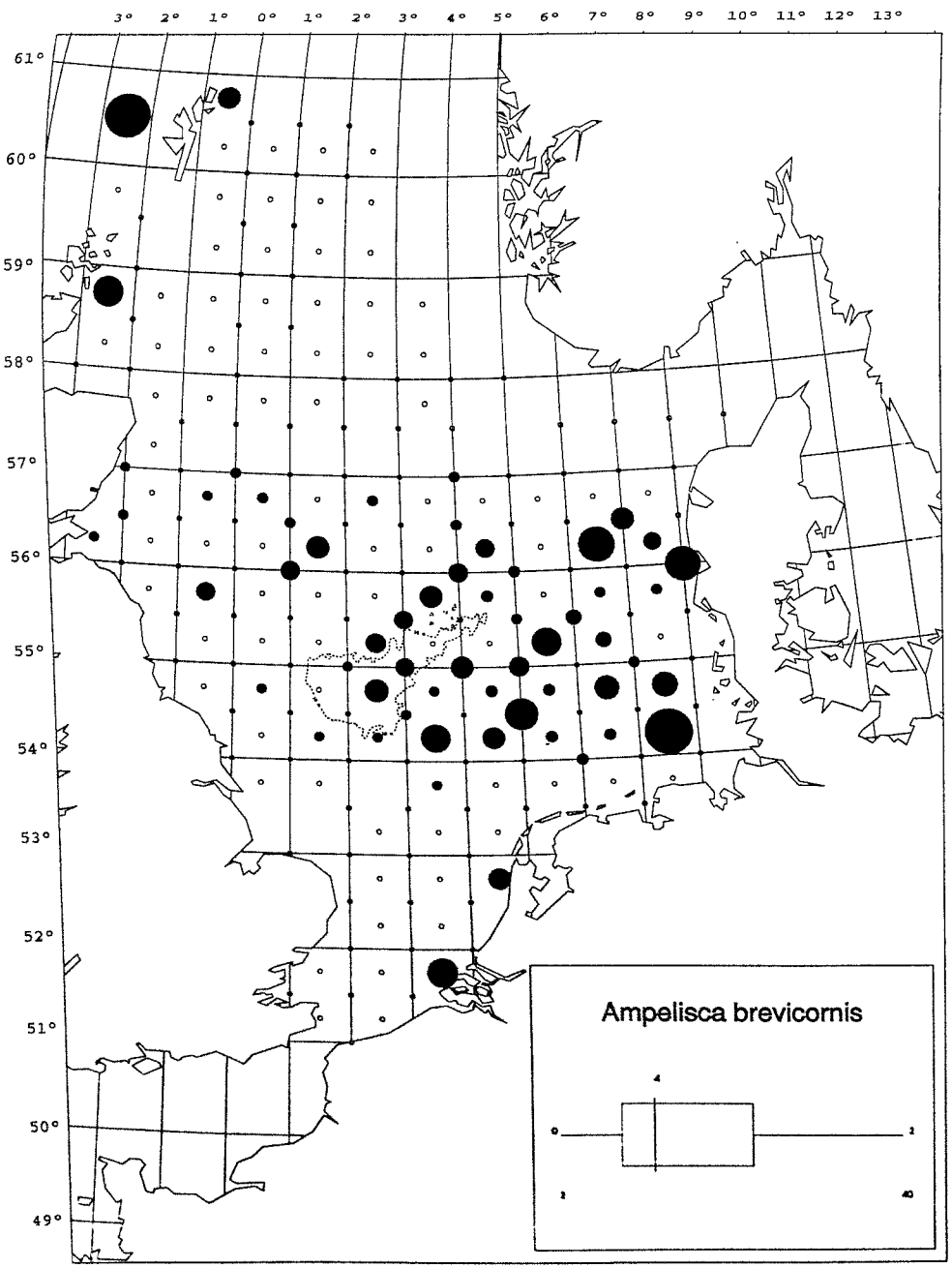
On each map contained in this Annex, the box-and-whisker plot expresses the frequency distribution of the non-zero observations on a logarithmic scale. The plot shows the median observations as a vertical line. Its (back-transformed) value is written on top of the box (e.g., 7 in the case of *Abra alba*). The box is determined, to its left- and right-hand sides, by the first and third quartiles of the data. To either side of the box extend the whiskers. These are limited by the most extreme observation lying within the bound quartile value ± 1.5 times the interquartile distance. Their value (also back-transformed) is given under the box-and-whisker plot (2 and 90, respectively, in the case of *Abra alba*). The number of observations falling beyond the whiskers, called outliers, is given by the numbers to the left and right of the box-and-whisker plot (0 and 1, respectively, for *Abra alba*).

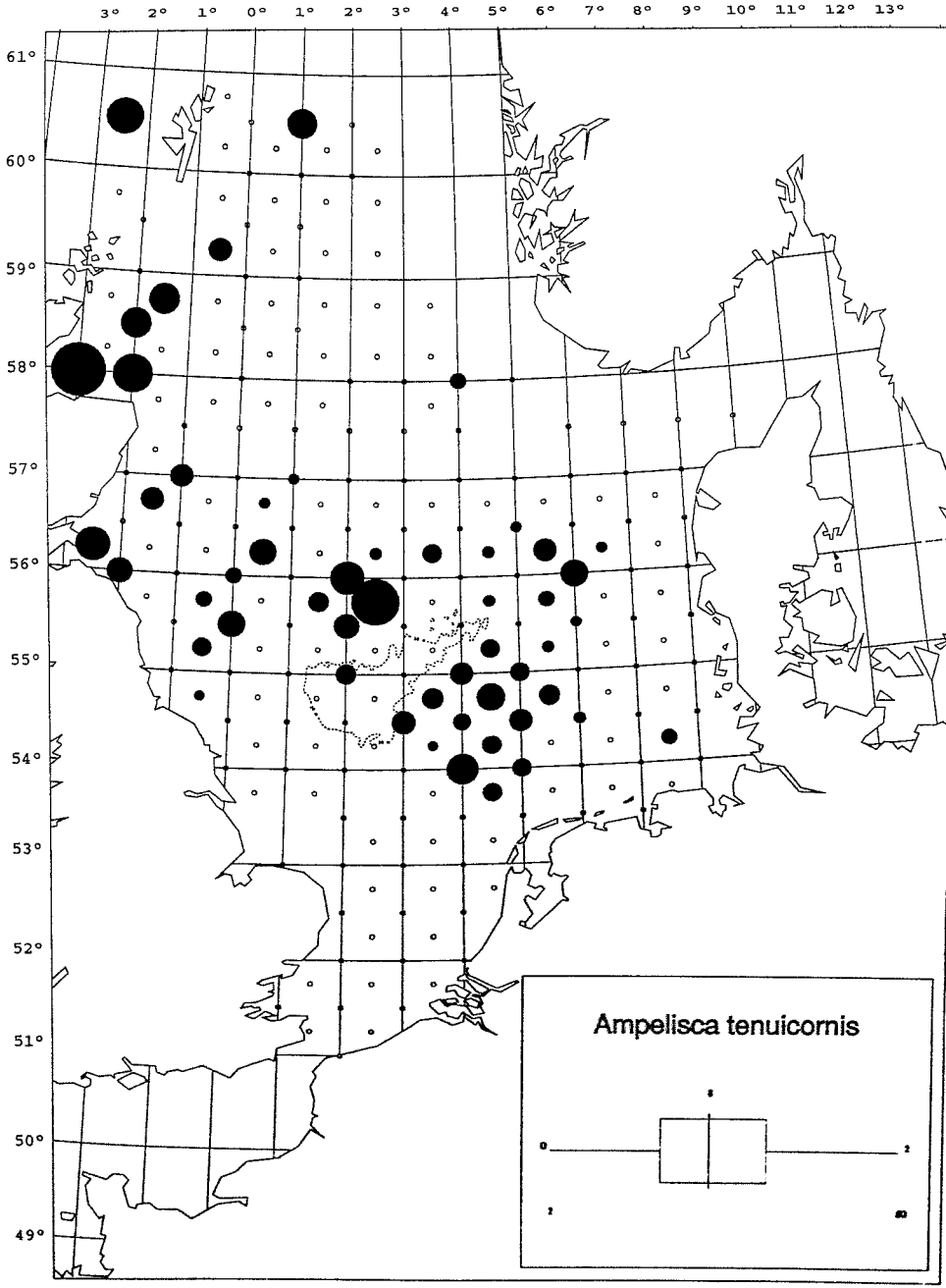
The radius of the circles in the map are the ln-transformed abundances of the species. For example, the maximum density recorded for *Abra alba* was 251.2 ind./m^2; thus, the radius of the largest circle is about 5.52 mm.

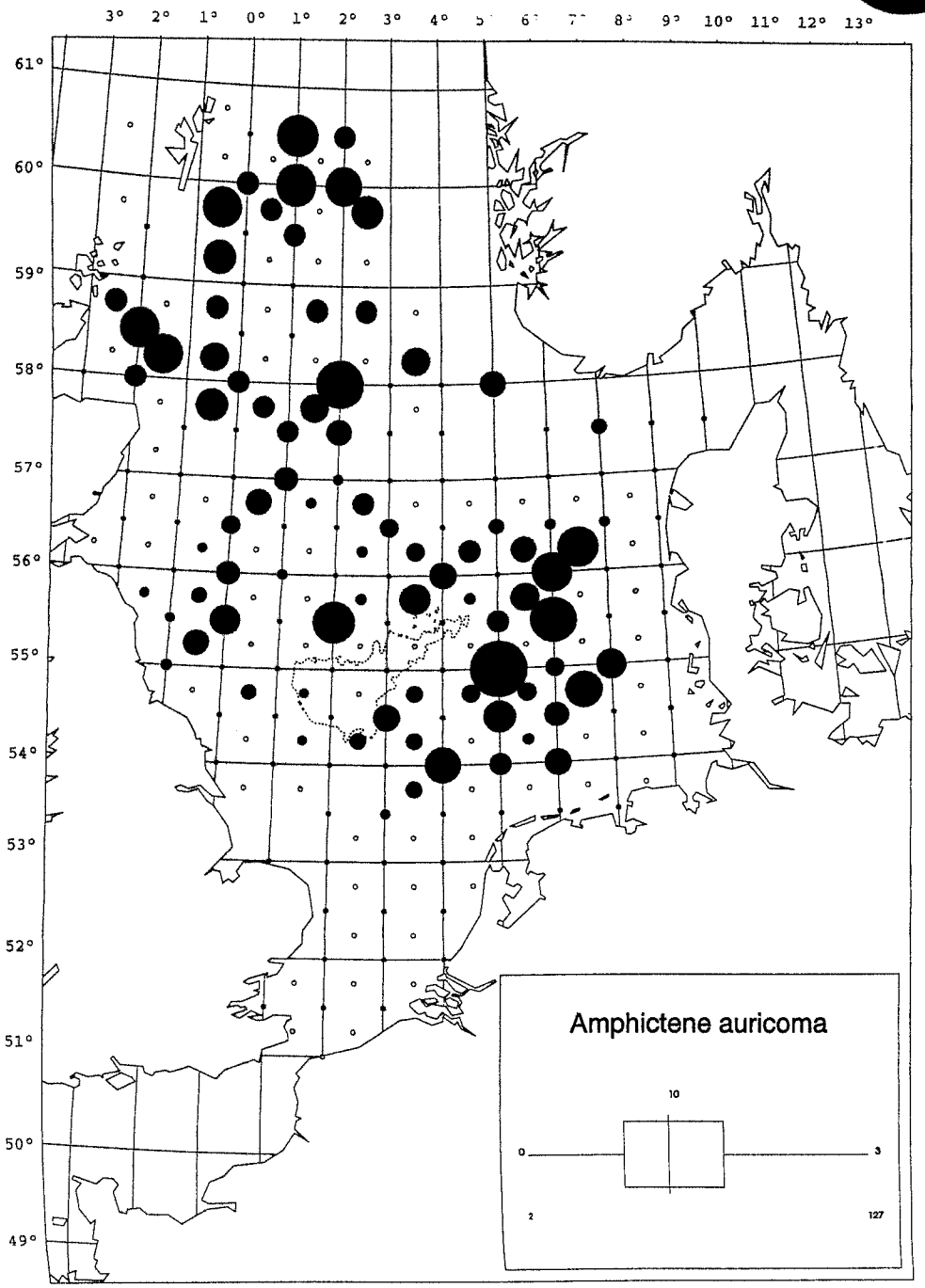


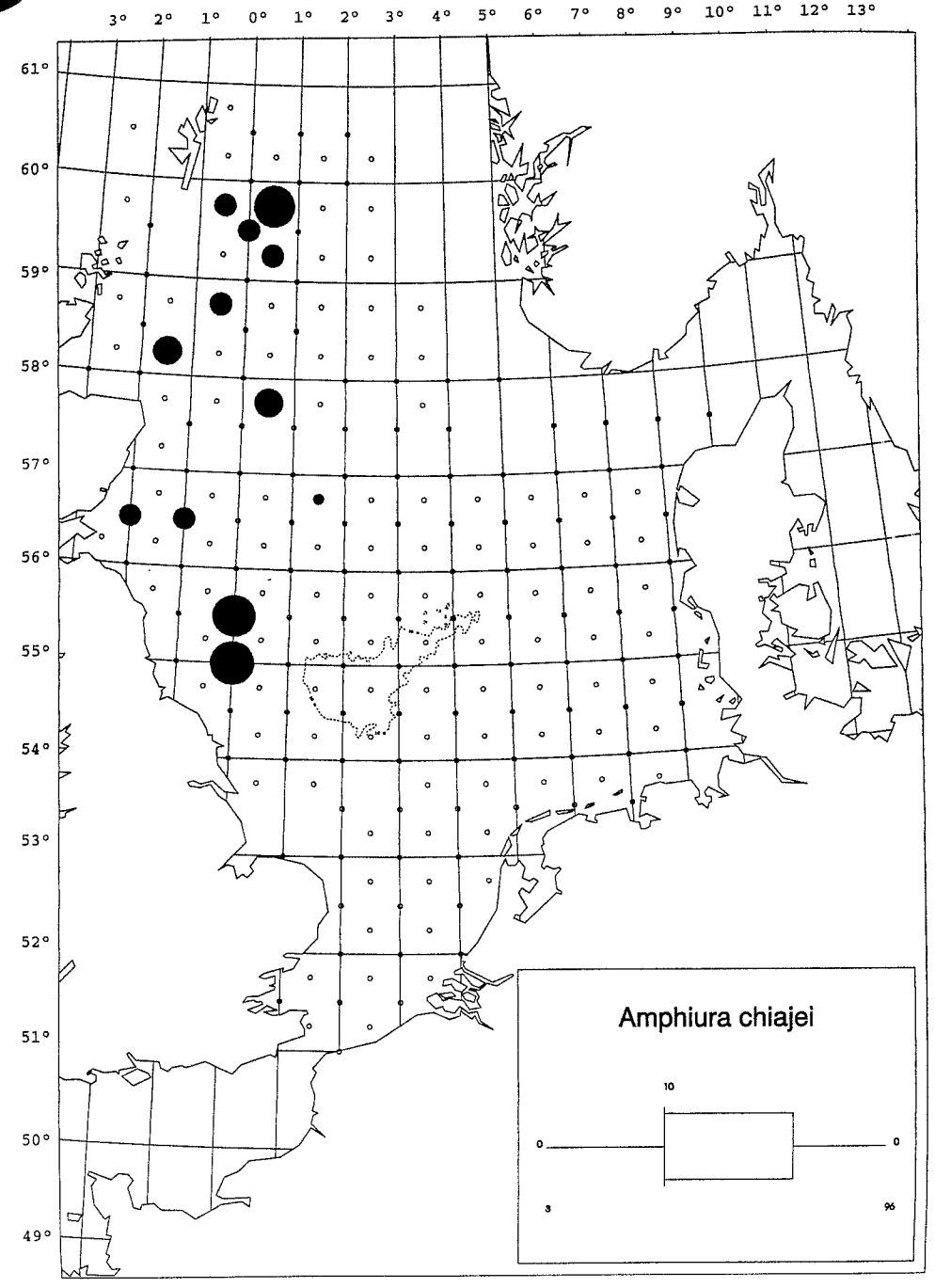

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Abra nitida
16
0
0
2
100

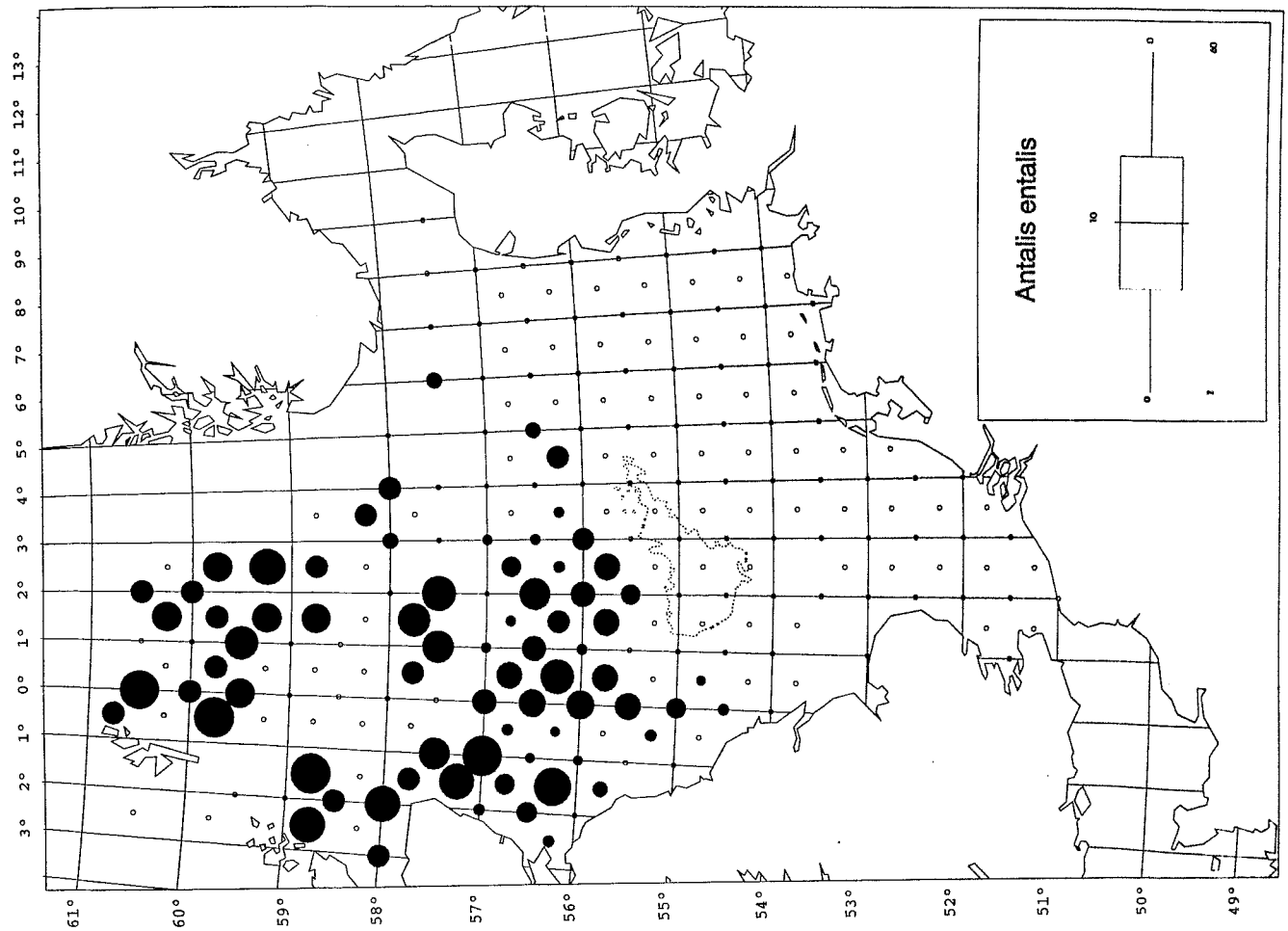

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Abra prismatica
10
0
1
2
100

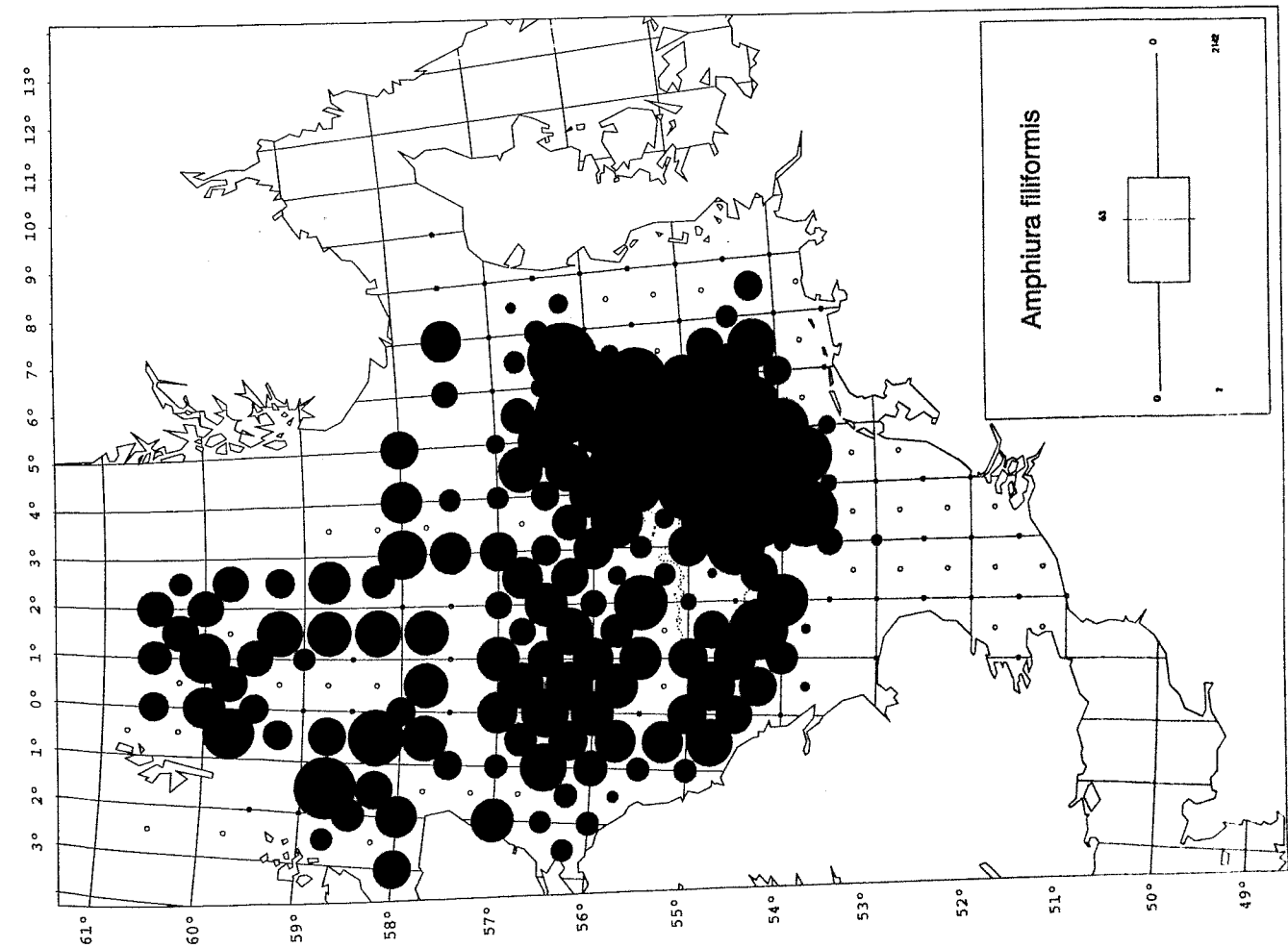

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61°
60°
59°
58°
57°
56°
55°
54°
53°
52°
51°
50°
49°
Ampelisca brevicornis

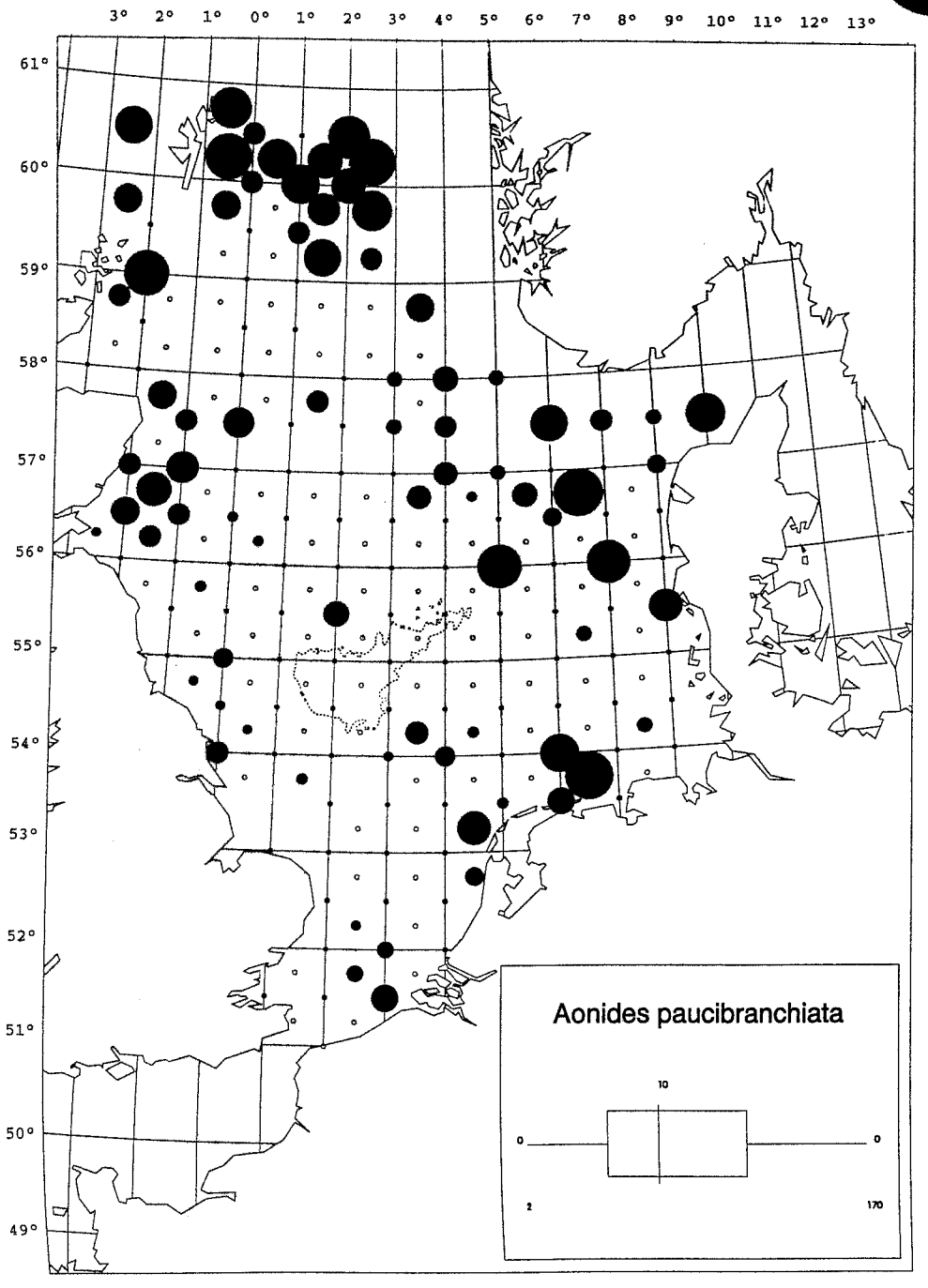

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61°
60°
59°
58°
57°
56°
55°
54°
53°
52°
51°
50°
49°
Ampelisca tenuicornis

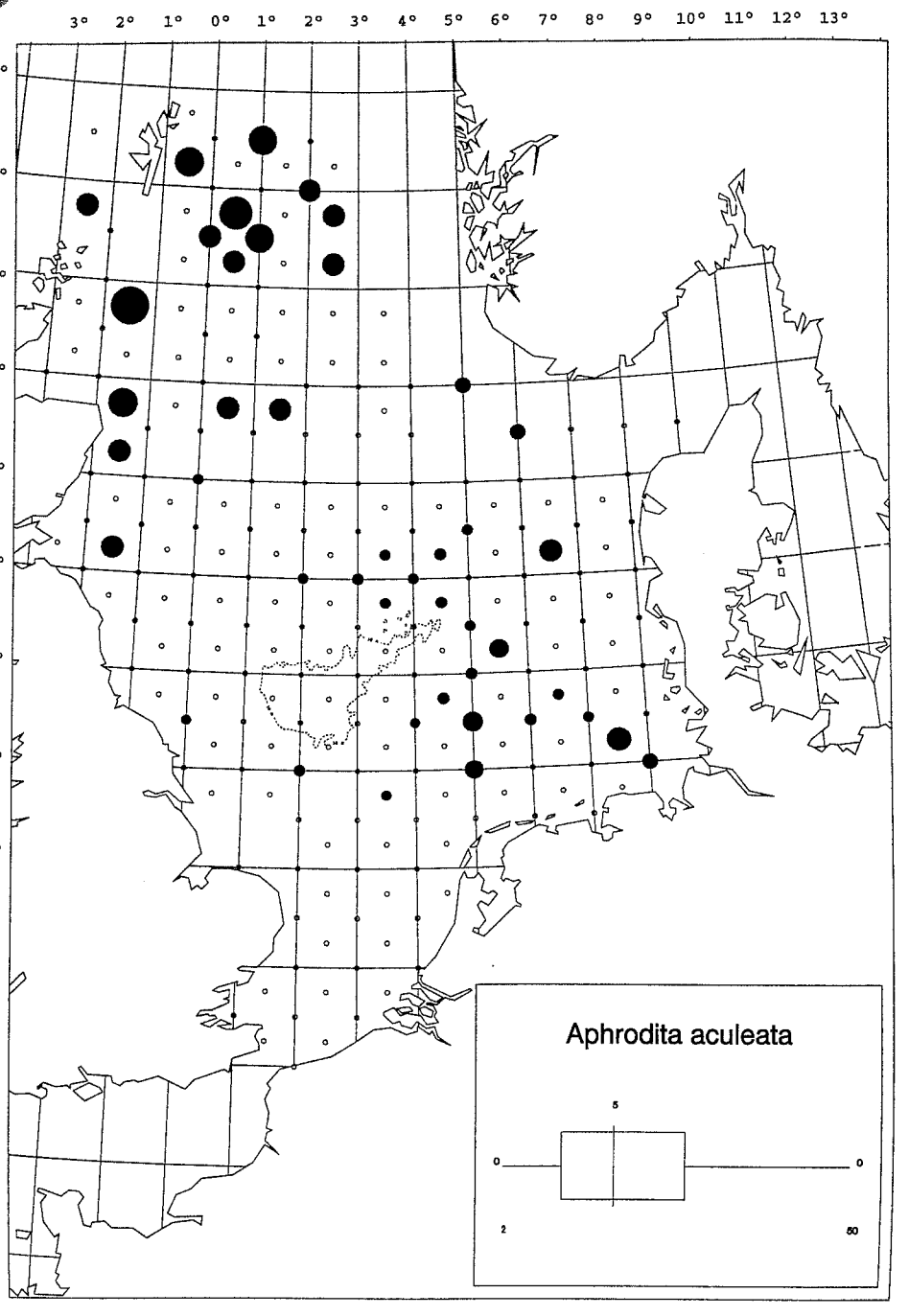

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Amphictene auricoma
10
0
3
2
127

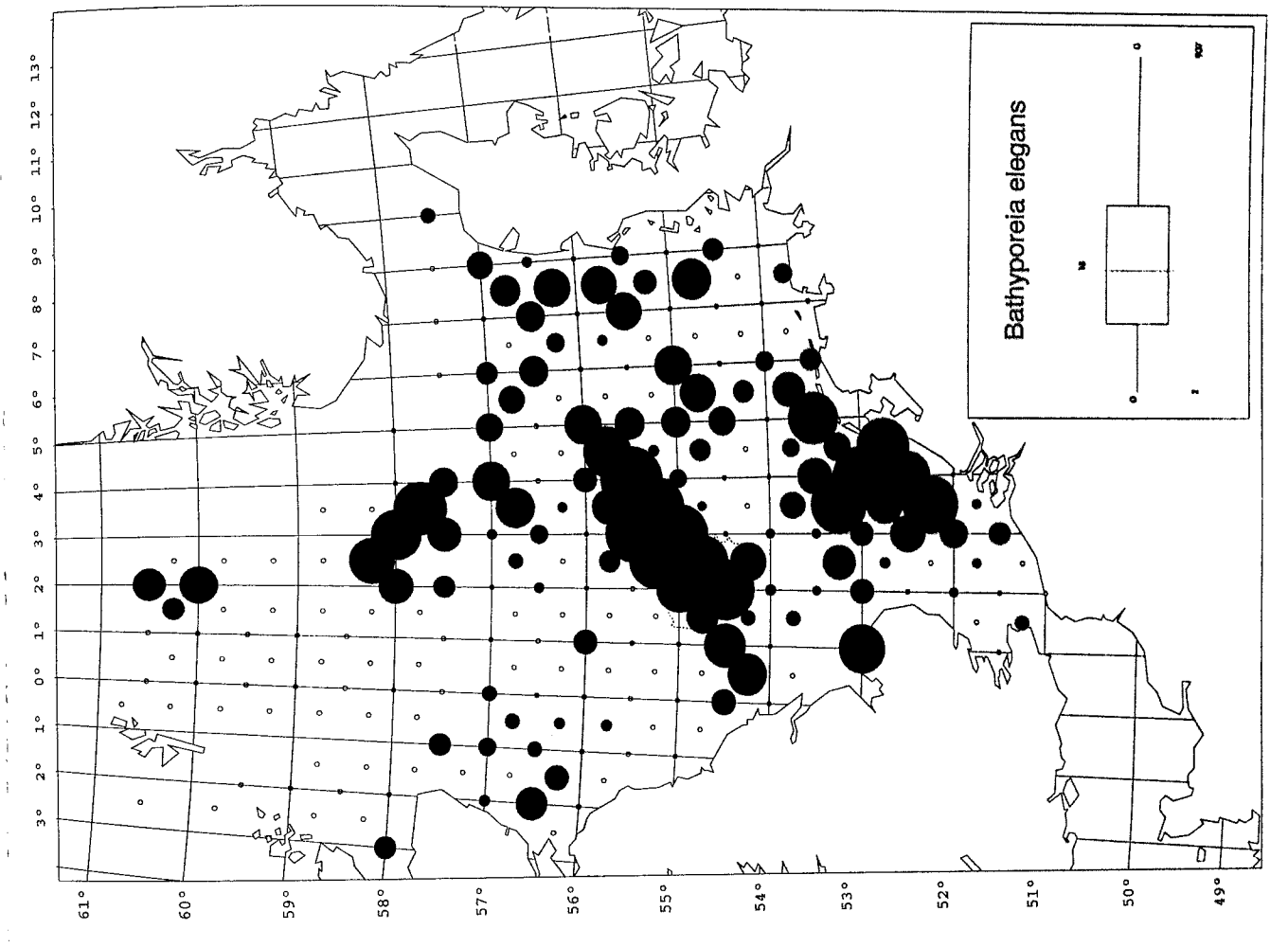

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Amphiura chiajei
10
0
0
3
95

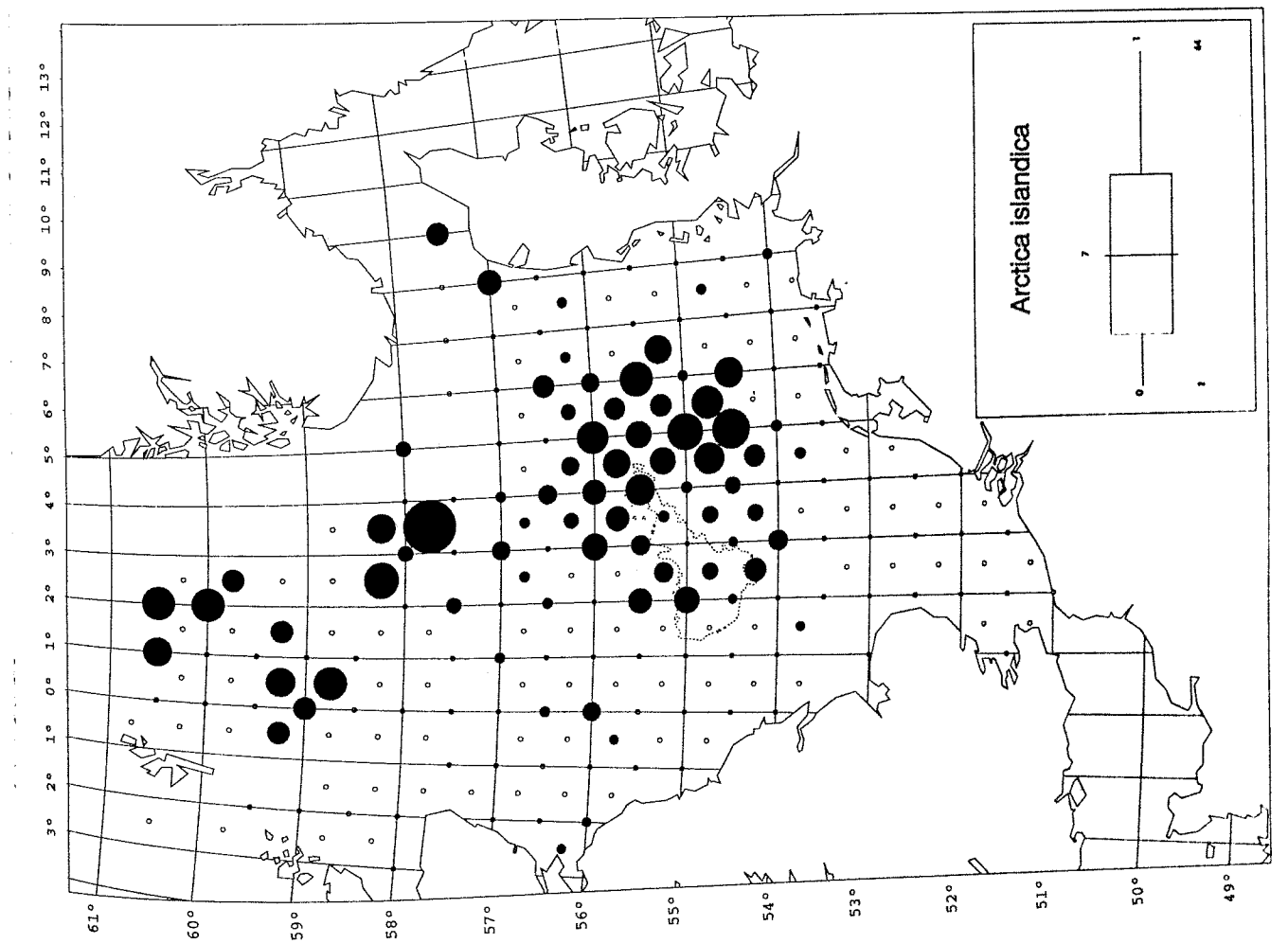

Antalis entalis
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°

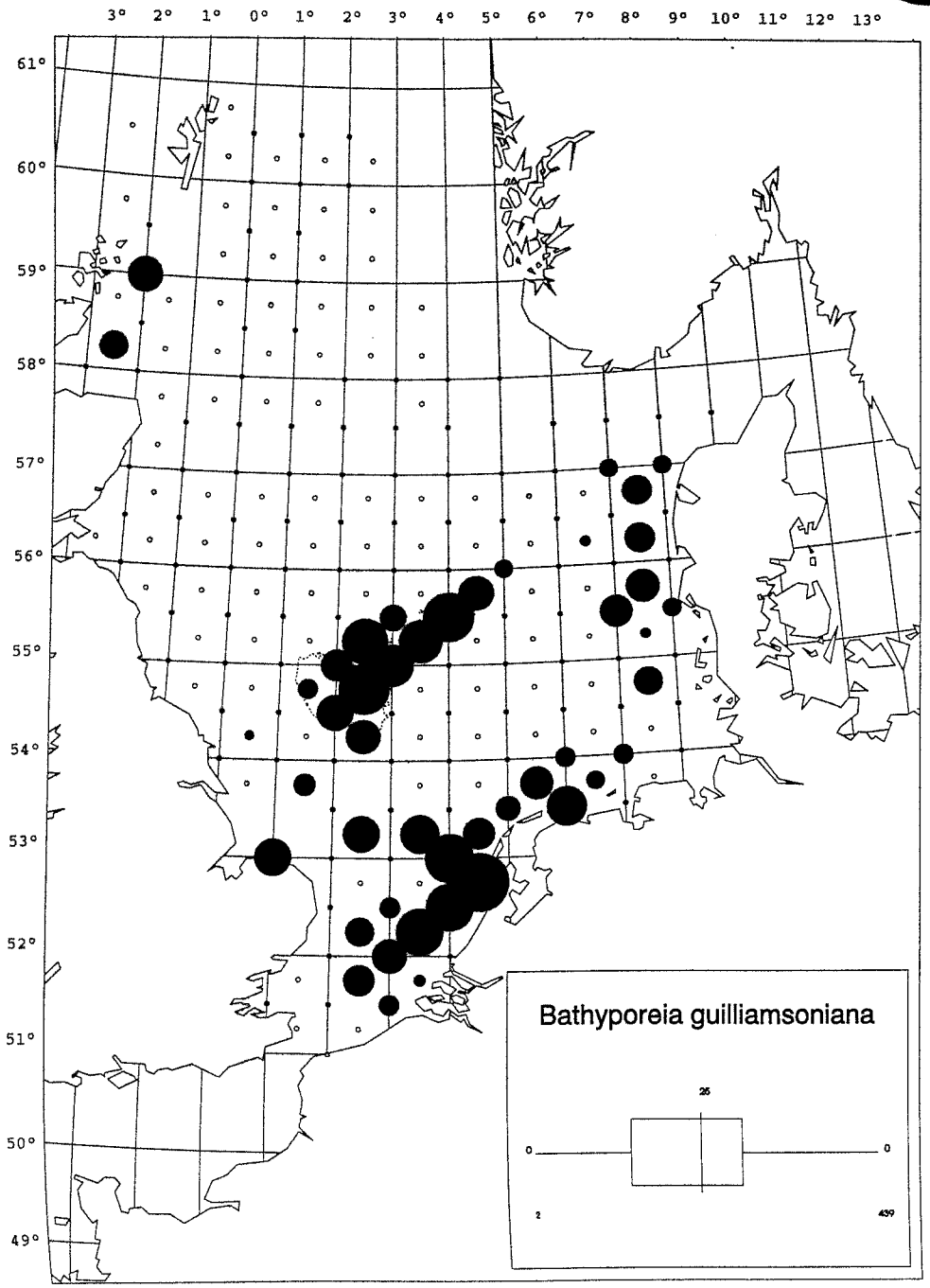

Amphiura filiformis
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°

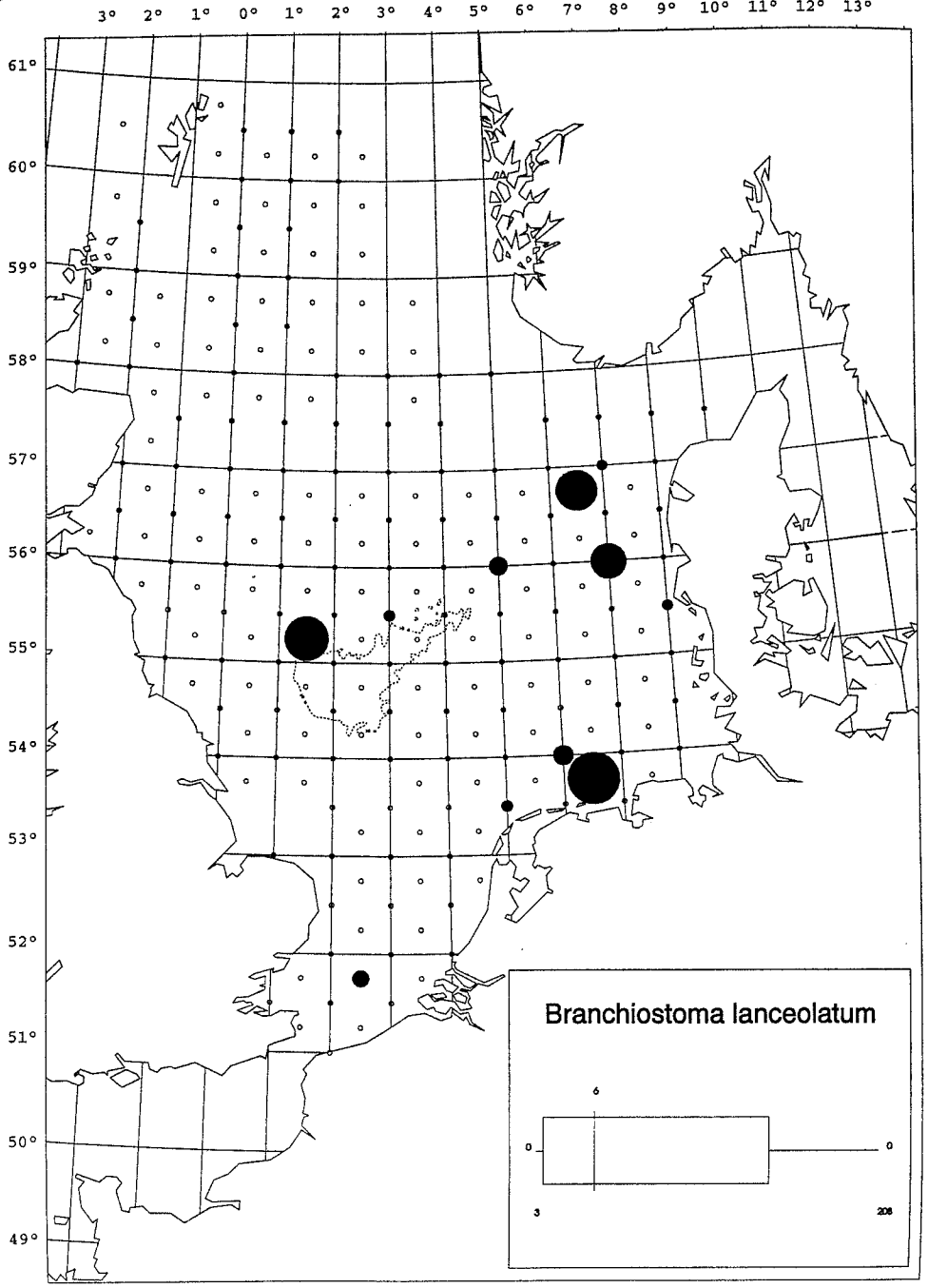

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Aonides paucibranchiata
10
0
0
2
170

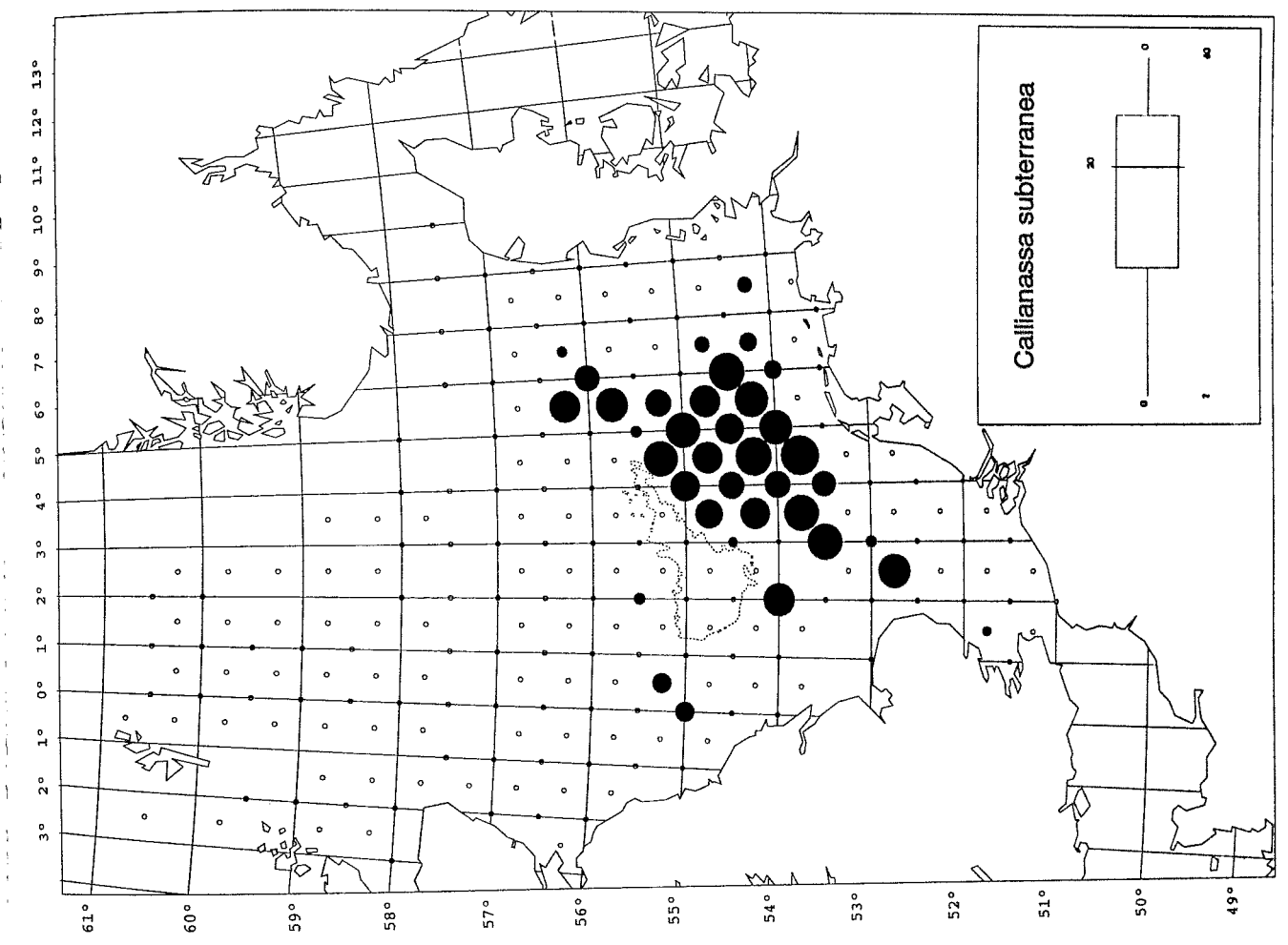

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Aphrodita aculeata
5
0
0
2
80

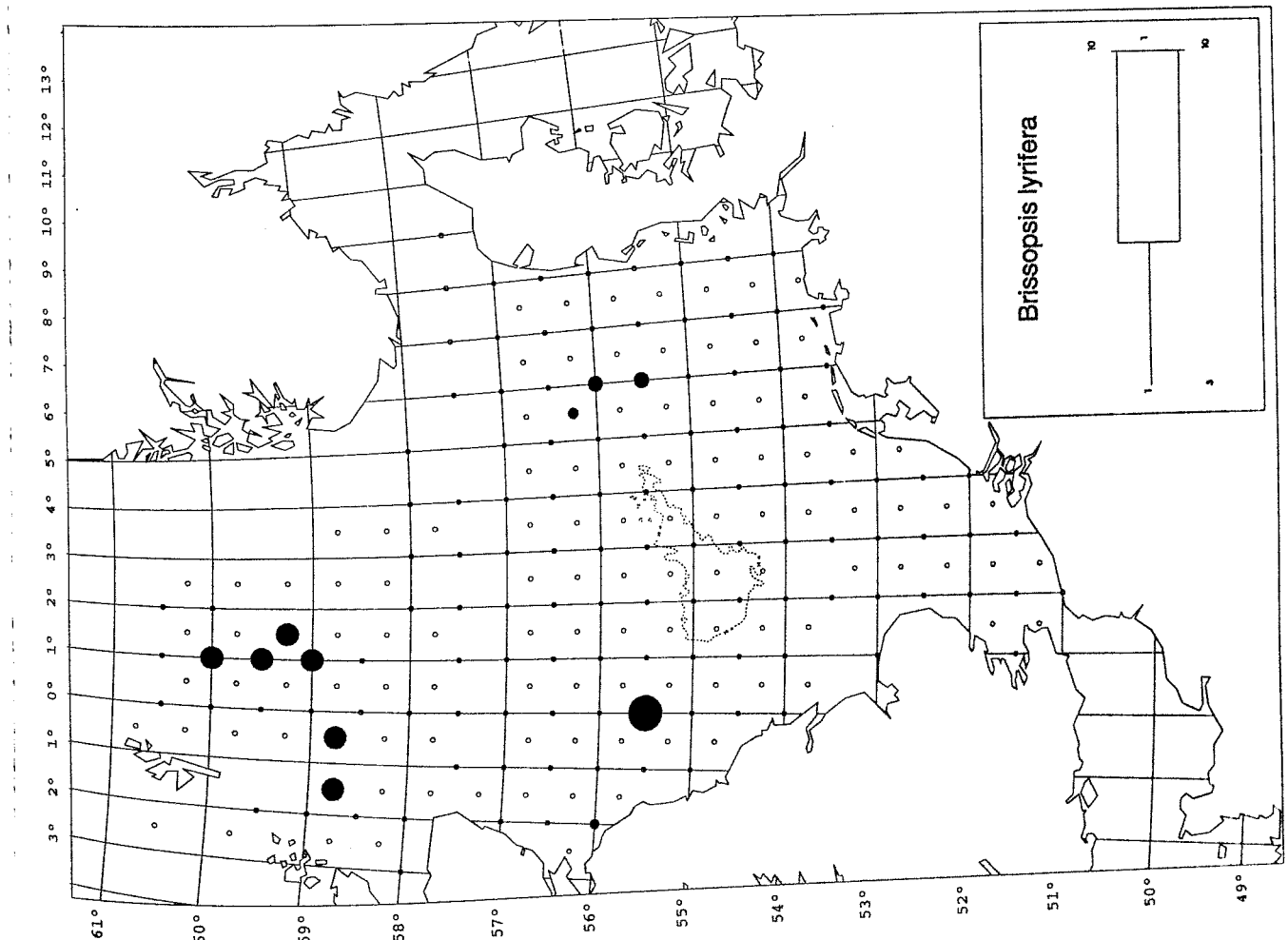

Bathyporeia elegans

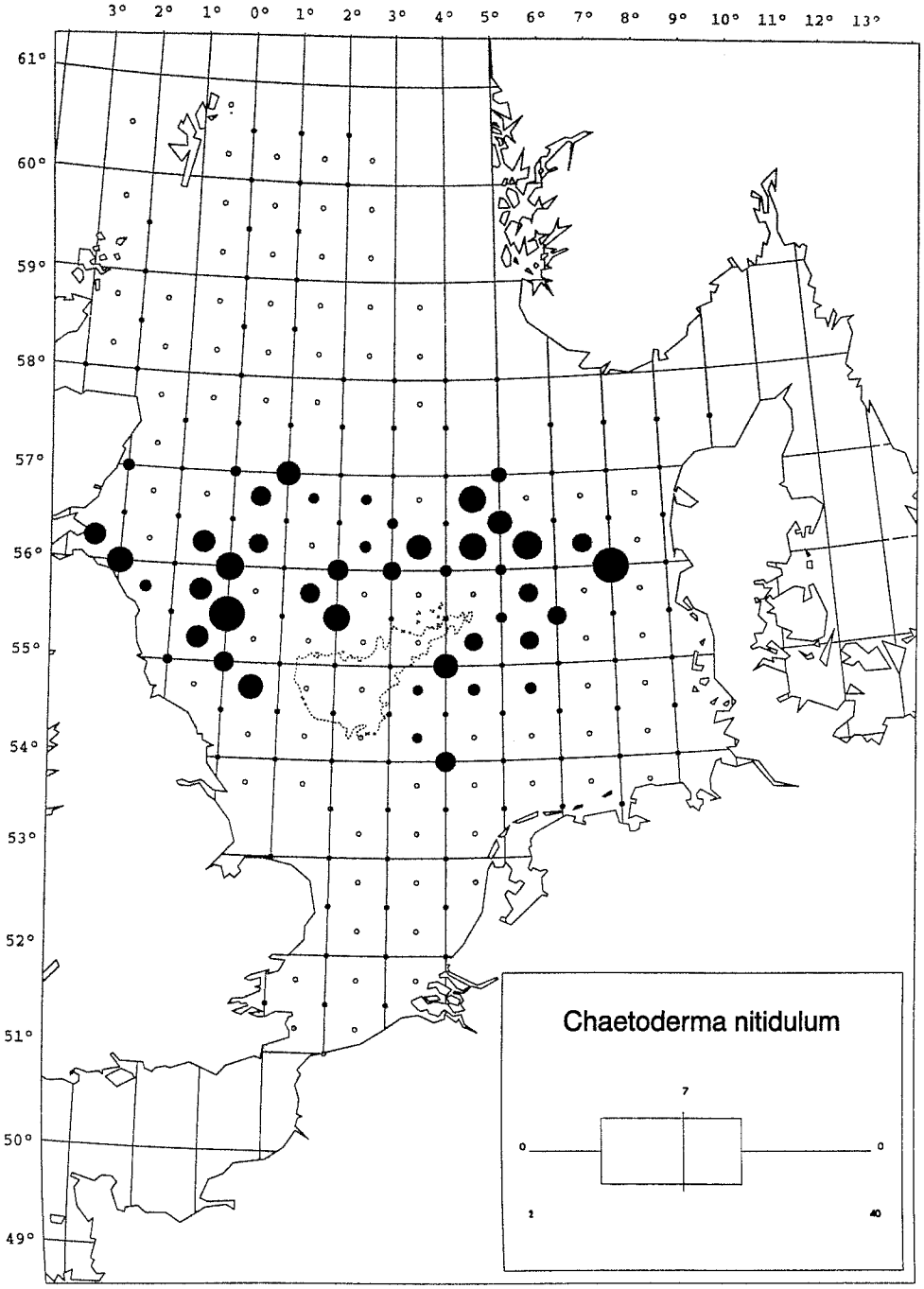

Arctica islandica

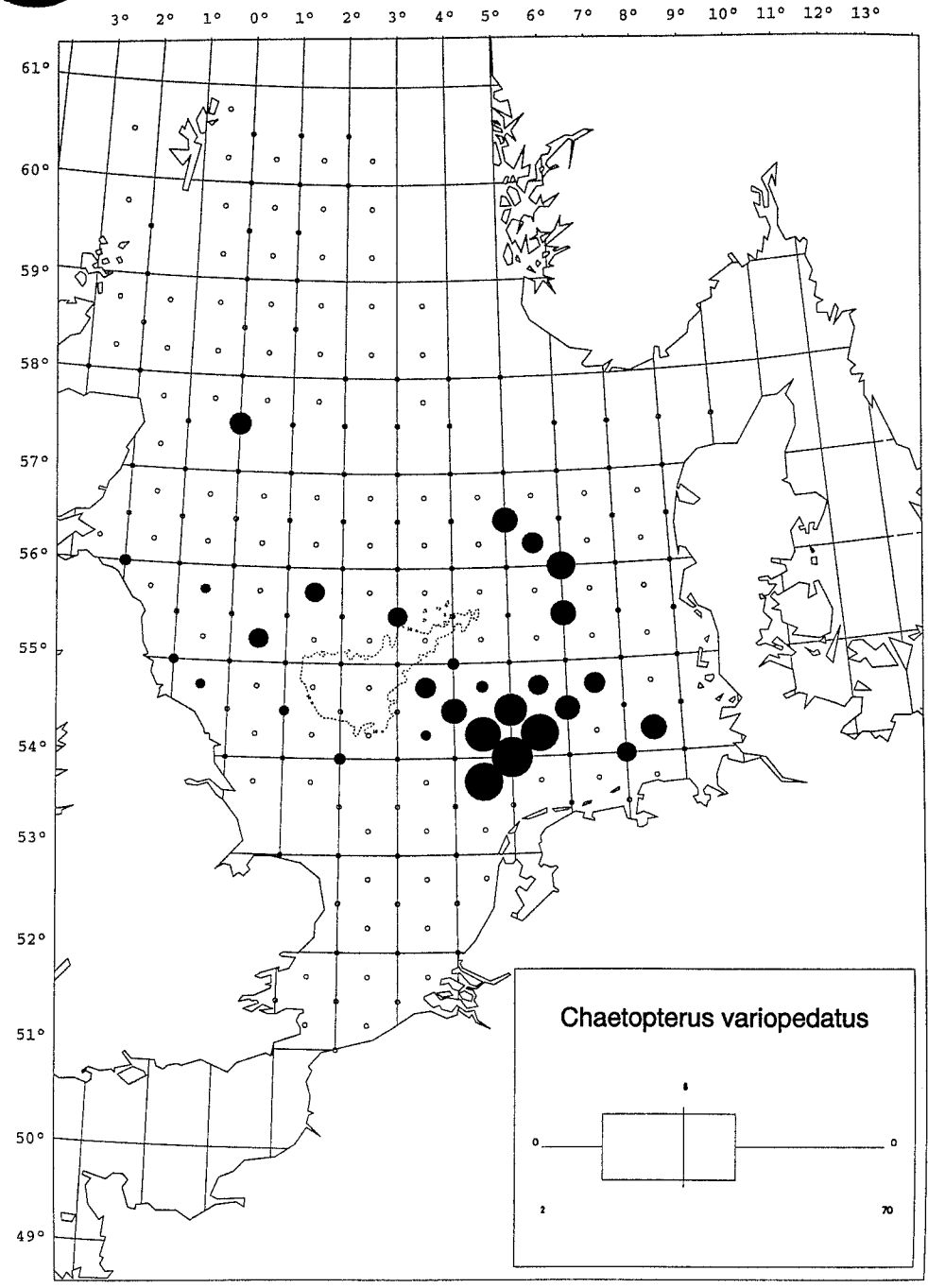

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Bathyporeia guilliamsoniana
26
0
0
2
439

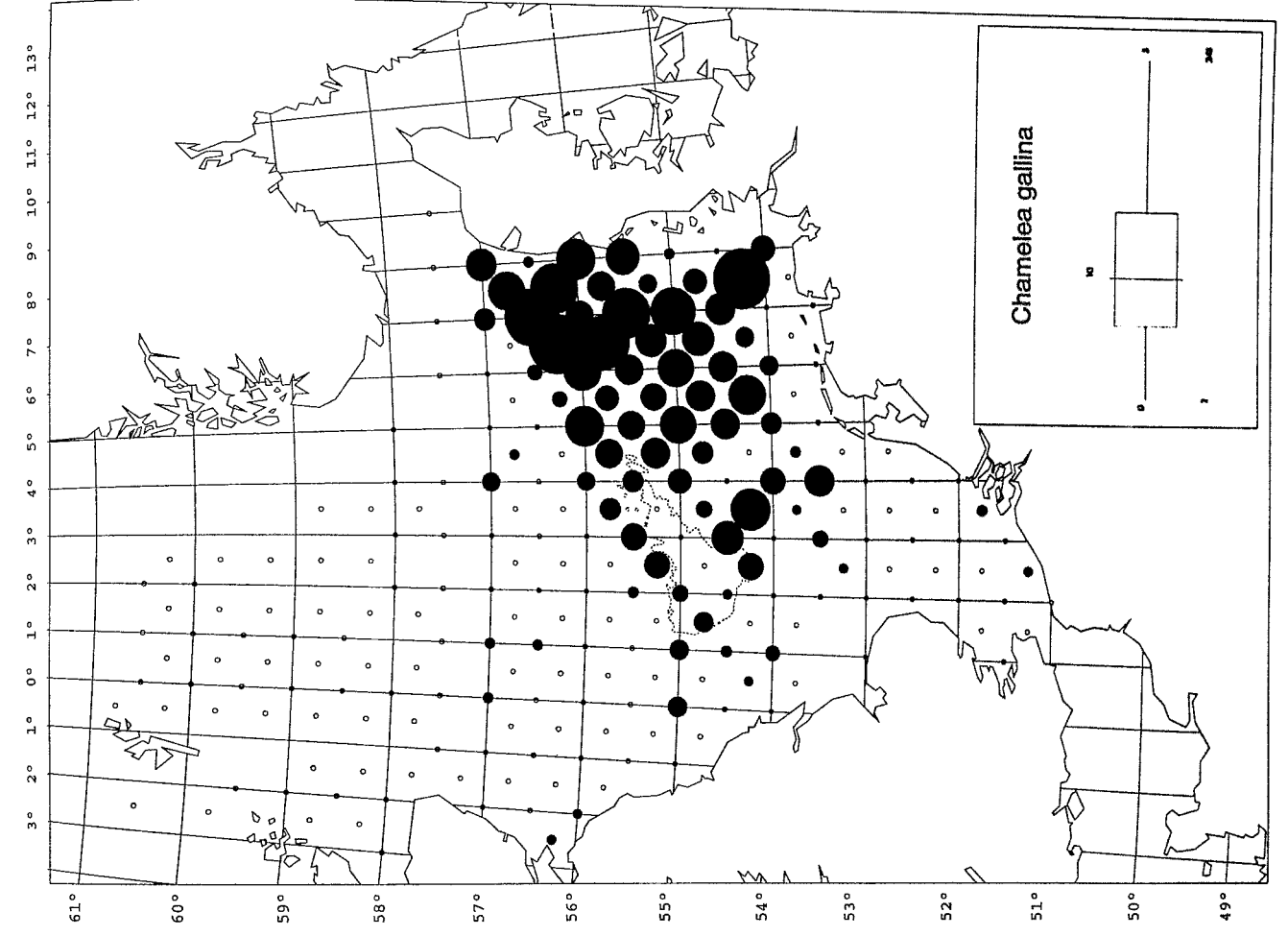

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Branchiostoma lanceolatum
6
0
0
3
208

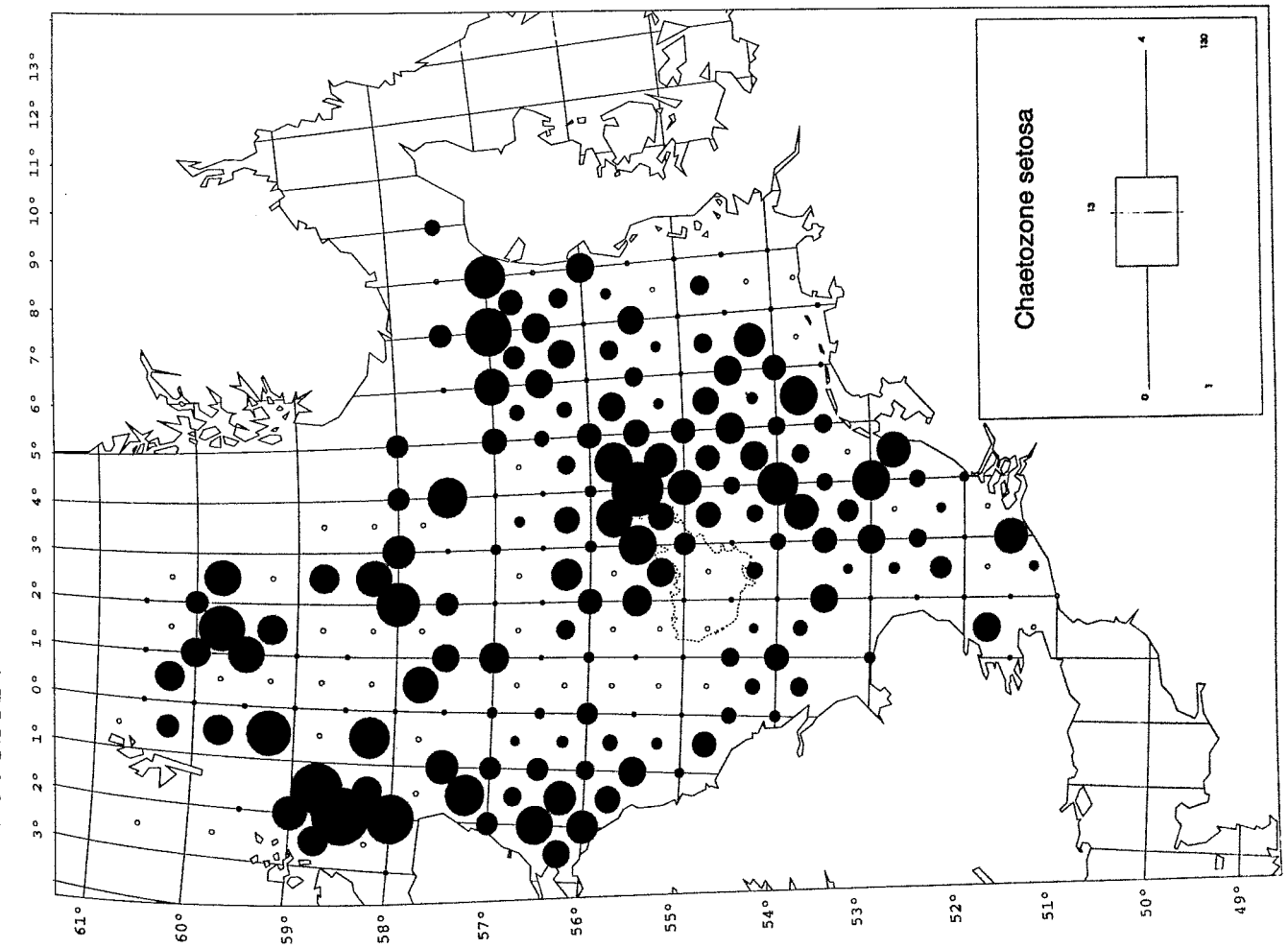

Callianassa subterranea
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°

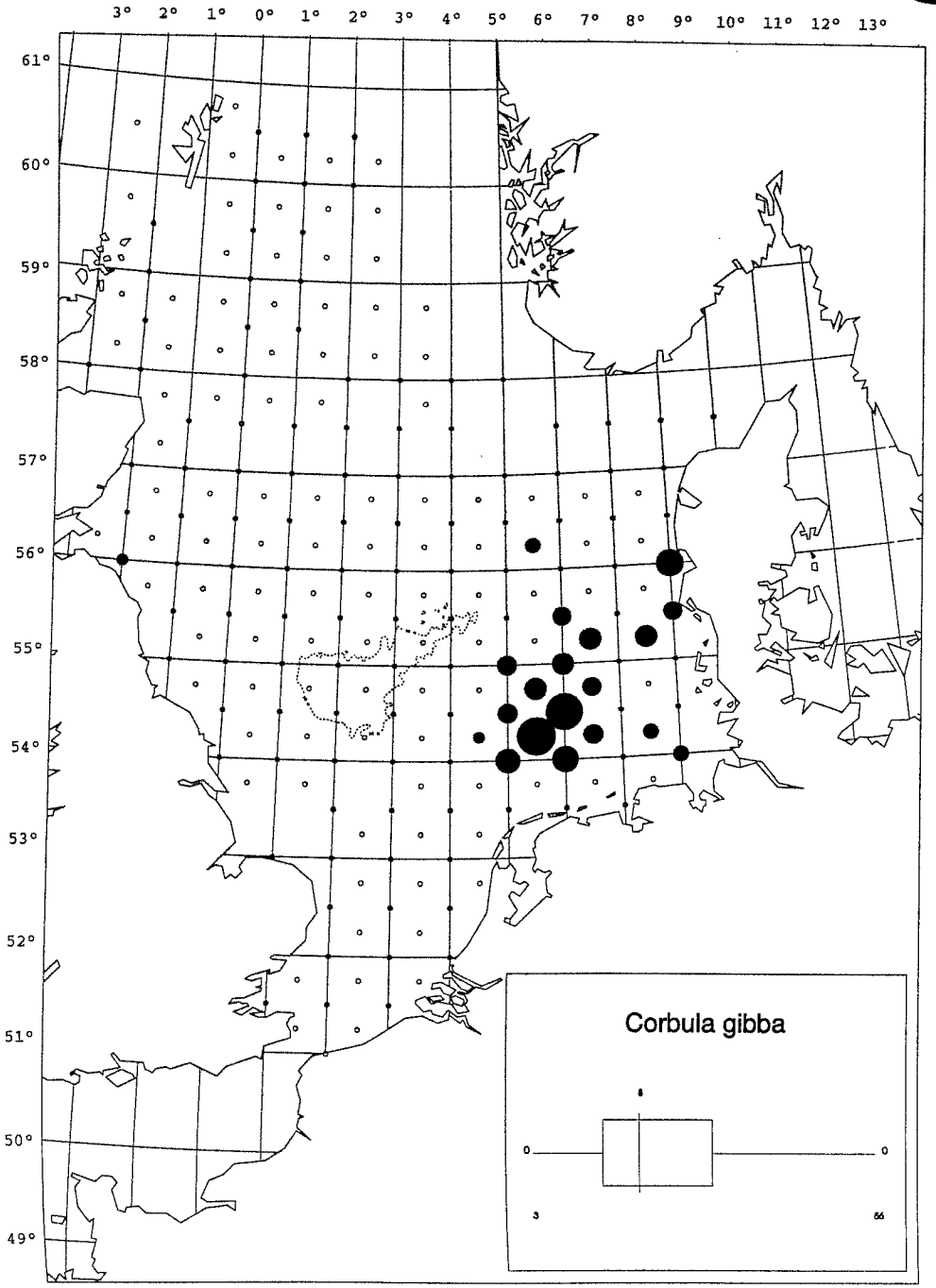

Brissopsis lyrifera
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°

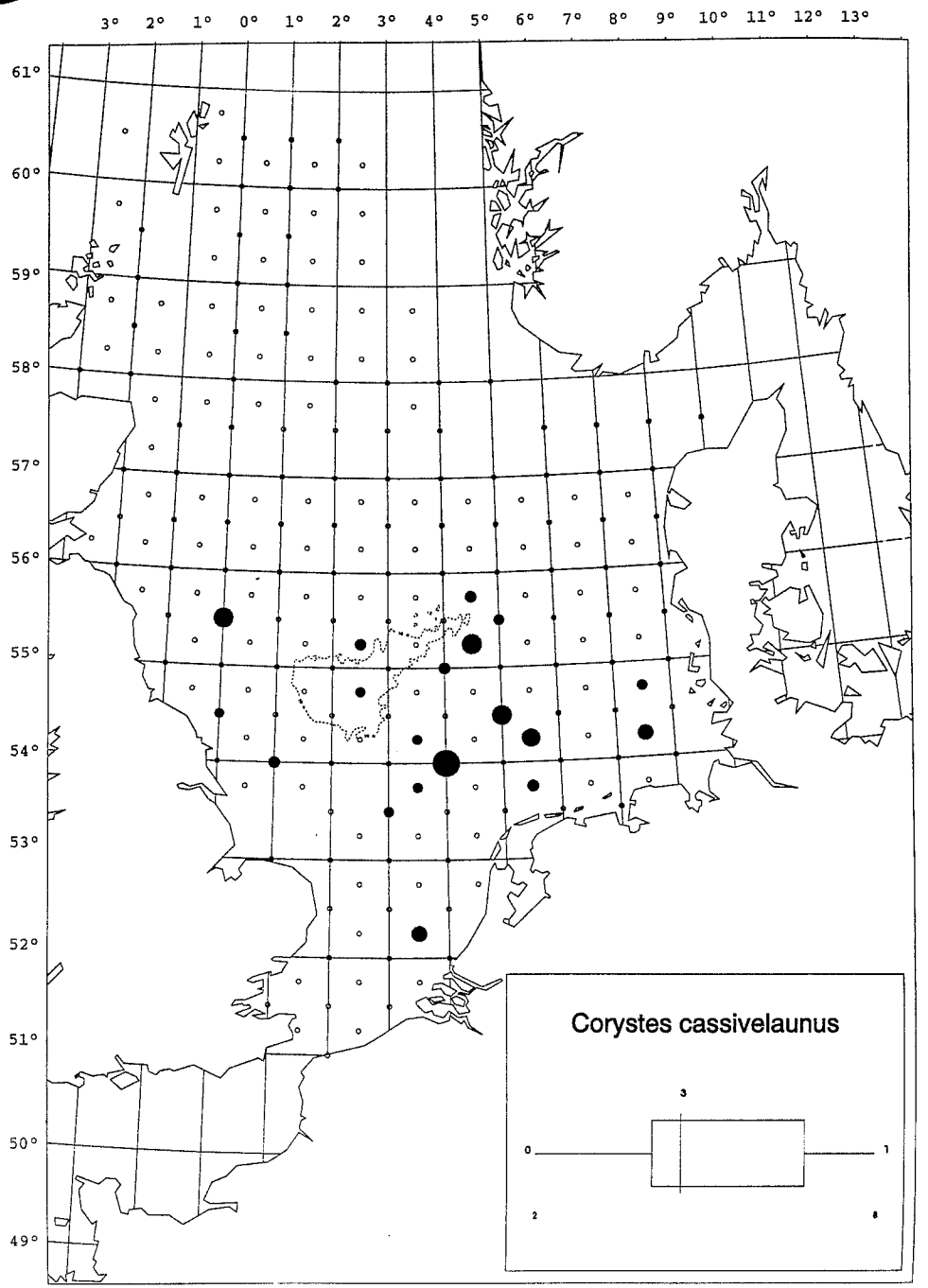

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Chaetoderma nitidulum
7
0
0
1
40

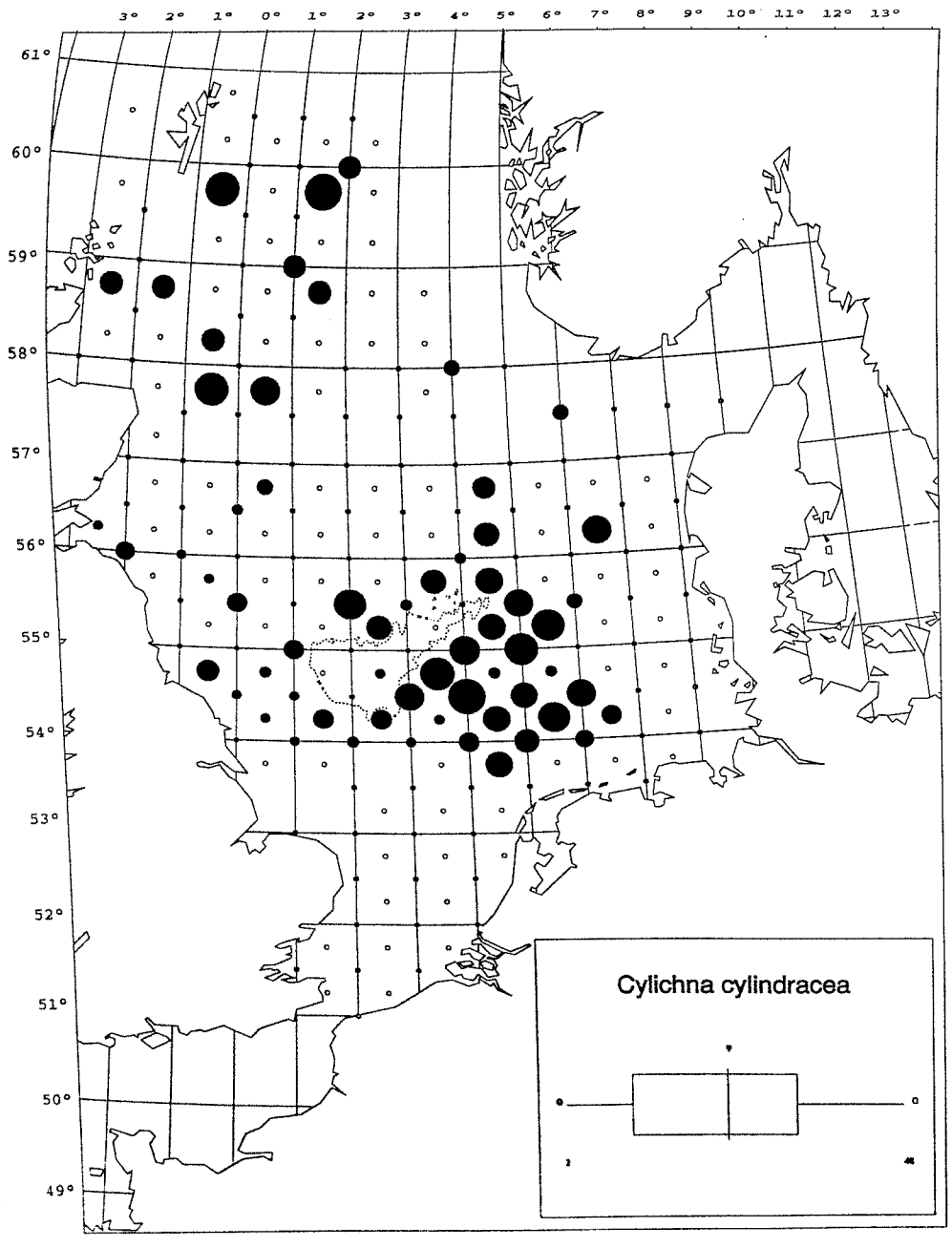

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Chaetopterus variopedatus
8
0
0
2
70

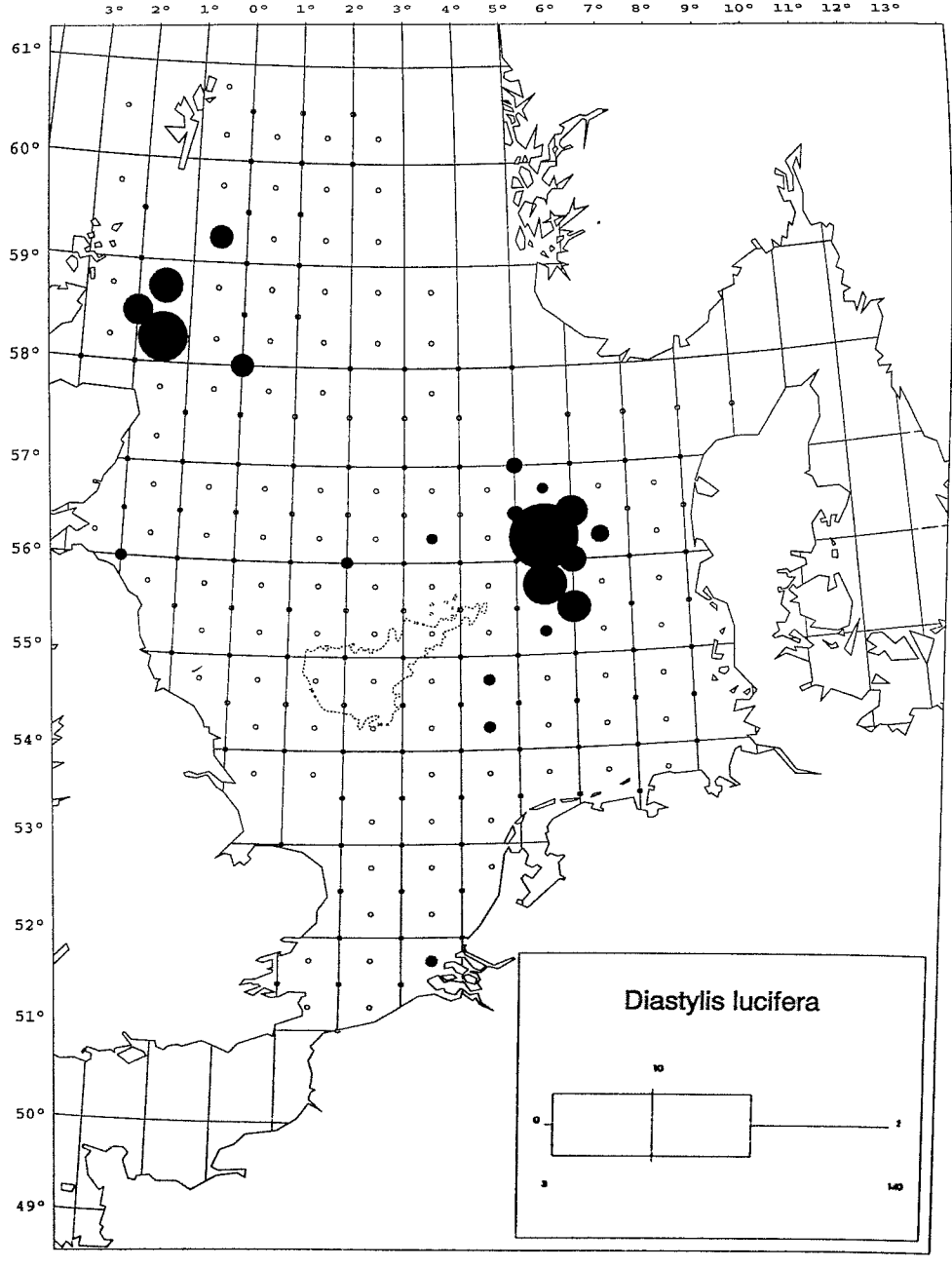

Chamelea gallina
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°

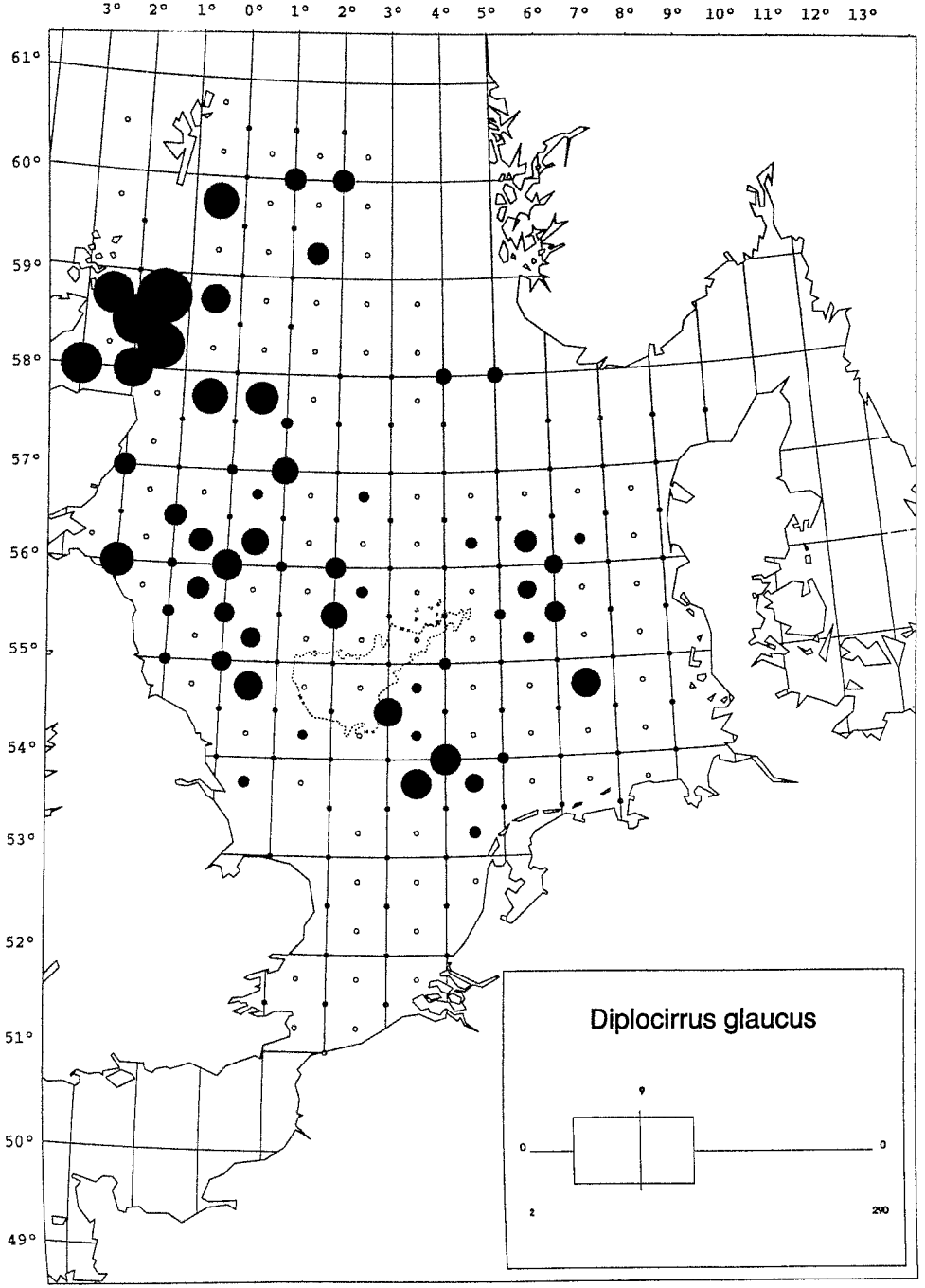

Chaetozone setosa
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°

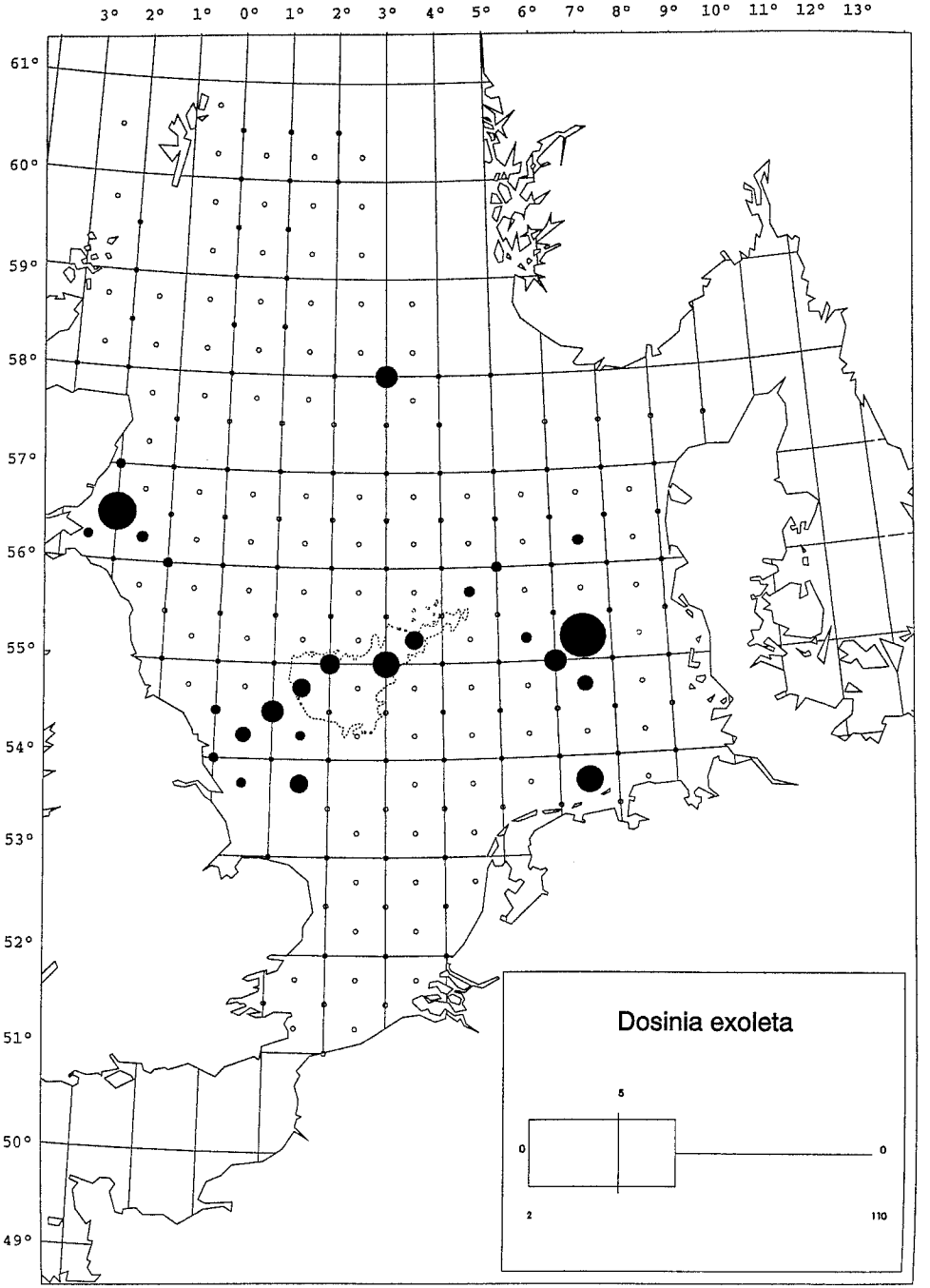

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61°
60°
59°
58°
57°
56°
55°
54°
53°
52°
51°
50°
49°
Corbula gibba
8
0
0
3
66

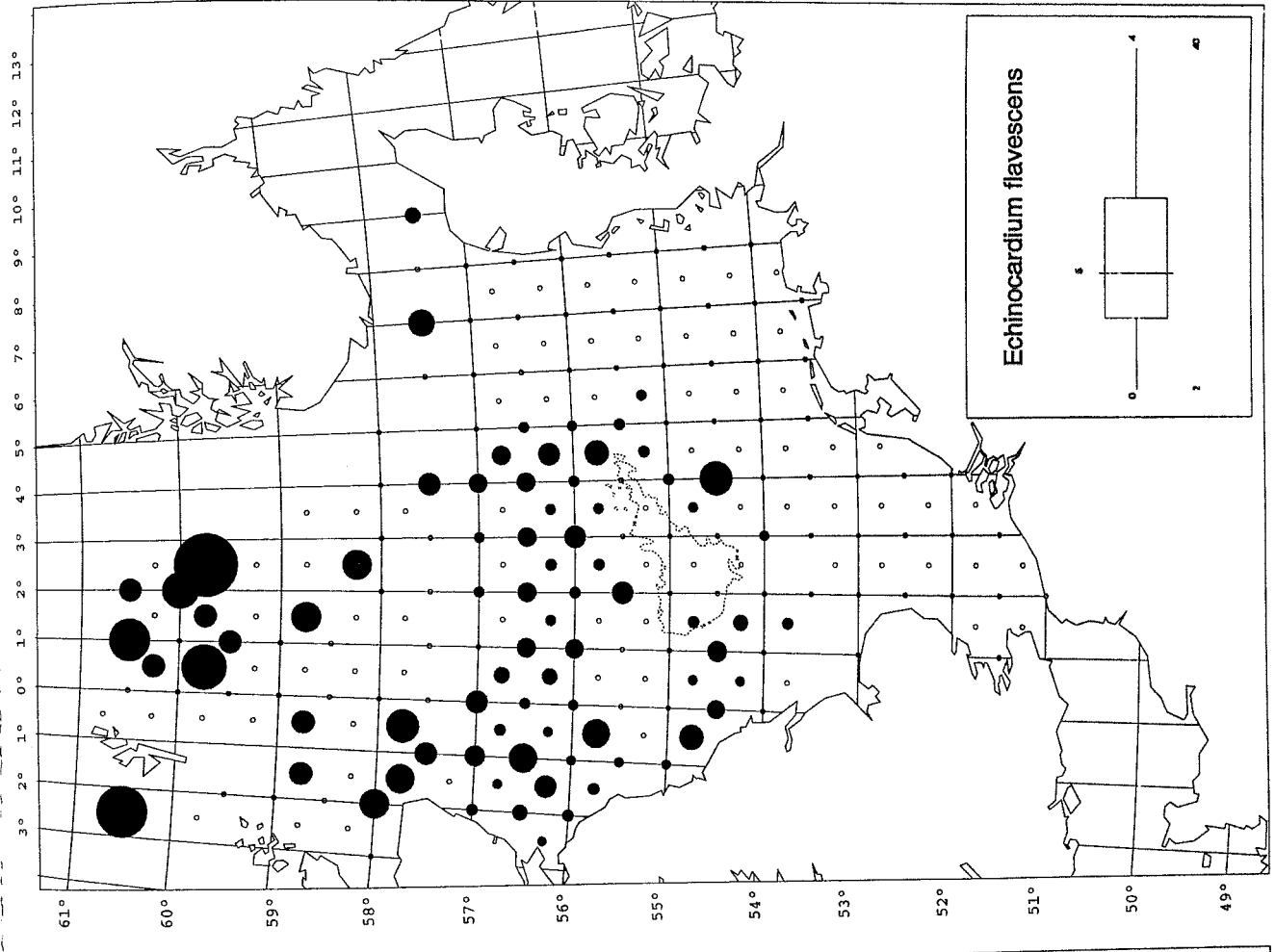

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61°
60°
59°
58°
57°
56°
55°
54°
53°
52°
51°
50°
49°
Corystes cassivelaunus
3
0
1
2
8

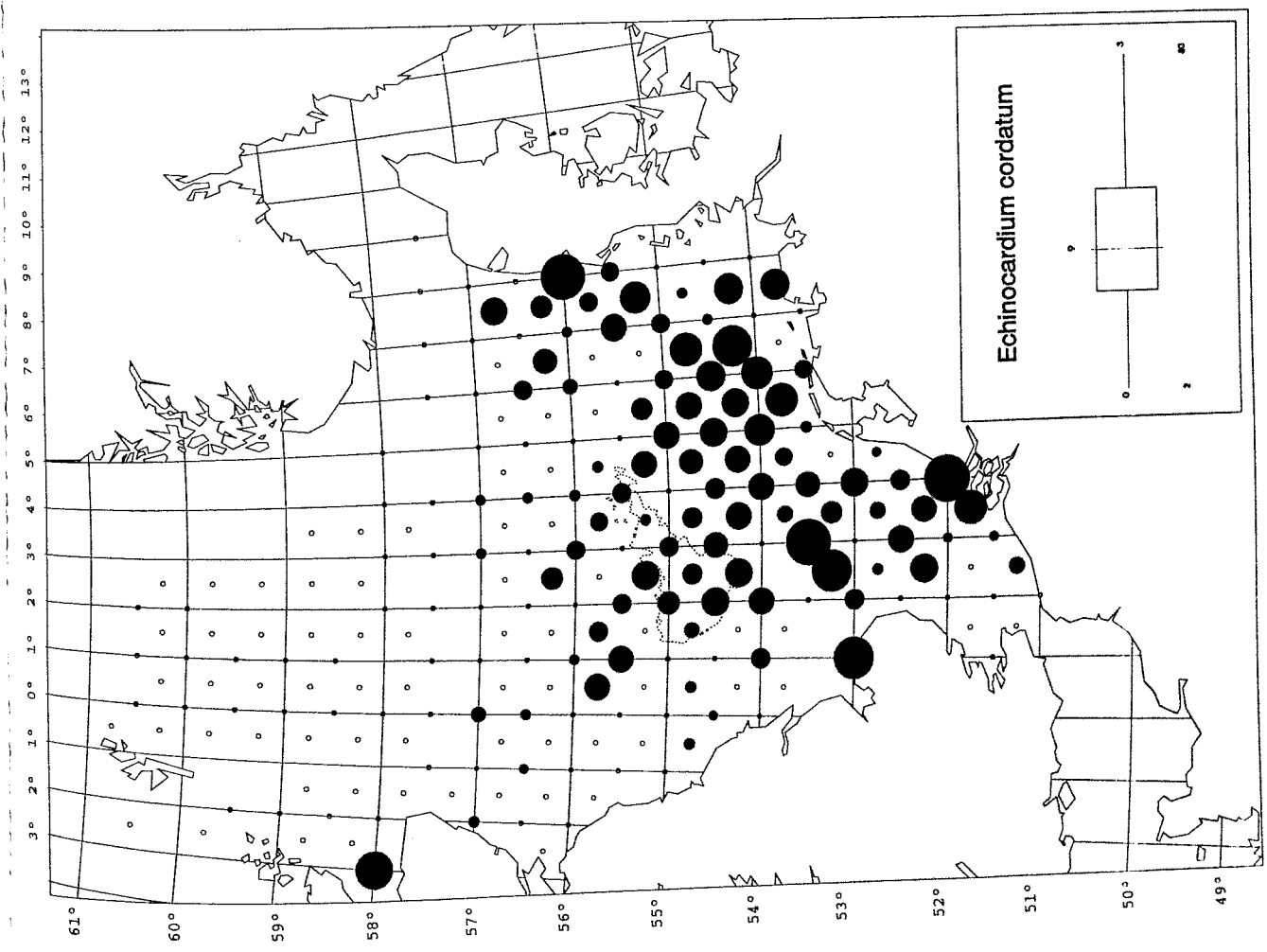

Cylichna cylindracea

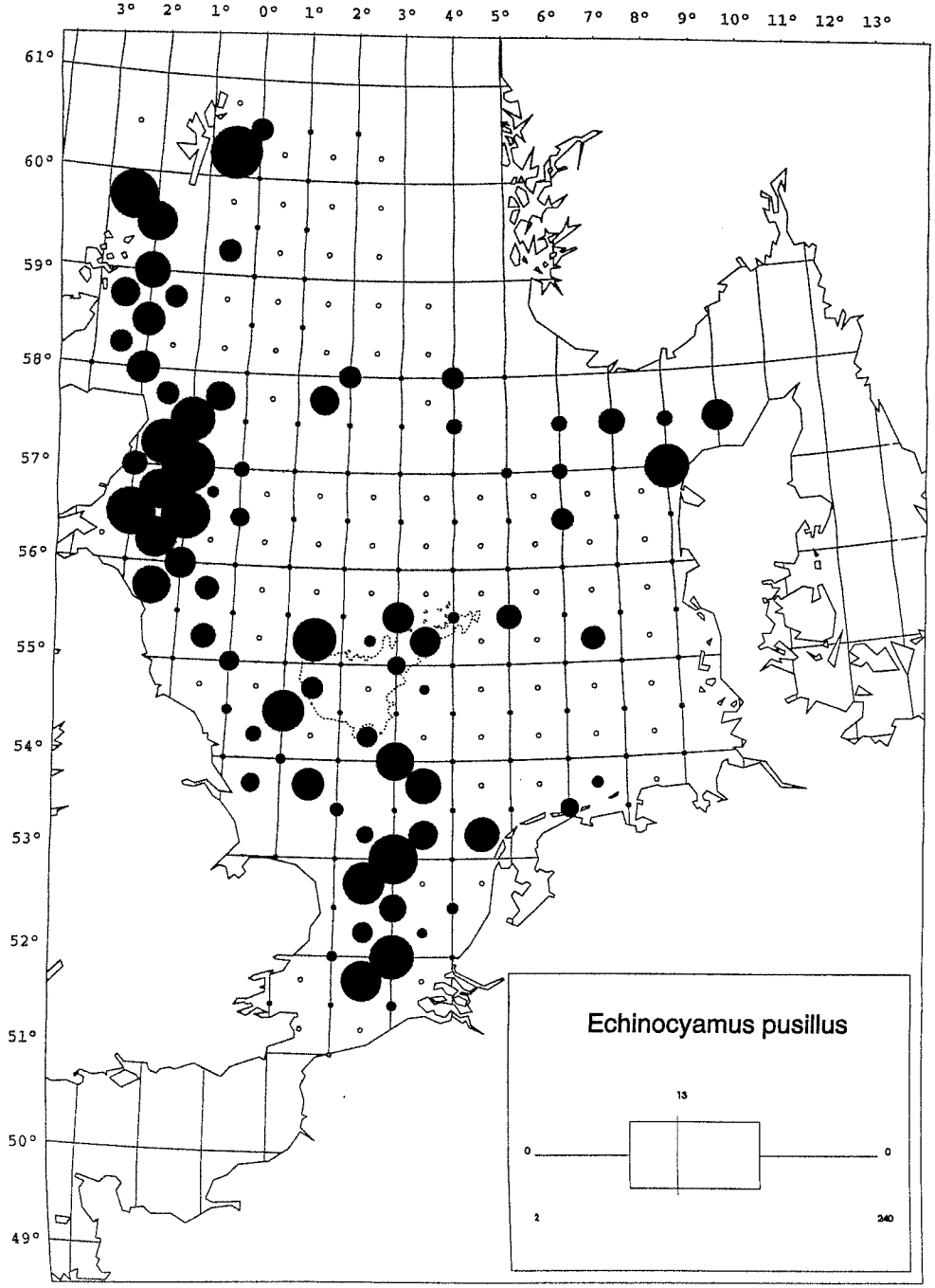

Diastylis lucifera

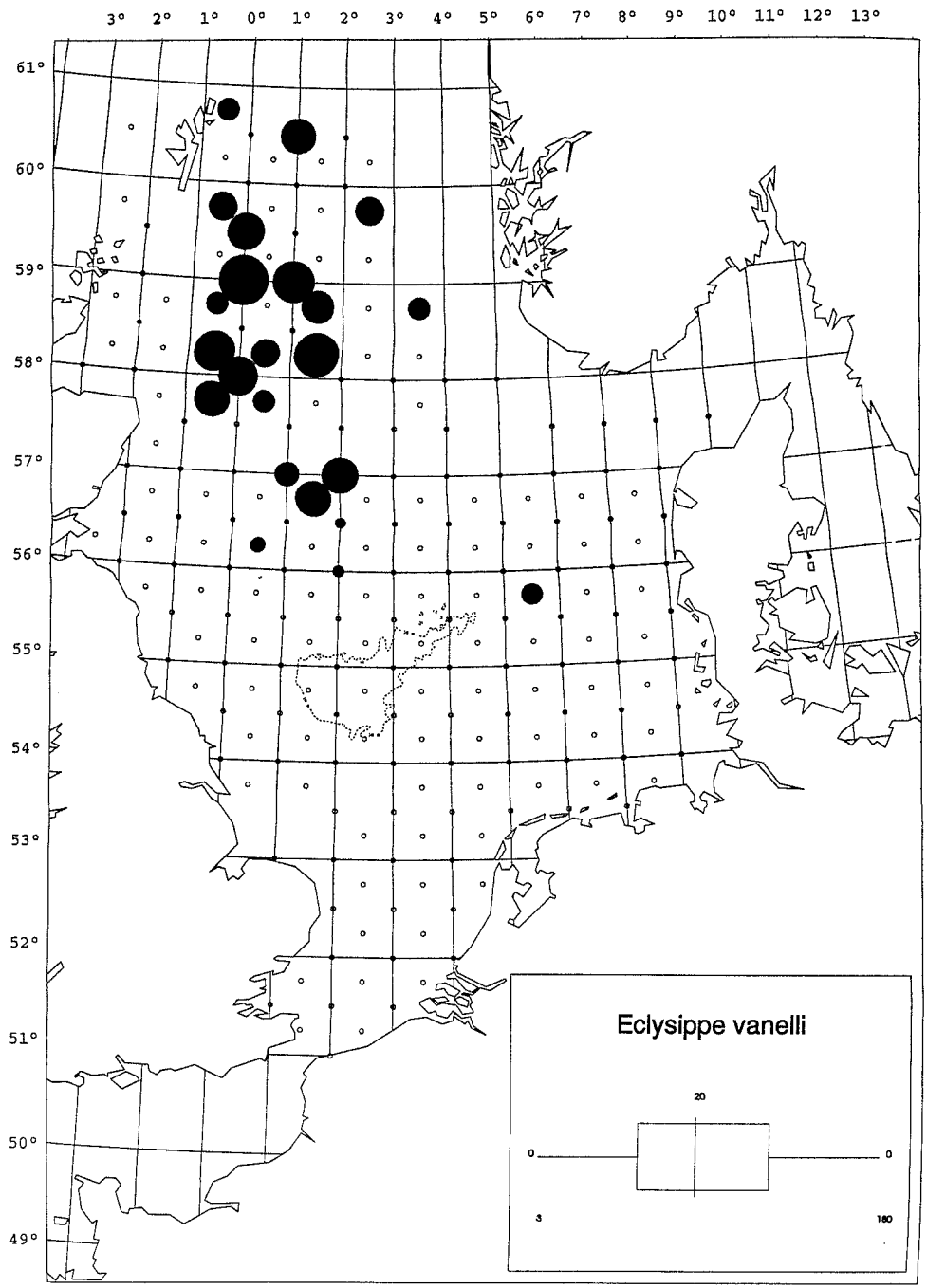

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Diplocirrus glaucus
9
0
0
2
290

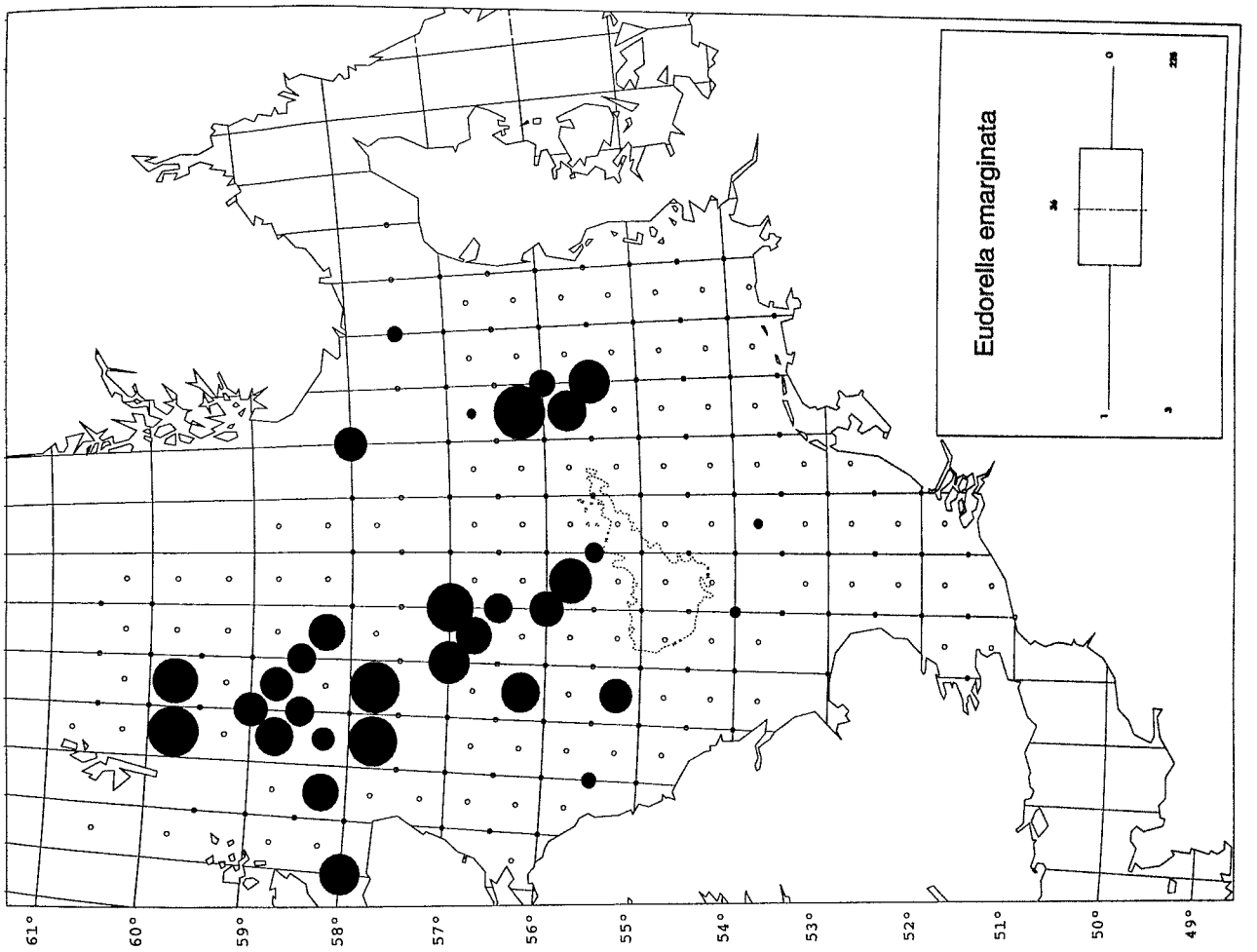

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Dosinia exoleta
5
0
0
2
110

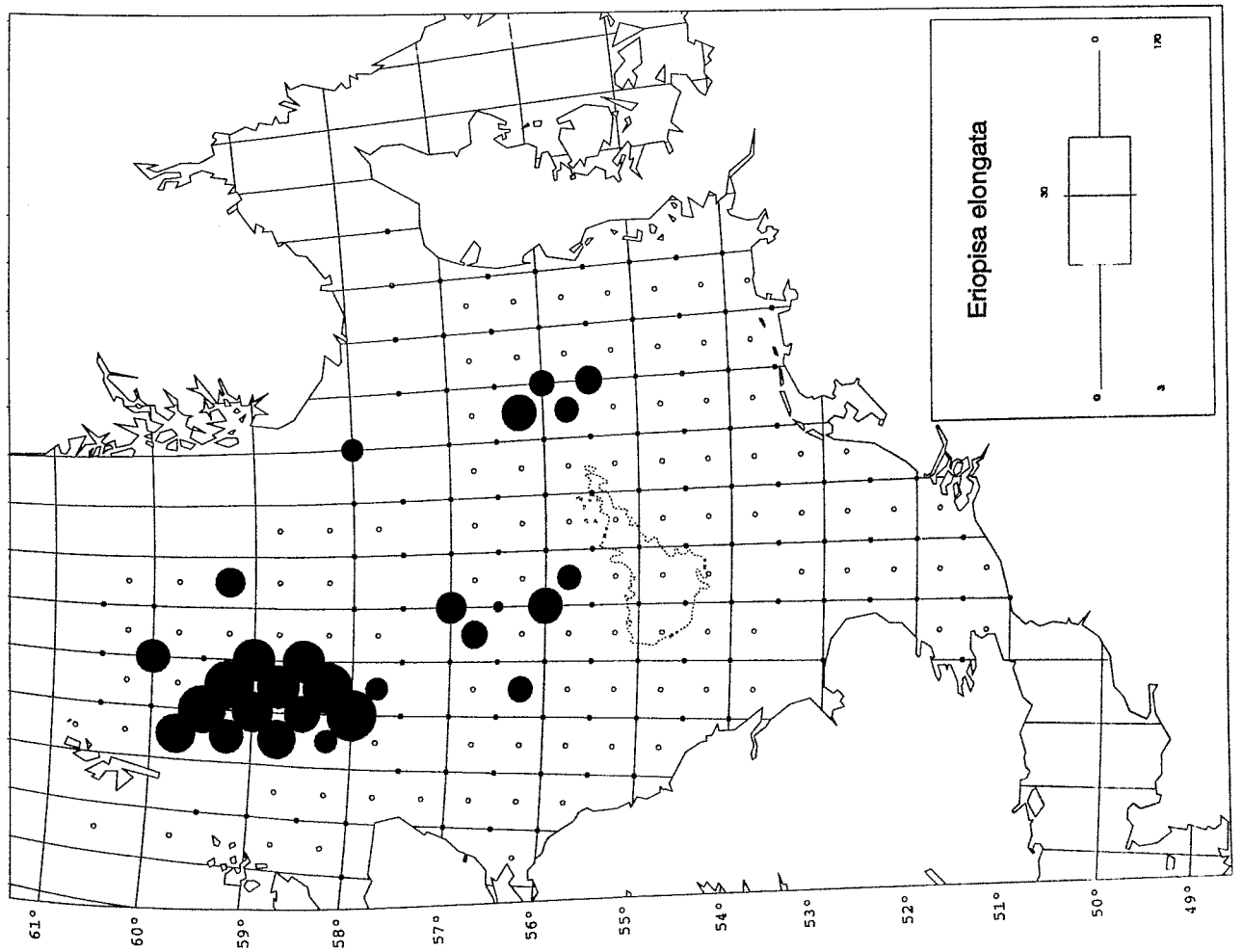

Echinocardium flavescens
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°

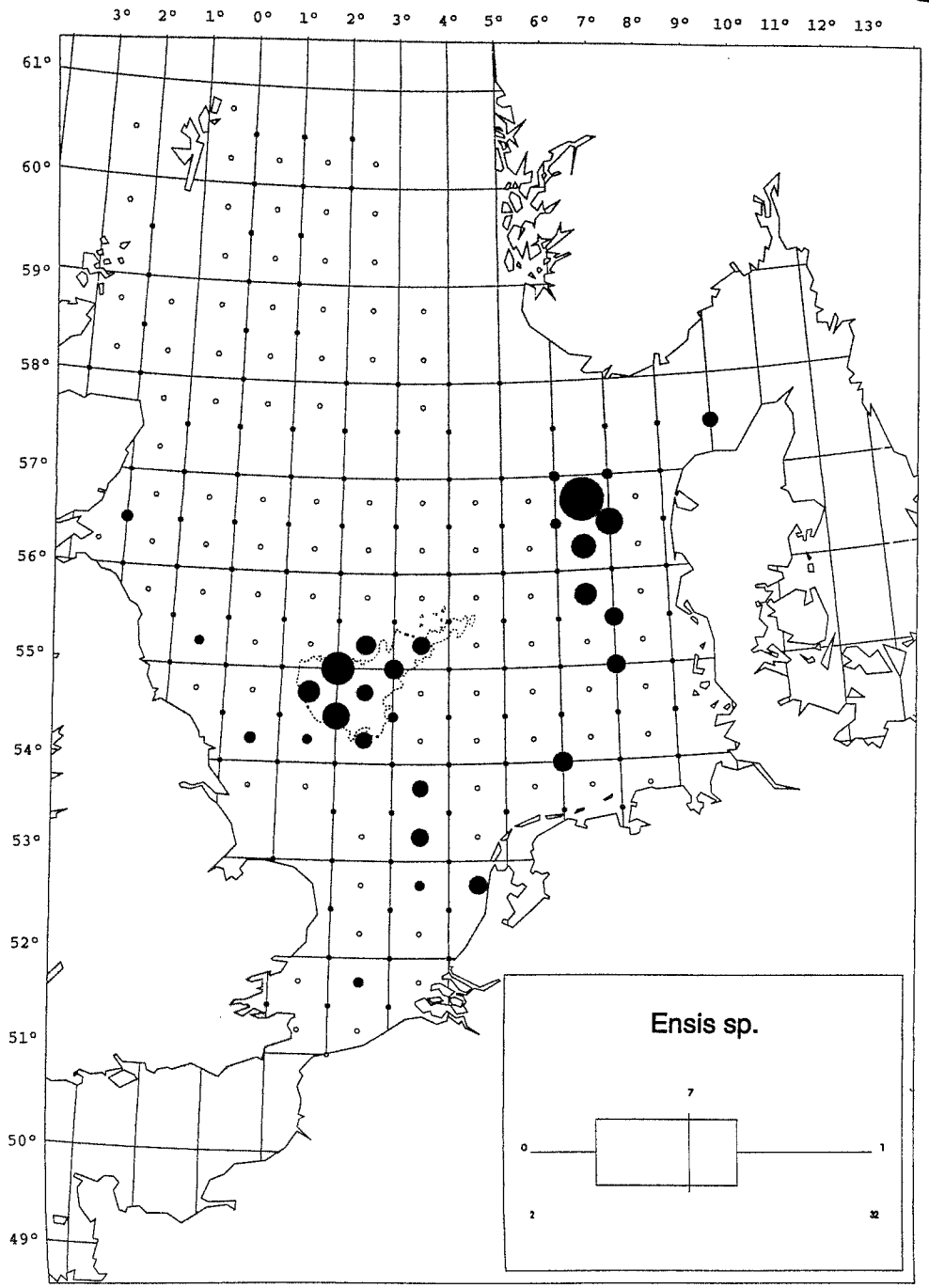

Echinocardium cordatum
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°

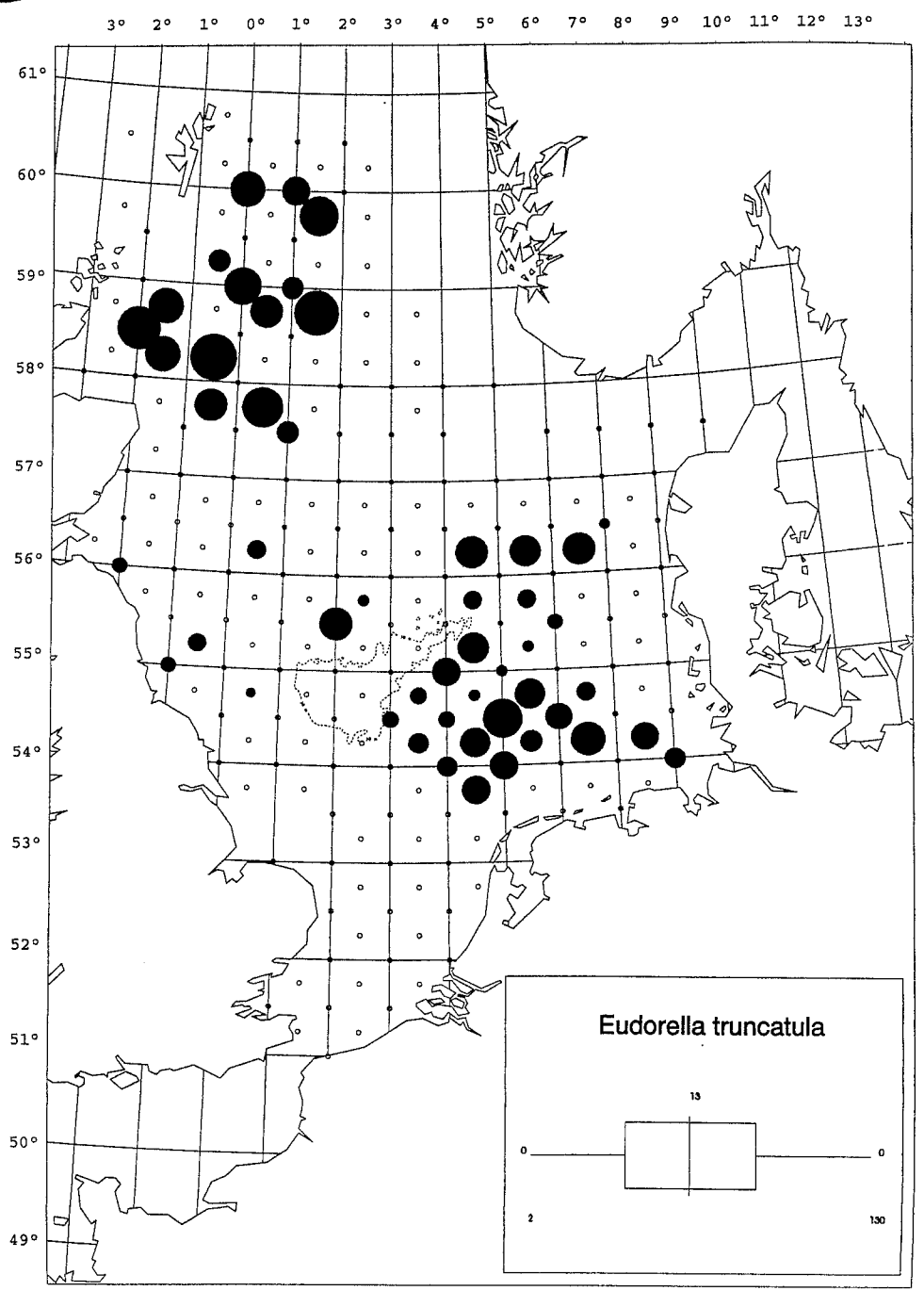

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Echinocyamus pusillus
13
0
0
2
240

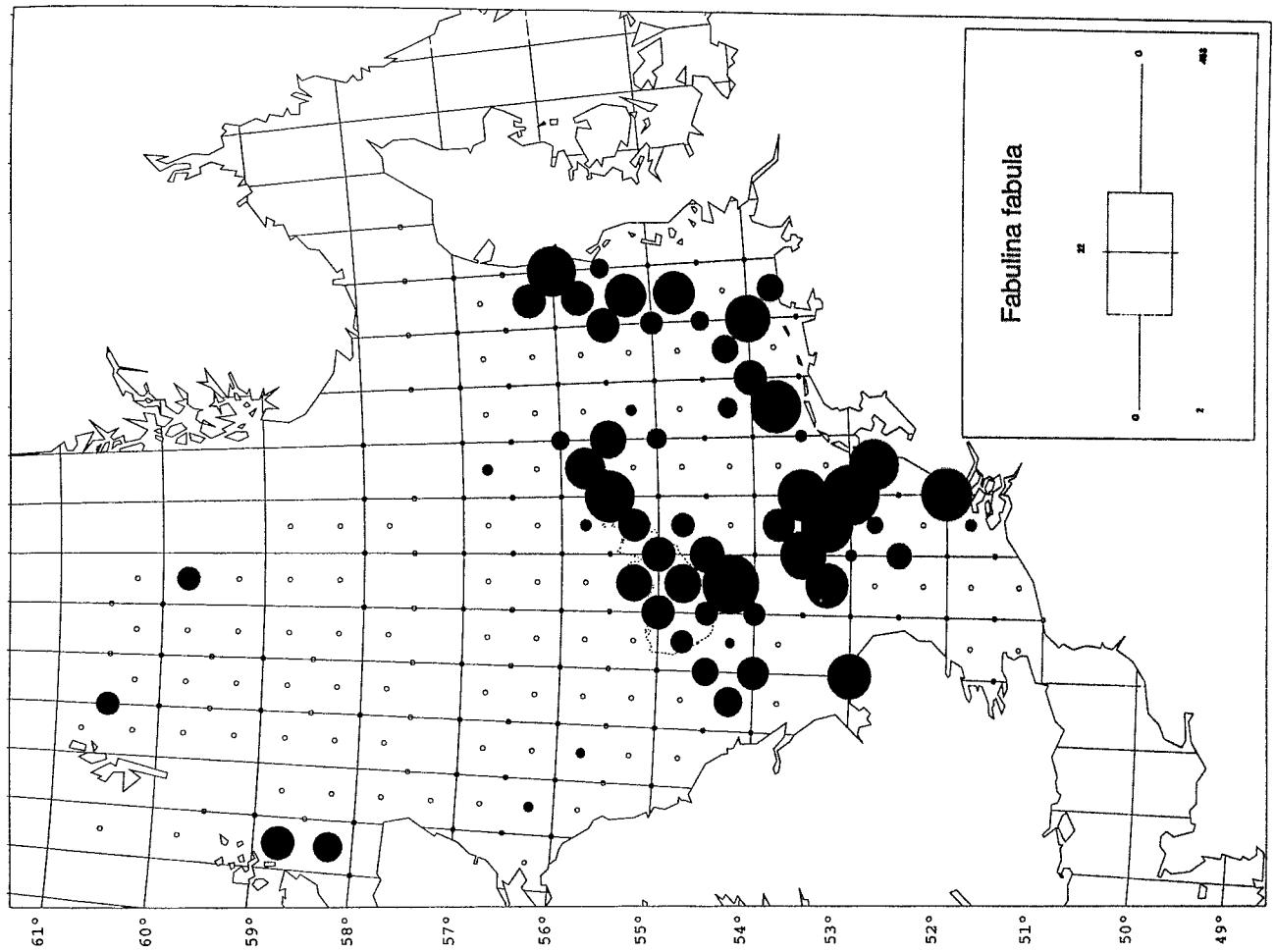

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Eclysippe vanelli
20
0
0
3
180

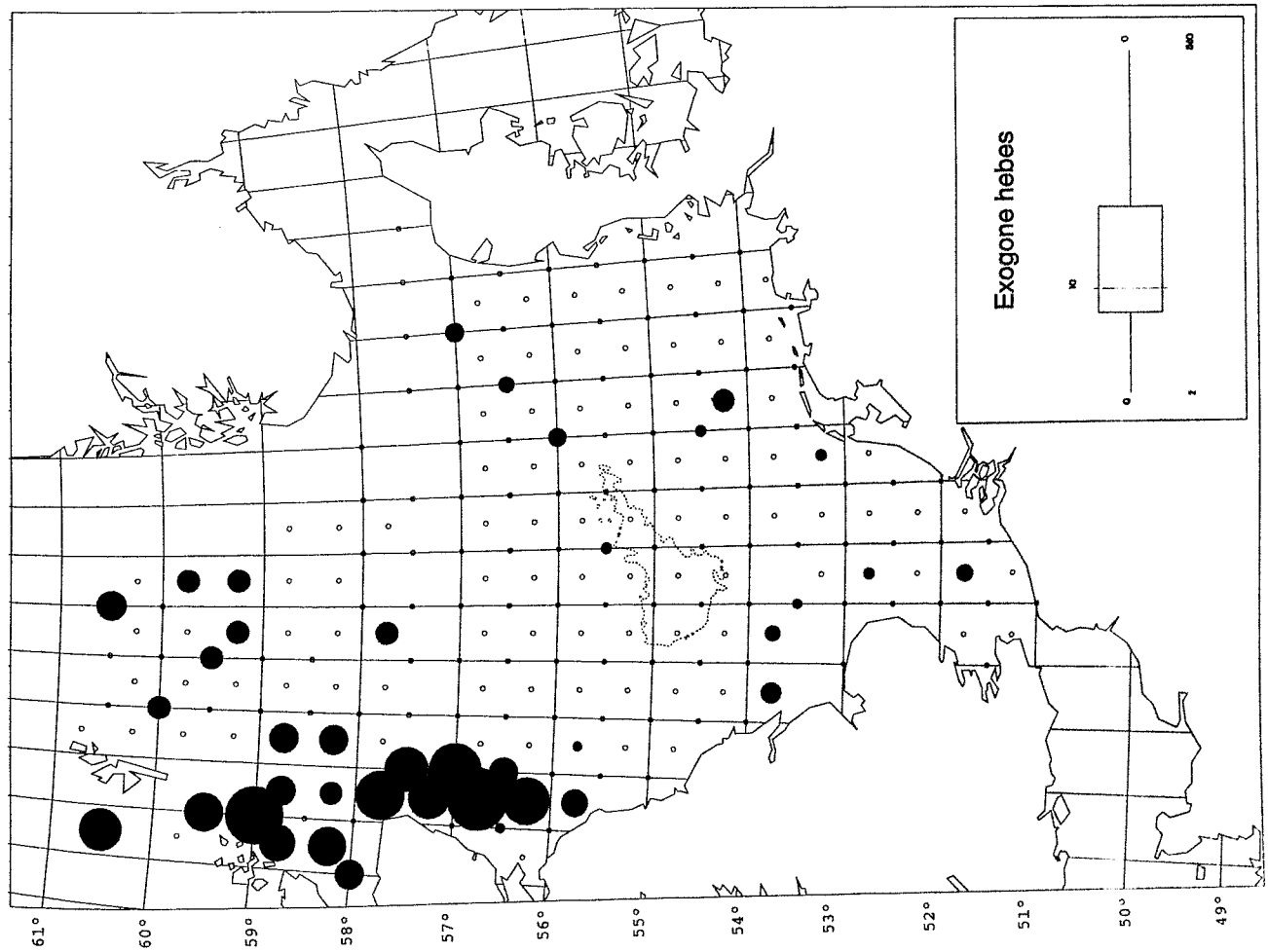

Eudorella emarginata
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°

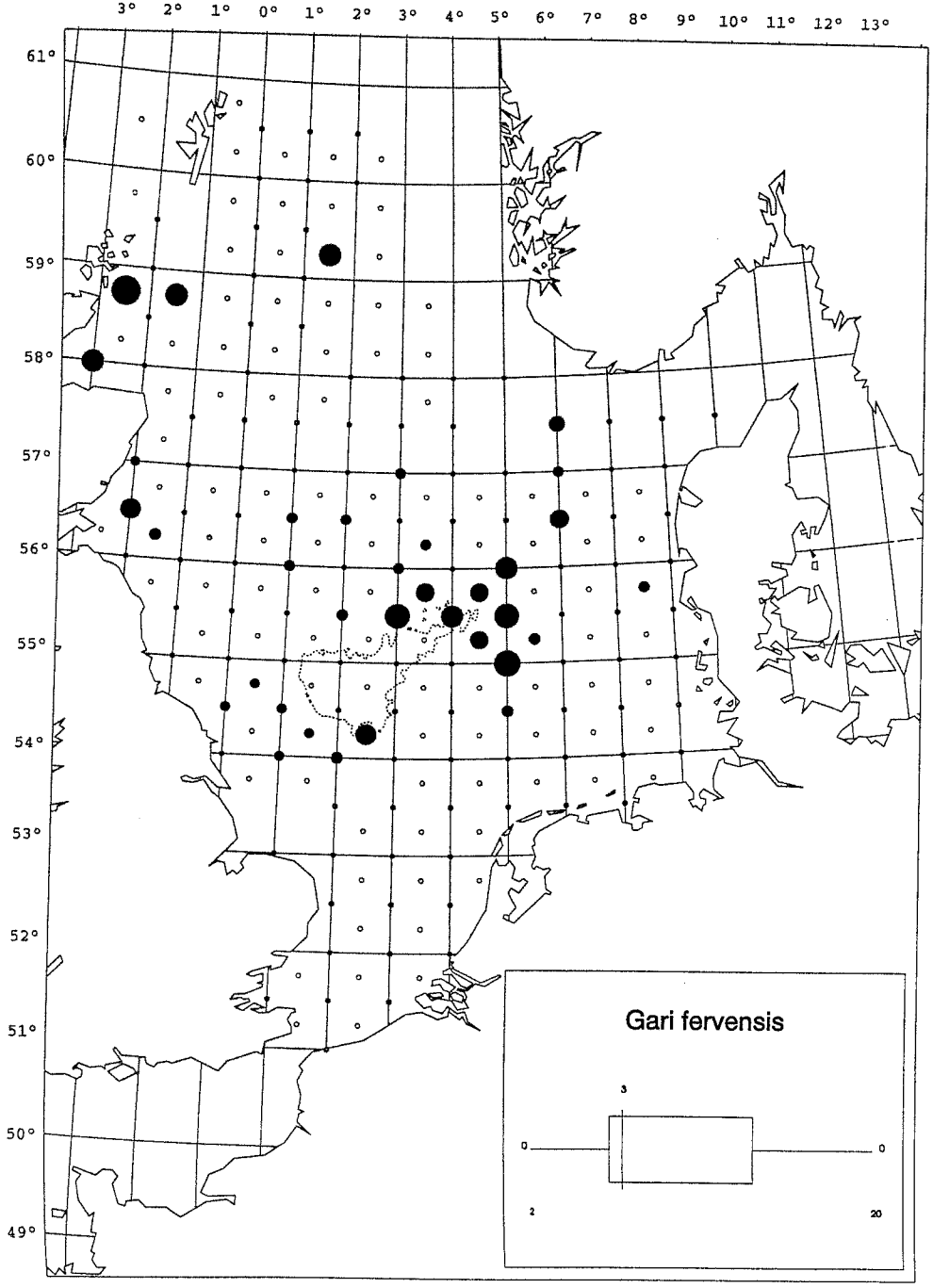

Eriopisa elongata
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°

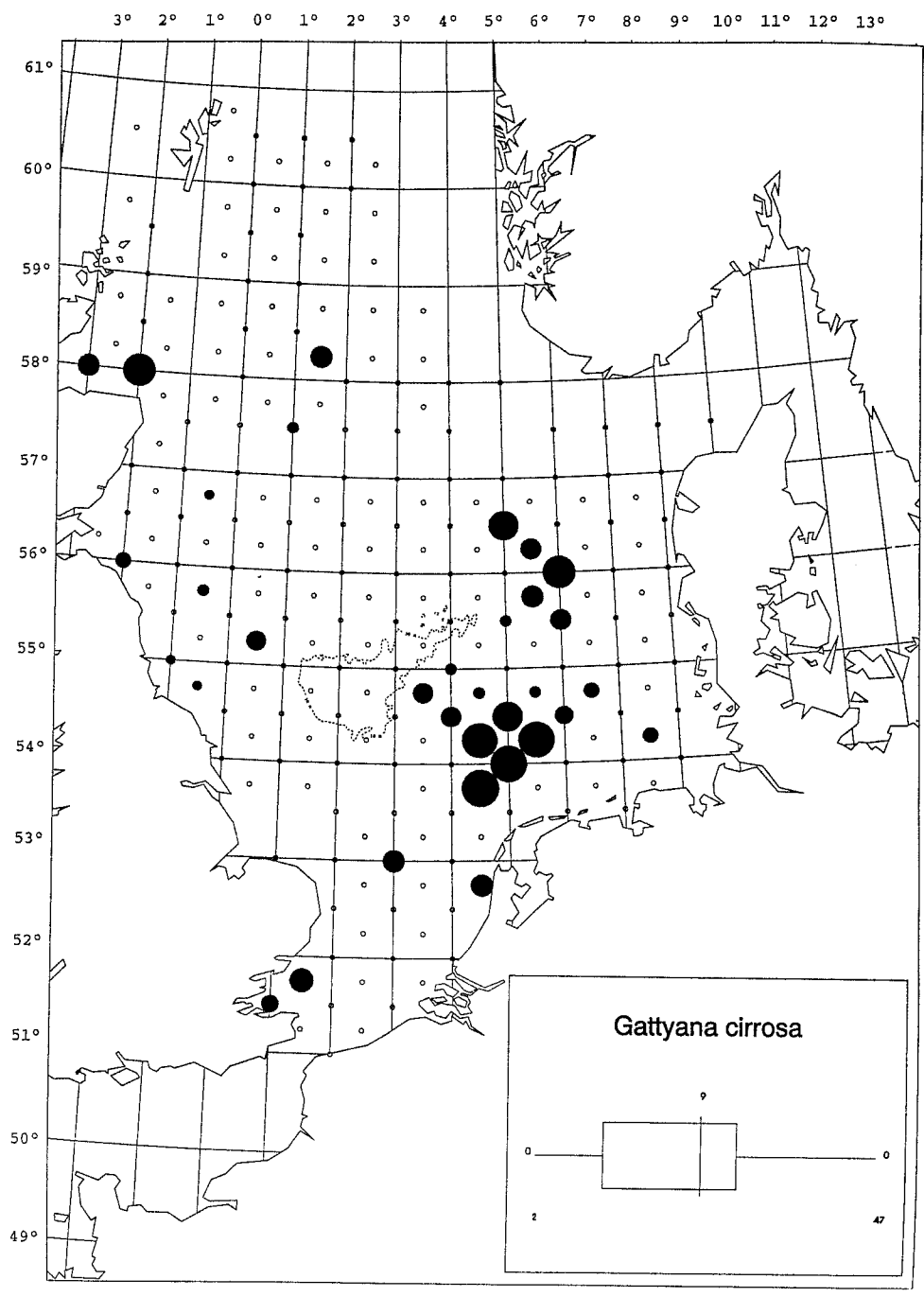

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61°
60°
59°
58°
57°
56°
55°
54°
53°
52°
51°
50°
49°
Ensis sp.
7
0
1
2
32

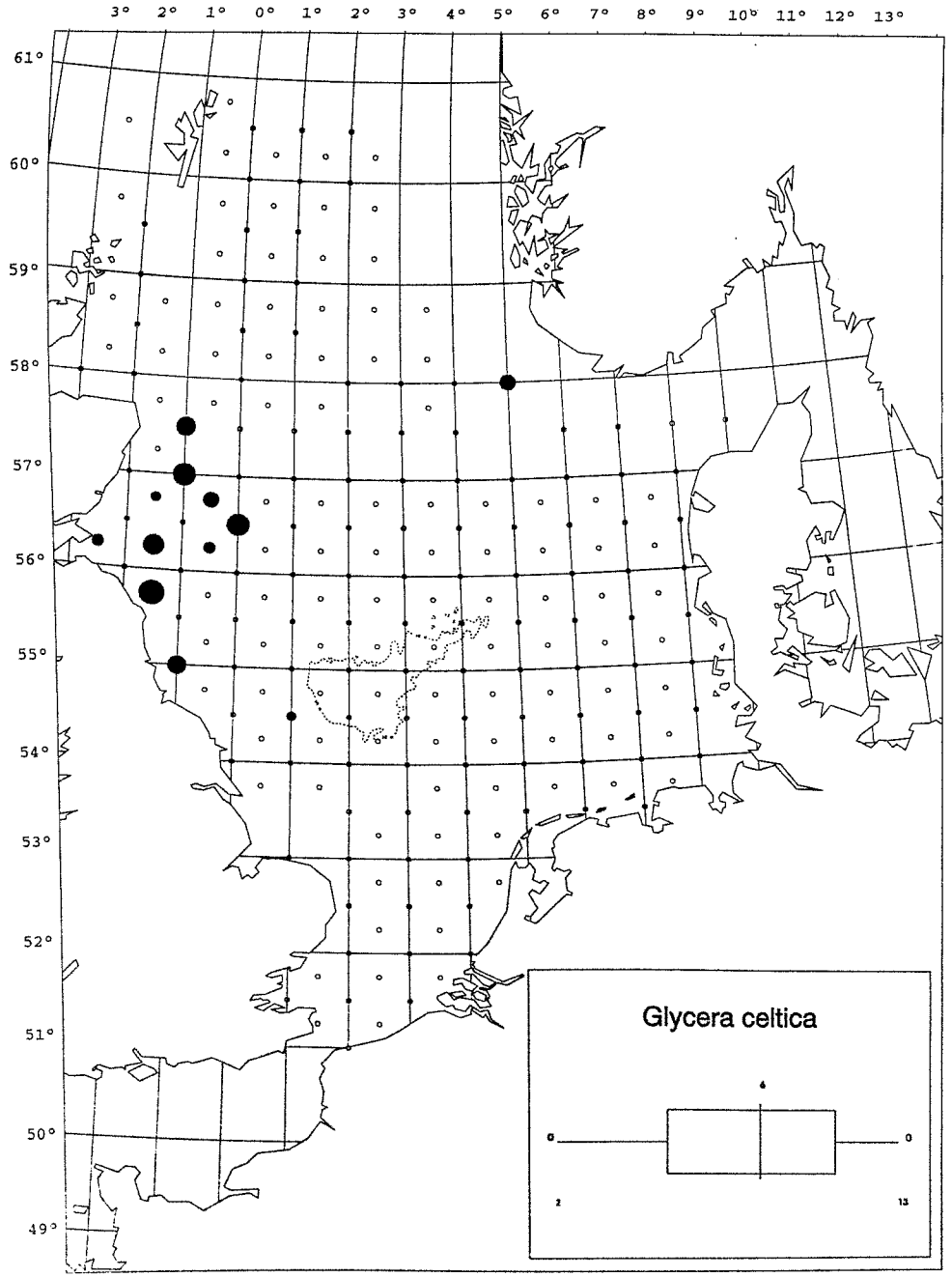

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61°
60°
59°
58°
57°
56°
55°
54°
53°
52°
51°
50°
49°
Eudorella truncatula
13
0
0
2
130

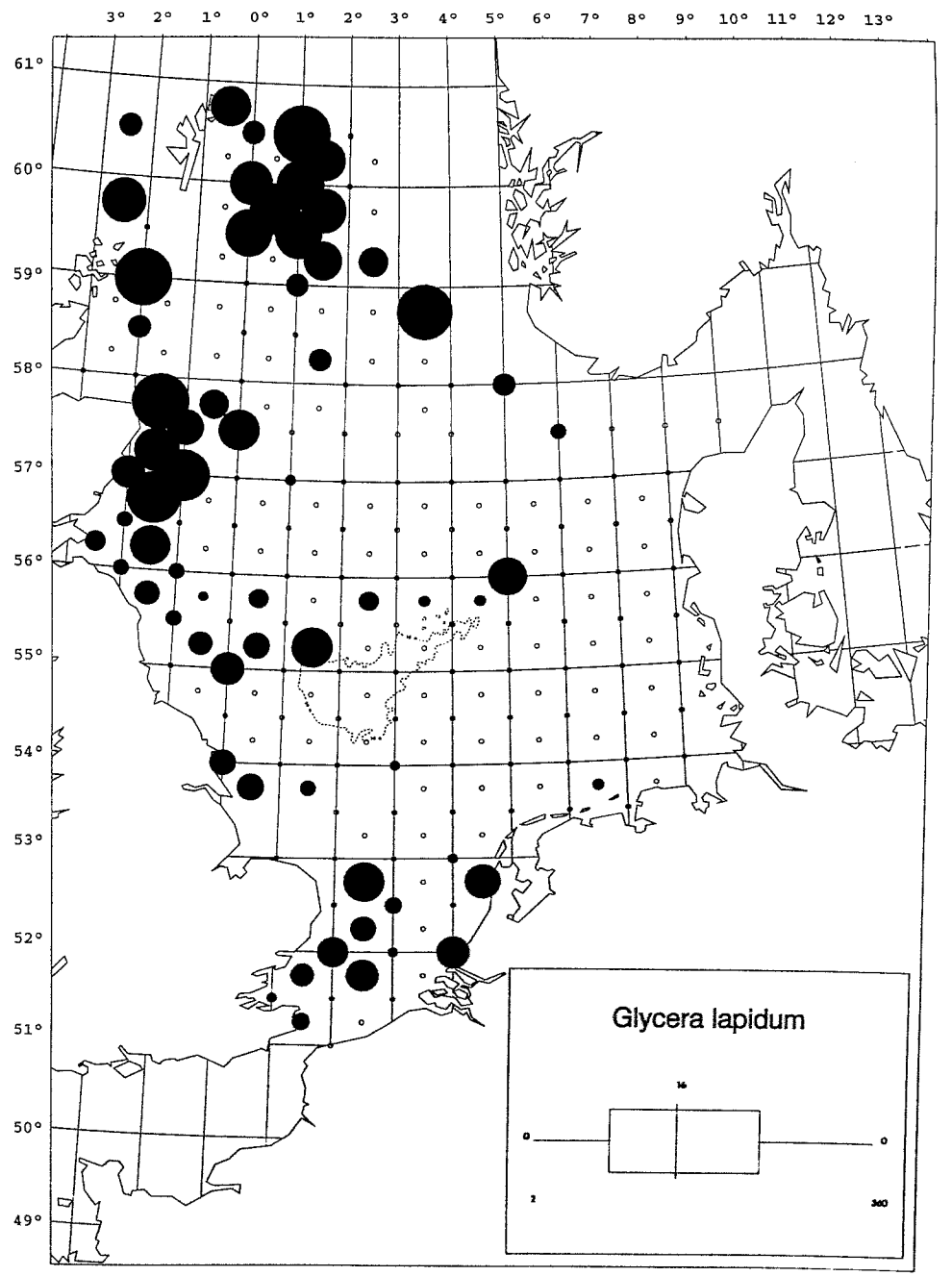

Fabulina fabula
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°

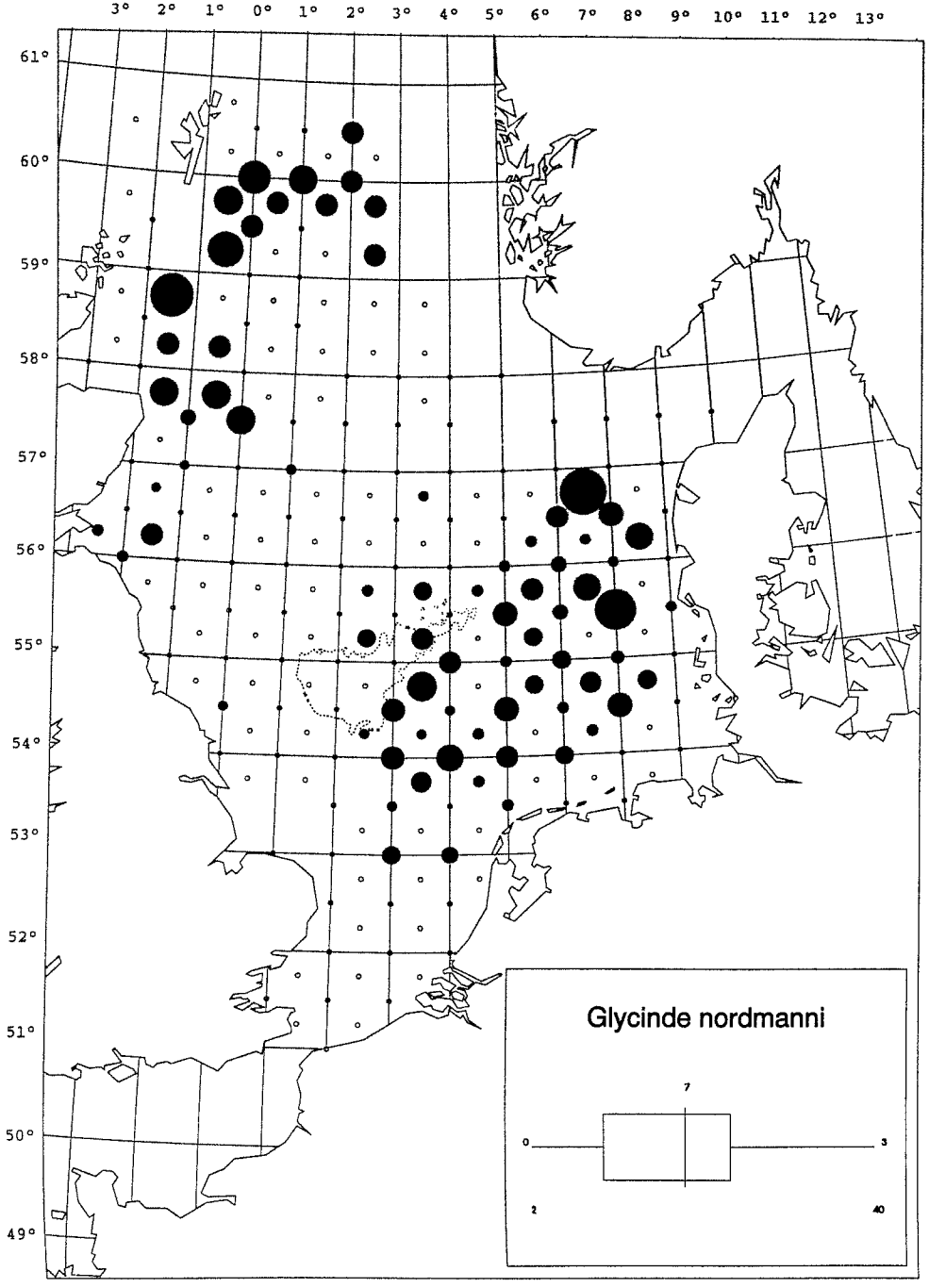

Exogone hebes
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°

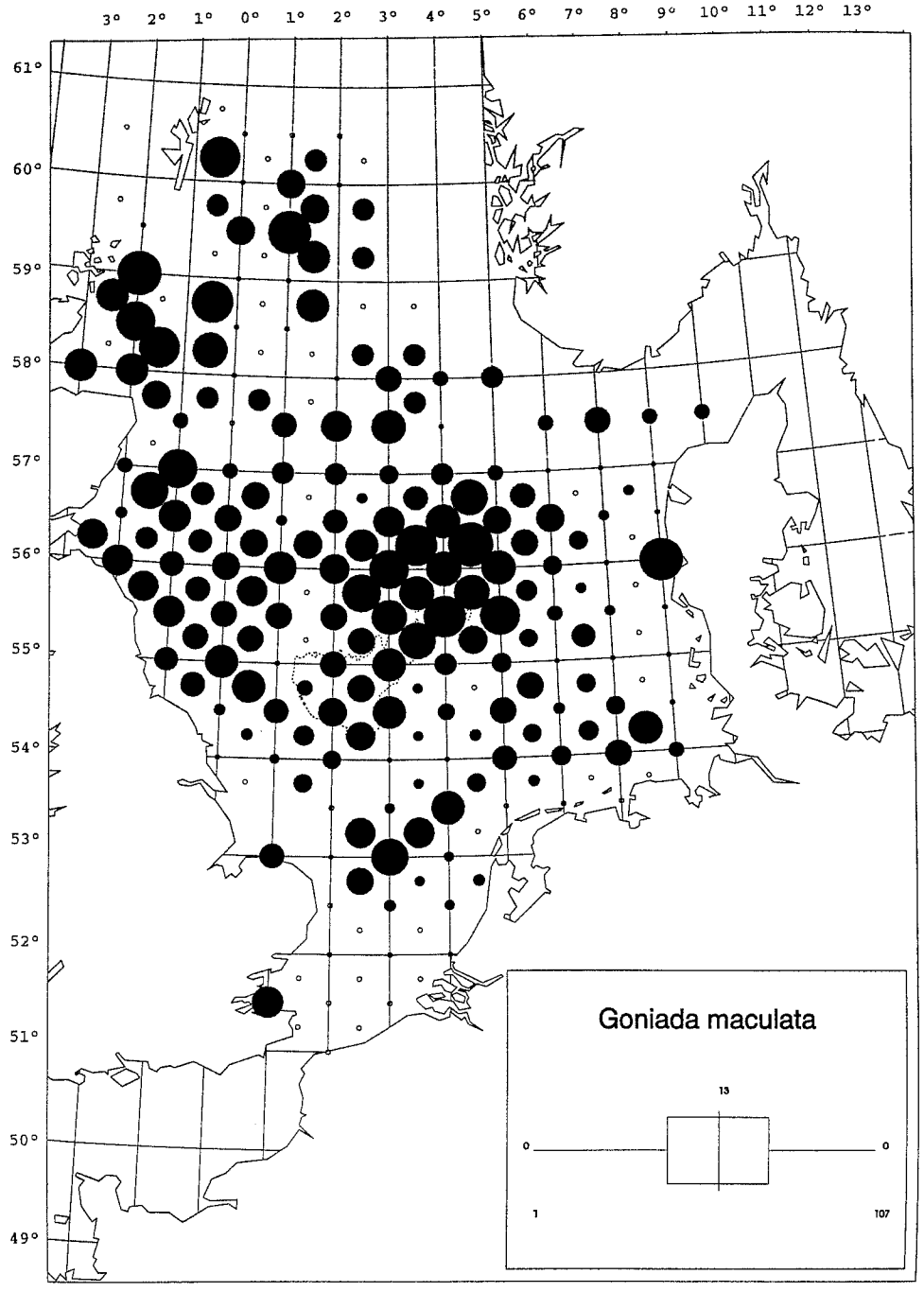

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Gari fervensis
3
0
0
2
20

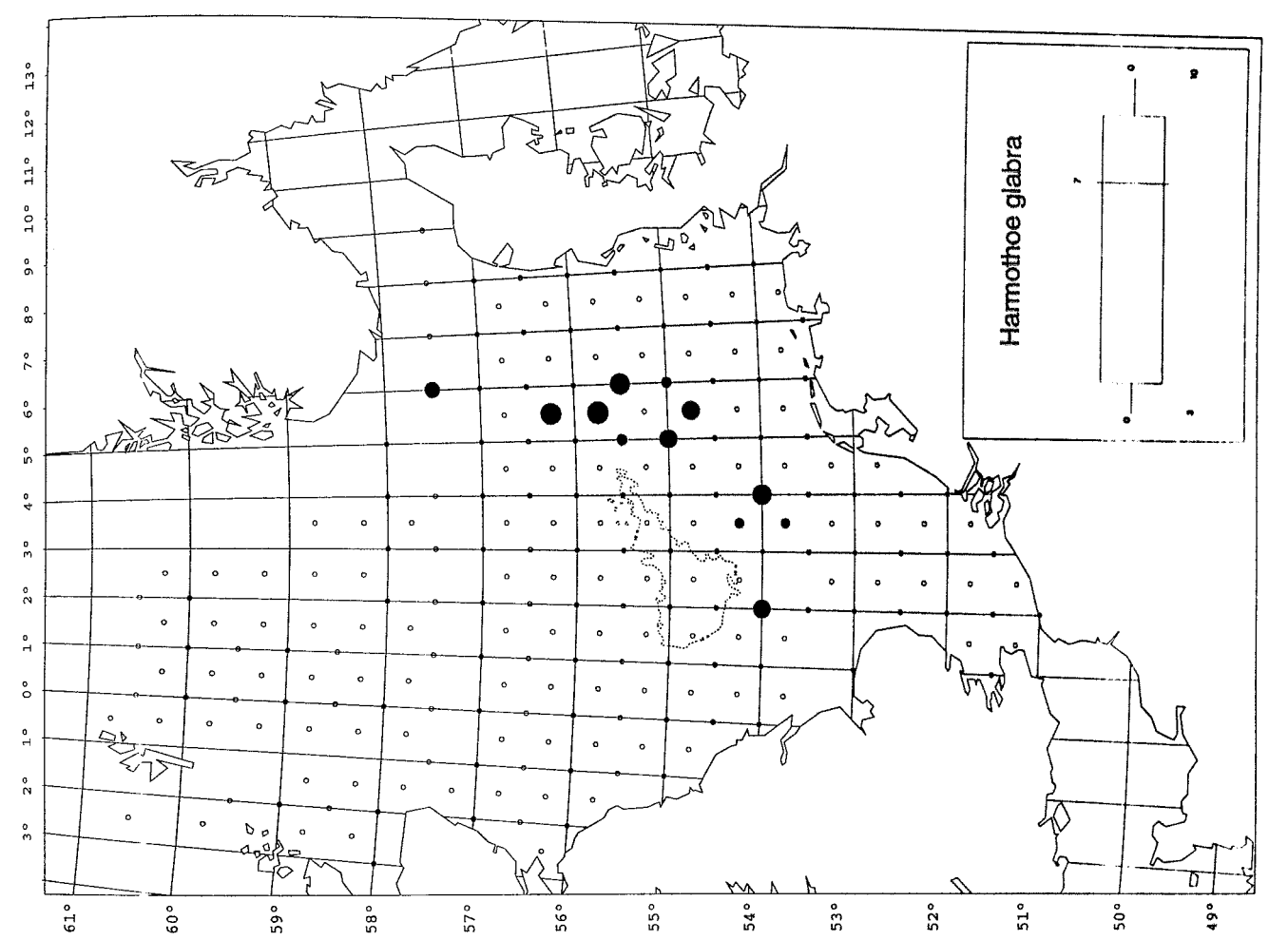

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Gattyana cirrosa
9
0
0
2
47

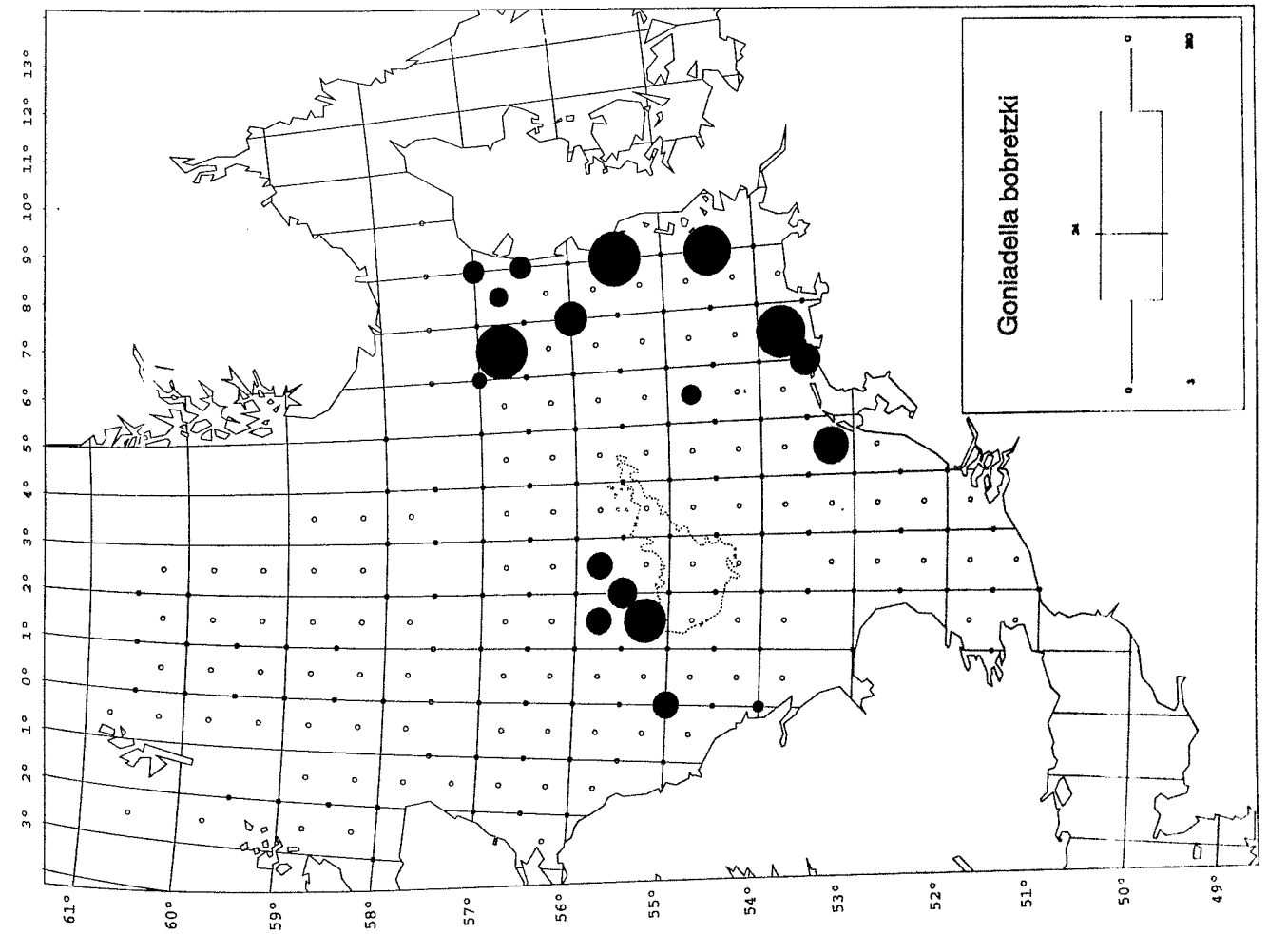

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Glycera celtica
6
0
0
2
13

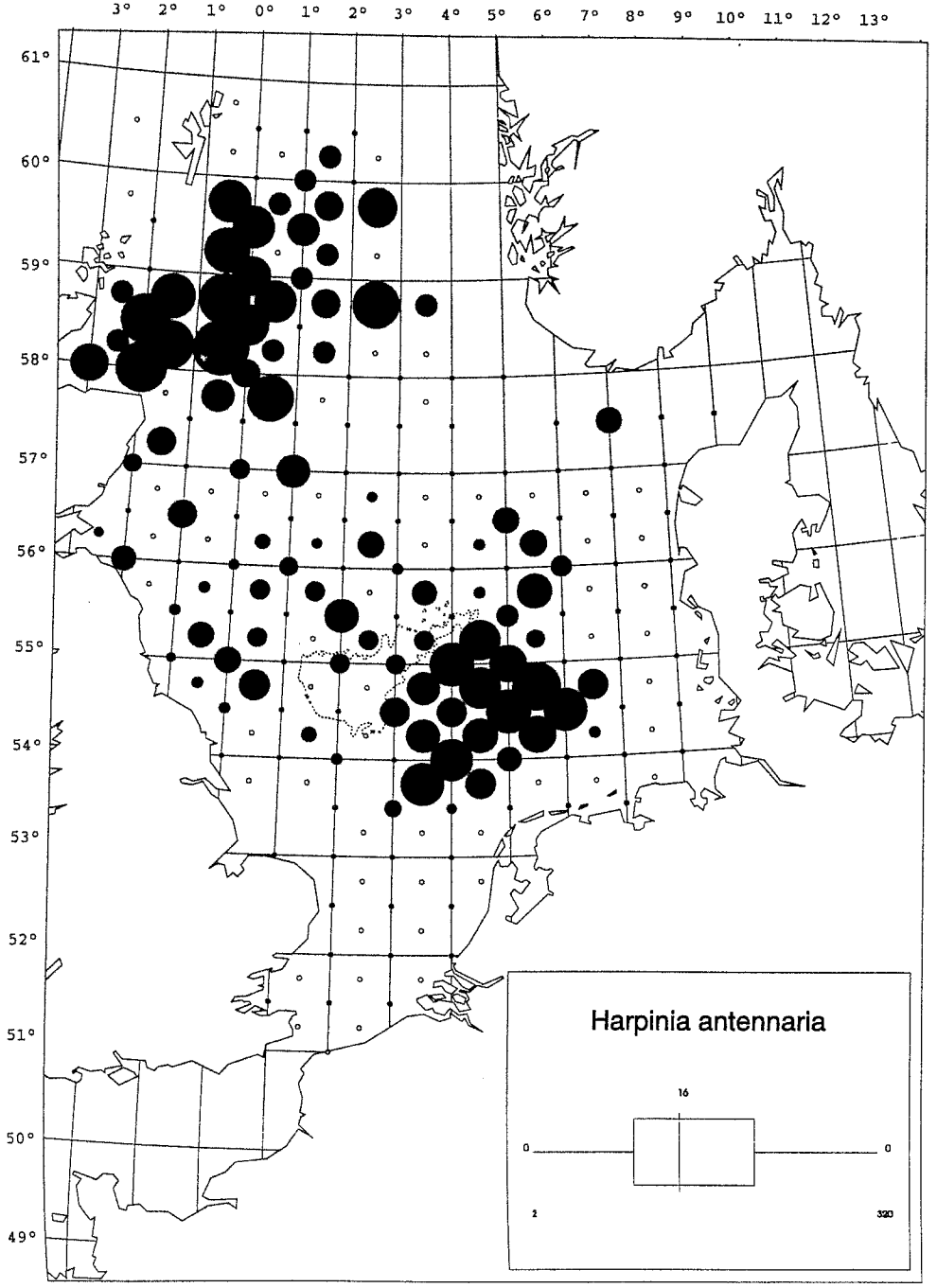

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Glycera lapidum
16
0
0
2
360

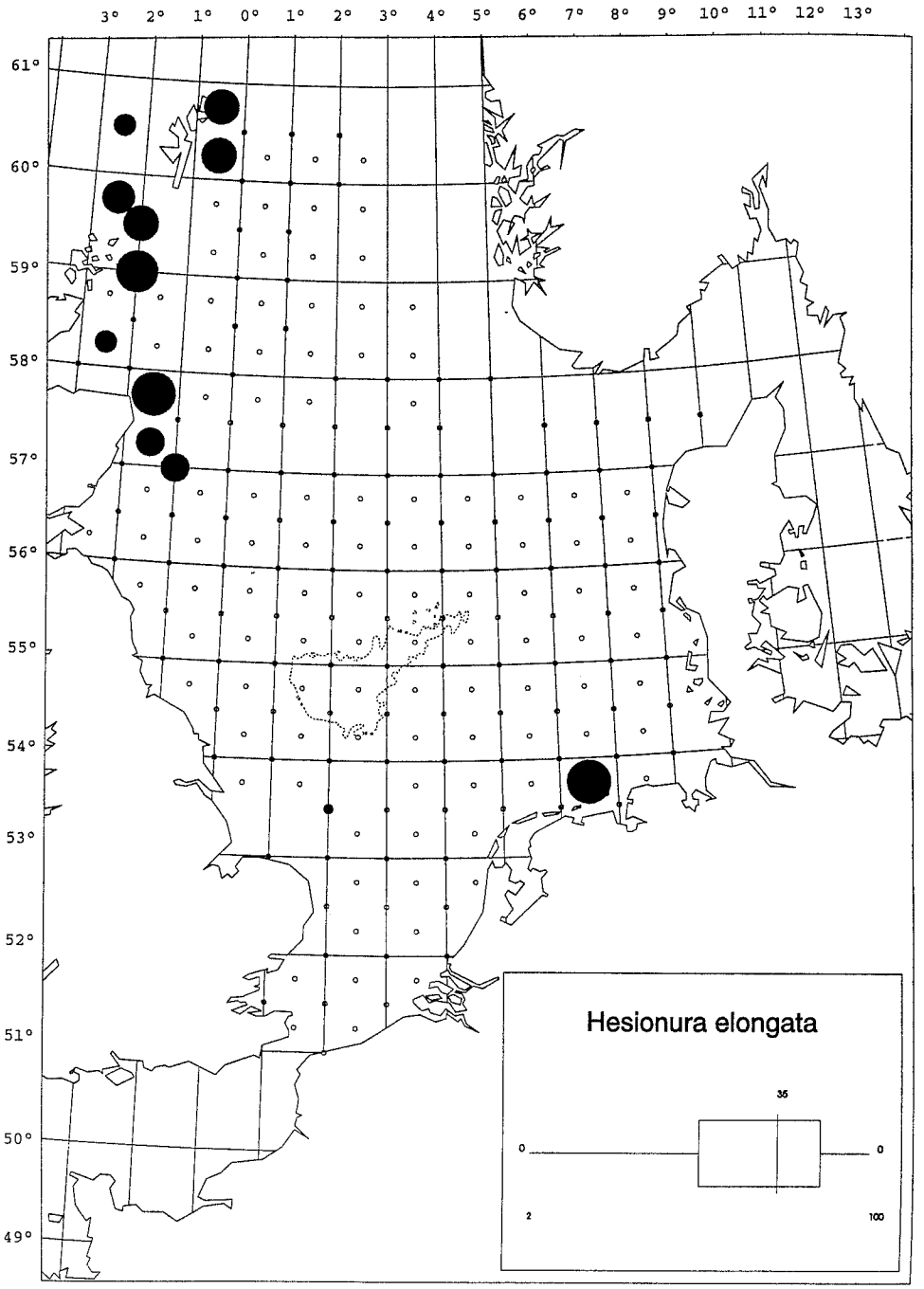

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Glycinde nordmanni
7
0
3
2
40

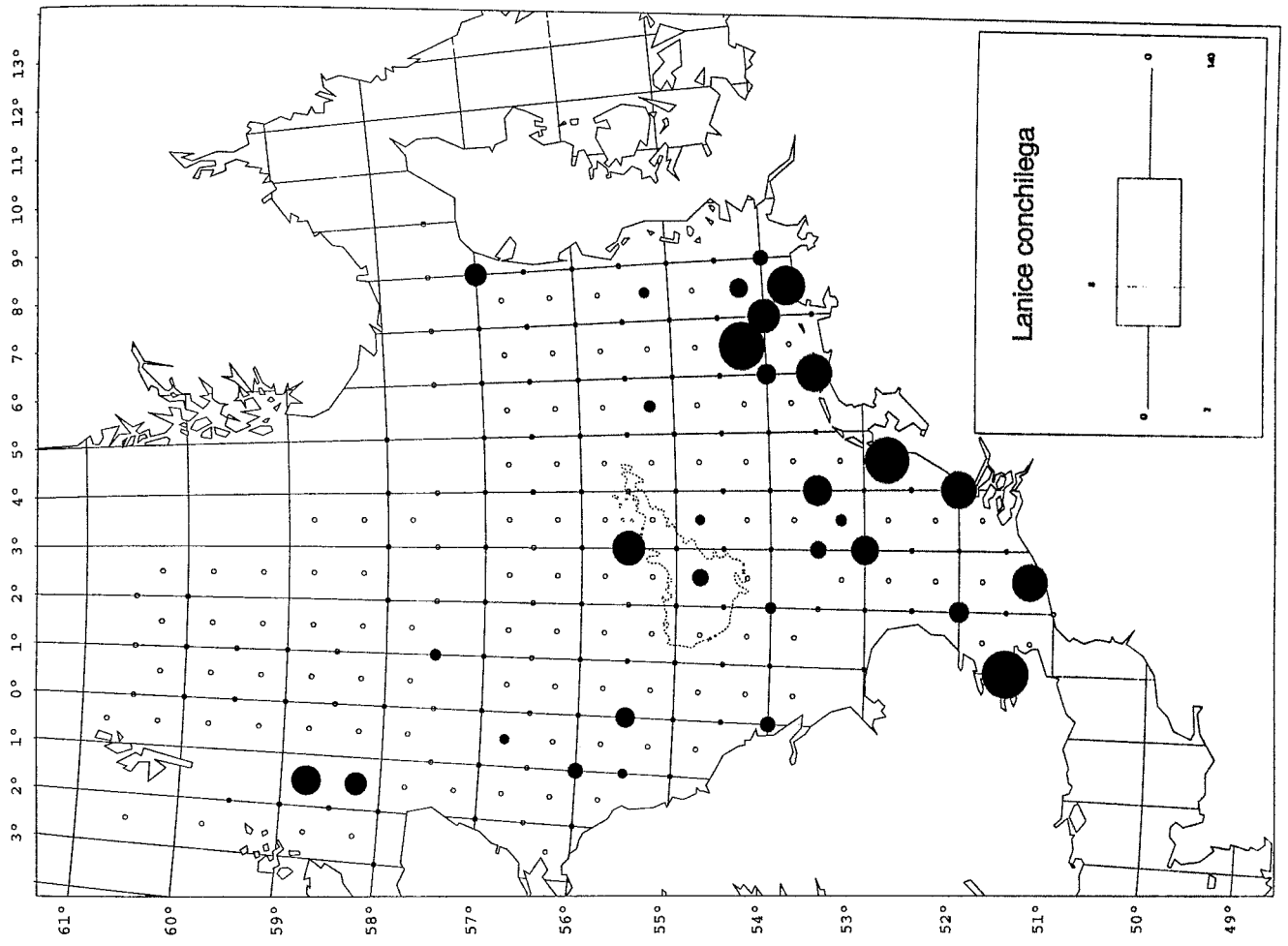

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Goniada maculata
13
0
0
1
107

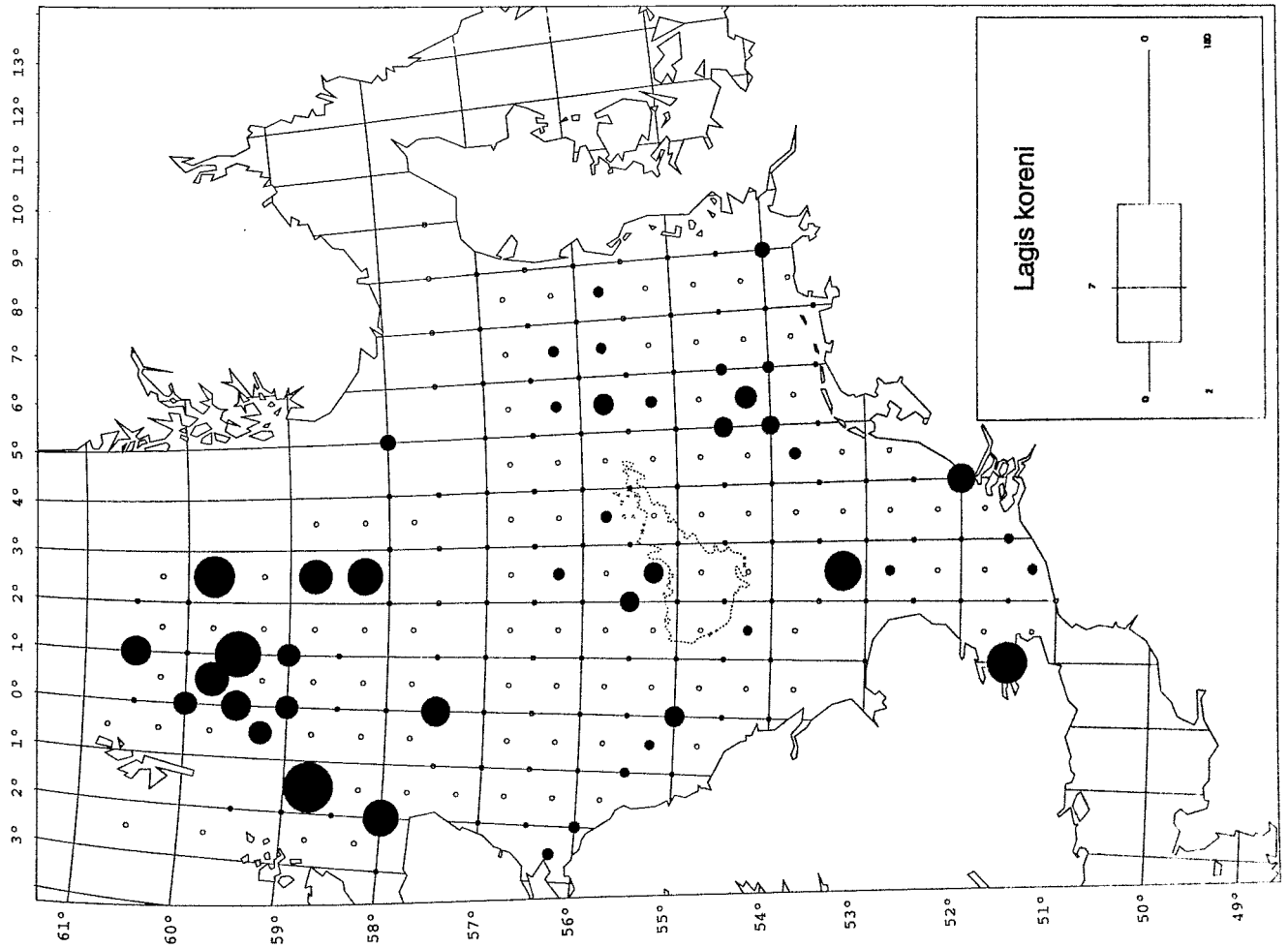

Harmothoe glabra
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°

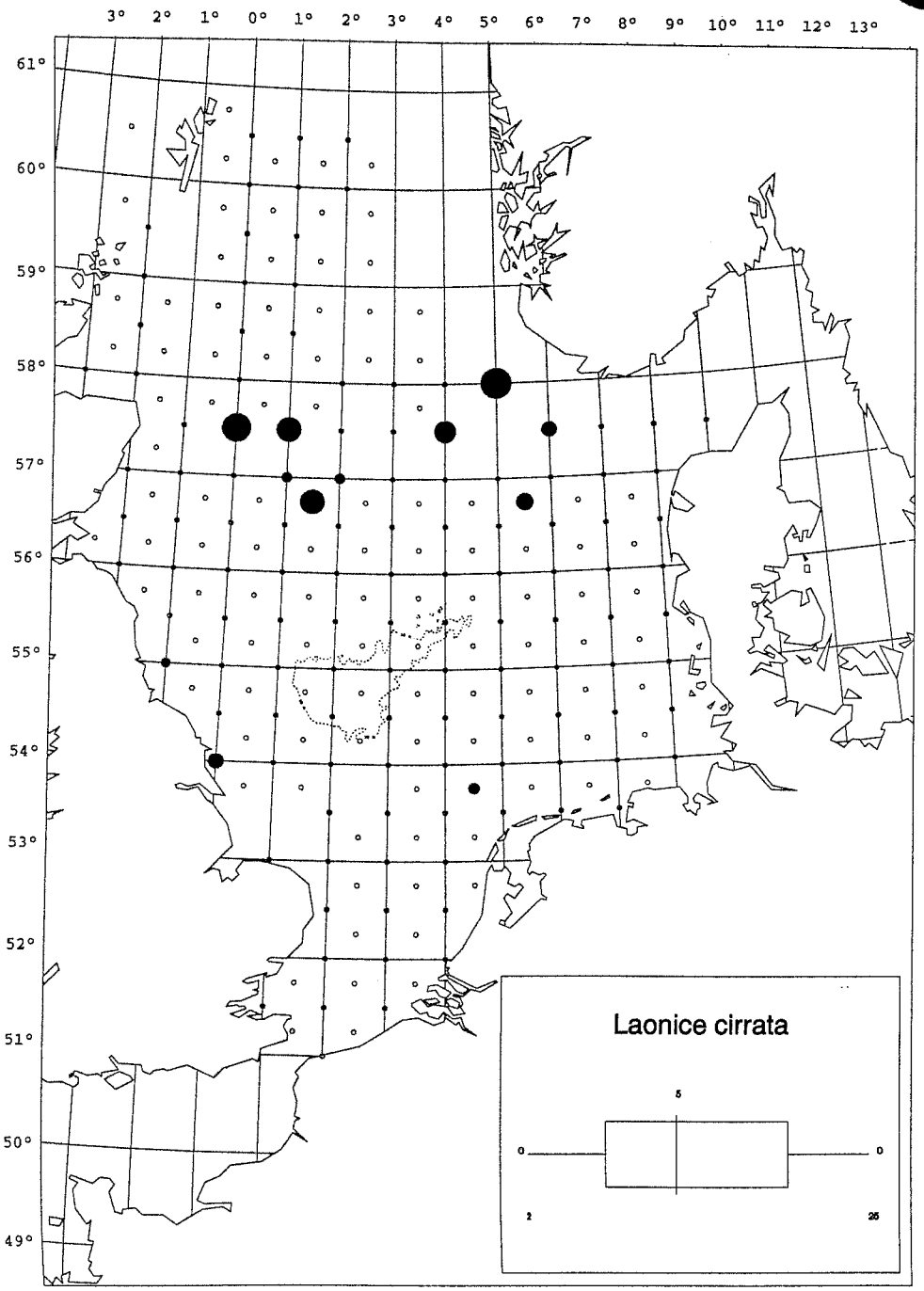

Goniadella bobretzki
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°

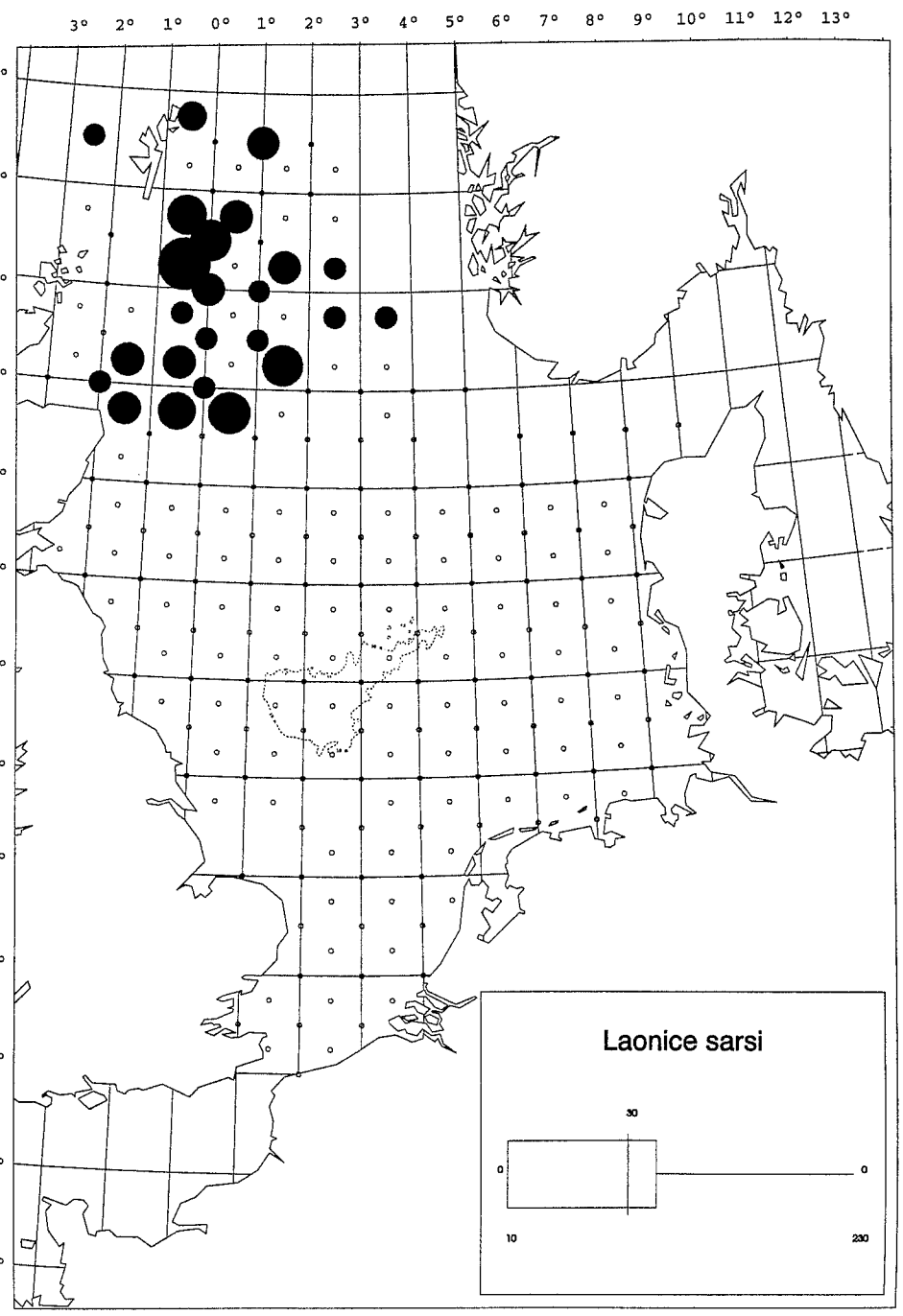

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Harpinia antennaria
16
0
0
2
320

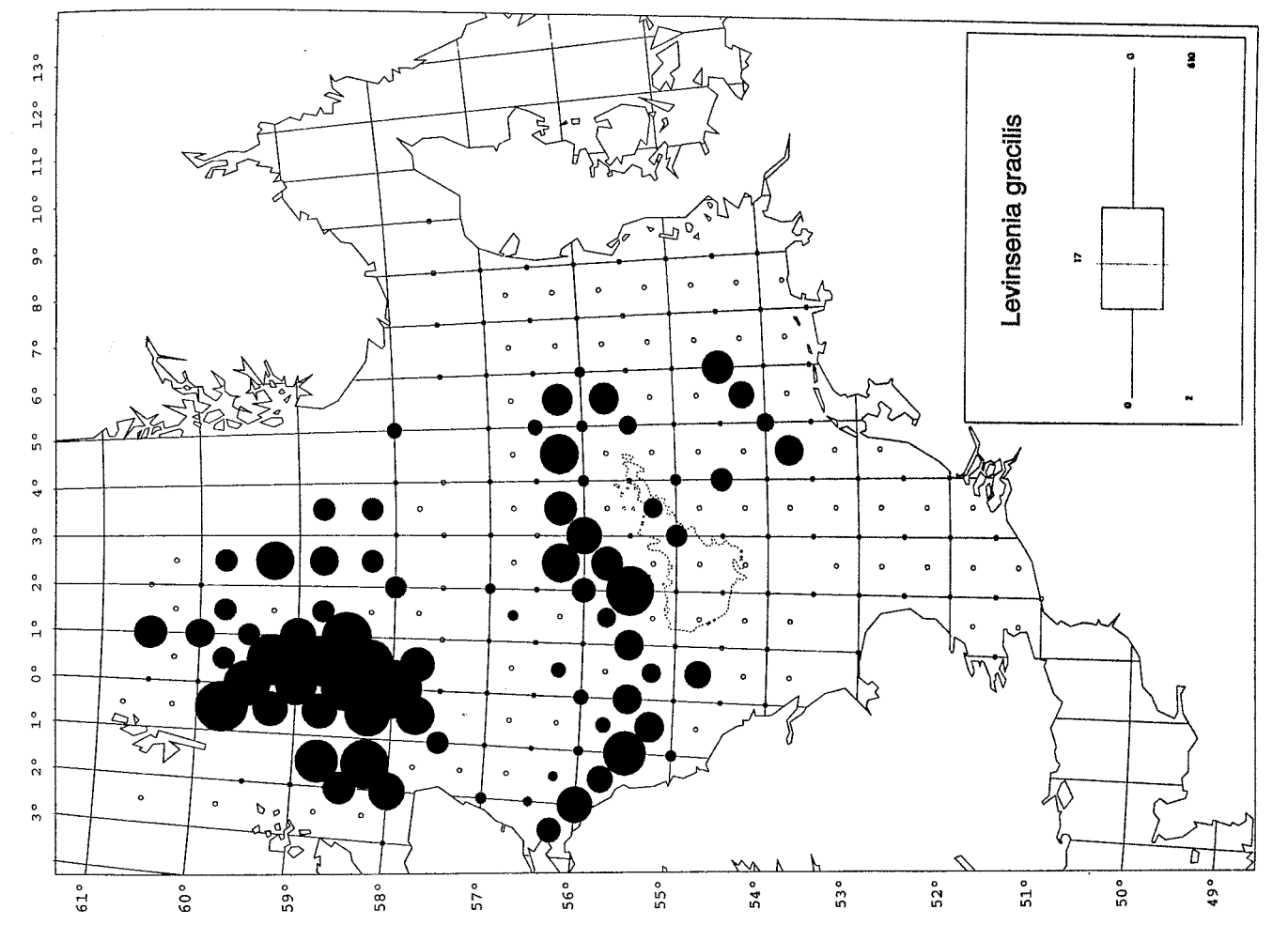

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Hesionura elongata
35
0
0
2
100

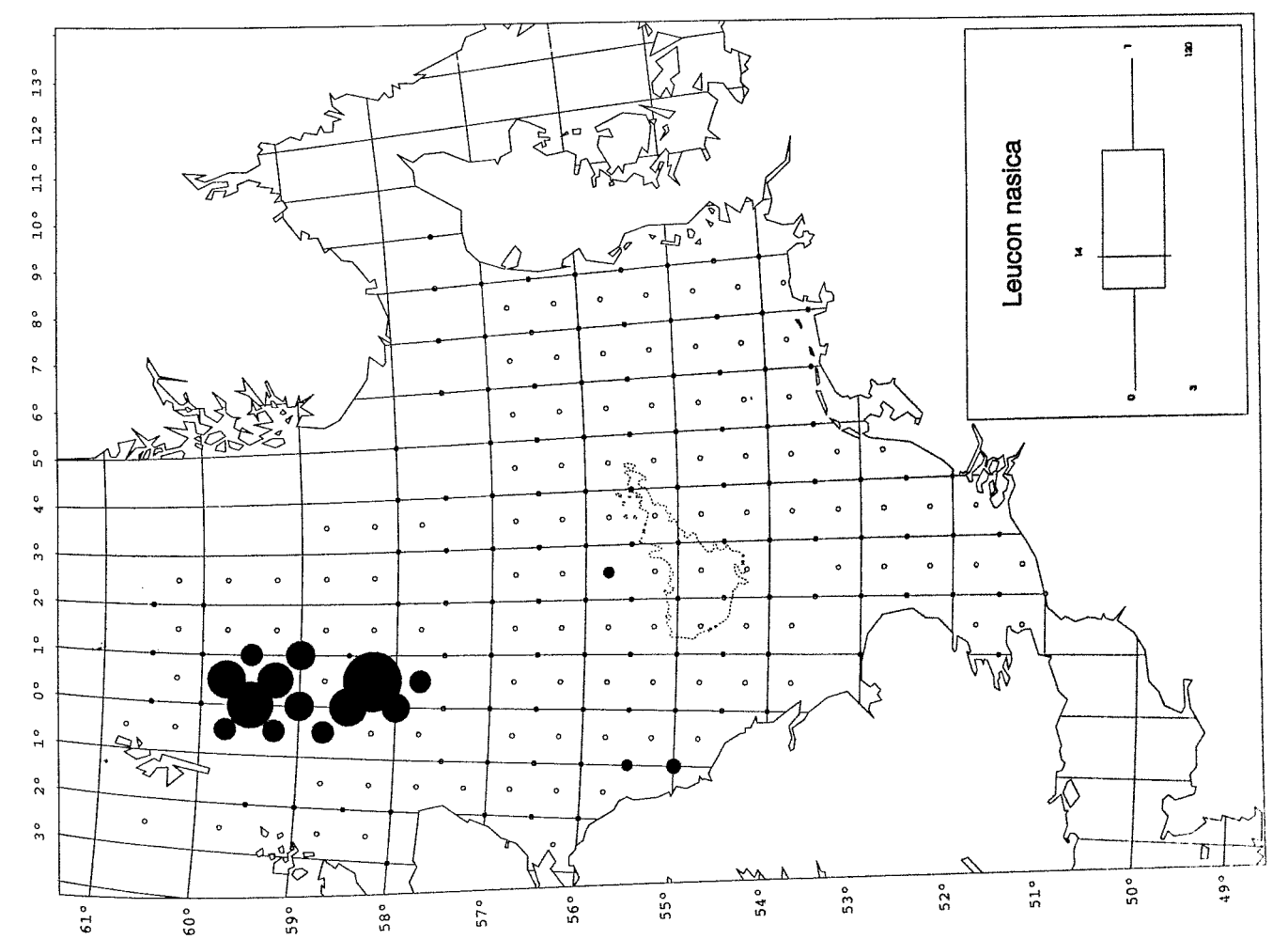

Lanice conchilega

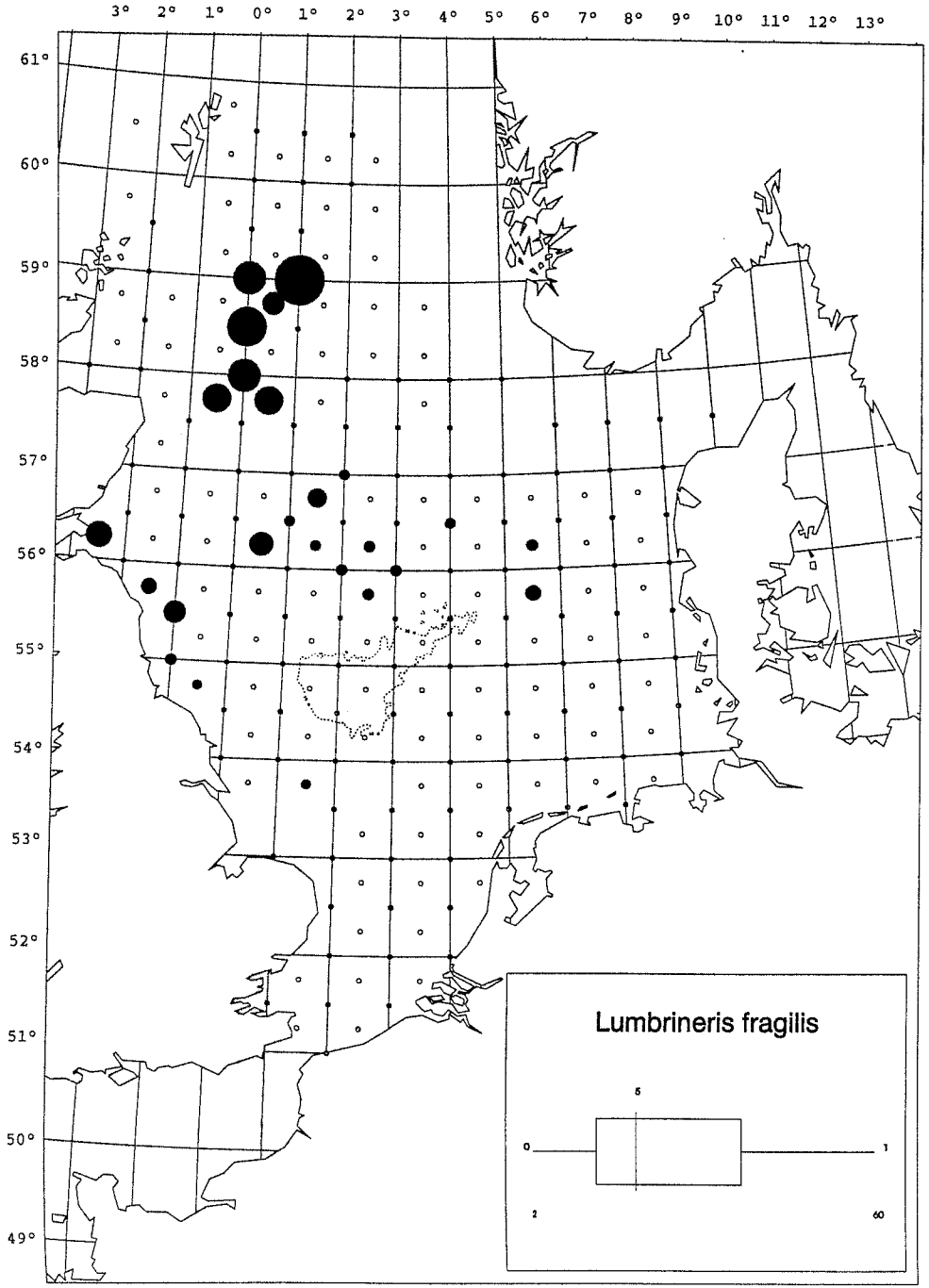

Lagis koreni

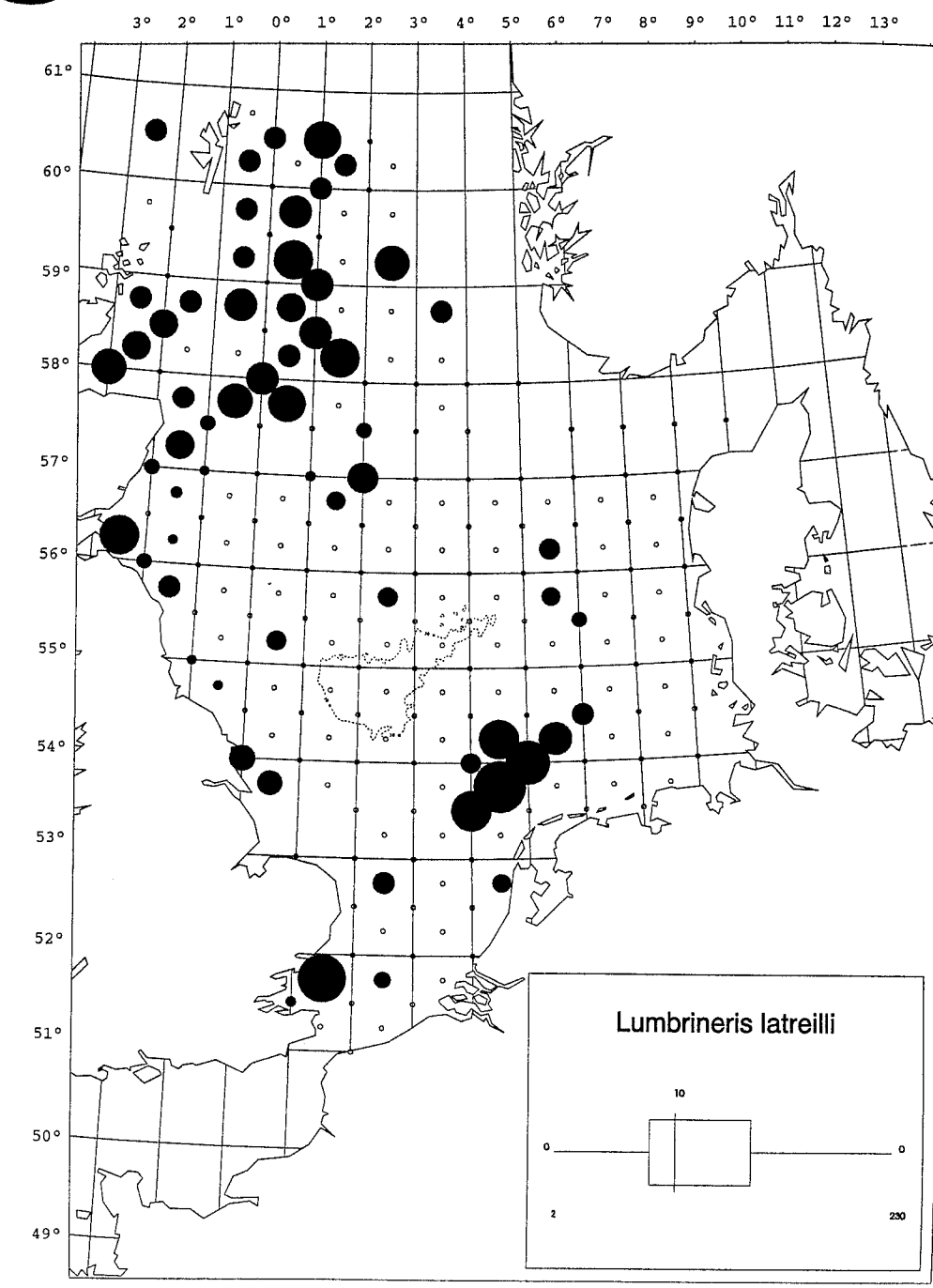

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Laonice cirrata
5
0
0
2
26

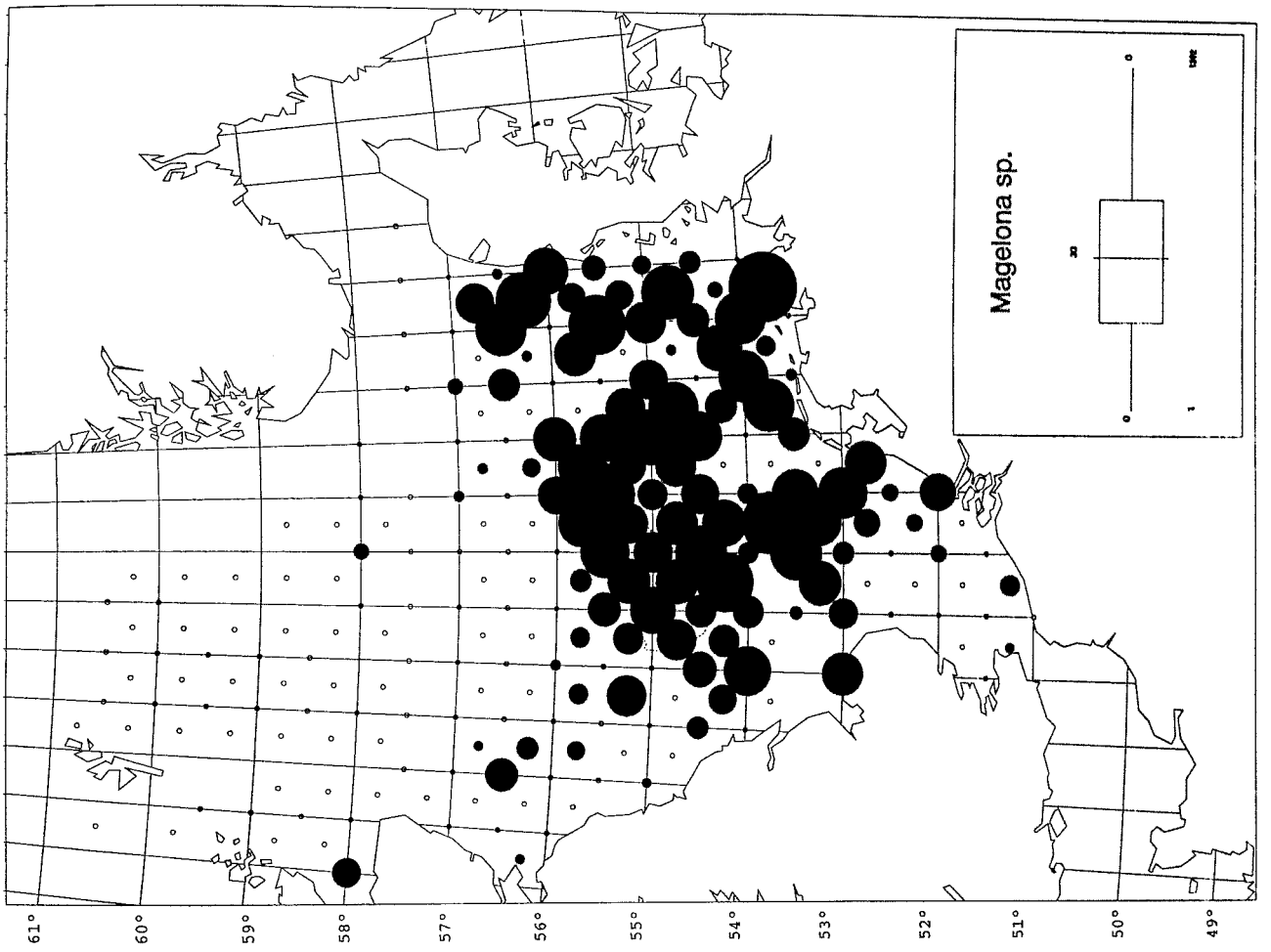

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Laonice sarsi
30
0
0
10
230

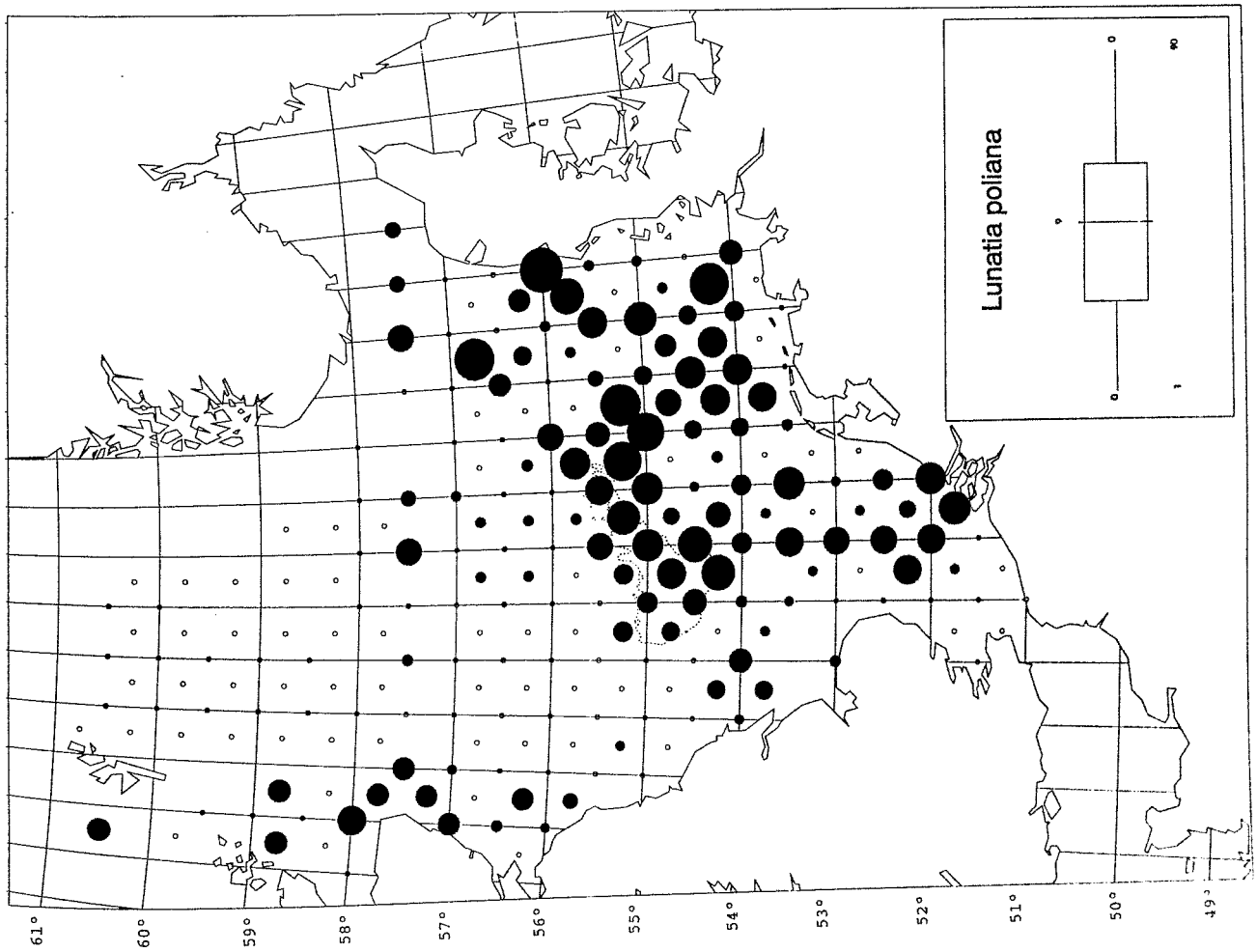

Levinsenia gracilis
0
17
610
0
2
61°
60°
59°
58°
57°
56°
55°
54°
53°
52°
51°
50°
49°
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°

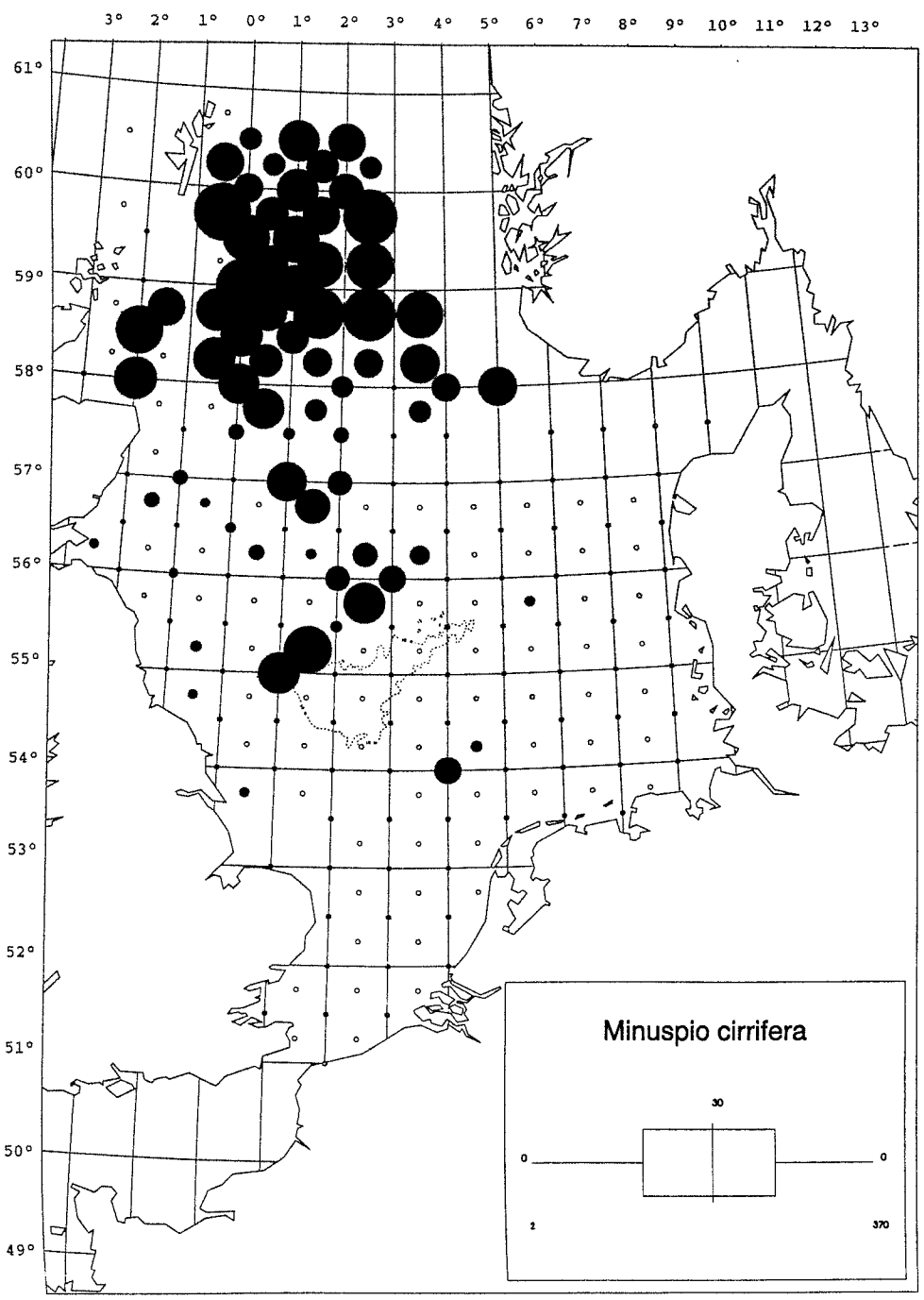

Leucon nasica
0
14
120
1
3
61°
60°
59°
58°
57°
56°
55°
54°
53°
52°
51°
50°
49°
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°

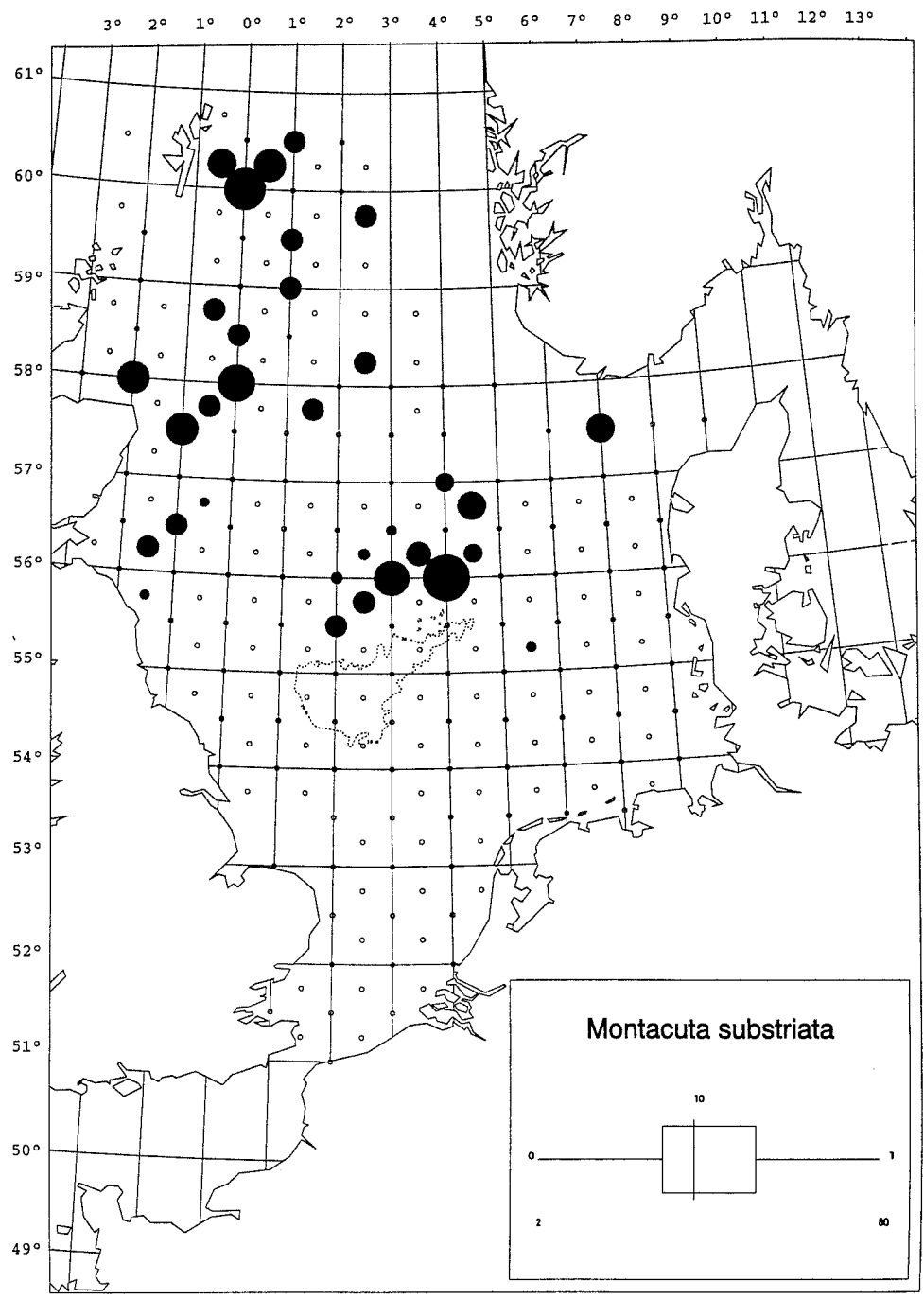

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Lumbrineris fragilis
5
0
1
2
60

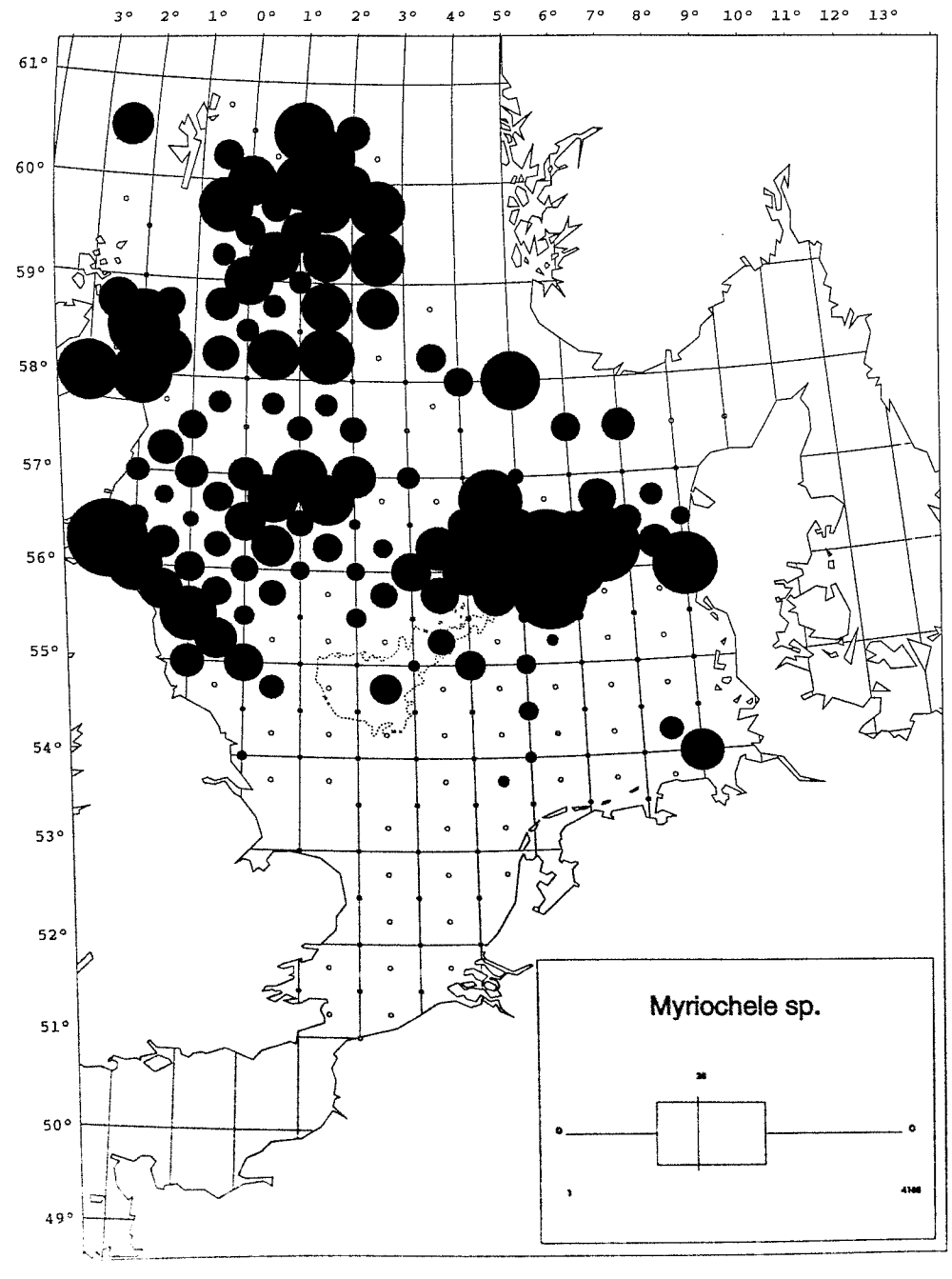

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Lumbrineris latreilli
10
0
0
2
230

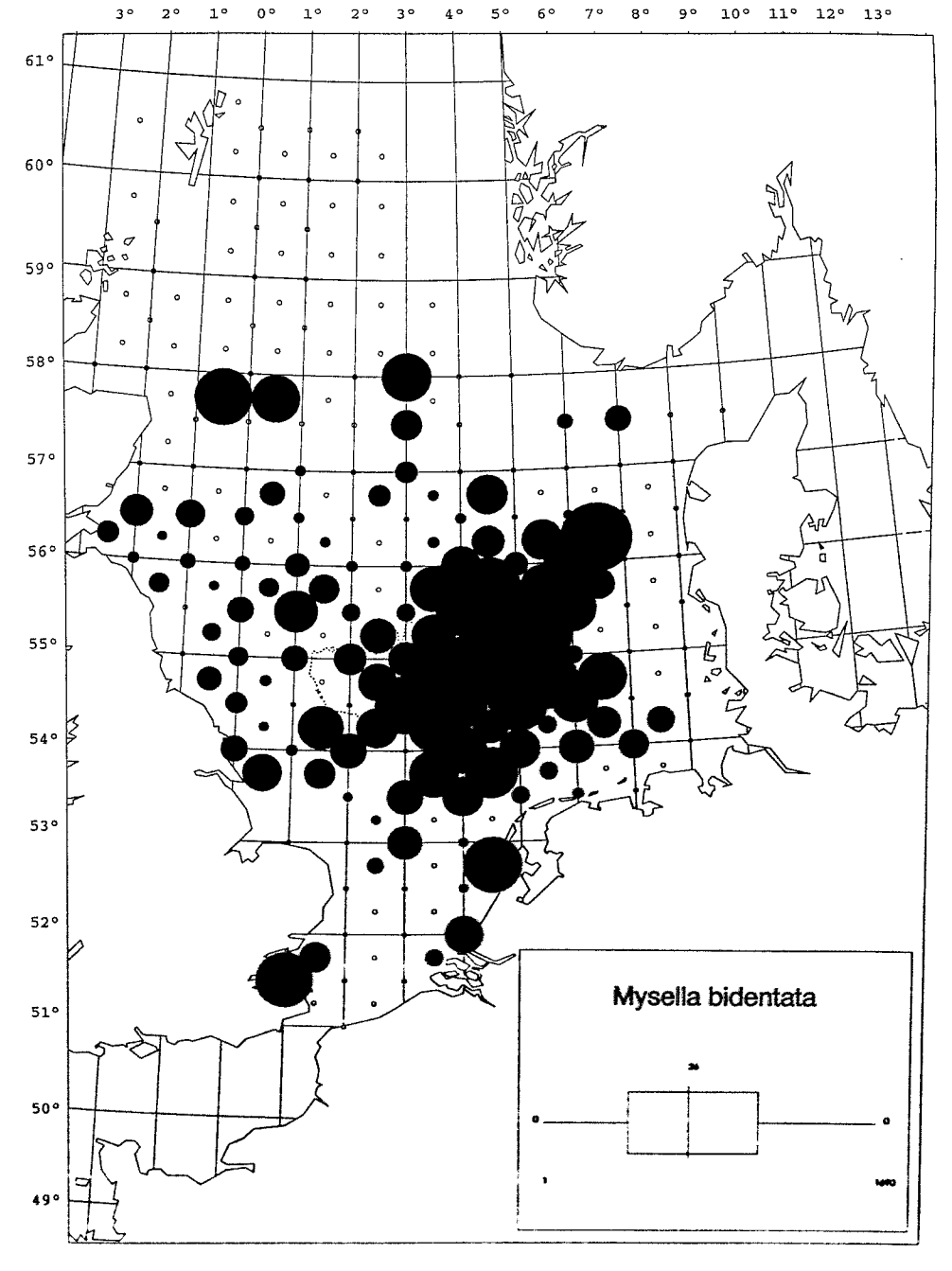

Magelona sp.
61°
60°
59°
58°
57°
56°
55°
54°
53°
52°
51°
50°
49°
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°

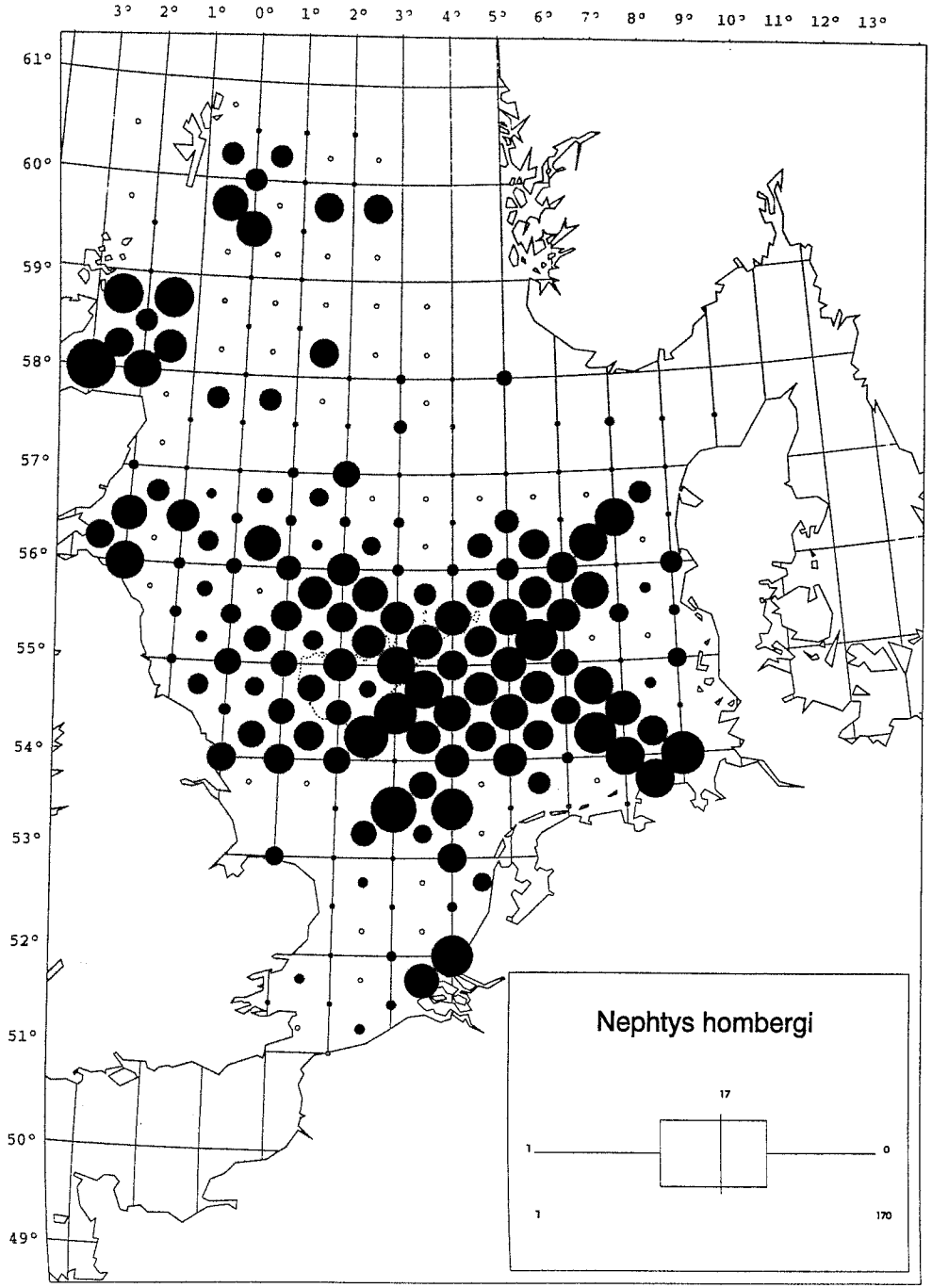

Lunatia poliana
61°
60°
59°
58°
57°
56°
55°
54°
53°
52°
51°
50°
49°
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°

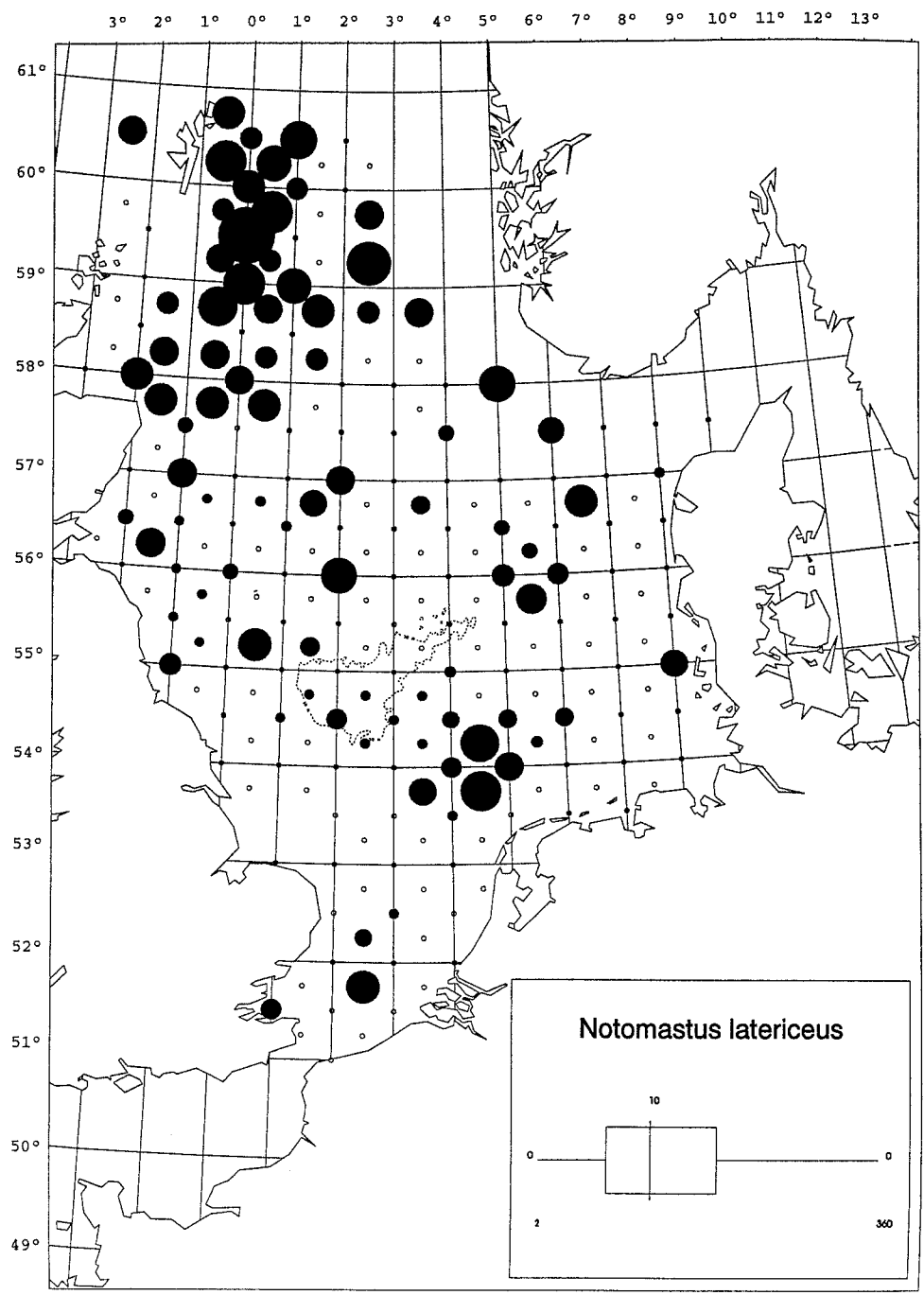

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Minuspio cirrifera
30
0
0
2
370

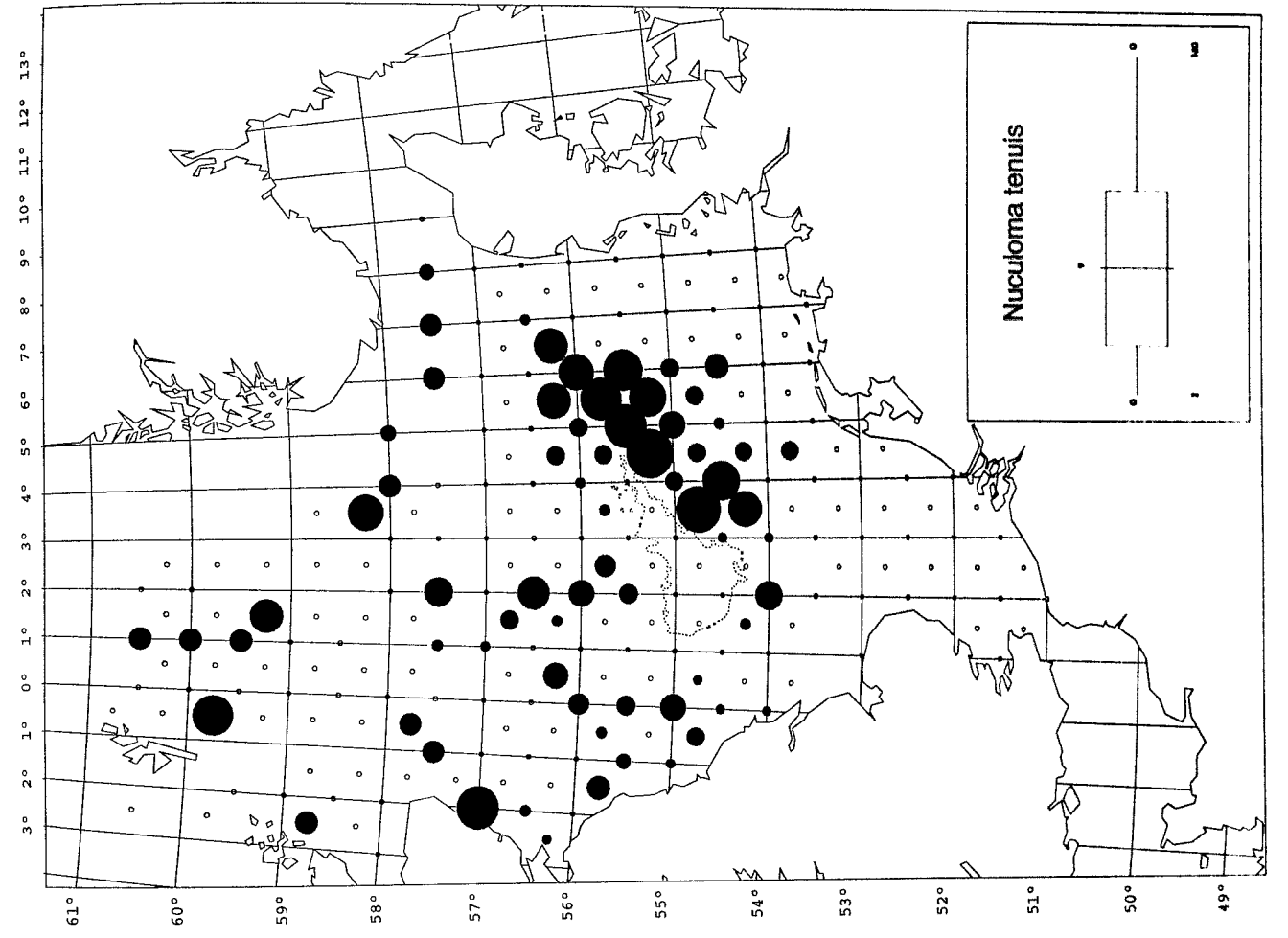

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Montacuta substriata
10
0
1
2
80

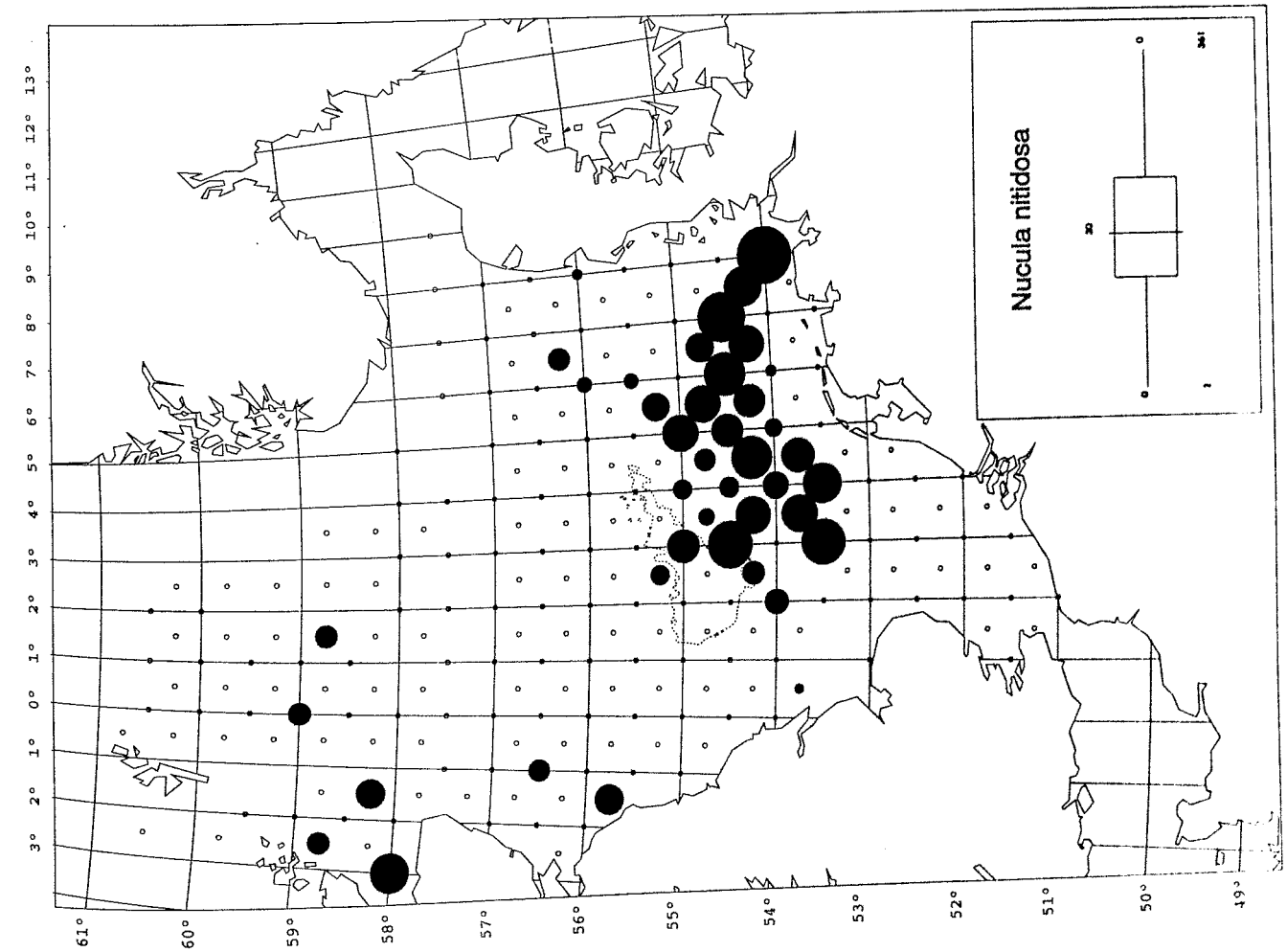

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Myriochele sp.

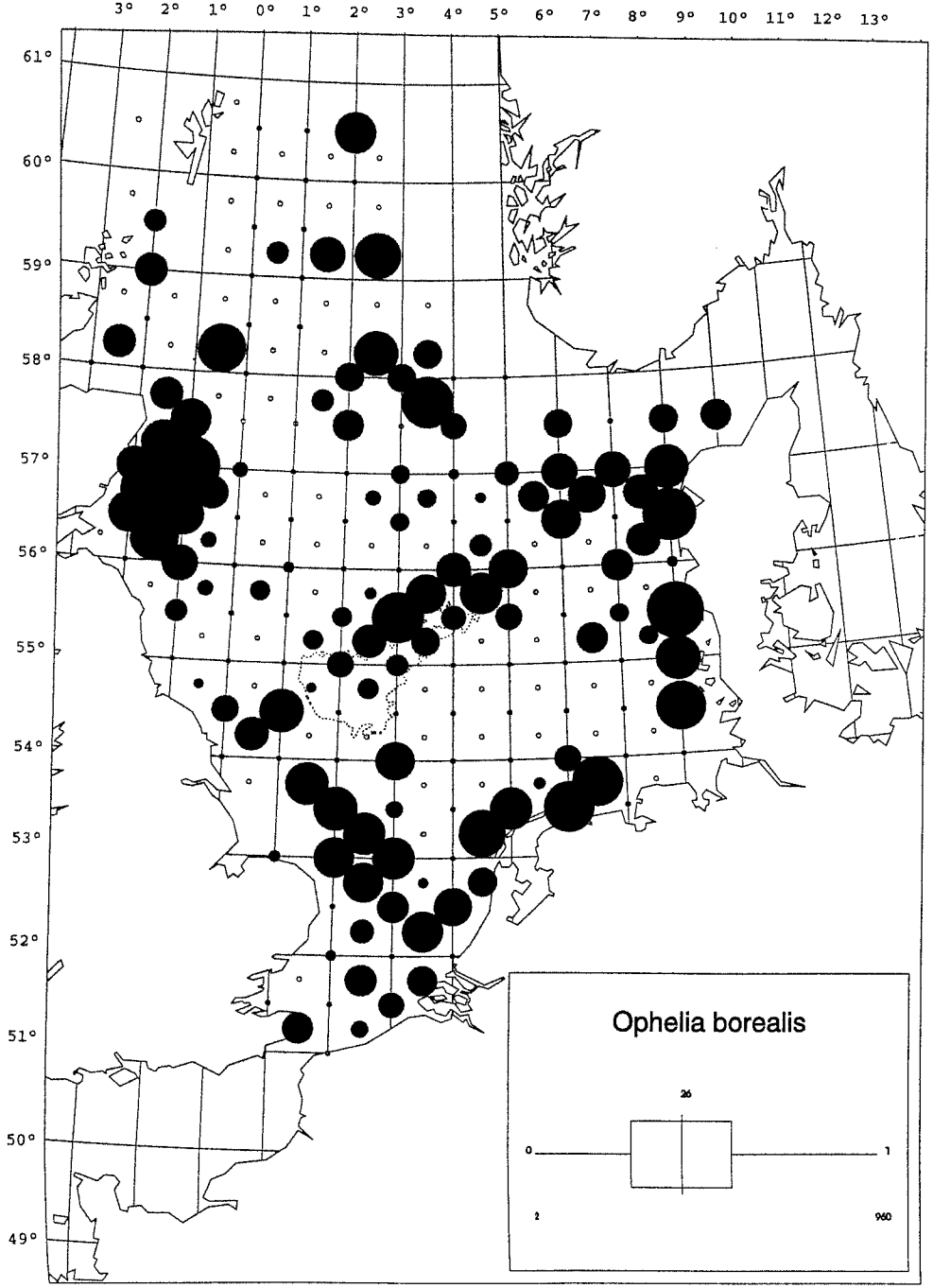

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Mysella bidentata

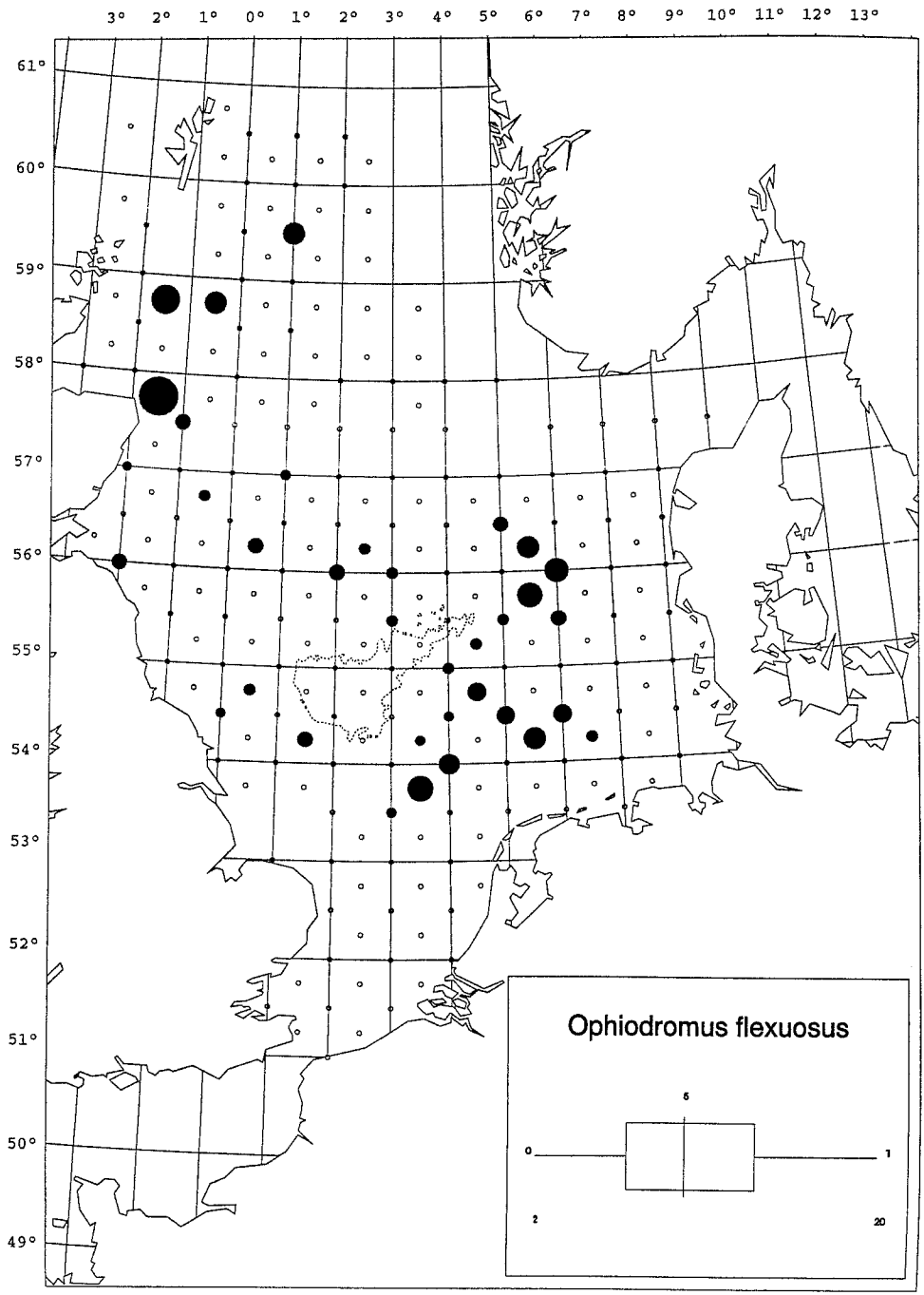

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Nephtys hombergi
17
1
0
1
170

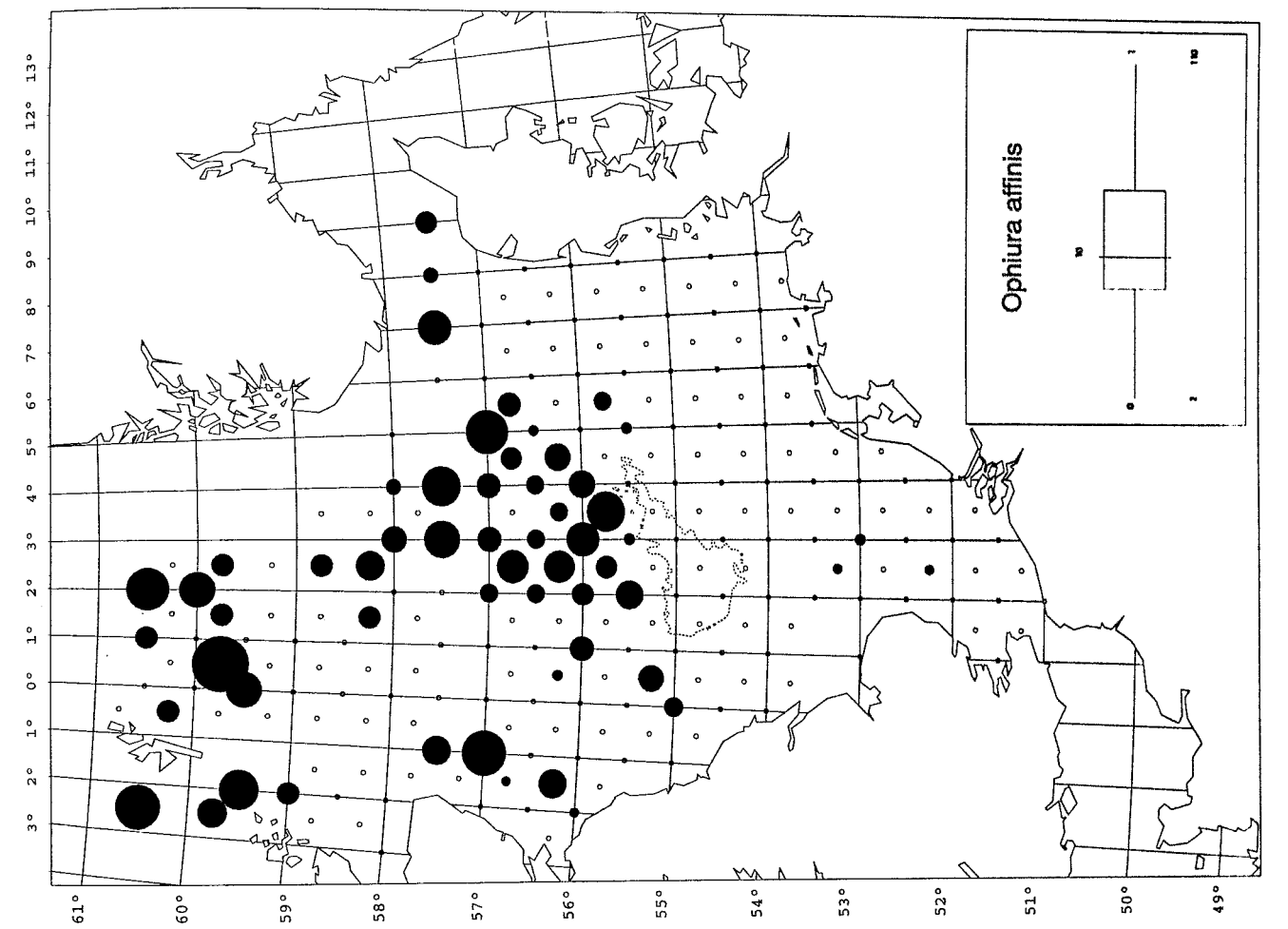

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Notomastus latericeus
10
0
0
2
360

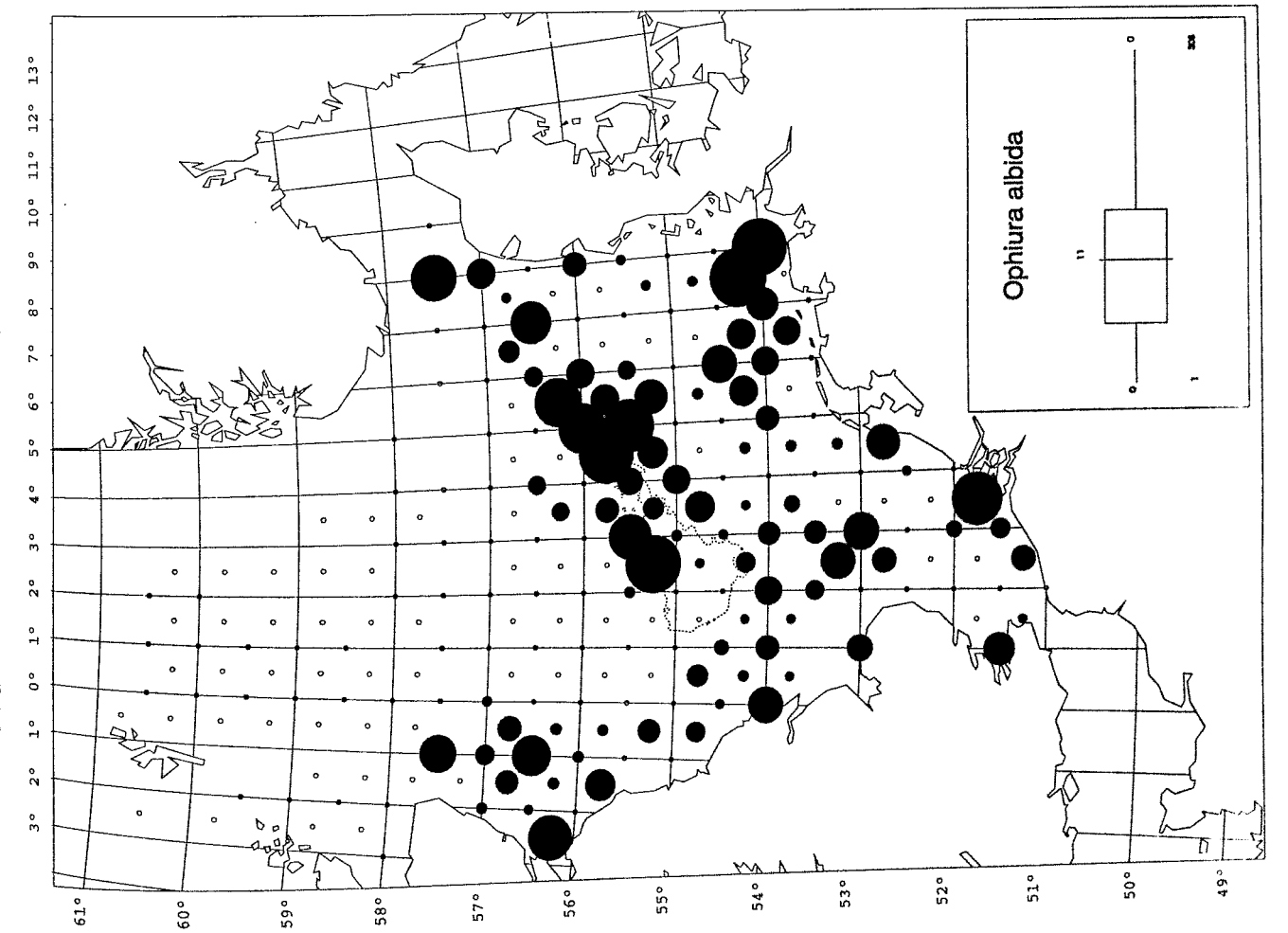

Nuculoma tenuis
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°

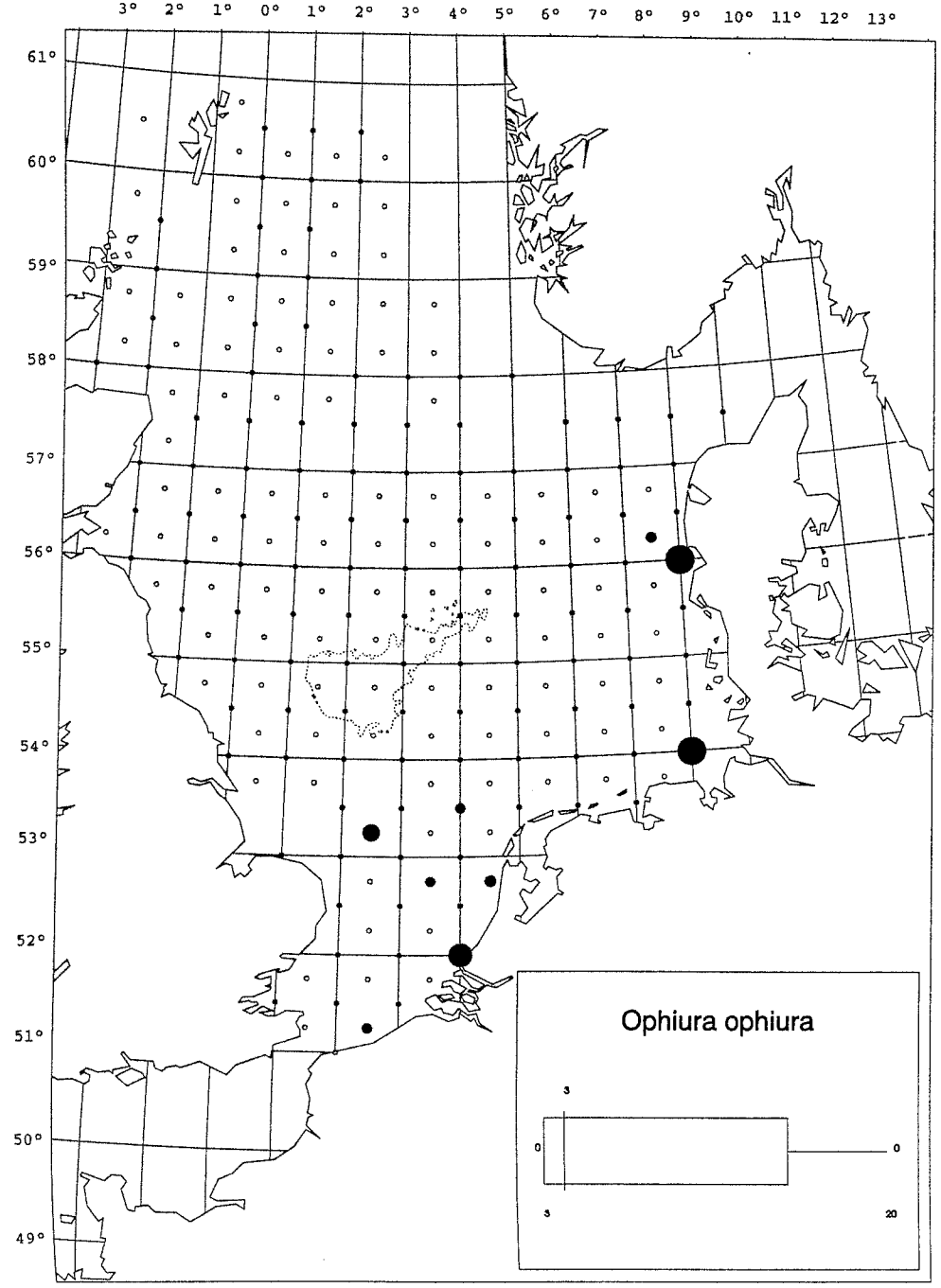

Nucula nitidosa
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°

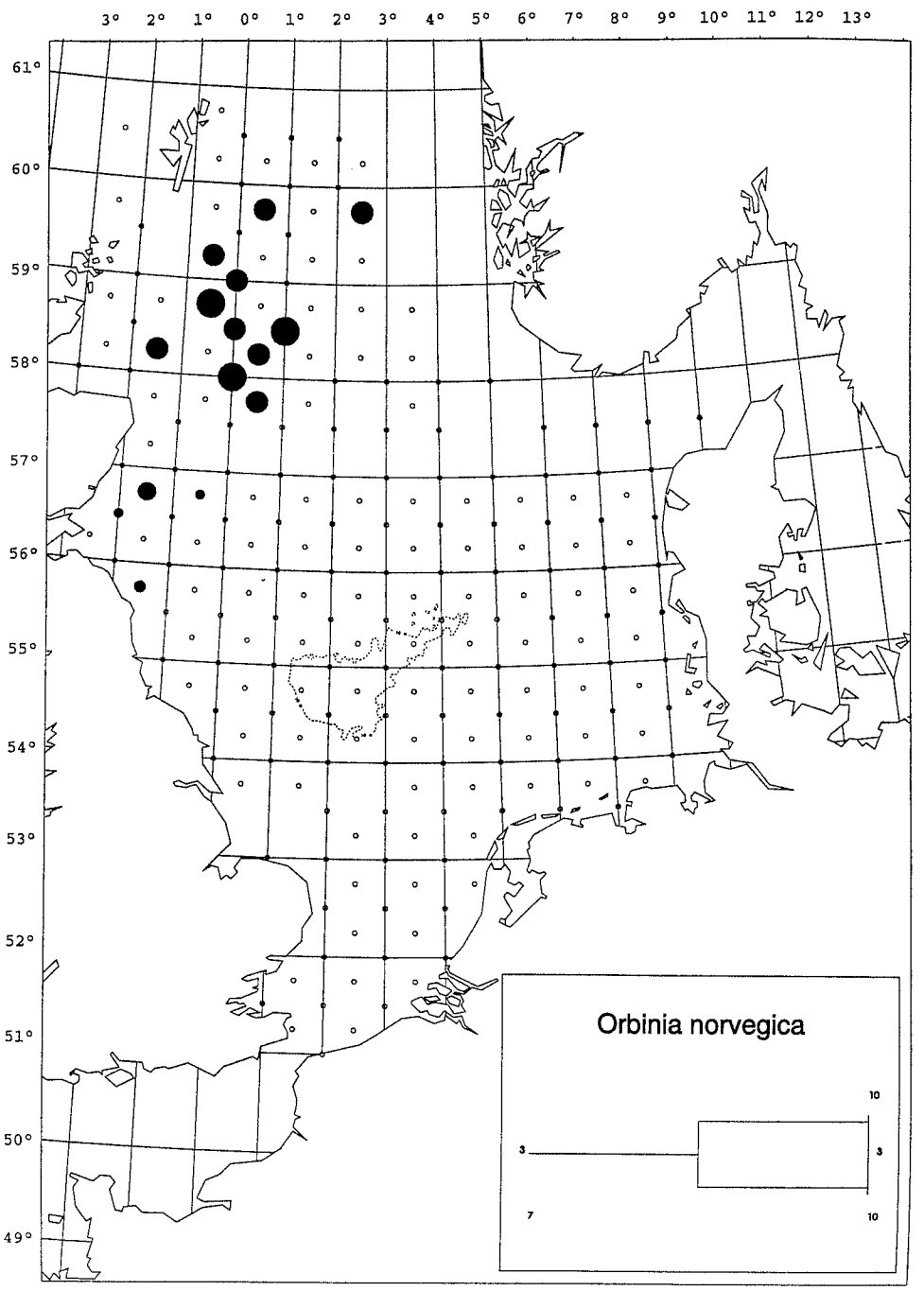

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Ophelia borealis
26
0
1
2
960

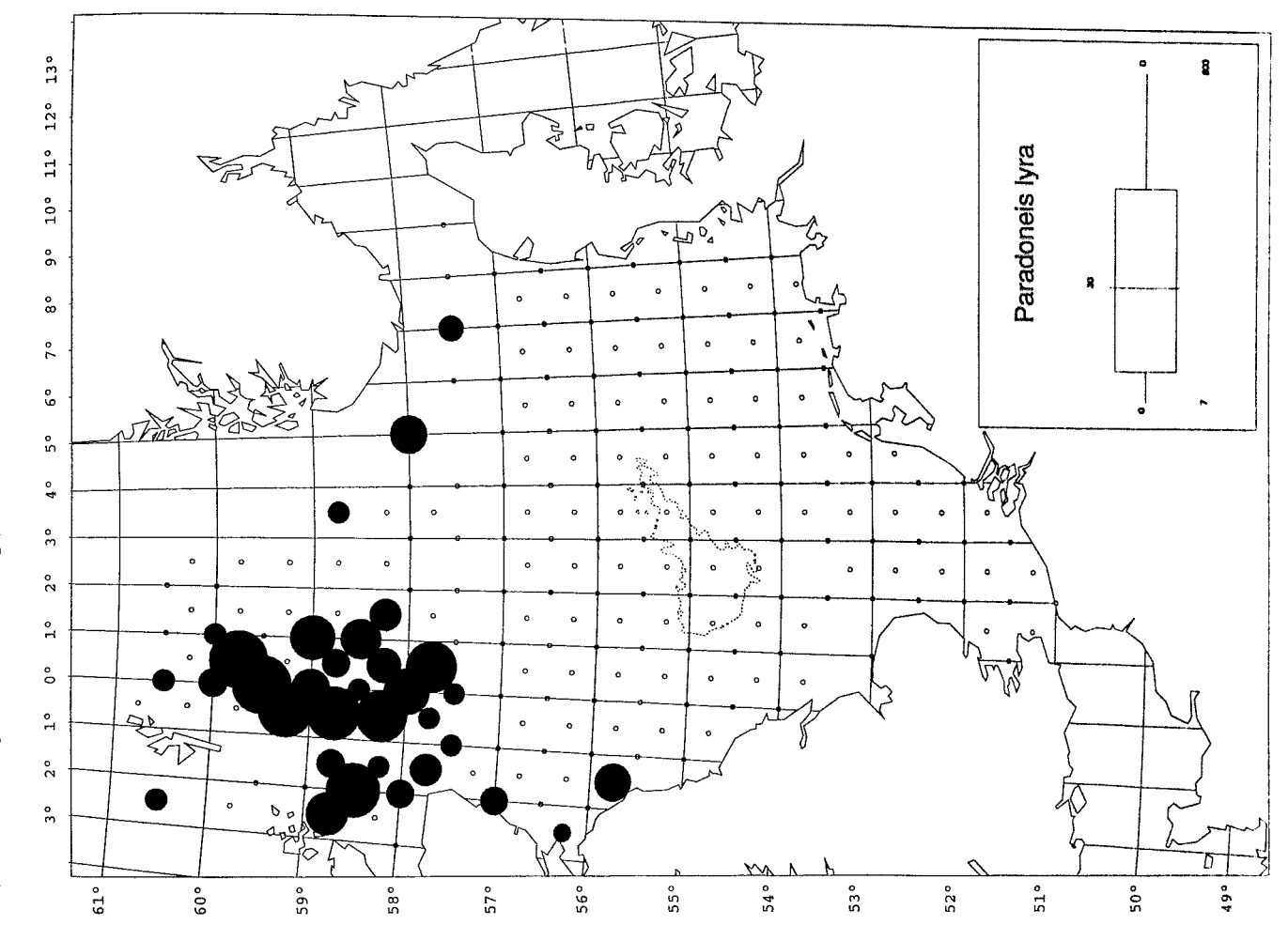

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Ophiodromus flexuosus
6
0
1
2
20

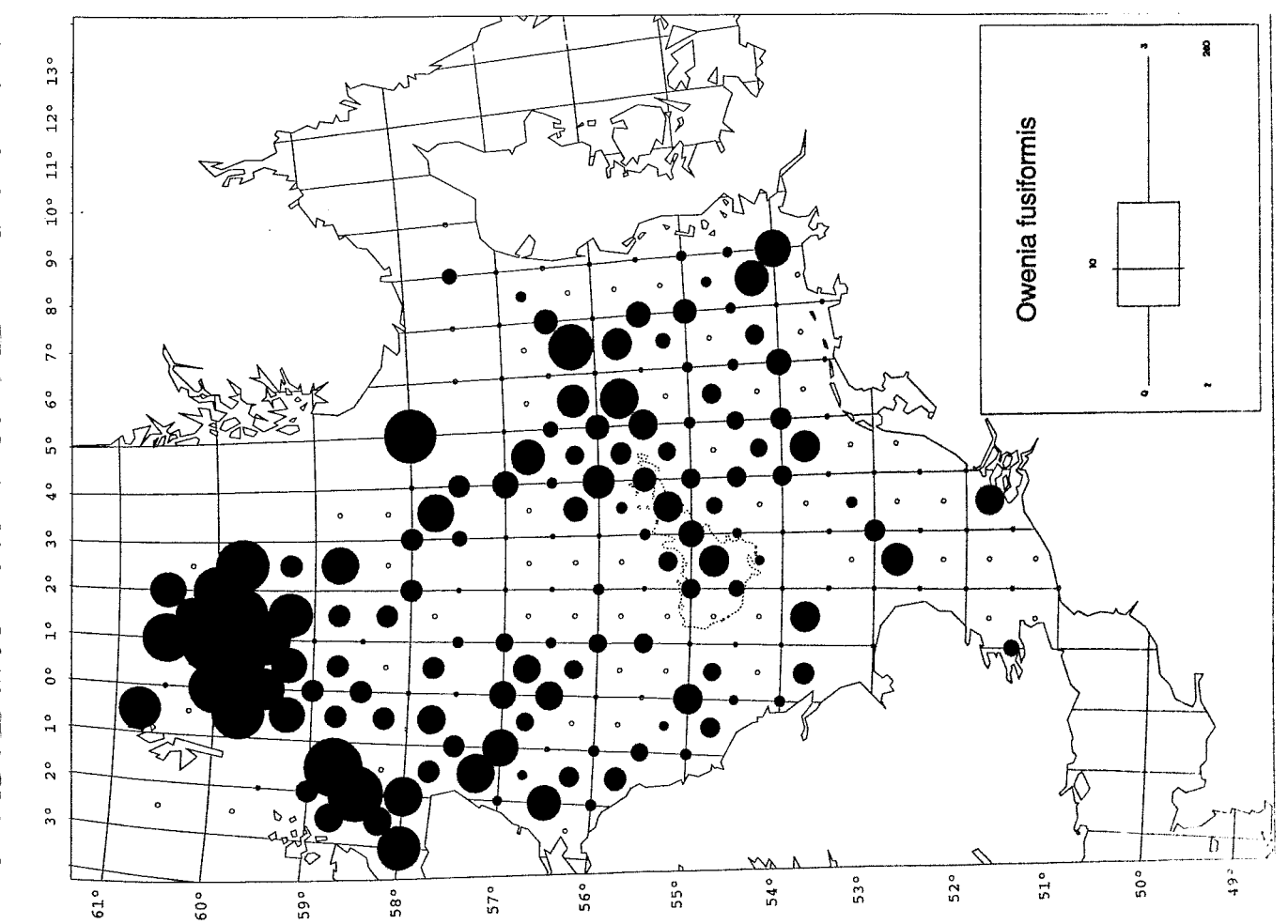

Ophiura affinis
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°

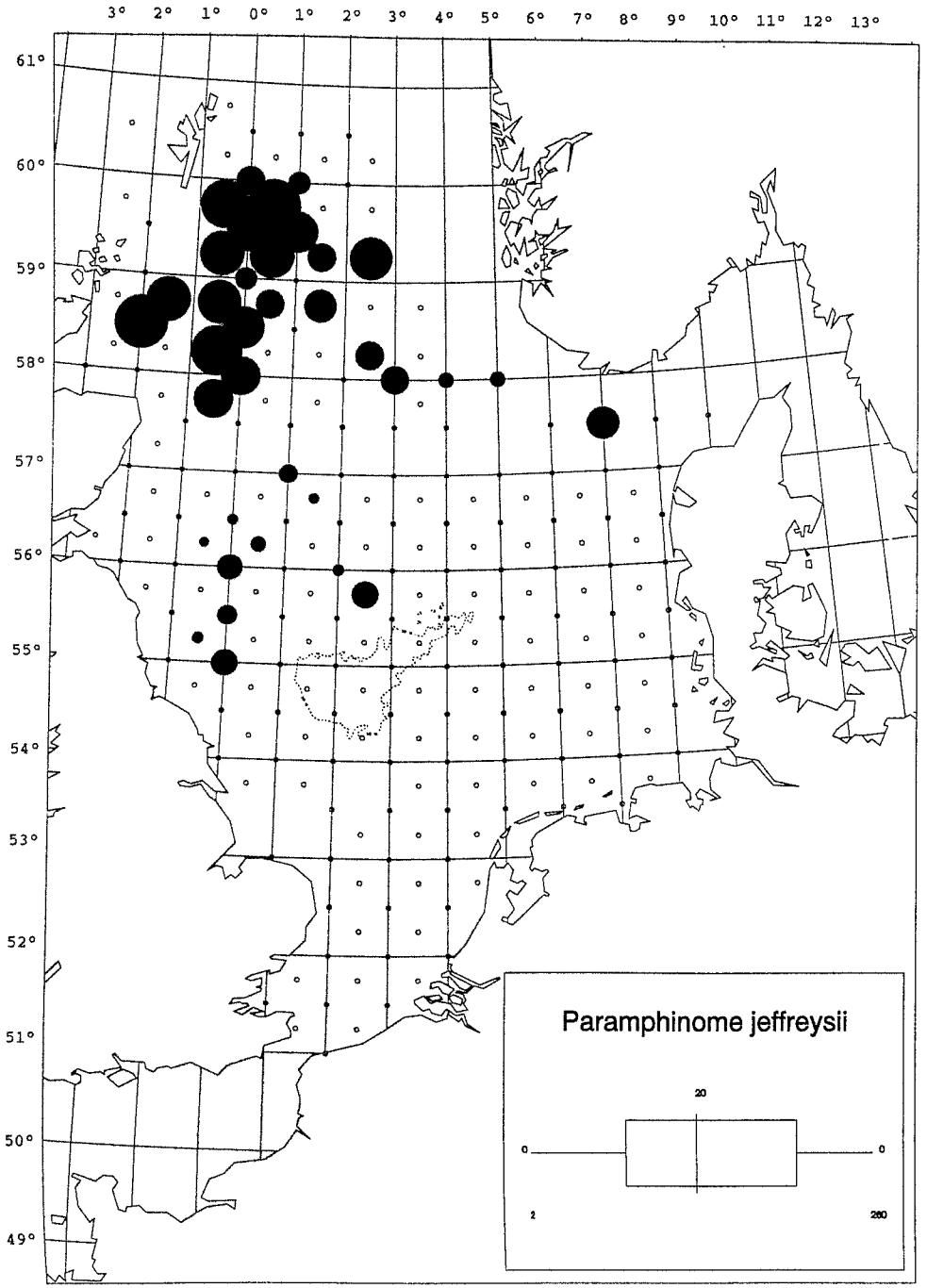

Ophiura albida
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°

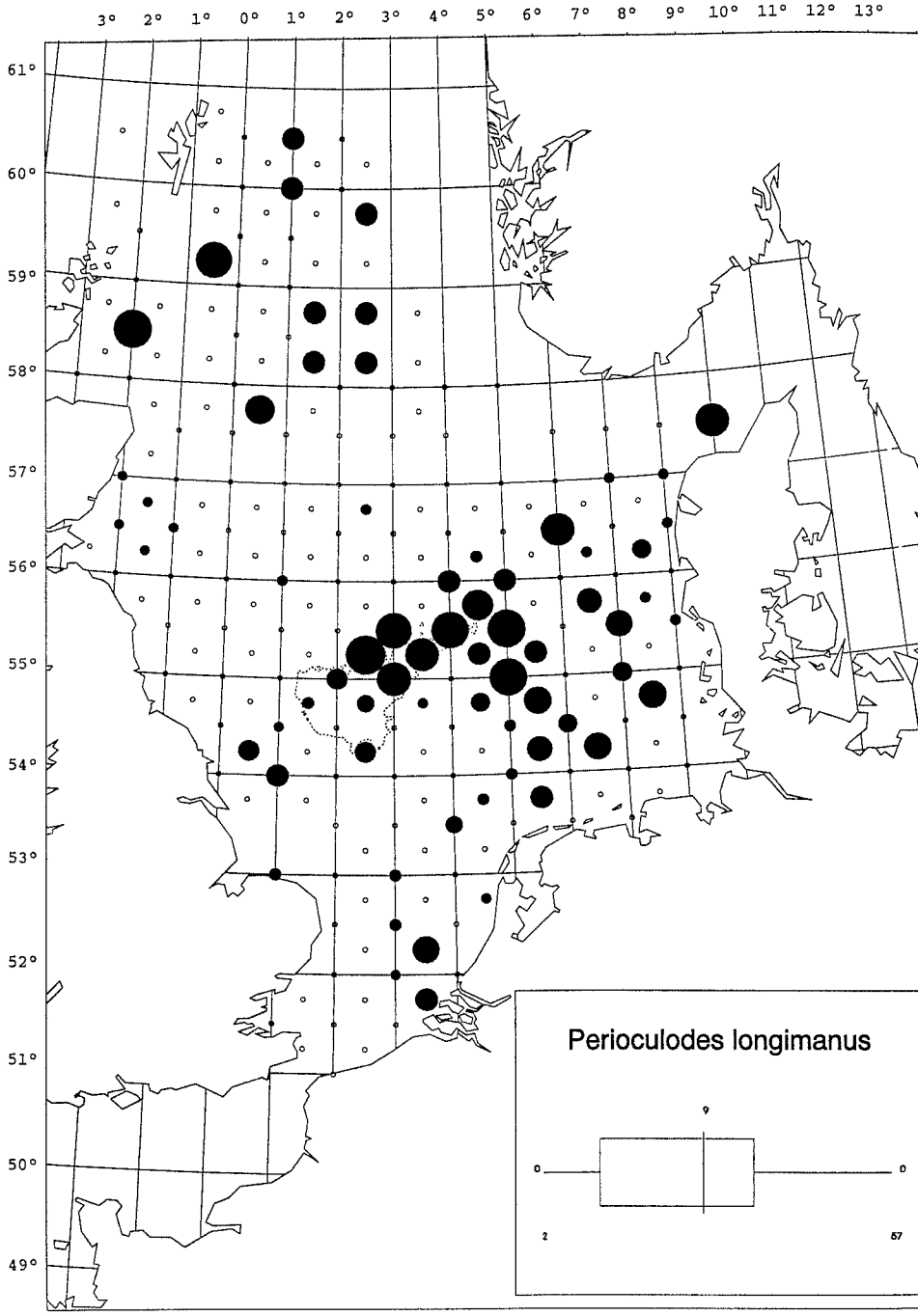

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Ophiura ophiura
3
0
0
3
20

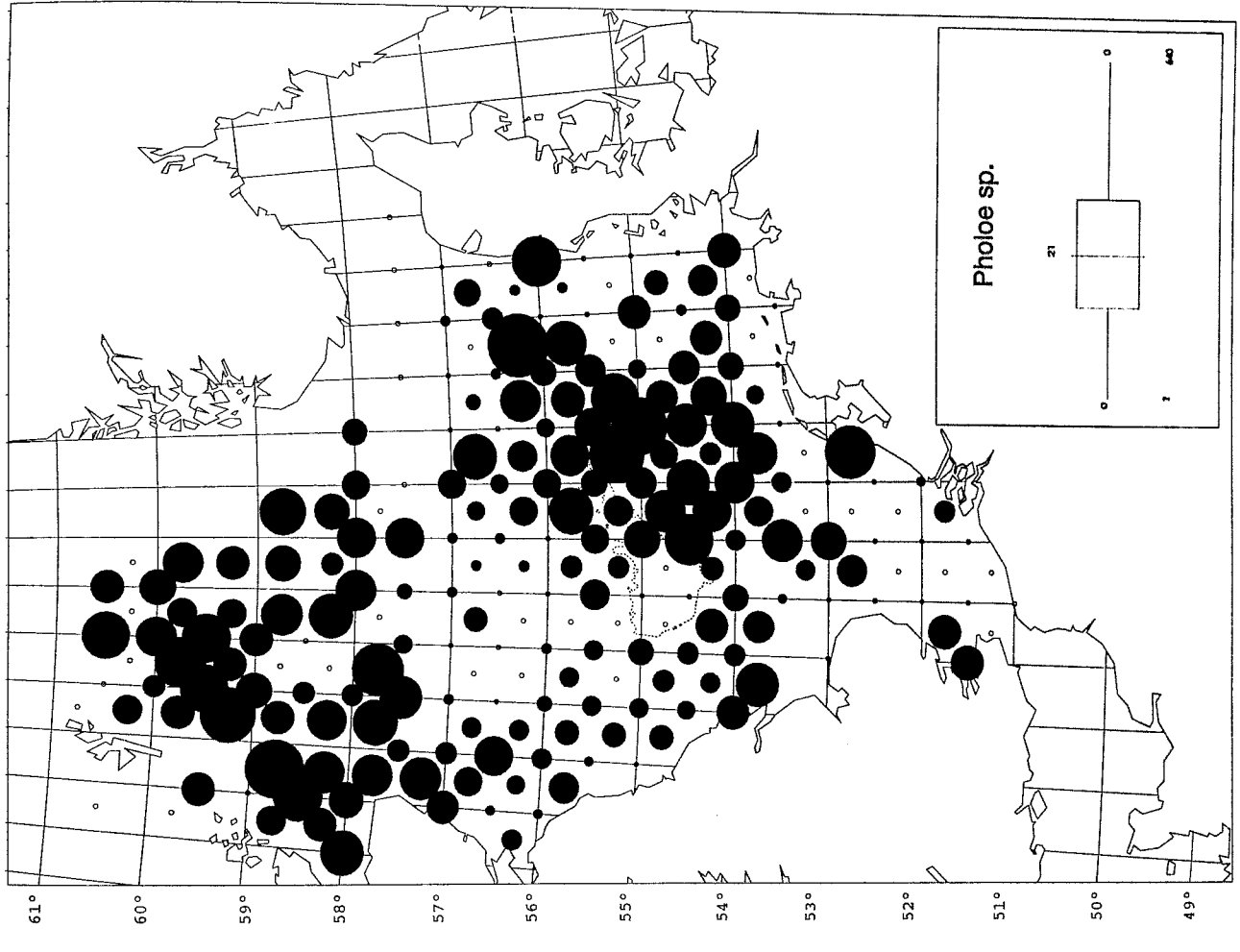

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Orbinia norvegica
10
3
3
7
10

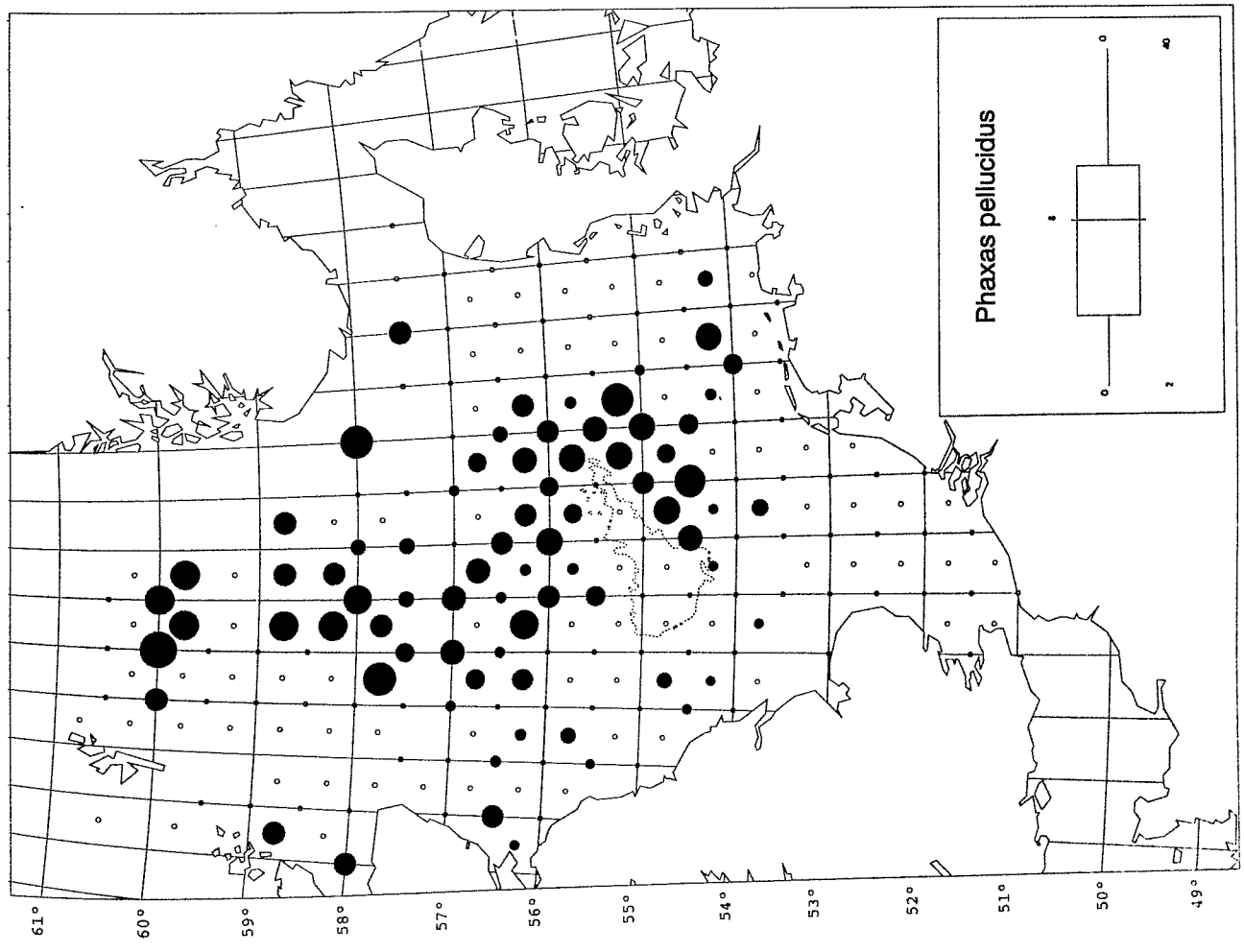

Paradoneis lyra
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°

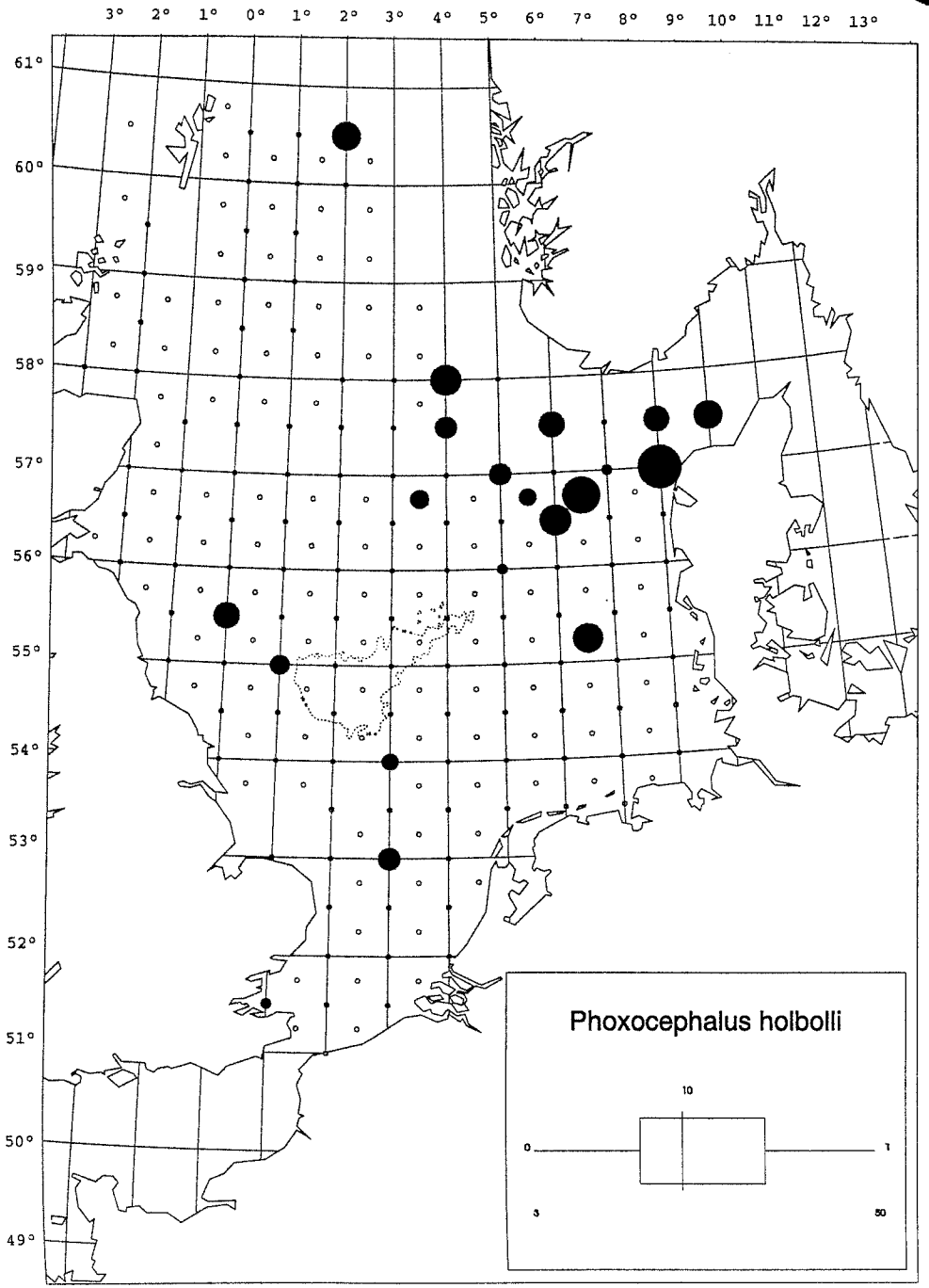

Owenia fusiformis
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50°
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°

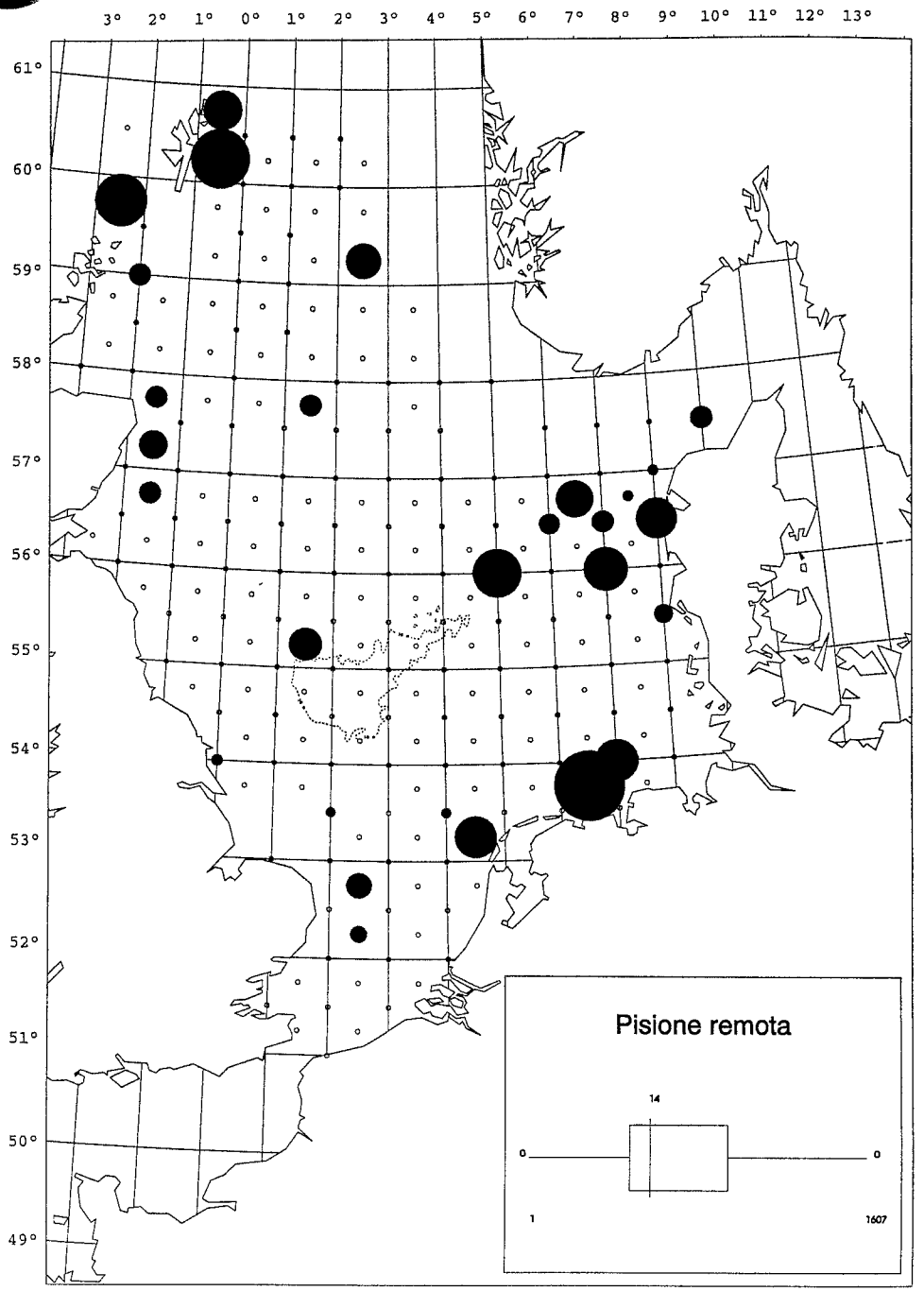

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Paramphinome jeffreysii
20
0
0
2
280

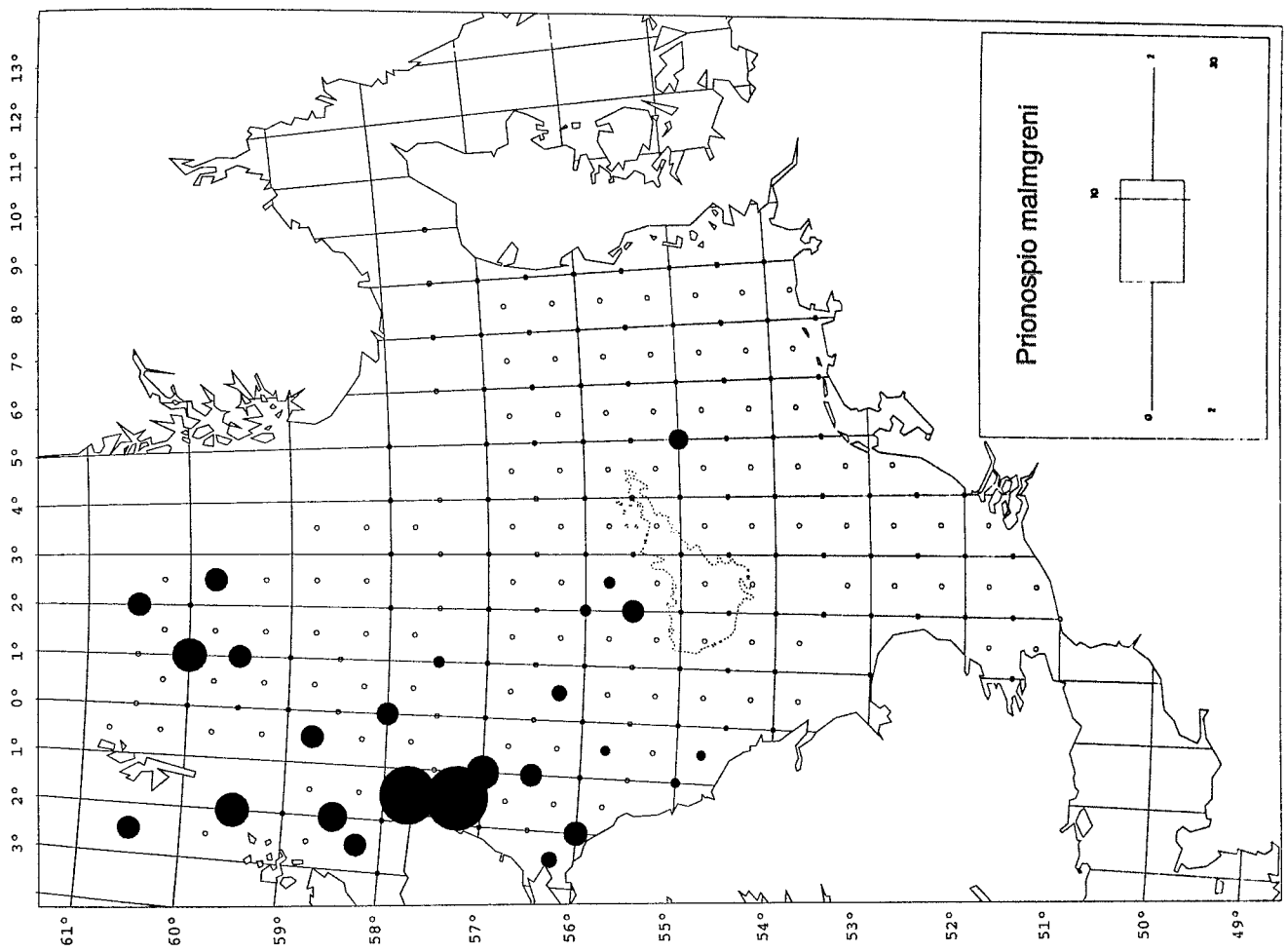

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Perioculodes longimanus
9
0
0
2
57

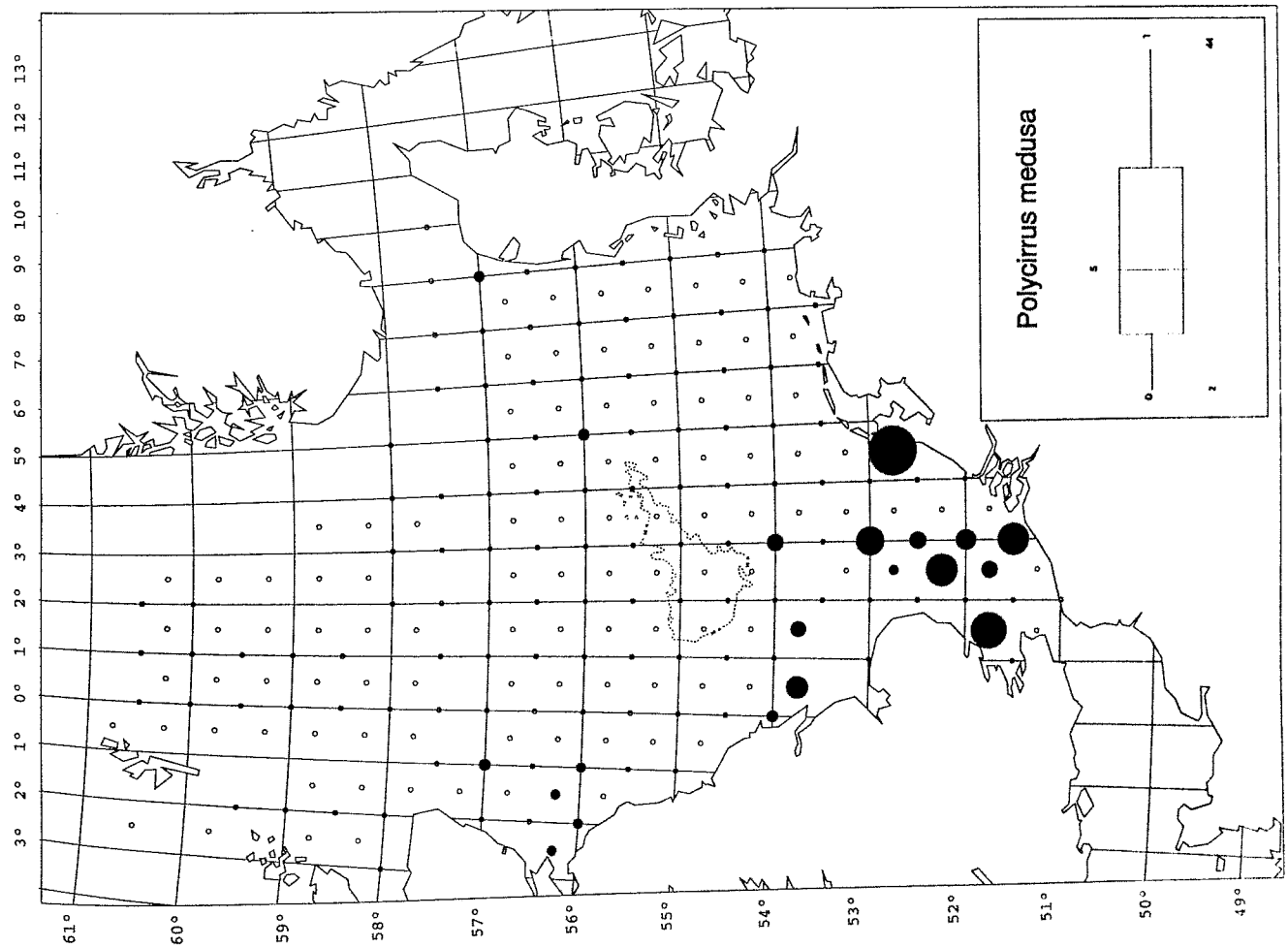

Pholoe sp.
21
0
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°

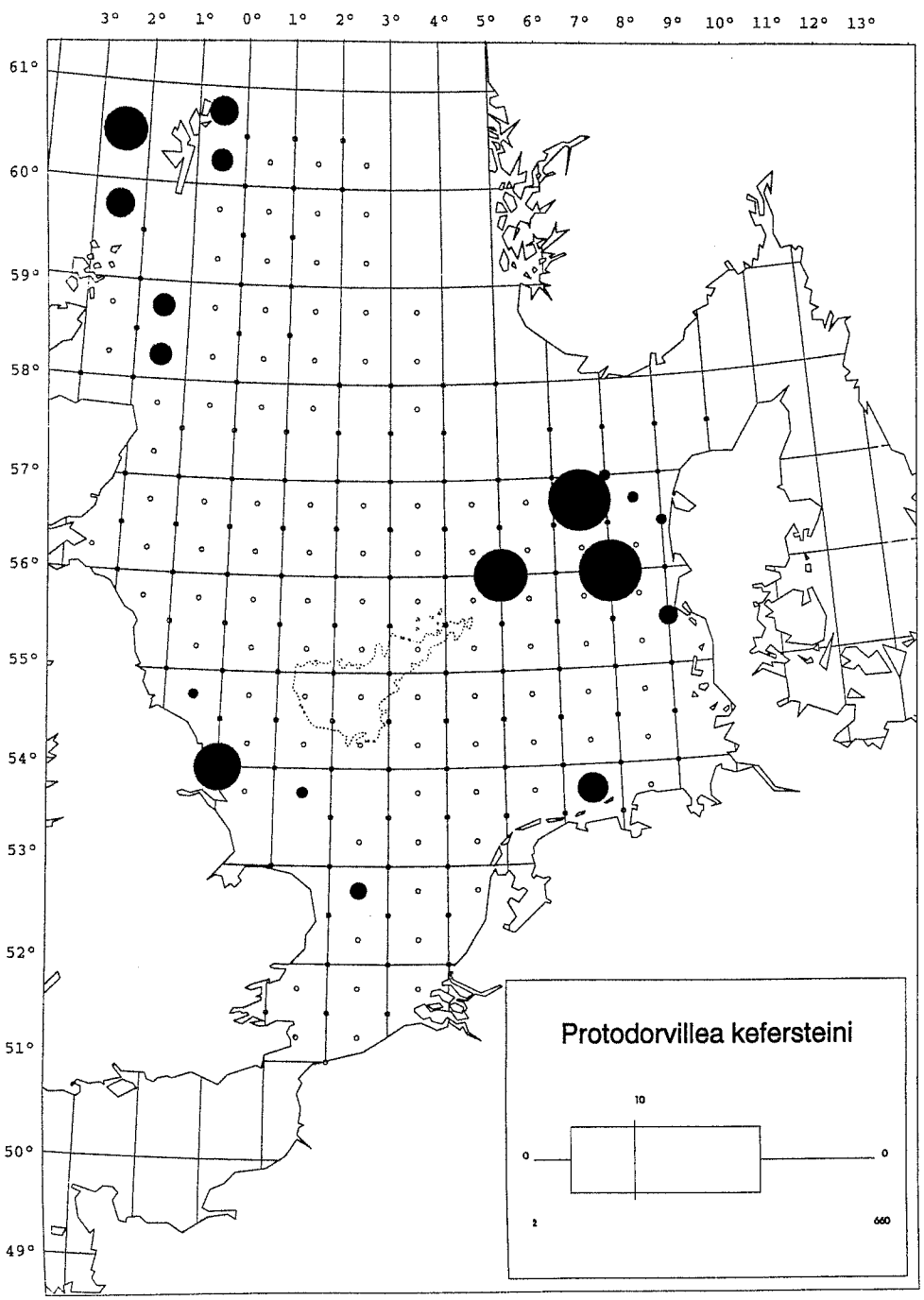

Phaxas pellucidus
0
40
8
2
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°

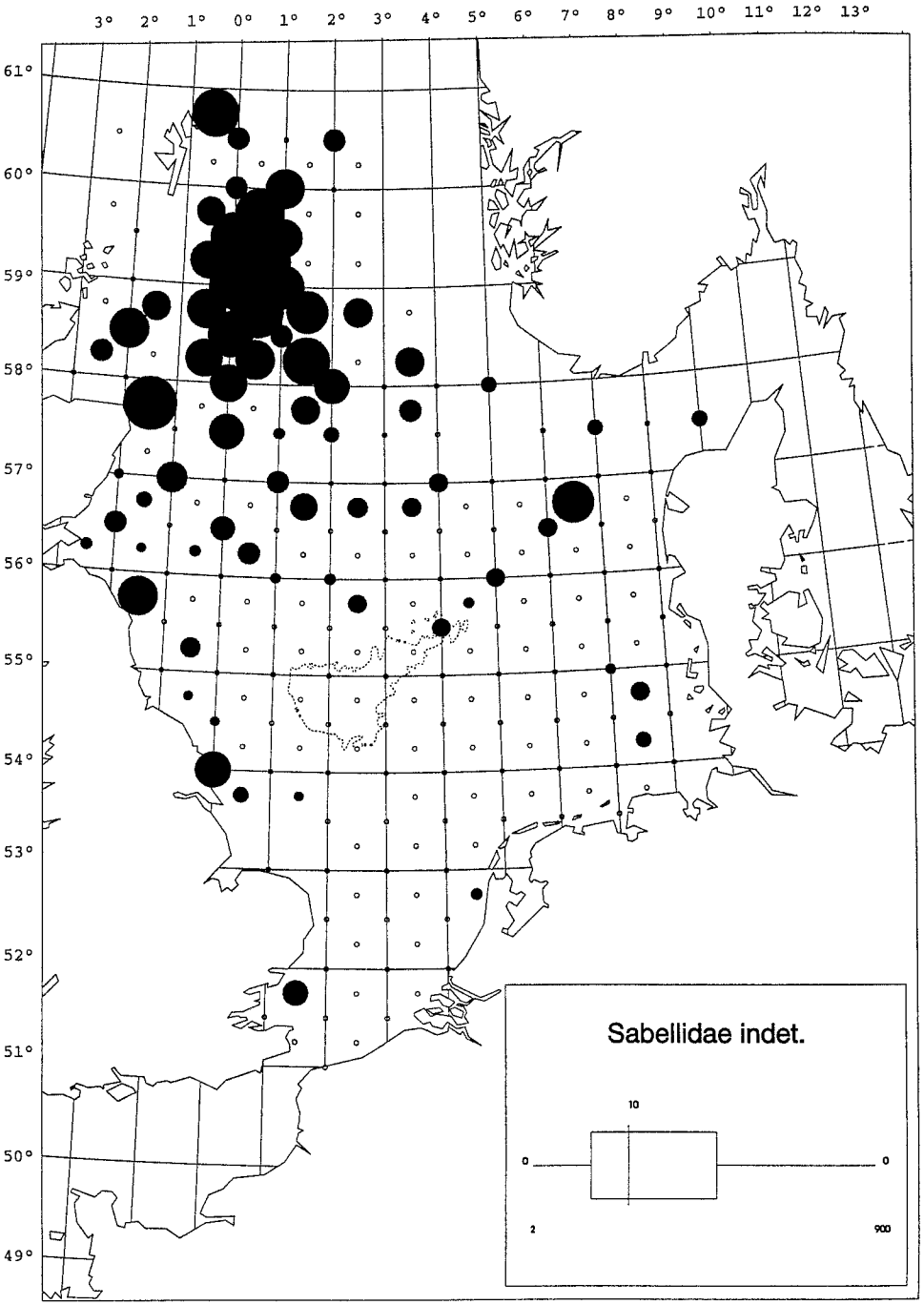

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Phoxocephalus holbolli
10
0
1
3
80

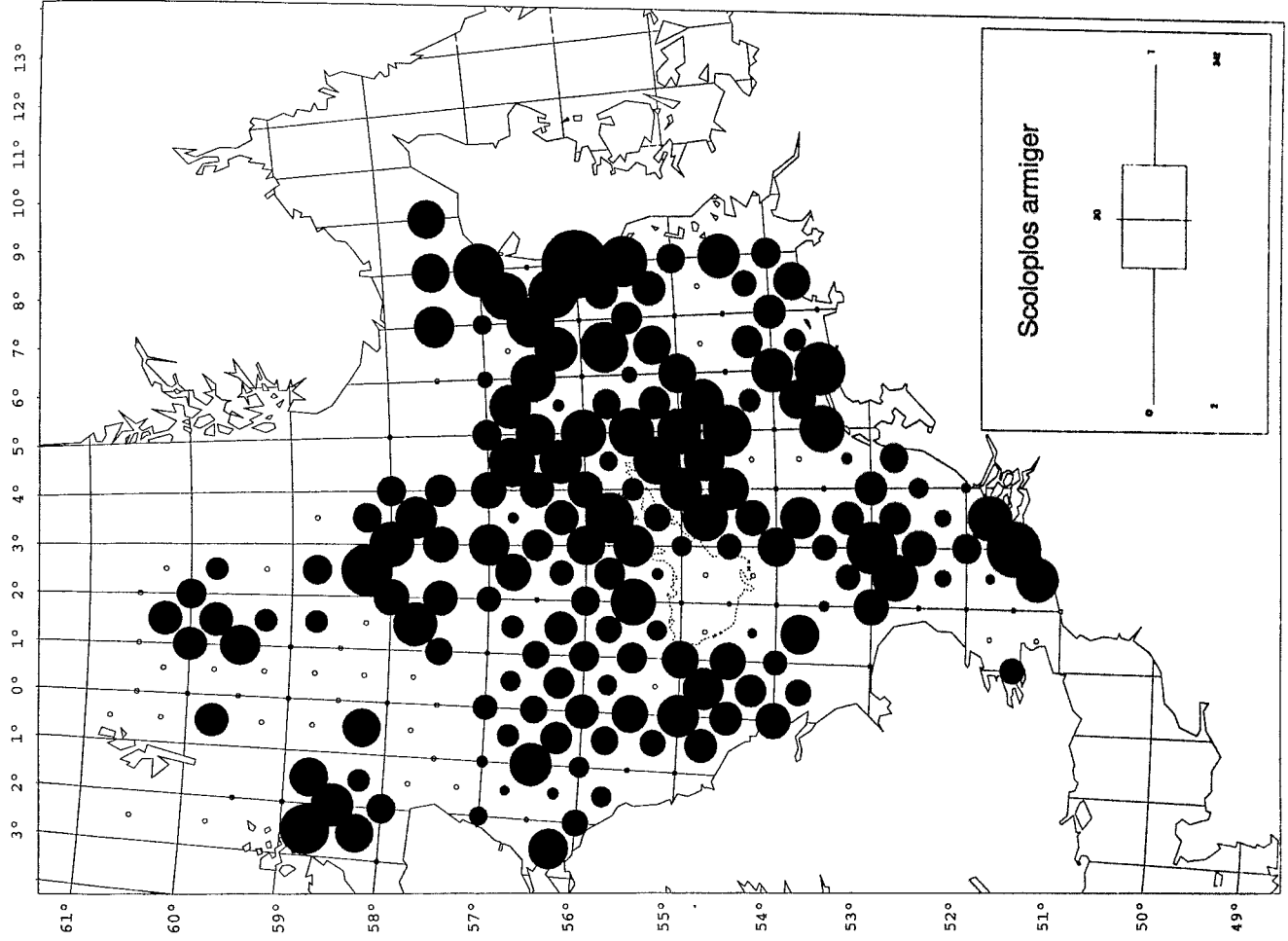

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Pisione remota
14
0
0
1
1607

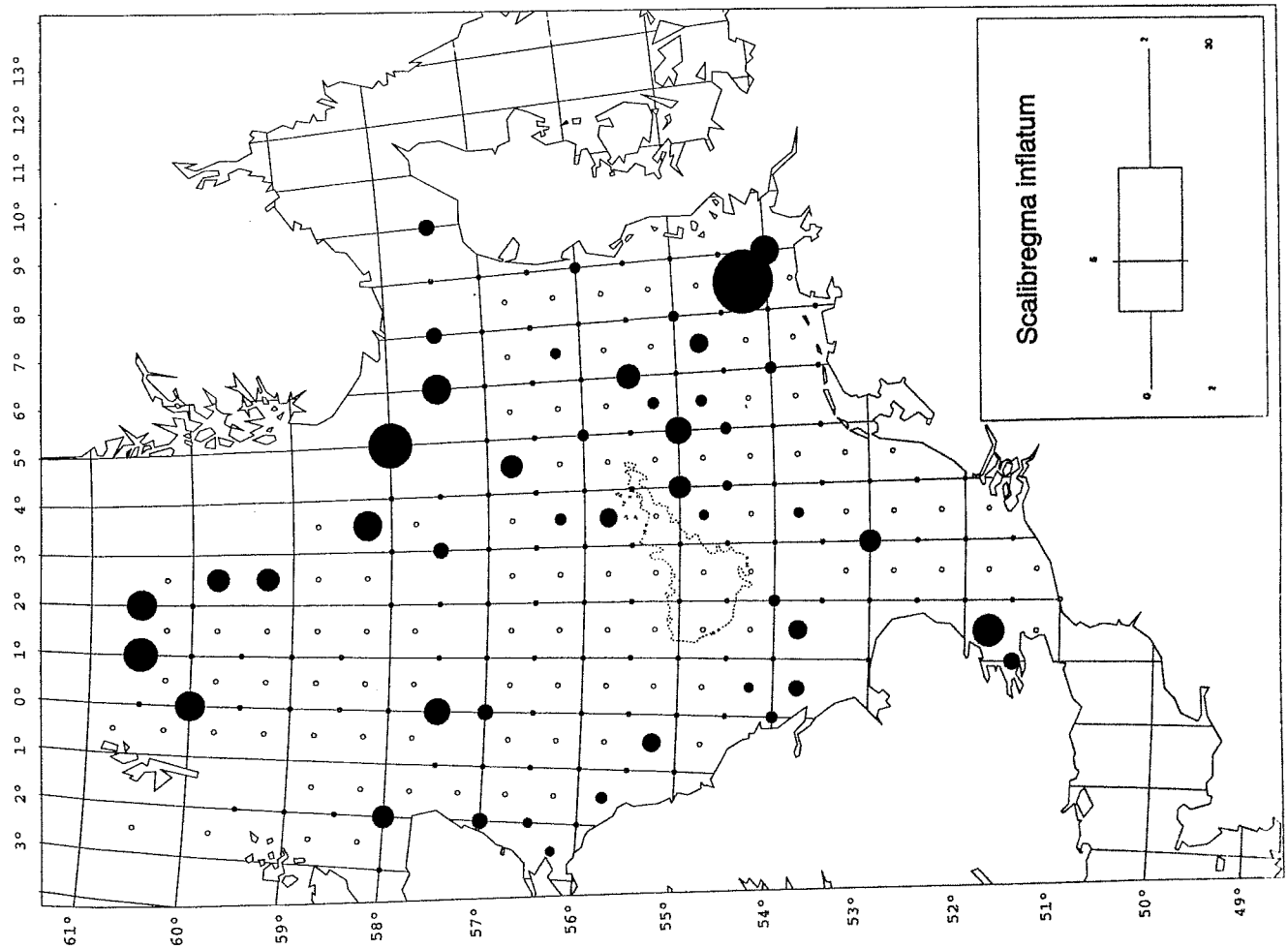

Prionospio malmgreni
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°

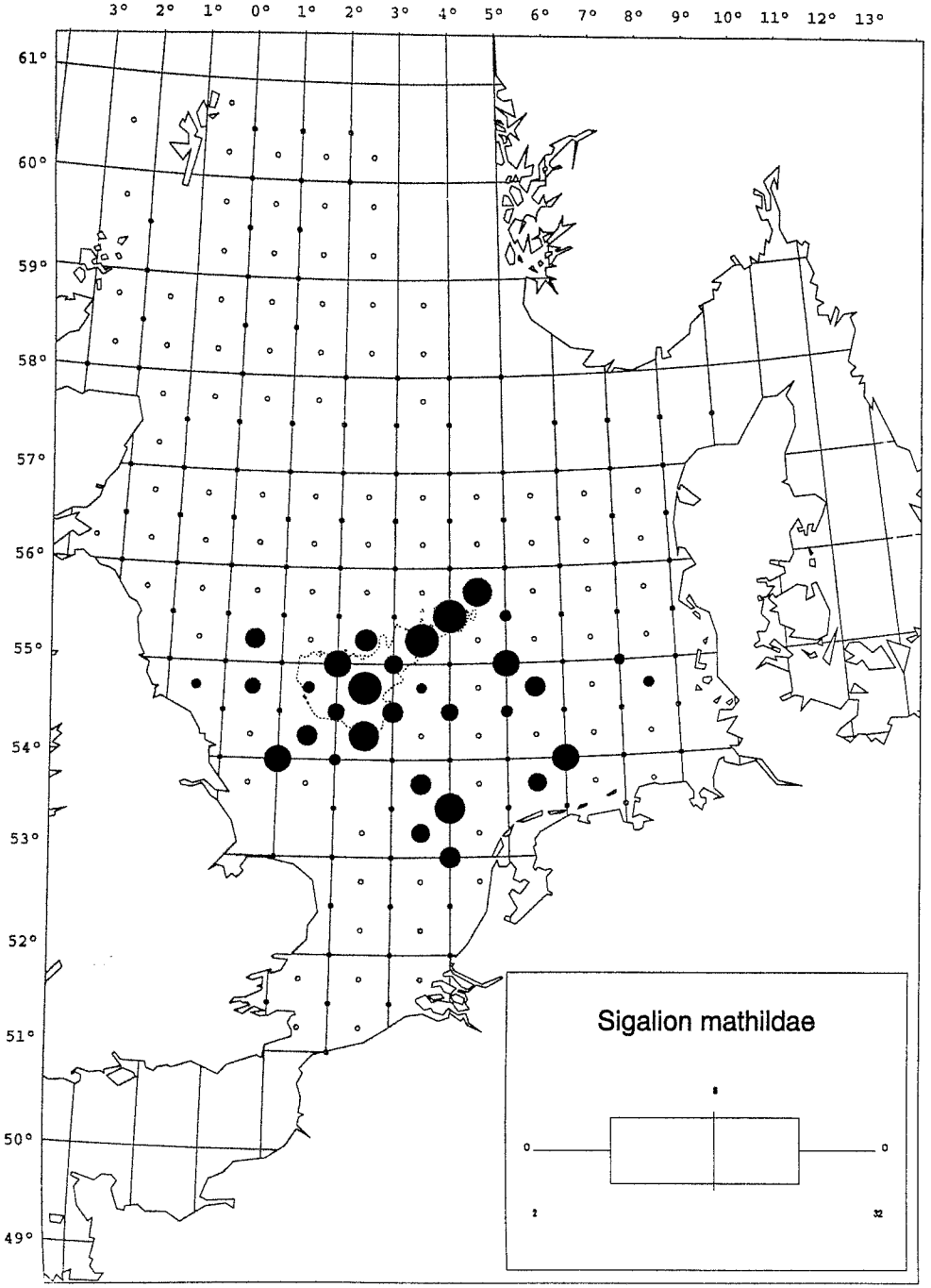

Polycirrus medusa
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°

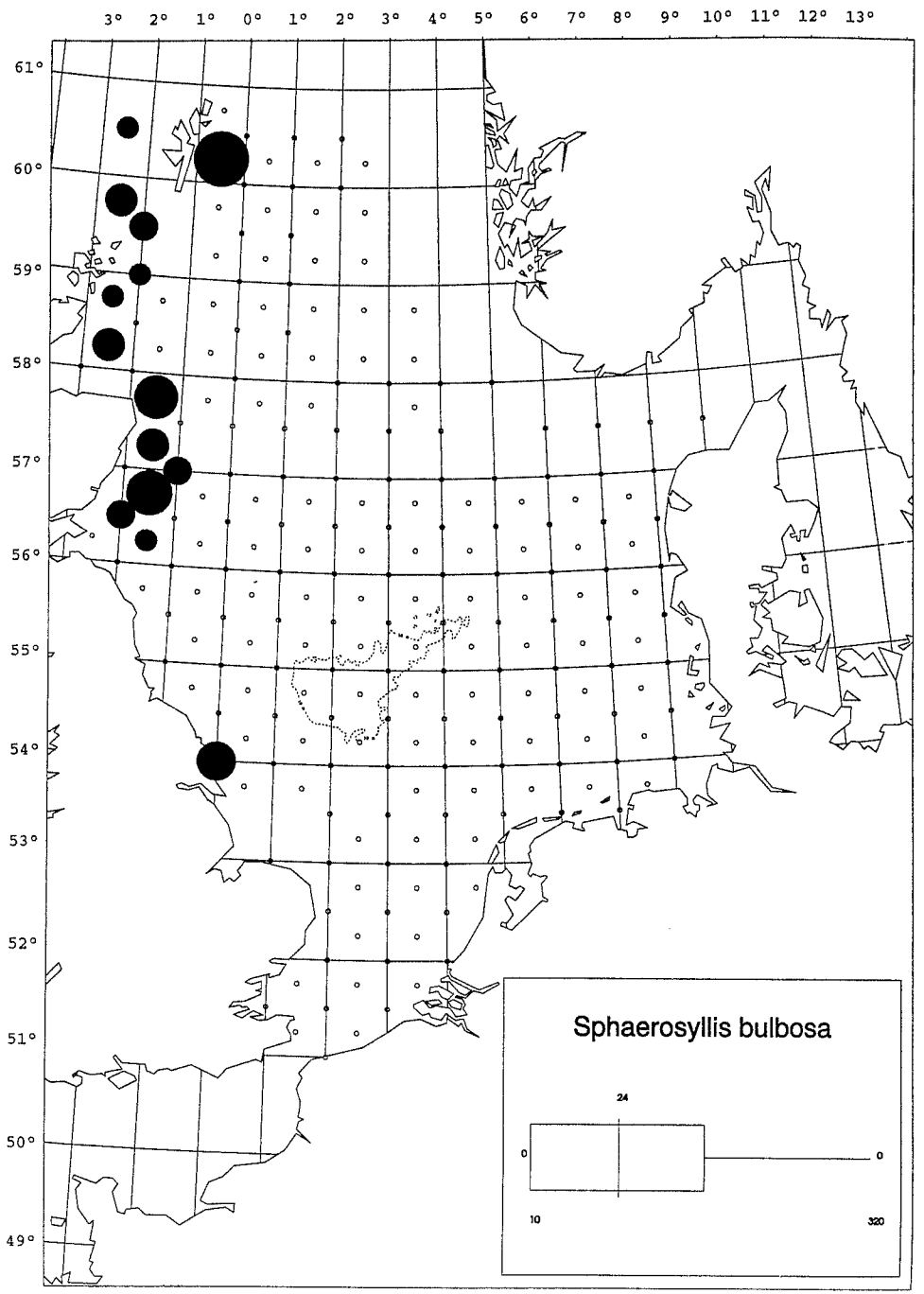

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Protodorvillea kefersteini
10
0
0
2
660

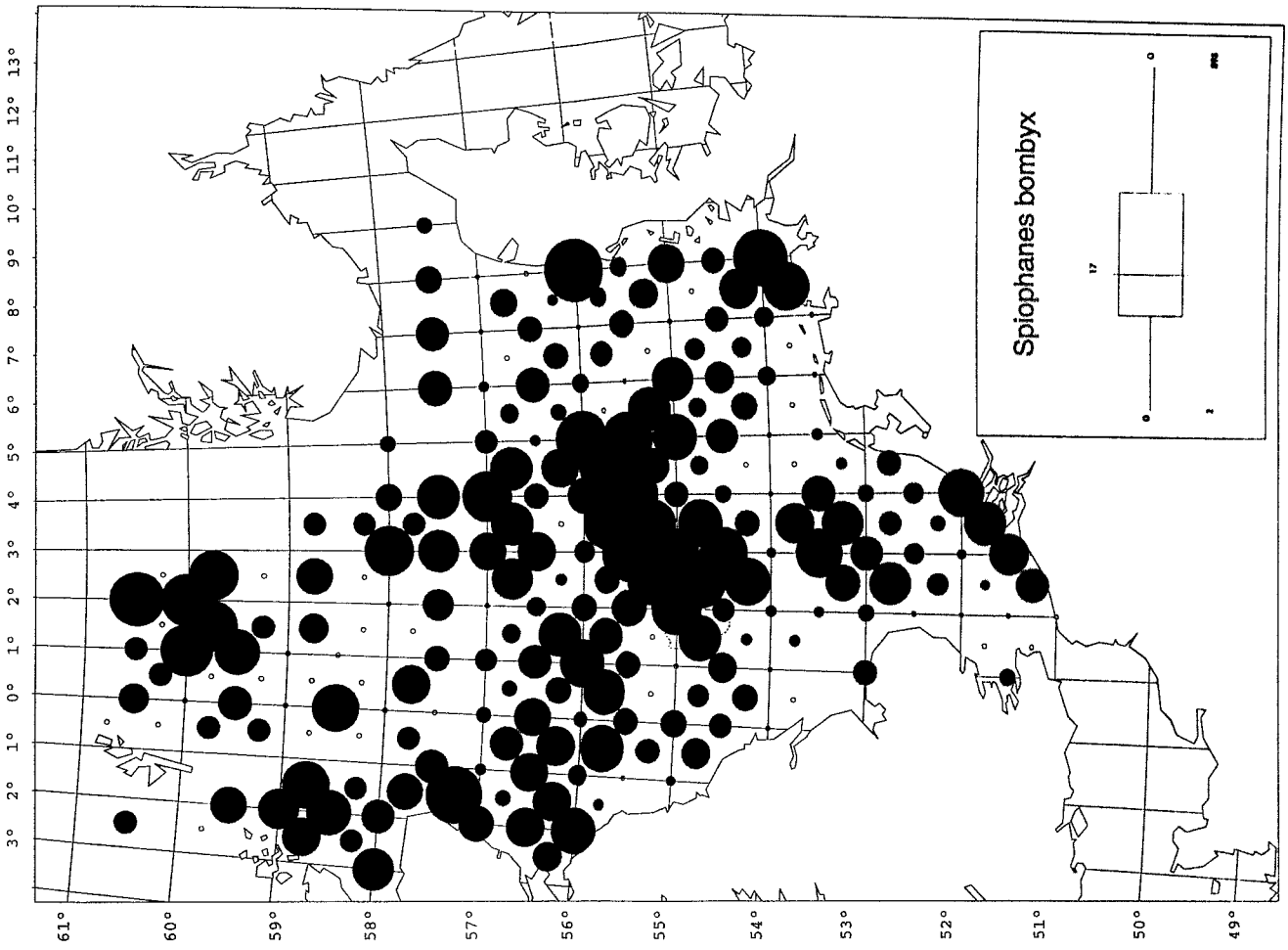

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Sabellidae indet.
10
0
0
2
900

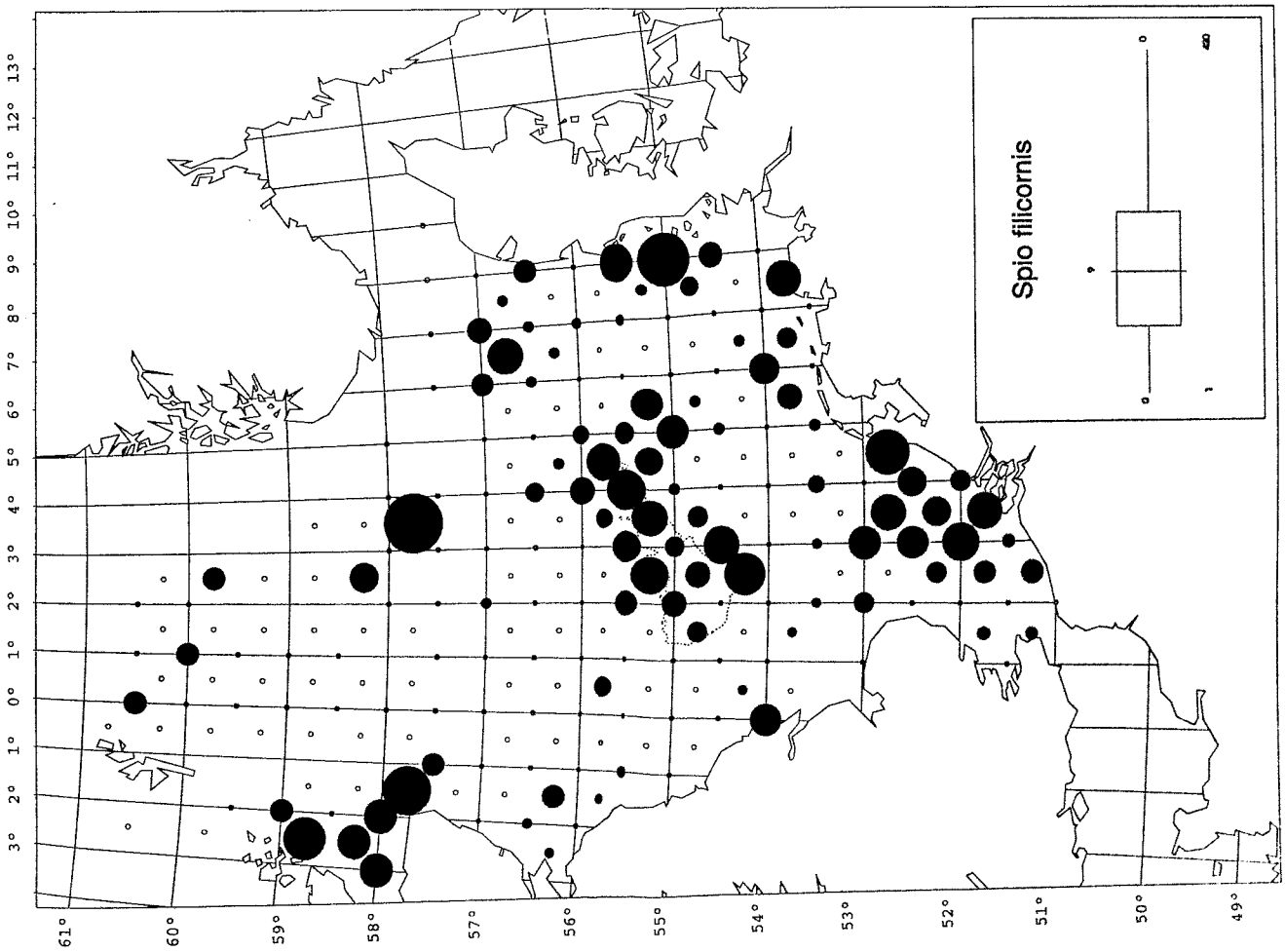

Scoloplos armiger
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°

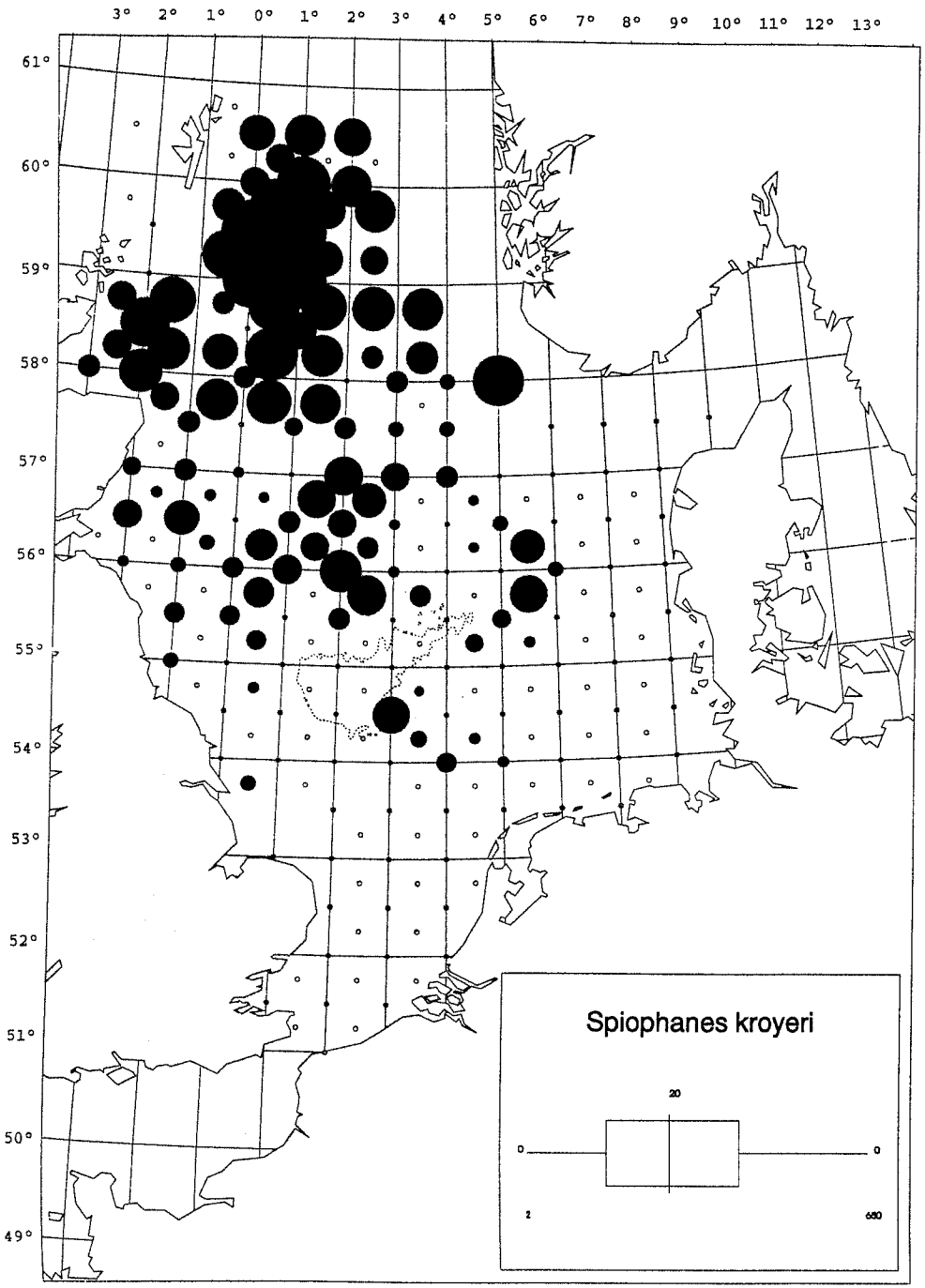

Scalibregma inflatum
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°

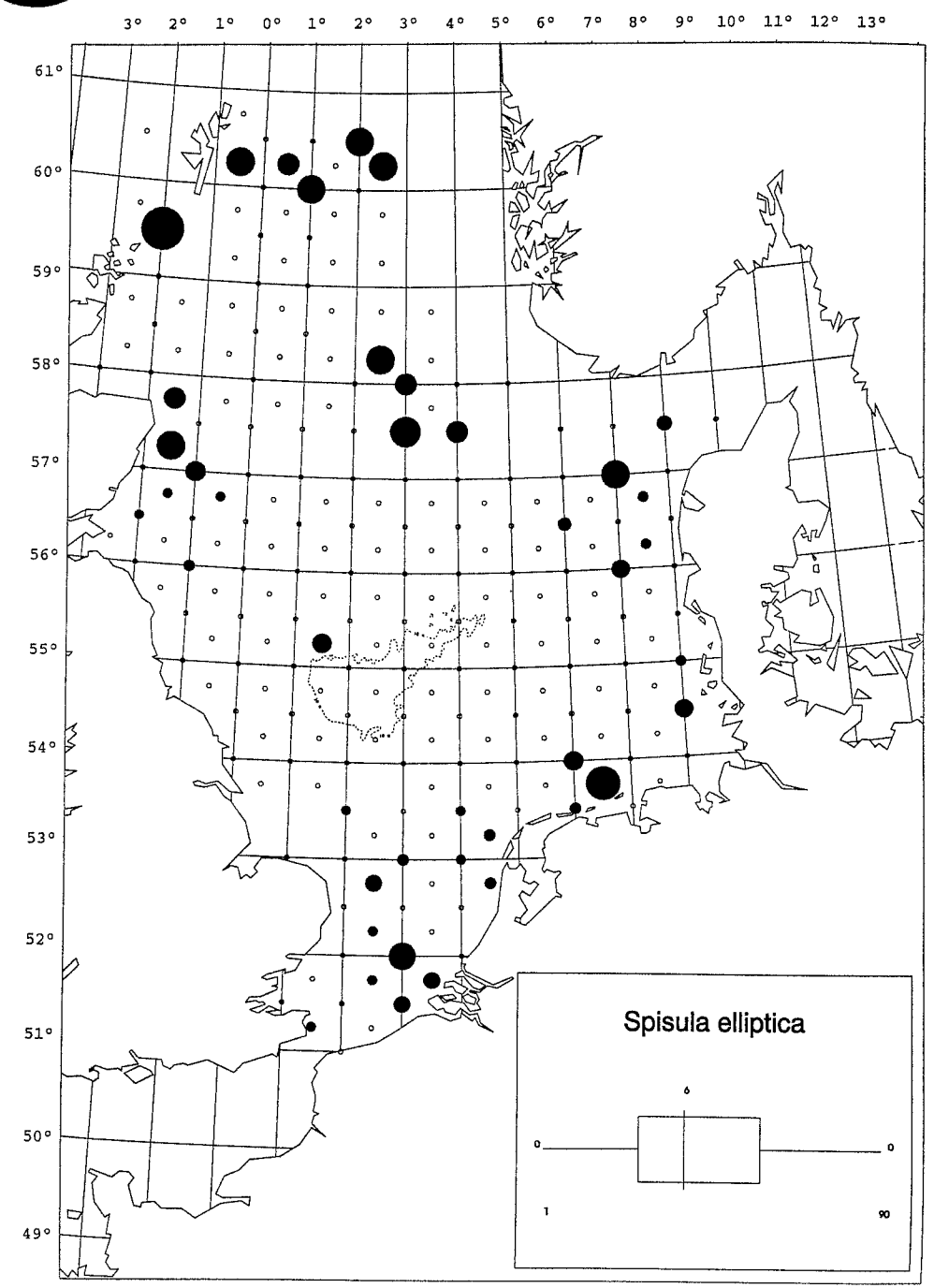

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Sigalion mathildae
8
0
0
2
32

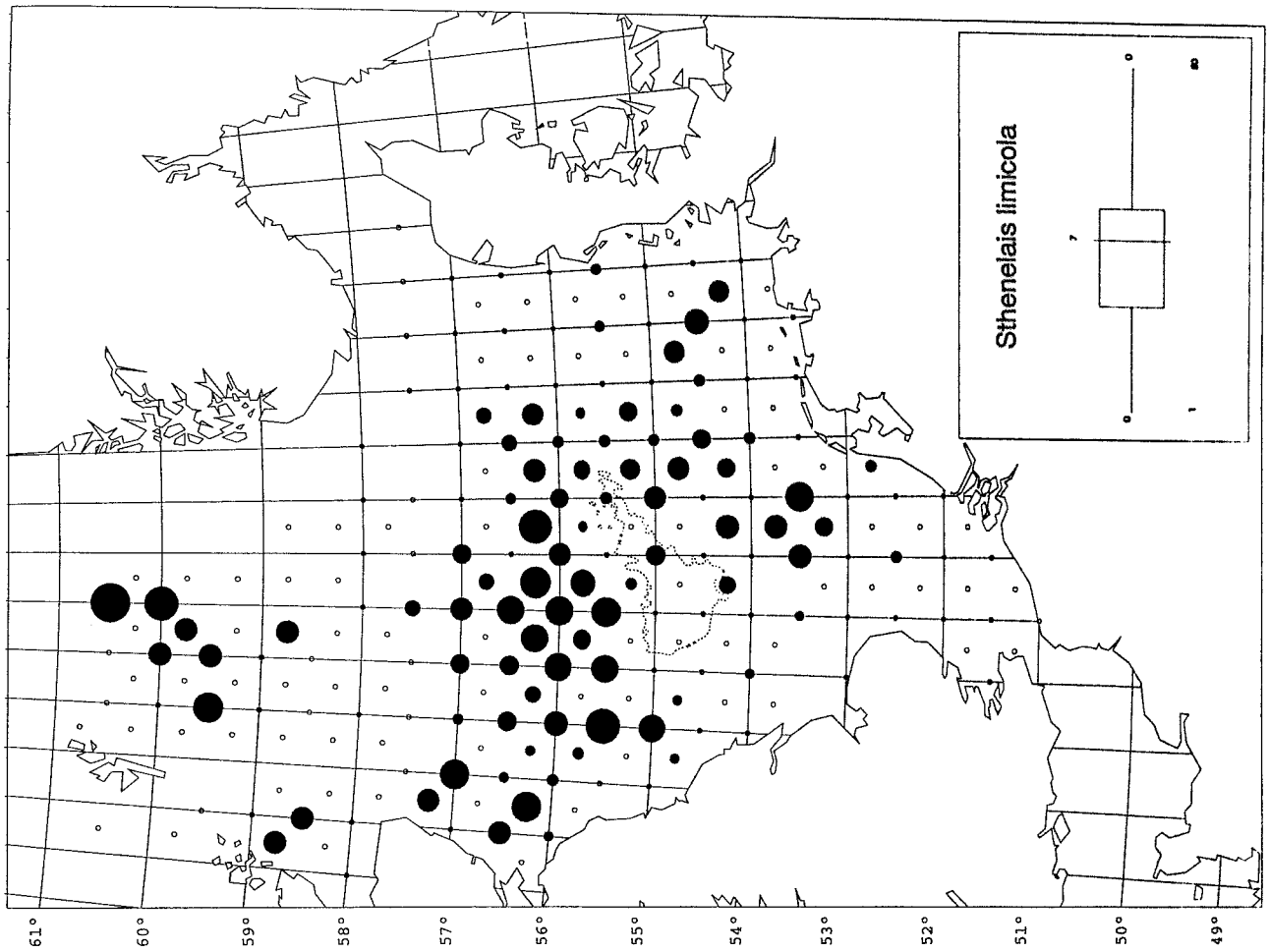

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Sphaerosyllis bulbosa
24
0
0
10
320

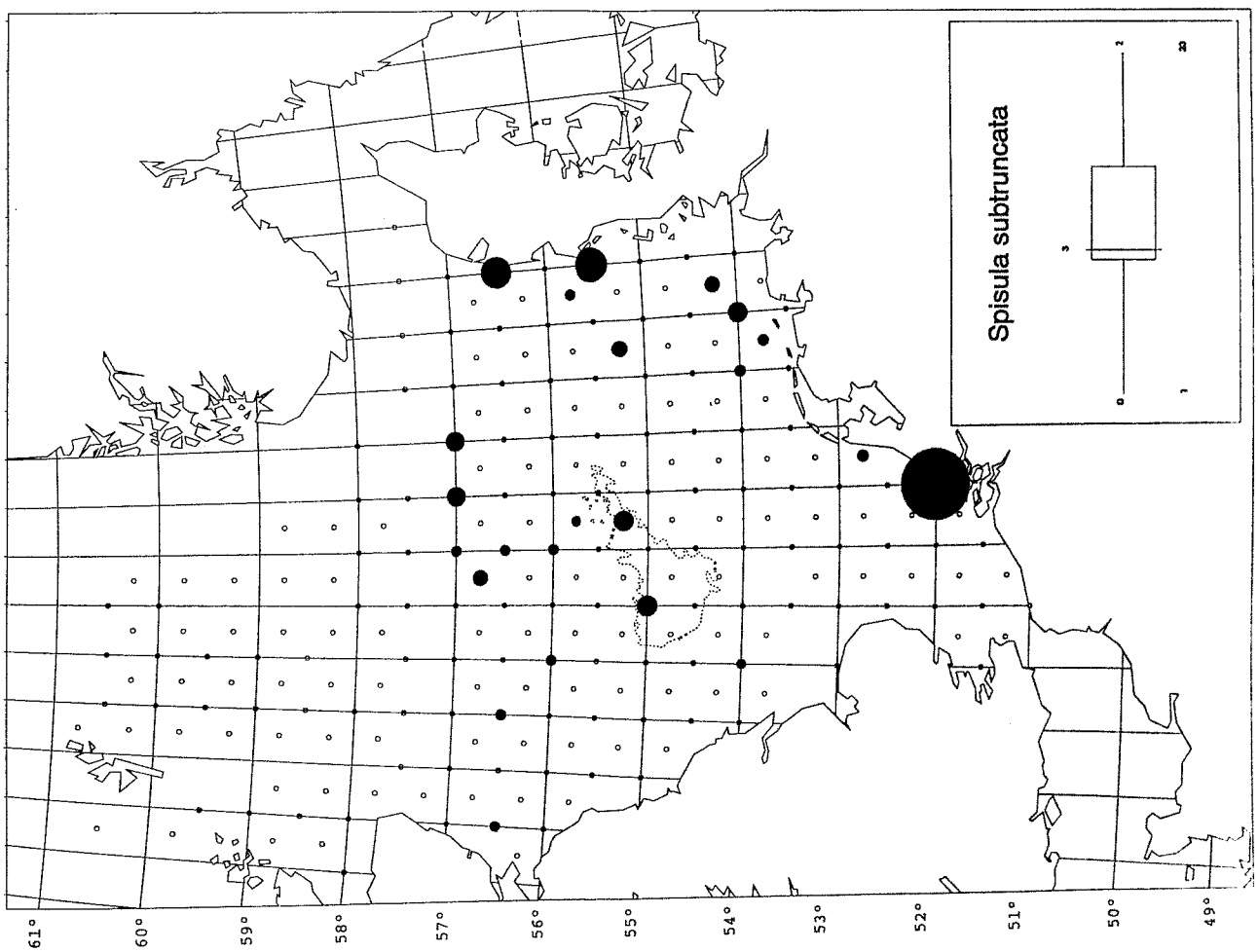

Spiophanes bombyx
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°

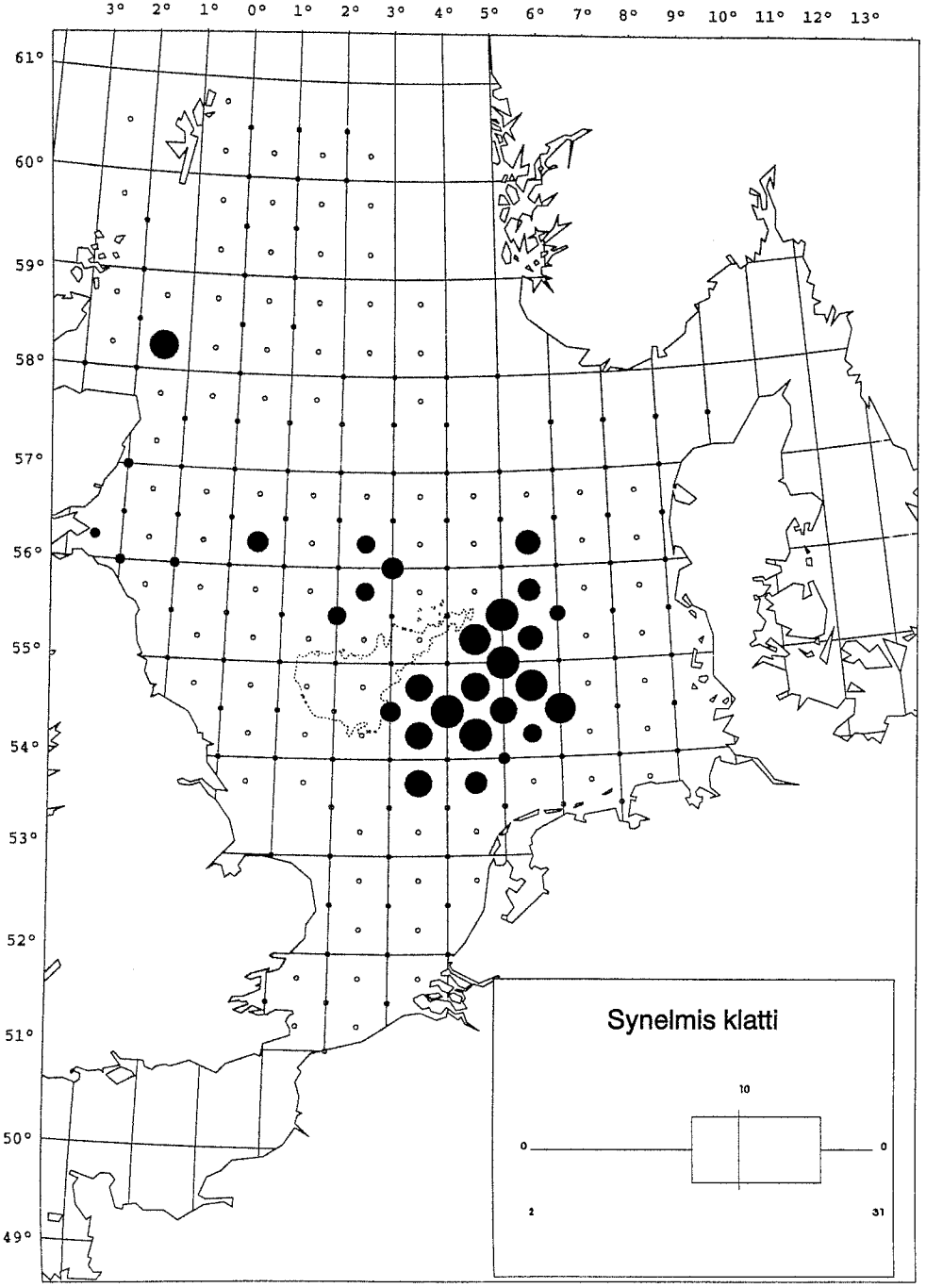

Spio filicornis
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°

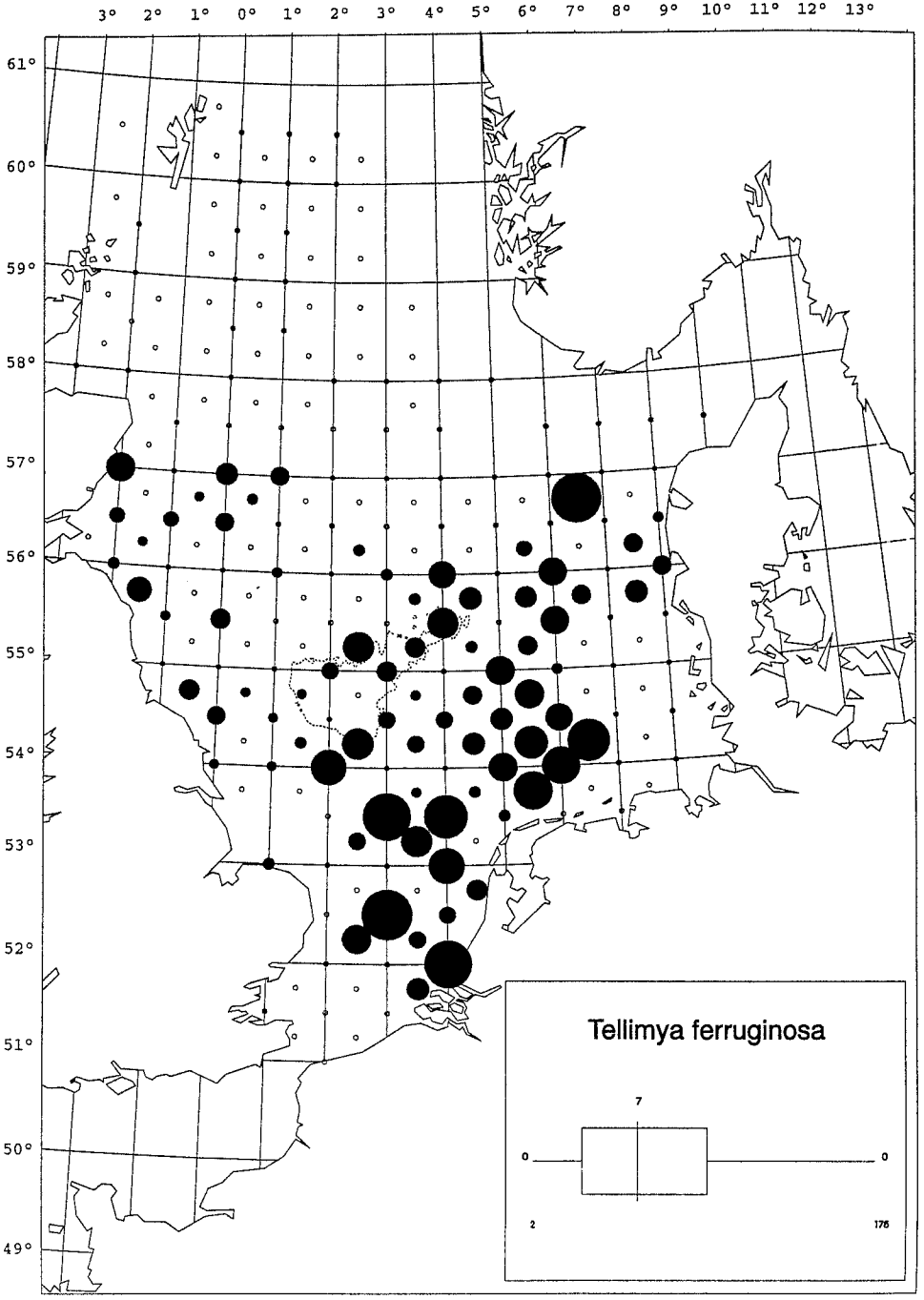

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Spiophanes kroyeri
20
0
0
2
680

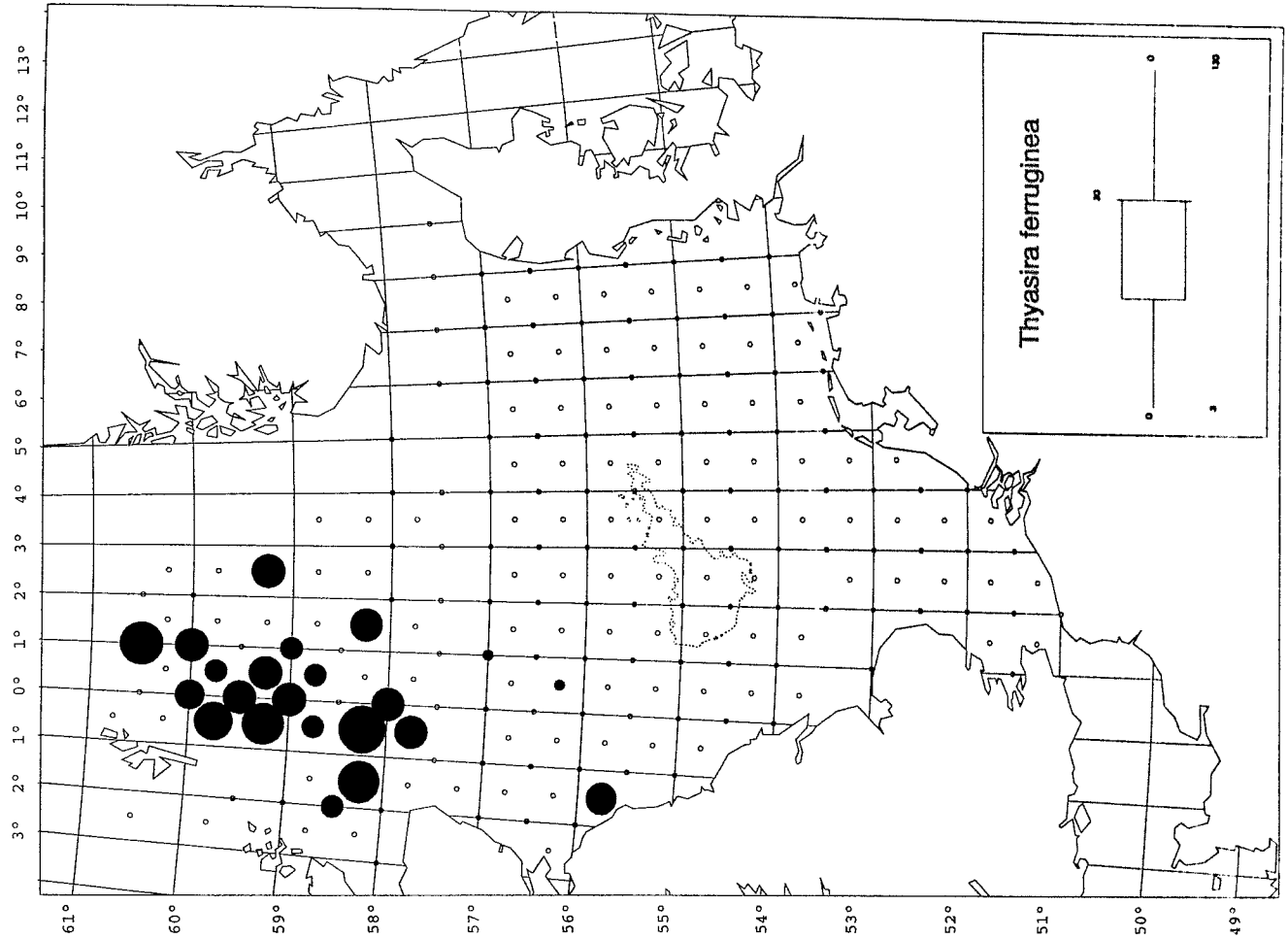

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Spisula elliptica
6
0
0
1
90

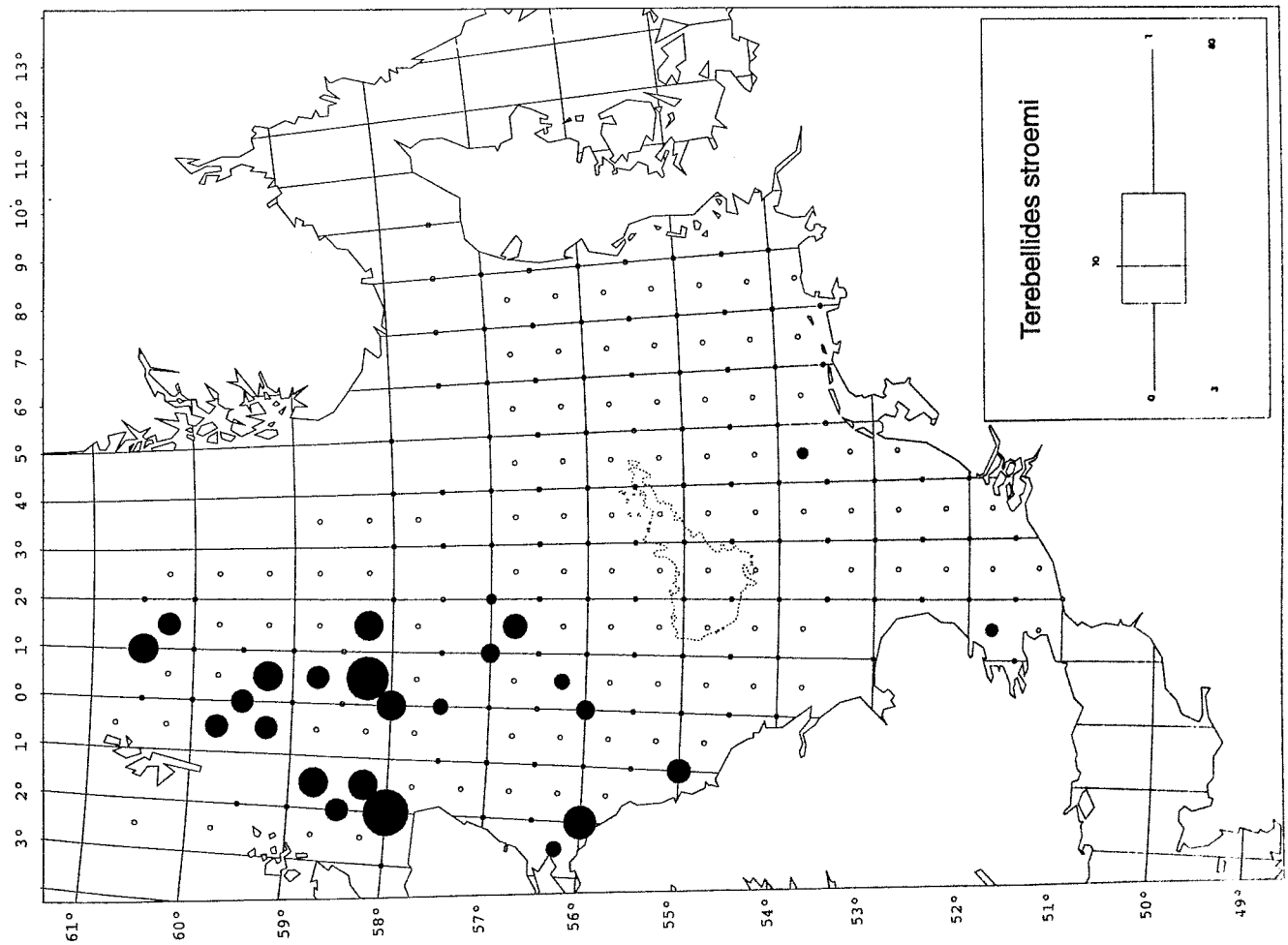

Sthenelais limicola
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°

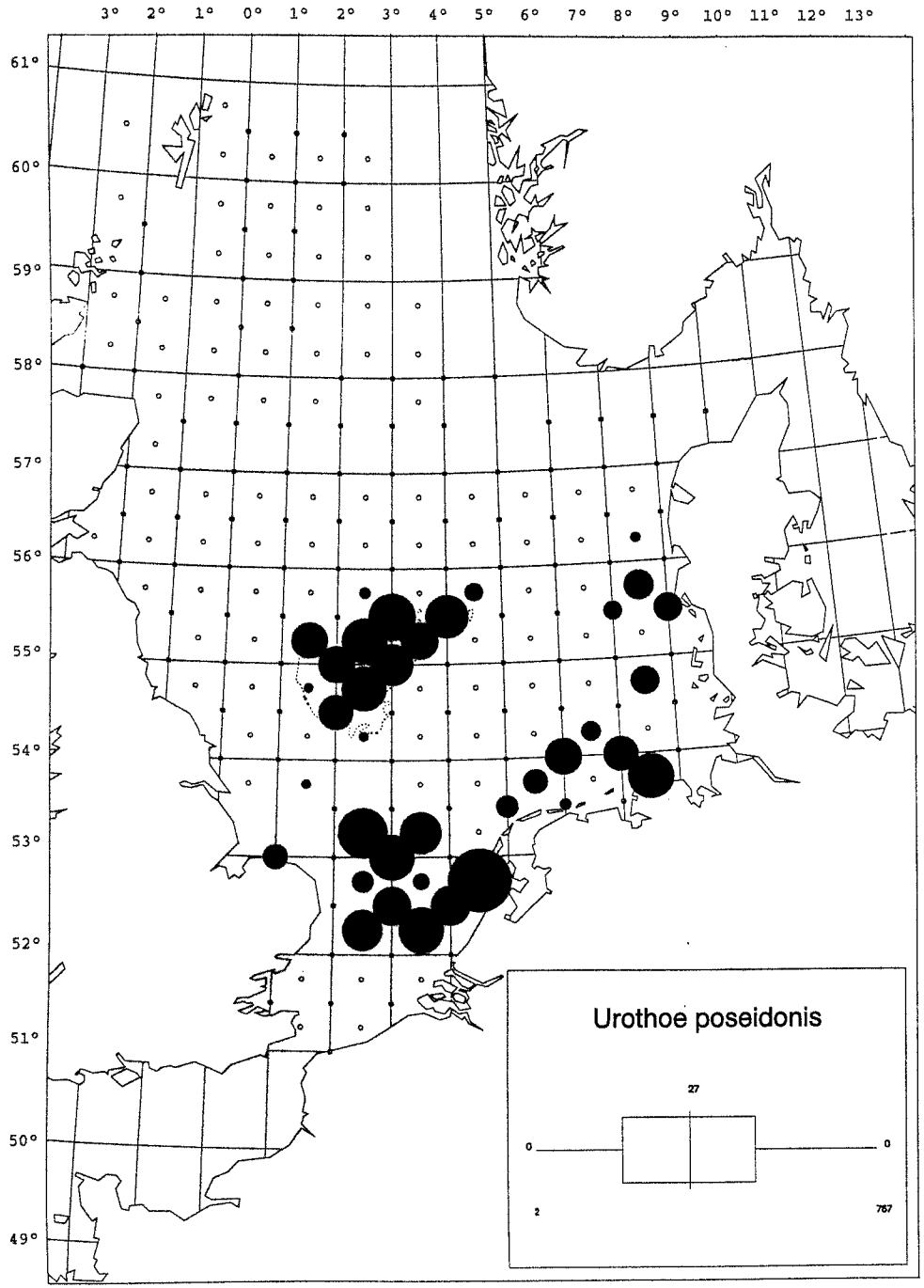

Spisula subtruncata
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°

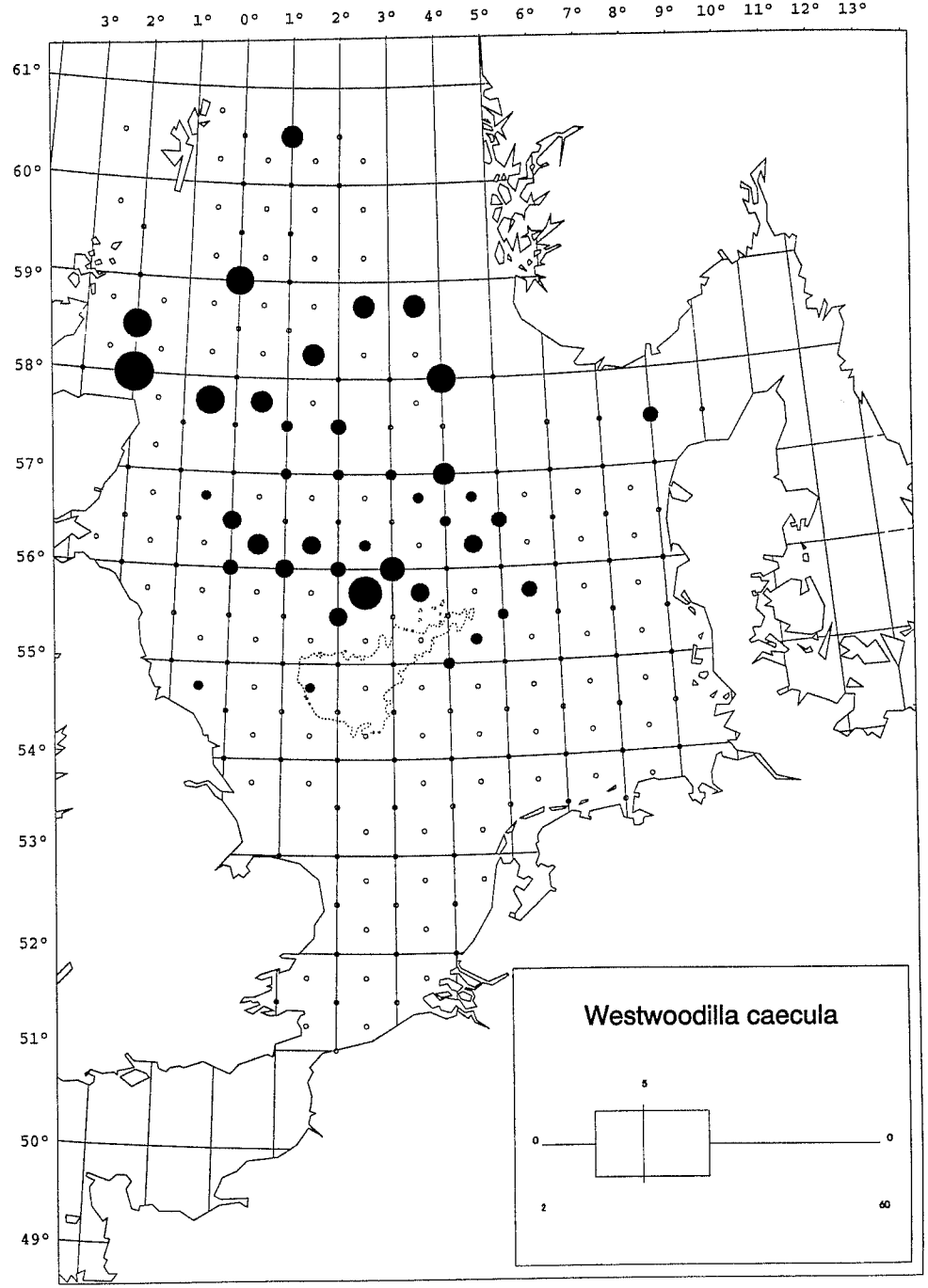

3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Synelmis klatti
10
0
0
2
31


3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Tellimya ferruginosa
7
0
0
2
176


Thyasira ferruginea
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°


Terebellides stroemi
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°


3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Urothoe poseidonis
27
0
0
2
757


3° 2° 1° 0° 1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13°
61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49°
Westwoodilla caecula
5
0
0
2
60